FINAL

REMEDIAL INVESTIGATION AND FEASIBILITY STUDY (RI/FS) WORK PLAN

FOR THE

US OIL RECOVERY SUPERFUND SITE
AREA OF INVESTIGATION 1
400 N. RICHEY STREET
PASADENA, TEXAS

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LIST OF ACRONYMS

AOC	Administrative Order on Consent
AOI	Area of Investigation
APAR	Affected Property Assessment Report
AST	Aboveground storage tank
bgs	below ground surface
BERA	Baseline Ecological Risk Assessment
BHHRA	Baseline Human Health Risk Assessment
BMP	Best Management Practice
BTEX	Benzene, Toluene, Ethylbenzene, and Total Xylenes
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
Chipman	Chipman Chemical Company
CIP	Community Involvement Plan
COC	Chain-of-custody
COPCs	Constituents of Potential Concern
COPECs	Chemicals of Potential Ecological Concern
CPT	Cone Penetrometer Testing
DPT	Direct-Push Technology
DQO	Data Quality Objectives
DSHS	Department of State Health Services
EDDs	Electronic Data Deliverables
EHA	Espey, Huston & Associates
ERA	Ecological Risk Assessment
EPA	United States Environmental Protection Agency
ESA	Environmental Site Assessment
foc	fraction organic carbon
FEMA	Federal Emergency Management Agency
FS	Feasibility Study
FSP	Field Sampling Plan
ft msl	feet mean sea level
HASP	Health and Safety Plan
HRS	Hazard Ranking System
HRSC	High-resolution Site Characterization
HSC	Houston Ship Channel
mg/kg	Milligrams per Kilogram
mg/L	Milligrams per Liter
MQL	Method Quantitation Limit
NAPL	Non-Aqueous Phase Liquid
NCP	National Contingency Plan
NOAA	National Oceanic and Atmospheric Administration
NOD	Notice of Deficiency
NOV	Notice of Violation
NPL	National Priorities List
OVM	Organic Vapor Meter

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PBW	Pastor, Behling & Wheeler, LLC
PCB	Polychlorinated Biphenyls
PCL	Protective Concentration Level
PCSM	Preliminary Conceptual Site Model
PDF	Portable Document Format
PRGs	Preliminary Remediation Goals
PRP	Potentially Responsible Parties
PSAs	Potential Source Areas
QA	Quality Assurance
QAA	Quality Assurance Associates, LLC
QAPP	Quality Assurance Project Plan
QC	Quality Control
PCBs	Polychlorinated Biphenyls
PSV	Preliminary Screening Value
PWS	Public Water Supply Well System
RAGS	Risk Assessment Guidance for Superfund
RAP	Remedial Action Plan
RI	Remedial Investigation
RME	Reasonable Maximum Exposure
ROST	Rapid Optical Screening Tool
RPM	Remedial Project Manager
RRC	Railroad Commission of Texas
RSL	Regional Screening Level
SAP	Sampling and Analysis Plan
SLERA	Screening Level Ecological Risk Assessment
SOP	Standard Operating Procedure
SOW	Statement of Work
SPLP	Synthetic Precipitate Leaching Procedure
SVOCs	Semi-volatile Organic Compounds
TCEQ	Texas Commission on Environmental Quality
TCLP	Toxicity Characteristic Leaching Procedure
TDS	Total Dissolved Solids
TDWR	Texas Department of Water Resources
TPH	Total Petroleum Hydrocarbons
TPWD	Texas Parks and Wildlife Department
TRRP	Texas Risk Reduction Program
TWC	Texas Water Commission
USCB	United States Census Bureau
USDA	United States Department of Agriculture
USGS	United States Geological Survey
USOR	US Oil Recovery
VOCs	Volatile Organic Compounds
WP	Work Plan
WRN	Work Plan Refinement Notice

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1.0 INTRODUCTION

The US Oil Recovery (USOR) Superfund Site (the Site) is comprised of three separate parcels of land located on North Richey Street in Pasadena, Harris County, Texas, in an industrial area situated north of Highway 225 (Figures 1 and 2). The Site consists of:

- Area of Investigation 1 (AOI-1, also referred to as the USOR Property), located at 400 North Richey Street (Figure 3); and
- Area of Investigation 2 (AOI-2, also referred to as the MCC Property), located at 200 North Richey Street (Figure 2) (two separate properties).

When the Site was last operational, it was known as US Oil Recovery LP and operated as a used oil processing and waste treatment facility (USOR LP and related entities herein referred to as "USOR LP"). The Site was proposed to the National Priorities List (NPL) on September 16, 2011, and was placed on the National Priorities List on September 18, 2012. An Administrative Settlement Agreement and Administrative Order on Consent (Removal Action AOC) for a Removal Action for the Site (both AOI-1 and AOI-2) was executed by certain Potentially Responsible Parties (PRP Group, or Respondents) and the U.S. Environmental Protection Agency (EPA) on August 25, 2011. An AOC for the AOI-1 Remedial Investigation/Feasibility Study (RI/FS) was executed by the Respondents and the EPA effective on May 14, 2015. Note that the term RI/FS as used in this document references plans and anticipated work only at AOI-1.

This RI/FS Work Plan (RI/FS WP) was prepared on behalf of the Respondents in accordance with Paragraphs 21 through 24 of the Statement of Work (SOW) for the RI/FS, which is Appendix B to the RI/FS AOC. This RI/FS WP is based largely on the Technical Scope of Work developed for AOI-1, which is an Appendix to the SOW for AOI-1, as described in more detail below.

The RI/FS WP format and elements have been developed in accordance with guidance developed by the EPA (EPA, 1988). The RI/FS WP was prepared in conjunction with a Sampling and Analysis Plan (SAP), also prepared in accordance with EPA guidance (EPA, 1988). The SAP consists of two documents:

1) Field Sampling Plan (FSP) (Volume 1 of the SAP) [Pastor, Behling & Wheeler, LLC (PBW), 2015a], which presents specific sampling locations, equipment, and procedures to be used during the RI/FS; and

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2) Quality Assurance Project Plan (QAPP) (Volume 2 of the SAP) (PBW, 2015b), which present quality assurance/quality control (QA/QC) policies, organization, objectives, functional activities, and other specific QA/QC activities for the RI/FS.

A Health and Safety Plan (HASP) (PBW, 2015c) was also prepared and provides the results of a hazard assessment conducted for the prescribed work tasks, and the health and safety requirements and protocols that will minimize hazards to RI/FS field workers.

1.1 ISSUES POSED BY THE SITE

The Preliminary Assessment Report prepared by the Texas Commission on Environmental Quality (TCEQ) (TCEQ, 2011) for AOI-1 indicated that complete pathways may exist at AOI-1 for:

1) Groundwater - due to potential releases to groundwater at AOI-1;
2) Surface water - due to releases via surface water runoff from AOI-1 to Vince Bayou;
3) Soil - due to spills/releases at AOI-1 during historic industrial operations, and
4) Air - due to reported releases of hazardous substances in air downwind of AOI-1 during historical industrial operations.

The Hazard Ranking System (HRS) Documentation Record (EPA, 2011b) for AOI-1 contained the following conclusions:

1) Hazardous substances present at the property and in waste materials previously handled at the property include volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), pesticides, herbicides, and metals;
2) Identified and observed on-going releases of hazardous substances were occurring from the AOI-1 property into Vince Bayou through stormwater runoff; and
3) The predominant threat to human populations, animals or the food chain is the potential for exposure by direct contact with volatile organic compounds, metals, flammables, corrosives, and unknown waste material at AOI-1 and in nearby Vince Bayou and its sediments.

The intent of the RI/FS is to evaluate the nature and extent of possible releases resulting from historical operations at the USOR Property, to obtain data to fill data gaps identified in the Preliminary Conceptual Site Model (PCSM) for the USOR property (contained in the Technical Scope of Work for AOI-1, included as an Appendix to the SOW), to assess the potential human health and environmental risks due to the presumed releases at the USOR Property, and allow the development and evaluation of remedial alternatives.

1.2 OBJECTIVES

Consistent with EPA guidance, the specific objectives of the RI/FS are to: (1) characterize site conditions; (2) evaluate the nature and extent of the contamination; (3) assess the risks to human health and the

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environment; (4) identify remedial action objectives for those chemicals and media posing an unacceptable risk; (5) develop preliminary remediation goals (PRGs) to address the remedial action objectives; (6) develop, screen and evaluate potential remedial technologies consistent with the PRGs; (7) examine the potential performance and cost benefit of the remedial alternatives that are being considered; and (8) summarize and present the data so that an appropriate remedy (if warranted) consistent with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), can be selected by EPA.

Consistent with Paragraph 2 of the SOW, an "iterative" approach to data collection will be used during the RI/FS to maximize overall investigative effectiveness and efficiency and assist in decision making. Also, consistent with the SOW and the Triad Approach (EPA, 2003), a streamlined data assessment and reporting process is proposed for the RI/FS. The iterative sampling program will start with the investigation of on-property (defined as the area inside the existing fence at the USOR Property) soil, groundwater, surface water, and sediment and off-property (defined as the area outside of the existing fence at the USOR Property) soil and groundwater. The iterative sampling will proceed to off-property sediment, surface water, and other environmental media, as appropriate. This iterative program will use the data collected in previous phase(s) of investigation to help focus constituents of potential concern (COPCs) and investigation areas for subsequent sampling efforts. This approach will help minimize the likelihood of making erroneous decisions with data that are difficult to interpret, do not support the performance or acceptance criteria defined in this RI/FS WP, or do not support the overall project goal of identifying potential risks associated with past AOI-1 activities. Additional detail on the approach to data collection is provided in Section 5.6.

This RI/FS WP documents the decisions and evaluations made during the development of the Scope of Work (i.e., the RI/FS scoping process) and presents a summary of the work to be performed during the RI/FS. The RI/FS WP also presents the initial evaluation of existing AOI-1 data and background information, and describes the project management team and schedule.

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2.0 SITE BACKGROUND AND PHYSICAL SETTING

2.1 SITE DESCRIPTION

2.1.1 Current Site Conditions

2.1.1.1 Current Conditions

The approximately 12.2 acre USOR Property was most recently used as a used oil processing and waste treatment facility by USOR LP. USOR LP began operations on the property around June 2003 and acquired the property in December 2003. Prior to June 2003, multiple businesses operated on the property, including chemical manufacturing companies (specializing in fertilizers and/or herbicides/pesticides), a cow hide exporter, and a leather tanner. Section 2.2 contains a more detailed listing of the operational history of the property.

USOR LP had ceased operations in June of 2010, prior to the state-court appointed Receivership in July of 2010. An office building, security guard shack, and large warehouse (approximately 25,000 square feet in size) are present on the property. The warehouse includes a former laboratory, machine shop, parts warehouse, and a material processing area that included a filter press. More than 1,000 drums and poly totes containing various industrial wastes were present within the warehouse. An EPA-approved removal action performed by contractors under the direction of the PRP Group characterized these wastes, which generally consisted of organic solvents, oily liquids, and solids and corrosive acids and bases, and then disposed of the wastes and the containers off-site. A tank farm with approximately 32 aboveground storage tanks (ASTs) and various sumps containing industrial wastes located within secondary containment is present at the north end of the warehouse; the liquids in these tanks were removed and disposed off-site as part of an EPA-approved removal action. A removal action for removal and off-site disposal of the AST solids is currently being planned. A large, concrete-walled aeration basin (also called the bioreactor) was formerly located west of the tank farm but was removed as part of an EPA-approved removal action. A stormwater containment pond is located west of the warehouse and south of the former aeration basin. Approximately 225 roll-off boxes are located on the USOR Property; however, the wastes (generally consisting of oily liquids and solids) that were left in the roll-off boxes by USOR LP have been removed and properly disposed as part of an EPA-approved removal action. An inactive rail spur enters the south-central part of the USOR Property from the south and extends north along the west side of the warehouse. A utility right-of-way with various pipelines is present within the

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southern part of the USOR Property and pipelines are also present outside of but adjacent to the USOR Property along the eastern and western sides.

Currently, the USOR Property is enclosed within a six-foot chain link security fence with locked gates. Security cameras have been installed and access is monitored by a security contractor.

2.1.1.2 Land Use

The USOR Property was developed for industrial purposes in approximately 1947 and land use has remained industrial since that time.[1] In July 2015, the Receiver for US Oil Recovery LP placed a restrictive covenant on the USOR Property at 400 N. Richey (State of Texas, 2015) (Appendix A). The restrictive covenant includes the following use limitations:

- Commercial/Industrial Use: The USOR Property shall not be used for any purposes other than commercial/industrial uses, as that term is defined under 30 Texas Administrative Code §350.4(a)(13), and thus shall not be used for human habitation or for other purposes with a similar potential for human exposure (which would include and not be limited to residential, hospitals, schools, day-care, etc.); and
- Groundwater: The groundwater underlying the USOR Property shall not be used for any beneficial purpose, including: (1) drinking water or other potable uses; (2) the irrigation or watering of landscapes, (3) agricultural uses, or (4) commercial/industrial. For any activities that may result in potential exposure to the groundwater, a plan must be in place to address and ensure the appropriate handling, treatment and disposal of any affected soils or groundwater.

AOI- 1 is currently located within an area of mixed commercial/industrial and residential land use. Specifically, land use/description in the vicinity of the USOR Property currently includes the following (Figure 2):

- North:
  - Undeveloped land that includes high-tension power lines;
  - Vince Bayou;
  - The Crown Hill Cemetery; and
  - Heavy industrial property located further north (Gulf Coast Waste Disposal Authority, Houston Ship Channel (HSC)).
- East:
  - Undeveloped land that includes high-tension power lines;
  - N. Richey Street;
  - Vince Bayou;
  - Heavy industrial property located further east; and
  - A former paper mill (Champion International/Simpson Paper) on the property across Vince Bayou from AOI-1 (Figure 2).

[1] The City of Pasadena does not have a zoning ordinance.

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- South;
  - MCC Property;
  - East-west oriented pipeline right-of-way along the southern boundary of the USOR Property;
  - East-west oriented railroad line (Port Terminal Railroad tract);
  - Additional east-west oriented pipeline right-of-way to the north of the railroad line; and
  - Heavy industrial and commercial property located further south.
- West:
  - North-south pipeline right-of-way;
  - City of Pasadena stormwater detention basin; and
  - Heavy industrial property located further west (including coke-fired power generation facility operated by AES Deepwater, Inc.).

Vince Bayou is located to the north and east of the USOR Property, is joined by Little Vince Bayou to the east of the USOR Property, and flows to the north and intersects with the east flowing HSC approximately 0.4 miles north of the USOR Property. The closest residential land use is located approximately 0.08 miles (400 feet) south-southwest of the southwest corner of the USOR Property. The nearest public park (Light Company Park) is located approximately 0.24 miles (1,300 feet) south of the southern property boundary. The nearest school (Pasadena High School) is located approximately 0.5 miles southeast of the southern USOR Property boundary.

The PCSMs are based on the premise that the land use is limited to commercial/industrial and that there is no use of the shallow groundwater (see above).

In 2010, the population of Pasadena, Texas was 149,043 and the population of Houston, Texas was 2,099,451 (2010 census; USCB, 2014a; USCB, 2014b). The racial/ethnic makeup of Pasadena is as follows (USCB, 2014b):

- White: 75.3%
- African American: 2.3%
- Native American: 0.7%
- Asian: 2.1%
- Pacific Islander: 0.1%
- Other races: 16.5%
- Two or more races: 2.9%

Of these races, 62.2% self-identify as Hispanic or Latino.

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2.1.2 Environmental Setting

2.1.2.1 Topography

The Site is located on the edge of a gently sloping coastal plain. The topography of the property is generally flat with elevations ranging from 2.5 to 20 feet above mean sea level (ft. msl) (Figure 3). On the southern part of AOI-1, there is a gradual slope (approximately 12 feet decrease in elevation over 350 feet) towards N. Richey Street. On the northern part of AOI-1, the slope increases to a moderate slope (approximately 10 feet decrease in elevation over 175 feet) between the USOR Property and Vince Bayou.

2.1.2.2 Surface Water

AOI-1 is located in the San Jacinto River Basin. AOI-1 is located adjacent to the confluence of Vince Bayou (also called Big Vince Bayou) and Little Vince Bayou. Vince Bayou flows to the north and enters the HSC Segment 1007 approximately 0.4 mile north of the USOR Property boundary. The HSC (Surface Water Segments 1005, 1006, and 1007) is a dredged and improved natural water course that connects the Port of Houston terminals and numerous petrochemical plants, refineries, and terminals to Galveston Bay. The channel is approximately 50 miles long and is dredged to 45 feet depth. The water uses for Segment 1007 and Segment 1006 of the HSC are navigation and industrial water supply (Figure 30 TAC 307.10(1)). No recreation, aquatic life, or domestic water supply uses are defined for the segment. Approximately 49 domestic and 147 industrial outfalls are permitted for wastewater discharge into Segment 1007 (per TCEQ website, accessed September 2014).

Non-contained stormwater (i.e., overland flow) from much of the USOR Property drains to the northeast, north, and northwest into Vince Bayou. Stormwater in the southern portion of the property flows south and east to a bar ditch located along the west side of N. Richey Street. This roadside ditch conveys stormwater to Vince Bayou at the bridge where N. Richey Street crosses Vince Bayou. Stormwater has been observed to collect in the concrete parking lot located to the east of the warehouse due to down-grade concrete curbing. Stormwater appears to enter the property along the southern property boundary from the railroad right-of-way. Ponded water occurs occasionally in a low spot in the southwestern part of the property adjacent to the inactive rail spur. Based on observations of this area over the past few years, the water appears to occur intermittently and is apparently the result of stormwater runoff from areas to the south and west. Stormwater also collects in the stormwater containment pond located to the west of the warehouse.

The Federal Emergency Management Agency Flood Rate Insurance Map Panel Number 48201C0905L for

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Harris County shows the USOR Property in Zone AE (1% Annual Chance of Flood), and Zone X (0.25% Annual Chance of Flood) (FEMA, 2007) (Figure 2). Zone AE extends approximately 200 to 300 feet west of N. Richey Street and 300 feet south of Vince Bayou. The southwestern portion of AOI-1 (west of the abandoned rail spur) is outside the flood zone.

2.1.2.3 Wetlands

According to the National Wetlands Inventory map that covers the USOR Property, the area between the approximate northern property boundary and Vince Bayou is classified as Estuarine and Marine Wetlands (estuarine, intertidal emergent, persistent, irregularly flooded (designation E2EM1P)) (USFWS, 2014) (Figure 4). A very small portion of the USOR property appears to be included in the areal extent of this wetland area. Vince Bayou, Little Vince Bayou, and HSC are classified as Estuarine and Marine Deepwater estuarine (subtidal, unconsolidated bottom, excavated (designation E1UBLx)).

2.1.2.4 Ecological Setting

The USOR Property is located in a highly developed area near major freeways, roadways, and urban and industrial development. The property contains minimal undisturbed habitat and resident wildlife appears scarce. There is no evidence that the USOR Property is consistently being utilized by wildlife.

The Texas Parks and Wildlife Department Annotated County Lists of Rare Species for Harris County (TPWD, 2015) (last updated March 23rd, 2015) lists the threatened and endangered species that are shown on Table 1. Species with either a Federal or State threatened or endangered status are shown on Table 1 along with an analysis of the current status of the species and the likelihood that any of these species could be present at AOI-1. Based on an analysis of the USOR property conditions and a review of the species habitat requirements, it is unlikely that any of the special status species (Federal or State listed) are present at the USOR property or in Vince Bayou/Little Vince Bayou.

Historic plant communities were tall and mid-grass prairies (USDA, 2014). Grazing and industrial development resulted in the loss of the tall/midgrass species which allowed woody plants such as the Chinese tallow tree and annual weeds to invade the area.

A Fish and Shellfish Consumption Advisory (ADV-3) for Upper Galveston Bay (including the HSC) was issued by the Texas Department of Health (now the Department of State Health Services (DSHS)) in 1990 due to concentrations of polychlorinated dibenzofurans and polychlorinated dibenzo-p-dioxins in catfish and

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blue crab that could pose a risk to human health. ADV-3 recommended that adult recreational and/or subsistence fishers limit consumption of catfish and/or blue crab to no more than one 8-ounce serving meal per month and that children under the age of 12 and women of childbearing age not consume catfish or blue crab from these waters (DSHS, 2013). The advisory was revised in 2001 to include organochlorine pesticides and PCBs and to include the San Jacinto River downstream of US Highway 90 (ADV-20). After the first phase of the Seafood Consumption Safety Monitoring Program in 2004, DSHS issued ADV-28 in 2005 due to concentrations of PCBs in spotted seatrout that could pose a risk to human health. ADV-28 recommended that adults limit consumption of spotted seatrout to no more than one 8-ounce serving meal per month and that children, women who were nursing, pregnant, or who may become pregnant not consume spotted seatrout from the HSC (including the tidal portion of the San Jacinto River) and Galveston Bay. ADV-35 was issued in July 2008 as the result of the 2006 and 2007 studies which indicated that gafftopsail catfish and spotted seatrout contained concentrations of dioxins and PCBs that exceeded the DSHS guidelines for the protection of human health. ADV-35 extended ADV-28 to the remainder of the Galveston Bay estuary (DSHS, 2014).

2.1.2.5 Meteorology

Pasadena, Texas is within a humid subtropical region. The Gulf of Mexico has a large effect on the climate of the area (Kasmarek and Strom, 2002). Average annual precipitation is approximately 54 inches and peak rainfall months are June and October. Summers are generally of long duration and hot, with high relative humidity and prevailing winds from the southwest. Winters are generally of short duration and mild, with moderate relative humidity and prevailing winds from the northwest. During the summer months atmospheric convection cells can produce low to high rates of localized rainfall, and infrequently, moisture-laden tropical air masses produce moderate to extremely high rates of rainfall (Kasmarek and Strom, 2002). The warmest month of the year is August with an average maximum temperature of 93°F. The coldest month of the year is January with an average minimum temperature of 45°F (NOAA, 2014a).

The wind rose for the City of Houston shows the prevailing winds are predominately (~40% of the time) out of the south to east quadrant at a speed less than 16 knots (18.4 miles per hour) for the period of record 1984-1992 (TCEQ, 2014a). Calm winds (less than 1 knot or 1 mph) occur about 9.2 percent of the time.

In the last 70 years, 12 tropical storms or hurricanes have made landfall within 25 nautical miles of the HSC (NOAA, 2014b). The center tracks of four storms, Tropical Storms Allison (June 1989 and 2001) and two unnamed storms (July 1943, October, 1949), passed within 4 nautical miles (4.5 miles) of the Site. The October 1949 unnamed storm passed within two miles of the USOR Property and made landfall in Lake

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Jackson as a Category 4 hurricane. Approximately 22 inches of rain was recorded at Hobby Airport for October 1949.

2.1.3 Geologic and Hydrogeologic Framework

2.1.3.1 Geology and Hydrogeology

The soils at AOI-1 are mapped as Lake Charles-Urban Land complex (Lu) (USDA, 2014). The Lake Charles portion of the complex is described as clay soils (0 to 80 inches) that are moderately well drained with high runoff potential when thoroughly wet (hydrologic soil group D). Water movement through the soil is restricted or very restricted. The Urban Land portion of the complex applies to the developed portions of the USOR Property (i.e., the buildings and other improvements).

The surface geologic unit at AOI-1 is the Beaumont Formation (also known regionally as the Beaumont Clay) (Figure 5). In the vicinity of AOI-1, the Beaumont Formation is dominantly clay and mud of low permeability, high water-holding capacity, high compressibility, high to very high shrink-swell potential, poor drainage, level to depressed relief, low shear strength, and high plasticity (Barnes, 1982). The geologic units include interdistributary muds, abandoned channel-fill muds, and overbank fluvial muds (Barnes, 1982). The Beaumont Formation is estimated to be about 100 feet thick in the vicinity of AOI-1 (Baker, 1979; Lang and Winslow, 1950), although this depth should be considered very approximate given the lack of available data for the AOI-1 vicinity.

Previous soil borings completed at AOI-1 indicate that the shallow subsurface materials are consistent with the description of the Beaumont Formation from the literature. Three borings drilled in 1991 (Espey, Huston & Associates, Inc., 1991a) to a maximum depth of 16 ft. below ground surface (ft bgs) indicated that AOI-1 is underlain by clay, silty clay, sandy silt, and clayey silt. Fill materials were also encountered at one of the three boring locations. The top of the saturated zone in the clays and silts was approximately 11 to 12.5 ft bgs (Espey, Huston & Associates, 1991a) and groundwater was observed at approximately 10-11 ft bgs in open borings (EFEH & Associates, 2001). Numerous borings drilled to the south of AOI-1 at the location of a release of crude oil from a pipeline (Figure 2) in 2014 also indicate that clays with occasional silt, sand, and gravel are present to a depth of approximately 30 feet (URS, 2014).

Underlying the Beaumont Formation are the Montgomery and Bentley Formations (together referred to as the Lissie Formation). The Lissie Formation consists of interbedded sands, silts, and clays. Beneath the Lissie Formation is the Willis Sand, which consists of gravel, sand, silt, and clay. The Willis Sand is also

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the base of the Chicot Aquifer (see below) (Baker, 1979; Lang and Winslow, 1950). Quaternary alluvium is present at the surface to the north of AOI-1 across Vince Bayou. The Quaternary alluvium consists of clay, silt, and sand with abundant organic matter locally and includes point bar, natural levee, stream channel, backswamp, coastal marsh, mud-flat, and narrow beach deposits.

The Goliad Sand and Fleming Formation (also known as the Burkeville Confining System) underlie the Willis Sand. The Goliad Sand and Fleming Formation consist of clay, sand, and sandstone interbeds, with some occasional limestone encountered in the Goliad Sand. The sands consist of medium to coarse grained quartz and chert (Barnes, 1982). Beneath the Fleming Formation is the Oakville Sandstone formation (also known as the Jasper Aquifer) (Baker, 1979; Lang and Winslow, 1950).

The two primary hydrogeologic units in the vicinity of AOI-1 are the Chicot and Evangeline Aquifers. The Chicot consists of the Beaumont Formation, Lissie Formation, and Willis Sand. The upper part of the Chicot Aquifer consists of the Beaumont Formation and does not typically yield large volumes of groundwater to wells due to the presence of clay and silt and lack of interconnected sand units. The groundwater in the upper part of the Chicot Aquifer is also likely to be high in dissolved solids (i.e., "hard") (Lang and Winslow, 1950). Groundwater in the lower part of the Chicot Aquifer (Lissie and Willis) is of good quality, although the salinity increases toward the coast. The base of the Chicot Aquifer is estimated to occur at approximately 800 ft bgs in the vicinity of AOI-1 (Baker, 1979; Lang and Winslow, 1950).

The Evangeline Aquifer underlies the Chicot aquifer and consists of the Goliad Sand and the upper part of the Fleming Formation. The Evangeline Aquifer is estimated to be approximately 2,400 feet thick in the vicinity of AOI-1. The Chicot and Evangeline Aquifers are geologically similar, the main differentiating factor being differing hydraulic conductivity. The Evangeline Aquifer is thought to be one of the most prolific aquifers in the region, producing large amounts of good quality groundwater in the region. The salinity of the groundwater in the Evangeline Aquifer also increases toward the coast. The top of the Evangeline Aquifer in the vicinity of AOI-1 is approximately 800 ft bgs.

The general direction of groundwater flow within the Chicot and Evangeline Aquifers is from the northwest to the southeast (Kasmarek and Strom, 2002). Precipitation entering through the outcrop areas to the northwest of the Site flows downward and laterally through the aquifers toward the coast where it eventually discharges into coastal areas and into Galveston Bay (Kasmarek and Strom, 2002). Based on

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previously conducted site investigation activities, shallow groundwater was encountered 7 to 13 ft bgs and generally flows to the east-northeast (EPA, Preliminary Assessment Report, 2011b).

2.1.3.2 Groundwater Use

The results of a review of online water well databases of the United States Geological Survey (USGS) and Texas Department of Water Resources (TDWR) are summarized on Table 2 and included in Appendix B. A summary of the review is as follows:

1) The database lists a total of 262 wells within one mile of the USOR Property.
2) A total of 105 of the wells are listed as monitoring wells.
3) A total of 102 wells are listed as plugged or destroyed.
4) A total of 14 wells have incomplete information regarding use, ownership, etc.
5) The remaining 41 wells are listed as either unused (5 wells), used for industrial purposes (35 wells) or used for public supply purposes (one well). These 41 wells are listed on Table 2.
6) Two of the wells are listed as being owned by the City of Pasadena, and one of these two wells is listed as being used for public supply (State Well 6523101, approximately 0.5 miles east of the USOR Property, in the Evangeline Aquifer). The City of Pasadena has indicated that these wells are not currently being used as public water supply wells (Personal Communication with Mr. Rick Helton, City of Pasadena, Public Works Department, Water Division, September 29, 2014).

According to the City of Pasadena website, the City of Pasadena obtains its drinking water from surface water (Brazos River) and nine groundwater supply wells (pumping from the Gulf Coast Aquifer) (City of Pasadena, 2014). However, the locations of those nine groundwater supply wells are not provided on the City of Pasadena website. As mentioned above, the City of Pasadena has indicated that they are not currently using any groundwater supply wells in the vicinity of the USOR Property for public water supply.

The City of Pasadena provides water to its residents via a municipal water system, as described above.

As described in Section 5.6 below and in the FSP, a walking survey of immediately adjacent properties (within 500 feet of the USOR Property boundary) will be conducted during the RI/FS to identify the potential presence of un-registered groundwater supply wells.

In summary, based on water well database information and depth to a potable aquifer, it is unlikely that groundwater is being used for any purpose in the immediate vicinity of the USOR Property (i.e., on any adjacent properties). As part of the RI/FS process, the future use of groundwater at the subject property will be prohibited through the use of a restrictive covenant. Furthermore, given the hydrogeologic

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characteristics of the USOR Property area (i.e., likely groundwater flow paths moving toward Vince Bayou), any use of the groundwater in the vicinity would be hydraulically up-gradient of any potential impacts from industrial operations at the USOR Property.

2.2 SITE HISTORY

A detailed summary of the history for the USOR Property is provided in the following sections and was developed through a review of historical aerial photographs (1944, 1953, 1962, 1978, 1979, 1989, 1995, 2002, and 2004-2011), investigation report summaries, and regulatory agency correspondence, inspection reports, historic property maps, historical topographic maps, and miscellaneous memoranda and communication records. References are provided for the key historical events listed below. Historical aerial photographs used to prepare the summary are provided in Appendix C to this work plan.

PBW noted numerous inconsistencies in dates, technical details, waste material volumes, sample locations, analytical results, etc. during its review of the historical documentation listed above. Many of the documents reviewed are over 20 years old and complete copies were not available. The summary below primarily includes information that could be verified from multiple sources. In cases where key information could not be verified, the most accurate summary that could be developed is provided.

2.2.1 Historical Aerial Photograph Review

Based on the review of a USGS topographic map from 1919 and aerial photographs from 1919 through 2011, the USOR Property (as defined by the current property boundary) appears to have been first developed by the mid-1940s. This is consistent with other historical documents indicating that the Chipman Chemical Company (Chipman) began industrial operations by approximately 1946.

A 1919 topographic map shows the property as undeveloped land.

In the 1944 aerial photograph, a rail spur with a loading/unloading area can be seen on the southwestern portion of the property, but no buildings are present. Small areas of disturbed soils are visible along the eastern property line. A drainage ditch traverses from west to east in the central portion of the property. Industrial activity can be seen in the vicinity of the current City of Pasadena stormwater impoundment on the property west of AOI-1. North Richey St. appears to be an unimproved dirt road. A drainage feature is observed east of North Richey Road, entering Vince Bayou approximately 400 feet south of the current confluence of Little Vince Bayou and Vince Bayou.

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In the two 1953 aerial photographs, several small buildings are present at the current location of the warehouse and tanks and a sludge bed can also be seen[2]. The drainage ditch in the central portion of the property has been filled, possibly due to the construction of the southern portion of the current warehouse. The southern area of the property is primarily undeveloped grassland. Areas of bare soil are observed in the northeastern portion of the property and directly north of the property next to Vince Bayou. Land east of Vince Bayou has been cleared.

In the 1962 aerial photograph, additional buildings, which appear to be portions of the current warehouse and the main office, have been constructed. A pipeline can be seen crossing Vince Bayou east of the southern part of the USOR Property. The drainage features observed on the 1944 and 1953 aerial photographs are no longer present. The current confluence of Little Vince Bayou and Vince Bayou is visible in the 1962 aerial photograph, indicating that Little Vince Bayou was re-routed sometime between 1953 and 1962.

In the 1978 and 1979 aerial photographs, the tanks and sludge bed seen in the 1953 and 1962 photographs appear to have been removed, but a small vault or pit can be seen at the northern edge of the former tank area. A few areas of disturbed, bare, and stockpiled soil can be identified in the photograph on the western side of the property and north of the northern fence. North Richey St. has the current due-north alignment and the current bridge over Vince Bayou north of the USOR Property is present.

By 1989, the individual buildings seen in earlier photographs were connected to form the current warehouse. Numerous pipelines can also be seen crossing Vince Bayou south of AOI-1 and the railroad tracks. A small area of disturbed soil can be seen directly east of the northern end of the warehouse.

In the 1995 and 2002 aerial photographs, the property improvements are similar to previous photographs. A possible drainage pathway can be seen from the vault (originally seen in the 1978 aerial) to the northwest corner of the property. Buildings are present on the property northeast of the confluence of Vince and Little Vince Bayous. The rail spur appears to be overgrown and unused in the 2002 aerial photograph. The buildings northeast of Vince Bayou seen in prior photographs are no longer present but some stockpiled materials can be seen in the aerial photograph. Bare soil areas are present in the northwestern area of the property and a small drainage feature is present east of the warehouse and north of the office building.

[2] The "sludge bed" is noted on a historical map of the Chipman Chemical Company operations, circa 1956.

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In the 2004 aerial photograph, the northern section of the warehouse building had been demolished and a tank farm containing approximately 20 ASTs has been constructed. Additional processing equipment can be seen between the warehouse and the tank farm. The stormwater containment pond can be seen west of the warehouse. Stockpiled material, possibly soil, is present in the northeastern corner of the property. Stockpiled material, roll-off boxes, and other storage containers, equipment, and tanks can be seen adjacent to the warehouse and tank farm. Several areas of disturbed soil are visible in the southern part of the property near the rail spur and the fence line next to the pipeline corridor. Bare soil is observed outside the gate north of the entrance road.

In the 2005 aerial photograph, additional tanks have been constructed in the tank farm relative to the 2004 photograph. Bare soil is present along the northern fence line north of the tank farm. Stockpiled equipment is present next to the southeastern corner of the warehouse, and stockpiled materials and roll-off boxes are present south of the entrance road. The bare soil previously seen outside the gate along the entrance road is now a parking area.

In the 2006 aerial photograph, stockpiled equipment is present next to the southeastern corner of the warehouse, and stockpiled materials and roll-off boxes are present south of the entrance road, as in the 2005 photograph. Stockpiled material is present at two locations to the west of the warehouse.

In the 2007 and 2008 aerial photographs, an aboveground pipe can be observed traversing the southeastern portion of the property. Bare soil and drainage from the parking lot outside the fence appears to enter the property directly east of the office building. A loading/unloading area next to the ASTs can be seen on the 2007 aerial photograph. The bioreactor in the northeast corner of the property is first present in the 2007 photograph.

In the 2011 aerial photograph, the stormwater containment pond west of the warehouse appears to be lined and numerous roll-off boxes are located south of the entrance drive. Ponded water can be seen in the paved area between the warehouse and office building. Roll-off boxes are also present along the western property line, between the tank farm and bioreactor as well as east of the warehouse.

2.2.2 Site Operational History

Chipman is the first documented operator at the USOR Property. From 1946 to 1967, Chipman's operations included the blending, formulation, and storage of liquid, solid-granular, and solid-dust herbicides and

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pesticides, including arsenical pesticides, and chlorate and borate pesticides and herbicides (Bayer, 2012; Rhodia, 2012). In 1967, Chipman merged with Rhodia, Inc. Reportedly, Rhodia manufactured fertilizer and sulfuric acid at AOI-1 (TCEQ, 2006); however other documents state that Rhodia continued Chipman's operations (Bayer, 2012). Rhodia and Chipman are predecessor companies to Bayer Crop Sciences, Inc. (Bayer).

Subsequently, from 1973 to 1982, North American Hide Exporters reportedly tanned leather and/or traded raw cattle hides at the property (Hide, 2012). From 1982 to 2003, various owners and lessees operated at the property, including activities related to processing of animal hides. Animal hides were cured with salt to preserve them prior to shipping (TCEQ, 2006). Documents also report that arsenic may have been used in the tanning process (TCEQ, 2006); however, historically, animal hides were tanned using either tannins from the bark and leaves of plants or chromium sulfate (EPA, 1995).

USOR LP began operating a used oil processing and waste treatment facility on the property on June 1, 2003, and purchased the USOR Property on December 13, 2004 (Ameristar, 2012). In 2009, US Oil Recovery No. 2 LLP (operating as MCC Recycling LLP) acquired the former City of Pasadena wastewater treatment plant at 200 N. Richey, and USOR LP's activities at 400 N. Richey St. property expanded to include activities at the 200 N. Richey property.

USOR LP processed used oil and oily sludges, municipal solid waste, characteristically hazardous waste, non-hazardous landfill leachate, contaminated stormwater, wastewater generated from industrial and non-industrial interceptor traps, and Class 1 and Class II industrial waste subject to the wastewater treatment unit exemptions. Wastes were treated by de-watering, via reclamation of recyclable materials through the neutralization of acidic or caustic materials, and/or by the removal of solid materials in the waste through screening, clarification, and biological activity (EPA, 2011b).

After the waste was received by USOR LP, the waste was separated into several concrete pits (presumably those located near the ASTs (Truck Bay Sumps, Figure 3). Wastewater with greater than five percent solids was sent to the concrete pits to be de-watered and solidified. Solids were mixed with lime kiln dust, cement kiln dust, and/or sawdust. Wastewater with less than five percent solids and decant from the other wastewater pits were piped into treatment tanks for the separation of oily liquids and suspended solids. Wastewater was further treated by introducing water treatment chemicals to break the oil/water emulsions and to adjust the pH to precipitate heavy metals. Prior to 2009 the treated wastewater was sent to a wastewater disposal company. After 2009, the treatment effluents were piped via a 6-inch pipeline to the

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wastewater treatment plant (MCC Recycling LLP) property for further treatment and discharge (TCEQ, 2011).

Recovered oily liquids were stored in tanks and recycled at AOI-1. Solidified/dried solids were shipped offsite for disposal (EPA, 2011, Reference 13).

2.2.3 Investigation History

Previous investigations at AOI-1 included the activities described below. As appropriate, data from these investigations are discussed in Section 3.1 of this Work Plan.

Soil Sampling for Rhodia, Inc. (Former Owner) (1971) – More than 300 soil samples were collected from various depths up to 72 inches and were analyzed for arsenic by Shilstone Testing Laboratory, Inc. (Bayer, 2012). No sample locations are available. Arsenic concentrations ranged from less than 10 milligrams per kilogram (mg/kg) to greater than 3,000 mg/kg. The highest concentrations of arsenic were detected in the upper 24 inches of the soil column, but elevated concentrations were also detected at some locations below 24 inches.

Soil Sampling for Rhodia, Inc. (1972-1973) – Approximately 80 samples of soil and water from miscellaneous locations (surface soil, construction pit, ponded water, underground sump, etc.) were collected and analyzed for arsenic (Bayer, 2012). Although no sample locations are provided, the samples were apparently collected from the west side of the present warehouse. Arsenic concentrations in soil samples ranged from the detection limit to 4,000 mg/kg. Arsenic concentrations in water ranged from the detection limit to 2,000 milligrams per liter (mg/L).

Phase 2A Environmental Site Assessment (ESA) for Hoyer USA, Inc. (1991) – The Phase 2A ESA dated October 31, 1991 was prepared by Espey, Huston & Associates, Inc. (1991a) for Hoyer USA, Inc. for an investigation of a below-grade concrete vault that was located west of the warehouse (see description of 1978 and 1979 aerial photographs in Section 2.2.1 above). Three soil samples were collected from three soil borings (B-1, B-2, B-3) (Figure 6) at depths ranging from 11 to 13 feet and one groundwater sample was collected. Samples were analyzed for chlorinated pesticides, polychlorinated biphenyls (PCBs), VOCs, acid extractable organics (phenols), SVOCs, and metals (arsenic and copper). Arsenic was detected in the soil samples at concentrations ranging from 59.6 to 6,120 mg/kg (Table 3). Xylene was detected in one of the soil samples at a concentration of 0.028 mg/kg (Table 4). Various pesticides were detected in the soil samples at concentrations ranging from 0.0037 mg/kg to 8.7 mg/kg (Table 6). Arsenic was detected in the groundwater sample at a concentration of 5.77 mg/L (Table 7). Three pesticides were detected in the groundwater sample at concentrations ranging from 0.00004 mg/L to 0.00022 mg/L (Table 7).

Phase 2B Environmental Site Assessment (ESA) for Covesud S.A. (1991) – A Phase 2B ESA dated November 14, 1991 was prepared by Espey, Huston & Associates, Inc. (1991b) for Covesud, S.A to evaluate a below-grade pit discovered inside the warehouse during the previous Phase 2A ESA. Samples of sludge and water were collected from the pit and were analyzed for arsenic, copper, VOCs, SVOCs,

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total petroleum hydrocarbons (TPH), and pesticides. Arsenic, copper, and various VOCs, SVOCs, and pesticides were detected in the samples. TPH was also detected in one of the samples.

Phase II Environmental Site Assessment for Covesud, S.A. (1995) – Seven surface soil samples and three water samples from three concrete pits containing water and wastewater were collected by Environmental Remedies, Inc. (1995). The samples were analyzed for Toxicity Characteristic Leaching Procedure (TCLP) metals, VOCs, and SVOCs. Sample locations were not provided in the existing copy of the report. Composite samples from Pit 1 identified the presence of mercury and several VOCs and SVOCs. Water samples from Pit 2 identified the presence of barium, cadmium, chromium, and lead. There were no results or summary information for Pit 3, only a description of its dimensions and how this was "nothing more than a water gathering pit adjacent to a valve/fire hydrant".

Soil Sampling by Extra Environmental, Inc. for North American Hide Exporters (1998) – As described in a report dated March 2, 1998 prepared by Extra Environmental Inc. (1998), 20 surface soil samples (0-6 inches) were collected in the vicinity of the former vault located to the west of the warehouse (see previous entries in this section) (Sample numbers 1 through 20, Figure 6). Samples were analyzed for arsenic. Arsenic concentrations varied from the detection limit (<2.5 mg/kg) to 190 mg/kg (Table 3). The report indicated three areas of potential impact: (1) north of the former vault area where the highest concentrations occurred; (2) south of the former vault area and adjacent to the former warehouse; and (3) south of the former vault area and west of the former warehouse.

Environmental Site Assessment for ReMax Southeast (2001) – As described in an Environmental Site Assessment report prepared by EFEH & Associates (EFEH, 2001), soil and groundwater samples were collected and analyzed for arsenic, and one groundwater sample was analyzed for chlorinated pesticides. Due to poor documentation in the existing copy of the report, it is difficult to draw conclusions regarding sampling locations and analytical results. The report indicated that the rail spur at the rear of the property had been removed and that the warehouse was being used to store appliances and for church storage.

Affected Property Assessment Report (APAR) (2002) – An APAR dated May 16, 2002 was submitted by Mr. Decker McKim to the TCEQ. The APAR summarizes data that were collected during previous investigations at AOI-1 and contains no new data. TCEQ issued a Notice of Deficiency (NOD) on August 29, 2002, and requested a revised report to fulfill the Agency reporting requirements. It also required further information related to the use of the critical protective concentration level (PCL) for arsenic of 200 mg/kg, since 18 soil samples exceeded the soil to groundwater PCL of 2.5 mg/kg. The letter also requested Synthetic Precipitate Leaching Procedure (SPLP) testing be performed on soil samples. The APAR was approved by TCEQ on October 17, 2003.

Report of Buried Waste Pit Removal (2003) – A report dated September 22, 2003 was submitted by USOR LP and documented the removal of the buried waste pit located west of the warehouse (TCEQ, 2011, Reference 11). No analytical data or sample location maps are provided in the existing copy of the report.

TCEQ Waste Program Sampling (2005) – Samples of surface soil were collected by a TCEQ Region Waste Program investigator from an area of apparent distressed vegetation near a manhole on the southeast side of the USOR property (TCEQ, 2011). The samples were analyzed for RCRA metals; copper; nickel; zinc; benzene, toluene, ethylbenzene, and total xylenes (BTEX); and TPH. Sample locations and analytical laboratory reports were not provided in the TCEQ Investigation Report, though some analytical results were tabulated in the report and are included in Tables 3 and 4 of this RI/FS WP. According to the report, results showed concentrations above TCEQ Commercial/Industrial PCLs for soil protective of Class 1/2 groundwater for arsenic, lead, and mercury (Sample groups T-11590 and T-11591,

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Table 3). The elevated concentrations were near the manhole and at the stormwater outfall near the front gate. It should be noted that $^{Tot}Soil_{Comb}$ PCLs were not exceeded for any of the compounds evaluated.

TCEQ Waste Program Sampling (2006) – Soil samples were collected by TCEQ personnel at three locations: (1) the northwest corner of the tank farm where an oil spill occurred (sample E-1, Figure 6); (2) at the north end of the former buried waste pit (see above) located to the west of the warehouse building (sample E-3, Figure 6); and (3) in a drainage area west of the warehouse building (sample E-2, Figure 6) (TCEQ, 2011). Samples were analyzed for metals, pesticides, VOCs and SVOCs (Tables 3 through 6). The samples contained concentrations of arsenic, barium, lead, mercury, several pesticides, SVOCs, and VOCs exceeding commercial/industrial PCLs. According to USOR LP, impacted soil from the oil spill was removed although there is no information related to the actual removal of the soil.

TCEQ Waste Program Sampling (2007) – Six soil samples were collected by TCEQ Region 12 Waste Program investigator after a leak was observed in the aeration basin (bioreactor) (TCEQ, 2011). Sample locations are shown on Figure 6 (Samples T20169-1 through T20169-6). Samples were analyzed for metals and total petroleum hydrocarbons (TPH) (Tables 3 and 4). The two samples collected on the adjacent property contained petroleum hydrocarbons that required remediation. All six samples contained arsenic, lead, and/or mercury exceeding TCEQ TRRP Tier 1 residential PCLs. There is no indication that the release migrated beyond the sampling point 88 feet north of the USOR property boundary.

Report on Completion of Remediation Activities (2009) – A letter report dated October 12, 2009 was submitted to TCEQ by USOR LP (TCEQ, 2011) that documented the completion of remediation activities following a March 14, 2009 release of wastewater from the bioreactor (aeration basin). After removal of approximately 115 cubic yards of soil from the release area, 24 soil samples were collected and analyzed for metals, VOCs, and SVOCs (sample group A1, Figure 6). Arsenic concentrations ranged from 0.917 mg/kg to 54.7 mg/kg (Table 3, Figure 6) and indicated that some samples collected to the north of the property boundary contained elevated arsenic concentrations. VOCs and SVOCs were not detected in any of the samples.

EPA START–3 Trip Report (2011) – In March 2011, Weston Solutions, Inc., an EPA contractor, collected samples of soil from the USOR property and from areas outside of the USOR property (samples SS-01 through SS-05, Figure 6), and samples of surface water and sediment from Vince Bayou and Little Vince Bayou (sample groups SW- and SED-, Figure 6) (EPA, 2011b). Samples were analyzed for metals, VOCs, and SVOCs. Sample results from these historical sampling activities are shown Tables 3, 8, 9, and 10. Sample locations are shown on Figure 6.

2.2.4 Removal/Response Actions

This section describes past removal or remedial actions that have been performed at AOI-1. In addition, proposed remedial actions performed by the PRP Group or currently being performed under the direction of the PRP Group are described.

2.2.4.1 Property Owner Actions

December 7, 1973 – As described in a progress report from Rhodia Inc., Chipman Division dated December 7, 1973 (Bayer, 2012) related to actions required following a court hearing, the removal of 5,000 cubic yards of arsenic-contaminated soil from an area on the west side of the warehouse building

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was completed. The contaminated soil was disposed in a pit (or pits) located on the southwestern part of the property (see Figures B-1-5 and B-1-6 in Appendix C, possibly showing the location of the disposal pit or pits). The pit or pits were excavated, lined with lime, filled with the arsenic-contaminated soil from the west side of the warehouse, and covered with soil.

1990 – Arsenic-contaminated soil was removed and placed in a pit on the west side of the warehouse and mixed with lime to form calcium arsenate and thus render it insoluble in water (TCEQ, 2011, Reference 27). This is later referred to as the "arsenic waste pit".

September 22, 2003 - USOR LP removed 1,608 cubic yards of arsenic waste and soil from a buried waste pit on the west side of the warehouse (TCEQ, 2011, Reference 23). This material was disposed at an off-site disposal facility.

2009 - Following a release of "a few hundred gallons" of wastewater (TCEQ, 2011, Reference 30) from the west side of the bioreactor on March 14, 2009, which migrated north on the property for a distance of approximately 150 feet and then outside of the USOR Property a distance of another approximately 200 feet to the north, USOR LP initiated response actions that included removal of liquids by vacuum truck and removal of about three inches of soil by dozer, backhoe, and hand excavation from the affected areas. A total volume of approximately 115 cubic yards of soil was disposed at an off-site disposal facility.

2.2.4.2 EPA Lead Actions

July through August 2010 - EPA performed an Emergency Response and Removal Action at AOI-1 during the period between July 1 and August 2, 2010 (EPA, 2011b). The removal action activities included securing and inventorying 225 roll-off boxes, 797 drums, and 212 poly totes and disposing of approximately 392,000 gallons of non-hazardous material off-site.

November 2010 – Following a heavy rain, TCEQ investigators observed that an "oily liquid" had drained from the parking lot area, down the front driveway, and into the bar ditch located along N. Richey Street (TCEQ, 2011, Reference 18). After gaining access to the property, TCEQ personnel observed oily liquid in the parking lot, several of the truck bays, and the secondary containment area of the tank farm. Liquids were recovered from the north and south secondary containment tank farm areas, sumps and bays, and parking lot (TCEQ, 2011, Reference 18). As a result of several tanks leaking in the north tank farm, oily liquid and sludge from the tanks were drained into the containment area (TCEQ, 2011, Reference 18). Approximately 410,000 gallons of non-hazardous oily liquid waste were transported off-site for fuels blending/recycling. Approximately 11,751 gallons of hazardous sludge and five drums of hazardous sludge washout were disposed off-site. In addition, nine vacuum boxes containing 89.36 tons of non-hazardous sludge and four vacuum boxes of hazardous sludge were disposed of off-site. EPA personnel completed the emergency response on December 20, 2010 (TCEQ, 2011, Reference 18).

2.2.4.3 PRP Removal Actions

The PRP Group is in the process of implementing a series of removal actions to address current potential source areas on the USOR Property. Specific removal action scopes were described in addenda to the EPA-approved Site Stabilization and Monitoring Work Plan submitted in accordance with the Removal

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Action AOC requirements. Periodic discharges of stormwater from the containment pond to Vince Bayou are performed as needed in accordance with an authorization from the EPA and TCEQ.

2.2.4.4 Other Actions in the Site Vicinity

On March 29, 2013, a release of light crude oil was identified from the Shell Pipeline Company LP (Shell) West Columbia 16-inch pipeline located to the south of the USOR property. The actual release location is approximately 325 feet from the southern property boundary (Figure 2). The estimated volume of the release was 940 barrels (about 40,000 gallons). Approximately 50 barrels (2,100 gallons) of crude oil was released to Vince Bayou via a storm drain (EPA OSC, 2013) located upstream of the USOR Property. The release to Vince Bayou was contained using hard and sausage boom and recovered.

The upland release area was excavated by Shell and approximately 4,689 tons of affected soils were disposed off-site (URS, 2014). A crude oil recovery system was installed and URS is continuing to recover oil from the system, though the volume of oil recovered has decreased over time. Crude oil is also being removed from monitoring wells, as needed. To date, approximately 377 barrels (15,840 gallons) of oil have been recovered. A slurry wall was installed to the west of the release area/pipeline corridor, between the release area/pipeline corridor and a residential neighborhood. The land-side component of the release response action is being conducted by Shell via the voluntary cleanup program of the Railroad Commission of Texas (RRC). The formal agreement to conduct the voluntary cleanup is between CenterPoint Energy (the landowner) and the RRC.

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3.0 INITIAL EVALUATION

3.1 EXISTING DATA

The environmental data from the previous AOI-1 investigations described in Section 2.2.3 were evaluated to provide a preliminary indication of conditions at AOI-1 and to provide a basis for the list of COPCs for the RI/FS at AOI-1. Existing data were also reviewed and used during development of the PCSMs and the data needs summary (See Sections 3.3 and 3.4, below).

Existing soil and groundwater data from the USOR Property were compiled into the following tables provided in this RI/FS WP:

Table 3 - Metals Concentrations in Soil Samples
Table 4 – Volatile Organic Compound and Total Petroleum Hydrocarbons Concentrations in Soil Samples
Table 5 –Semi-Volatile Organic Compound Concentrations in Soil Samples
Table 6 – Pesticide Concentrations in Soil Samples
Table 7 – Metals and Pesticides Concentrations in Groundwater Samples
Table 8 – Metals Concentrations in Surface Water Samples – 2011 Data
Table 9 – Metals Concentrations in Sediment Samples – 2011 Data
Table 10 – Volatile and Semi-Volatile Organic Compound Concentrations in Sediment Samples – 2011 Data

The soil data tables also contain any data from off-property areas that were investigated as a result of past releases from the USOR Property. Surface water and sediment data collected for EPA in 2011 (Weston Solutions, Inc., 2011) from Vince Bayou and Little Vince Bayou were also compiled since these data have been used by EPA to rank the Site using the HRS. Please note that data from Vince Bayou and Little Vince Bayou likely reflect constituents derived from non-Site areas since there are other industrial activities along the bayous and the bayous are tidally influenced. All of the existing data are used for scoping purposes only and are not intended for use in risk assessment calculations or as the sole basis for evaluation of potential remedial alternatives in the FS. Sampling locations for the existing data shown in the tables are shown on Figure 6.

It should be noted that historic data for soil and groundwater at the USOR Property are limited. Furthermore, much of the soil and groundwater data from historical documentation for the USOR Property are of limited value due to the absence of supporting information such as sample location maps, QA/QC data, and/or analytical method information. Also, the use of older data is compromised due to changes in analytical methods, QA/QC procedures, etc. For these reasons, some data from previous

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investigations at the USOR Property were not included in the summary tables. Finally, due to the range of different qualifiers used in the historical data packages reviewed, laboratory qualifiers (flags) were not included for all data in summary Tables 3 through 10. A consistent set of qualifiers was developed and used for the data summary tables.

Given these limitations, the existing data were not formally compared to the preliminary risk-based screening values (PSVs), which were developed for the RI/FS and are used as the basis for the evaluation of data collected during the RI/FS. The detailed description of the process used to identify and use PSVs for each sample medium is provided in Section 5.6 and the PSVs are provided in the QAPP (Tables 2-11).

3.2 POTENTIAL SOURCE AREAS AND CHEMICALS OF POTENTIAL CONCERN

The following Potential Source Areas (PSAs) were identified at AOI-1 based on the operations history, previous investigations, and existing data, as described above.

1) Drums;
2) Bioreactor (Aeration Basin);
3) Sumps;
4) Totes;
5) Containment Pond;
6) AST;
7) Roll-off Boxes/Frac Tanks;
8) Impacted Soil (including the former buried waste pit to the west of the warehouse that was identified in historical documents);
9) Unknown Subsurface Sources (Pits, Sumps, etc.); and
10) Pipelines.

PSAs 1-7 listed above represent the various vessels that were used to contain waste materials handled during USOR's operations at AOI-1, and were the vessels that were left at AOI-1 when USOR LP ceased operations at the property. Removal actions to address PSAs 1-7 have either been implemented or will be implemented at AOI-1. PSA 8 (Impacted Soil) is included as a PSA to address any release of COPCs that may have resulted from the use of PSAs 1-7 for waste containment, but that was not addressed as part of the removal actions. PSA 9 (Unknown Surface Sources) is included to address potential unknown sources of COPCs that were not addressed in previous investigations or referenced in historical documents. PSA 10 is included to address the potential release of COPCs from the various pipelines used during USOR's operations (e.g., the pipeline that connected AOI-1 to AOI-2, as described in Section 2.2.1).

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As also mentioned in Section 2.2.4.3, removal actions to address PSAs 1-7 listed above are being developed and implemented. Some of these removal actions have been completed. Due to the nature of the remaining removal actions and the associated field work, there is the potential for interference with the performance of the activities described in this RI/FS WP. Consequently, the RI/FS schedule described in Section 6.0 and shown on Figure 10 coordinates the RI/FS activities with the planned removal action work so as to avoid any potential interference between these efforts.

A preliminary list of COPCs has been developed based on historical data for hazardous substances present at the USOR Property, waste materials previously handled or currently present at the USOR Property, and analytical laboratory results of samples of environmental media collected from the USOR Property and nearby off-property areas. Samples were collected by EPA and TCEQ (or their contractors) during release response actions prior to July 2010 or stabilization activities conducted by EPA (see Section 2.2.4). Prior to July 2010, samples were collected during release-related response actions including samples of liquids leaking from containment vessels, ponded liquids, and/or impacted soil. After July 2010, liquid, sludge and solid samples were collected from drums, the bioreactor, sumps, poly totes, above-ground storage tanks, the containment pond, and roll-off boxes. Samples were analyzed for VOCs, SVOCs, pesticides, metals, and TPH. As summarized in the HRS Documentation Record (EPA, 2011b), VOCs, SVOCs, pesticides, metals, and TPH were detected in the samples and are associated with the USOR Property. A review of past industrial operations at the USOR Property and the results of previous environmental investigations conducted at the USOR Property support the inclusion of VOCs, SVOCs, pesticides, herbicides, and metals on the initial list of COPCs for the RI/FS. For example, metals (arsenic), pesticides, and herbicides are included due to historic use of the property for the manufacture of arsenical pesticide products, and the blending and storage of pesticides and herbicides. Therefore, samples for the first iteration of data collection will be analyzed for VOCs, SVOCs, metals, pesticides, herbicides, and TPH. The specific analytes for each COPC group are listed in Tables 2 through 11 of the QAPP, including the method quantitation limit (MQL) for each analyte.

Based on the information provided in the Evaluation of Analytical Data Collected for PCBs and Dioxins, dated November 19, 2013 (PBW, 2013) and subsequent clarifying correspondence with the EPA, these two classes of contaminants are not included in the list of COPCs for USOR Operations. However, if unambiguous sources of PCBs and/or dioxins are discovered on property then this decision will be revisited.

The COPC list will be refined after each iteration of the RI/FS as USOR Property data are evaluated such

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that only those COPCs that originated at the USOR Property are moved forward in future iterations, as described more fully in Section 5.6.

3.3 PRELIMINARY CONCEPTUAL SITE MODEL

PCSMs are presented for human health and ecological pathways as Figures 7 and 8, respectively. PCSMs present the current understanding of the type and occurrence of potential contaminant sources and possible exposure pathways associated with AOI-1. Consistent with EPA RI/FS Guidance (EPA, 1988), the PCSMs were developed on the basis of existing AOI-1 conditions (i.e., land use, historical process knowledge, hydrogeology, source areas, COPCs, and existing data). The hypotheses presented in the PCSMs will be tested iteratively, refined, and modified as warranted as data are collected during the RI. The AOI-1 conditions and available information used to develop the initial PCSMs were discussed in Section 2.0, Site Background and Physical Setting.

The human health and ecological PCSMs for the USOR Property (Figures 7 and 8) show the potential range of exposure pathways including the primary and secondary sources, the primary and secondary release mechanisms, the exposure media (i.e., soil, groundwater, surface water, sediment, air, etc.), and potential receptors. The processes or mechanisms by which receptors may possibly come into contact with USOR Property-related COPCs are shown from left to right on the figures. Exposure pathways are dependent on current and future land use, which is expected to remain as an industrial land use (through implementation of a restrictive covenant during the RI/FS process). An exposure pathway is defined by the presence of the following four elements (EPA, 1989a):

- A source material and mechanism of constituent release to the environment;
- An environmental migration or transport media (e.g., soil) for the released constituents;
- A point of contact with the media of interest; and
- An exposure route (e.g., ingestion) at the point of contact.

An exposure pathway is considered "complete" if all four elements are present.

Potentially complete human health exposure pathways are indicated with a "C" in the potential receptors column of Figure 7. Potentially complete pathways are assumed to be complete based on existing information. Although a pathway may be preliminarily identified as potentially complete, additional data are often needed to confirm that the pathway is complete and evaluate the significance of the potentially complete pathway. The PCSM also identifies possibly complete pathways with a "P" in the potential receptors column of Figure 7. At this stage of the RI/FS, it is not known whether these media have been

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impacted by USOR Property-related activities. Information related to potentially and possibly complete exposure pathways will be used to identify data gaps and help guide the data collection effort, ultimately ensuring that sufficient data are collected to facilitate quantitative evaluation of these pathways in the human health risk assessment. Pathways that are not viable are considered incomplete and are identified with an "I" in the potential receptors column on Figure 7, most often because the receptor will not contact the media specified.

Potentially complete ecological exposure pathways are indicated with a "C" in the potential receptors column of Figure 8. Potentially complete pathways are assumed to be complete based on existing information. Although a pathway may be preliminarily identified as potentially complete, additional data are often needed to confirm that the pathway is complete and evaluate the significance of the potentially complete pathway. The ecological PCSM also identifies potentially complete pathways for which potential exposures will be evaluated in an iterative manner with a "P" in the potential receptors column of Figure 8. At this stage of the RI/FS, it is not known whether these media have been impacted by USOR Property-related activities. Information related to complete and potentially complete exposure pathways will be used to identify data gaps and help guide the data collection effort, ultimately ensuring that sufficient data are collected to facilitate quantitative evaluation in the ecological risk assessment. Pathways that are not viable are considered incomplete and are identified with an "I" in the potential receptors column on Figure 8, most often because the receptor will not contact the media specified.

3.4 DATA NEEDS IDENTIFICATION

Based on an evaluation of the potentially complete pathways identified in Figures 7 and 8, and an analysis of the information needed to assess the completeness of these pathways, the data needs listed in Table 11 were developed for AOI-1. Table 11 illustrates the data needs evaluation process by identifying the conceptual model exposure routes that were either potentially complete, possibly complete, or incomplete; identifying the specific data needs for determining whether that pathway is complete and significant; listing the existing data that were reviewed as part of an initial evaluation; and conceptually describing the RI activities to be performed to fill the identified data need. The conceptual descriptions of RI activities in this table were then used to develop the framework of the RI/FS tasks described in Section 5.6 of this work plan.

The FS will be developed based on RI (and associated risk assessment) findings and conclusions. he development and evaluation of remedial alternatives, if warranted, will be performed as specified in the

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RI/FS guidance. First, the risk assessment findings will be used to develop remedial action objectives. General response actions will be developed to address these objectives, and preliminary technologies/alternatives associated with those response actions will be screened.

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4.0 WORK PLAN RATIONALE

This section addresses the data requirements for the human health and ecological risk assessments and the remedial alternatives evaluation, and describes how the proposed remedial investigation will satisfy these data needs.

4.1 DATA QUALITY OBJECTIVES

Data quality objectives (DQOs) are developed as part of the systematic planning process to define the type and quality of the data sufficient to characterize the USOR Property, conduct human health and ecological risk assessments, and perform the evaluation of remedial alternatives. The DQOs, therefore, support the rationale for the USOR Property investigation strategy and approach detailed in the following section.

The DQOs have been developed in general accordance with the "Guidance on Systematic Planning Using the Data Quality Objectives Process, EPA QA/G-4" (EPA, 2006). When data are collected during the RI/FS, the EPA-recommended systematic planning tool is the DQO process. The DQO process is a seven-step planning approach to develop sampling designs for data collection activities that support decision-making. The seven steps of the DQO process described by EPA are:

1. State the problem.
2. Identify the goal of the study.
3. Identify information inputs.
4. Define the boundaries of the study.
5. Develop the analytic approach.
6. Specify performance or acceptance criteria.
7. Develop the plan for obtaining data.

As noted in Section 1.0, the overall issue to be addressed by the RI/FS is to evaluate the nature and extent of contamination resulting from operations at the USOR Property, to obtain data to fill data gaps in the PCSM for the USOR Property, to assess the risk from contamination at the USOR Property to human health and the environment, and allow the development and evaluation of remedial alternatives. More specific problems and subsequent steps in the DQO process vary for each of the indeterminate or complete and potentially significant exposure routes identified in the PCSM and used to develop the data needs in Table 11. The seven DQO steps for each of these exposure routes were completed as part of the QAPP development process and are addressed on a receptor/media basis in Section 2.4 of the QAPP.

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4.2 WORK PLAN APPROACH

The general technical approach for the RI/FS at AOI-1 is based on the following overarching components:

- Developing PCSMs that focus the RI/FS on potential receptors and an evaluation of the risks associated with the potential exposure pathways identified in the PCSMs through a receptor-based investigation program. As the investigation proceeds, the PCSMs are updated to incorporate the information obtained;
- Considering the potential contaminant issues at AOI-1 within the context of the local and regional environmental issues, specifically those related to historical and current impacts to Vince Bayou and the HSC from industrial activities and pollution unrelated to operations at AOI-1;
- Understanding that the investigative approach must consider the desired end point for the property (e.g., industrial re-use of the property), while characterizing the nature and extent of COPCs and supporting remedy selection and design (if necessary);
- Recognizing at the project outset that the investigative and, if necessary, remediation approach must consider current and anticipated land use(s) at AOI-1, which dictate potential human health and ecological exposure pathways;
- Selecting the right combination and sequencing of rapid site characterization technologies (e.g., HRSC) and conventional sampling and analysis techniques to yield cost-effective, defensible site characterization data that facilitate risk assessment and remedial planning;
- Developing a base of information that documents the effectiveness of natural attenuation processes to remediate contamination so that these processes can be considered fully during remedy selection, as appropriate for the COPCs and Site conditions for AOI-1, and in accordance with the National Contingency Plan; and
- Seeking opportunities to leverage the possible remedial actions at AOI-1 with potential industrial re-use of the property, as appropriate.

These overarching components of the RI/FS approach have been used as a foundation for the development of the detailed RI/FS Tasks 1-4, 6, and 7 described in Section 5.0.

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5.0 RI/FS TASKS

As noted in Section 1.2, this RI/FS WP documents the decisions and evaluations made during the development of the Scope of Work (i.e., the RI/FS scoping process) and presents a summary of the work to be performed during the RI/FS. The RI/FS WP also presents the initial evaluation of existing AOI-1 data, and describes the project management team and schedule.

The following tasks are designed to meet the objectives of the RI/FS.

5.1 TASK 1: SCOPING

The purpose of Task 1 (Project Planning) is to determine how the RI/FS will be managed and controlled. Scoping of the RI/FS at AOI-1 was completed by the PRP Group, EPA, and TCEQ early in the process to prepare the Scope of Work included as an appendix to the SOW. The Scope of Work was prepared using the following primary sources of existing information regarding AOI-1:

- Information describing hazardous substance sources, migration pathways, and potential human and environmental receptors was obtained from reports prepared by EPA, TCEQ, and previous consultants, other historical documents in the administrative record compiled by EPA, examination of historical aerial photographs, and through multiple visits to the property.
- Existing data from previous investigations by the TCEQ and EPA were tabulated by media (i.e., soil, groundwater, surface water, and sediment) and type of analyte (i.e., metals, VOCs, SVOCs, pesticides/herbicides). This information was provided in Tables 2 through 8 of the Scope of Work for AOI-1, which were then included as Tables 3 through 10 in this Work Plan, as described previously. Please note that additional data were added to the summary tables after completion of the Scope of Work, and these data are included in Tables 3 through 10 in this Work Plan.

The information contained in the Scope of Work document was used as the primary basis for this RI/FS WP.

Additional evaluation of existing information was conducted to prepare this RI/FS WP, including:

- Existing information regarding physiography, geology, hydrogeology, hydrology, meteorology, and ecology of AOI-1 was obtained from the literature (e.g., regional publications), TCEQ reports (TCEQ, 2011), and selected documents in the EPA administrative file.
- Existing information regarding demographics and land use was obtained from various sources and the Community Involvement Plan (EPA, 2011a).

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- Existing data describing residential, municipal, or industrial groundwater wells on and near the AOI-1, and data identifying surface water uses for areas surrounding AOI-1, were obtained from various sources.

- Existing data regarding threatened, endangered, or rare species; sensitive environmental areas; or critical habitats on and near the USOR Property were obtained from Texas Parks and Wildlife Department (TPWD, 2014). This information is described in Section 2.1.2.4 of this RI/FS WP.

5.2 TASK 2: REMEDIAL INVESTIGATION/FEASIBILITY STUDY WORK PLAN

The RI/FS WP (this document) is developed in conjunction with the RI/FS SAP and the HASP. The following specific elements are included in this RI/FS WP in accordance with the RI/FS AOC (SOW Paragraphs 21 through 24) and EPA Guidance (EPA, 1988):

- A comprehensive description of the work to be performed, the methodologies to be utilized, and a corresponding schedule for completion;

- Rationale for performing the required activities;

- A statement of the problem(s) and potential problem(s) posed by AOI-1 and the objectives of the RI/FS;

- A background summary for AOI-1, which includes the geographic location, and to the extent possible, a description of the physiography, hydrology, geology, and demographics; the ecological, cultural, and natural resource features; a synopsis of the history of AOI-1 and a description of previous responses and sampling events that have been conducted at AOI-1 by local, state, federal, or private parties;

- A summary of the existing data in terms of physical and chemical characteristics of the contaminants identified, and their distribution among the environmental media at AOI-1;

- A description of the management strategy developed during scoping;

- PCSMs; and

- A detailed description of the tasks to be performed, information needed for each task and for the Baseline Risk Assessment, information to be produced during and at the conclusion of each task, and a description of the work products and deliverables to be submitted to the EPA.

5.3 TASK 3: REMEDIAL INVESTIGATION/FEASIBILITY STUDY SAMPLING AND ANALYSIS PLAN

The RI/FS SAP provides a mechanism for planning field activities. The SAP consists of the following:

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- Volume I – the RI/FS FSP defines in detail the sampling and data gathering methods that will be used for the project. It includes discussions of sampling objectives, sample rationale, locations and frequency, sampling equipment and procedures (including standard operating procedures or SOPs), and sample handling and analysis.

- Volume II – the QAPP describes the project objectives and organization, functional activities, and QA/QC protocols that will be used to achieve the desired DQOs. The RI/FS QAPP also addresses sampling procedures, sample custody, analytical procedures, data reduction, data validation, data reporting, and personnel qualifications.

The RI/FS SAP, including the FSP and QAPP, addressing the above requirements is submitted to EPA concurrent with this RI/FS WP. The FSP and QAPP provide for the preparation of Work Plan Refinement Notices (WRNs) as the need for additional field sampling or quality assurance procedures are identified during the course of the RI/FS.

5.4 TASK 4: REMEDIAL INVESTIGATION/FEASIBILITY STUDY HEALTH AND SAFETY PLAN

An RI/FS HASP must be in place prior to any on-site activities. The HASP describes the safety and health protocols for PBW personnel and contractors during RI/FS field activities. The plan assigns personnel responsibilities, prescribes mandatory safety procedures, and establishes personal protective equipment requirements for the various field investigation tasks. The HASP provides for the addition of plan addenda as additional sampling or health and safety activities are identified during the course of the RI/FS.

5.5 TASK 5: COMMUNITY INVOLVEMENT PLAN

The development and implementation of community relations activities are the responsibilities of EPA. A Community Involvement Plan (CIP) was prepared by EPA (EPA 2015) to facilitate two-way communication between the communities in and surrounding the Site and EPA and to encourage community involvement in Site activities. EPA will utilize the community involvement activities outlined in this plan to ensure that the community is continuously informed and provided opportunities to be involved. Per the CIP, EPA has established a local repository for information about the Site at the Pasadena Public Library, 1201 Jeff Ginn Memorial Drive, Pasadena, Texas, 77506.

EPA drew upon several information sources to develop the CIP, including community interviews, Site visits, and Site files. EPA's Regional Office will oversee the implementation of the community involvement activities outlined in the Plan. As indicated therein, EPA will revise the CIP as community

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concern warrants or at least every three years until the Site is closed. The extent of the Respondents' involvement in community relations activities will be determined by EPA.

5.6 TASK 6: SITE CHARACTERIZATION

Site characterization involves the implementation of the RI/FS WP as detailed in the SAP, including the FSP and QAPP, and in accordance with the HASP. The specific subtasks of the RI/FS outlined below are focused on environmental media (i.e., soil, groundwater, surface water, and sediment), and involve coordination of field investigation and data analyses activities. As described in Section 1.2 of this RI/FS WP, and consistent with EPA's expectations as noted in Paragraph 2 of the SOW, an "iterative" approach to data collection will be used during the RI/FS to maximize the overall investigative effectiveness and efficiency and assist in decision making. In the first iteration of data collection (Iteration 1), samples will be collected from 1) on-property soil, groundwater, surface water, and sediment, and 2) off-property soil and groundwater. All samples will be analyzed for the initial list of COPCs. The results of the evaluation of the first iteration data (i.e., comparison to screening levels) will then be used to develop an investigative strategy for off-property sediment and surface water (Iteration 2) based on those COPCs that were determined to have originated at the USOR Property. Iteration 2 will include sampling of surface water and sediment in Vince Bayou and possibly Little Vince Bayou, as appropriate, with sample locations/collection details and analyte list developed based on data from the previous investigation iteration. Finally, based on the evaluation of all previously collected data in Iterations 1 and 2, sampling of fish, shellfish, and/or other biota in Vince Bayou (and possibly Little Vince Bayou) will be conducted during Iteration 3, if warranted. Evaluations of "background" concentrations of COPCs in relevant environmental media will be conducted, as described in the sections below. It is envisioned that a streamlined data evaluation and reporting process will be used to move from iteration to iteration in the RI as efficiently as possible (see below). After each data collection iteration the PCSMs presented in Figures 7 and 8 will be updated and refined as necessary. The iterative approach to the investigation and the streamlined data evaluation and reporting process are described in greater detail below.

To assess the extent of COPCs in environmental media during the RI/FS, an extent evaluation will be conducted. For each environmental medium to be evaluated at the USOR Property, lists of preliminary screening values (PSVs) for the applicable COPCs were established (Tables 2-11 of the QAPP). PSVs are the available human health-based and ecological-based criteria for a given media, using available literature sources. In general, the lowest PSV for a particular COPC will be used to evaluate extent of that COPC at AOI-1. The PSVs for the human health assessment are conservative risk-based regional

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screening levels (RSLs) published by EPA (EPA, 2014) and, in the absence of EPA RSLs, the TCEQ PCLs adjusted to a 10^{-6} carcinogenic risk (TCEQ, 2014). The PSVs for the ecological assessment are risk-based ecological screening values. The extent evaluation PSVs will be updated to reflect currently available values at the time of evaluation for all compounds detected and may also be revised to account for background concentrations if appropriate (based on the presence of background concentrations of a specific COPC). It should also be noted that although the PSVs will be used to evaluate the lateral extent of a COPC, COPC concentrations that exceed PSVs may not necessarily be indicative of adverse effects. Finally, the PSVs will not be used as target remediation criteria.

The following sections provide a summary of the data collection approach and the investigation tasks to be completed for the RI/FS at AOI-1.

5.6.1 RI/FS Data Collection Approach

The PCSMs, the conceptual descriptions of RI/FS activities in the data needs summary table (Table 11), and the DQOs in the QAPP were used to develop the initial RI/FS data collection activities and sample locations described in the following sections. Historical information (e.g., maps, aerial photographs, previous investigation reports, reports of releases at AOI-1, and other documentation), property reconnaissance, and to a lesser degree the limited existing data, were used to guide the placement of initial investigation locations. Appendix D provides a more detailed discussion of the rationale for each sample location for on-property media as well as off-property soil sample locations. These samples were selected to optimize the likelihood of detecting potential impacts from the USOR Property. Relative to a grid-based sampling program, these judgmental samples will likely overestimate potential risk, and as such this sampling approach will provide a higher degree of confidence in evaluating whether the COPC originated at the USOR Property. The number of samples and sample locations ultimately needed to satisfy overall RI/FS objectives will be determined by the USOR Property conditions and the data obtained during the several iterative phases of the RI/FS, as described below. However, consistent with the overarching objective of the RI/FS, sample numbers/locations are proposed herein for the initial investigation iteration (i.e., on-property soil, groundwater, surface water and sediment sampling and off-property soil and groundwater) to fill the identified data needs.

As noted previously, the first iteration of data collection will focus on on-property environmental media (i.e., on-property soil, on-property groundwater, on-property surface water and on-property sediment) and off-property soil and groundwater. This is due to the nature of the USOR Property where the source areas

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are located topographically higher than some of the potential receptors and potential impacts are primarily related to the movement of COPCs from the USOR Property to the receptors via surface drainage. Furthermore, receptors in Vince Bayou and Little Vince Bayou also are potentially impacted from the other documented industrial activities within the Vince Bayou and Little Vince Bayou watershed. In this regard, the determination of the impacts from the USOR Property, versus those from other sources of contaminants to Vince Bayou and Little Vince Bayou, must be carefully executed through the iterative progression of investigation activities beginning on the USOR Property and adjacent properties and working toward Vince Bayou and Little Vince Bayou and including a comprehensive background study for media of potential concern (see below). This approach will allow for the allocation of the relative contributions of COPCs to Vince Bayou and Little Vince Bayou among the multiple potential sources.

A data assessment meeting will be held after completing the data collection for each iteration to review the data, prior to proceeding with the next iteration of sampling. The iterative data collection program is described conceptually in the following table.

ITERATION	DESCRIPTION
1	AOI-1 on-property media (soil, groundwater, and surface water/sediment in the low-lying areas on the southwestern portion of AOI-1) and off-property soil and groundwater will be sampled and analyzed for the initial list of COPCs (metals, VOCs, SVOCs, pesticides, herbicides, and TPH). After data validation, the sample concentrations will be compared to the PSVs for that medium for the extent evaluation. Data assessment tools (summary tables, maps, GIS data visualization, etc.) will be used to assist in making this determination. A working "data assessment" meeting will be held with the EPA, TCEQ and Trustees stakeholders where the data are reviewed and decisions are made regarding: 1) COPCs that will be carried forward and COPCs that can be eliminated from subsequent iterations of the RI/FS; and 2) locations of off-property surface water and sediment samples for the second iteration of the RI/FS. A Workplan Refinement Notice (WRN) with the agreed-upon recommendations for the next iteration of sampling will be prepared for EPA approval. Upon receiving EPA approval, the specific activities proposed in the WRN will be initiated.
2	AOI-1 off-property surface water and sediment will be sampled and analyzed for the COPCs that were carried forward from the first iteration of sampling. After data validation, a working "data assessment" meeting will be held with the EPA, TCEQ and Trustees stakeholders where the data are compared to PSVs and decisions are made regarding 1) COPCs that will be carried forward and COPCs that can be eliminated from subsequent iterations of the RI/FS based on whether that COPC originated at the USOR Property; 2) methods and locations for collection of fish and shellfish samples (if necessary) from Vince Bayou (and Little Vince Bayou, if needed) for the third iteration of the RI/FS; 3) other sampling and analytical considerations, etc. A WRN with the agreed-upon recommendations for the next iteration of sampling will be prepared for EPA

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	approval. Upon receiving EPA approval, the specific activities proposed in the WRN will be initiated.
3	Prior to sampling fish and/or shellfish, sediment and surface water data from Iteration 2 will be evaluated to determine what COPCs should be included in the fish/shellfish sampling program per recommendations and procedures identified in TCEQ, 2002, which is largely based on EPA procedures for evaluating potential impacts from the fish ingestion pathway when establishing surface water quality standards. Fish and shellfish will be sampled and analyzed for the COPCs that were carried forward from the second iteration of sampling. After data validation, the sample concentrations will be compared to the PSVs for biota and/or background concentrations to determine whether or not a COPC originated from the USOR Property. A working "data assessment" meeting will be held with the EPA, TCEQ and Trustees stakeholders where the data are reviewed and decisions are made regarding the need for subsequent sampling for any media.

Given that the number of samples, the locations of the samples, and analytes to be measured in the samples for the off-property sediment, surface water, and fish/shellfish cannot be determined until after the on-property media and off-property soil and groundwater data are evaluated, locations for off-property sediment, surface water, and fish/shellfish (or aquatic and fish dietary items) sampling activities that are described in the following sections cannot be determined at this time. Detailed descriptions of the RI data collection activities are provided below and in the FSP, including descriptions of data collection activities for all iterations of the RI/FS. In other words, even though a particular media will not be sampled in the first iteration of the RI/FS (e.g., off-property sediment), the proposed methods for collection of those particular media samples are included in this RI/FS WP. The specific locations, analytes, and other information required for data collection in Iterations 2 and 3 will be provided in WRNs, including the use of appropriate statistical methods, and the proposed activities will not be initiated until after EPA approval of a specific WRN.

Depending on the results of the initial RI/FS sampling activities, it may be necessary to evaluate concentrations of COPCs present in AOI-1 soil samples that may not be associated with historical AOI-1 industrial activities (i.e., background). Similarly, background concentrations of COPCs in surface water, sediment, and fish or other biota in Vince Bayou and Little Vince Bayou may also need to be evaluated. Background evaluations will be based on the likelihood of specific COPCs being present due to natural or anthropogenic factors unrelated to historical AOI-1 industrial activities. Additional details on background studies, as appropriate, are provided in the following sections. The full scope of the background studies will be developed in conjunction with the EPA, TCEQ, and trustee stakeholders, once it is determined that these studies are necessary, and will include the location(s) for sampling, the number of samples, the

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COPCs to be analyzed, the methods to be used to collect the samples, and the methods to be used to evaluate the data. That additional information will be provided in one or more WRNs as necessary.

Additional information that becomes available during the RI/FS will be considered and the RI/FS WP, FSP, and QAPP updated, as appropriate (e.g., the addition of sampling locations at the location of a previously unknown release) through the WRN process described previously. Also, field observations made during the field investigation will be used to guide additional investigation efforts and/or sampling, as appropriate.

5.6.2 General Investigation Activities

In addition to the pathway-based data needs identified through the PCSM process, several types of data/information are also necessary for completion of the RI/FS. These are listed at the end of Table 11 and include the following:

1) Identification of the potential presence of threatened and endangered species in the USOR Property vicinity;
2) Location of subsurface utilities present at the USOR Property and off-property areas;
3) Evaluation of the erosion potential of soils;
4) Evaluation and analysis of climatic conditions (e.g., precipitation, wind direction, temperature, etc.) that may affect the RI and risk assessments;
5) Zoning and land use in the AOI-1 vicinity
6) Location of the flood plain at AOI-1 (on-property and off-property);
7) Identification of historic USOR Property ownership activities, deed records, restrictive covenants, or deed notices;
8) Evaluation of the presence of ecological habitat; and
9) Conduct of a water well records search to identify registered water wells located within one mile of the USOR Property, including a walking survey of immediately adjacent properties to identify the potential presence of un-registered water wells.

Some of these activities have been completed or partially completed to prepare the RI/FS WP, FSP, and QAPP. As the RI/FS proceeds, these activities will continue and be updated as new data becomes available. Ultimately, the RI Report and risk assessments will utilize the information generated from these activities.

5.6.3 Analytical Methods and Analytes

The historic USOR Property ownership, information about past releases and operations at the property, previous environmental sampling conducted to-date at the property, and waste sampling conducted during

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emergency response activities indicate that various metals, petroleum hydrocarbons, pesticides and herbicides, VOCs, and SVOCs have potentially been released at AOI-1. Based on the COPCs described above, samples for the first iteration of data collection will be analyzed for the following list of COPCs using the methods listed in the following table:

COPC	ANALYTICAL METHODS (AQUEOUS)	ANALYTICAL METHOD (SOLIDS)
VOCs	SW Method 8260B	SW Method 5035/8260B
SVOCs	SW Method 8270D	SW Method 8270D
Metals	SW Methods 6010D/6020B/7470A	SW Methods 6010D/6020B/7471B
Pesticides	SW Method 8081B	SW Method 8081B
Herbicides	SW Method 8151A	SW Method 8151A
TPH	TX 1005	TX 1005

Additional information regarding the specific COPCs for each analytical group, the analytical methods to be used, and the QA/QC procedures to be used during the RI/FS is provided in the QAPP.

The COPCs for off-property sediment, surface water and biota will be developed based on the results from the previous iterations of the investigation and whether the COPC was shown to originate at the USOR Property. Sample collection techniques, analytical method details, and other analyses that will be conducted on selected samples (e.g., total organic carbon, total dissolved solids, bulk density, grain size, etc.) are described in detail in the FSP and QAPP.

5.6.4 Investigation Tasks

5.6.4.1 Iteration 1 - AOI-1 On-Property and Off-Property Soil Investigation

The objective of Iteration 1 is to characterize on-property soil, groundwater, surface water and sediment and off-property soil and groundwater to evaluate the lateral and vertical extent of COPCs. Background soil samples will be collected as well, as discussed below. The general approach to Iteration 1 sampling activities is provided in the following sections. Methods for sample collection are described in Section 5 of the FSP for the various exposure media.

Soil Sampling

Soil samples will be collected at locations based on historical or industrial activities and/or releases and areas that receive drainage from potential source areas. Further discussion of the sampling rationale is provided in Appendix D of this RI/FS WP. The proposed soil sample locations are presented on Figure 9.

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The locations of the actual sample stations may be adjusted based on field observations, access issues, and/or professional judgment. Soil samples are not proposed to be collected beneath the warehouse building given that the concrete slab appears to be approximately five-feet thick. Soil samples will initially be collected from locations adjacent to the warehouse. The need for investigation of the soil beneath the slab will be based on the initial soil sampling results.

At each soil sample location, samples will be collected from the following intervals (if above the saturated zone):

- Surface soil (0 to 0.5 ft bgs);
- Shallow soil (0.5 to 5.0 ft bgs) – actual sample interval will be selected based on field conditions such as organic vapor meter (OVM) readings or potential indications of contamination (e.g. staining, odor, etc.), or from the 4.0 to 5.0 feet bgs interval if potential indications of contamination are not observed in the field; and
- Subsurface soil (greater than 5.0 feet bgs) - actual sample interval will be selected based on field conditions such as OVM readings or other signs of contamination (e.g. staining, odor, etc.), or from the one-foot interval above the saturated zone if potential indications of contamination are not observed in the field.

From the soil sample intervals listed above, actual samples will be collected based on the location and purpose of the particular sample. For samples located within areas of current or historical industrial activity and/or releases, all three sample intervals will be collected. Samples collected within areas that receive runoff from potential source areas will be collected from the uppermost two intervals of the three intervals described above (see Figure 9).

Soil samples will be collected in accordance with the methods described in Section 5.3 of the FSP. Soil samples will be analyzed for the initial list of COPCs, as described in the FSP (Table 3 of the FSP). Should any COPCs in a soil sample from the deepest interval of a boring, but above the uppermost saturated zone, exceed their respective PSVs as detailed in the QAPP, then additional deeper soil samples will be collected as needed to define the vertical extent of that COPC. In the event that the uppermost saturated zone is impacted by COPCs above PSVs, soil samples from below the uppermost saturated zone (e.g., in unsaturated soil beneath the uppermost saturated zone), may be collected, if necessary to fill a risk-based or FS data need.

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Background Soil Sampling

As mentioned above, preliminary background sample locations and a sampling approach are provided herein for the soil investigation. A background soil sample was previously collected by EPA in 2009 in the City of Pasadena Memorial Park (approximately 3,700 feet south of AOI-1) during an investigation of a release from AOI-2 (ATSDR, 2009). The location of Memorial Park is shown on Figure 2. The concentrations of metals and several organic compounds were consistent with what would be expected for an urban area (Tables 3 and 4). Therefore, a background soil sample area is proposed at Memorial Park, located along Vince Bayou approximately 3,000 feet (0.60 miles) south of the USOR property boundary (see Figure 2). Per historical imagery available from Google Earth, this area has been either undeveloped or a recreational park since 1944 (the earliest date that aerial photograph coverage is available). The park has included walking/jogging trails, picnic areas, basketball courts, soccer fields, baseball fields, a skate park, etc. through its history. This location was also chosen due to its proximity to Vince Bayou and, therefore, will include an area that is tidally influenced and an upland area that is not tidally influenced. Collection of samples from this area will require access permission from the City of Pasadena.

A preliminary sampling approach is as follows:

- Within the Memorial Park background area, 10 samples will be collected from the upland area and 10 samples will be collected from a tidally-influenced area within the overall background sampling area;
- Samples will be collected from the surface soil interval (0 to 0.5 ft. bgs); and
- Samples will be collected using the same sampling methods as those used for samples at the USOR Property (see FSP).

The full scope of the background study including the exact location(s) for sampling, the COPCs to be analyzed, and the methods to be used to evaluate the data will be developed in conjunction with the EPA, TCEQ, and trustee stakeholders, and will be documented in a WRN.

Soil Fate and Transport Characterization Samples

Representative samples will be collected to evaluate fate and transport characteristics for COPCs in soil. Locations of samples for fate and transport characterization will be selected based on the types of COPCs exceeding PSVs and will be analyzed for COPC-specific fate and transport parameters such as bulk density, specific gravity, fraction organic carbon (foc), permeability, plasticity, porosity, pH, etc., as determined during the RI/FS. Additional detail is provided on Table 3 of the FSP.

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5.6.4.2 Iteration 1 - AOI-1 On-Property and Off-Property Groundwater Investigation

The objective of the groundwater investigation is to evaluate the lateral and vertical extent of COPCs in the uppermost groundwater-bearing unit and the potential presence of non-aqueous phase liquids (NAPLs) associated with past USOR Property activities. The groundwater investigation will consist of an initial high-resolution site characterization (HRSC) phase that will be used to refine monitoring well placement and completion details. In addition, hydraulic testing will be conducted in selected wells to estimate the hydraulic conductivity of the uppermost groundwater-bearing unit.

High-Resolution Site Characterization

Concepts of the HRSC will be incorporated into the on-property groundwater investigation, as appropriate based on AOI-1 conditions. The locations for HRSC are based on limited knowledge of the characteristics of AOI-1 and are thought to be appropriate for the size of the site. Per HRSC guidance (EPA, 2013), the spacing for investigation locations is dependent on the geological environment and the distribution of contaminant concentrations. These variables are not currently known. Evaluation of the initial HRSC data, along with data from the soil sampling and other RI/FS activities, will allow for a better understanding of Site conditions and the potential need for additional data collection (including HRSC, if appropriate) during subsequent iterations of the RI/FS.

Initially, a series of vertical subsurface profiles using cone penetrometer testing (CPT) and/or the rapid optical screening tool (ROST) will be conducted perpendicular to the direction of groundwater flow (presumed to be to the northeast toward Vince Bayou, based on previous investigations at AOI-1) (Figure 9). These profiles will allow for the collection of a large amount of subsurface data in a short period of time. The CPT/ROST locations will be advanced to the base of the uppermost groundwater-bearing unit. Although limited information is available on the subsurface stratigraphy, it is likely that the uppermost groundwater bearing unit is no deeper than 30 ft bgs; therefore, the projected maximum depth of the CPT/ROST investigations will be 50 feet. At most of the transect locations, only the CPT tool will be advanced to provide stratigraphic information (i.e., soil type – sand, silt, or clay). At locations in the central part of the USOR Property around the warehouse, the CPT and ROST tool will be advanced. The ROST tool provides information on soil type and the potential presence of NAPL in soils. If the presence of NAPL is observed at any location, advancement of the CPT/ROST tool will be halted and the borehole

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will be immediately sealed to minimize the potential of downward migration of NAPL. If evidence of NAPL is not observed, the CPT/ROST boring will continue until the base of the uppermost groundwater-bearing unit.

The CPT/ROST borings will be ground-truthed using DPT soil borings. After review of the CPT/ROST data, DPT borings will be conducted at a subset of the CPT/ROST boring locations (Figure 9). For the DPT borings, soil will be collected for visual inspection for the entire length of the boring. Furthermore, the CPT/ROST borings will be completed prior to the on-property soil investigation described above. Information from the CPT/ROST borings may be used to revise the locations, sampling intervals, etc. for the on-property soil borings. Use of CPT/ROST is not currently proposed for the off-property groundwater investigation.

Additional HRSC techniques will be evaluated as the investigation proceeds. For instance, the collection of depth-discrete groundwater samples using multi-level sampling tools may be proposed if distinct multiple groundwater bearing units are observed, or if the groundwater-bearing units are of significant thickness.

Information from the HRSC techniques, in conjunction with information from the monitoring wells (stratigraphy, water levels, etc.) will allow for assessment of the potential hydrogeologic connection between USOR Property groundwater and Vince Bayou.

Detailed procedures for the groundwater HRSC program are provided in the FSP.

Monitoring Well Installation and Groundwater Sampling

Monitoring wells will be installed within areas of current and/or historical industrial activities and areas receiving drainage from potential source areas. Proposed locations for on-property groundwater sampling are presented on Figure 9. Selected CPT and CPT/ROST borings will be ground-truthed with an adjacent soil boring to confirm the accuracy of the CPT and/or CPT-ROST data (see SB-4 on Figure 9, for example). Monitoring well locations may be modified in the field based on accessibility constraints, field observations, and/or data collected during the HRSC phase. Methods for monitoring well installation, development, water-level measurement (including NAPL measurements, if any NAPL is present), and groundwater sampling are presented in Section 5.4 of the FSP. Groundwater samples will be collected using a peristaltic or bladder pump in accordance with low-flow sampling procedures detailed in Section

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5.4 of the FSP. Groundwater samples will be analyzed for the suite of analytes listed in Table 3 of the FSP.

The locations for off-property groundwater monitoring wells will be developed based on the data collected from the 1) on-property and off-property soil investigation (i.e., presence of source areas, COPCs in soil, NAPL, etc.), 2) the on-property monitoring wells (i.e., the presence of COPCs in groundwater samples, groundwater flow directions, hydraulic characteristics of the groundwater-bearing unit(s), and 3) other information collected during the initial stages of the RI/FS.

If data suggests off-property flow of impacted groundwater, assuming property owner permission is obtained, a staff gauge will be installed at an appropriate location within Vince Bayou to evaluate the potential for groundwater-surface water interactions between shallow groundwater at AOI-1 and Vince Bayou.

The monitoring well and staff gauge locations will be surveyed by a licensed surveyor using Texas State Plane Coordinates. Top of casing elevations for the monitoring wells (and measurement point elevation for the staff gauges) will be surveyed relative to MSL.

Detailed procedures for groundwater monitoring well installation/sampling and staff gauge installation are provided in the FSP.

Hydraulic Testing

Hydraulic testing (slug testing) will be conducted in selected wells to estimate the hydraulic conductivity of the groundwater bearing unit(s). Wells for hydraulic testing will be selected based on lithologic data, water-level measurements, drawdown/recharge behavior during development and sampling, etc. The goal is to select wells that represent the range of hydraulic conditions in the water-bearing unit to be evaluated. These data will be used to establish groundwater classification [in conjunction with total dissolved solids (TDS) concentrations], estimate groundwater flow velocities, evaluate contaminant transport, etc. Detailed procedures for hydraulic testing and data analysis are provided in the FSP.

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Additional Groundwater Delineation

Additional delineation of the lateral or vertical extent of COPCs in groundwater will be conducted by installing additional monitoring wells, as needed. Additional monitoring wells will be installed in deeper groundwater-bearing units, if necessary based on the initial data. The scope of additional groundwater delineation activities will be developed after the on- and off-property groundwater investigations have been conducted and the data assessed. This information will be provided in a WRN submitted to EPA and the proposed activities will not be initiated until after EPA approval of the WRN.

Water Well Survey

As described in Section 2.1.3.2 of this RI/FS WP, based on a search of water well records, no active public water supply wells were identified within one mile of AOI-1. Furthermore, the potential for use of shallow groundwater for purposes other than drinking within the one-mile vicinity is very low given the probable poor quality of the water and limited yield from the shallow Beaumont Formation sand units. To confirm these initial findings, a field (walking or windshield) survey of the properties within 500 feet of the USOR Property boundary will be conducted to confirm/update information obtained from the water well records and to identify any water supply or other non-registered wells. If unregistered wells are identified during the water well survey, they will be noted as being either upgradient or downgradient from the Site, pending the determination of the hydraulic gradient in the shallow groundwater beneath the Site during the RI.

The locations of all City of Pasadena public supply water wells will be identified during the water well survey. Also, the depths and screened intervals of the wells will be compiled.

5.6.4.3 Iteration 1 – AOI-1 On-Property Surface Water Investigation

The objective of this task is to evaluate the extent of potential COPCs in surface water present at AOI-1 to evaluate potential human health and ecological risks. Samples of surface water will be collected from the two areas at the southwestern portion of AOI-1as shown on Figure 9, if possible. Collection of samples from these areas depends on conditions during the investigation since these areas likely do not always contain standing water. Furthermore, the nature of the on-property surface water will be evaluated during the RI/FS (i.e., whether the water is from intermittent or perennial). The samples will be analyzed for the initial list of COPCs. Sample collection methods are described in the FSP.

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5.6.4.4 Iteration 1 - AOI-1 On-Property Sediment Investigation

The objective of this investigation is to evaluate the lateral extent of COPCs in on-property sediments to evaluate potential human health and ecological risks. Sediment samples will be collected from the 0 to 6-inch depth interval from two areas of water accumulation in the southwestern portion of AOI-1. Proposed on-property sediment samples are presented on Figure 9. The samples will be analyzed for the initial list of COPCs and other parameters such as TOC, grain size, etc. Sample collection methods are described in the FSP.

5.6.4.5 Iteration 2 - AOI-1 Off-Property Surface Water and Sediment Investigation

Iteration 2 consists of a program for the evaluation of COPCs from USOR Property-related activities in Vince Bayou (and possibly Little Vince Bayou) surface water and sediment. A working "data assessment" meeting will be held with the EPA, TCEQ and Trustees stakeholders where the data from Iteration 1 are reviewed and decisions are made regarding: 1) COPCs that will be carried forward and COPCs that can be eliminated from subsequent iterations of the RI/FS; and 2) locations of off-property surface water and sediment samples for the Iteration 2 of the RI/FS. A WRN with the agreed-upon recommendations for the Iteration 2 sampling will be prepared for EPA approval and will not be initiated until after EPA approval of that WRN. As shown on Table 11, information on the watershed flow paths, surface water/sediment hydrodynamics, and other potential sources of COPCs to Vince Bayou and Little Vince Bayou will be reviewed during the development of this program. General sampling procedures for Iteration 2 sampling are described in Sections 5.5 and 5.6 of the FSP, but may be revised prior to performance of the Iteration 2 investigation, as necessary.

As mentioned above, preliminary background sample locations are provided herein for the off-property surface water and sediment investigation. Two surface water and sediment samples were collected for EPA (Weston, 2011) in areas considered to be background: (1) SED-01, located in Little Vince Bayou immediately upstream of the confluence of Little Vince Bayou with Vince Bayou (Figure 6); and (2) SED-02, located in Vince Bayou immediately upstream of AOI-2 (Figure 6). Several metals and organic compounds were measured in the sediment samples; metals and chloroform were measured in the surface water samples. Additionally, in 2009, EPA collected sediment samples upstream of AOI-1 adjacent to Memorial Park (ATSDR, 2009). Several organic compounds and metals were detected in the sediment sample. The background sampling proposed in this RI/FS WP will provide for a more extensive data set that will be important in evaluating the nature and extent of contamination and estimating risks.

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Background surface water and sediment sample areas are proposed at three areas as shown on Figure 2, as follows:

- Background Surface Water/Sediment Area 1 is located in Sims Bayou, upstream (west) of Vince Bayou along the HSC. This location is tidally influenced and is therefore potentially impacted by the HSC. Sims Bayou is similar in size, salinity, and urban/industrial influences to Vince Bayou.
- Background Surface Water/Sediment Area 2 is just upstream of the confluence of Little Vince Bayou and Vince Bayou (near the SED-01 sample collected for EPA (Weston, 2011). This location would receive urban runoff as well as input from other industrial activities in the area that may have impacted Vince Bayou. This location is tidally influenced and is therefore potentially impacted by the HSC.
- Background Surface Water/Sediment Area 3 is located in Vince Bayou approximately 2,200 feet (0.42 miles) south (upstream) of AOI-1 in Vince Bayou adjacent to Memorial Park. This location would receive urban runoff from the area neighborhoods, but would not have been influenced by industrial activities at AOI-1. This location is tidally influenced and is therefore potentially impacted by the HSC.

The full scope of the surface water and sediment background study in Vince Bayou, including the exact location(s) for sampling, the COPCs to be analyzed, and the methods to be used to evaluate the data, will be developed in conjunction with the EPA, TCEQ, and trustee stakeholders and will be documented in one or more WRNs. Sample collection methods are provided in the FSP.

5.6.4.6 Iteration 3 - Off-Property Fish/Shellfish Investigation

Iteration 3 consists of a program for the evaluation of COPCs from USOR Property-related activities in Vince Bayou (and possibly Little Vince Bayou) fish, shellfish, and/or other biota. Sampling of fish/shellfish in Vince Bayou (and Little Vince Bayou) may be conducted if the results of previous RI/FS data collection iterations show that USOR Property-related COPCs are present in surface water and/or sediment at concentrations above screening levels (including background) or if bio-accumulative COPCs are present above applicable thresholds.

Prior to sampling fish/shellfish in Vince Bayou or Little Vince Bayou, sediment and surface water data from Iteration 2 will be evaluated to determine the COPCs that should be included in the fish/shellfish sampling program per recommendations and procedures identified in the guidance document *Determining PCLs for Surface Water and Sediment* (TCEQ, 2002). TCEQ, 2002 is largely based on EPA procedures for evaluating potential impacts from the fish ingestion pathway when establishing surface water quality standards. Fish and shellfish will be sampled and analyzed for the COPCs that were carried forward from Iteration 2. After data validation, the sample concentrations will be compared to the PSVs. A working "data assessment" meeting will be held with the EPA, TCEQ and Trustees stakeholders where

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the data comparisons are reviewed and decisions are made regarding the need for Iteration 3 sampling. General procedures for fish and shellfish sampling are provided in Section 5.7 of the FSP, but these procedures may be modified based on data collected during Iterations 1 and 2 and the specific objectives of the Iteration 3 sampling program, as defined prior to the performance of the Iteration 3 sampling.

A WRN will be developed that describes the appropriate species/biota for sampling, the methods for sampling, the COPCs to be analyzed, etc., and the proposed activities will not be initiated until EPA approves that WRN.

As mentioned above, background concentrations of COPCs in fish, shellfish, or other biota in Vince Bayou, Little Vince Bayou, and/or other appropriate locations would also likely need to be evaluated. The scope of a background study, if necessary, will be developed in conjunction with the EPA, TCEQ, and trustee stakeholders, once it is determined that these studies are necessary, and will include the location(s) for sampling, the number of samples, the COPCs to be analyzed, the methods to be used to collect the samples, and the methods to be used to evaluate the data.

5.7 TASK 7: RISK ASSESSMENT

A Baseline Human Health Risk Assessment (BHHRA) and Ecological Risk Assessment (ERA) will be prepared for AOI-1 as described in the AOC. The Human Health and Ecological Risk Assessment processes and the activities to be performed as part of each are generally described below.

The FSP and QAPP were designed to ensure that data collected during the RI are appropriate for quantitative risk assessment. After RI/FS data collection, the data will be subject to validation using procedures specified in the QAPP to ensure that these data are of adequate quality for quantitative risk assessment and to support risk management decisions. Data selected for use in the quantitative risk assessment will be of overall high quality as defined and quantified in the QAPP.

5.7.1 Human Health Risk Assessment

A BHHRA will be conducted to evaluate and assess the risk to human health posed by COPCs present at AOI-1. The results of the BHHRA will be used to evaluate whether remedial action is necessary and the objectives of the identified remedial actions.

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The risk assessment process described herein uses the methodology that the Superfund Program has established for characterizing the nature and extent of potential risks and for developing and evaluating remedial options. Because it is a risk-based process, risk assessment data needs are considered throughout the RI/FS, from Work Plan development and project scoping to designing and implementing remedial actions identified in the FS. The risk assessment methodology that will be used is based on the risk-based approaches described by EPA in Risk Assessment Guidance for Superfund (RAGS), Volume 1, Human Health Evaluation Manual, Part A (EPA, 1989a) and various supplemental and associated guidance documents. The risk assessment process is generally composed of four components:

- COPC identification;
- Exposure assessment;
- Toxicity assessment; and
- Risk characterization.

Contaminant Identification

To focus subsequent efforts in the risk assessment process, the RI/FS analytical data will be reviewed and COPCs identified based on the screening processes described in RAGS (EPA 1989a).

Exposure Assessment

The objectives of the exposure assessment are to more fully characterize potential exposure pathways, to characterize potentially exposed populations, and to determine the levels of potential exposure. PCSMs described in Section 3.3 provide information related to potentially complete exposure pathways. This portion of the risk assessment will further evaluate the PCSM in context of the RI/FS data and the BHHRA. The source characteristics and release mechanisms for each COPC will be identified on the basis of the existing data and data generated during the RI/FS. The potential environmental transport and transfer mechanisms will be evaluated to assess migration pathways. The next step will be to identify potential exposure points for identified receptors and describe potential uptake mechanisms when a receptor comes into contact with a COPC in a specific environmental medium.

Once the exposure pathways are understood, the potential for exposure will be assessed. Identification of current and potential land uses in the area where exposure may occur is critical to this assessment. Reasonable maximum exposure (RME) scenarios will be developed, which reflect the nature of the exposures that could occur based on the expected use of the area.

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Toxicity Assessment

The toxicity assessment will consider the types of adverse health or environmental effects associated with individual or multiple exposures, the relationship between magnitude of exposures and adverse effects, and related uncertainties, such as the weight-of-evidence for a chemical's potential adverse effect. Toxicity and dose-response information will be used to generate both qualitative and quantitative estimates of risk associated with the COPCs.

Risk Characterization

The potential risks of adverse health or environmental effects for each of the scenarios described in the exposure assessment will be characterized. The estimates of risk will be obtained by integrating information developed during the toxicity and exposure assessments to characterize the potential or actual risks (carcinogenic, noncarcinogenic and environmental). The risk associated with each potential exposure route for COPCs will be described. Weight-of-evidence issues associated with toxicity data and other uncertainties related to the exposure assessment will be discussed.

A Draft BHHRA will be submitted to EPA for review. A Final BHHRA will be prepared based on EPA's comments on the Draft BHHRA and submitted for EPA approval.

5.7.2 Ecological Risk Assessment

The SOW for the RI/FS at AOI-1, provided as an attachment to the AOC, requires an ERA. As outlined in the SOW and EPA's Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessments (EPA, 1997), the ERA includes an eight-step approach for conducting a scientifically defensible ERA:

1. Screening-Level Problem Formulation and Ecological Effects Evaluation;
2. Screening-Level Preliminary Exposure Estimate and Risk Calculation;
3. Baseline Risk Assessment Problem Formulation;
4. Study Design and Data Quality Objectives;
5. Field Verification of Sampling Design;
6. Site Investigation and Analysis of Exposure and Effects;
7. Risk Characterization; and
8. Risk Management.

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Briefly, Steps 1 and 2 of the process are the initial screening phases of the ERA in which existing information is reviewed to preliminarily identify the ecological components that are potentially at risk, the Chemicals of Potential Ecological Concern (COPECs), and the transport and exposure pathways that are important to the ERA. This process is conducted using conservative assumptions to avoid underestimating risk or omitting receptors or COPECs, and constitutes the Screening Level Ecological Risk Assessment (SLERA). In Step 2, a quantitative screening-level risk is estimated using the screening ecotoxicity values developed in Step 1. The ERA process will also follow TCEQ, 2014b (Conducting Ecological Risk Assessments at Remediation Sites in Texas). The Tier 2 SLERA as described by TCEQ corresponds to the Steps 1 and 2 in the EPA process. The ERA will address both the aquatic pathways associated with the nearby bayou and terrestrial urban tolerant species found at AOI-1.

As indicated in SOW Paragraph 35(b)(ii), at the end of Step 2, the Respondents will decide, with concurrence from the EPA, whether the information available is adequate to support a risk management decision. The three possible decisions at this point will be: 1) there is adequate information to conclude that ecological risks are negligible and therefore no need for remediation on the basis of ecological risk; 2) the information is not adequate to make a decision at this point, and the ecological risk assessment process will continue to Step 3; or 3) the information indicates a potential for adverse ecological effects, and a more thorough assessment is warranted. A fourth possible decision not included in the SOW could be that there is adequate information to support a risk management decision such as taking action to eliminate an identified exposure pathway. The decision and its basis will be included in the Draft SLERA submitted to EPA for review, if applicable. If it is determined that a more thorough assessment is warranted, the desktop SLERA will be revised to incorporate TCEQ SLERA concepts such as use of Lowest Effect Concentration, receptor specific area use adjustments and background comparisons, prior to initiation of EPA's Step 3 analysis.

If performed, Steps 3 through 8 as listed above are conducted in a sequential fashion based on the results and conclusions of the previous step. Step 3 uses the results of the SLERA to identify methods for risk analysis and characterization and clearly defines the risk questions to be addressed in the subsequent steps. Steps 4 through 7 include formalization of the data needs, data collection, and data analysis for the risk characterization and typically comprise the Baseline Ecological Risk Assessment (BERA). The type of specific data to be collected to support the AOI-1 BERA (e.g., tissue analysis, toxicity testing or metals speciation) will be defined following the SLERA and cannot be described at this time. Risk management activities are the eighth step in the process.

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5.8 TASK 8: TREATABILITY STUDIES

Treatability testing will be performed, if warranted and required by EPA, to assist in the detailed analysis of remedial alternatives. In addition, if applicable, testing results and operating conditions shall be used in the detailed design of the selected remedial technology. Candidate technologies for a treatability studies program will be identified and the need for treatability testing will be considered as the RI/FS proceeds. Treatability studies may consist of laboratory screening, bench-scale testing, and/or pilot-scale testing. The specific data requirements for a treatability testing program will be determined and refined during the characterization of AOI-1 and the development and screening of remedial alternatives. Currently no treatability studies are anticipated; however, should the necessity for treatability testing be determined, a testing Work Plan will be submitted to EPA for review and approval.

5.9 TASK 9: REMEDIAL INVESTIGATION REPORT

Upon completion of all RI data collection and data validation activities, a Draft RI Report will be prepared and submitted to EPA for review. The RI Report format will be based on applicable guidance (EPA, 1988) and will include a summary of the results of the field activities to characterize AOI-1, classification of groundwater beneath AOI-1, nature and extent of COPCs, and appropriate site-specific discussions for fate and transport of COPCs. A Final RI Report will be prepared based on EPA's comments on the Draft RI Report and submitted for EPA approval.

The RI findings will be presented in a project meeting with EPA to be held after submittal of the Final RI Report. Additional topics to be discussed at this meeting will include remedial action objectives, candidate technologies and remedy alternatives envisioned for the FS, and comparative analysis of these alternatives.

5.10 TASK 10: FEASIBILITY STUDY

Upon EPA approval of the RI, BHHRA, and SLERA reports, a FS Report will be will be prepared for AOI-1. Per the SOW, the FS process includes the development and screening of alternatives for remedial action, a detailed analysis of alternatives for remedial action, if warranted. Draft and Final FS Reports will be developed and submitted, as follows:

- Development and Screening of Alternatives for Remedial Action - an appropriate range of remedial alternatives will be evaluated through development and screening.

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- Detailed Analyses of Alternatives for Remedial Action - a detailed analysis of remedial alternatives for the candidate remedies identified during the screening process. This detailed analysis will follow the EPA's guidance document titled "Interim Final Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA" (EPA, 1988) and other appropriate guidance documents. The major components of the detailed analysis of alternatives for remedial action will consist of an analysis of each option against the following CERCLA evaluation criteria:
    - Overall protection of human health and the environment;
    - Compliance with Applicable or Relevant and Appropriate Requirements (ARARs);
    - Long-term effectiveness and permanence;
    - Reduction of toxicity, mobility, or volume;
    - Short-term effectiveness;
    - Implementability; and
    - Cost.

  A separate discussion for the comparative analysis of all options with respect to each other in a manner consistent with the National Contingency Plan (NCP) will also be prepared. Compliance with ARARs will include consideration of chemical-specific, location-specific, and action-specific ARARs. Consideration of ARARs is also conducted during the RI/FS (e.g., use of chemical-specific ARARs during development of PSVs and delineation of the nature and extent of contamination).

- Draft FS Report - a Draft FS Report which documents the activities conducted during the development and screening of alternatives and the detailed analyses of alternatives, as described above, will be prepared and submitted for EPA review. EPA's guidance document titled "Interim Final Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA" (EPA, 1988), specifically Table 6-5 (Suggested FS Report Format), will be utilized for the suggested FS Report content and format.

- Final FS Report – a Final FS Report will be prepared based on EPA's comments (and any public comments provided by EPA) and submitted for EPA approval.

The RI/FS for AOI-1, including remedy selection, will be conducted in accordance with EPA guidance on "green remediation". "Green remediation" is the practice of considering all environmental effects of cleanup actions and incorporating options to minimize the environmental footprints of cleanup actions (EPA, 2009). The core elements of green remediation are as follows:

- Reducing total energy use and increasing the percentage of energy from renewable resources:
- Reducing air pollutants and greenhouse gas emissions;
- Reducing water use and negative impacts on water resources;
- Improving materials management and waste reduction efforts; and
- Protecting ecosystem services during site cleanup.

In particular, the green remediation Best Management Practices (BMPs) contained in various EPA guidance documents will be considered during the RI/FS.

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6.0 PROJECTED SCHEDULE

The projected schedule for conducting the RI/FS is shown on Figure 10. This schedule is subject to revision based on changes in assumed EPA review time periods, weather conditions, modifications or additions to the scope of work described herein based on the data obtained, delays in obtaining access to any properties to be sampled, potential interference with removal actions or associated field work, or other factors as the RI/FS proceeds. As appropriate, this schedule will be periodically revised and included in Bi-Monthly Progress Reports required under Paragraph 44 of the AOC. Bi-Monthly Progress Reports will be submitted by the 15th of every other month with the first report provided by the 15th of the month following EPA approval of the RI/FS WP.

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7.0 PROJECT MANAGEMENT PLAN

The management organization for the RI/FS and the key personnel assigned to the project are shown on Figure 11, and the project management team members, along with identification of the key personnel assigned to the project, are described in the following sections.

EPA Remedial Project Manager (RPM). The EPA RPM is the primary point of contact within the EPA for the project. The EPA RPM is responsible for the overall direction of the project in accordance with the provisions of the RI/FS AOC, this RI/FS WP, the FSP, and the QAPP.

USOR Project Coordinator. The USOR Project Coordinator will provide the principal point of contact and control for matters concerning the project and field investigation implementation. In consultation with the Respondents (the USOR PRP Group Steering Committee and USOR PRP Group Technical Committee), the USOR Project Coordinator will:

- Coordinate field investigation activities and develop a detailed schedule;
- Establish project policies and procedures to meet the specific objectives of the project;
- Review the work performed on each project to help ensure its quality, responsiveness and timeliness; and
- Represent the project team at meetings and public hearings, if necessary.

RI/FS Manager. The RI/FS Manager will direct and supervise the RI/FS work. The RI/FS Manager's responsibilities will be to review all RI/FS project work to ensure that it meets the specific project goals, meets technical standards, and is in accordance with the objectives and procedures discussed herein. The RI/FS Manager is responsible for developing staffing requirements, orienting field staff concerning the project, and developing mechanisms to review and evaluate each work product. Additionally, the RI/FS Manager will be responsible for maintaining the official, approved QAPP, and distributing the QAPP and any subsequent QAPP revisions, addenda, and amendments to the individuals named in the distribution list.

Site Safety Officer. The Site Safety Officer will be responsible for overall health and safety practices associated with the field work. Specific functions and duties will include the following tasks:

- Establish the requirements of the project HASP (PBW, 2014c);
- Arrange or conduct audits of field activities to ensure that proper health and safety procedures are being used; and
- Communicate with the RI/FS Manager, Field Investigation Manager, and field technical staff concerning project issues related to health and safety.

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Human Health Risk Assessment Manager. The Human Health Risk Assessment Manager will direct and supervise human health risk assessment activities. The Human Health Risk Assessment Manager will provide input to the development of the RI/FS WP and will direct human-health risk-related data evaluation activities. The Human Health Risk Assessment Manager's responsibilities will be to ensure that human health risk assessment work meets the specific project goals, meets technical standards, and is in accordance with the objectives and procedures discussed in the RI/FS WP, FSP, QAPP, and HASP.

Ecological Risk Assessment Manager. The Ecological Risk Assessment Manager will direct and supervise ecological risk assessment activities. The Ecological Risk Assessment Manager will provide input to the development of the RI/FS WP and will direct ecological-health risk-related data evaluation activities. The Ecological Risk Assessment Manager's responsibilities will be to ensure that ecological risk assessment work meets the specific project goals, meets technical standards, and is in accordance with the objectives and procedures discussed in the RI/FS WP, FSP, QAPP, and HASP.

Field Investigation Manager. The Field Investigation Manager will be responsible for the field work performed as part of a specific RI/FS activity. Duties of the Field Investigation Manager will include:

- Maintaining field records;
- Continually surveying the work area for potential work hazards and relate any new information to RI/FS personnel at the Tailgate Safety Meeting held each day prior to beginning field activities;
- Ensuring that field personnel are properly trained, equipped, and familiar with standard operating procedures (SOPs) and the HASP;
- Overseeing sample collection, handling and shipping; ensuring proper functioning of field equipment; and
- Informing the laboratory when samples are shipped to the lab and verifying samples arrived at the lab.

The primary duty of the Field Investigation Manager is to ensure that the field sampling is performed in accordance with the FSP and the QAPP. The Field Investigation Manager will also require that appropriate personal protective equipment will be worn and disposed of according to the HASP. In addition, the Field Investigation Manager may be responsible for preparing monitoring reports for review by the RI/FS Manager.

FS Manager. The FS Manager will direct and supervise FS activities, including development and implementation of any treatability studies, assembling of remedial action alternatives and evaluation of these alternatives in the FS. The FS Manager's responsibilities will ensure that FS activities meet the specific

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project goals, meet technical standards, and are in accordance with the objectives and procedures discussed in the RI/FS WP, FSP, QAPP, and HASP.

QA Manager. The QA Manager will assist in preparation of the QAPP, review the associated FSP, and provide technical assistance in the resolution of QA/QC or analytical chemistry issues. Other responsibilities include an evaluation of sampling procedures, laboratory analyses, and project documentation with respect to the QAPP requirements. The QA Manager will oversee the review of laboratory data packages and preparation of data validation reports in conformance with the requirements of the QAPP. The QA Manager will remain independent of direct involvement in day-to-day operations, but will have direct access to staff, as necessary, to resolve any QA issues. The QA Manager has sufficient authority to stop work on the investigation as deemed necessary in the event of substantive QA/QC issues. Independent QA management will be provided by QAALLC. Specific functions and duties include:

- Performing QA audits on various phases of the project's operations, as necessary;
- Reviewing and approving the QAPP and other QA plans and procedures;
- Reviewing validation of data collected relative to RI/FS activities and the QAPP; and
- Providing QA technical assistance to project staff.

The QA Manager will notify the Respondents' Project Coordinator of particular circumstances that may adversely affect the quality of data and ensure implementation of corrective actions needed to resolve nonconformances noted during assessments.

Laboratory Project Manager. The Laboratory Project Manager will be responsible for ensuring laboratory resources are available to PBW as needed for the project and will provide oversight of final laboratory reports. The Laboratory Project Manager will oversee performance of analytical tests conducted as part of the project. The Laboratory Project Manager is responsible for providing the Field Investigation Manager a confirmation of sample receipt and for notifying the Field Investigation Manager of any sample integrity issues (holding time exceedance, chain-of-custody [COC] discrepancies, etc.) promptly when discovered. The Laboratory Project Manager is also responsible for internal laboratory review of data for adherence to the requirements of the project QAPP, the laboratory QA Manual and SOPs. The Laboratory Project Manager is also responsible for submitting the final data package, including the electronic data deliverable, within the requested turnaround time.

Contractors. Numerous contractors will be utilized during the RI/FS investigation to complete the required RI/FS tasks. Contractors will be required to prepare a HASP for their personnel and associated

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activities, in compliance with the HASP prepared for the investigation, and adhere to the applicable requirements of the RI/FS WP, FSP, and QAPP to ensure work is performed appropriately. The following is a list of the types of contractors and their responsibilities. Other contractors will be used during the RI/FS, as necessary.

Environmental Drilling: The environmental drilling contractor will be responsible for providing the personnel and equipment necessary to conduct drilling related tasks identified in the RI/FS WP. These tasks include:

- Cone penetrometer testing (CPT) or the rapid optical scanning tool (ROST);
- Advancing boreholes for monitoring well and soil borings (hollow-stem auger and direct push, respectively);
- Construction of monitoring wells and surface completions;
- Decontamination of drilling equipment;
- Submittal of state required well registrations;
- Plugging and abandonment of wells (if necessary); and
- Obtaining necessary drilling permits and implementing traffic control plans when drilling in public right of ways.

Sediment/Surface Water/Tissue Sampling: Off-site sediment, surface water and tissue samples, if needed, will be collected by a contractor with experience in the collection and processing of sediment samples from channels and bayous as well as ultra-clean water collection techniques. The contractor will have a Texas Parks and Wildlife Department collection permit for biological samples.

Surveying: The location and elevation of newly installed soil boring, CPT/ROST, and monitoring wells, and any other relevant features, will be surveyed for position by a professional Texas-licensed surveyor. The surveyor will be responsible for providing appropriate technical drawings and electronic data in accordance with Section 5.9 of the FSP.

Site Maintenance: General mowing and maintenance of the USOR Property is provided by a local contractor. The contractor provides equipment and personnel to mow, clear brush and shrubs from the fence line, and make minor repairs to fencing.

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8.0 DATA MANAGEMENT PLAN

Data management provides a process for tracing the path of the data from their generation in the field or laboratory to their final use or storage. The following elements are included in this process: recording, validation, transformation, transmittal, reduction, analysis, tracking, and storage and retrieval.

8.1 DATA RECORDING

Sample collection will be documented and tracked using field forms, field logbook entries, and Chain-of-Custody Records. Field personnel will complete these forms, which will then be reviewed for correctness and completeness by the Field Investigation Manager. Copies of these forms will be maintained in the project files. Examples of field forms are included in the SOPs provided in the FSP.

8.2 DATA VALIDATION

Data validation is addressed in Section 5 of the QAPP. Draft and Final reports will include validated data with appropriate flagging. Data rejected during the validation process will not be used and will be discussed in the applicable portions of any final reports. If data is rejected based on issues with performance or QA/QC, corrective action will be taken as described in the QAPP.

8.3 DATA TRANSFORMATION

Since data will be collected and/or reported using proper units according to the QAPP, no data transformation is expected. If data transformation is necessary, the transformation procedures will be added to the QAPP as addenda.

8.4 DATA TRANSMITTAL

The Field Investigation Manager will be responsible for assuring that field data are entered onto the appropriate field data forms, and will report any problems to the RI/FS Manager. The Field Investigation Manager will submit the complete field data forms to the RI/FS Manager for review and error checking.

The Field Investigation Manager will also ensure that all samples collected in the field are submitted to the laboratory according to the methods outlined in the QAPP or the FSP. The laboratory will submit the analytical results to the RI/FS Manager or Field Investigation Manager as electronic data deliverables

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(EDDs) in a spreadsheet format and as a final data report in hard copy or electronic format (i.e., Portable Document Format (PDF)).

Once reviewed by the RI/FS Manager or Field Investigation Manager for obvious transcription or reporting errors, the final data report will be transmitted and ready for validation by the QA Manager. Following data validation, any data qualifiers added to data during the validation process will be imported into the project database. Entry or upload of EDDs and data qualifiers into the project database will be completed by a designee of the RI/FS Manager. The data and qualifiers will be initially verified by the individual entering the data. Upon completion of the initial verification step, a report will be generated of the data and verified by the RI/FS Manager against the original data. Only final versions of electronic data will be entered into the database. All electronic data will be verified before and after incorporation into the database against the final reports that accompany the data.

All qualified data will be included with the data packages during all subsequent data transmittal processes. The final hard copy data validation checklists will be included with the data in the RI report. All field forms and lab data will be organized and stored by sample location allowing for easy access if needed. Data can be transferred electronically either on disc, CD, or as an email attachment as agreed with the EPA RPM.

8.5 DATA ANALYSIS

Data analysis will be conducted as described on an activity basis in Section 5.6 of this RI/FS WP. Applications that may be utilized to analyze the data include common spreadsheet and database software. The results of data analysis for each activity will be presented in the RI Report.

8.6 DATA STORAGE AND RETRIEVAL

PBW's RI/FS Manager is responsible for project data storage and retrieval. Laboratory data that are provided electronically will be archived electronically, and where printed as part of the paper data report package, will also be archived in paper form. Both the electronic data and hard copies will be maintained in PBW's Houston, TX office. In general, all records and data must be retained for a period of 10 years following commencement of construction of any remedial action which is selected following completion of the RI/FS, per Section XIV, Paragraph 63 of the AOC.

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TABLES

Table 1 - Threatened and Endangered Species - Harris County

Common Name[1]	Scientific Name	Status[2]		Description	Potential Presence?[3]		Comment
		Federal	Texas		Terrestrial	Aquatic	
Amphibian							
Houston Toad	*Anaxyrus houstonensis*	LE	E	Lives primarily on land. The Houston Toad burrow into the sand for protection from cold weather in the winter (hibernation) and hot, dry conditions in the summer (aestivation) (TPWD, 2014). Houston Toads disappeared from the Houston area (Harris, Fort Bend and Liberty counties) during the 1960s following an extended drought and the rapid urban expansion of the city of Houston. Although this species has been found in nine additional counties (Austin, Bastrop, Burleson, Colorado, Lavaca, Lee, Leon, Milam, Robertson) as recently as the 1990s, several of these populations have not been seen since they were first discovered. Of the few remaining populations, the largest is in Bastrop County (IUCN, 201). According to Animal Diversity Web (ADW, 2014), the Houston Toad is limited to an extremely small range in southeastern Texas. Since its discovery in 1953 it has never been found north of Burleson County, south of Fort Bend County, east of Liberty County, or west of Bastrop County. It is likely that the Houston Toad is now extirpated from Fort Bend, Harris and Liberty counties (Forstner and Dixon, 2011). Houston Toads are restricted to areas with sandy, friable soil such as loblolly pine forest, mixed deciduous forest, post oak savannah, and coastal prairie (IUNC, 2014). Plants that are often present in Houston Toad habitat include loblolly pine, post oak, bluejack or sandjack oak, yaupon, and little bluestem (TPWD, 201). Breeding may occur from late January to late June, but usually earlier than May, in rain pools, flooded fields, roadside ditches, and natural or man-made ponds. Optimal habitats are non-flowing, fishless pools that persist for at least 60 days (long enough for larvae to metamorphose) (IUCN, 2014). The Houston Toad is associated with soils of the Sparta, Carrizo, Goliad, Queen City, Reklaw, Weches and Willis geologic formations (TPWD, 2014).	N	N	Most likely extripated from Harris County. Additionally, most of the USOR property is paved with vegetation limited to several areas. Soil type and vegetation on USOR property are not preferred by the Houston Toad.
Birds							
American Peregrine Falcon	*Falco peregrinus anatum*	DL	T	Year-round resident and local breeder in West Texas, nests in tall cliffs; also, migrant across state from more northern breeding areas in US and Canada, winters along coast and farther south; occupies wide range of habitats during migration, including urban, concentrations along coast and barrier islands; low-altitude migrant, stopovers at leading landscape edges such as lake shores, coastlines, and barrier islands (TPWD, 2014). These birds feed on shorebirds, ducks and when living in the city, will catch pigeons (Cornell, 2014).	N	N	Unlikely to feed on local prey in urban/industrial area, habitat fragmented; possible rare fly-overs.
Bald Eagle	*Haliaeetus leucocephalus*	DL	T	Found primarily near rivers and large lakes; nests in tall trees or on cliffs near water; communally roosts, especially in winter; hunts live prey, scavenges, and pirates food from other birds. The Bald Eagle population in Texas is divided into two populations; breeding birds and nonbreeding or wintering birds. Breeding populations occur primarily in the eastern half of the state and along coastal counties from Rockport to Houston. Nonbreeding or wintering populations are located primarily in the Panhandle, Central, and East Texas, and in other areas of suitable habitat throughout the state (TPWD, 2014). Bald eagles scavenge many meals by harassing other birds or by eating carrion. They eat mainly fish, but also hunt mammals, gulls and waterfowl (Cornell, 2014).	N	N	Unlikely to feed on local prey in urban/industrial area, habitat fragmented; possible rare fly-overs.
Peregrine Falcon	*Falco peregrinus tundrius*	DL	T	Migrates across the state from more northern breeding areas in US and Canada to winter along coast and farther south; subspecies no longer listed in Texas, but because the subspecies are not easily distinguishable at a distance, reference is generally made only to the species level (TPWD, 2014). These birds feed on shorebirds, ducks and, when living in the city, will catch pigeons (Cornell, 2014).	N	N	Unlikely to feed on local prey in urban/industrial area, habitat fragmented; possible rare fly-overs.
Red Knot	*Calidris canutus rufa*	T		Red knots migate long distances in flocks northward through the United States. This bird prefers the shoreline of coast and bays and also uses mudflats during rate inland encounters. Primary prey items include coquina clam (*Donax* spp.) on beaches and dwarf surf clam (*Mulinia lateralis*) in bays. Its habitat is primarily seacoasts on tidal flats and beaches, herbaceous wetland and tidal flats and shore.	N	N	Habitat not present at USOR property.
Red-cockaded Woodpecker	*Picoides borealis*	LE	E	Nests in cavities in older pines (60+ years); forages in younger pines (30+ years); prefers longleaf, shortleaf and loblolly (TPWD, 2014).	N	N	Habitat not present at USOR property.
Sprague's Pipit	*Anthus spragueii*	C		Only in Texas during migration and winter, mid September to early April; short to medium distance, diurnal migrant; strongly tied to native upland prairie, can be locally common in coastal grasslands, uncommon to rare further west; sensitive to patch size and avoids edges (TPWD, 2014). This is a songbird on the northern prairie and open grassland. It feeds and nests on the ground. It eats mostly insects and spiders as well as some seeds (Cornell, 2014).	N	N	Unlikely to feed on local prey in urban/industrial area, habitat fragmented; possible rare fly-overs.
White-faced Ibis	*Plegadis chihi*		T	Prefers freshwater marshes, sloughs, and irrigated rice fields, but will attend brackish and saltwater habitats; nests in marshes, in low trees, on the ground in bulrushes or reeds, or on floating mats. The white-faced ibis seems to prefer freshwater marshes, where it can find insects, newts, leeches, earthworms, snails and especially crayfish, frogs and fish. They roost on low platforms of dead reed stems or on mud banks. In Texas, they breed and winter along the Gulf Coast and may occur as migrants in the Panhandle and West Texas (TPWD, 2014).	N	N	The white-faced ibis prefers freshwater marshes and not the marine/brackish waters of Vince Bayou. Small depressed area on USOR property does not hold water for extended periods of time. They roost on low platforms of dead reed stems or on mud banks. Preferred habitat is not found on or around USOR property.
White-tailed Hawk	*Buteo albicaudatus*		T	Found near coast on prairies, cordgrass flats, and scrub-live oak; further inland on prairies, mesquite and oak savannas, and mixed savanna-chaparral; breeding March - May (TPWD, 2014). The population is increasing and it has an extremely large home range. It is considered to be of "least concern" as described by the BirdLife International 2012 (IUCN, 2014). This hawk prefers open country, primarily savanna, prairie and arid habitats of mesquite and cacti. It eats mostly mammals (Cornell, 2014).	N	N	Unlikely to feed on local prey in urban/industrial area, habitat fragmented; possible rare fly-overs.
Whooping Crane	*Grus americana*	LE	E	Potential migrant via plains throughout most of state to coast; winters in coastal marshes of Aransas, Calhoun, and Refugio counties (TPWD, 2014). Breeds in freshwater marshes and prairies. Uses grain fields, shallow lakes and lagoons and saltwater marshes on migration and in winter. The whooping crane eats mollusks, crustaceans, insects, fish, frogs and some seeds and grain (Cornell, 2014).	N	N	Unlikely to feed on local prey in urban/industrial area, habitat fragmented; possible rare fly-overs.
Wood Stork	*Mycteria americana*		T	Forages in prairie ponds, flooded pastures or fields, ditches, and other shallow standing water, including salt-water; usually roosts communally in tall snags, sometimes in association with other wading birds (i.e. active heronries); breeds in Mexico and birds move into Gulf States in search of mud flats and other wetlands, even those associated with forested areas; formerly nested in Texas, but no breeding records since 1960 (TPWD, 2014). This species has an extremely large home range and the population is decreasing (IUCN, 2014). This bird eats mostly fish (Cornell, 2014).	N	N	Unlikely to feed on local prey in urban/industrial area, habitat fragmented; possible rare fly-overs.
Fishes							
Creek Chubsucker	*Erimyzon oblongus*		T	Found in tributaries of the Red, Sabine, Neches, Trinity, and San Jacinto rivers; small rivers and creeks of various types; seldom in impoundments; prefers headwaters, but seldom occurs in springs; young typically in headwater rivulets or marshes; spawns in river mouths or pools, riffles, lake outlets, upstream creeks (TPWD, 2014). Range includes North American Atlantic slope from southern Maine to the Altamaha River, Georgia and the Lake Ontario drainage, New York. Listed as "Least Concern" in view of the large extent of occurrence, large number of subpopulations and locations and large population size (IUCN, 2014). This species is highly sensitive to siltation and populations are declining in streams subject to siltation (Espey, 2009).	N	N	Generally found in freshwater and therefore unlikely to be found in Vince Bayou near USOR property.

Table 1 - Threatened and Endangered Species - Harris County

Common Name[1]	Scientific Name	Status[2]		Description	Potential Presence?[3]		Comment
		Federal	Texas		Terrestrial	Aquatic	
Smalltooth Sawfish	*Pristis pectinata*	LE	E	Different life stages have different patterns of habitat use; young found very close to shore in muddy and sandy bottoms, seldom descending to depths greater than 32 ft (10 m); in sheltered bays, on shallow banks, and in estuaries or river mouths; adult sawfish are encountered in various habitat types (mangrove, reef, seagrass, and coral), in varying salinity regimes and temperatures, and at various water depths, feed on a variety of fish species and crustaceans (TPWD, 2014). The Smalltooth Sawfish has been wholly or nearly extirpated from large areas of its former range in the Atlantic Ocean by fishing (trawl and inshore netting) and habitat modification. Negative records from scientific surveys, anecdotal fisher observations, and fish landings data over its historic range infer a population reduction of ≥95% over a period of three generations (i.e., 1962 to present). The remaining populations are now small and fragmented. The species can only be reliably encountered in the Bahamas (where suitable habitat is available) and the United States (Georgia south to Louisiana). It is rare but present in Honduras, Belize, Cuba, Sierra Leone, and possibly Guinea-Bissau and Mauritania. Threats to Smalltooth Sawfish still exist today in areas where sawfish are unprotected and habitat modification (mangrove removal) and inshore netting still occurs. The sawtooth can exist in both saltwater and freshwater, tending to prefer fairly shallow water with muddy of sandy bottoms such as rivers, streams, creeks, bays, lagoons and estuaries. Florida has established three wildlife refuges to protect the habitat of the smalltooth sawfish and in the hope that numbers might increase sufficiently for re-colonization of other areas. It has been protected from harvesting in Florida since 1992 and over the rest of American waters since 2003 (IUCN, 2014).	N	N	Not likely to be found in Vince Bayou because of the inland nature of the bayou. Texas is not listed within its current range or listed observations by the IUCN (2014) <maps.iucnredlist.org/map.html?id=18175>.
Mammals							
Louisiana Black Bear	*Ursus americanus luteolus*	LT	T	Possible as transient, bottomland hardwoods and large tracts of inaccessible forested areas (TPWD, 2014).	N	N	Presence unlikely due to urban nature of area and lack of preferred habitat.
Rafinesque's Big-eared Bat	*Corynorhinus rafinesquii*		T	Roosts in cavity trees of bottomland hardwoods, concrete culverts and abandoned man-made structures (TPWD, 2014). The foraging habitat is primarily mature forest in both upland and lowland areas. This species is very intolerant of disturbance (natural or human) and may abandon roost sites or hibernation sites if subjected to disturbance. This species is listed as "Least Concern" because of its wide distribution, presumed stable population, successful recuperation population programs, and occurrence of individuals in protected areas (IUCN, 2014).	N	N	Unlikely to be present because of lack of roosting sites and active urban area.
Red Wolf	*Canis rufus*	LE	E	Extirpated; formerly known throughout eastern half of Texas in brushy and forested areas, as well as coastal prairies (TPWD, 2014).	N	N	Considered extirpated from region.
Mollusks							
Louisiana Pigtoe	*Pleurobe mariddellii*		T	Found in streams and moderate-size rivers, usually flowing water on substrates of mud, sand, and gravel; not generally known from impoundments; Sabine, Neches, and Trinity (historic) River basins (TPWD, 2014). Ranged from eastern Texas drainages into Louisiana, but has been exceptionally rare in recent decades. Since the mid-1990s, small numbers of living specimens have been found in the Neches River and some of its tributaries and the Angelina River (TPWD, 2009).	N	N	All three species are freshwater mussels and would not be found in Vince Bayou. Occurrences have been in the San Jacinto freshwater river basin.
Sandbank Pocketbook	*Lampsilis satura*		T	Small to large rivers with moderate flow and swift current on gravel, gravel-sand, and sand bottoms; East Texas, Sulfur south through San Jacinto River basins; Neches River (TPWD, 2014).	N	N	
Texas Pigtoe	*Fusconaia flava*		T	Rivers with mixed mud, sand, and fine gravel in protected areas associated with fallen trees or other structures; East Texas River basins, Sabine through Trinity rivers as well as San Jacinto River (TPWD, 2014).			
Reptiles							
Alligator Snapping Turtle	*Macrochelys temminckii*		T	Perennial water bodies; deep water of rivers, canals, lakes, and oxbows; also swamps, bayous, and ponds near deep running water; sometimes enters brackish coastal waters; usually in water with mud bottom and abundant aquatic vegetation; may migrate several miles along rivers (TPWD, 2014). Alligator snapping turtles live in freshwater areas in the Southeastern United States. They generally live in the deepest water within their habitat: large rivers, canals, lakes, swamps, and rivers. Hatchlings and juveniles usually live in smaller streams (ADW, 2014).	N	N	Not likely to be found in Vince Bayou because of salinity. No consistent freshwater bodies on USOR property that would support this species.
Green Sea Turtle	*Chelonia mydas*	LT	T	Gulf and bay system; shallow water seagrass beds, open water between feeding and nesting areas, barrier island beaches; adults are herbivorous feeding on sea grass and seaweed; juveniles are omnivorous feeding initially on marine invertebrates, then increasingly on sea grasses and seaweeds; nesting behavior extends from March to October, with peak activity in May and June (TPWD, 2014). Green Sea Turtles are found in tropical and portions of subtropical oceans worldwide. They are found in the Atlantic Ocean from the eastern United States along coastal South America to South Africa. They are found throughout the Caribbean Sea and portion of the Mediterranean. They are also found throughout the warm waters of the Indian and Pacific Oceans. The only time they emerge from the water is when they are nesting (ADW, 2014).	N	N	Species found in open bodies of water and not in small side tributaries such as Vince Bayou. Occurrence is highly unlikely near USOR property.
Kemp's Ridley Sea Turtle	*Lepidochelys kempii*	LE	E	Gulf and bay system, adults stay within the shallow waters of the Gulf of Mexico; feed primarily on crabs, but also snails, clams, other crustaceans and plants, juveniles feed on sargassum and its associated fauna; nests April through August (TPWD, 2014). They can be found from Nova Scotia and Newfoundland to Bermuda. Nesting Ridleys are found mainly in the Gulf of Mexico. In migration, they follow two major routes: one heads north to the Mississippi coastline and the second extends southward to the shores of the Yucatan Peninsula at the Campeche Bank. This turtle mainly stays near shallow coastal regions characterized by bays and lagoons. These turtles prefer waters that have sandy or muddy bottoms, but also may take to the open seas. At sea, this species has the ability to dive to great depths (ADW, 2014).	N	N	Species found in open bodies of water and not in small side tributaries such as Vince Bayou. Occurrence is highly unlikely near USOR property.
Leatherback Sea Turtle	*Dermochelys coriacea*	LE	E	Gulf and bay systems, and widest ranging open water reptile; omnivorous, shows a preference for jellyfish; in the US portion of their western Atlantic nesting territories, nesting season ranges from March to August (TPWD, 2014). Although leatherbacks are most often found in tropical waters, they are distributed around the globe in temperate oceans, and even on edges of subarctic water. The leatherback sea turtle travels further north than any other sea turtle. They live in Northern Atlantic waters as far north as Newfoundland, Nova Scotia, and Labrador. They also inhabit South Atlantic Waters, as far south as Argentina and South Africa. This turtle inhabits waters as far east as Britain and Norway (ADW, 2014).	N	N	Species found in open bodies of water and not in small side tributaries such as Vince Bayou. Occurrence is highly unlikely near USOR property.
Loggerhead Sea Turtle	*Caretta caretta*	LT	T	Gulf and bay system primarily for juveniles, adults are most pelagic of the sea turtles; omnivorous, shows a preference for mollusks, crustaceans, and coral; nests from April through November (TPWD, 2014). Preferred habitat changes throughout the life cycle. Adult females go ashore to lay eggs and seem to prefer steeply sloped, high energy beaches. When hatchlings emerge from the nest, they head for the ocean. Young juveniles are typically found among drifting sargassum mats in warm ocean currents. Older juveniles and adults are most often found in coastal waters and tend to prefer a rocky or muddy substrate over a sandy one. They may also be found near coral reefs and venturing into salt marshes, brackish lagoons, and the mouths of rivers (ADW, 2014).	N	N	Species found in open bodies of water and not in small side tributaries such as Vince Bayou. Occurrence is highly unlikely near USOR property.
Timber/Canebrake Rattlesnake	*Crotalus horridus*		T	Swamps, floodplains, upland pine and deciduous woodlands, riparian zones, abandoned farmland; limestone bluffs, sandy soil or black clay; prefers dense ground cover, i.e. grapevines or palmetto (TPWD, 2014).	N	N	Not expected in study area due to limited and fragmented habitat. Surrounding areas are dominated by urban development and active agricultural fields. Continuous undisturbed scrub shrub and forested habitat is required.

Table 1 - Threatened and Endangered Species - Harris County

Common Name[1]	Scientific Name	Status[2]		Description	Potential Presence?[3]		Comment
		Federal	Texas		Terrestrial	Aquatic	
Texas Horned Lizard	*Phrynosoma cornutum*		T	Open, arid and semi-arid regions with sparse vegetation, including grass, cactus, scattered brush or scrubby trees; soil may vary in texture from sandy to rocky; burrows into soil, enters rodent burrows, or hides under rock when inactive (TPWD, 2014).	N	N	Diet is primarily harvester ants. No harvester ant nests were noted on USOR property. Unlikely to be present given the lack of suitable habitat for this species.
Plants							
Texas Prairie Dawn	*Hymenoxys texana*	LE	E	Endemic in Texas; in poorly drained, sparsely vegetated areas (slick spots) at the base of mima mounds in open grassland or almost barren areas on slightly saline soils that are sticky when wet and powdery when dry; flowering late February-early April (TPWD, 2014). This species is limited to saline prairies within the Houston Coastal Prairie (Singhurst, et al., 2014). During 2009-2010, Singhurst et al. studied this species at three prairie sites in Harris County, but the locations are north of Houston in the Katy Prairie Conservancy.	N	N	This species has not been observed on USOR property.

Notes:

1. Taxa provided in the Texas Parks and Wildlife Departments (TPWD) Rare, Threatened, and Endangered Species of Texas List for Harris County. Last revision May 23, 2015.
   <http://tpwd.texas.gov/gis/rtest/> Only taxa listed as candidate, threatened or endangered on either the federal or state list are included.
2. T = Threatened; E = Endangered; C = Candidate for Listing; LT = Listed Threatened; LE = Listed Endangered; DL = De-Listed.
3. Likelihood of potential presence at the USOR Property based on review of species habitat information and characterization of USOR Property.

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Table 2
Summary of Water Wells Within 1 Mile of USOR Property

Well Number[1]	Map ID[2]	Owner	Depth (feet)	Aquifer or Usage
Wells Within 0.25 Mile Radius				
6523120	5	City of Pasadena	834	Evangeline/Unused
Wells Within 0.25 to 0.5 Mile Radius				
6523122	D34	Champion Paper	974	Evangeline/Industrial
6523123	D30	Champion Paper	1,275	Evangeline/Industrial
6523124	D33	Champion Paper	1,937	Evangeline/Industrial
6523129	H95	USGS	940	Evangeline/Industrial
6523130	H94	USGS	319	Chicot/Unused
6523131	H96	USGS	172	Chicot/Unused
6523132	H97	USGS	45	Chicot/Monitoring
1164	H69	AES Western Power	940	Industrial
4116	48	Centerpoint Energy	660	Industrial
4473	36	AES Deepwater	599	Industrial
Wells Within 0.5 to 1.0 Mile Radius				
10815	V199	Eduardo Valadez	120	Industrial
204750	V198	Eddie Valdez	200	Industrial
2100	200	Reddy Ice	350	Industrial
2847	P186	Houston Shell & Concrete	485	Industrial
2849	P184	Houston Shell & Concrete	485	Industrial
1012331	H101	AES Deepwater	590	Chicot
2848	P185	Houston Shell & Concrete	640	Industrial
6523247	Y256	Port Terminal Railroad	715	Evangeline/Unused
1162	Q171	AES Western Power	776	Industrial
6523136	Q175	USGS/HL&P Deepwater	809	Evangeline/Industrial
6523139	H100	HL&P Deepwater	836	Evangeline/Industrial
6523115	P174	Crown Central	922	Evangeline/Industrial
1339	Y250	Pasadena Refining	922	Industrial
1163	M165	AES Deepwater	930	Industrial
6523106	M164	USGS/HLP	940	Evangeline/Industrial
1415	AA245	Houston Refining	1226	Evangeline
6523146	133	Arco	1260	Evangeline/Industrial
1340	P170	Crown Central	1260	Industrial
6523101	J102	City of Pasadena	1262	Evangeline/Public Supply
6523203	214	Crown Central	1262	Evangeline/Industrial
1342	U195	Pasadena Refining	1274	Industrial
6523204	Y228	Crown Central	1274	Evangeline/Industrial
6523147	W206	Texaco	1376	Evangeline/Unused
6523102	AB260	USGS/Texaco	1410	Evangeline/Industrial
1863	AB254	GATX	1468	Industrial
1413	135	Lyondell/Houston Refining	1700	Industrial

Table 2
Summary of Water Wells Within 1 Mile of USOR Property

Well Number[1]	Map ID[2]	Owner	Depth (feet)	Aquifer or Usage
1338	U196	Pasadena Refining	1827	Evangeline
6523128	O169	USGS	1701	Evangeline/Industrial
6523110	167	Crown Central	1827	Evangeline/Industrial
6523108	T197	USGS/Lyondell	1844	Evangeline/Industrial
1416	T189	Houston Refining	1844	Evangeline

Notes :

1. Texas Water Development Board (TWDB), United States Geological Survey (USGS), or other well ID.
2. See map in Appendix A.

Table 3 - USOR Area of Investigation 1
Metals Concentrations in Soil Samples

Location	Sample ID	Sample Date	Aluminum (mg/kg)	Antimony (mg/kg)	Arsenic (mg/kg)	Barium (mg/kg)	Beryllium (mg/kg)	Cadmium (mg/kg)	Chromium (mg/kg)	Cobalt (mg/kg)	Copper (mg/kg)	Lead (mg/kg)	Manganese (mg/kg)	Mercury (mg/kg)	Nickel (mg/kg)	Selenium (mg/kg)	Silver (mg/kg)	Vanadium (mg/kg)	Zinc (mg/kg)
March 2011 EPA START-3 Sampling Event (Westo, 2011) (HRS, p. 14, Reference 44)																			
SS-01	SS-01-03-51	03/01/11	11000	<1.5J	5.9J	117	<0.75J	<0.75J	15.2J	4.2J	19.3J	53.3J	83.4J	0.21	9.8J	<3.7	<0.75	17.1J	106J
SS-02	SS-02-03-51	03/01/11	21800	<1.3J	11.9J	198	<1.3J	<0.65J	17.2J	6.7J	9J	24.7J	345J	0.12J	12.3J	<6.5	<0.65	29.1J	25.5J
SS-03	SS-03-03-51	03/01/11	20800	<1.3J	205J	402	<3.3J	<0.67J	30.1J	19.1J	15.9J	38.3J	1170J	0.15	21.5J	<16.7	<0.67	48.3J	37.2J
SS-03	SS-03-03-52	03/01/11	18700	<1.3J	464J	718	<13.1J	<0.65J	40.8J	57.7J	<26.2J	58.1J	3600J	0.16	30.9J	<65.4	<0.65	65.9J	36.3J
SS-04	SS-04-03-51	03/01/11	8700	1.8J	10.5J	217	<0.83J	<0.83J	13.5J	3.8J	14.4J	37.3J	240J	<0.12J	8.9J	<4.2	<0.83	15.1J	129J
SS-05	SS-05-03-51	03/01/11	10200	<1.3J	2.1J	117	<0.66J	<0.66J	14.6J	4.3J	10.8J	55J	190J	0.083J	7.9J	<3.3	<0.66	16J	76.7J
2005 TCEQ Investigation (HRS, p.10) (USOR Preliminary Assessment Reference 25) (Sample locations uncertain but are from near the manhole and outfall at the southeast corner of AOI-1)																			
T11590-1	T11590-1	10/7/05	---	---	29.3	---	---	---	34.9	---	22.7	36.9	---	0.43	19.6	---	---	---	312
T11590-2	T11590-2	10/7/05	---	---	115	---	---	---	---	---	---	30.7	---	0.09	16.3	---	---	---	203
T11590-3	T11590-3	10/7/05	---	---	55.3	---	---	---	---	---	---	27.0	---	0.14	---	---	---	---	122
T11590-4	T11590-4	10/7/05	---	---	66.5	---	---	---	31.0	---	26.7	68.9	---	0.35	18.3	---	---	---	574
T11591-1 (1A)	T11591-1 (1A)	10/7/05	---	---	46.3	720.0	---	---	47.4	---	49.2	40.8	---	0.20	27.0	---	---	---	489
T11591-2 (2A)	T11591-2 (2A)	10/7/05	---	---	43.4	577.0	---	---	35.8	---	44.5	48.8	---	0.18	26.1	---	---	---	668
T11591-3 (3A)	T11591-3 (3A)	10/7/05	---	---	66.6	1680.0	---	---	61.2	---	81.6	64.3	---	0.46	41.3	---	---	---	1010
February 2006 TCEQ Investigation (TCEQ, 2006) (Preliminary Assessment Ref. 27)																			
E-1	(T12735-10)	2/23/06	---	---	456	1300	---	1.4	65.8	---	26.8	75.1	---	0.33	14.0	<1.2	<1.2	---	336
E-2	(T12735-11)	2/23/06	---	---	9.1	2.5	---	<0.68	33.9	---	14.5	12.5	---	0.029	21.8	<1.4	<1.4	---	58.6
E-3	(T12735-12)	2/23/06	---	---	166.0	1920.0	---	3	82	---	222	372	---	2.5	108	<3.2	<3.2	---	---
December 2007 TCEQ Investigation (TCEQ, 2007) (Preliminary Assessment Ref. 17)																			
T20169-1	T20169-1	12/17/07	---	---	16.5	89.5	---	<0.65	11.0	---	---	14.7	---	0.22	---	<1.3	<1.3	---	---
T20169-2	T20169-2	12/17/07	---	---	1.1	95.8	---	<0.61	14.1	---	---	15.5	---	0.19	---	<1.2	<1.2	---	---
T20169-3	T20169-3	12/17/07	---	---	17.4	165.0	---	<0.68	16.4	---	---	22.0	---	0.18	---	<1.4	<1.4	---	---
T20169-4	T20169-4	12/17/07	---	---	20.2	156.0	---	<0.76	18.5	---	---	22.2	---	0.26	---	<1.5	<1.5	---	---
T20169-5	T20169-5	12/17/07	---	---	39.9	163.0	---	<0.92	90.3	---	---	24.5	---	0.79	---	<1.8	<1.8	---	---
T20169-6	T20169-6	12/17/07	---	---	4.0	72.4	---	<0.78	23.6	---	---	18.5	---	0.18	---	<1.6	<1.6	---	---
USOR Letter to TNRCC (TCEQ) regarding remediation efforts related to spill from west side of bioreactor (HRS, p. 10, Reference 5, p. 504) (Preliminary Assessment Reference 30)																			
A1-1	A1-1	08/31/09	---	---	6.761	76.11	---	<0.5	7.029	---	---	13.63	---	0.068	---	<0.5	<0.5	---	---
A1-2	A1-2	08/31/09	---	---	7.614	57.26	---	<0.5	7.855	---	---	9.468	---	0.167	---	<0.5	<0.5	---	---
A1-3	A1-3	08/31/09	---	---	9.071	82.98	---	<0.5	32.88	---	---	12.88	---	0.127	---	<0.5	<0.5	---	---
A1-4	A1-4	08/31/09	---	---	28.71	67.02	---	0.66	7.964	---	---	12.35	---	0.604	---	<0.5	<0.5	---	---
A1-5	A1-5	08/31/09	---	---	6.34	58.72	---	<0.5	6.831	---	---	12.72	---	0.088	---	<0.5	<0.5	---	---
A1-6	A1-6	08/31/09	---	---	3.757	58.21	---	<0.5	5.08	---	---	8.191	---	0.03	---	<0.5	<0.5	---	---
A1-7	A1-7	08/31/09	---	---	0.917	151.7	---	<0.5	4.078	---	---	7.497	---	0.013	---	<0.5	<0.5	---	---
A1-8	A1-8	08/31/09	---	---	14.34	176.2	---	<0.5	6.747	---	---	15.47	---	0.304	---	<0.5	<0.5	---	---
A1-9	A1-9	08/31/09	---	---	2.135	214	---	<0.5	5.151	---	---	5.997	---	0.025	---	<0.5	<0.5	---	---
A1-10	A1-10	08/31/09	---	---	2.224	64.58	---	<0.5	14.44	---	---	12.74	---	0.033	---	<0.5	<0.5	---	---
A1-11	A1-11	08/31/09	---	---	1.621	202.9	---	<0.5	14.22	---	---	7.826	---	0.011	---	<0.5	<0.5	---	---
A1-12	A1-12	08/31/09	---	---	24.57	72.81	---	<0.5	9.942	---	---	75.9	---	0.165	---	<0.5	<0.5	---	---
A1-13	A1-13	08/31/09	---	---	54.7	196.3	---	<0.5	8.439	---	---	17.55	---	0.274	---	<0.5	<0.5	---	---
A1-14	A1-14	08/31/09	---	---	9.18	88.99	---	<0.5	8.36	---	---	38.46	---	0.302	---	<0.5	<0.5	---	---
A1-15	A1-15	08/31/09	---	---	9.947	75.52	---	<0.5	5.714	---	---	14.45	---	0.57	---	<0.5	<0.5	---	---
A1-16	A1-16	08/31/09	---	---	6.639	66.67	---	<0.5	4.696	---	---	8.191	---	0.236	---	<0.5	<0.5	---	---
A1-17	A1-17	08/31/09	---	---	2.381	59.49	---	<0.5	4.479	---	---	7.32	---	0.053	---	<0.5	<0.5	---	---
A1-19	A1-19	08/31/09	---	---	1.296	87.16	---	<0.5	15.63	---	---	13.72	---	0.015	---	<0.5	<0.5	---	---
A1-20	A1-20	08/31/09	---	---	1.536	139.8	---	<0.5	6.712	---	---	7.89	---	0.019	---	<0.5	<0.5	---	---
A1-4A	A1-4A	09/28/09	---	---	4.47	159.6	---	<0.5	9.06	---	---	2.75	---	<0.01	---	<0.5	<0.5	---	---
A1-8A	A1-8A	09/29/09	---	---	48	144.2	---	<0.5	10.8	---	---	4.88	---	0.055	---	<0.5	<0.5	---	---
A1-12A	A1-12A	09/30/09	---	---	28.7	73.5	---	<0.5	11.4	---	---	9.25	---	1.294	---	0.574	<0.5	---	---
A1-13A	A1-13A	10/01/09	---	---	22.6	75	---	<0.5	11.4	---	---	11	---	0.329	---	<0.5	<0.5	---	---
A1-14A	A1-14A	10/02/09	---	---	13.1	67.5	---	<0.5	8.67	---	---	5.09	---	<0.01	---	<0.5	<0.5	---	---

Table 3 - USOR Area of Investigation 1
Metals Concentrations in Soil Samples

Location	Sample ID	Sample Date	Aluminum (mg/kg)	Antimony (mg/kg)	Arsenic (mg/kg)	Barium (mg/kg)	Beryllium (mg/kg)	Cadmium (mg/kg)	Chromium (mg/kg)	Cobalt (mg/kg)	Copper (mg/kg)	Lead (mg/kg)	Manganese (mg/kg)	Mercury (mg/kg)	Nickel (mg/kg)	Selenium (mg/kg)	Silver (mg/kg)	Vanadium (mg/kg)	Zinc (mg/kg)
2003 USOR Letter to TCEQ Regarding Remediation Efforts Related to "Buried Waste Pit" (USOR Preliminary Assessment, Reference 23)																			
#1, #2, #3 Comp	#1	07/23/03	---	0.047	<0.005	1.76	<0.005	<0.004	<0.007	---	---	<0.01	---	<0.005	<0.015	0.021	<0.006	---	---
#1, #2, #3 Comp	#2	07/23/03	---	0.054	0.012	1.87	<0.005	<0.004	<0.007	---	---	<0.01	---	<0.005	<0.015	<0.005	<0.006	---	---
October 2009 Health Consultation for MCC Recycling, LLP Facility (ATSDR, 2009) (MCC Preliminary Assessment, Reference 11)																			
Memorial Park	Background Soil	May 2009	---	---	4.1	150	---	0.48	13	---	---	63	---	0.093	---	0.3J	0.14J	---	---
1991 Espey, Houston & Associates, Phase 2A Environmental Site Assessment (USOR Preliminary Assessment, Ref. 19)																			
B-1 11-12'	B-1 11-12'	09/30/91	---	---	59.6	---	---	---	---	---	4.7	---	---	---	---	---	---	---	---
B-2 11-11.5'	B-2 11-11.5'	09/30/91	---	---	180	---	---	---	---	---	5.4	---	---	---	---	---	---	---	---
B-3 12.5-13'	B-3 12.5-13'	09/30/91	---	---	6120	---	---	---	---	---	3.9	---	---	---	---	---	---	---	---
1998 Extra Environmental Inc. Sampling Report for North American Hide Exporters																			
1	1	02/11/98	---	---	190	---	---	---	---	---	---	---	---	---	---	---	---	---	---
2	2	02/11/98	---	---	120	---	---	---	---	---	---	---	---	---	---	---	---	---	---
3	3	02/11/98	---	---	<2.5	---	---	---	---	---	---	---	---	---	---	---	---	---	---
4	4	02/11/98	---	---	95	---	---	---	---	---	---	---	---	---	---	---	---	---	---
5	5	02/11/98	---	---	6.2	---	---	---	---	---	---	---	---	---	---	---	---	---	---
6	6	02/11/98	---	---	180	---	---	---	---	---	---	---	---	---	---	---	---	---	---
7	7	02/11/98	---	---	20	---	---	---	---	---	---	---	---	---	---	---	---	---	---
8	8	02/11/98	---	---	36	---	---	---	---	---	---	---	---	---	---	---	---	---	---
9	9	02/11/98	---	---	25	---	---	---	---	---	---	---	---	---	---	---	---	---	---
10	10	02/11/98	---	---	22	---	---	---	---	---	---	---	---	---	---	---	---	---	---
11	11	02/11/98	---	---	33	---	---	---	---	---	---	---	---	---	---	---	---	---	---
12	12	02/11/98	---	---	62	---	---	---	---	---	---	---	---	---	---	---	---	---	---
13	13	02/11/98	---	---	42	---	---	---	---	---	---	---	---	---	---	---	---	---	---
14	14	02/11/98	---	---	2.7	---	---	---	---	---	---	---	---	---	---	---	---	---	---
15	15	02/11/98	---	---	170	---	---	---	---	---	---	---	---	---	---	---	---	---	---
16	16	02/11/98	---	---	<2.5	---	---	---	---	---	---	---	---	---	---	---	---	---	---
17	17	02/11/98	---	---	32	---	---	---	---	---	---	---	---	---	---	---	---	---	---
18	18	02/11/98	---	---	21	---	---	---	---	---	---	---	---	---	---	---	---	---	---
19	19	02/11/98	---	---	<2.5	---	---	---	---	---	---	---	---	---	---	---	---	---	---
20	20	02/11/98	---	---	120	---	---	---	---	---	---	---	---	---	---	---	---	---	---

Notes:
1. --- = No value available for that compound for that sample.
2. < = not detected above reporting limit
3. J = estimated concentration.
4. Not all qualifier flags from original data are included in this table.
5. Only metals detected in at least one soil sample are included in this table.

Table 4 - USOR Area of Investigation 1
Volatile Organic Compound and Total Petroleum Hydrocarbons Concentrations in Soil Samples

Location	Sample ID	Sample Date	Benzene (mg/kg)	Ethylbenzene (mg/kg)	Styrene (mg/kg)	Tetrachloroethylene (mg/kg)	Toluene (mg/kg)	Xylenes (mg/kg)	TPH (C6-C12) (mg/kg)	TPH (C12-C28) (mg/kg)	TPH (C28-C35) (mg/kg)	TPH (C6-C35) (mg/kg)
March 2011 EPA START-3 Sampling Event (HRS, p. 14, Reference 44)												
SS-01	SS-01-03-51	3/1/2011	--	--	--	--	--	<0.0051	--	--	--	--
SS-02	SS-02-03-51	3/1/2011	--	--	--	--	--	<0.005	--	--	--	--
SS-03	SS-03-03-51	3/1/2011	--	--	--	--	--	<0.0057	--	--	--	--
SS-03	SS-03-03-52	3/1/2011	--	--	--	--	--	<0.0057	--	--	--	--
SS-04	SS-04-03-51	3/1/2011	--	--	--	--	--	<0.0057	--	--	--	--
SS-05	SS-05-03-51	3/1/2011	--	--	--	--	--	<0.005	--	--	--	--
USOR Letter to TNRCC (TCEQ) regarding remediation efforts related to spill from west side of bioreactor (HRS, p. 10, Reference 5, p. 504) (Preliminary Assessment Reference 30)												
A1-1	A1-1	8/31/2009	---	---	---	---	---	<0.005	---	---	---	---
A1-2	A1-2	8/31/2009	---	---	---	---	---	<0.005	---	---	---	---
A1-3	A1-3	8/31/2009	---	---	---	---	---	<0.005	---	---	---	---
A1-4	A1-4	8/31/2009	---	---	---	---	---	<0.005	---	---	---	---
A1-5	A1-5	8/31/2009	---	---	---	---	---	<0.005	---	---	---	---
A1-6	A1-6	8/31/2009	---	---	---	---	---	<0.005	---	---	---	---
A1-7	A1-7	8/31/2009	---	---	---	---	---	<0.005	---	---	---	---
A1-8	A1-8	8/31/2009	---	---	---	---	---	<0.005	---	---	---	---
A1-9	A1-9	8/31/2009	---	---	---	---	---	<0.005	---	---	---	---
A1-10	A1-10	8/31/2009	---	---	---	---	---	<0.005	---	---	---	---
A1-11	A1-11	8/31/2009	---	---	---	---	---	<0.005	---	---	---	---
A1-12	A1-12	8/31/2009	---	---	---	---	---	<0.005	---	---	---	---
A1-13	A1-13	8/31/2009	---	---	---	---	---	<0.005	---	---	---	---
A1-14	A1-14	8/31/2009	---	---	---	---	---	<0.005	---	---	---	---
A1-15	A1-15	8/31/2009	---	---	---	---	---	<0.005	---	---	---	---
A1-16	A1-16	8/31/2009	---	---	---	---	---	<0.005	---	---	---	---
A1-17	A1-17	8/31/2009	---	---	---	---	---	<0.005	---	---	---	---
A1-19	A1-19	8/31/2009	---	---	---	---	---	<0.005	---	---	---	---
A1-20	A1-20	8/31/2009	---	---	---	---	---	<0.005	---	---	---	---
October 2009 Health Consultation for MCC Recycling, LLP Facility (ATSDR, 2009) (MCC Preliminary Assessment, Reference 11)												
Memorial Park	Background Soil	May 2009	---	---	---	---	---	---	---	---	---	---
February 2006 TCEQ Investigation (TCEQ, 2006) (Preliminary Assessment Ref. 27)												
E-1	(T12735-10)	2/23/2006	0.0024 J	<0.0014	0.0043	<0.0015	0.0118	<0.0043	216 J	1820	702	2730
E-2	(T12735-11)	2/23/2006	---	---	---	---	---	---	<10	<8.6	<21	<21
E-3	(T12735-12)	2/23/2006	<0.73	17.1	7.83	4.59	19.9	109	12200	71900	12600	96600
December 2007 TCEQ Investigation (TCEQ, 2007) (Preliminary Assessment Ref. 17)												
T20169-1	T20169-1	12/17/2007	---	---	---	---	---	---	88.3	384	142	614
T20169-2	T20169-2	12/17/2007	---	---	---	---	---	---	306	1130	327	1760
T20169-3	T20169-3	12/17/2007	---	---	---	---	---	---	519	2310	643	6480
T20169-4	T20169-4	12/17/2007	---	---	---	---	---	---	66	611	188	865
T20169-5	T20169-5	12/17/2007	---	---	---	---	---	---	299	3070	1020	4390
T20169-6	T20169-6	12/17/2007	---	---	---	---	---	---	<11	42.8	<4.7	42.8
1991 Espey, Houston & Associates, Phase 2A Environmental Site Assessment (Preliminary Assessment, Ref. 19)												
B-1	B-1 11-12'	9/30/1991	---	---	---	---	---	<0.005	---	---	---	---
B-2	B-2 11-11.5'	9/30/1991	---	---	---	---	---	<0.005	---	---	---	---
B-3	B-3 12.5-13'	9/30/1991	---	---	---	---	---	0.028	---	---	---	---

Notes:
1. --- = No value available for that compound for that sample.
2. < = not detected above reporting limit
3. J = estimated concentration.
4. Not all qualifier flags from original data are included in this table.
5. Only compounds detected in at least one soil sample are included in this table.

Table 5 - USOR Area of Investigation 1
Semi-Volatile Organic Compound Concentrations in Soil Samples

Location	Sample ID	Sample Date	1,4-Dichlorobenzene (mg/kg)	2-Methylnapthalene	Acenapthene (mg/kg)	Acenaphthylene (mg/kg)	Anthracene (mg/kg)	Benzo (a) anthracene (mg/kg)	Benzo (a) pyrene (mg/kg)	Benzo (b) fluoranthene (mg/kg)	Benzo (g,h,i) perylene (mg/kg)	Benzo (k) fluoranthene (mg/kg)	Bis(2-Ethylhexyl)phthalate (mg/kg)	Butyl benzyl phthalate (mg/kg)	Chrysene (mg/kg)	Di-n-butylphthalate (mg/kg)	Fluoranthene (mg/kg)	Fluorene (mg/kg)	Indeno (1,2,3-cd) pyrene (mg/kg)	Methyl ethyl ketone (mg/kg)	Naphthalene (mg/kg)	Phenanthrene (mg/kg)	Pyrene (mg/kg)
March 2011 EPA START-3 Sampling Event (HRS, p. 14, Reference 44)																							
SS-01	SS-01-03-51	3/1/2011	<0.0051	---	---	---	---	<0.767	1.32	1.68	1.36	0.98	---	---	1.31	<0.767	1.54	---	1.17	<0.0051	<0.307	0.425	1.56
SS-02	SS-02-03-51	3/1/2011	<0.005	---	---	---	---	<0.66	<0.66	<0.66	<0.66	<0.66	---	---	<0.66	<0.737	<0.264	---	<0.66	<0.005	<0.264	<0.264	<0.264
SS-03	SS-03-03-51	3/1/2011	0.702	---	---	---	---	<0.652	<0.652	<0.652	<0.652	<0.652	---	---	<0.652	<0.652	<0.261	---	<0.652	<0.0057	<0.261	<0.261	<0.261
SS-03	SS-03-03-52	3/1/2011	0.986	---	---	---	---	<0.646	<0.646	<0.646	<0.646	<0.646	---	---	<0.646	<0.652	<0.258	---	<0.646	<0.0061	<0.258	<0.258	<0.258
SS-04	SS-04-03-51	3/1/2011	<0.0057	---	---	---	---	<0.784	<0.784	<0.784	<0.784	<0.784	---	---	<0.784	<0.784	0.668	---	<0.784	<0.0057	<0.313	<0.313	0.784
SS-05	SS-05-03-51	3/1/2011	<0.662	---	---	---	---	1.15	1.68	1.99	1.46	1.26	---	---	1.69	<0.662	2.64J	---	1.21	<0.005	<0.265	0.813J	2.66
USOR Letter to TNRCC (TCEQ) regarding remediation efforts related to spill from west side of bioreactor (HRS, p. 10, Reference 5, p. 504) (Preliminary Assessment Reference 30)																							
A1-1	A1-1	8/31/2009	<0.005	---	---	---	---	<3.33	<3.33	<3.33	<4	<3.33	---	---	<3.33	<3.33	<3.33	---	<3.33	1.24	0.0059	<3.33	<3.33
A1-2	A1-2	8/31/2009	<0.005	---	---	---	---	<3.33	<3.33	<3.33	<4	<3.33	---	---	<3.33	<3.33	<3.33	---	<3.33	<0.005	0.0074	<3.33	<3.33
A1-3	A1-3	8/31/2009	<0.005	---	---	---	---	<3.33	<3.33	<3.33	<4	<3.33	---	---	<3.33	<3.33	<3.33	---	<3.33	<0.005	<0.005	<3.33	<3.33
A1-4	A1-4	8/31/2009	<0.005	---	---	---	---	<3.33	<3.33	<3.33	<4	<3.33	---	---	<3.33	<3.33	<3.33	---	<3.33	<0.005	<0.005	<3.33	<3.33
A1-5	A1-5	8/31/2009	<0.005	---	---	---	---	<3.33	<3.33	<3.33	<4	<3.33	---	---	<3.33	<3.33	<3.33	---	<3.33	<0.005	<0.005	<3.33	<3.33
A1-6	A1-6	8/31/2009	<0.005	---	---	---	---	<3.33	<3.33	<3.33	<4	<3.33	---	---	<3.33	<3.33	<3.33	---	<3.33	<0.005	<0.005	<3.33	<3.33
A1-7	A1-7	8/31/2009	<0.005	---	---	---	---	<3.33	<3.33	<3.33	<4	<3.33	---	---	<3.33	<3.33	<3.33	---	<3.33	<0.005	<0.005	<3.33	<3.33
A1-8	A1-8	8/31/2009	<0.005	---	---	---	---	<3.33	<3.33	<3.33	<4	<3.33	---	---	<3.33	<3.33	<3.33	---	<3.33	<0.005	<0.005	<3.33	<3.33
A1-9	A1-9	8/31/2009	<0.005	---	---	---	---	<3.33	<3.33	<3.33	<4	<3.33	---	---	<3.33	<3.33	<3.33	---	<3.33	<0.005	<0.005	<3.33	<3.33
A1-10	A1-10	8/31/2009	<0.005	---	---	---	---	<3.33	<3.33	<3.33	<4	<3.33	---	---	<3.33	<3.33	<3.33	---	<3.33	<0.005	<0.005	<3.33	<3.33
A1-11	A1-11	8/31/2009	<0.005	---	---	---	---	<3.33	<3.33	<3.33	<4	<3.33	---	---	<3.33	<3.33	<3.33	---	<3.33	<0.005	<0.005	<3.33	<3.33
A1-12	A1-12	8/31/2009	<0.005	---	---	---	---	<3.33	<3.33	<3.33	<4	<3.33	---	---	<3.33	<3.33	<3.33	---	<3.33	<0.005	<0.005	<3.33	<3.33
A1-13	A1-13	8/31/2009	<0.005	---	---	---	---	<3.33	<3.33	<3.33	<4	<3.33	---	---	<3.33	<3.33	<3.33	---	<3.33	<0.005	<0.005	<3.33	<3.33
A1-14	A1-14	8/31/2009	<0.005	---	---	---	---	<3.33	<3.33	<3.33	<4	<3.33	---	---	<3.33	<3.33	<3.33	---	<3.33	<0.005	<0.005	<3.33	<3.33
A1-15	A1-15	8/31/2009	<0.005	---	---	---	---	<3.33	<3.33	<3.33	<4	<3.33	---	---	<3.33	<3.33	<3.33	---	<3.33	<0.005	<0.005	<3.33	<3.33
A1-16	A1-16	8/31/2009	<0.005	---	---	---	---	<3.33	<3.33	<3.33	<4	<3.33	---	---	<3.33	<3.33	<3.33	---	<3.33	<0.005	<0.005	<3.33	<3.33
A1-17	A1-17	8/31/2009	<0.005	---	---	---	---	<3.33	<3.33	<3.33	<4	<3.33	---	---	<3.33	<3.33	<3.33	---	<3.33	<0.005	<0.005	<3.33	<3.33
A1-19	A1-19	8/31/2009	<0.005	---	---	---	---	<3.33	<3.33	<3.33	<4	<3.33	---	---	<3.33	<3.33	<3.33	---	<3.33	<0.005	<0.005	<3.33	<3.33
A1-20	A1-20	8/31/2009	<0.005	---	---	---	---	<3.33	<3.33	<3.33	<4	<3.33	---	---	<3.33	<3.33	<3.33	---	<3.33	<0.005	<0.005	<3.33	<3.33
October 2009 Health Consultation for MCC Recycling, LLP Facility (ATSDR, 2009) (MCC Preliminary Assessment, Reference 11)																							
Memorial Park	Background Soil	May 2009	---	---	---	---	---	1.8	1.3	1.9	0.43	1.4	---	---	1.7	<0.11	3.3	---	0.54	---	<0.086	1.1	2.5
February 2006 TCEQ Investigation (TCEQ, 2006) (Preliminary Assessment Ref. 27)																							
E-1	(T12735-10)	2/23/2006	<0.78	0.717 J	0.62 J	1.7 J	1.05 J	<0.76	2.57	7.24	<0.94	2.57	11.8	1.03	<0.8	<0.71	2.2	<0.53	<1.1	---	<3.06	<0.72	2.22
E-2	(T12735-11)	2/23/2006	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
E-3	(T12735-12)	2/23/2006	<2	347	21.5	<1.9	<2.6	23.4	29.8	43.5	<2.4	16.7	36.4	20.6	34	<4.55	21.4	19	20	---	211	88.5	77.1
December 2007 TCEQ Investigation (TCEQ, 2007) (Preliminary Assessment Ref. 17)																							
T20169-1	T20169-1	12/17/2007	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
T20169-2	T20169-2	12/17/2007	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
T20169-3	T20169-3	12/17/2007	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
T20169-4	T20169-4	12/17/2007	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
T20169-5	T20169-5	12/17/2007	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
T20169-6	T20169-6	12/17/2007	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
1991 Espey, Houston & Associates, Phase 2A Environmental Site Assessment (Preliminary Assessment, Ref. 19)																							
B-1	B-1 11-12'	9/30/1991	<2.18	---	---	---	---	<2.18	<2.18	<2.18	<2.18	<2.18	---	---	<2.18	2.9	<2.18	---	<2.18	---	<2.18	<2.18	<2.18
B-2	B-2 11-11.5'	9/30/1991	<2.18	---	---	---	---	<2.18	<2.18	<2.18	<2.18	<2.18	---	---	<2.18	7.8	<2.18	---	<2.18	---	<2.18	<2.18	<2.18
B-3	B-3 12.5-13'	9/30/1991	<2.18	---	---	---	---	<2.18	<2.18	<2.18	<2.18	<2.18	---	---	<2.18	6.4	<2.18	---	<2.18	---	<2.18	<2.18	<2.18

Notes:
1. --- = No value available for that compound for that sample.
2. < = not detected above reporting limit
3. J = estimated concentration.
4. Not all qualifier flags from original data are included in this table.
5. Only compounds detected in at least one soil sample are included in this table.

Table 6 - USOR Area of Investigation 1
Pesticide Concentrations in Soil Samples

Location	Sample ID	Sample Depth (ft below grade)	Aldrin (mg/kg)	alpha-BHC (mg/kg)	alpha-Chlordane (mg/kg)	beta-BHC (mg/kg)	delta-BHC (mg/kg)	gamma-BHC (mg/kg)	gamma-Chlordane (mg/kg)	4,4'-DDD (mg/kg)	4,4'-DDE (mg/kg)	4,4'-DDT (mg/kg)	Dieldrin (mg/kg)	Endosulfan sulfate (mg/kg)	Endrin (mg/kg)	Endrin aldehyde (mg/kg)	Heptachlor (mg/kg)	Heptachlor Epoxide (mg/kg)	Methoxychlor (mg/kg)	Toxaphene (mg/kg)
February 2006 TCEQ Investigation (TCEQ, 2006) (Preliminary Assessment Ref. 27)																				
E-1	(T12735-10)	---	<0.00048	0.0049	0.0032	<0.0006	<0.0006	---	0.0238	0.0441	0.0625	0.0162	0.0226	<0.0012	<0.0014	<0.0017	0.00063	0.0016	<0.0088	<0.015
E-2	(T12735-11)	---	<0.00056	<0.0005	<0.00047	<0.0008	<0.0008	---	<0.00047	<0.0014	<0.0018	<0.0021	<0.0013	<0.0014	<0.0016	<0.002	<0.00065	<0.00047	<0.01	30.6
E-3	(T12735-12)	---	0.282	<0.012	0.227	0.27	<0.017	---	0.586	0.552	1.07	0.384	1.16	<0.031	<0.036	<0.045	<0.015	<0.011	<0.23	<0.4
1991 Espey, Houston & Associates, Phase 2A Environmental Site Assessment (Preliminary Assessment, Ref. 19)																				
B-1	B-1 11-12'	11/12/13	<0.0027	<0.002	---	<0.004	<0.006	<0.0027	---	<0.0074	<0.0024	<0.008	<0.0013	<0.0442	<0.004	<0.0154	---	---	<0.118	---
B-2	B-2 11-11.5'	11-11.5	0.0047	0.024	---	0.0158	<0.006	<0.0027	---	0.0094	0.0037	0.0211	<0.0013	<0.0442	<0.004	<0.0154	---	---	<0.118	---
B-3	B-3 12.5-13'	12.5-13	<0.070	<0.05	---	1.2	0.37	<0.07	---	3.8	2.6	8.7	1.7	4.6	8.2	4.2	---	---	8.4	---

Notes:
1. --- = No value available for that compound for that sample.
2. < = not detected above reporting limit
3. J = estimated concentration.
4. Not all qualifier flags from original data are included in this table.
5. Only compounds detected in at least one soil sample are included in this table.

Table 7 - USOR Area of Investigation 1
Metals and Pesticides Concentrations in Groundwater Samples

Location	Sample ID	Date Sampled	Arsenic (mg/L)	Copper (mg/L)	alpha-BHC (mg/L)	beta-BHC (mg/L)	gamma-BHC (mg/L)
1991, Espey, Houston & Associates (Preliminary Asssessment, Ref. 19)							
B-1	B-1	9/30/1991	5.77	0.17	0.00008	0.00022	0.00004

Notes:
1. < = not detected above reporting limit
2. Only compounds detected in at least one sample are included in this table.

Table 8 - USOR Area of Investigation 1
Metals Concentrations in Surface Water Samples
2011 Data

Location	Sample ID	Date Sampled	Aluminum (mg/L)	Antimony (mg/L)	Arsenic (mg/L)	Barium (mg/L)	Beryllium (mg/L)	Cadmium (mg/L)	Chromium (mg/L)	Cobalt (mg/L)	Copper (mg/L)	Iron (mg/L)	Lead (mg/L)	Magnesium (mg/L)	Manganese (mg/L)	Mercury (mg/L)	Nickel (mg/L)	Potassium (mg/L)	Selenium (mg/L)	Silver (mg/L)	Vanadium (mg/L)	Zinc (mg/L)
March 2011 EPA START-3 Sampling Event (HRS, p. 14, Reference 44)																						
PPE-01	PPE-01-00-11-20110303	3-Mar-11	0.426 J	<0.002	0.0158 J	0.0704	<0.001	<0.001	0.004 J	<0.001	0.002 J	0.211	0.0018 J	229	0.0336	<0.0002	0.0045	82.3	<0.005	<0.001	0.0009 J	0.0172 J
PPE-02	PPE-02-00-11-20110303	3-Mar-11	0.284 J	<0.002	0.0191 J	0.0655 J	<0.001	<0.001	0.0033 J	<0.001	0.0024 J	<0.2	<0.002	280	0.0338	<0.0002	0.0036 J	97	<0.005	<0.001	<0.005	0.0128 J
PPE-03	PPE-03-00-11-20110302	2-Mar-11	<0.02	<0.002	0.0192 J	0.0789	<0.001	<0.001	0.004 J	<0.001	<0.002	0.202	<0.001	260 J	0.0429	<0.0002	0.0042	90.4 J	<0.005	<0.001	<0.005	0.0131 J
PPE-04	PPE-04-00-11-20110302	2-Mar-11	<0.02	<0.002	0.0188 J	0.0917	<0.001	<0.001	0.0039 J	<0.001	<0.002	0.0977 J	<0.001	285	0.0453	<0.0002	0.0042	95 J	0.0054J	<0.001	0.0012 J	0.0098 J
PPE-05	PPE-05-00-11-20110301	1-Mar-11	<0.02	<0.002	0.0192 J	0.0688	<0.001	<0.001	0.0032 J	<0.001	<0.002	0.141 J	<0.001	258 J	0.0469	<0.0002	0.0039	89 J	0.0105J	<0.001	<0.0024	0.0142 J
PPE-06	PPE-06-00-11-20110301	1-Mar-11	<0.02	<0.002	0.0191 J	0.0695	<0.001	<0.001	<0.002	<0.001	<0.002	0.171 J	<0.001	232	0.0465	<0.0002	0.0041	81	0.0087J	<0.001	0.0015 J	0.0149 J
SED-01	BG-01-00-11-20110303	3-Mar-11	0.069 J	<0.004	0.021 J	0.0582 J	<0.002	<0.001	<0.004	<0.002	<0.004	<0.4	<0.002	240	0.0352	<0.0002	<0.002	85.5	<0.01	<0.001	<0.01	0.0201 J
SED-02	BG-02-00-11-20110301	1-Mar-11	<0.02	<0.002	0.0149 J	0.0728	<0.001	<0.001	<0.002	<0.001	<0.002	0.16 J	0.0016 J	264	0.0426	<0.0002	0.0039	89.8	<0.005	0.0017 J	0.0027 J	0.0141 J
SW-01	SW-01-00-11-20110302	2-Mar-11	<0.02	<0.002	0.02 J	0.0768	<0.001	<0.001	0.0043 J	<0.001	<0.002	0.16 J	<0.001	256	0.0381	<0.0002	0.0041	88.9	<0.005	<0.001	0.002 J	0.0139 J
SW-02	SW-02-00-11-20110302	2-Mar-11	<0.02	<0.002	0.0189 J	0.0738	<0.001	<0.001	0.0042 J	<0.001	<0.002	0.121 J	0.001	267	0.0372	<0.0002	0.0042	92.6	<0.005	<0.001	0.00016 J	0.0125 J
SW-03	SW-03-00-11-20110303	3-Mar-11	1.42	<0.002	0.0169 J	0.083	<0.001	<0.001	0.006 J	0.0018J	0.0058 J	1.24	0.016	245	0.0786	<0.0002	0.0055	86.5	<0.005	<0.001	0.0038 J	0.0347 J
SW-04	SW-04-00-11-20110303	3-Mar-11	0.466	<0.002	0.0148 J	0.0687	<0.001	<0.001	0.0041 J	<0.001	0.002 J	0.247	0.0025	230	0.0344	<0.0002	0.0041	82.5	<0.005	<0.001	0.00021 J	0.0152 J
SW-05	SW-05-00-11-20110303	3-Mar-11	0.118 J	<0.002	0.018 J	0.0612 J	<0.001	<0.001	0.0029 J	<0.001	0.0035 J	<0.2	<0.002	232	0.0314	<0.0002	0.0038 J	82.3	<0.005	<0.001	<0.005	0.015 J
SW-06	SW-06-00-11-20110302	2-Mar-11	0.277	<0.002	0.0143 J	0.0486	<0.001	<0.001	0.0033 J	<0.001	0.0012 J	0.0686 J	<0.001	121	0.0235	<0.0002	0.0035	50.6	<0.005	<0.001	<0.005	0.0185 J
SW-07	SW-07-00-11-20110303	3-Mar-11	0.306	<0.002	0.0132 J	0.0518	<0.001	<0.001	<0.002	<0.001	0.0014 J	0.0986 J	0.001	139	0.0247	<0.0002	0.0038	55.8	<0.005	<0.001	0.00042 J	0.0188 J
SW-08	SW-08-00-11-20110303	3-Mar-11	0.152 J	<0.002	0.0159 J	0.0533 J	<0.001	<0.001	0.0028 J	<0.001	0.0016 J	<0.2	<0.002	169	0.0261	<0.0002	0.0032 J	75.1	<0.005	<0.001	<0.005	0.0131 J
SW-09	SW-09-00-11-20110302	2-Mar-11	<0.02	<0.002	0.0189 J	0.092	<0.001	<0.001	0.0037 J	<0.001	<0.002	0.0942 J	<0.001	288 J	0.0445	<0.0002	0.0042	94.7 J	0.0057J	<0.001	0.00065 J	0.0091 J
SW-10	SW-10-00-11-20110302	2-Mar-11	<0.02	<0.002	0.0185 J	0.0617	<0.001	<0.001	0.0032 J	<0.001	<0.002	0.0932 J	<0.001	229 J	0.0334	<0.0002	0.0037	80.8 J	0.0064J	<0.001	0.0016 J	0.0147 J
SW-11	SW-11-00-11-20110301	1-Mar-11	<0.02	<0.002	0.0168 J	0.0662	<0.001	<0.001	<0.002	<0.001	<0.002	0.101 J	<0.001	217	0.0427	<0.0002	0.0039	78.3	0.0067	<0.001	0.0021 J	0.014 J

Notes:
1. All surface water samples from Vince Bayou are included on this table, regardless of their location relative to Area of Investigation 1 or Area of Investigation 2.
2. Samples SED-01 and SED-02 were collected at background locations
3. J = estimated concentration.
4. < = not detected above reporting limit.
5. Not all qualifier flags from original data are included in this table.
6. Only compounds detected in at least one sample are included in this table.

Table 9 - USOR Area of Investigation 1
Metals Concentrations in Sediment Samples
2011 Data

Location	Sample ID	Sample Date	Aluminum (mg/kg)	Arsenic (mg/kg)	Barium (mg/kg)	Beryllium (mg/kg)	Cadmium (mg/kg)	Calcium (mg/kg)	Chromium (mg/kg)	Cobalt (mg/kg)	Copper (mg/kg)	Iron (mg/kg)	Lead (mg/kg)	Magnesium (mg/kg)	Manganese (mg/kg)	Mercury (mg/kg)	Nickel (mg/kg)	Potassium (mg/kg)	Selenium (mg/kg)	Silver (mg/kg)	Sodium (mg/kg)	Vanadium (mg/kg)	Zinc (mg/kg)
October 2009 Health Consultation for MCC Recycling, LLP Facility (ATSDR, 2009) (MCC Preliminary Assessment, Reference 11)																							
Memorial Park	Background Soil	May 2009	NR	6.7	370	NR	0.43	NR	10	NR	NR	NR	8.6	NR	NR	0.063 U	NR	NR	0.42J	0.64 U	NR	NR	NR
March 2011 EPA START-3 Sampling Event (HRS, p.14, Reference 44)																							
PPE-01	PPE-01-03-51	3/3/2011	9620	10.3J	103	0.67U	0.67U	20000	20.4J	4J	13.6J	11300J	76.3	3080	164J	0.35	7.2J	1530	3.4 UJ	1	1870	17.1J	71J
PPE-02	PPE-02-03-51	3/3/2011	12800	4.7J	115	0.79U	0.79U	8820	24.9J	5.6J	22.7J	13200J	120	3930	155J	0.32	13J	2040	7.9 UJ	2.3	2180	18.5J	118J
PPE-03	PPE-03-03-51	3/2/2011	8550	2.2J	78.6	0.85UJ	1.1J	17200	14.4J	3.4J	15.5J	10000	57.3J	3140	74.3J	0.11J	7.3J	1620	---	1.1	2490J	13.7J	112J
PPE-04	PPE-04-03-51	3/2/2011	7480	2J	85.2	0.72UJ	0.72UJ	18000	14J	4.6J	13.9J	9740	32J	2790	94.1J	0.064J	7.8J	1420	---	0.72U	2070J	16J	76.3J
PPE-05	PPE-05-03-51	3/2/2011	13300	2.4J	96.4	0.95UJ	0.95UJ	28900	17.2J	4.8J	18.7J	13600	41.2J	4390	123J	0.13J	10.3J	2430	---	0.95U	3080J	18.7J	116J
PPE-06	PPE-06-03-51	3/2/2011	10500	2.6J	102	0.88UJ	0.88UJ	32700	16.4J	4.5J	17.7J	12000	34.8J	3830	118J	0.051J	8.6J	1920	---	0.88U	2080J	17.7J	101J
SED-01	BG-01-03-51	3/3/2011	16900	2.3J	196	0.81J	0.65U	133000	12.4J	4.3J	5.9J	15200J	10.3	6330	148J	0.0083J	9.5J	2970	3.3 UJ	0.65U	1440	20.1J	16.9J
SED-02	BG-02-03-51	3/2/2011	10100	2.3J	81	0.7UJ	0.7UJ	25200	16.2J	4.3J	16.7J	12600	50.5J	3630	158J	0.076J	7.8J	1880	---	0.7U	2120J	16.1J	74J
SW-01	SED-01-03-51	3/2/2011	9760	13.1J	117	0.82UJ	0.82UJ	34100	18.9J	5.7J	15.7J	13700	106J	3420	215J	0.15J	8.9J	1710	---	0.82U	2600J	20J	103J
SW-02	SED-02-03-51	3/2/2011	18900	11.8J	150	0.93J	0.68UJ	29200	13.1J	4.9J	5.2J	16400	15.6J	4140	113J	0.92	7.6J	2230	---	0.68U	2020J	21.2J	16.6J
SW-03	SED-03-03-51	3/2/2011	14400	5.9J	114	0.87U	0.87U	18200	19.9J	4.7J	21.7J	14000J	64.4	4550	91.8J	0.32	10.8J	2360	4.4 UJ	1.7	2460	19.9J	118J
SW-04	SED-04-03-51	3/3/2011	6310	19.3J	109	0.67U	0.67U	9000	15.8J	3.4J	10.4J	6030J	57.5	1770	83.8J	1.8	6.5J	997	3.4 UJ	0.7	982	17.4J	30.6J
SW-05	SED-05-03-51	3/3/2011	8000	1.3J	62	0.74U	0.74U	6880	11.4J	2J	9.7J	8650J	38.4	2280	71J	0.13J	5.5J	1260	3.7 UJ	0.74U	1790	9.8J	65.9J
SW-06	SED-06-03-51	3/3/2011	7700	4J	86.7	0.6U	0.6U	137000	15.9J	3.8J	12.2J	11600J	57.1	4620	305J	0.075J	9J	1080	6 UJ	0.6U	1470	13.9J	132J
SW-07	SED-07-03-51	3/3/2011	10800	2.4J	89	0.69U	0.69U	16000	17J	5J	11.8J	12800J	55	4070	203J	0.14	9.4J	1760	3.5 UJ	0.92	1270	17.7J	87.4J
SW-08	SED-08-03-51	3/3/2011	17100	2.9J	291	1.1J	0.9	8890	40.6J	5.8J	45.3J	16200J	196	5640	116J	0.81	17J	2630	8.2 UJ	7.9	2220	23.9J	160J
SW-09	SED-09-03-51	3/2/2011	12800	2.2J	110	0.74J	0.69UJ	19900	21.1J	4.4J	14.8J	14600	122J	4330	106J	0.33	10.1J	2190	---	1.8	2220J	18.8J	114J
SW-10	SED-10-03-51	3/2/2011	15400	5.9J	178	3.4UJ	0.68UJ	3740	19.6J	26.7J	9.5J	17400	30.1J	2450	1030J	0.013J	14.1J	1740	---	0.68U	1770J	48.7J	13.5J
SW-11, PPE-06A	SED-11-03-51	3/2/2011	2630	2.3J	41.7	0.64UJ	0.64UJ	137000	23.4J	1.6J	8.1J	5640	9.8J	9770	310J	0.027J	4.5J	639U	---	0.64U	1160J	15J	40.1J

Notes:
1. All sediment samples from Vince Bayou are included on this table, regardless of their location relative to Area of Investigation 1 or Area of Investigation 2.
2. Samples SED-01 and SED-02 were collected at background locations
3. J = estimated concentration.
4. < or U = not detected above reporting limit.
5. Not all qualifier flags from original data are included in this table.
6. Only compounds detected in at least one sample are included in this table.
7. NR - Not reported in reference.

Table 10 - USOR Area of Investigation 1
Volatile and Semi-Volatile Organic Compound Concentrations in Sediment Samples
2011 Data

Location	Sample ID	Sample Date	Anthracene (mg/kg)	Benzo (a) anthracene (mg/kg)	Benzo (a) pyrene (mg/kg)	Benzo (b) fluoranthene (mg/kg)	Benzo (g,h,i) perylene (mg/kg)	Benzo (k) fluoranthene (mg/kg)	Bis (2-ethylhexyl) phthalate (mg/kg)	Carbon disulfide (mg/kg)	Chlorobenzene (mg/kg)	Chrysene (mg/kg)	Dibenz (a,h) anthracene (mg/kg)	Di-n-octyl phthalate (mg/kg)	Fluoranthene (mg/kg)	Fluorene (mg/kg)	Indeno (1,2,3-cd) pyrene (mg/kg)	Methyl acetate (mg/kg)	2-Methylnaphthalene (mg/kg)	Naphthalene (mg/kg)	Phenanthrene (mg/kg)	Pyrene (mg/kg)	Toluene (mg/kg)	Xylenes (mg/kg)
October 2009 Health Consultation for MCC Recycling, LLP Facility (ATSDR, 2009) (MCC Preliminary Assessment, Reference 11)																								
Memorial Park	Background Soil	May 2009	0.013 U	0.0044J	0.014	0.019J	0.026 U	0.039 U	0.033 U	NR	NR	0.013J	0.014J	0.017J	0.02 U	0.013 U	0.013J	NR	0.026 U	0.02 U	0.013 U	0.02 U	NR	NR
March 2011 EPA START-3 Sampling Event (HRS, p.14, Reference 44)																								
PPE-01	PPE-01-03-51	3/3/2011	<0.289	<0.723	<0.723	<0.723	<0.723	<0.723	<0.723	<0.0982	<0.0982	<0.723	<0.723	<0.723	<0.289	<0.289	<0.723	<0.245	<0.289	<0.289	<0.289	<0.289	<0.0982	<0.196
PPE-02	PPE-02-03-51	3/3/2011	<0.294	0.778	1.26	1.56	1.45J	1.01	<0.735	<0.0999	<0.0999	1.17	<0.735	<0.735	1.58	<0.294	1.1	<0.25	<0.294	<0.294	0.428	1.54	<0.0999	<0.2
PPE-03	PPE-03-03-51	3/2/2011	<0.309	0.934	1.24	1.49	0.892	0.982	7.45	0.146B	<0.1	1.27	<0.772	<0.772	2.28	<0.309	<0.772	<0.25	<0.309	<0.309	0.318	2.43	<0.1	<0.2
PPE-05	PPE-05-03-51	3/2/2011	<0.406	1.4	2.16	2.55	1.79	1.65	1.88	<0.0992	<0.0992	2.43	<1.01	<1.01	3.15	<0.406	1.59	<0.248	0.544	0.416	1.25	3.71	<0.0992	<0.198
PPE-05	PE-05-03-52 Field D	3/2/2011	<0.31	1.19	1.82	2.2	1.64	1.27	1.97	<0.1	<0.1	2	<0.776	<0.776	2.65	<0.31	1.45	0.299	<0.31	<0.31	0.941	2.74	<0.1	<0.2
PPE-06	PPE-06-03-51	3/2/2011	<0.332	1.29	2.01	2.41	1.57	1.62	1.95	<0.0999	<0.0999	2.25	<0.831	<0.831	2.81	<0.332	1.42	<0.25	<0.332	<0.332	0.834	3.37	<0.0999	<0.2
SED-01	BG-01-03-51	3/3/2011	<0.252	<0.629	<0.629	<0.629	<0.629	<0.629	<0.629	<0.099	<0.099	<0.629	<0.629	<0.629	<0.252	<0.252	<0.629	<0.248	<0.252	<0.252	<0.252	<0.252	<0.099	<0.198
SED-02	BG-02-03-51	3/2/2011	<0.278	1.16	1.74	1.9	1.37	1.39	<0.694	<0.0998	<0.0998	1.75	<0.694	<0.694	2.53	<0.278	1.16	<0.249	<0.278	<0.278	0.75	2.74	<0.0998	<0.2
SW-01	SED-01-03-51	3/2/2011	<0.278	2.05	2.82	3.04	2.27	1.99	0.904B	<0.0836	<0.0836	3.02	<0.695	<0.695	4.72	<0.278	2.08	0.485	<0.278	<0.278	1.79	4.73	<0.0836	<0.167
SW-02	SED-02-03-51	3/2/2011	<0.267	<0.668	<0.668	<0.668	<0.668	<0.668	<0.668	<0.0998	<0.0998	<0.668	<0.668	<0.668	0.491	<0.267	<0.668	<0.25	<0.267	<0.267	<0.267	0.513	<0.0998	<0.2
SW-03	SED-03-03-51	3/2/2011	<0.279	1.2	1.69	1.94	1.36J	1.62	<0.699	<0.1	<0.1	1.65	<0.699	<0.699	2.67	<0.279	1.27	<0.25	<0.279	<0.279	0.741	2.19	<0.1	0.2
SW-04	SED-04-03-51	3/3/2011	<0.268	<0.669	<0.669	<0.669	<0.669	<0.669	<0.669	<0.0999	<0.0999	<0.669	<0.669	<0.669	<0.268	<0.268	<0.669	<0.25	<0.268	<0.268	<0.268	<0.268	<0.0999	<0.2
SW-05	SED-05-03-51	3/3/2011	<0.263	1.62	2.5	2.93	2.1J	1.86	<0.657	<0.0999	<0.0999	2.22	0.725	<0.657	3.08	<0.263	1.95	<0.25	<0.263	<0.263	0.711	3.2	<0.0999	<0.2
SW-06	SED-06-03-51	3/3/2011	<0.241	<0.603	1	1.06	0.824J	0.701	<0.603	<0.1	<0.1	0.737	<0.603	<0.603	0.887	<0.241	0.656	<0.25	<0.241	<0.241	0.363	0.968	<0.1	<0.2
SW-07	SED-07-03-51	3/3/2011	<0.27	0.889	1.5	1.87	1.63J	1.33	<0.675	<0.0998	<0.0998	1.44	<0.675	<0.675	2.01	<0.27	1.41	<0.25	<0.27	<0.27	0.579	2.19	<0.0998	<0.2
SW-08	SED-08-03-51	3/3/2011	<0.303	<0.757	0.998	1.21	0.92	<0.757	<0.757	<0.1	<0.1	0.872	<0.757	<0.757	1.07	<0.303	0.774	<0.25	<0.303	<0.303	<0.303	1.14	<0.1	<0.2
SW-10	SED-10-03-51	3/2/2011	<0.252	<0.63	<0.63	<0.63	<0.63	<0.63	<0.63	<0.0997	<0.0997	<0.63	<0.63	<0.63	<0.252	<0.252	<0.63	<0.249	<0.252	<0.252	<0.252	<0.252	<0.0997	<0.199
Station 14368		4/23/2002	0.110J	0.506	0.506	0.612	ND	0.461	0.94	ND	ND	0.736	ND	ND	1.59	ND	0.328	---	ND	ND	0.328	1.06	0.0151	ND
Station 11301		4/23/2002	0.130J	1.03	1.25	13.4	ND	1.2	0.474	ND	ND	1.49	ND	ND	2.64	ND	0.86	---	ND	ND	1.17	2.03	ND	ND

Notes:
1. All sediment samples from Vince Bayou are included on this table, regardless of their location relative to Area of Investigation 1 or Area of Investigation 2.
2. Samples SED-01 and SED-02 were collected at background locations
3. J = estimated concentration.
4. < or U or ND = not detected above reporting limit.
6. Only compounds detected in at least one sample are included in this table.
7. Concentration based on historical averages from TNRCC database information for Station 11299.
8. NR - Not reported in reference.

TABLE 11
DATA NEEDS SUMMARY
USOR PROPERTY – AREA OF INTEREST 1

PRELIMINARY CONCEPTUAL SITE MODEL POTENTIAL EXPOSURE MEDIUM[1]	ITERATIVE DATA NEED	APPROACH TO FILL DATA NEED		
		EXISTING DATA REVIEWED	REMEDIAL INVESTIGATION ACTIVITY	REMEDIAL INVESTIGATION APPROACH AND DATA COLLECTION METHODS
On-Property Groundwater (and Off-Property Groundwater, if needed)	1) AOI-1-specific hydrogeology (hydraulic gradient, hydraulic conductivity, hydrostratigraphy, lithology, etc.). 2) Nature and extent of COPC concentrations. 3) General groundwater chemistry at AOI-1 (salinity, cations/anions, groundwater classification, etc.). 4) Uses of groundwater at and in the vicinity of AOI-1. 5) Discharge of groundwater to surface water. 6) Potential for groundwater to contribute to vapor intrusion and ambient air. 7) Potential presence of other groundwater plumes in the area.	1) Existing hydrogeology data for AOI-1. 2) Area water well survey (locations, use, depth, etc. of wells). 3) Historic groundwater concentration data. 4) Surrounding property groundwater quality data.	1) Evaluate AOI-1 hydrogeology. 2) Evaluate concentrations of COPCs in uppermost groundwater-bearing unit. 3) Perform more detailed water well and water use survey of area. 4) Perform a water well records search within one mile of AOI-1. Confirm that nearby properties are provided potable water from the local municipality. 5) Perform subsurface utility survey to identify obstructions for drilling program and preferential pathways for migration of COPCs. 6) Identify ongoing and/or historic spills/releases that have or have the potential to impact groundwater. 7) Evaluate potential for discharge of groundwater to	1) Perform initial high-resolution site characterization (HRSC) using a combination of assessment methods (e.g., cone penetrometer testing, depth-discrete groundwater sampling of the uppermost groundwater unit, and traditional soil borings). 2) Install permanent groundwater monitoring wells at pre-selected locations based on results of review of initial property characterization results. 3) Measure general groundwater parameters (temperature, specific conductance, pH, dissolved oxygen (DO). oxidation-reduction potential (ORP), TDS, etc.). 4) Collect groundwater samples to characterize on-property groundwater and evaluate potential impacts from source areas. Assess the potential for off-property migration and vertical migration on-property, if needed. Based on the results, refine the AOI-1 COPC list. 5) Conduct groundwater sampling events to assess seasonal variability e.g., quarterly for a year, evaluate, then determine appropriate monitoring program). 6) Perform hydraulic testing (slug testing) in selected wells. This data will be used with TDS data to establish groundwater classification. 7) Evaluate total versus dissolved concentrations of metals in groundwater samples. 8) Perform a water well records search to identify registered water wells located within one mile of AOI-1. In addition, perform a walking survey of immediately adjacent properties (500 feet from the property boundary) to identify the potential presence of un-registered water wells. 9) Assess the hydrogeologic connection and the potential for discharge of groundwater to Vince

TABLE 11
DATA NEEDS SUMMARY
USOR PROPERTY – AREA OF INTEREST 1

PRELIMINARY CONCEPTUAL SITE MODEL POTENTIAL EXPOSURE MEDIUM[1]	ITERATIVE DATA NEED	APPROACH TO FILL DATA NEED		
		EXISTING DATA REVIEWED	REMEDIAL INVESTIGATION ACTIVITY	REMEDIAL INVESTIGATION APPROACH AND DATA COLLECTION METHODS
			surface water. 8) Evaluate groundwater data to assess possibility of vapor intrusion (model).	Bayou through the evaluation of water levels and site stratigraphy, and the development of hydrogeologic cross-sections.
On- and Off[2]-Property Soil	1) Nature and extent of COPC concentrations in soil. 2) Potential source areas (e.g., bioreactors, tank farm, roll off boxes, former buried waste pit, etc.). 3) Surface water drainage patterns. 4) General soil characteristics to evaluate impact on COPC mobilization and sequestration in soil. 5) Background concentrations of COPCs in soil.	1) Concentrations of COPCs in soil collected during various investigations at AOI-1, and correlation of existing soil data with potential sources (including historical sources).	1) Evaluate lateral and vertical extent of COPCs in samples of surface soil (0 to 0.5 ft bgs), shallow soils (0.5 to 5 ft bgs) and subsurface soil (greater than 5 ft bgs). 2) Collect general soil chemistry data (pH, TOC, grain size, etc.). 3) Evaluate topography and preferential surface water drainage pathways. 4) Identify ongoing and/or historic spills releases that have or have the potential to impact soil.	1) Use detailed topographic survey of AOI-1 and adjacent and contiguous off-property areas (toward Vince Bayou) to identify drainage areas. 2) Advance soil borings to top of uppermost water-bearing unit to characterize surface and subsurface soil. 3) Collect discrete soil samples for laboratory analysis of COPCs. 4) Analyze selected representative samples for potential fate and transport parameters (total organic carbon, bulk density, etc.). 5) Evaluate property characteristics (e.g., presence and quality of vegetative cover, soil type, etc.) to qualitatively evaluate potential for erosion of soil. 6) Refine COPC list based on existing and newly-acquired data set. 7) Evaluate soil COPC concentrations relative to background COPC data.

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TABLE 11
DATA NEEDS SUMMARY
USOR PROPERTY – AREA OF INTEREST 1

PRELIMINARY CONCEPTUAL SITE MODEL POTENTIAL EXPOSURE MEDIUM[1]	ITERATIVE DATA NEED	APPROACH TO FILL DATA NEED		
		EXISTING DATA REVIEWED	REMEDIAL INVESTIGATION ACTIVITY	REMEDIAL INVESTIGATION APPROACH AND DATA COLLECTION METHODS
On-Property Sediment (southeast areas of AOI-1 where surface water is present for the majority of the year)	1) Concentrations of COPCs in on-property sediment samples. 2) Nature of on-property sediment, i.e., is it beneath ponded rainwater or from other sources, is it ephemeral, etc.? 3) Adequacy of the habitat in the areas where sediment is present.	1) Source data (concentrations of COPCs, source type, etc.) 2) Historical information on releases from AOI-1. 3) Surface runoff patterns at AOI-1 to areas of standing water. 4) Concentrations of COPCs in on-property soil (no on-property sediment data are available).	1) Identify ongoing and/or historic spills/releases that have or have the potential to impact on-property sediment. 2) Collect sediment samples from areas of standing water on-property.	1) As appropriate based on the nature of the sediment at AOI-1, collect sediment samples for analysis of AOI-1 COPCs, TOC, grain size, etc. 2) Evaluate COPC data relative to PSVs for this exposure medium.
On-Property Surface Water (southeast areas of AOI-1 where surface water is present for the majority of the year)	1) Concentrations of COPCs in on-property surface water samples. 2) Nature of the on-property surface water; i.e., is it ponded rainwater or from other sources, is it ephemeral, etc.?	1) Source data (concentrations of COPCs, source type, etc.) 2) Historical information on releases from AOI-1. 3) Surface runoff patterns at AOI-1 to areas of standing water. 4) Nature and extent of COPCs in on-property soil.	1) Identify ongoing and/or historic spills/releases that have or have the potential to impact on-property surface water. 2) Collect data necessary to characterize surface water flow regime and origin of standing water.	1) Perform detailed topographic survey to indicate where standing water will collect on-property. 2) As appropriate based on the nature of the surface water, collect surface water samples from standing water for analysis of COPCs. For metals, analysis will be conducted for total and/or dissolved concentrations depending on the COPC (and as designated by eco benchmark table). 3) Evaluate COPC data relative to PSVs for this exposure medium.

TABLE 11
DATA NEEDS SUMMARY
USOR PROPERTY – AREA OF INTEREST 1

PRELIMINARY CONCEPTUAL SITE MODEL POTENTIAL EXPOSURE MEDIUM[1]	ITERATIVE DATA NEED	APPROACH TO FILL DATA NEED		
		EXISTING DATA REVIEWED	REMEDIAL INVESTIGATION ACTIVITY	REMEDIAL INVESTIGATION APPROACH AND DATA COLLECTION METHODS
On-Property Air	1) COPC concentrations in on-property air (derived from COPCs concentrations in on-property soil).	1) Concentrations of COPCs in on-property soil collected during various investigations at AOI-1. 2) Review of existing ambient air monitoring data for area, if available.	1) Use on-property soil COPC concentration data to estimate and/or model potential emissions of volatile organic compounds and fugitive dust in on-property air.	1) Evaluate AOI-1 characteristics (e.g., presence and quality of vegetative cover, soil type, etc.). 2) Evaluate local meteorological data. 3) Estimate and/or model potential COPC concentrations in on-property air using on-property soil and groundwater COPC concentrations data and qualitative data described above.
Off-Property Air	1) COPC concentrations in off-property air (derived from COPCs concentrations in off-property soil)	1) Concentrations of COPCs in off-property soil collected during various investigations at the Property. 2) Review of existing ambient air monitoring data for property area, if available.	1) Use off-property soil COPC concentration data to estimate and/or model potential emissions of volatile organic compounds and fugitive dust in off-property air.	1) Evaluate off-property characteristics (e.g., presence and quality of vegetative cover, soil type, etc.). 2) Evaluate local meteorological data. 3) Estimate and/or model potential COPC concentrations in off-property air using off-property soil COPC concentrations data and qualitative data described above.

TABLE 11
DATA NEEDS SUMMARY
USOR PROPERTY – AREA OF INTEREST 1

PRELIMINARY CONCEPTUAL SITE MODEL POTENTIAL EXPOSURE MEDIUM[1]	ITERATIVE DATA NEED	APPROACH TO FILL DATA NEED		
		EXISTING DATA REVIEWED	REMEDIAL INVESTIGATION ACTIVITY	REMEDIAL INVESTIGATION APPROACH AND DATA COLLECTION METHODS
Off-Property Surface Water [2]	1) Presence of surface water and associated uses. 2) Watershed sub-basin. 3) Commercial, industrial, and municipal activities located along Vince Bayou and Little Vince Bayou (up-stream of AOI-1), including the identification of permitted outfalls. 4) Documented "spills/ releases" within the watershed sub-basin that had and/or continue to have the potential to impact surface water at AOI-1. 5) Surface water flow characteristics. 6) Background concentrations of COPCs in Vince Bayou and Little Vince Bayou surface water. 7) Concentrations of COPCs in surface water samples attributable to AOI-1 sources.	1) Source data (concentrations of COPCs, source type, etc.). 2) Historical information on releases from AOI-1 to soil and surface water. 3) Surface water drainage patterns at AOI-1 to off-property areas, extending to Vince Bayou and Little Vince Bayou. 4) Nature and extent of COPCs in on-property and off-property soil. 5) COPC concentration data from samples of surface water. 6) Surface water advisories and associated data.	1) Delineate the boundary and drainage within the watershed sub-basin. 2) Identify potential land use practices that might have impacted surface water adjacent to AOI-1. 3) Identify on-going and/or historic spills/releases that have or have the potential to impact surface water. 4) Collect data to characterize surface water flow regime (e.g., flow velocity, groundwater to surface water interactions, etc.). 5) Evaluate the surface water quality and the potential presence of COPCs in surface water.	1) Obtain information from the USGS and other local sources to define the extent and flow paths within the watershed sub-basin. 2) Perform an area reconnaissance to identify properties located within the watershed sub-basin that have the potential to impact the surface water system. After facility identification, obtain regulatory information from public sources to confirm facility operations. 3) Perform a regulatory database search to identify spills and/or releases that have occurred within the watershed that reached or had the potential to reach Vince Bayou or Little Vince Bayou. 4) Obtain publically available information on the physical flow properties of Vince Bayou and Little Vince Bayou (e.g., under normal and storm events). 5) Collect surface water samples in Vince Bayou and Little Vince Bayou for analysis of water quality parameters and COPCs. As part of this assessment, address total versus dissolved COPC concentrations, designed to address ecological benchmark criteria. 6) Evaluate Vince Bayou and Little Vince Bayou surface water sample COPC data relative to background COPC data for surface water samples collected in Little Vince Bayou as well as upstream in Vince Bayou.

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TABLE 11
DATA NEEDS SUMMARY
USOR PROPERTY – AREA OF INTEREST 1

PRELIMINARY CONCEPTUAL SITE MODEL POTENTIAL EXPOSURE MEDIUM[1]	ITERATIVE DATA NEED	APPROACH TO FILL DATA NEED		
		EXISTING DATA REVIEWED	REMEDIAL INVESTIGATION ACTIVITY	REMEDIAL INVESTIGATION APPROACH AND DATA COLLECTION METHODS
Off-Property Sediment [2]	1) Sediment and surface water hydrodynamics in Vince and Little Vince Bayou. 2) Background concentrations of COPCs in Vince Bayou and Little Vince Bayou sediment. 3) Concentrations of COPCs in sediment samples attributable to potential AOI-1 sources.	1) Source data (concentrations of COPCs, source type, etc.). 2) Historical information on releases from AOI-1. 3) Surface water drainage patterns from property extending to Vince Bayou and Little Vince Bayou. 4) Nature and extent of COPCs in on-property and off-property soil. 5) COPC concentration data from historic sediment samples.	1) Identify ongoing and/or historic spills/releases that have or have the potential to impact off-property sediment. 2) Collect data necessary to characterize sediment regime (sediment thickness, depositional patterns, TOC, grain size, etc.). 3) If necessary based on iterative approach to characterization, collect samples of sediment for analysis of AOI-1 COPCs.	1) Refine AOI-1 COPC list by evaluating source area, soil and groundwater sample data. 2) Collect sediment samples in Vince Bayou and Little Vince Bayou for analysis of AOI-1 COPCs, if warranted. 3) Evaluate potential for AOI-1 to contribute COPCs to sediment in Vince Bayou above background levels collected in Little Vince Bayou and upstream in Vince Bayou. 4) Evaluate general chemistry of sediment (pH, TOC, grain size, organic carbon, etc.) in all samples.

ED_004012_00007943-00091

TABLE 11
DATA NEEDS SUMMARY
USOR PROPERTY – AREA OF INTEREST 1

PRELIMINARY CONCEPTUAL SITE MODEL POTENTIAL EXPOSURE MEDIUM[1]	ITERATIVE DATA NEED	APPROACH TO FILL DATA NEED		
		EXISTING DATA REVIEWED	REMEDIAL INVESTIGATION ACTIVITY	REMEDIAL INVESTIGATION APPROACH AND DATA COLLECTION METHODS
Fish/Shellfish[2]	1) Identify fish/shellfish species present and affinity for Vince Bayou and Little Vince Bayou near AOI-1. 2) Concentrations of COPCs in fish/shellfish tissue attributable to AOI-1 sources. 3) Assess the potential for fish/shellfish consumption in the area.	1) Source data (concentrations of COPCs, source type, etc.). 2) Historical information on releases from AOI-1. 3) Surface runoff patterns at AOI-1 to off-property areas, including surface water. 4) Nature and extent of COPCs in on-property and off-property soil. 5) COPC concentration data from samples of surface water, sediment and fish/shellfish. 6) Fish/shellfish advisories and associated data. 7) Other data from trustees.	1) Identify ongoing and/or historic spills/releases that have or have the potential to impact fish/shellfish. 2) Collect data necessary to characterize aquatic conditions relative to fish in Vince Bayou and Little Vince Bayou (e.g., fish/shellfish species present, property fidelity, prey items, etc.). 3) If necessary based on iterative approach to characterization, collect fish/shellfish samples for analysis of AOI-1 COPCs.	1) Refine property COPC list by evaluating source area, soil and groundwater sample data. 2) Identify fish/shellfish species present and affinity for property. 3) Collect fish/shellfish samples in Vince Bayou and Little Vince Bayou for analysis of AOI-1 COPCs, if warranted. 4) Evaluate potential for AOI-1 to contribute COPCs to fish/shellfish tissue in Vince Bayou above background concentrations measured in fish from Little Vince Bayou and upstream in Vince Bayou.

TABLE 11
DATA NEEDS SUMMARY
USOR PROPERTY – AREA OF INTEREST 1

PRELIMINARY CONCEPTUAL SITE MODEL POTENTIAL EXPOSURE MEDIUM[1]	ITERATIVE DATA NEED	APPROACH TO FILL DATA NEED		
		EXISTING DATA REVIEWED	REMEDIAL INVESTIGATION ACTIVITY	REMEDIAL INVESTIGATION APPROACH AND DATA COLLECTION METHODS
General Data Needs	1) Collect qualitative data needed to support risk assessments such as the presence of T&E species, land use in the vicinity, receptor survey and use restrictions at AOI-1. 2) Identify potential preferential subsurface migration pathways. 3) Identify vegetative cover. 4) Identify climate patterns. 5) Identify land use within the watershed sub-basin. 6) Assess the potential for flooding. 7) Identify historic property ownership and use. 8) Assess the presence and quality of ecological habitat. 9) Identify any restrictive covenants on-property			1) Contact TPWD to determine potential presence of T&E species in the vicinity. 2) Contact the City of Pasadena Engineering Department to obtain a map of all subsurface utilities in the vicinity of AOI-1. In addition, contact the pipeline companies that operate subsurface pipelines in on-property and adjacent properties. 3) Assess the erosion potential of soils, which could create off-property impacts, extending to Vince Bayou. 4) Understand precipitation, prevailing wind direction, and assess how these parameters could impact mobilization of COPCs. 5) Obtain a current aerial photograph and access information from the City of Pasadena to obtain zoning information to define land use. 6) Obtain floodplain maps from FEMA to delineate the 100-year floodplain. 7) Establish historic property ownership and use through obtaining a chain-of-title and historic documents, extending back to a date, prior to property development. 8) Perform a reconnaissance and use public data to identify ecological habitats. 9) Evaluate property record to identify any restrictive covenants on-property.

See table notes on following page.

ED_004012_00007943-00093

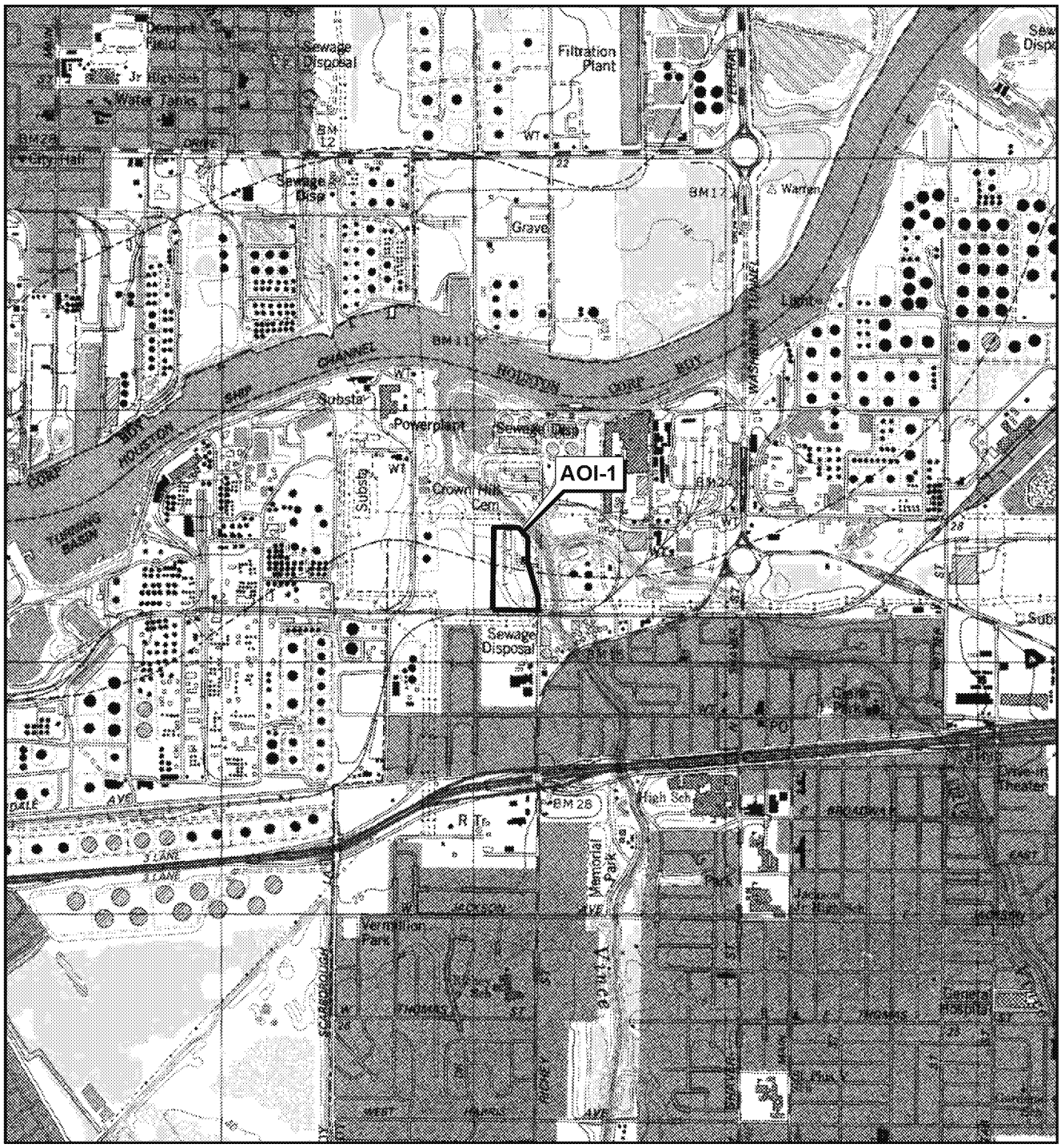
TABLE 11
DATA NEEDS SUMMARY
USOR PROPERTY – AREA OF INTEREST 1

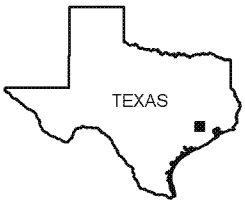
Notes:
1) Refer to Exposure Medium column on Figure 1 for human health receptors and on Figure 2 for ecological receptors.
2) Sampling of these media to be performed in conjunction with appropriate background sampling, if necessary.
3) Color coding per Figures 1 and 2, as follows:

Green – Primary media to be sampled during initial stage of RI/FS.
Blue – Second iteration media to be sampled based on primary media sample data.
Pink – Third iteration media to be sampled based on primary media and second iteration media sample data.
Yellow – For human health risk assessment, exposure medium concentration will be estimated using primary media sample concentrations.

ED_004012_00007943-00094

FIGURES





QUADRANGLE LOCATIONS

N

Scale in Feet

0 1000 2000

SOURCE:
Base map from www.tnris.gov, Pasadena, TX 7.5 min. USGS quadrangle dated 1982.

US OIL RECOVERY SUPERFUND SITE

PASADENA, HARRIS COUNTY, TEXAS

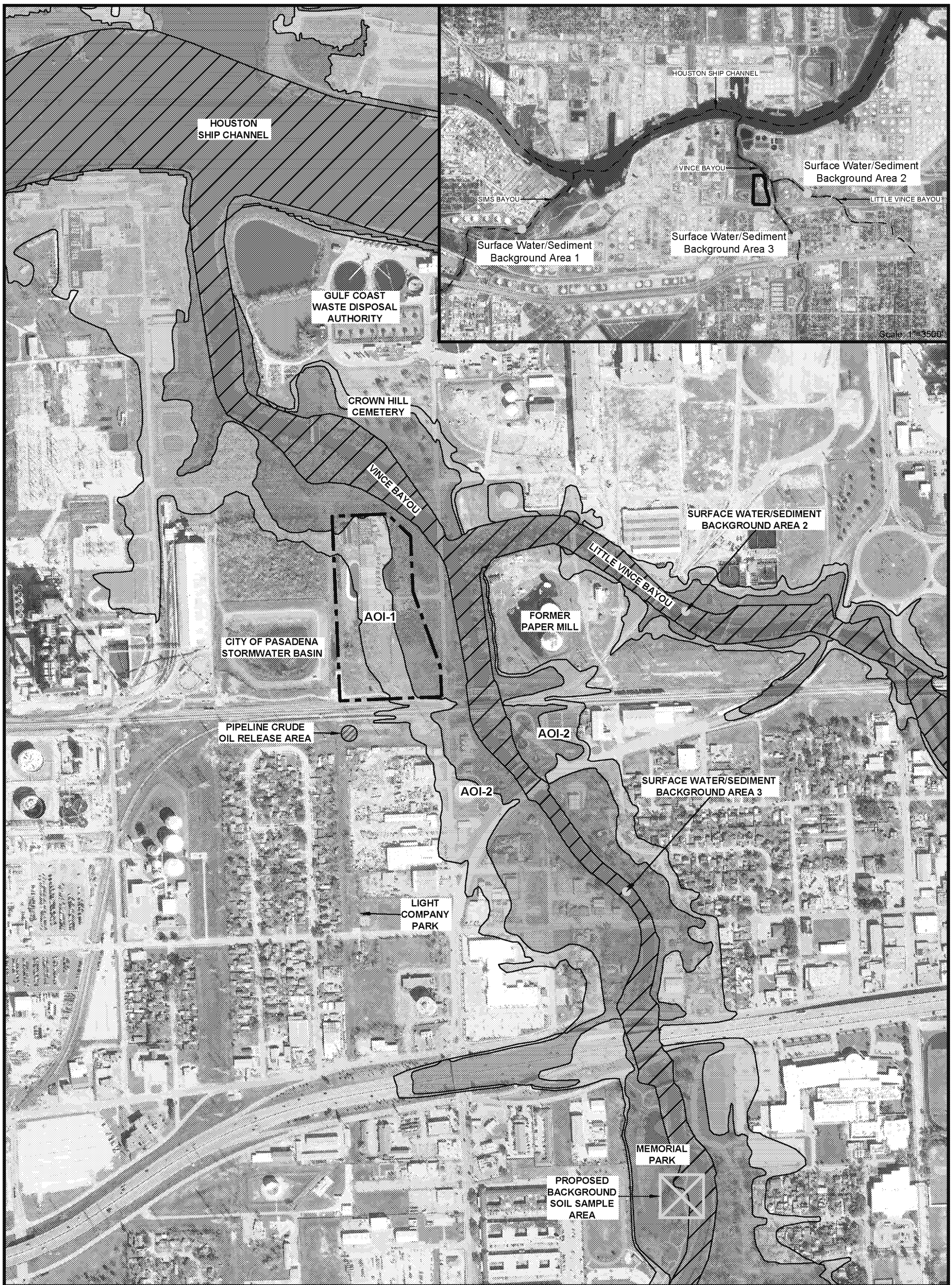
Figure 1

SITE LOCATION MAP

PROJECT: 3333-2	BY: AJD	REVISIONS
DATE: DEC., 2015	CHECKED: MKW	

PASTOR, BEHLING & WHEELER, LLC

CONSULTING ENGINEERS AND SCIENTISTS



EXPLANATION

- Approx. Property Boundary
- 100 Yr Flood Plain - Zone AE (1% Annual Chance Flood Event)
- Floodway Areas in Zone AE
- Other Flood Areas - Zone X (0.2% Annual Chance Flood)
- Background Surface Water & Sediment Sample Area

Note:
Source of Flood Plain Area, http://www.fema.gov, FIRM map # 48201C0905L, Harris County, 2007.

N

Approx. Scale in Feet

0 275 550

Source:
Houston-Galveston Area Council, April 2012 Image, 2012 Aerial Imagery Data is the sole property of Houston-Galveston Area Council, which reserves all rights thereto. Use or reproduction of this data is strictly prohibited absent written consent from the Houston-Galveston Area Council.

US OIL RECOVERY SUPERFUND SITE

PASADENA, HARRIS COUNTY, TEXAS

Figure 2

SITE VICINITY MAP

PROJECT: 3333-2	BY: AJD	REVISIONS
DATE: DEC., 2015	CHECKED: MKW	

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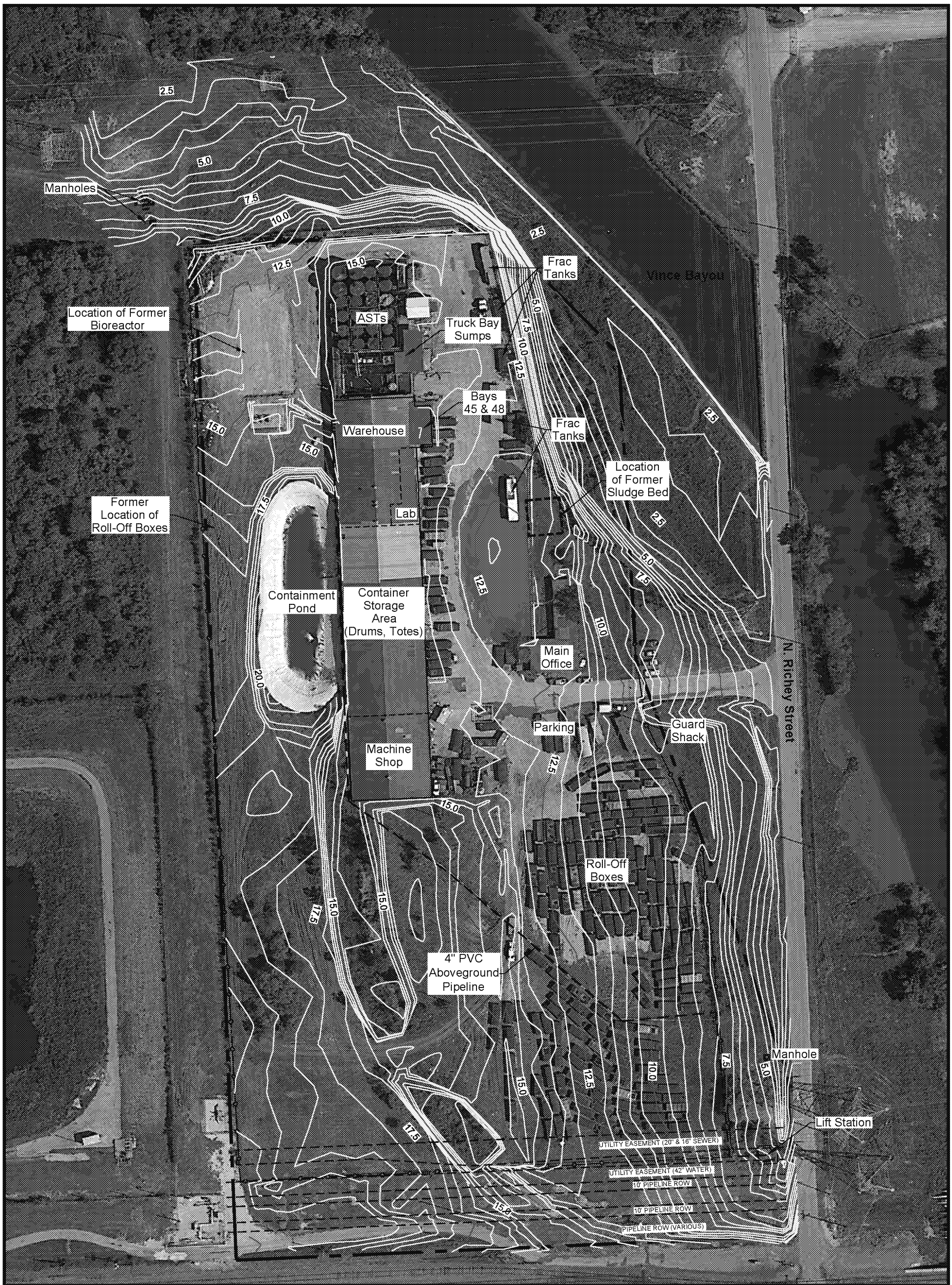

EXPLANATION

Approx. Property Boundary

Approx. Security Fence

15.0 Topographic Contours from Survey Conducted in June/July 2013

1. Coordinates based on Texas Coordinate System NAD 83 (2011) (EPOCH 2010.0000), South Central Zone.
2. Elevations based on NAVD88 (GEOID12A)
3. Contour Interval 0.5 ft.

N

Approx. Scale in Feet

0 50 100

Source:
Imagery taken from Google Earth, photography dated April 8, 2014.

US OIL RECOVERY SUPERFUND SITE

PASADENA, HARRIS COUNTY, TEXAS

Figure 3

SITE MAP - AOI-1

PROJECT: 3333-2	BY: AJD	REVISIONS
DATE: DEC., 2015	CHECKED: MKW	

PASTOR, BEHLING & WHEELER, LLC

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EXPLANATION

- Approx. Property Boundary
- Estuarine and Marine Deepwater
- Estuarine and Marine Wetland
- Freshwater Emergent Wetland
- Freshwater Pond

N

Approx. Scale in Feet

0 250 500

Source:
National Wetland Inventory, U.S. Fish & wildlife Service, Wetlands Online Mapper, accessed 2015.

US OIL RECOVERY SUPERFUND SITE
PASADENA, HARRIS COUNTY, TEXAS

Figure 4

WETLAND MAP
(AS IDENTIFIED BY USFWS)

PROJECT: 3333-2	BY: AJD	REVISIONS
DATE: DEC., 2015	CHECKED: MKW	

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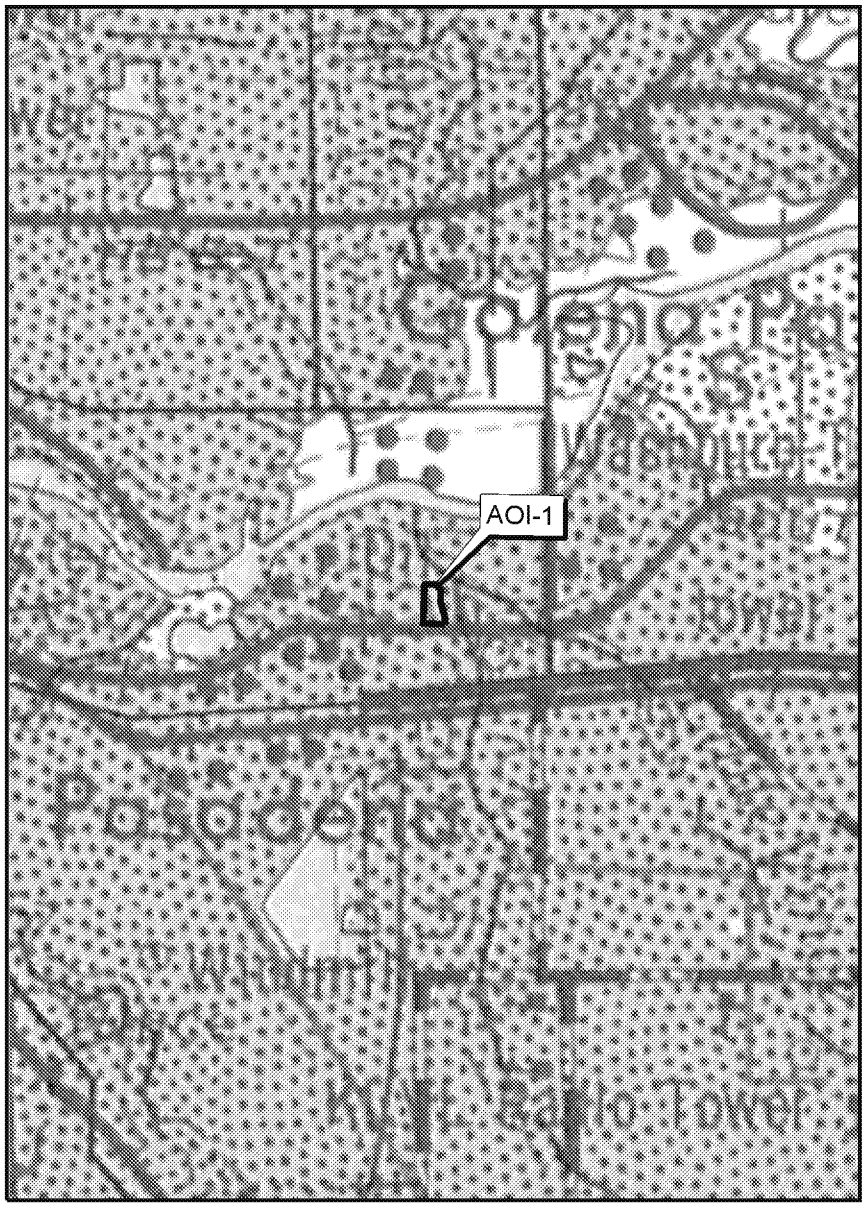

EXPLANATION

Fill and Spoil

Qal
Alluvium

Qb
Beaumont Formation

Holocene
Pleistocene
QUATERNARY

N

Scale 1:250,000

0 1

Statute Miles

Source: www.tnris.org, Geologic Atlas of Texas, Houston Sheet (Revised 1982).

US OIL RECOVERY SUPERFUND SITE

PASADENA, HARRIS COUNTY, TEXAS

Figure 5

REGIONAL GEOLOGIC MAP

PROJECT: 3333-2	BY: AJD	REVISIONS
DATE: DEC., 2015	CHECKED: MKW	

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EXPLANATION

- Approx. Property Boundary
- Approx. Security Fence
- Approx. Soil Sample Location
- Approx. Surface Water Sample Location
- Approx. Background Surface Water and Sediment Sample Location

Notes:

1. See tables 2-9 for sample data.

N

Approx. Scale in Feet

0 100 200

Source:
Imagery taken from Google Earth, photography dated April 8, 2014.

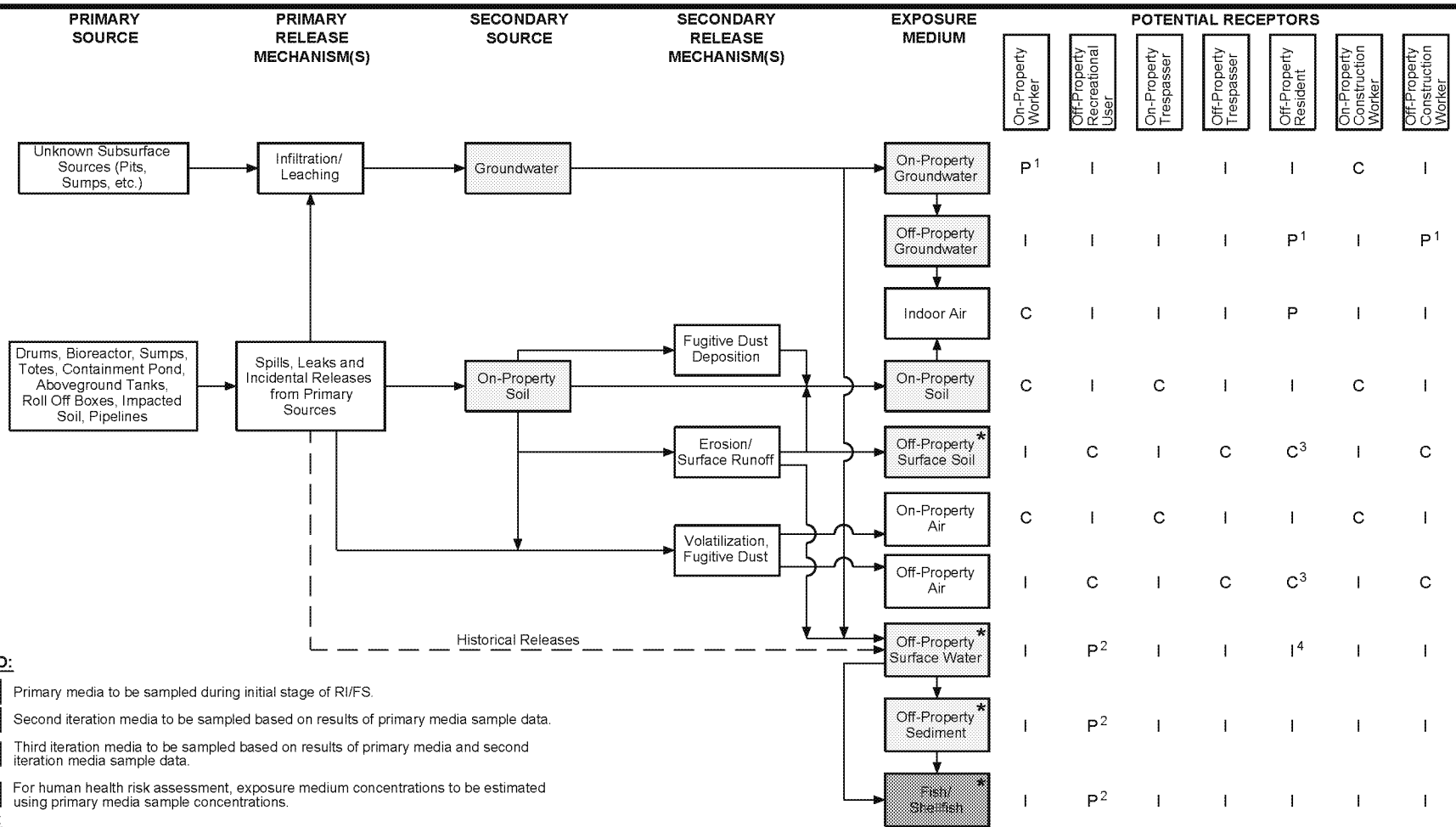
US OIL RECOVERY SUPERFUND SITE
PASADENA, HARRIS COUNTY, TEXAS

Figure 6

HISTORICAL SAMPLE LOCATION MAP

PROJECT: 3333-2	BY: AJD	REVISIONS
DATE: DEC., 2015	CHECKED: MKW	

PASTOR, BEHLING & WHEELER, LLC
CONSULTING ENGINEERS AND SCIENTISTS



LEGEND:

- Primary media to be sampled during initial stage of RI/FS.
- Second iteration media to be sampled based on results of primary media sample data.
- Third iteration media to be sampled based on results of primary media and second iteration media sample data.
- For human health risk assessment, exposure medium concentrations to be estimated using primary media sample concentrations.

Notes:

C Pathway is potentially complete.

P Pathway is possibly complete.

I Pathway is incomplete.

1 It is unlikely that shallow groundwater in this area is useable given the salinity. However, data will be collected to characterize the salinity of all relevant groundwater bearing units. A survey of the on- and off-property area for the presence of water wells will also be performed as part of the groundwater investigation. Potential impacts will be investigated to ensure that these pathways are incomplete for off-property groundwater and/or deeper groundwater units, if appropriate.

2 Potential exposures and associated chemicals of concern for these receptors will be evaluated through an iterative process in consideration of primary source data and data for transport media collected during the RI/FS.

3 Potential impacts from soil VOC and particulate dust emissions potentially impacting nearby residents will be evaluated based on the primary media data to evaluate the completeness of migration pathways to off-property air, fruit trees, above-ground and below-ground produce, and domestic livestock.

4 Surface water is not a potable or agricultural resource due to high natural salinity and bacterial levels in the area.

* Sampling of these media to be performed in conjunction with appropriate background sampling.

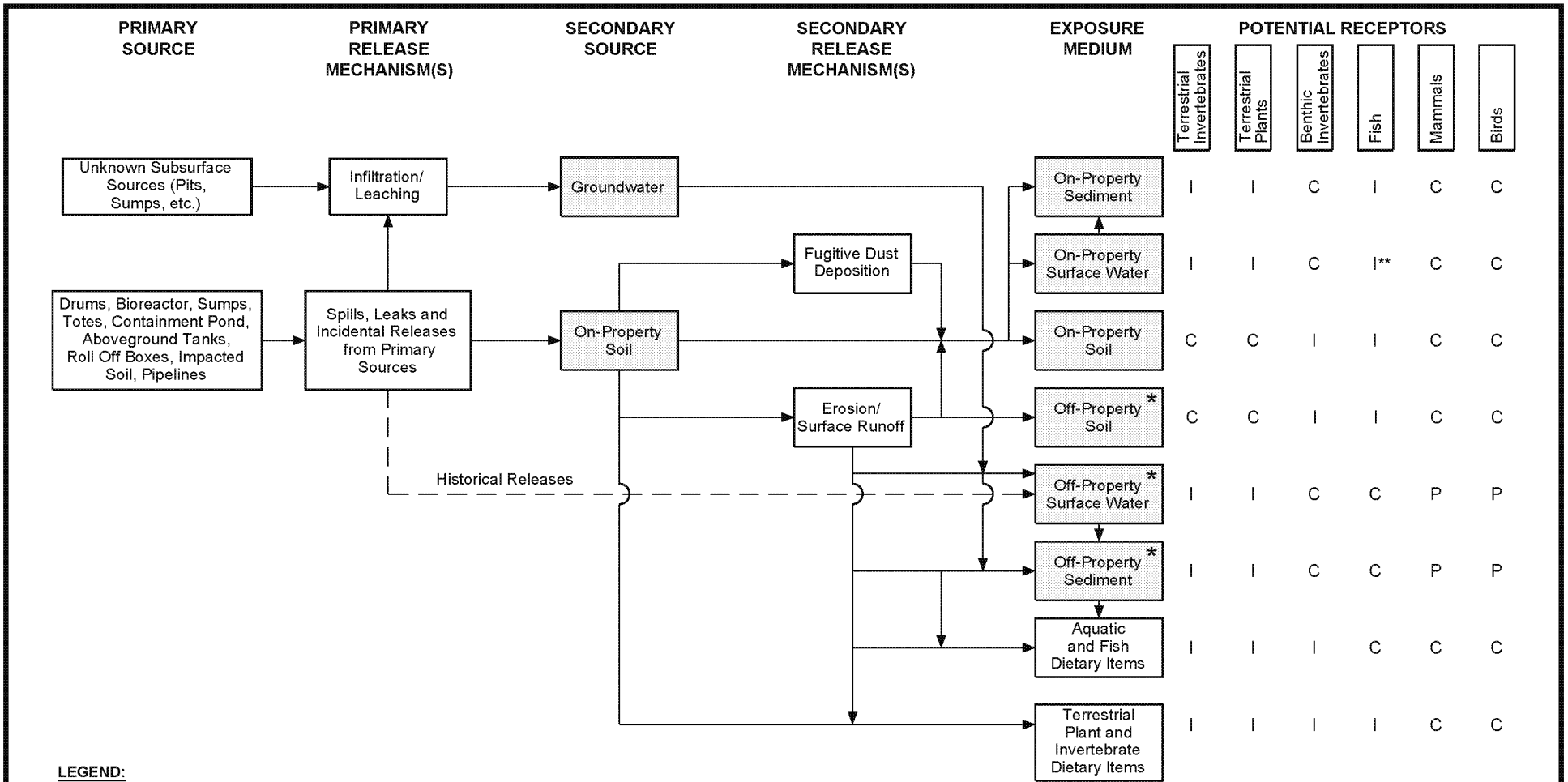
US OIL RECOVERY SUPERFUND SITE
PASADENA, HARRIS COUNTY, TEXAS

Figure 7

HUMAN HEALTH PRELIMINARY CONCEPTUAL SITE MODEL USOR PROPERTY

PROJECT: 3333-2	BY: AJD	REVISIONS
DATE: DEC., 2015	CHECKED: KHT	

PASTOR, BEHLING & WHEELER, LLC
CONSULTING ENGINEERS AND SCIENTISTS



LEGEND:

- Primary media to be sampled during initial stage of RI/FS.
- Second iteration media to be sampled based on results of primary media sample data.
- For screening level ecological risk assessment, exposure medium concentrations to be estimated using primary media sample concentrations.

Notes:

C Pathway is potentially complete.

I Pathway is incomplete.

P Potential exposures for COPCs will be evaluated in an iterative manner based on sample results from primary media.

* Sampling of these media to be performed in conjunction with appropriate background sampling.

** Fish were not observed. If fish are observed during investigation activities, this pathway will be evaluated.

US OIL RECOVERY SUPERFUND SITE

PASADENA, HARRIS COUNTY, TEXAS

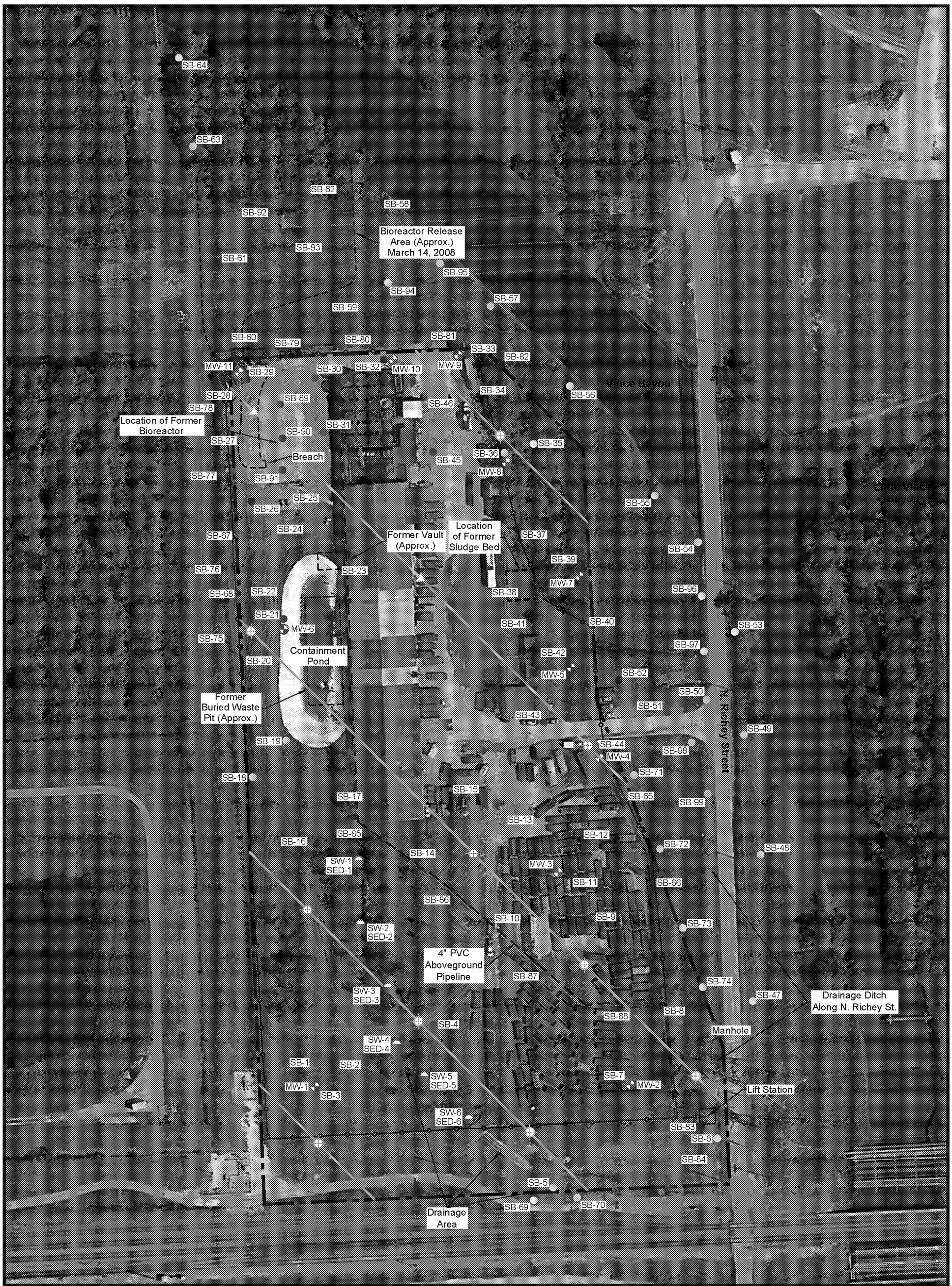
Figure 8

ECOLOGICAL PRELIMINARY CONCEPTUAL SITE MODEL USOR PROPERTY

PROJECT: 3333-2	BY: AJD	REVISIONS
DATE: DEC., 2015	CHECKED: KHT	

PASTOR, BEHLING & WHEELER, LLC

CONSULTING ENGINEERS AND SCIENTISTS



EXPLANATION

- Approx. Property Boundary
- Approx. Security Fence
- Proposed Soil Boring Location (Source Areas/Industrial Activities)
- Proposed Soil Boring Location (Drainage Areas)
- Proposed Surface Water/ Sediment Sample Location
- Proposed Monitoring Well Location
- Proposed CPT/ROST Transect Location
- Proposed CPT Location
- Proposed CPT/ROST Location

Note:
All locations are approximate and subject to change.

N

Approx. Scale in Feet
0 60 120

Source:
Imagery taken from Google Earth, photography dated April 8, 2014.

US OIL RECOVERY SUPERFUND SITE
PASADENA, HARRIS COUNTY, TEXAS

Figure 9

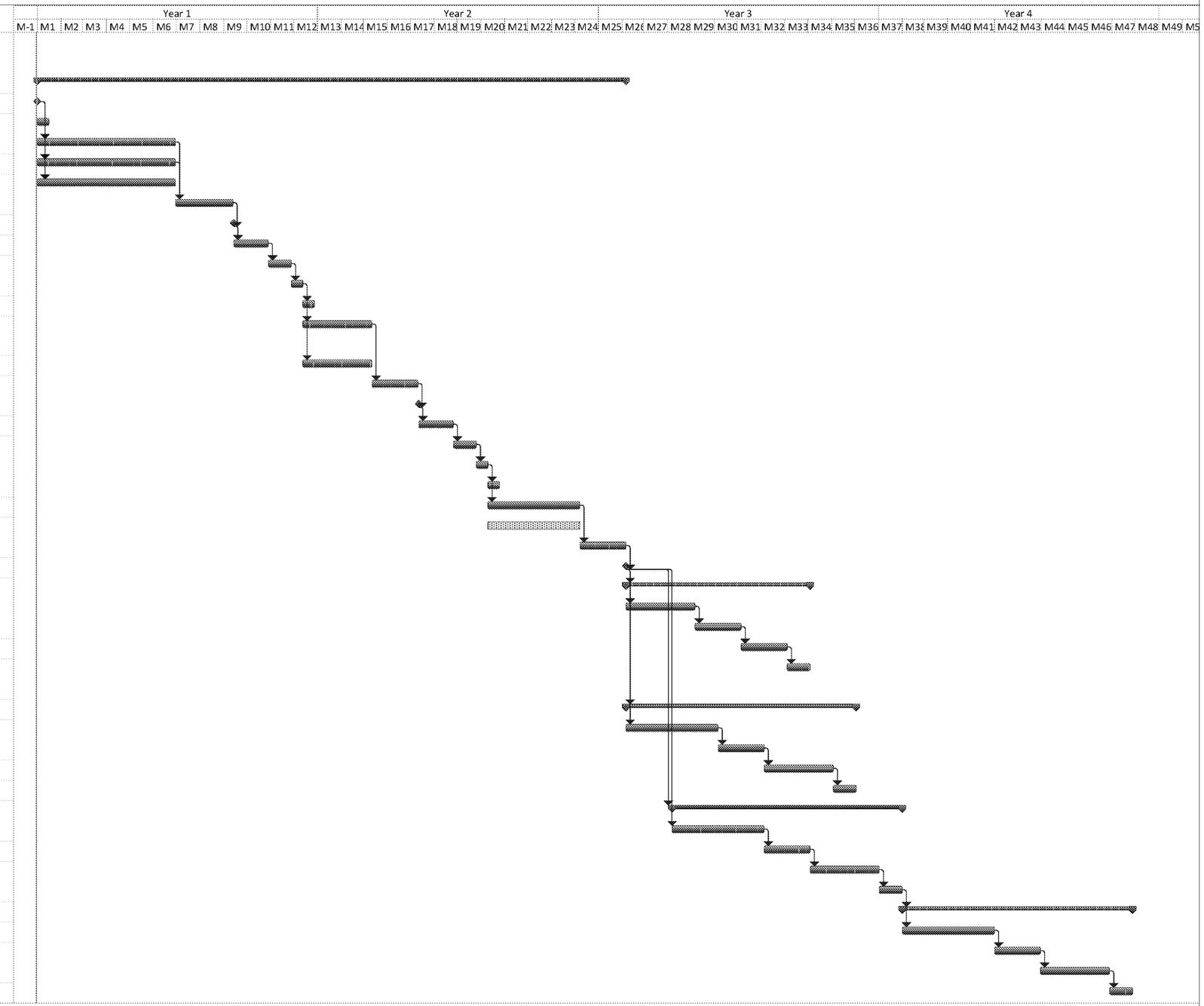
AREA OF INVESTIGATION 1 PROPOSED SAMPLING LOCATIONS RI/FS ITERATION 1

PROJECT: 3333-2	BY: AJD	REVISIONS
DATE: DEC., 2015	CHECKED: MKW	

PASTOR, BEHLING & WHEELER, LLC
CONSULTING ENGINEERS AND SCIENTISTS

Figure 10
Preliminary RI/FS Schedule - AOI-1

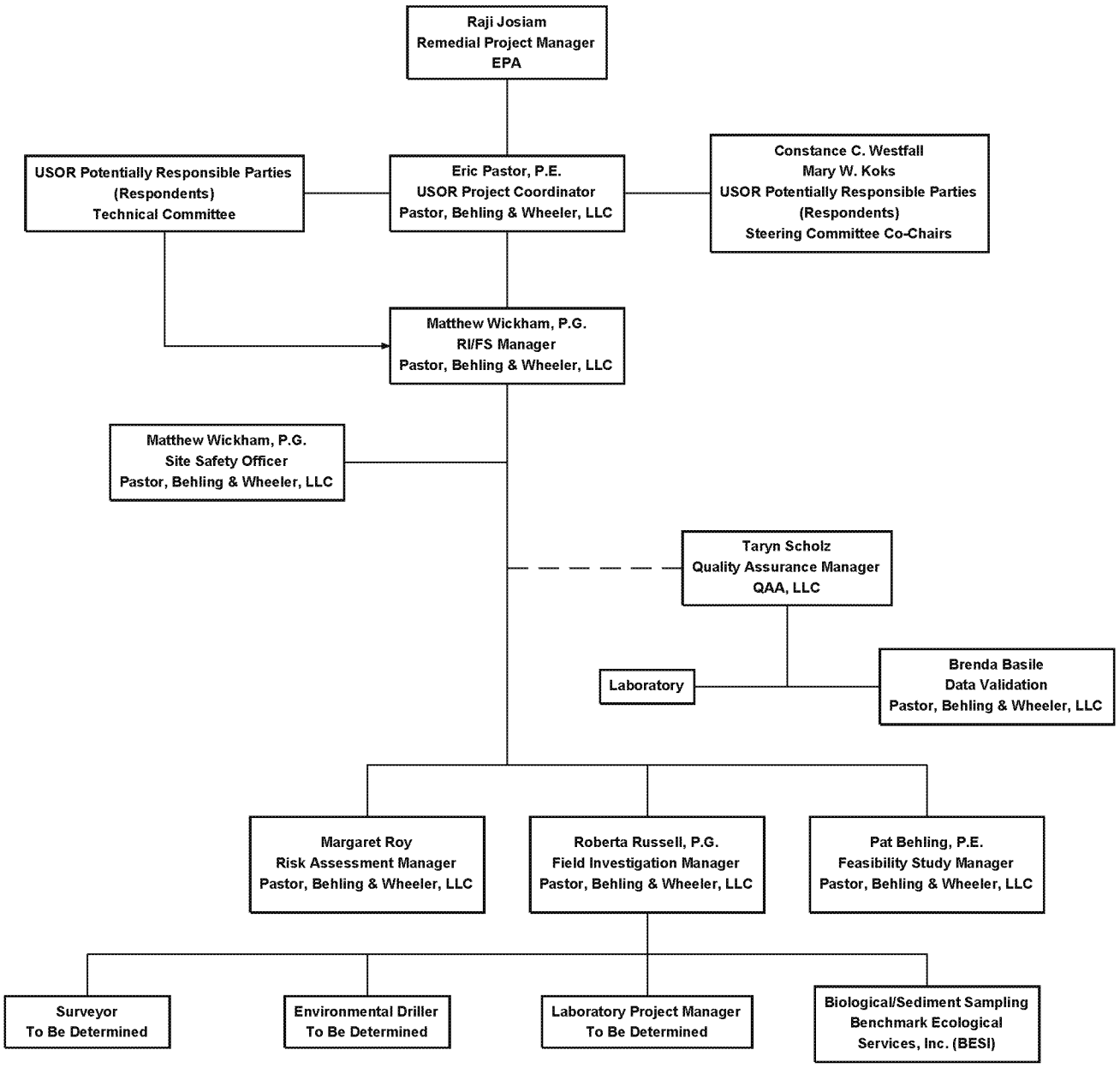
ID	Task Name	Duration	Start	Finish
1	**REPORTING (Begins after approval of RI/FS Workplan)**	**1428 days**	**Day 0**	**Day 1428**
2	Bi-Monthly Progress Report (Due 15th of every other month)	1428 days	Day 0	Day 1428
3	**SITE CHARACTERIZATION**	**767 days**		
4	Completion of Removal Actions and Approval of Final RI/FS Work Plan	0 days	Day 1	Day 1
5	Provide Field Notice and Insurance Certificates to EPA	15 days	Day 1	Day 16
6	Iteration 1 - On-Property Investigations (Soil, GW, SW, Sediment)	180 days	Day 1	Day 181
7	Iteration 1 - Off-Property Investigations (Soil, Groundwater)	180 days	Day 1	Day 181
8	Iteration 1 - Background Soil Investigation	180 days	Day 1	Day 181
9	Iteration 1 - Data Assessment	75 days	Day 181	Day 256
10	Data Assessment Meeting with EPA/TCEQ	1 day	Day 256	Day 257
11	Iteration 1 - Development of Draft Workplan Refinement Notice (WRN)	45 days	Day 257	Day 302
12	***Iteration 1 - Review/Comment on WRN - EPA/TCEQ***	30 days	Day 302	Day 332
13	Iteration 1 - Prepare Final WRN	15 days	Day 332	Day 347
14	***Review/Approve Final WRN - EPA/TCEQ***	15 days	Day 347	Day 362
15	Iteration 2 - Off-Property Investigations (Vince Bayou Surface Water, Sediment)	90 days	Day 347	Day 437
16	Iteration 2 - Background Sediment/Surface Water Investigation	90 days	Day 347	Day 437
17	Iteration 2 - Data Assessment	60 days	Day 437	Day 497
18	Iteration 2 - Data Assessment Meeting with EPA/TCEQ	1 day	Day 497	Day 498
19	Iteration 2 - Development of Draft WRN	45 days	Day 498	Day 543
20	***Iteration 2 - Review/Comment on WRN - EPA/TCEQ***	30 days	Day 543	Day 573
21	Iteration 2 - Prepare Final WRN	15 days	Day 573	Day 588
22	***Review/Approve Final WRN - EPA/TCEQ***	15 days	Day 588	Day 603
23	Iteration 3 - Off-Property Investigations (Vince Bayou Biota)	120 days	Day 588	Day 708
24	Iteration 3 - Background Biota (if needed)	120 days	Day 588	Day 708
25	Iteration 3 - Data Assessment	60 days	Day 708	Day 768
26	Iteration 3 - Data Assessment Meeting with EPA/TCEQ	1 day	Day 767	Day 768
27	**SCREENING LEVEL ECOLOGICAL RISK ASSESSMENT**	**240 days**		
28	Prepare Draft SLERA	90 days	Day 768	Day 858
29	***Review/Comment on SLERA - EPA/TCEQ***	60 days	Day 858	Day 918
30	Prepare Final SLERA	60 days	Day 918	Day 978
31	***Review/Approve Final SLERA - EPA/TCEQ***	30 days	Day 978	Day 1008
32	**BASELINE ECOLOGICAL RISK ASSESSMENT (IF NEEDED)**	**TBD**		
34	**BASELINE HUMAN HEALTH RISK ASSESSMENT**	**300 days**		
35	Prepare Draft BHHRA	120 days	Day 768	Day 888
36	***Review/Comment on Draft BHHRA - EPA/TCEQ***	60 days	Day 888	Day 948
37	Prepare Final BHHRA	90 days	Day 948	Day 1038
38	***Review/Approve Final BHHRA - EPA/TCEQ***	30 days	Day 1038	Day 1068
39	**REMEDIAL INVESTIGATION REPORT**	**300 days**		
40	Prepare Draft RI Report	120 days	Day 828	Day 948
41	***Review/Comment on Draft RI Report - EPA/TCEQ***	60 days	Day 948	Day 1008
42	Prepare Final RI Report	90 days	Day 1008	Day 1098
43	***Review/Approve Final RI Report - EPA/TCEQ***	30 days	Day 1098	Day 1128
44	**FEASIBILITY STUDY**	**300 days**		
45	Prepare Draft FS Report	120 days	Day 1128	Day 1248
46	***Review/Comment on Draft FS Report - EPA/TCEQ***	60 days	Day 1248	Day 1308
47	Prepare Final FS Report	90 days	Day 1308	Day 1398
48	***Review/Approve Final FS Report - EPA/TCEQ***	30 days	Day 1398	Day 1428



US Oil Superfund Site
Pasadena, Harris County, TX
Page 1 of 1

Task | Milestone | Summary | Project Summary | External Milestone | Inactive Milestone | Inactive Summary | Duration-only | Manual Summary Rollup | Manual Summary | Start-only | Finish-only | Deadline | Progress | If Necessary

This schedule is subject to revision based on changes in assumed EPA review periods, weather, modifications to the scope of work, delays in obtaining access to properties, and/or potential interference with removal actions and associated field work.



LEGEND:

——— Formal Project Communications Line

— — Informal Project Communications Line (as needed)

US OIL RECOVERY SUPERFUND SITE
PASADENA, HARRIS COUNTY, TEXAS

Figure 11

PROJECT ORGANIZATION

PROJECT: 3333-2	BY: AJD	REVISIONS
DATE: DEC., 2015	CHECKED: MKW	

PASTOR, BEHLING & WHEELER, LLC
CONSULTING ENGINEERS AND SCIENTISTS

APPENDIX A

RESTRICTIVE COVENANT

20150339322
07/30/2015 ER $32.00

RESTRICTIVE COVENANT FOR LIMITATION ON USES, CONSTRUCTION AND GROUNDWATER USE

RESTR
K

STATE OF TEXAS §
COUNTY OF HARRIS §

This Restrictive Covenant is filed to provide information concerning certain use limitations upon that real property (the "Property") described in Exhibit A, attached hereto and incorporated herein by reference.

As of the date of this Restrictive Covenant, the record owner of fee title to the Property described in Exhibit A is U.S. Oil Recovery L.L.P.

An environmental investigation is currently being performed at the Property under the direction of the United States Environmental Protection Agency ("EPA") and Texas Commission on Environmental Quality ("TCEQ"). The appropriate land use for the Property is commercial/industrial.

On May 22, 2012, by order of the 125th District Court in Harris County, Texas Eva S. Engelhart was appointed as Receiver over the Property. In her capacity as Receiver, Eva S. Engelhart has agreed to place the following restrictions on the Property in favor of the USOR Site PRP Group and Bayer CropScience Inc. (collectively herein, "Respondents"), and the TCEQ, the State of Texas, and the EPA.

ER 072-24-2088

NOW THEREFORE, in consideration of the premises, and other good and valuable consideration, the receipt and sufficiency of which is hereby acknowledged, the following restrictive covenants in favor of the Respondents, TCEQ, the State of Texas, and EPA are placed on the Property, to-wit:

1. Commercial/Industrial Use

   The Property shall not be used for any purposes other than commercial/industrial uses, as that term is defined under 30 Texas Administrative Code §350.4(a)(13), and thus shall not be used for human habitation or for other purposes with a similar potential for human exposure (which would include and not be limited to residential, hospitals, schools, day-care, etc.).. Portions of the soils and/or groundwater of the Property contain certain identified chemicals of concern. Future users of the Property are advised to review and take into consideration environmental data from publicly available sources (i.e., TCEQ and EPA) prior to utilizing the Property for any purpose.

2. Groundwater

   The groundwater underlying the Property shall not be used for any beneficial purpose, including: (1) drinking water or other potable uses; (2) the irrigation or watering of landscapes, (3) agricultural uses, or (4) commercial/industrial. For any activities that may result in potential exposure to the groundwater, a plan must be

in place to address and ensure the appropriate handling, treatment and disposal of any affected soils or groundwater.

3. These restrictions shall be a covenant running with the land.

For additional information, contact:

U.S. Environmental Protection Agency, Region 6
Superfund Division (6RC-S)
1445 Ross Avenue, Suite 1200
Dallas, Texas 75202-2733
ATTN: Assistant Regional Counsel

TCEQ
Central Records
12100 Park 35 Circle, Building E
Austin, TX 78753

Mail: TCEQ
Remediation Division/Superfund
P.O. Box 13087
Austin, TX 78711-3087

State of Texas
Office of the Texas Attorney General
Natural Resources Division
300 W. 15th Street
Austin, TX 78701

Eva S. Engelhart
Receiver for U.S. Oil Recovery L.L.P.
Ross, Banks, May, Cron & Cavin, P.C.
2 Riverway, Suite 700
Houston, Texas 77056

The restrictions imposed by this Restrictive Covenant may be rendered of no further force or effect only by a release executed by the Respondents, TCEQ, the State of Texas, and EPA or their successors and filed in the same Real Property Records as those in which this Restrictive Covenant is filed.

ER 072-24-2089

EXECUTED this 29th day of July, 2015.

Eva S. Engelhart
Receiver for U.S. Oil Recovery L.L.P.
By: _____

Name: Eva S. Engelhart
Title: Receiver

2OR

STATE OF TEXAS §
§
COUNTY OF HARRIS §

BEFORE ME, on this the 29 day of July, personally appeared Eva S. Engelhart, Receiver for the U.S. Oil Recovery L.L.P., known to me to be the person whose name is subscribed to the foregoing instrument, and acknowledged to me that she executed the same for the purposes and consideration and in the capacity herein expressed.

GIVEN UNDER MY HAND AND SEAL OF OFFICE, this 29 day of July, 2015.

NOTARY PUBLIC STATE OF TEXAS
CHRISTINE ESCAMILLA
My Commission Expires
October 31, 2017

Notary Public in and for the State of Texas

My Commission Expires: 10-31-17

ER 072-24-2090

EXHIBIT "A"

LEGAL DESCRIPTION OF THE PROPERTY

ER 072-24-2091

Metes and Bounds Description - 12.16 Acres

1EE

Being a 12.16 acre (Call 12.2335 acres) tract comprising part of Lots 5 and 6, Outlot 35, Townsite of Pasadena (Vol. 93, Pg. 21, Harris County Deed Records) in the William Vince Survey, A-78, Harris County, Texas. Said tract being the same property described in U.S. Oil Recovery, L.L.P. Deed (Harris County Clerk File No. Y133118) and more particularly described by metes and bounds as follows:

BEGINNING at a iron rod with aluminum cap "RPLS 4524" (N 13,827,369.59 E 3,168,096.05) set for the Southeast corner of this tract at the intersection of the north right-of-way line of Port Terminal Railroad (100' ROW) and the West right-of-way line of North Richey Road (40' ROW) and from which a found iron rod with cap "WEISSER" bears N 87°30'13"E - 40.00'.

Thence S 87°30'13"W (Call S 87°37'10"W) along the north right-of-way of Port Terminal Railroad a distance of 592.33 feet (Call 597.02') to a iron rod with cap "RAINWATER" found for the Southwest corner of this 12.16 acre tract.

Thence N 02°22'31"W (Call N 02°28'30"W) along the East line of that certain Texas Pipeline Company tract (Vol. 1824, Pg. 279, HCDR) a distance of 1075.50 feet (Call 1075.62') to a iron rod with aluminum cap "RPLS 4524" set for the Northwest corner of this 12.16 acre tract and from which iron rod with cap "RPLS 4314" found for the NE corner of Lot 4 and NW corner of Lot 5, Outlot 35 bears S 87°35'41"W - 60.00' and N 02°23'37"W - 172.00'.

Thence N 87°35'41"E (Call N 87°37'10"E) along the South line of that certain Houston Lighting and Power Co. tract (Vol. 1574, Pg. Pg. 69, HCDR) a distance of 323.09 feet to a iron rod with aluminum cap "RPLS 4524" set for the Northeast corner of this 12.16 acre tract.

Thence S 44°34'08"E (Call S 46°04'03"E) along the Southwesterly line of that certain Harris County Flood Control District tract (Vol. 6812, Pg. 280, HCDR) a distance of 180.90 feet (Call 187.03') to a point for corner.

Thence S 03°13'10"E (Call S 02°28'30"E) along the West line of said HL & P tract; passing at 123.14 feet a iron rod with cap "RAINWATER" found on line; for a total distance of 322.84 feet to a iron rod with cap "RAINWATER" found for a point for corner.

Thence S 20°06'29"E (Call S 19°57'20"E) along the West line of said HL & P tract a distance of 466.02 feet (Call 466.07') to a iron rod with cap "RAINWATER" found for a point for corner.

Thence S 02°43'05"E (Call S 02°28'30"E) along the West right-of-way of North Richey Road a distance of 173.71 feet (Call 173.23') to the POINT OF BEGINNING.

Bearings and coordinates based on Texas Coordinate System NAD83 (2011) (Epoch:2010.0000) South Central Zone

Surveyed on the ground: 02/10/2015 - 02/17/2015.

Martin Olson Survey Inc.

Kevin A Olson
Texas Registered Professional Surveyor No. 4524
US Oil Recovery North tract.doc

KEVIN A. OLSON
4524

ER 072-24-2092

20150339322

Pages 6

07/30/2015 08:41 AM

e-Filed & e-Recorded in the

Official Public Records of

HARRIS COUNTY

STAN STANART

COUNTY CLERK

Fees $32.00

ER 072-24-2093

RECORDERS MEMORANDUM
This instrument was received and recorded electronically and any blackouts, additions or changes were present at the time the instrument was filed and recorded.

Any provision herein which restricts the sale, rental, or use of the described real property because of color or race is invalid and unenforceable under federal law.
THE STATE OF TEXAS
COUNTY OF HARRIS
I hereby certify that this instrument was FILED in File Number Sequence on the date and at the time stamped hereon by me; and was duly RECORDED in the Official Public Records of Real Property of Harris County, Texas.

COUNTY CLERK
HARRIS COUNTY, TEXAS

APPENDIX B

WATER WELL SEARCH RESULTS

PHYSICAL SETTING SOURCE MAP - 3384061.2s

0 1/4 1/2 1 Miles

- County Boundary
- Major Roads
- Contour Lines
- Earthquake epicenter, Richter 5 or greater
- Water Wells
- Public Water Supply Wells
- Cluster of Multiple Icons
- Groundwater Flow Direction
- Indeterminate Groundwater Flow at Location
- Groundwater Flow Varies at Location
- Closest Hydrogeological Data
- Oil or gas wells

SITE NAME: USOR ADDRESS: 400 North Richey Street Pasadena TX 77506 LAT/LONG: 29.7162 / 95.2202	CLIENT: EHS Support CONTACT: Amy Bauer INQUIRY #: 3384061.2s DATE: August 10, 2012 3:24 pm

Copyright © 2012 EDR, Inc. © 2010 Tele Atlas Rel. 07/2009.

DRAFT For Discussion Purposes Only

GEOCHECK® - PHYSICAL SETTING SOURCE SUMMARY

Hydric Status: Unknown

Corrosion Potential - Uncoated Steel: Not Reported

Depth to Bedrock Min: > 0 inches

Depth to Watertable Min: > 0 inches

No Layer Information available.

LOCAL / REGIONAL WATER AGENCY RECORDS

EDR Local/Regional Water Agency records provide water well information to assist the environmental professional in assessing sources that may impact ground water flow direction, and in forming an opinion about the impact of contaminant migration on nearby drinking water wells.

WELL SEARCH DISTANCE INFORMATION

DATABASE	SEARCH DISTANCE (miles)
Federal USGS	1.000
Federal FRDS PWS	Nearest PWS within 1 mile
State Database	1.000

FEDERAL USGS WELL INFORMATION

MAP ID	WELL ID	LOCATION FROM TP
H90	USGS2651435	1/4 - 1/2 Mile NW
H91	USGS2651437	1/4 - 1/2 Mile NW
H92	USGS2651436	1/4 - 1/2 Mile NW
H93	USGS2651434	1/4 - 1/2 Mile NW
M138	USGS2651296	1/2 - 1 Mile NNW
O172	USGS2651429	1/2 - 1 Mile WNW
Q173	USGS2651457	1/2 - 1 Mile NW
T194	USGS2651386	1/2 - 1 Mile WSW
AA246	USGS2651529	1/2 - 1 Mile WSW
AB259	USGS2651341	1/2 - 1 Mile North

FEDERAL FRDS PUBLIC WATER SUPPLY SYSTEM INFORMATION

MAP ID	WELL ID	LOCATION FROM TP
No PWS System Found		

Note: PWS System location is not always the same as well location.

DRAFT For Discussion Purposes Only

STATE DATABASE WELL INFORMATION

MAP ID	WELL ID	LOCATION FROM TP
A1	TXMON2000056476	1/8 - 1/4 Mile South
A2	TXMON2000056475	1/8 - 1/4 Mile South
A3	TXMON2000056474	1/8 - 1/4 Mile South
A4	TXMON2000056477	1/8 - 1/4 Mile South
5	TXWDB4000027335	1/8 - 1/4 Mile SSW
A6	TXMON2000056452	1/4 - 1/2 Mile South
A7	TXMON2000056451	1/4 - 1/2 Mile South
A8	TXMON2000056454	1/4 - 1/2 Mile South
A9	TXMON2000056453	1/4 - 1/2 Mile South
B10	TXMON2000057031	1/4 - 1/2 Mile NW
B11	TXMON2000057030	1/4 - 1/2 Mile NW
B12	TXMON2000057029	1/4 - 1/2 Mile NW
B13	TXMON2000057034	1/4 - 1/2 Mile NW
B14	TXMON2000057033	1/4 - 1/2 Mile NW
B15	TXMON2000057032	1/4 - 1/2 Mile NW
A16	TXPLU2000016357	1/4 - 1/2 Mile South
A17	TXPLU2000016356	1/4 - 1/2 Mile South
A18	TXPLU2000016359	1/4 - 1/2 Mile South
A19	TXPLU2000016358	1/4 - 1/2 Mile South
C20	TXMON2000056398	1/4 - 1/2 Mile SSE
C21	TXMON2000056397	1/4 - 1/2 Mile SSE
C22	TXMON2000056399	1/4 - 1/2 Mile SSE
C23	TXMON2000056401	1/4 - 1/2 Mile SSE
C24	TXMON2000056400	1/4 - 1/2 Mile SSE
C25	TXMON2000056369	1/4 - 1/2 Mile South
C26	TXMON2000056368	1/4 - 1/2 Mile South
C27	TXMON2000056370	1/4 - 1/2 Mile South
C28	TXMON2000056372	1/4 - 1/2 Mile South
C29	TXMON2000056371	1/4 - 1/2 Mile South
D30	TXWDB4000027508	1/4 - 1/2 Mile ENE
E31	TXPLU2000016333	1/4 - 1/2 Mile South
E32	TXPLU2000016332	1/4 - 1/2 Mile South
D33	TXWDB4000027509	1/4 - 1/2 Mile ENE
D34	TXWDB4000027536	1/4 - 1/2 Mile ENE
E35	TXPLU2000016310	1/4 - 1/2 Mile South
36	TXGH30000001984	1/4 - 1/2 Mile West
C37	TXMON2000056321	1/4 - 1/2 Mile South
C38	TXMON2000056322	1/4 - 1/2 Mile South
C39	TXMON2000056323	1/4 - 1/2 Mile South
C40	TXMON2000056320	1/4 - 1/2 Mile South
C41	TXMON2000056317	1/4 - 1/2 Mile South
C42	TXMON2000056318	1/4 - 1/2 Mile South
C43	TXMON2000056319	1/4 - 1/2 Mile South
F44	TXMON2000056551	1/4 - 1/2 Mile WSW
F45	TXMON2000056473	1/4 - 1/2 Mile SW
F46	TXMON2000056472	1/4 - 1/2 Mile SW
F47	TXMON2000056471	1/4 - 1/2 Mile SW
48	TXGH30000002040	1/4 - 1/2 Mile WNW
G49	TXPLU2000016307	1/4 - 1/2 Mile SSW
G50	TXPLU2000016308	1/4 - 1/2 Mile SSW
G51	TXPLU2000016309	1/4 - 1/2 Mile SSW
G52	TXPLU2000016304	1/4 - 1/2 Mile SSW

DRAFT Discussion Purposes Only

STATE DATABASE WELL INFORMATION

MAP ID	WELL ID	LOCATION FROM TP
G53	TXPLU2000016305	1/4 - 1/2 Mile SSW
G54	TXPLU2000016306	1/4 - 1/2 Mile SSW
F55	TXPLU2000016387	1/4 - 1/2 Mile WSW
F56	TXPLU2000016386	1/4 - 1/2 Mile WSW
F57	TXPLU2000016388	1/4 - 1/2 Mile WSW
F58	TXPLU2000016390	1/4 - 1/2 Mile WSW
F59	TXPLU2000016389	1/4 - 1/2 Mile WSW
F60	TXPLU2000016382	1/4 - 1/2 Mile WSW
F61	TXPLU2000016381	1/4 - 1/2 Mile WSW
F62	TXPLU2000016383	1/4 - 1/2 Mile WSW
F63	TXPLU2000016385	1/4 - 1/2 Mile WSW
F64	TXPLU2000016384	1/4 - 1/2 Mile WSW
F65	TXPLU2000016391	1/4 - 1/2 Mile WSW
F66	TXPLU2000016394	1/4 - 1/2 Mile WSW
F67	TXPLU2000016393	1/4 - 1/2 Mile WSW
F68	TXPLU2000016392	1/4 - 1/2 Mile WSW
H69	TXGH30000002063	1/4 - 1/2 Mile NW
E70	TXPLU2000016256	1/4 - 1/2 Mile South
E71	TXPLU2000016257	1/4 - 1/2 Mile South
E72	TXMON2000056249	1/4 - 1/2 Mile South
E73	TXMON2000056250	1/4 - 1/2 Mile South
E74	TXPLU2000016258	1/4 - 1/2 Mile South
E75	TXPLU2000016262	1/4 - 1/2 Mile South
E76	TXPLU2000016263	1/4 - 1/2 Mile South
E77	TXPLU2000016261	1/4 - 1/2 Mile South
E78	TXPLU2000016259	1/4 - 1/2 Mile South
E79	TXPLU2000016260	1/4 - 1/2 Mile South
E80	TXPLU2000016255	1/4 - 1/2 Mile South
I81	TXPLU2000016246	1/4 - 1/2 Mile South
I82	TXPLU2000016249	1/4 - 1/2 Mile South
I83	TXPLU2000016248	1/4 - 1/2 Mile South
I84	TXPLU2000016247	1/4 - 1/2 Mile South
I85	TXPLU2000016250	1/4 - 1/2 Mile South
I86	TXPLU2000016253	1/4 - 1/2 Mile South
I87	TXPLU2000016254	1/4 - 1/2 Mile South
I88	TXPLU2000016251	1/4 - 1/2 Mile South
I89	TXPLU2000016252	1/4 - 1/2 Mile South
H94	TXWDB4000027601	1/4 - 1/2 Mile NW
H95	TXWDB4000027600	1/4 - 1/2 Mile NW
H96	TXWDB4000027602	1/4 - 1/2 Mile NW
H97	TXWDB4000027603	1/4 - 1/2 Mile NW
J98	TXWDB4000027348	1/4 - 1/2 Mile ESE
J99	TXWDB4000027341	1/2 - 1 Mile ESE
H100	TXWDB4000027627	1/2 - 1 Mile NW
H101	TXEQ30000004589	1/2 - 1 Mile NW
J102	TXWDB4000027329	1/2 - 1 Mile ESE
103	TXMON2000057470	1/2 - 1 Mile NW
K104	TXMON2000056284	1/2 - 1 Mile SE
K105	TXMON2000056285	1/2 - 1 Mile SE
K106	TXMON2000056286	1/2 - 1 Mile SE
K107	TXMON2000056283	1/2 - 1 Mile SE
K108	TXMON2000056295	1/2 - 1 Mile SE

DRAFT Discussion Purposes Only

STATE DATABASE WELL INFORMATION

MAP ID	WELL ID	LOCATION FROM TP
K109	TXMON2000056281	1/2 - 1 Mile SE
K110	TXMON2000056282	1/2 - 1 Mile SE
K111	TXMON2000056292	1/2 - 1 Mile SE
K112	TXMON2000056291	1/2 - 1 Mile SE
K113	TXMON2000056294	1/2 - 1 Mile SE
K114	TXMON2000056293	1/2 - 1 Mile SE
K115	TXMON2000056288	1/2 - 1 Mile SE
K116	TXMON2000056287	1/2 - 1 Mile SE
K117	TXMON2000056290	1/2 - 1 Mile SE
K118	TXMON2000056289	1/2 - 1 Mile SE
119	TXGH30000001929	1/2 - 1 Mile ESE
L120	TXMON2000056955	1/2 - 1 Mile ENE
L121	TXMON2000056956	1/2 - 1 Mile ENE
L122	TXMON2000056954	1/2 - 1 Mile ENE
L123	TXMON2000056952	1/2 - 1 Mile ENE
L124	TXMON2000056953	1/2 - 1 Mile ENE
L125	TXMON2000056959	1/2 - 1 Mile ENE
L126	TXMON2000056960	1/2 - 1 Mile ENE
L127	TXMON2000056957	1/2 - 1 Mile ENE
L128	TXMON2000056958	1/2 - 1 Mile ENE
L129	TXMON2000056981	1/2 - 1 Mile ENE
L130	TXMON2000056980	1/2 - 1 Mile ENE
L131	TXMON2000056983	1/2 - 1 Mile ENE
L132	TXMON2000056982	1/2 - 1 Mile ENE
133	TXWDB4000027305	1/2 - 1 Mile WSW
L134	TXPLU2000016606	1/2 - 1 Mile ENE
135	TXGH30000002028	1/2 - 1 Mile WNW
M136	TXWDB4000027697	1/2 - 1 Mile NNW
M137	TXWDB4000027729	1/2 - 1 Mile NNW
M139	TXMON2000057688	1/2 - 1 Mile NNW
M140	TXMON2000057687	1/2 - 1 Mile NNW
M141	TXMON2000057686	1/2 - 1 Mile NNW
M142	TXMON2000057691	1/2 - 1 Mile NNW
M143	TXMON2000057690	1/2 - 1 Mile NNW
M144	TXMON2000057689	1/2 - 1 Mile NNW
M145	TXMON2000057682	1/2 - 1 Mile NNW
M146	TXMON2000057681	1/2 - 1 Mile NNW
M147	TXMON2000057680	1/2 - 1 Mile NNW
M148	TXMON2000057685	1/2 - 1 Mile NNW
M149	TXMON2000057684	1/2 - 1 Mile NNW
M150	TXMON2000057683	1/2 - 1 Mile NNW
M151	TXMON2000057692	1/2 - 1 Mile NNW
M152	TXMON2000057701	1/2 - 1 Mile NNW
M153	TXMON2000057700	1/2 - 1 Mile NNW
M154	TXMON2000057699	1/2 - 1 Mile NNW
M155	TXMON2000057704	1/2 - 1 Mile NNW
M156	TXMON2000057703	1/2 - 1 Mile NNW
M157	TXMON2000057702	1/2 - 1 Mile NNW
M158	TXMON2000057695	1/2 - 1 Mile NNW
M159	TXMON2000057694	1/2 - 1 Mile NNW
M160	TXMON2000057693	1/2 - 1 Mile NNW
M161	TXMON2000057698	1/2 - 1 Mile NNW

DRAFT For Discussion Purposes Only

STATE DATABASE WELL INFORMATION

MAP ID	WELL ID	LOCATION FROM TP
M162	TXMON2000057697	1/2 - 1 Mile NNW
M163	TXMON2000057696	1/2 - 1 Mile NNW
M164	TXWDB4000027742	1/2 - 1 Mile NNW
M165	TXGH30000002122	1/2 - 1 Mile NNW
166	TXEQ30000004538	1/2 - 1 Mile West
167	TXWDB4000027622	1/2 - 1 Mile NE
N168	TXMON2000057872	1/2 - 1 Mile NNE
O169	TXWDB4000027556	1/2 - 1 Mile WNW
P170	TXGH30000002050	1/2 - 1 Mile ENE
Q171	TXGH30000002112	1/2 - 1 Mile NW
P174	TXWDB4000027564	1/2 - 1 Mile ENE
Q175	TXWDB4000027728	1/2 - 1 Mile NW
176	TXMON2000056499	1/2 - 1 Mile ESE
N177	TXMON2000057926	1/2 - 1 Mile NNE
R178	TXPLU2000016027	1/2 - 1 Mile South
R179	TXPLU2000016026	1/2 - 1 Mile South
R180	TXPLU2000016029	1/2 - 1 Mile South
R181	TXPLU2000016028	1/2 - 1 Mile South
S182	TXMON2000057550	1/2 - 1 Mile NW
S183	TXMON2000057551	1/2 - 1 Mile NW
P184	TXGH30000002051	1/2 - 1 Mile ENE
P185	TXGH30000002053	1/2 - 1 Mile ENE
P186	TXGH30000002052	1/2 - 1 Mile ENE
R187	TXPLU2000016014	1/2 - 1 Mile South
T188	TXEQ30000004490	1/2 - 1 Mile WSW
T189	TXGH30000001931	1/2 - 1 Mile WSW
R190	TXPLU2000015996	1/2 - 1 Mile South
R191	TXPLU2000015997	1/2 - 1 Mile South
R192	TXPLU2000015998	1/2 - 1 Mile South
R193	TXPLU2000015995	1/2 - 1 Mile South
U195	TXGH30000002068	1/2 - 1 Mile ENE
U196	TXGH30000002069	1/2 - 1 Mile ENE
T197	TXWDB4000027328	1/2 - 1 Mile WSW
V198	TXMON2000056847	1/2 - 1 Mile East
V199	TXGH30000002018	1/2 - 1 Mile East
200	TXGH30000001919	1/2 - 1 Mile ESE
V201	TXPLU2000016566	1/2 - 1 Mile East
V202	TXPLU2000016565	1/2 - 1 Mile East
V203	TXPLU2000016569	1/2 - 1 Mile East
V204	TXPLU2000016568	1/2 - 1 Mile East
V205	TXPLU2000016567	1/2 - 1 Mile East
W206	TXWDB4000027886	1/2 - 1 Mile North
207	TXMON2000055854	1/2 - 1 Mile SSE
208	TXPLU2000017152	1/2 - 1 Mile NNW
X209	TXPLU2000017005	1/2 - 1 Mile NW
X210	TXPLU2000017006	1/2 - 1 Mile NW
X211	TXPLU2000017004	1/2 - 1 Mile NW
X212	TXMON2000057900	1/2 - 1 Mile NW
X213	TXPLU2000017003	1/2 - 1 Mile NW
214	TXWDB4000027604	1/2 - 1 Mile ENE
X215	TXPLU2000017040	1/2 - 1 Mile NW
216	TXWDB4000027327	1/2 - 1 Mile WSW

DRAFT Discussion Purposes Only

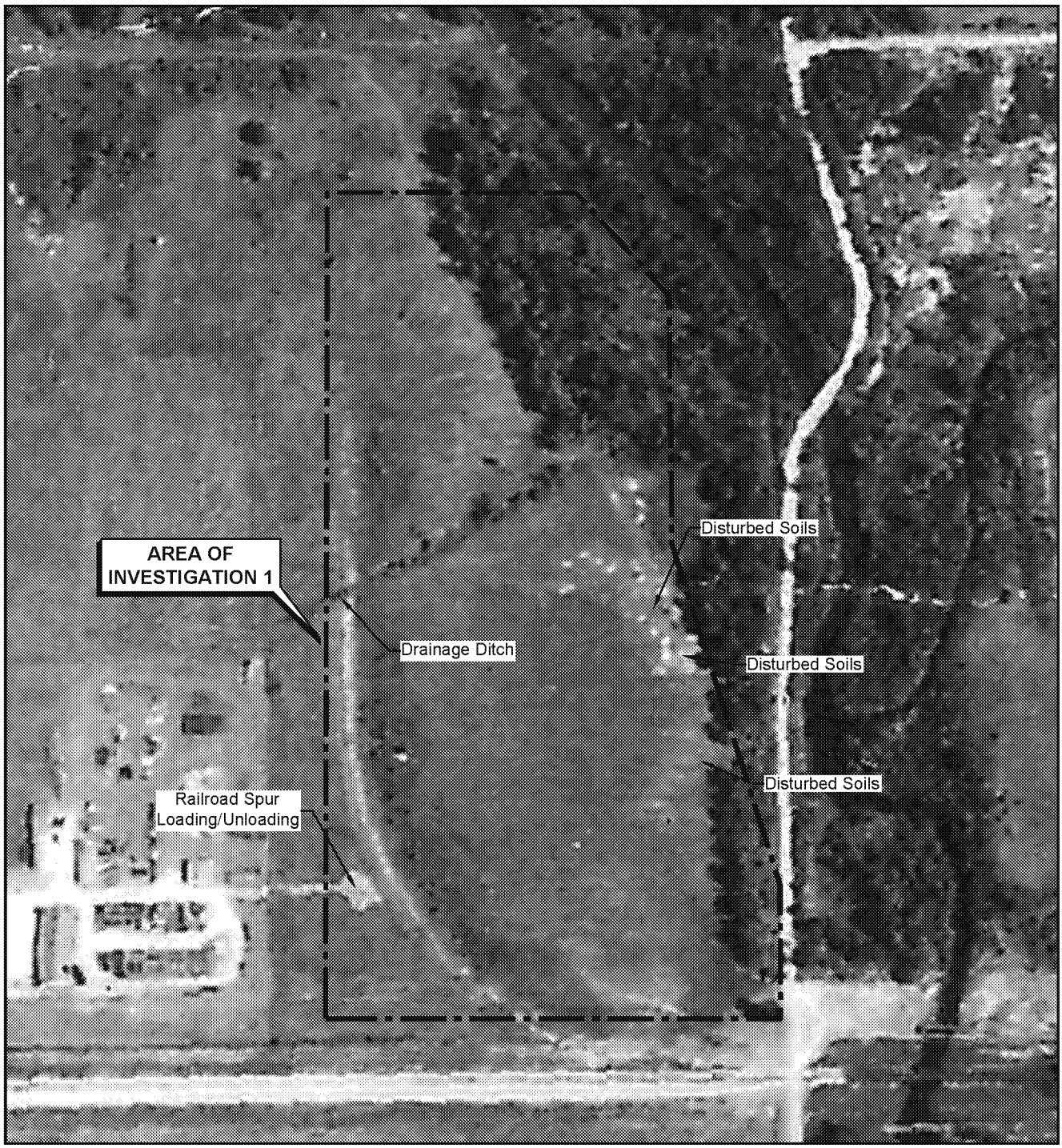
STATE DATABASE WELL INFORMATION

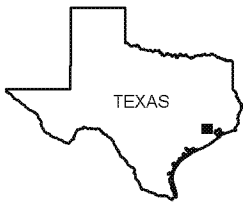
MAP ID	WELL ID	LOCATION FROM TP
X217	TXPLU2000017001	1/2 - 1 Mile NW
X218	TXPLU2000017002	1/2 - 1 Mile NW
X219	TXPLU2000016999	1/2 - 1 Mile NW
X220	TXPLU2000017000	1/2 - 1 Mile NW
X221	TXPLU2000017039	1/2 - 1 Mile NW
X222	TXPLU2000017070	1/2 - 1 Mile NW
X223	TXPLU2000017071	1/2 - 1 Mile NW
X224	TXPLU2000017069	1/2 - 1 Mile NW
X225	TXPLU2000017067	1/2 - 1 Mile NW
X226	TXPLU2000017068	1/2 - 1 Mile NW
X227	TXPLU2000016998	1/2 - 1 Mile NW
Y228	TXWDB4000027565	1/2 - 1 Mile ENE
W229	TXPLU2000017249	1/2 - 1 Mile North
X230	TXPLU2000017065	1/2 - 1 Mile NW
X231	TXPLU2000017066	1/2 - 1 Mile NW
Z232	TXMON2000058210	1/2 - 1 Mile North
X233	TXPLU2000017104	1/2 - 1 Mile NW
X234	TXPLU2000017103	1/2 - 1 Mile NW
X235	TXPLU2000017102	1/2 - 1 Mile NW
X236	TXPLU2000017037	1/2 - 1 Mile NW
X237	TXPLU2000017036	1/2 - 1 Mile NW
X238	TXPLU2000017038	1/2 - 1 Mile NW
Z239	TXMON2000058211	1/2 - 1 Mile North
X240	TXPLU2000017063	1/2 - 1 Mile NW
X241	TXPLU2000017064	1/2 - 1 Mile NW
X242	TXPLU2000017061	1/2 - 1 Mile NW
X243	TXPLU2000017062	1/2 - 1 Mile NW
X244	TXPLU2000017035	1/2 - 1 Mile NW
AA245	TXGH30000001909	1/2 - 1 Mile WSW
X247	TXPLU2000017101	1/2 - 1 Mile NW
X248	TXPLU2000017099	1/2 - 1 Mile NW
X249	TXPLU2000017100	1/2 - 1 Mile NW
Y250	TXGH30000002056	1/2 - 1 Mile ENE
AA251	TXEQ30000004474	1/2 - 1 Mile WSW
X252	TXPLU2000017098	1/2 - 1 Mile NW
X253	TXPLU2000017097	1/2 - 1 Mile NW
AB254	TXGH30000002189	1/2 - 1 Mile North
X255	TXPLU2000017096	1/2 - 1 Mile NW
Y256	TXWDB4000027557	1/2 - 1 Mile ENE
AC257	TXMON2000058073	1/2 - 1 Mile NNW
AC258	TXMON2000058074	1/2 - 1 Mile NNW
AB260	TXWDB4000027930	1/2 - 1 Mile North
AC261	TXMON2000058072	1/2 - 1 Mile NNW
262	TXMON2000058306	1/2 - 1 Mile North

DRAFT FOR DISCUSSION PURPOSES ONLY

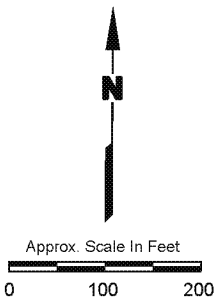
APPENDIX C

HISTORICAL AERIAL PHOTOGRAPHS





AERIAL PHOTO LOCATION



SOURCE:
Base map from Google Earth, dated December 1944.

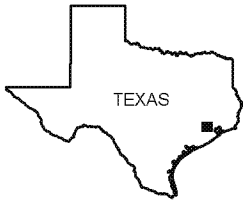
US OIL RECOVERY SUPERFUND SITE
PASADENA, HARRIS COUNTY, TEXAS

Appendix C-1-1

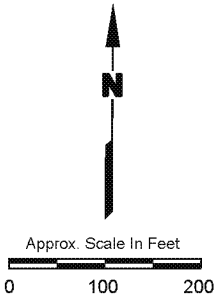
1944 AERIAL PHOTOGRAPH

PROJECT: 3333-2	BY: AJD	REVISIONS
DATE: DEC., 2015	CHECKED: MKW	

PASTOR, BEHLING & WHEELER, LLC
CONSULTING ENGINEERS AND SCIENTISTS



AERIAL PHOTO LOCATION



SOURCE:
Base map from Google Earth, dated December 1953.

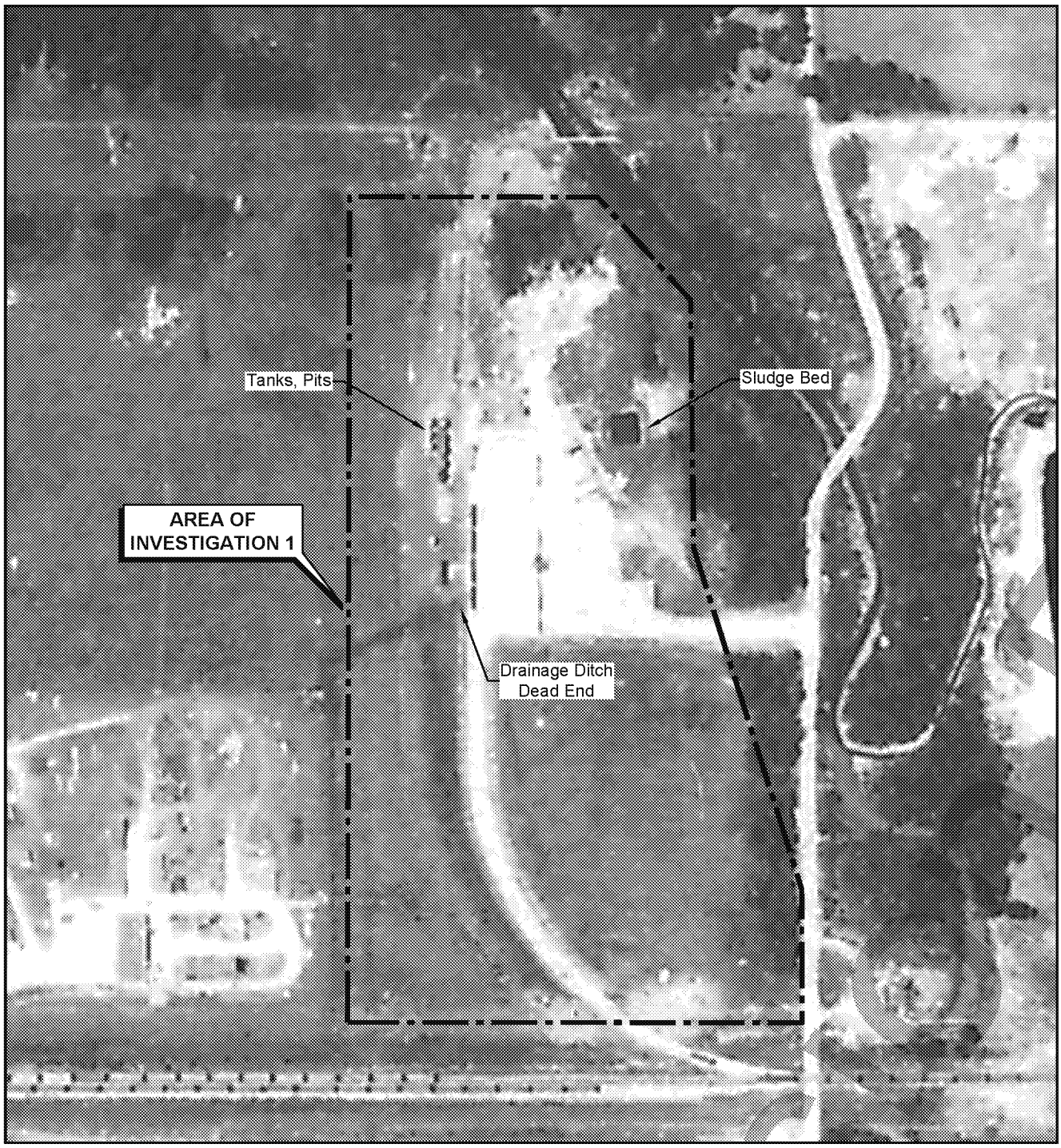
US OIL RECOVERY SUPERFUND SITE
PASADENA, HARRIS COUNTY, TEXAS

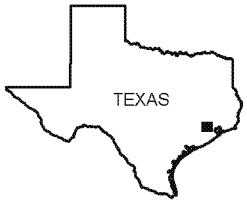
Appendix C-1-2

1953 AERIAL PHOTOGRAPH

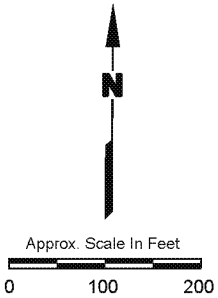
PROJECT: 3333-2	BY: AJD	REVISIONS
DATE: DEC., 2015	CHECKED: MKW	

PASTOR, BEHLING & WHEELER, LLC
CONSULTING ENGINEERS AND SCIENTISTS





AERIAL PHOTO LOCATION



SOURCE:
Base map from EDR Report dated August 13, 2012, Pasadena, TX.

US OIL RECOVERY SUPERFUND SITE

PASADENA, HARRIS COUNTY, TEXAS

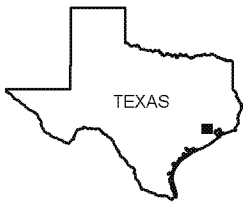
Appendix C-1-3

1953 AERIAL PHOTOGRAPH

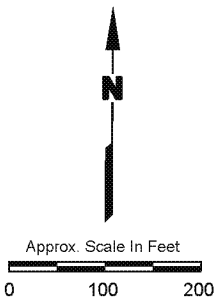
PROJECT: 3333-2	BY: AJD	REVISIONS
DATE: DEC., 2015	CHECKED: MKW	

PASTOR, BEHLING & WHEELER, LLC

CONSULTING ENGINEERS AND SCIENTISTS



AERIAL PHOTO LOCATION



SOURCE:
Base map from EDR Report dated August 13, 2012, Pasadena, TX.

US OIL RECOVERY SUPERFUND SITE

PASADENA, HARRIS COUNTY, TEXAS

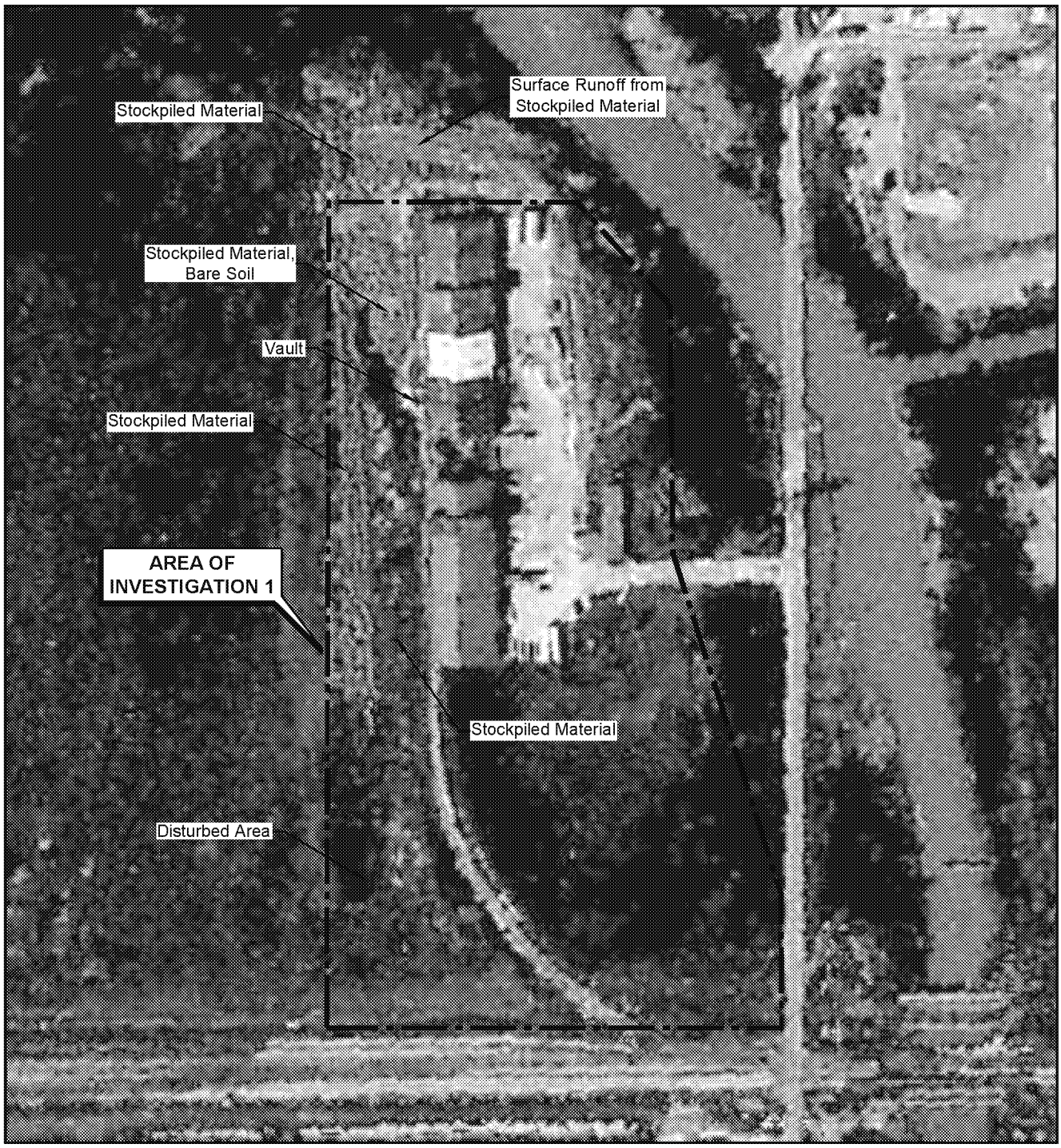
Appendix C-1-4

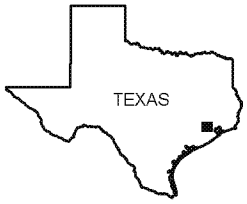
1962 AERIAL PHOTOGRAPH

PROJECT: 3333-2	BY: AJD	REVISIONS
DATE: DEC., 2015	CHECKED: MKW	

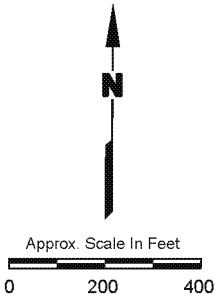
PASTOR, BEHLING & WHEELER, LLC

CONSULTING ENGINEERS AND SCIENTISTS





AERIAL PHOTO LOCATION



SOURCE:
Base map from Google Earth, dated December 1978.

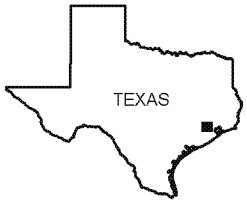
US OIL RECOVERY SUPERFUND SITE
PASADENA, HARRIS COUNTY, TEXAS

Appendix C-1-5

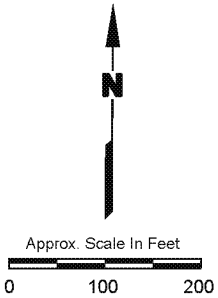
1978 AERIAL PHOTOGRAPH

PROJECT: 3333-2	BY: AJD	REVISIONS
DATE: DEC., 2015	CHECKED: MKW	

PASTOR, BEHLING & WHEELER, LLC
CONSULTING ENGINEERS AND SCIENTISTS



AERIAL PHOTO LOCATION



SOURCE:
Base map from EDR Report dated August 13, 2012, Pasadena, TX.

US OIL RECOVERY SUPERFUND SITE

PASADENA, HARRIS COUNTY, TEXAS

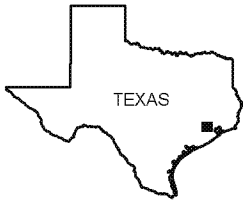
Appendix C-1-6

1979 AERIAL PHOTOGRAPH

PROJECT: 3333-2	BY: AJD	REVISIONS
DATE: DEC., 2015	CHECKED: MKW	

PASTOR, BEHLING & WHEELER, LLC

CONSULTING ENGINEERS AND SCIENTISTS



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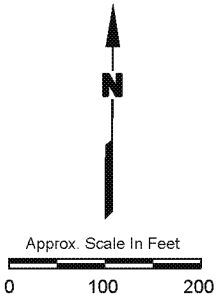


SOURCE:
Base map from EDR Report dated August 13, 2012, Pasadena, TX.

US OIL RECOVERY SUPERFUND SITE

PASADENA, HARRIS COUNTY, TEXAS

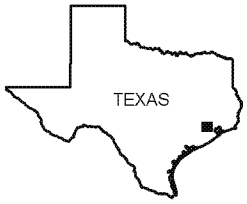
Appendix C-1-7

1989 AERIAL PHOTOGRAPH

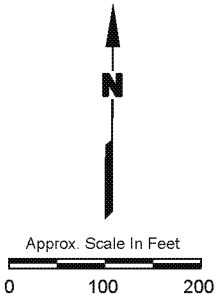
PROJECT: 3333-2	BY: AJD	REVISIONS
DATE: DEC., 2015	CHECKED: MKW	

PASTOR, BEHLING & WHEELER, LLC

CONSULTING ENGINEERS AND SCIENTISTS



AERIAL PHOTO LOCATION



SOURCE:
Base map from Google Earth, dated January 1995.

US OIL RECOVERY SUPERFUND SITE

PASADENA, HARRIS COUNTY, TEXAS

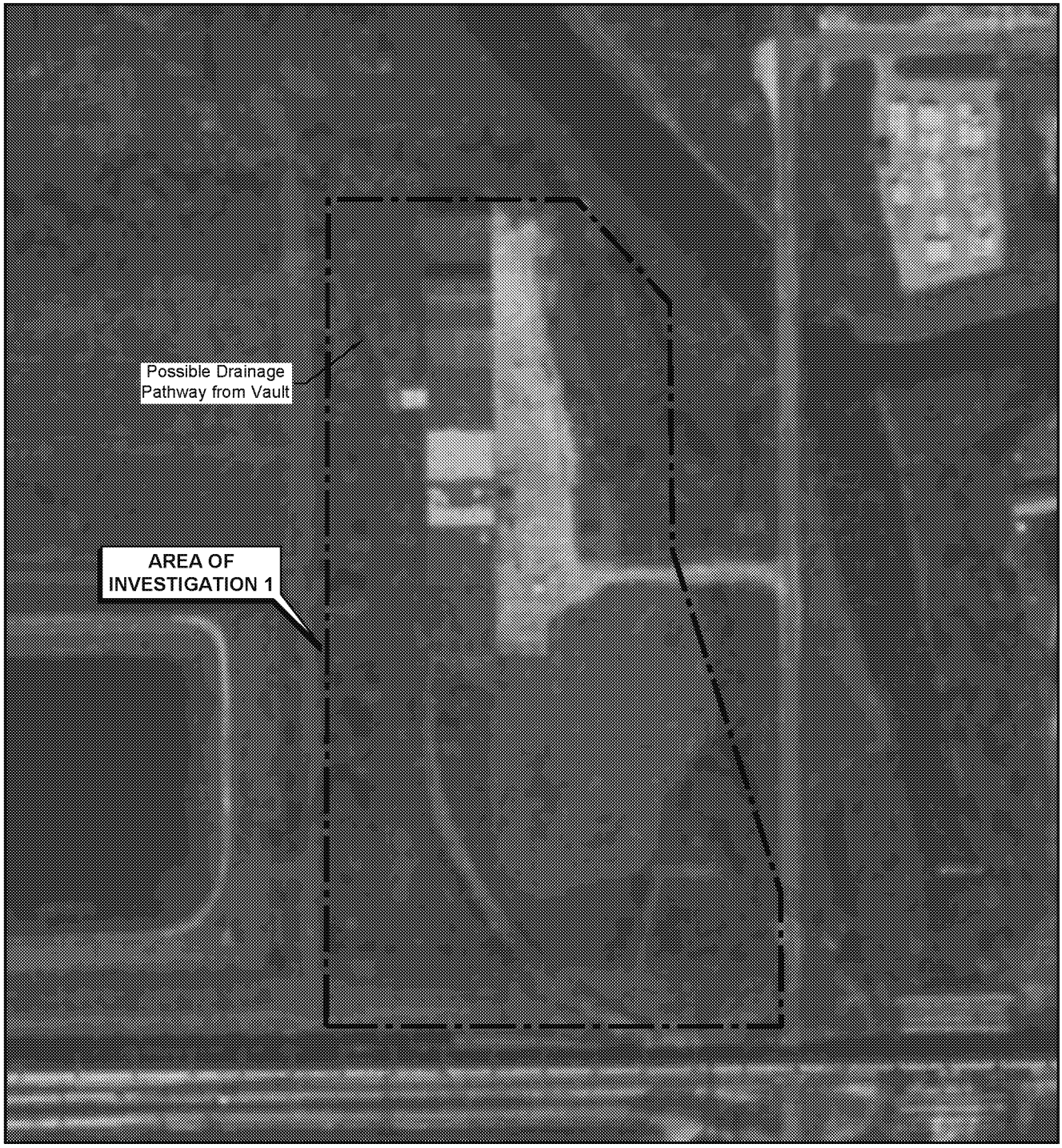
Appendix C-1-8

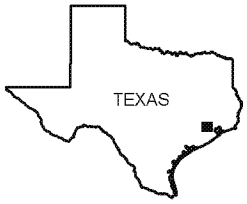
1995 AERIAL PHOTOGRAPH

PROJECT: 3333-2	BY: AJD	REVISIONS
DATE: DEC., 2015	CHECKED: MKW	

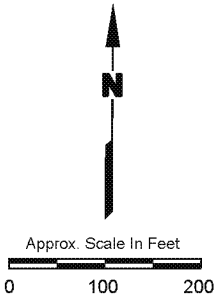
PASTOR, BEHLING & WHEELER, LLC

CONSULTING ENGINEERS AND SCIENTISTS





AERIAL PHOTO LOCATION



SOURCE:
Base map from EDR Report dated August 13, 2012, Pasadena, TX.

US OIL RECOVERY SUPERFUND SITE

PASADENA, HARRIS COUNTY, TEXAS

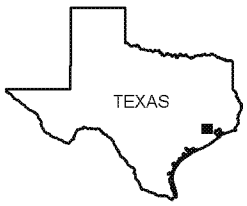
Appendix C-1-9

1995 AERIAL PHOTOGRAPH

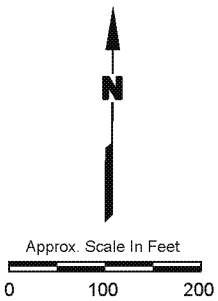
PROJECT: 3333-2	BY: AJD	REVISIONS
DATE: DEC., 2015	CHECKED: MKW	

PASTOR, BEHLING & WHEELER, LLC

CONSULTING ENGINEERS AND SCIENTISTS



AERIAL PHOTO LOCATION



SOURCE:
Base map from Google Earth, dated October 2002.

US OIL RECOVERY SUPERFUND SITE

PASADENA, HARRIS COUNTY, TEXAS

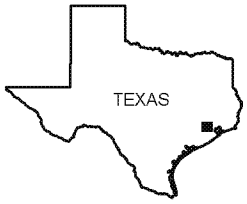
Appendix C-1-10

2002 AERIAL PHOTOGRAPH

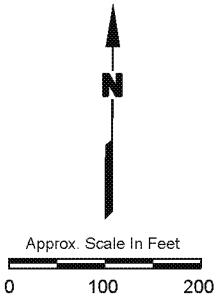
PROJECT: 3333-2	BY: AJD	REVISIONS
DATE: DEC., 2015	CHECKED: MKW	

PASTOR, BEHLING & WHEELER, LLC

CONSULTING ENGINEERS AND SCIENTISTS



AERIAL PHOTO LOCATION



SOURCE:
Base map from Google Earth, dated February 2004.

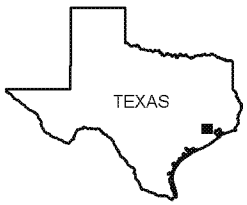
US OIL RECOVERY SUPERFUND SITE
PASADENA, HARRIS COUNTY, TEXAS

Appendix C-1-11

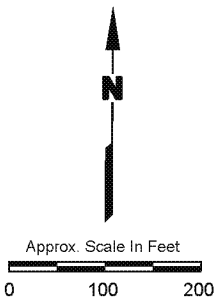
2004 AERIAL PHOTOGRAPH

PROJECT: 3333-2	BY: AJD	REVISIONS
DATE: DEC., 2015	CHECKED: MKW	

PASTOR, BEHLING & WHEELER, LLC
CONSULTING ENGINEERS AND SCIENTISTS



AERIAL PHOTO LOCATION



SOURCE:
Base map from Google Earth, dated April 2005.

US OIL RECOVERY SUPERFUND SITE

PASADENA, HARRIS COUNTY, TEXAS

Appendix C-1-12

2005 AERIAL PHOTOGRAPH

PROJECT: 3333-2	BY: AJD	REVISIONS
DATE: DEC., 2015	CHECKED: MKW	

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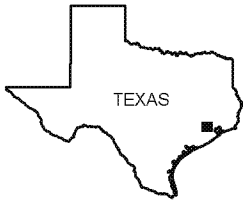

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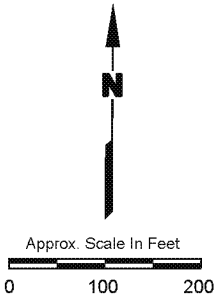

SOURCE:
Base map from Google Earth, dated January 2006.

US OIL RECOVERY SUPERFUND SITE

PASADENA, HARRIS COUNTY, TEXAS

Appendix C-1-13

2006 AERIAL PHOTOGRAPH

PROJECT: 3333-2	BY: AJD	REVISIONS
DATE: DEC., 2015	CHECKED: MKW	

PASTOR, BEHLING & WHEELER, LLC

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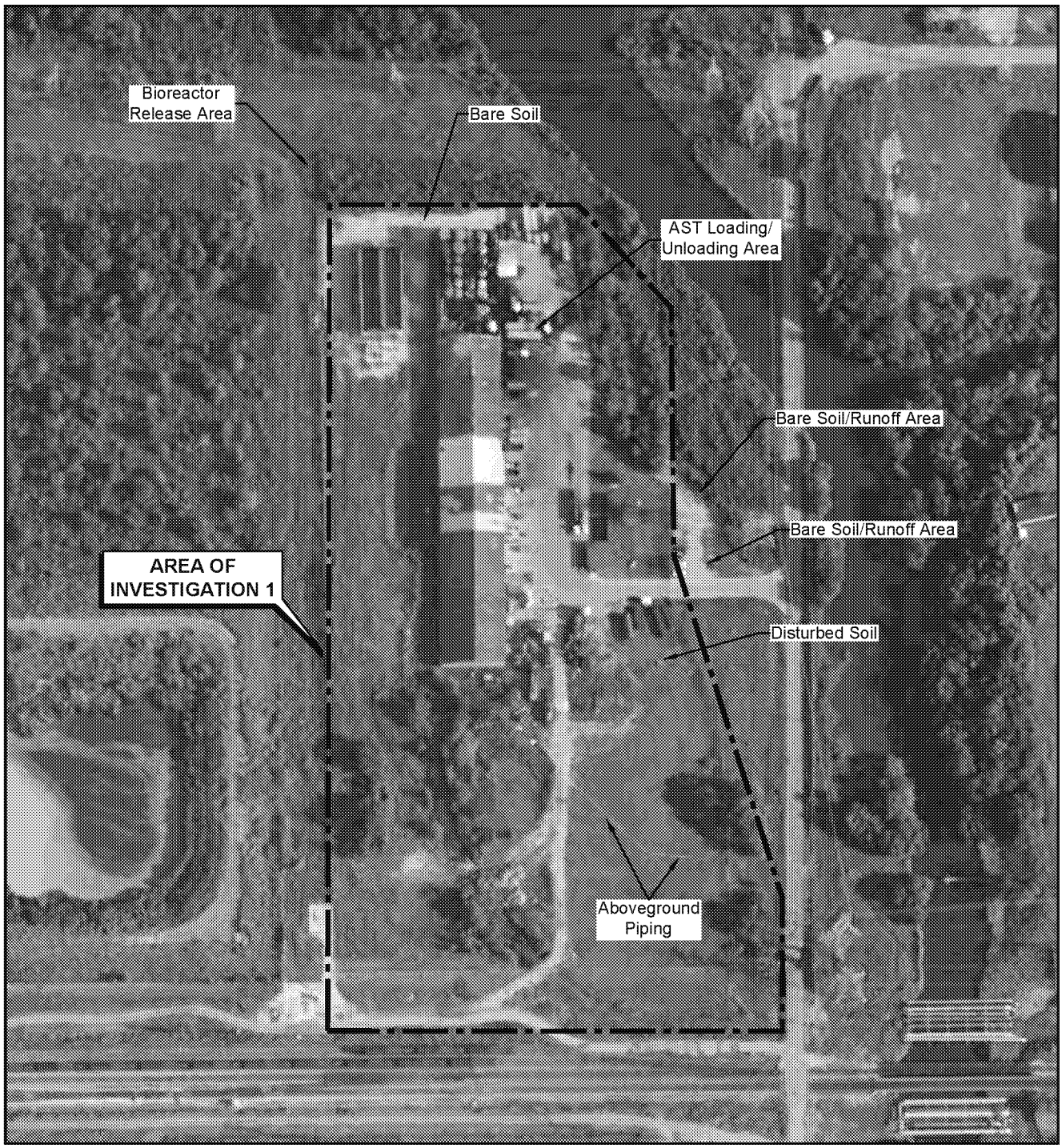

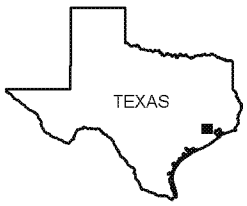

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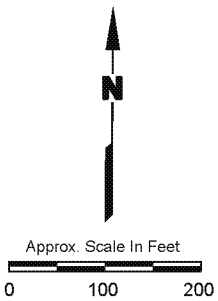

SOURCE:
Base map from Google Earth, dated September 2007.

US OIL RECOVERY SUPERFUND SITE
PASADENA, HARRIS COUNTY, TEXAS

Appendix C-1-14

2007 AERIAL PHOTOGRAPH

PROJECT: 3333-2	BY: AJD	REVISIONS
DATE: DEC., 2015	CHECKED: MKW	

PASTOR, BEHLING & WHEELER, LLC
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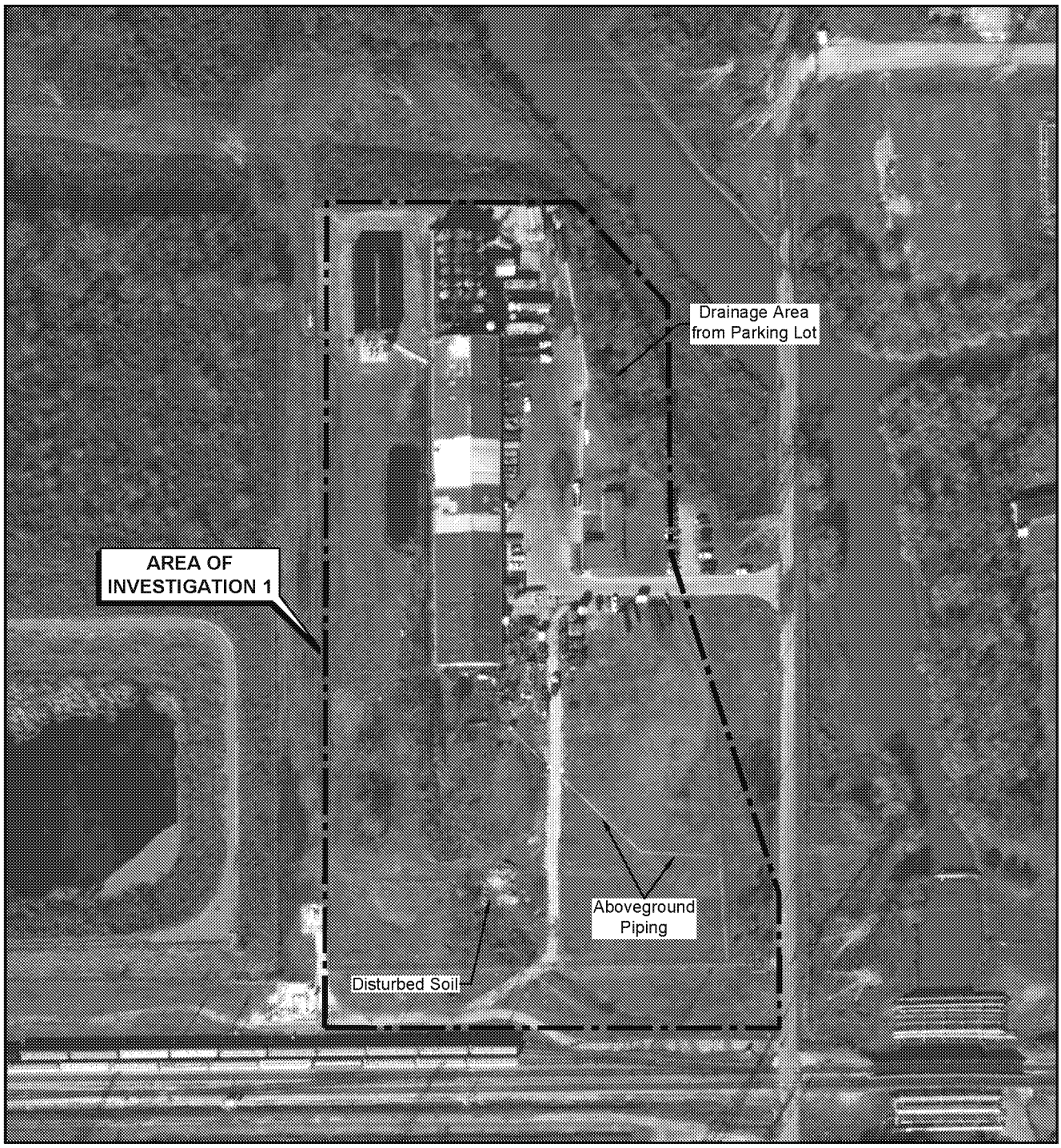

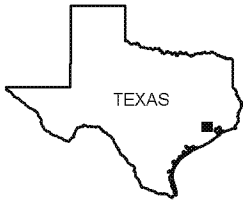

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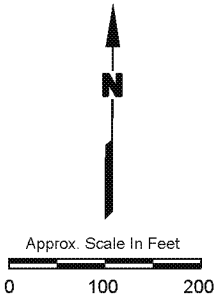

SOURCE:
Base map from Google Earth, dated January 2008.

US OIL RECOVERY SUPERFUND SITE

PASADENA, HARRIS COUNTY, TEXAS

Appendix C-1-15

2008 AERIAL PHOTOGRAPH

PROJECT: 3333-2	BY: AJD	REVISIONS
DATE: DEC., 2015	CHECKED: MKW	

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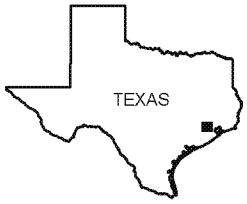

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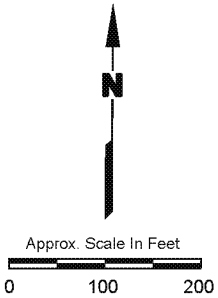

SOURCE:
Base map from Google Earth, dated March 2012.

US OIL RECOVERY SUPERFUND SITE

PASADENA, HARRIS COUNTY, TEXAS

Appendix C-1-16

2011 AERIAL PHOTOGRAPH

PROJECT: 3333-2	BY: AJD	REVISIONS
DATE: DEC., 2015	CHECKED: MKW	

PASTOR, BEHLING & WHEELER, LLC

CONSULTING ENGINEERS AND SCIENTISTS

APPENDIX D

SAMPLING RATIONALE

APPENDIX D
AREA OF INVESTIGATION 1
RI/FS WORK PLAN
SAMPLING RATIONALE

This document summarizes the proposed sample locations and provides additional support for the investigative approach described in the RI/FS WP and FSP.

SAMPLING RATIONALE

SOIL SAMPLE LOCATIONS

On-property and off-property soil sample locations (Figure 9 of the RI/FS WP, Figure 4 of the FSP) and information relied upon to determine sampling locations is presented below. This information is based on review of historic USOR Property documents, historic aerial photographs (see Appendix C of the RI/FS WP), and reconnaissance observations at the USOR Property.

Soil samples will be collected to evaluate the lateral and vertical extent of constituents of potential concern (COPCs) in soils. Soil sample collection intervals are based on location-specific information (i.e., deeper samples collected from "source" or "process related" areas and shallower samples collected from surface water runoff areas), as follows:

- At locations within areas of current or historical industrial activity and/or releases, all three sample intervals will be collected (i.e., 0 to 0.5 ft bgs; 0.5 to 5 ft bgs; and greater than 5.0 ft bgs). These locations are noted with an IA in the following table and a red circle on Figure 9 of the RI/FS WP.
- At locations within areas that receive runoff from potential source areas, the uppermost two intervals will be collected (i.e., 0 to 0.5 ft bgs; and 0.5 to 5 ft bgs). These locations are noted with a D in the following table and a light blue circle on Figure 9 of the RI/FS WP.

Preliminary soil sample locations shown on Figure 9 of RI/FS WP and Figure 4 of the FSP are subject to revision based on the data and information collected during the field investigation.

On-Property Soil Boring Location Rationale

Sample Location	Potential Source	Sample Location Rationale
SB-1	IA	Railroad spur loading/unloading pad observed in the 1944 aerial photograph (attached).
SB-2,3	IA	Lack of vegetation in this area on aerial photographs such as 1978, as well as text in historic reports regarding burial of arsenic contaminated soils in this general location.
SB-4	IA	Disturbed soil based on 2004 and 2008 aerial photographs.
SB-7	IA	Disturbed soils on the southeastern portion of the property based on 2004 aerial photograph.
SB-9,10,11, 65, 66	IA	Southeastern tank/roll-off box storage area used for the temporary containment of waste material.
SB-12	IA	Disturbed soils along the eastern property boundary based on 1944 aerial photograph and location of tank/roll-off box storage area used for the temporary containment of waste material.
SB-13	IA	Disturbed soils on the south-central portion of Site based on 2004, 2005, and 2007 aerial photographs; and location of tank/roll-off box storage area used

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		for the temporary containment of waste material.
SB-14	IA	Stockpiled equipment on the southeast corner of the warehouse based on 2005 aerial photograph.
SB-15	IA	Equipment staging area east of the machine shop based on 2005 aerial photographs.
SB-16	IA	Soil sample collected in 2001 with elevated arsenic concentration.
SB-17	IA	Stockpiled material west of the machine shop and south of the containment basin based on 1978, and 2006 aerial photographs.
SB-18	D	Drainage ditch enters the property from the western property based on the 1944 aerial photograph.
SB-19	D	Drainage ditch extending from the western property dead ends at the railroad tracks, west of the warehouse, based on the 1953 aerial photograph.
SB-20, 67, 68	IA	Northwestern property boundary adjacent to the containment pond and in the vicinity of the tanks/roll-off boxes used for the temporary containment of waste material.
SB-21	IA	Immediately west of the containment pond.
SB-22	IA	Possible stockpiled material located to the west of the warehouse based on the 1978 aerial photograph, possible stockpiled material located to the west of the containment pond in the 2006 aerial photograph, and location of tanks/roll-off boxes used for the temporary containment of waste material.
SB-23	IA	Underground vault and run-off area west of the warehouse in numerous aerial photographs.
SB-24	IA	Five cylindrical and four square tanks/pits west of the warehouse based on the 1953 aerial photograph, soil disturbance west of the warehouse based on the 1989 aerial photograph, drainage path extending north from containment pond observed in the 2005 aerial photograph, and stockpiled material north of the containment pond as observed in the 2006 aerial photograph.
SB-25	IA	Soil sample collected on 1998 with elevated arsenic concentration.
SB-26	IA	Drainage path extends north from the pit/pad in 1995 aerial photograph, bare soil along the northwestern property boundary based on 2002 aerial photograph, stockpiled material in the 2004 aerial photograph, and location of tanks/roll-off boxes used for the temporary containment of waste material.
SB-27	IA	West of the bioreactors where tanks/roll-off boxes used for the temporary containment of waste material.
SB-28	IA	Bare soil areas along the northwestern property boundary based on 2002 aerial photograph.
SB-29	IA	Surface water drainage path away from bioreactor, based on property reconnaissance observations.
SB-30	IA	Bare soil area in the 2005 and 2007 aerial photographs, north of the containment pond, and tanks/roll-off boxes used for the temporary containment of waste material.
SB-31	IA	Stockpiled material west of the AST area in the 1978 and 2004 aerial photographs, northwestern Site property boundary and around the aeration basin, and tanks/roll-off boxes used for the temporary containment of waste material.
SB-32	IA	Bare soils north of the ASTs based on the 2007 aerial photograph.
SB-33	IA	Bare soil on the north property boundary on 1953 aerial photograph, stockpiled material on the northeast corner of the Site based on 2004 aerial

		photograph, and tanks/roll-off boxes used for the temporary containment of waste material.
SB-40	IA	Bare soil that appears to receive runoff from the gravel parking area north of the entrance road, based on the 2007 aerial photograph.
SB-41	IA	Surface water accumulation area that drains to the east, just northwest of the office building, based on visual observations and aerial photographs (e.g., 2011).
SB-42	IA	Disturbed soils along the east boundary in the 1944 aerial photograph, and surface water drainage path observed during Site reconnaissance.
SB-43	IA	Disturbed soil south of office building as observed in the 1944 aerial photograph.
SB-44	IA	Surface water drainage area along southern entrance road based on reconnaissance observations (see 2011 aerial photograph)
SB-45	IA	Adjacent and southeast of AST loading/unloading area (see 2007 aerial photograph).
SB-46	IA	Adjacent and northeast of AST loading/unloading area (see 2007 aerial photograph)
SB-85, 86, 87, 88	IA	Adjacent to aboveground pipeline
SB-89, 90, 91	IA	Soil exposed after removal of bioreactor

Off-Property Soil Boring Location Rationale

SB-5	D	Storm water appears to enter the property at this location from the south, based on aerial photographs and property visit visual observations.
SB-6	D	Storm water drainage ditch west of N. Richey Street at southeast property boundary.
SB-8	IA	Soil sample next to manhole where TCEQ observed discharge on 10/7/2005 and collected soil samples that were measured with elevated arsenic concentrations.
SB-34	IA	Disturbed soil at the northeast corner of the property based on the 1989 aerial photograph.
SB-35	D	Drainage from earthen/gravel parking area east of the warehouse based on the 2002 aerial photograph.
SB-36	D	Drainage from parking area east of the AST area based on 2008 aerial photograph, and tanks/roll-off boxes used for the temporary containment of waste material.
SB-37	IA	Bare soil adjacent and east-northeast of sludge bed based on 1953 aerial photograph and historical USOR Property drawings.
SB-38	IA	Sludge bed on the northeast corner of the property based on the 1953 aerial photograph.
SB-39	IA	Bare soil that appears to receive runoff from the gravel parking area north of the entrance road, based on the 2007 aerial photograph.
SB-47	D	Storm water drainage ditch east of N. Richey Street.
SB-48	D	Surface water discharge point into Vince Bayou.
SB-49	D	Storm water drainage ditch east of N. Richey Street, east of the entrance drive.
SB-50	D	Storm water drainage ditch west of N. Richey Street and north of the entrance drive.

SB-51	IA	Bare soil north of the entrance road, between N. Richey Street and the entrance gate, based on the 2004 aerial photograph.
SB-52	IA	Gravel parking area north of the entrance road to the property, prior to entering the property, based on the 2005 aerial photograph.
SB-53	D	Storm water drainage ditch east of N. Richey Street.
SB-54	D	Storm water drainage ditch west of N. Richey Street, where surface water discharges into Vince Bayou.
SB-55	D	Storm water drainage northeast of the property, where surface water discharges into Vince Bayou.
SB-56	D	Surface water discharge into Vince Bayou.
SB-57	D	Surface water discharge into Vince Bayou.
SB-58	IA	Bare soil disturbance north of the property based on 1953 aerial photograph.
SB-59	IA	Storm water run-off from material stockpiled on northern portion of property based on 1978 aerial photograph.
SB-60	IA	Soil sample collected on 12/17/2007 where TCEQ observed run-off from a release at the bioreactor.
SB-61	IA	Stockpiled material north of the property boundary in the 1978 aerial photograph and bare soil area north of property based on 2004 aerial photograph.
SB-62	IA	Bare earthen area north of Site based on 2004 aerial photograph.
SB-63	D	Bare earthen area north of Site based on 2004 aerial photograph drains to this area.
SB-64	D	Bare earthen area north of Site based on 2004 aerial photograph drains to this area.
SB-69	D	Storm water appears to enter the property at this location from the south, based on aerial photographs and property visit visual observations.
SB-70	D	Storm water appears to enter the property at this location from the south, based on aerial photographs and property visit visual observations.
SB-71	D	Adjacent to location of tank/roll-off box storage area used for the temporary containment of waste material.
SB-72	D	Adjacent to location of tank/roll-off box storage area used for the temporary containment of waste material.
SB-73	D	Adjacent to location of tank/roll-off box storage area used for the temporary containment of waste material.
SB-74	D	Adjacent to location of tank/roll-off box storage area used for the temporary containment of waste material.
SB-75	IA	Adjacent to the containment pond and in the vicinity of the tanks/roll-off boxes used for the temporary containment of waste material.
SB-76	IA	Adjacent to the containment pond and in the vicinity of the tanks/roll-off boxes used for the temporary containment of waste material.
SB-77	IA	Adjacent to the containment pond and in the vicinity of the tanks/roll-off boxes used for the temporary containment of waste material.
SB-78	IA	Adjacent to the containment pond and in the vicinity of the tanks/roll-off boxes used for the temporary containment of waste material.
SB-79	IA	Adjacent to bioreactor and tank area
SB-80	IA	Adjacent to bioreactor and tank area
SB-81	IA	Adjacent to bioreactor and tank area

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SB-82	IA	Adjacent to tanks/roll-off boxes used for the temporary containment of waste material and in area of drainage away from parking lot
SB-83	IA	Adjacent to lift station on Southeast corner of property
SB-84	IA	Adjacent to lift station on Southeast corner of property
SB-92	IA	Based on reported release near electrical tower
SB-93	IA	Based on reported release near electrical tower
SB-94	D	Drainage toward bayou from reported releases to the southeast
SB-95	D	Drainage toward bayou from reported releases to the southeast
SB-96	D	Storm water drainage ditch west of N. Richey Street, where surface water drains toward Vince Bayou.
SB-97	D	Storm water drainage ditch west of N. Richey Street, where surface water drains toward Vince Bayou.
SB-98	D	Drainage from parking lot
SB-99	D	Storm water drainage ditch west of N. Richey Street, could receive runoff from property

MONITOR WELL SAMPLE LOCATIONS

Presented below is a description of on-property and off-property monitor well locations (Figure 9 of the RI/FS WP, Figure 4 of the FSP) based on review of historic documents, historic aerial photographs, and reconnaissance observations. Monitor wells will be completed within the corresponding soil boring.

Preliminary monitor wells sample locations are subject to revision based on the data and information collected during the field investigation.

Sample Location	Sample Location Rationale
MW-1 (SB-3)	Southwestern corner of the property where a lack of vegetation and notes in reports reference burial of arsenic impacted soils. Assumed to be hydraulically up-gradient of the main operational area.
MW-2 (SB-7)	Southeastern corner of the property where disturbed soils were observed. Assumed to be hydraulically up-gradient of the main operational area.
MW-3 (SB-11)	Southeastern portion of the property where tanks/roll-off boxes are used for the temporary containment of waste material. Assumed to be hydraulically up-gradient of the main operational area.
MW-4 (SB-44)	Surface water drainage area along southern property entrance road based on reconnaissance observations. Assumed hydraulically down-gradient of warehouse maintenance area.
MW-5 (SB-42)	Near the east-central property boundary, northeast of the office where a soil disturbance was noted and adjacent to a surface water drainage path extending from the concrete truck staging area. Assumed to be hydraulically down-gradient of the warehouse maintenance area.
MW-6 (SB-21)	West of the containment pond where historic excavation was performed. Assumed to be hydraulically up-gradient of operational area.
MW-7 (SB-39)	Bare soil that appears to receive runoff from the gravel parking area north of the entrance road, based on the 2007 aerial photograph. Assumed hydraulically down-gradient of warehouse container storage area and containment pond.
MW-8 (SB-36)	Drainage from parking area east of the AST area based on 2008 aerial photograph, and tanks/roll-off boxes used for the temporary containment of waste material.

	Assumed hydraulically down-gradient of AST areas.
MW-9 (SB-33)	Near the northern property boundary in areas of bare soil disturbances and where tanks/roll-off boxes are used for the temporary containment of waste material. Assumed to be hydraulically down-gradient of the main AST area.
MW-10 (SB-32)	Bare soils north of the ASTs based on the 2007 aerial photograph. Assumed to be hydraulically down-gradient of the main AST area.
MW-11 (SB-29)	Surface water drainage path away from bioreactor, based on reconnaissance observations. Assumed hydraulically down-gradient of the bioreactor.

SURFACE WATER AND SEDIMENT SAMPLE LOCATIONS

Presented below is a description of on-property surface water and sediment sample locations (Figure 9 of the RI/FS WP, Figure 4 of the FSP) based on review of historic documents, historic aerial photographs, and reconnaissance observations.

Preliminary surface water and sediment sample locations are subject to revision based on the data and information collected during the field investigation.

Sample Location	Sample Location Rationale
SW-1/SED-1 SW-2/SED-2 SW-3/SED-3	Northern part of former railroad spur area in southwest portion of USOR Property. Observed to retain water based on reconnaissance.
SW-4/SED-4 SW-5/SED-5 SW-6/SED-6	Southern part of former railroad spur area in southwest portion of USOR Property. Observed to retain water based on reconnaissance.

As indicated in the RI/FS WP and FSP, off-property sediment and surface water sample locations will be determined based on the information obtained during on-property soil, groundwater, surface water and sediment sampling and off-property soil and groundwater sampling.