APPENDIX NOT INCLUDED

Pre-Final 90% Remedial Design - Northern Impoundment

San Jacinto River Waste Pits Site
Harris County, Texas

International Paper Company &
McGinnes Industrial Maintenance Corporation

June 27, 2022

100027142

The Power of Commitment

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List of Acronyms

AASHTO	-	American Association of State Highway and Transportation Officials
ACBM	-	Articulated Concrete Block Mat
AISC	-	American Institute of Steel Construction
AMSL	-	Average Mean Sea Level
AOC	-	Administrative Settlement Agreement and Order on Consent for Remedial Design
ARAR	-	Applicable or Relevant and Appropriate Requirements
ASCE	-	American Society of Civil Engineers
ASTM	-	American Society for Testing and Materials
BBL	-	Barrel, measurement unit for barges, equivalent to 42 gallons of liquid
bgs	-	Below Ground Surface
BHHRA	-	Baseline Human Health Risk Assessment
BMP	-	Best Management Practice
^{137}Cs	-	Cesium-137
CFR	-	Code of Federal Regulations
cm	-	Centimeter
cm/s	-	Centimeters per Second
cm/year	-	Centimeters per Year
CME	-	Central Mine Equipment
COD	-	Chemical Oxygen Demand
COPC	-	Constituent of Potential Concern
CPT	-	Cone Penetrometer Test
CQA/QCP	-	Construction Quality Assurance/Quality Control Plan
CU	-	Consolidated Undrained
CWA	-	Coastal Water Authority
CY	-	Cubic Yard
D	-	Dead Load
DI	-	Deionized
DPT	-	Direct Push Technology
DU	-	Decision Unit
EM	-	Engineer Manual by United States Army Corps of Engineers
EPA	-	Environmental Protection Agency
ERP	-	Emergency Response Plan
FSP	-	Field Sampling Plan
Evoqua	-	Evoqua Water Technologies LLC
F	-	Fluid Load
FEMA	-	Federal Emergency Management Agency
FS	-	Feasibility Study
ft	-	Feet, measurement unit for length, height, or distance
ft^2	-	Square Feet
ft^3	-	Cubic Feet
ft/day	-	Feet per Day
ft/s	-	Feet per Second
F_y	-	Yield Stress
GAC	-	Granular Activated Carbon
GCV	-	Generalized Cross Validation
GHD	-	GHD Services Inc.

GHG	-	Greenhouse Gas
gpd	-	Gallons per Day
gpm	-	Gallons per Minute
GPS	-	Global Positioning System
H	-	Lateral Earth Pressure
HASP	-	Health and Safety Plan
HCFCD	-	Harris County Flood Control District
HDPE	-	High-Density Polyethylene
I	-	Barge Impact
I-10	-	Interstate Highway-10
IBC	-	Intermediate Bulk Containers
IC	-	Institutional Control
ICIAP	-	Institutional Controls Implementation and Assurance Plan
IPC	-	International Paper Company
K_d	-	Wind Directionality
K_e	-	Ground Elevation Factor
kip	-	Kilopound
kip/ft	-	Kilopound per Foot
ksi	-	Kilopound per Square Inch
K_z	-	Velocity Pressure Exposure Coefficient
K_{zt}	-	Topographic Factor
lb	-	Pound
lb/ft^2	-	Pounds per Square Foot
lb/ft^3	-	Pounds per Cubic Foot
LC	-	Load Combination
$L_{SH,t}$	-	Rising or Falling Limb of the Hydrograph at the Sheldon Gage at Time, t
MARS	-	Multivariate Adaptive Regression Splines
MIMC	-	McGinnes Industrial Maintenance Corporation
mg/L	-	Milligrams per Liter
ML	-	Minimum Level
MNR	-	Monitored Natural Recovery
mph	-	Miles per Hour
MRI	-	Maximum Recurrence Interval
N	-	Number of Observations
N_e	-	Effective Number of Parameters
NAVD88	-	North American Vertical Datum of 1988
ng/kg	-	Nanograms per Kilogram
NTU	-	Nephelometric Turbidity Units
O&M	-	Operations and Maintenance
Pa	-	Pascal
^{210}Pb	-	Lead-210
PBR	-	Permit By Rule
PCBs	-	Polychlorinated Biphenyls
PCF	-	Pounds per Cubic Foot
PDI	-	Pre-Design Investigation
PDI-1	-	First Phase Pre-Design Investigation
PDI-2	-	Second Phase Pre-Design Investigation
PFD	-	Process Flow Diagram

pg/L	-	Picograms per Liter
PMT	-	Pressuremeter Test
POHA	-	Port of Houston Authority
psi	-	Pounds per Square Inch
PTW	-	Principal Threat Waste
PVC	-	Polyvinyl Chloride
QAPP	-	Quality Assurance Project Plan
q_z	-	Velocity Pressure
RA	-	Remedial Action
RAO	-	Remedial Action Objective
RC	-	Remedial Contractor
RCRA	-	Resource Conservation and Recovery Act
RD	-	Remedial Design
RDWP	-	Remedial Design Work Plan
RI	-	Remedial Investigation
RI/FS	-	Remedial Investigation/Feasibility Study
ROD	-	Record of Decision
ROW	-	Right-of-Way
RPD	-	Relative Percent Difference
RSS	-	Residual Sum of Squares
SSA	-	Sand Separation Area
SDI	-	Supplemental Design Investigation
SF	-	Safety Factor
SM	-	Standard Method
SOW	-	Statement of Work
SPT	-	Standard Penetration Test
SVOC	-	Semi-volatile Organic Compound
SWMP	-	Site Wide Monitoring Plan
SWPPP	-	Stormwater Pollution Prevention Plan
TAC	-	Texas Administrative Code
TCDD	-	2,3,7,8-tetrachlorinated dibenzo-p-dioxin
TCEQ	-	Texas Commission on Environmental Quality
TCLP	-	Toxicity Characteristic Leaching Procedure
TCRA	-	Time Critical Removal Action
TDS	-	Total Dissolved Solids
$TEQ_{DF,M}$	-	TCDD Toxicity Equivalent for Mammals
TexTox	-	Texas Toxicity Screening
TOC	-	Total Organic Carbon
TODP	-	Transportation and Off-Site Disposal Plan
TSS	-	Total Suspended Solids
TSWP	-	Treatability Study Work Plan
TSWQS	-	Texas Surface Water Quality Standard
TWG	-	Technical Working Group
TxDOT	-	Texas Department of Transportation
USACE	-	United States Army Corps of Engineers
UCS	-	Unconfined Compressive Strength
USGS	-	United States Geological Survey
USCS	-	Unified Soil Classification System

UU	-	Unconsolidated Undrained
V_{100}	-	Design wind velocity with MRI of 100 years
V_{3000}	-	Design wind velocity with MRI of 3000 years
VOC	-	Volatile Organic Compound
WQBEL	-	Water Quality-Based Effluent Limitation
W	-	Wind Load
W_e	-	Wind Load, Exterior
W_i	-	Wind Load, Interior
$WSE_{SH,t}$	-	Water Surface Elevation at the Sheldon Gage at Time, t
$WSE_{SJ,t}$	-	Water Surface Elevation at the Northern Impoundment at Time, t
WTS	-	Water Treatment System
µm	-	Micron
µg/L	-	Micrograms per Liter

1. Introduction

GHD Services Inc. (GHD), on behalf of International Paper Company (IPC) and McGinnes Industrial Maintenance Corporation (MIMC; collectively referred to herein as the Respondents), submits to the United States Environmental Protection Agency (EPA) this *Pre-Final 90% Remedial Design - Northern Impoundment* (90% RD) for the San Jacinto River Waste Pits Site in Harris County, Texas (Site). This 90% RD was prepared pursuant to the requirements of the Administrative Settlement Agreement and Order on Consent for Remedial Design (AOC), Docket No. 06-02-18, with an effective date of April 11, 2018 (EPA, 2018a). The AOC includes a Statement of Work (SOW) that provides for a Pre-Final 90% RD for the Northern Impoundment to be submitted to the EPA. The *Preliminary 30% Remedial Design - Northern Impoundment* (30% RD) was submitted on May 28, 2020 (GHD, 2020b). Comments on the 30% RD (Comments) were received on July 16, 2020 (EPA, 2020g), and have been addressed in this 90% RD.

This 90% RD is being submitted following an additional investigation of conditions at the Northern Impoundment completed subsequent to submission of the 30% RD and in light of other developments related to the RD which are described in a letter from the Respondents dated March 24, 2022, to the Administrator and Superfund Division Chief for Region 6 (March 24 Letter; IPC and MIMC, 2022a). In the March 24 Letter, the Respondents requested that the EPA pursuant to 40 Code of Federal Regulations (CFR) §300.825 consider the need for modifications to the remedy selected by the EPA for the Northern Impoundment in the Record of Decision (ROD) (EPA, 2017), in light of: (1) significant increases in the volume), lateral extent and total average depth of impacted materials; (2) significantly increased complexity, risk, duration and cost of implementing the selected remedy as a result of the increased volume and depth; (3) implementability issues with the required engineered barrier using a best management practice (referred to herein as the best management practices [("BMP")] wall); (4) an inability to meet the ROD's requirement to excavate the waste material in certain areas "in the dry" (including in the portion of the Northern Impoundment referred to as the “northwest corner”) or to satisfy the ROD's requirement for "no discharges"; and (5) implementability issues and design changes necessitated by the Texas Department of Transportation (TxDOT) plans to replace and widen the Interstate Highway-10 (1-10) Bridge, which call into question fundamental assumptions underlying the RD related to access, the design of the BMP, and schedule. The March 24 Letter requested a pause in the schedule for submission of the 90% RD until such issues had been evaluated by the EPA.

In an April 15, 2022, letter (April 15 Letter; EPA, 2022b) written in response to the March 24 Letter, the EPA Region 6 Administrator stated that Respondents should proceed with the submission of this 90% RD for EPA review and comment “even if select portions of the design may later require revision.” It further stated that “[t]o the extent there are uncertainties about design issues, including access, that are still unresolved in June 2022, or even the need for a partial re-design of parts of the best management practices in light of additional information, the EPA would expect these to be noted in the submittal” and that “[t]o the extent appropriate, we will evaluate the adequacy of the 90% design submittal in light of any valid issues, uncertainties, and additional information identified by Respondents and the EPA.”

The Respondents are submitting this 90% RD on the basis of the April 15 Letter, and have addressed below and in particular in Section 5.11, the “issues, uncertainties, and additional information” referenced above. Respondents have in addition submitted a letter to EPA dated June 21, 2022 (IPC and MIMC, 2022b), requesting an extension with respect to the northwest corner of the Northern Impoundment. The letter proposed a meeting to take place following EPA review of this 90% RD to discuss a path forward with respect to completing the RD.

1.1 Background

The Site is located in Harris County, Texas, east of the City of Houston, between two unincorporated areas known as Channelview and Highlands. The vicinity of the Site is shown on Figure 1-1. In 1965 and 1966, pulp and paper mill waste was reportedly transported by barge from the Champion Paper, Inc. paper mill in Pasadena, Texas, and deposited in the Northern Impoundment. The Preliminary Site Perimeter established by EPA for the remedial investigation (RI) encompasses this impoundment and the surrounding in-water and upland areas of the San Jacinto River and is depicted on Figure 1-1. The Northern Impoundment is located immediately north of the I-10 Bridge over the San Jacinto River. An area referred to in the AOC as the Sand Separation Area (SSA; Figure 1-2) is located to the northwest of the Northern Impoundment.

The Northern Impoundment is shown on Figure 1-2. Beginning in 2010, a Time Critical Removal Action (TCRA) was implemented by the Respondents under an Administrative Order on Consent with EPA (Docket No. 06-12-10, April 2010; EPA, 2010). Construction elements of the TCRA included placement of a stabilizing geotextile barrier over the eastern side of the Northern Impoundment, construction of a low-permeability geomembrane and geotextile barrier on the western side of the Northern Impoundment, and placement of armored cap material over the entire Northern Impoundment. Additional background information regarding the Northern Impoundment is contained in the *Remedial Investigation Report* (RI Report; Integral and Anchor QEA, 2013b). In June 2019, approximately 40,000 square feet of articulated concrete block mat (ACBM) were installed along the northwestern submerged slope of the armored cap, as described in the *Northwest Slope Enhancement Completion Report*, submitted to the EPA on August 13, 2019 (Integral and Anchor QEA, 2019).

The remedy selected by the EPA for the Northern Impoundment described in the ROD (EPA, 2017) includes the following:

- Removal of a portion of the existing armored cap material installed as part of the TCRA armored cap.
- Removal of approximately 162,000 cubic yards (CY) of waste material exceeding the clean-up level of 30 nanograms per kilogram (ng/kg) 2,3,7,8-tetrachlorinated dibenzo-*p*-dioxin (TCDD) toxicity equivalent ($TEQ_{DF,M}$) that is located beneath the armored cap and its stabilization, as necessary to meet the appropriate requirements for acceptance at a permitted disposal facility.

The ROD also specifies that Institutional Controls (ICs) will be used to prevent disturbance (dredging and anchoring) in the SSA and that monitored natural recovery (MNR) will be the remedy used for the SSA.

The Remedial Action Objectives (RAOs) for the Site, as identified in the ROD, include:

RAO 1: Prevent releases of dioxins and furans above clean-up levels from the former waste impoundments to sediments and surface water of the San Jacinto River.

RAO 2: Reduce human exposure to dioxins and furans from ingestion of fish by remediating sediments to appropriate clean-up levels.

RAO 3: Reduce human exposure to dioxins and furans from direct contact with or ingestion of paper mill waste, soil, and sediment by remediating affected media to appropriate clean-up levels.

RAO 4: Reduce exposures of benthic invertebrates, birds, and mammals to paper mill waste derived dioxins and furans by remediating affected media to appropriate clean-up levels.

The potential exposure of a future young recreational fisher to dioxin and dioxin-like compounds in sediment, as detailed in the *Baseline Human Health Risk Assessment* (BHHRA; Integral and Anchor QEA, 2013a), was considered in selecting a risk-based clean-up level for the Northern Impoundment. The BHHRA assumed that the young recreational fisher could be exposed through chronic (39 days per year for 6 years) incidental ingestion and dermal contact of impacted sediment and through ingestion of fish collected in areas with impacted sediment. The risk-based clean-up level for the Northern Impoundment was calculated to be 30 ng/kg $TEQ_{DF,M}$.

1.2 Remedial Design Approach

In accordance with the AOC, the remedial design (RD) process includes the use of a Technical Working Group (TWG) to provide technical expertise in the development and evaluation of the RD plans. The TWG has considered the pre-design investigation (PDI), Supplemental Design Investigation (SDI), Treatability Study results, and Northern Impoundment RD elements presented in this document. The TWG consists of representatives from the EPA, Texas Commission on Environmental Quality (TCEQ), the United States Army Corps of Engineers (USACE), GHD, and other technical subject matter experts, as needed. TWG Meetings have been conducted a total of 25 times since the RD was initiated, including on April 30, 2018, May 14 to 15, 2018, May 30, 2018, June 13, 2018, May 3, 2019, December 17, 2019, January 27 to 28, 2020, February 19, 2020, March 25, 2020, April 22, 2020, July 29, 2020, November 12, 2020, December 15, 2020, February 4, 2021, March 10, 2021, April 19, 2021, June 4, 2021, August 5, 2021, August 30, 2021, October 19, 2021, November 16, 2021, December 14, 2021, March 10, 2022, March 25, 2022, and April 14, 2022.

In addition, representatives from GHD and EPA conduct weekly meetings to discuss the ongoing design progress, key technical items, and decisions associated with these items.

With the exception of Monthly Progress Reports, a summary of the deliverables associated with the RD to date are listed below:

- On June 8, 2018, the *Draft First Phase Pre-Design Investigation Work Plan* (Integral and Anchor QEA, 2018a) was submitted to the EPA. The EPA provided comments and the *First Phase Pre-Design Investigation Work Plan* (Integral and Anchor QEA, 2018b) was submitted to the EPA on August 24, 2018. It was approved by the EPA on September 12, 2018 (EPA, 2018b). An Addendum to the First Phase Pre-Design Investigation Work Plan (Integral and Anchor QEA, 2018d) was submitted on October 18, 2018.
- On September 10, 2018, the *Draft Remedial Design Work Plan* (RDWP, Integral and Anchor QEA, 2018c) was submitted to the EPA and outlined plans for implementing the RD activities identified in the SOW. The EPA provided comments on the Draft RDWP on October 24, 2018. The *Remedial Design Work Plan* (Integral and Anchor QEA, 2018e) was submitted to the EPA on December 24, 2018.
- On December 7, 2018, a letter was submitted to the EPA (GHD, 2018) requesting a 48-day extension of the deadline for submittal of the *Draft Second Phase Pre-Design Investigation Work Plan* to allow time for the results from the First Phase Pre-Design Investigation (PDI-1) to be evaluated and incorporated. This extension request was approved by the EPA on December 18, 2018 (EPA, 2018c), effectively extending the date for all subsequent RD submittals.
- On February 11, 2019, the *Draft Second Phase Pre-Design Investigation Work Plan* (GHD, 2019a) was submitted to the EPA. The EPA provided comments to the work plan on April 18, 2019 (EPA, 2019a). On June 3, 2019, the *Final Second Phase Pre-Design Investigation Work Plan* (GHD, 2019d) was submitted to the EPA and approved by the EPA in written correspondence dated August 8, 2019 (EPA, 2019c).
- On February 11, 2019, the *Draft Treatability Study Work Plan* (GHD, 2019b) was submitted to the EPA. The EPA provided comments to the work plan on April 18, 2019 (EPA, 2019b). On May 20, 2019, the *Final Treatability Study Work Plan,* (GHD, 2019c) was submitted to the EPA and approved in written correspondence dated August 27, 2019 (EPA, 2019d).
- On September 27, 2019, a letter was submitted to the EPA (GHD, 2019e) requesting an extension to the deadline for both the 30% RD for the Northern and Southern Impoundments in response to a *force majeure* event caused by Tropical Storm Imelda, which caused significant flooding at the Northern Impoundment and the surrounding area beginning on September 17, 2019, and delayed the completion of field work related to the Second Phase PDI (PDI-2) from September 17 to October 7, 2019. In a letter dated October 30, 2019 (EPA, 2019f), the EPA approved a 24-day delay due to the *force majeure* event and an extension to the deadlines for submittal of the 30% RD for both the Northern Impoundment and the Southern Impoundment.
- On May 28, 2020, the 30% RD was submitted to the EPA. The EPA provided Comments on July 16, 2020 (EPA, 2020f). Responses to these Comments are summarized in Table 1-1 and the Comments have been addressed throughout this 90% RD.
- On August 21, 2020, a letter was submitted to the EPA (GHD, 2020e) requesting a 160-day extension of the November 13, 2020, deadline for submitting the 90% RD to April 22, 2021, to allow time to determine if significant constructability concerns raised in the 30% RD could be resolved and to obtain additional information about plans being developed by other agencies. The extension was approved by the EPA in a letter dated September 10, 2020 (EPA, 2020g).
- On February 3, 2021, a letter was submitted to the EPA (GHD, 2021a) requesting a 270-day extension of the deadline for the 90% RD to January 17, 2022, to allow time to conduct the SDI to better delineate the extent of

the impacted material for removal and to better understand geotechnical conditions to support the design. The extension was approved by the EPA in a letter dated March 29, 2021 (EPA, 2021a).

- On February 19, 2021, the *Supplemental Design Investigation Sampling Plan* (SDI Work Plan) (GHD, 2021b) was submitted to the EPA. EPA provided comments on the SDI Work Plan on March 29, 2021 (EPA, 2021b). On May 21, 2021, the *Supplemental Design Investigation Sampling Plan - Rev. 1* (Revised SDI Work Plan) (GHD, 2021c) was submitted to the EPA and approved by the EPA in written correspondence dated June 4, 2021 (EPA, 2021c).
- On October 1, 2021, a letter was submitted to the EPA (GHD, 2021f) requesting a 160-day extension of the deadline for the 90% RD to June 26, 2022, to allow for receipt, evaluation, and incorporation of the analytical, geotechnical, and supporting data from the SDI. As requested in an e-mail from the EPA dated October 28, 2021, a Request for Northern Impoundment Schedule Extension - Addendum (GHD, 2021h) was submitted on November 9, 2021, that included a revised schedule that provided for the staged submittal of all RD components required by the SOW to be included in the 90% RD. This extension request was approved by the EPA in a letter dated January 12, 2022 (EPA, 2022a). A further extension request specifically with respect to the northwest corner was submitted to the EPA on June 21, 2022 (IPC and MIMC, 2022b).

1.3 Objective

The objective of this 90% RD is to present a summary, consistent with the SOW, of the RD for the Northern Impoundment, with the exception of that portion of the Northern Impoundment, commonly referred to as the northwest corner. It also identifies “issues, uncertainties and additional information” related to the RD and the selected remedy, per the April 15 Letter.

This 90% RD includes a summary of the results from the PDI-1, PDI-2, SDI, and Treatability Studies. This 90% RD also includes a description of the primary design elements for the remedy selected in the ROD for the Northern Impoundment, including those related to the design and installation of the BMP wall, waste material removal methodology, and water treatment, but not including detailed design elements with respect to waste material removal methodology and water treatment for the northwest corner. Associated design drawings, specifications, and supplemental plans are also included in this 90% RD.

1.4 Document Organization and Supporting Deliverables

The remaining sections of this 90% RD are organized as follows:

- ***Section 2*** includes descriptions of the phased PDI and SDI for the Northern Impoundment that were performed and a summary of the results and conclusions from these events.
- ***Section 3*** includes a description of Treatability Studies performed for the Northern Impoundment and results.
- ***Section 4*** addresses the Applicable or Relevant and Appropriate Requirements (ARARs) that may be applicable to the Northern Impoundment remedial action (RA) work.
- ***Section 5*** details the design criteria assumptions that are the basis for the current BMP wall design, waste material removal and solidification methodology, transportation and disposal, and water treatment process elements of the Northern Impoundment RD.
- ***Section 6*** includes a description of the investigation activities conducted in the SSA during PDI-2 and the implications of the results of that investigation for MNR.
- ***Section 7*** includes a description of how the RA for the Northern Impoundment may be implemented in a manner that minimizes environmental impacts in accordance with the EPA’s *Principles for Greener Clean-Ups* (EPA, 2009).
- ***Section 8*** includes a list of the drawings and associated technical specifications developed to date for this 90% RD.

- ***Section 9*** includes descriptions of the supporting deliverables identified in the SOW: Health and Safety Plan (HASP), Emergency Response Plan (ERP), Field Sampling Plan (FSP), Quality Assurance Project Plan (QAPP), Site Wide Monitoring Plan (SWMP), Construction Quality Assurance/Quality Control Plan (CQA/QCP), Institutional Controls Implementation and Assurance Plan (ICIAP), Transportation and Off-Site Disposal Plan (TODP), and Monitored Natural Recovery (MNR) Plan.
- ***Section 10*** includes references to cited reports, correspondences and other documents.

This 90% RD includes supporting figures and tables that are referenced throughout the document. This 90% RD also includes the following appendices:

- **Appendix A** - PDI and SDI Supporting Documents (including aquifer test results for the PDI-1, and analytical laboratory reports, data validation reports, and a photographic log for PDI-1, PDI-2, and SDI).
- **Appendix B** - Geotechnical Engineering Report, including a SDI Geotechnical Data Report and the December 9, 2021 Hydraulic Heave Analysis Report (GHD, 2021i).
- **Appendix C** - Treatability Testing Supporting Documents (including water and waste material analytical laboratory reports, data validation reports, and a photographic log).
- **Appendix D** - ARAR Support Documents.
- **Appendix E** - Use of Area-Based Average Concentration to Meet Clean-Up Level.
- **Appendix F** - Hydrodynamic Modelling Report.
- **Appendix G** - Design Drawing Package.
- **Appendix H** - Design Specifications.
- **Appendix I** - BMP Structural Design Report.
- **Appendix J** - Supporting Deliverables (including HASP, ERP, FSP, QAPP, SWMP, CQA/QCP, ICIAP, TODP, and MNR Plan).
- **Appendix K** - SSA Supporting Documents (including analytical lab reports and data validation reports).

2. Design Investigations

In March 2011 and May 2012, the Respondents completed investigations at the Northern Impoundment as part of the RI. A summary and results of these investigations are included in the RI Report. The RI included installation of eight borings to total depths ranging from 7.5 to 12.5 feet (ft) below ground surface (bgs) to characterize waste material chemistry, the results of which provided the basis for the remedial alternative selected in the ROD.

The main objective of the Northern Impoundment PDI and the SDI was to delineate and refine the depth and volume of materials likely requiring removal, as well as to obtain site-specific geotechnical data to inform the design of the BMP, specified in the ROD.

The PDI for the Northern Impoundment was conducted in two phases (in 2018 and 2019) and the SDI was conducted in 2021, as described below.

2.1 First Phase Pre-Design Investigation (PDI-1)

PDI-1 activities in the Northern Impoundment were completed by Integral Consulting and Anchor QEA between November 5 and December 9, 2018, in accordance with the *First Phase Pre-Design Investigation Work Plan* (Integral and Anchor QEA, 2018b), dated August 24, 2018, and approved by the EPA on September 12, 2018 (EPA, 2018b), and the *Addendum to the First Phase Pre-Design Investigation Work Plan*, dated October 18, 2018 (Integral and Anchor QEA, 2018d).

The purpose of the PDI-1 for the Northern Impoundment was to:

– Characterize the waste material in the Northern Impoundment that contains concentrations of dioxins and furans greater than 30 ng/kg $TEQ_{DF,M}$.
– Evaluate the concentrations of dioxins and furans within the historic central berm separating the eastern and western sides of the Northern Impoundment, as well as the perimeter berm located at the southern edge of the Northern Impoundment.
– Evaluate geotechnical characteristics of the material contained within the Northern Impoundment to inform RD engineering controls.
– Assess the specific yield of the waste material in the Northern Impoundment and hydraulic conductivity and specific yield of the unconsolidated riverine deposits below the Northern Impoundment and above the Beaumont Clay formation, in order to evaluate permeability of the soils and the expected infiltration/seepage of water during excavation activities.

Northern Impoundment PDI-1 field activities included waste material sampling for chemistry, waste characterization, and geotechnical analyses at 17 boring locations (Figure 2-1). Soil borings were advanced from the surface to 18 ft bgs for dioxins and furans analysis, from the surface to 10 ft bgs for waste characterization analysis, and from the surface to the Beaumont Clay (to a maximum depth of 62 ft bgs) for geotechnical sampling and testing. Four monitoring wells were also installed and an aquifer test was conducted.

Upland soil borings were installed from November 5 to 19, 2018 at 10 locations (SJSB028 to SJSB037), at which analytical, geotechnical, and waste characterization samples were collected. Four of these borings were completed as monitoring wells to utilize for aquifer testing. Six geotechnical borings (SJGB018 to SJGB023) were installed outside the perimeter of the armored cap from November 28 to December 5, 2018. Finally, on December 9, 2018, boring SJSB038 was installed for analytical, geotechnical, and waste characterization sampling.

A photographic log documenting the PDI-1 field event is included as part of Appendix A.

2.1.1 PDI-1 Drilling Methodology

PDI-1 boring locations were placed in areas that could be accessed from either a barge secured outside the extent of the armored cap or from a land-based drilling rig.

A roto-sonic drilling rig was utilized to install the 17 geotechnical borings. Six geotechnical boring locations (SJGB018, SJGB019, SJGB020, SJGB021, SJGB022, and SJGB023) were located under water, outside the extent of the armored cap. For these locations, a barge-mounted roto-sonic drilling rig was used. A track-mounted Direct Push Technology (DPT) drilling rig was utilized for the analytical borings. All analytical borings were located on the upland portions of the Northern Impoundment. Boring SJSB038 was located in an area of the Northern Impoundment that is covered with water that fluctuates from 0 to 2 ft of water, depending upon the season and the tide. To ensure that the boring at this location could be completed with the terrestrial drilling equipment, road-base aggregate was brought in and placed to establish access to the boring location.

At locations accessible by standard terrestrial equipment, armored cap material was removed, and the geotextile and/or geomembrane liner was cut prior to drilling activities. At the conclusion of drilling, the borings were grouted to the top, the geotextile and/or geomembrane liner was repaired, and the armored cap material was replaced.

2.1.2 PDI-1 Analytical Sampling

A total of 11 borings were installed at locations in the Northern Impoundment for chemical sampling to fill in data gaps from the RI, as shown on Figure 2-1. Borings were generally installed to a depth of 18 ft bgs, with three borings (SJSB036, SJSB037, and SJSB038) installed to maximum depth of 12 to 13 ft bgs.

Discrete waste material samples were collected via DPT methodology and submitted for analysis consistent with the *First Phase Pre-Design Investigation Work Plan* (Integral and Anchor QEA, 2018b), with the exception of boring location SJS038 which was sampled with the use of a 7-inch diameter sonic core method, due to low recovery with the DPT methodology. With the exception of boring locations SJSB036, SJSB037, and SJSB038, all samples were collected in two-foot intervals. Borings SJSB036, SJSB037, and SJSB038 were used to determine a potential contact point differentiating waste from underlying soil. Samples for these borings were collected above and below the identified waste contact point.

All samples were analyzed by ALS Laboratories for dioxins and furans using EPA approved Method 1613B. Sample data validation was completed by a third-party validation firm (EcoChem, Inc.).

2.1.3 PDI-1 Geotechnical Sampling

A total of 17 geotechnical borings were installed in the Northern Impoundment to total depths ranging from 22 to 62 ft bgs to fill data gaps from the RI and to evaluate the geotechnical properties of the soil around the perimeter of the Northern Impoundment. PDI-1 geotechnical boring locations are shown on Figure 2-1. Disturbed samples were collected from standard penetration test (SPT) split-spoon samplers and analyzed for moisture content, plasticity (Atterberg limits), specific gravity, and grain size distribution. Undisturbed samples were collected using Shelby tube samplers and analyzed for consolidated undrained (CU) triaxial shear strength, direct shear strength testing, one-dimensional consolidation testing, and bulk density. All tests were performed in a laboratory setting, with the exception of blow counts that were conducted in the field. Geotechnical samples were analyzed by GeoTesting Express.

2.1.4 PDI-1 Waste Characterization Sampling

To support waste disposal planning, three composite samples were collected for waste characterization sampling, as depicted on Figure 2-1. Samples were collected from depths of 0 to 10 ft bgs. Samples were analyzed by ALS Laboratories for toxicity characteristic leaching procedure (TCLP) parameters (EPA Method 1311 [SW-846]), ignitability (Flashpoint - SW-846 1010A), corrosivity (pH - EPA 9040), and reactivity (Reactive cyanide - SW-846 7.3.3.2 and Reactive sulfides - SW-846 9034).

2.1.5 PDI-1 Aquifer Testing

As part of PDI-1 field activities, four 4-inch diameter temporary monitoring wells (SJTW014, SJTW015, SJTW016, and SJTW017) were installed to total depths ranging from 36 to 42 ft bgs and screened from 10 to 15 ft bgs to total depth. Locations of the monitoring wells are shown on Figure 2-1. The monitoring wells were developed and utilized for an *in-situ* hydraulic aquifer test (i.e., constant rate discharge pumping tests).

Aquifer testing was conducted on each monitoring well from December 4 through December 7, 2018. Each test was run for approximately 3 hours, with a downhole transducer in the pumping well and periodic water level gauging at the other three monitoring wells being used as observation wells. Monitoring wells SJTW-015, SJTW-016, and SJTW-017 all yielded high pumping rates ranging from 16 to 26 gallons per minute (gpm). Each well had a relatively stable drawdown ranging from 7 to 11 ft from the starting water level. After each test, recovery water level readings were collected and each well displayed a relatively rapid well recovery. Only well SJTW-014, in the southeast corner, exhibited slow recovery and supported a pumping rate of 0.2 gpm.

2.1.6 Summary of PDI-1 Results

2.1.6.1 PDI-1 Analytical Results

Of the 11 borings analyzed, 5 borings (SJSB029, SJSB030, SJSB031, SJSB034, and SJSB035) had dioxin and furan concentrations below 30 ng/kg $TEQ_{DF,M}$, in all intervals as seen on Figure 2-2. These borings were located within the historic central berm separating the eastern and western sides of the Northern Impoundment, as well as the berm located at the southern edge of the Northern Impoundment. This is consistent with the understood construction of the historic impoundment whereby native soil was used to create the central and southern berms.

Six boring locations (SJSB028, SJSB032, SJSB033, SJSB036, SJSB037, and SJSB038) had concentrations greater than 30 ng/kg $TEQ_{DF,M}$ in one or more intervals. Boring location SJSB028, installed on the far eastern edge of the southern berm, had concentrations above 30 ng/kg $TEQ_{DF,M}$, at a maximum depth of 6 ft bgs. Boring locations SJSB032 and SJSB033 were installed to 18 ft bgs along the western edge of the Northern Impoundment. Results from these boring locations indicated concentrations above 30 ng/kg $TEQ_{DF,M}$, to depths of 10 and 12 ft bgs, respectively. Borings SJSB036 and SJSB037 were installed to terminal depths of approximately 13 ft bgs. Concentrations above 30 ng/kg $TEQ_{DF,M}$, at these locations near the center of the western side were identified at a maximum depth of approximately 11 ft bgs at both borings. Boring SJSB038 on the eastern side of the Northern Impoundment was installed to a depth of 12 ft bgs and showed concentrations above 30 ng/kg $TEQ_{DF,M}$ at a depth of 11 ft bgs.

PDI-1 analytical results are shown on Figure 2-2. The validated analytical data, shown in Table 2-1, provides quality assurance that the data collected are usable. The analytical laboratory reports and data validation report are included as part of Appendix A.

2.1.6.2 PDI-1 Geotechnical Results

The PDI-1 geotechnical results identified the presence of interbedded clay, silt, and sand in the areas of the Northern Impoundment in which the geotechnical samples were collected. Soils down to 6 to 10 ft bgs have a high moisture content, with moisture content decreasing as depth increases. Atterberg classification of clay soils indicated that most of the clays are high plasticity, fat clays, with a slightly fewer number of samples classified as low plasticity, lean clays. Interspersed within these clays were samples showing high gravel/sand content. The PDI-1 geotechnical results are included in Appendix B and are further discussed in Section 5.3.3, as they relate to the Northern Impoundment RD.

2.1.6.3 PDI-1 Waste Characterization Results

Waste characterization results indicate that the Northern Impoundment waste material did not exhibit any of the four characteristics of hazardous waste (ignitability, corrosivity, reactivity, or toxicity) and are not Listed Wastes, as defined in Title 40 of the Code of Federal Regulations (CFR) Part 261, Subpart C. As a non-hazardous waste, the waste material would meet the definition of Class I or Class II industrial waste under the regulations governing classification of non-hazardous industrial solid waste in Texas (30 Texas Administrative Code [TAC] §335.505, 335.506, and 335.508).

Validated waste characterization data, shown in Table 2-2, provides quality assurance that the data collected are usable. The analytical laboratory reports and data validation report are included as part of Appendix A.

Additional waste characterization testing of Northern Impoundment waste material was performed as part of the 2019 Treatability Study, conducted concurrently with PDI-2, and as part of the 2021 SDI activities. See Section 3.3 for a summary of the Treatability Study waste characterization results. See Section 2.3.7.2 for a summary of the SDI waste characterization results.

2.1.6.4 PDI-1 Aquifer Testing Results

Analysis of the transducer and gauging data from the PDI-1 aquifer tests indicated that there was no meaningful connectivity between the observation wells and the temporary monitoring wells (SJTW014, SJTW015, SJTW016, and SJTW017) and that there is no influence on the water levels of nearby wells that is not also matched by the tidal fluctuations of the river. Results indicated that there is a strong hydrological connection between the river and the shallow sand/silt layer underlying the Northern Impoundment. The data show that the shallow groundwater system is controlled by the hydrological influence of the river. The BMP included in the design will cut off the interconnection between the shallow groundwater and the river within the areas of removal. The only groundwater infiltration to be considered in the design is local seepage of stored groundwater near the excavations. Aquifer test results are included as part of Appendix A.

2.2 Second Phase Pre-Design Investigation (PDI-2)

The PDI-2 fieldwork on the Northern Impoundment was conducted by GHD from September 4 through December 13, 2019, in accordance with the *Final Second Phase Pre-Design Investigation Work Plan* (PDI-2 Work

Plan; GHD, 2019d), dated June 3, 2019, and approved by the EPA on August 8, 2019 (EPA, 2019c). On September 17, 2019, Tropical Storm Imelda caused significant flooding at the Northern Impoundment, forcing all field activities to be suspended from September 17 to October 7, 2019. This event resulted in a *force majeure* event that delayed the completion of PDI-2 field activities. EPA approved a 24-day schedule extension due to the *force majeure* event on October 30, 2019 (EPA, 2019f),

The purpose of the PDI-2 was to:

- Fill data gaps identified in PDI-1 by refining the horizontal and vertical extent of the waste material with a $TEQ_{DF,M}$ greater than 30 ng/kg to quantify the volume of waste material requiring removal, and to inform the alignment of the BMP during removal activities.
- Fill geotechnical data gaps identified in PDI-1 by collecting geotechnical data to support evaluation of slope stability and inform the BMP design.
- Conduct topographic, bathymetric, and utility surveys to support design of access, staging, and excavation.
- Collect hydrographic data to inform engineering of the BMP.

The Northern Impoundment PDI-2 field activities included installation of 25 analytical sample borings and 9 geotechnical borings at a total of 29 locations, as shown on Figure 2-3. Cuttings from the geotechnical borings were also collected as composite samples for treatability testing, further discussed in Section 3. Borings were advanced from the surface to a maximum depth of either 18 or 30 ft bgs for analytical borings, and to a maximum depth ranging from 20 to 100 ft bgs for geotechnical borings.

A photographic log documenting the Northern Impoundment PDI-2 field event is included in Appendix A.

2.2.1 Drilling Methodology

Due to the location of the Northern Impoundment, portions of the impoundment are heavily influenced by tides and inclement weather. The water level across the Northern Impoundment can vary several feet in the course of one day, providing unique challenges to the use of the drilling methodologies implemented during the PDI-2. Boring installation and sampling were conducted by one of the following methodologies:

- Track mounted drilling rig (DPT and hollow-stem auger).
- Airboat-mounted drilling rig (DPT).
- Barge-mounted drilling rig (hollow stem auger).

Of the 29 boring locations selected for PDI-2, all but six were located in areas that were under water. The appropriate drilling equipment and methodology was selected specifically for each boring location as required by the Site conditions and water level of the San Jacinto River at the time each boring was advanced. PDI-2 boring locations are shown on Figure 2-3.

At locations accessible by standard terrestrial equipment, a mini-excavator was used to remove armored cap rock, then the geotextile and/or geomembrane liner was cut prior to drilling activities. At boring locations that were submerged under water, accessible only by airboat or barge-mounted drilling equipment, certified divers hand cleared the cap rock from each boring location, precisely cut the geotextile and/or geomembrane liner, and then installed a short surface casing (4 feet diameter High-Density Polyethylene [HDPE] pipe or 18-inch diameter steel pipe) to protect against sloughing of the surrounding surface cap materials during drilling. For underwater borings, a wider-diameter casing was first pushed through the extent of the impacted material (approximately 18 to 20 ft bgs) and then the drill rod was advanced through the casing to prevent the potential release of any impacted material to the river during drilling activities.

At the conclusion of drilling at all boring locations, the borings were grouted, the casing was pushed to the mudline (for underwater borings), the geotextile and/or geomembrane liner was repaired, and the armored cap rock was replaced.

2.2.2 PDI-2 Analytical Sampling

In accordance with the PDI-2 Work Plan (GHD, 2019d), the sampling program was designed to better define the placement of the outer BMP. To that end, 14 non-contingent, analytical borings (SJSB045 to SJSB058) were initially installed primarily along the outer perimeter of the Northern Impoundment, just inside the limits of the armored cap. Samples from these locations were analyzed and if the concentrations of dioxins and furans in a boring were found to be below 30 ng/kg $TEQ_{DF,M}$, the associated contingent boring location (located interior to the non-contingent boring) was installed and sampled. This methodology was repeated until a boring was found to have concentrations above 30 ng/kg $TEQ_{DF,M}$.

Nine contingent sample locations (SJSB046-C1, SJSB047-C1, SJSB049-C1, SJSB050-C1, SJSB052-C1, SJSB055-C1, SJSB055-C2, SJSB056-C1, and SJSB057-C1) were originally planned, as seen on Figure 2-3, but based upon the results of the 14 non-contingent analytical borings, only six out of the nine contingent borings (SJSB046-C1, SJSB047-C1, SJSB050-C1, SJSB052-C1, SJSB055-C1, SJSB056-C1) were installed and sampled. All borings were installed using DPT methodology to a depth of 18 ft bgs and samples were collected on two-foot intervals.

Several modifications were made to the original PDI-2 scope of work based upon field conditions and analytical data results. A *Work Plan Refinement Notice* (GHD, 2019f) was submitted to the EPA on October 11, 2019, and approved on October 22, 2019 (EPA, 2019e). Per this notice, sample location SJSB050-C1 was relocated approximately 100 ft to the east to better delineate the horizontal and vertical extent of the waste material on the eastern boundary of the Northern Impoundment. Also, per this notice, sample location SJSB058 was moved approximately 60 ft to the southeast to allow the boring to be completed as a land-based boring.

There were several instances where one of the perimeter non-contingent borings had results below the clean-up level, and the next interior boring location from that clean boring had results that exceeded the clean-up level at, or almost at, total depth. To better delineate the horizontal and vertical extent of waste material, borings were added between the clean boring and the impacted boring. An *Additional Work Plan Refinement Notice* (GHD, 2019g) was submitted to the EPA on November 1, 2019, and was approved on November 8, 2019 (EPA, 2019g*).* Per this notice, three borings (SJSB045-C1, SJSB048-C1, and SJSB053-C1) were added between clean and impacted borings as described above. In addition, two samples were taken at locations SJSB070 and SJSB071 along the southern boundary of the ACBM panels on the western side of the Northern Impoundment (see Figure 2-3). The five additional borings were sampled and analyzed at two-foot intervals from zero to 18 ft bgs.

A *Fourth Work Plan Refinement Notice* (GHD, 2019h) was submitted to the EPA on December 4, 2019, requesting to relocate boring location SJSB046-C1 approximately 45 ft to the north to better delineate the horizontal and vertical extent of waste material on the eastern side of the Northern Impoundment. The request was approved by the EPA on December 9, 2019 (EPA, 2019h).

Analytical results obtained during the initial PDI-2 sample data analysis indicated concentrations of dioxins and furans greater than 30 ng/kg $TEQ_{DF,M}$, at the terminal depth of 18 ft bgs at 3 locations (SJSB046, SJSB058, and SJSB048-C1). To fully delineate the vertical extent of impacted material, duplicate borings were installed directly adjacent to the original borings at these locations, as outlined in the *Additional Work Plan Refinement Notice* (GHD, 2019f) and the *Fourth Work Plan Refinement Notice* (GHD, 2019h). Each duplicate boring was installed directly adjacent to the original borings to a depth of 30 ft bgs. Discrete samples were collected for every two-foot interval between 18 and 30 ft bgs, for a total of six samples per boring. The 18 to 20 ft bgs interval at each duplicate boring was analyzed, while the remaining five samples were held by the lab pending results of the first depth interval. Analytical results indicated that concentrations of dioxins and furans were below 30 ng/kg $TEQ_{DF,M}$ at the 18 to 20 ft bgs depth interval for all three locations; thus, the remaining samples for subsequent depth intervals were not analyzed.

In summary, 25 analytical borings were completed. Three were completed as land-based borings and 22 were completed as water-based borings. Three of the 25 borings were drilled to 30 ft bgs. All others were drilled to 18 ft bgs.

All analytical samples were analyzed by Eurofins TestAmerica Laboratory for dioxins and furans using EPA Method 1613B and percent moisture using Standard Method (SM) 2540G. Data validation was completed by GHD.

2.2.3 PDI-2 Geotechnical Sampling

Upon review of the geotechnical data obtained during the PDI-1, data gaps were identified and documented in the PDI-2 Work Plan (GHD, 2019d). Additional geotechnical data was needed on the interior of the Northern Impoundment boundary on the eastern side of the central berm to inform the design of possible internal BMPs (being considered at the time) for a multi-cell remediation approach. The geotechnical analyses performed during the RI and PDI-1 were determined to be insufficient to inform BMP design. Specifically, there was no unconsolidated-undrained (UU) triaxial compression data to evaluate shear strength. As such, a total of nine geotechnical borings (SJGB024 through SJGB027, SJSB047, SJSB050, SJSB053, SJSB057, and SJSB058) were installed during the PDI-2. The geotechnical boring locations are shown on Figure 2-3.

Geotechnical borings were installed using a Central Mine Equipment (CME) mud-rotary drilling rig. Samples were collected and analyzed for moisture content (per American Society for Testing and Materials [ASTM] D2216), grain size with hydrometer (per ASTM D6913 and ASTM D7928), plasticity (Atterberg limits; per ASTM D4318), torvane shear (per ASTM D2537), and UU triaxial shear strength (per ASTM D2850) to depths ranging from 20 to 100 ft bgs. Geotechnical samples were sent to Tolunay-Wong Engineers, Inc. for analysis.

2.2.4 Sand Separation Area Sampling

Samples were collected during the PDI-2 sampling event to establish current conditions in the SSA. The samples were collected from nine locations shown on Figure 2-4 using Vibracore sampling devices and a dive team. At each location, samples were collected at depth intervals of 0 to 1 foot, 1 to 2 ft, 2 to 4 ft, and 4 to 6 ft below the sediment/surface water interface and analyzed for dioxins and furans. Eurofins TestAmerica analyzed the samples by EPA Method 8290 and percent solids. Samples were also collected at depth intervals of 2.5 centimeters (cm) (0.98 inches) from the sediment/surface water interface to a depth of 82.5 cm (32.5 inches) and analyzed for cesium-137 (^{137}Cs) and lead-210 (^{210}Pb) using EPA Method 901.1 by Teledyne Brown Engineering, Inc.

A detailed summary of sampling activities and results is included in Section 6.

2.2.5 Transducer Installation

On July 22, 2019, two transducers were installed on the west side of the Northern Impoundment to evaluate the hydrological conductivity of the shallow sand and silt zone beneath the Northern Impoundment and the river. One transducer was installed in monitoring well SJTW-016 and the other was installed in a piezometer that was manually driven into the river sediment just off the shore to the west of SJTW-016. Each was fitted with a telemetry device and transmits data that can be remotely accessed. The locations of the transducers are shown on Figure 2-3.

2.2.6 PDI-2 Topographic, Bathymetric, and Utility Survey

To support design elements related to access, staging, and excavation, a topographic and bathymetric survey was completed on the Northern Impoundment from July 8 through August 2, 2019. The survey was conducted by a surveyor (Morrison Surveying, Inc.) licensed in the state of Texas. Field data were collected using conventional surveying equipment, including a Trimble R8 GNSS, Trimble R10 global positioning system (GPS), and Geometrics 882 marine magnetometer using Hypack software to collect geophysical data, CEE Scope Fathometer using Hypack software to collect bathymetric data, and a Trimble SX10 scan station to collect topographic data. Surveying was completed on a 50-feet grid over the Northern Impoundment boundaries. Above-ground utilities were also noted during survey activities. Survey data was utilized to develop a topographical digital elevation map of the Northern Impoundment. This surface and all identified above and below-ground utilities have been incorporated into the design drawings.

2.2.7 Summary of PDI-2 Results

2.2.7.1 PDI-2 Analytical Results

A total of 25 analytical borings were sampled and analyzed for dioxins and furans during the PDI-2 activities. Of the 25 borings, 12 had concentrations above 30 ng/kg $TEQ_{DF,M}$ to depths ranging from 4 to 18 ft bgs and the remaining borings were all below 30 ng/kg $TEQ_{DF,M}$ down to 18 ft bgs, as shown on Figure 2-5. Consistent with the objectives of the PDI-2 investigation, borings along the northeastern and eastern sides of the Northern Impoundment exhibiting $TEQ_{DF,M}$ concentrations below 30 ng/kg are to be used in the RD to define the extent of the excavation and the alignment of the outer BMP. This is further discussed in Section 5.2.

All subsurface analytical results from the RI, PDI-1, and PDI-2 are shown in Table 2-6 and on Figure 2-9. The data bars on Figure 2-9 show the interval results as elevations, adjusted to account for the depth of surface water atop each boring location, giving an indication of the total depth of waste material to be excavated during the RA. Two borings locations (SJSB046-12 and SJSB071) had samples above 30 ng/kg $TEQ_{DF,M}$ in the deepest sample interval collected. These locations were further investigated in the 2021 SDI event.

The validated analytical PDI-2 data, shown in Table 2-3, provides quality assurance that the data collected are usable. The PDI-2 analytical laboratory reports and data validation reports are included as part of Appendix A.

2.2.7.2 PDI-2 Geotechnical Results

During the RI and PDI-1, the Northern Impoundment soil lithology was characterized as interbedded Recent Alluvial Sediments (silts, sands, and clays) to an approximate depth of -30 feet North American Vertical Datum of 1988 (NAVD88), which was confirmed during the PDI-2. The previous investigations also indicated that the Beaumont Clay formation extended below this reference elevation (-30 ft NAVD88) to a minimum elevation of -60 ft NAVD88 on the western side of the Northern Impoundment and to approximately -50 ft NAVD88 on the eastern side of the Northern Impoundment. Additional geotechnical borings installed during PDI-2 (specifically boring SJSB057) encountered the Beaumont Clay formation at approximately -80 ft NAVD88 (an additional 20 ft of thickness) on the western side and at approximately -50 to -65 ft NAVD88 (up to an additional 15 ft of thickness) on the eastern side. Additionally, the investigations prior to PDI-2 indicated a sand formation extending below the clay formation across the Northern Impoundment to approximately -80 ft NAVD88. These sands, although encountered in the PDI-2, were not found to be consistent across the Northern Impoundment.

The PDI-2 geotechnical results are included in Appendix B. Further analysis and discussion of the geotechnical data as it relates to the RD of the BMP are included in Section 5.2.3.

2.2.7.3 Transducer Results

Consistent with the results of the PDI-1 aquifer tests, data from the transducers indicated that there is a strong hydrological connection between the river and the shallow sand/silt layer underlying the Northern Impoundment. The water levels are nearly identical in all observed data, with a slightly dampened response time observed in the monitoring well data that matches pressure changes in soils versus a free-flowing river. As part of the RD, water pressure heads from the shallow permeable layer have been correlated with fluctuations in the river water levels and accounted for, as such.

2.3 Supplemental Design Investigation (SDI)

The BMP design detailed in the 30% RD was subsequently deemed to be infeasible and following submittal of the 30% RD, a new design approach for the BMP (a double wall BMP system) was developed, the alignment of the BMP was changed, and new approach to the excavation methodology was developed. Based on the changes in BMP design and alignment and changes in excavation methodology, data gaps were identified in the available analytical delineation and geotechnical data.

As discussed during a TWG Meeting on December 15, 2020, an additional field investigation was deemed necessary to address these data gaps in the analytical and geotechnical data and better inform the RD. A proposed plan to collect additional analytical and geotechnical data was presented in a TWG Meeting on February 5, 2021, and then formalized in the SDI Work Plan, submitted to the EPA on February 19, 2021 (GHD, 2021b). A TWG Meeting was held to discuss the details of the SDI Work Plan on March 10, 2021, and the EPA provided comments on the SDI Work Plan (EPA, 2021b) on March 29, 2021. On April 15, 2021, a draft Response to Comments table and figures were sent to the EPA in response to the EPA's comments and were then discussed in detail during a TWG Meeting that took place on April 19, 2021. After further discussion with the EPA regarding the SDI scope of work and other significant modifications to it, a revised SDI Work Plan (Revised SDI Work Plan) was submitted to the EPA on May 21, 2021 (GHD, 2021c). The EPA approved the Revised SDI Work Plan on June 4, 2021 (EPA, 2021c). Between the February submittal of the SDI Work Plan and the June approval of the Revised Work Plan, the scope of the SDI event grew substantially. Most notably, seven analytical boring locations were added, with six of those additional borings being located in very challenging water-based locations. The original 10-week schedule for field work thus expanded to more than 12 weeks. The SDI fieldwork was conducted by GHD from June 28, 2021, to September 16, 2021.

The objectives of the SDI included the following:

– Further delineate the vertical extent of the waste material exceeding the ROD clean-up level around the perimeter of the excavation area to support the BMP design, elements of the anticipated excavation methodology, and other aspects of the RD.
– Address data gaps for the vertical and horizontal extent of waste material exceeding the ROD clean-up level across the area anticipated to be excavated to better refine the estimated excavation bottom elevations and the volume of material to be removed (which had already increased due to the depths of the waste material encountered during the PDI).
– Collect additional geotechnical data along the conceptual alignment of the BMP to inform the BMP design.
– Collect additional hydraulic conductivity data of the material to be excavated to better estimate the amount of seepage water that will require management during the RA.
– Collect additional hydraulic conductivity and pore pressure data to evaluate the risk of hydraulic heave during the RA.

The SDI field activities included installation of 35 analytical sample borings and 17 geotechnical soundings (13 Cone Penetrometer Test [CPT] soundings and 4 instrumented boreholes), as shown on Figure 2-6. Borings were advanced from the surface to a maximum depth of 24 ft bgs for analytical borings, and to a maximum depth ranging from 24 to 75 ft bgs for geotechnical soundings.

A photographic log documenting the SDI field event is included in Appendix A.

2.3.1 SDI Drilling Methodology

Similar to the PDI-2 event, several drilling methodologies were employed to account for variable water levels at the Northern Impoundment. Boring installation and sampling were conducted using the following methodologies:

– Track mounted drilling rig (DPT).
– Airboat-mounted drilling rig (DPT).
– Track-mounted drilling rig (mud rotary).
– Truck-mounted CPT drilling rig.
– Truck-mounted CPT drilling rig secured to a floating modular barge.

Of the 35 analytical boring locations selected for SDI, all but 11 of them were located in areas that were under water. All water-based analytical borings were installed utilizing an airboat-mounted DPT rig and all land-based analytical borings were installed utilizing a track-mounted DPT rig. The three land-based piezometers were installed using a track-mounted mud-rotary rig and the land-based CPT soundings were performed using a truck-mounted CPT drilling rig. The water-based CPT soundings were taken using a truck-mounted CPT drilling rig secured to a floating modular barge. SDI boring and CPT locations are shown on Figure 2-6.

At locations accessible by standard terrestrial equipment, a mini-excavator was used to remove armored cap rock, then the geotextile and/or geomembrane was cut prior to drilling activities. At boring locations that were submerged but were accessible by airboat-mounted drilling equipment, certified divers hand cleared the cap rock from each boring location, precisely cut the geotextile liner, and marked the location with a buoy. The drilling rig then installed a short surface casing (4 ft diameter HDPE pipe or 18-inch diameter steel pipe) to protect against sloughing of the surrounding surface cap materials during drilling. For underwater borings, a wider-diameter casing was first pushed until refusal was encountered (approximately 5 to 7 ft bgs on the shallower locations and approximately 5 to 10 ft bgs on the deeper locations) and then the drill rod was advanced through the casing to prevent the potential release of any impacted material to the river during drilling activities. At the conclusion of drilling at all boring locations, the borings were grouted, the casing was pushed to the mudline (for underwater borings), the geotextile and/or geomembrane was repaired, and the armored cap rock was replaced.

As required by the Revised SDI Work Plan (GHD, 2021c), turbidity curtains were deployed around the northwest corner of the Northern Impoundment during the installation of the four soil borings in that area. The initial plan utilized curtains that spanned the full extent of the water column, but due to higher-than-expected water velocities in that area, it was not possible to maintain that configuration and the curtains were realigned to allow for shorter curtains across the deeper areas. The timeline of activities and the significant challenges encountered were detailed in a letter to the EPA dated September 28, 2021 (GHD, 2021e).

2.3.2 SDI Analytical Sampling

In accordance with the Revised SDI Work Plan (GHD, 2021c), the sampling program was designed to further delineate the vertical and horizontal extent of material exceeding the ROD clean-up level. To that end, a total of 373 discrete samples (including 61 field and lab duplicate samples) were collected from 35 locations across the Northern Impoundment. Discrete samples were collected from two-foot intervals, to a total depth of 24 ft bgs. The sample intervals from 0 to 18 ft bgs were analyzed by the analytical laboratory, and the sample intervals from 18 to 24 ft bgs were archived by the laboratory pending the results of the 16 to 18 ft bgs sample interval. Analysis of the 16 to 18 ft bgs interval from each location was prioritized to expedite the determination as to whether the samples from the deeper sample intervals should be analyzed. If the 16 to 18 ft interval yielded an analytical result with $TEQ_{D,F,M}$ levels above 30 ng/kg, one or more of the three deeper intervals from 18 to 24 ft were also analyzed.

There were five boring locations (SJSB072, SJSB075, SJSB077, SJSB083, and SJSB101) that were co-located with historical boring locations in which a sample interval below the clean-up standard was not observed at the bottom of the boring (SJGB010, SJGB012, SJSB036, SJSB046-C1, and SJSB071). Three of the five locations were in upland areas (SJSB072, SJSB075, SJSB077), and the other two locations (SJSB083 and SJSB101) were in areas that are normally covered in water.

For the co-located borings adjacent to historical borings with $TEQ_{D,F,M}$ levels above 30 ng/kg, with the exception of SJSB083 and SJSB101 which were analyzed for waste characterization purposes, only sample intervals in the co-located borings that were deeper than the terminal depth of each historical boring with $TEQ_{D,F,M}$ levels above 30 ng/kg were analyzed. For example, at proposed boring location SJSB072, the first sample interval analyzed was 8 to 10 ft bgs, because co-located historical boring SJGB012 had a $TEQ_{D,F,M}$ level above 30 ng/kg at its terminal depth of 8 ft bgs.

All analytical samples were analyzed by Eurofins TestAmerica Laboratory for dioxins and furans using EPA Method 1613B and percent moisture using SM 2540G. Data validation was completed by GHD.

2.3.3 SDI Geotechnical Sampling

To delineate the subsurface stratigraphy along or in reasonable proximity to the conceptual BMP alignment, thirteen CPT soundings were taken.

Twelve of these CPT soundings (SJCPT-001 through SJCPT-010, SJCPT-002A, and SJCPT-006A) were taken along or in reasonable proximity to the conceptual BMP alignment. The initial contractor engaged to complete the water-based CPT borings was unable to successfully reach terminal depth due to the insufficient capacity through resistive force of its CPT drill rig and associated vessel. After multiple attempts by the initial contractor to successfully anchor and reach terminal depth, the initial CPT contractor and CPT drill rig demobilized and a second contractor with a larger capacity truck-mounted CPT drilling rig secured to a floating modular barge was retained to complete the CPT soundings.

A thirteenth CPT sounding (SJCPT-011) was taken adjacent to piezometer location, SJMW-016, as a “calibration sounding” to provide both CPT data and geotechnical laboratory test data for comparison with the newly-collected CPT data from the other 12 CPTs.

To provide the corresponding laboratory test data for comparison, geotechnical samples were collected at different locations (depths) during borehole SJMW-16 advancement and sent to Thompson Engineering Geotechnical Laboratory for laboratory analysis. The samples were collected along the entire length of this deep boring, including from the surficial alluvium, Beaumont Clay and Beaumont Sand layers (historical investigations gathered limited data from these lower geological strata).

In addition, nine vane shear tests were performed near CPT locations SJCPT-01 to SJCPT-03, and SJCPT-05 to SJCPT-10 using manual equipment. Vane shear tests were conducted in approximately 1.5 ft increments and progressed up to 24 ft bgs or until refusal, in order to define shear strength values within the surficial alluvions and calibrate the CPT results. The locations of the CPT soundings are shown on Figure 2-6.

Using the common set of information and well-defined relationships for various parameters available, the CPT results obtained from the 12 soundings along the current conceptual BMP alignment were calibrated against data from SJMW-016, and correlated to vane shear tests and existing geotechnical laboratory test data from past investigations. Physical geotechnical samples were collected and analyzed from SJMW-017 as supplemental geotechnical data.

2.3.4 Waste Characterization Sampling

Six waste characterization samples were collected from three analytical borings (SJSB083, SJSB101, and SJSB102). The original plan, as detailed in the Revised SDI Work Plan (GHD, 2021c), had been to collect duplicate samples from each planned 2-ft interval from 0 to 24 ft bgs in soil borings SJSB083 and SJSB101 and to archive the duplicates for potential waste characterization, pending dioxins analytical results. Upon receipt of the dioxins analytical results, the two samples in each boring with the highest dioxins concentration would have been identified and the duplicate samples from each of those intervals would have been analyzed for Resource Conservation and Recovery Act (RCRA) hazardous waste characteristics per EPA-required test methodology in 40 CFR Part 261. As detailed in SDI Sampling Plan Refinement Notice - 1, submitted to the EPA on July 26, 2021 (GHD, 2021d) and approved by the EPA on August 4, 2021 (EPA, 2021d), due to short analytical hold times for some of the RCRA hazardous waste characteristics parameters, the plan was revised to pre-select the intervals for analysis based upon historic dioxins data from nearby soil borings. Based upon data from historic soil boring SJSB046-C1, the 8 to 10 ft bgs and 10 to 12 ft bgs intervals were selected for waste characterization analysis from SJSB083. Based upon historic soil boring SJSB071, the 0 to 2 ft bgs and 2 to 4 ft bgs intervals were selected for waste characterization analysis from SJSB101.

Due to shipping delays, the waste characterization samples for SJSB083 were delivered to the analytical laboratory outside of the approved temperature range. The samples were analyzed, but in order to bolster the dataset for waste characterization, a third location was selected to collect waste characterization samples. Duplicate samples from two 2-ft intervals (8 to 10 ft bgs and 10 to 12 ft bgs) were collected from SJSB102 to analyze for waste characterization parameters. Waste characterization data is included in Table 2-5 and Appendix A.

2.3.5 Supplemental Data Collection

In addition to the sampling described above, supplemental data was collected to support the design of turbidity control measures for use during installation and removal of the BMP during the RA. These data collection activities focused on thicknesses of surface materials, geotechnical characteristics of surficial sediment, and velocity measurements in locations outside the proposed BMP alignment. Each of these data collection activities is described below.

2.3.5.1 Sediment and Rock Thickness

The extent and thickness of armored rock cap along the conceptual alignment of the BMP was investigated, together with the thickness of any sediment deposited on top of the armored rock cap. The information was collected by diver-assisted probing at specific intervals and further verified by examining past quarterly bathymetry surveys.

2.3.5.2 Surficial Sediments Geotechnical Properties

Ten samples of river sediment that had deposited on top of the armored rock cap were collected in Lexan® tubes that were hand driven into the sediment to collect a minimum 6-inch thick sample. The sediment within each tube was composited to form a single sample for geotechnical analyses. Samples were collected in proximity to corresponding CPT locations (SJCPT001 through SJCPT010, not including SJCPT-002A and SJCPT-006A) as shown on Figure 2-6.

Divers were required to clear surficial rock at six locations (SJCPT005 through SJCPT010) prior to driving each of the performed CPTs. At the time of clearing the CPT locations, the nearby six surficial sediment samples were collected at these six locations. An additional four locations (SJCPT001 through SJCPT004) were also sampled in a similar manner though the removal of rock at these locations was not necessary. Some boring locations were adjusted based on field conditions.

Both sets of samples were shipped under chain of custody procedures to a geotechnical laboratory for testing. Each sample were tested for water content (ASTM D2216), dry density (ASTM D2937), Atterberg limits (ASTM D4318), specific gravity (ASTM D854), particle size distribution (ASTM D422) and organic carbon content (ASTM D2974). The samples were also tested for consistency/stickiness using the Natural Resources Conservation Service method.

2.3.5.3 Water Velocity and Turbidity Measurements

During the week of November 8, 2021, two velocity meters (e.g., acoustic doppler current profiler) were deployed in locations outside of the conceptual BMP alignment, in accordance with the Revised SDI Work Plan (GHD, 2021c). Four turbidity monitors were deployed at the same time in accordance with the *Revised Ambient Turbidity Measurements Plan*, submitted to the EPA on October 6, 2021 (GHD, 2021g) and approved by the EPA on October 15, 2021 (EPA, 2021e). The four turbidity monitors and one of the two velocity monitors (Velocity Monitor A to the northwest) were removed from the river during the week of June 7, 2022. Velocity Monitor B will remain deployed for up to six more months. The locations of the meters are shown on Figure 2-8. Data from the velocity and turbidity monitors will be used to inform the turbidity monitoring and controls plan to be implemented during installation and removal of the BMP during the RA. Data from December 2021 through June 2022 is summarized in the SWMP (Appendix J).

2.3.6 Piezometer Installation

Four piezometers were installed using mud-rotary drilling equipment during the SDI to better understand the hydraulic conductivity and subsurface hydrostatic pressure of the groundwater bearing units below the Northern Impoundment. The locations of the piezometers are shown on Figure 2-6.

A shallow piezometer was installed and screened from the ground surface to -8 ft NAVD88 at boring SJMW-014 to get a better understanding of the hydraulic conductivity of the waste material itself. An intermediate piezometer was installed and screened from approximately -15 to -25 ft NAVD88 at boring SJMW-015 to obtain a better understanding of the hydraulic conductivity of the zone directly below the waste material. Deep piezometers were installed at borings SJMW-016 and SJMW-017 to better evaluate the potential for hydraulic heave during excavation activities. These piezometers extend into the sand layer below the Beaumont Clay Formation. SJMW-016 was screened from approximately -60 to -70 ft NAVD88, and SJMW-017 was screened from approximately -65 to -75 ft NAVD88, each representing the top ten feet of the lower sand layer below the Beaumont Clay.

During the installation of deep piezometers (SJMW-016 and SJMW-017), split spoon and Shelby Tube samples were collected as explained in Section 2.3.3. The samples were shipped under chain of custody procedures to the Thompson Engineering geotechnical laboratory for testing. Selected samples were analyzed for Unconsolidated Undrained Compression Test (ASTM D2850), Atterberg limits (ASTM D4318), moisture content (ASTM D2216), grain size (ASTM D6913/D7928), and #200 wash (ASTM D1140).

All four piezometers were constructed of 2-inch diameter Schedule 40 polyvinyl chloride (PVC) threaded casing. After development, a transducer was installed in each, and a slug test was performed to evaluate the lateral hydraulic conductivity of the strata through which each piezometer was screened. The locations of piezometers SJMW-014 and SJMW-015 were selected from adjacent boring log data to capture the highest representative conductivity values to inform choices on peak excavation seepage rates and water volumes. The hydraulic head in the lower sand was measured after development of the two deep piezometers (piezometer locations SJMW-016 and SJMW-017) to determine the confined hydrostatic pressure.

Pressuremeter Tests (PMT) were also performed by Braun Intertec at multiple intervals in the two deep piezometers boreholes using Texam Pressuremeter equipment. The tests were performed to evaluate the pressuremeter modulus, the limit pressure and the at-rest horizontal pressures of the surficial alluvium and Beaumont Clay Formation.

2.3.7 Summary of SDI Results

2.3.7.1 SDI Analytical Results

A total of 35 analytical borings were sampled and analyzed for dioxins and furans during the SDI activities. Of the 35 borings, 30 borings had concentrations above 30 ng/kg $TEQ_{DF,M}$ to depths ranging from 0 to 22 ft bgs and the remaining borings were all below 30 ng/kg $TEQ_{DF,M}$ at a depth of 18 ft bgs, as shown on Figure 2-7. Consistent with the objectives of the SDI, an interval below 30 ng/kg $TEQ_{DF,M}$ was encountered at the terminal depth of every soil boring, establishing vertical delineation of the waste material. Data from the SDI also identified waste material exceeding 30 ng/kg $TEQ_{DF,M}$ at elevations deeper than previously encountered (-28.36 ft NAVD88 at SJSB098).

Due to the apparent variability of the SDI results in some borings (which often include an interval with results above 30 ng/kg $TEQ_{DF,M}$ below several feet of material with results below 30 ng/kg $TEQ_{DF,M}$), a subset of data consisting of 36 selected sample intervals from the full SDI dataset was selected to be re-extracted and reanalyzed by the analytical laboratory. These re-extractions are identified in Table 2-4 as Laboratory Duplicates and the results from these samples are in addition to the 19 field duplicates that were collected and analyzed as a part of project quality assurance procedures. To evaluate the data, the relative percent difference (RPD) was calculated for each set of duplicates. Consistent with the criteria listed in the QAPP for sediment field duplicate samples, the RPD was compared to an acceptance criteria of 100% or less. Using this criteria, analysis of the duplicate data found there to be 8 of the 36 sets of data in the lab duplicate set that were above the 100% RPD threshold and four of the 19 sets above the threshold for the field duplicate sets. Given the small sample extraction amount required for the analysis and the notoriously high variability of sediment samples, this amount of variation in the duplicate datasets was deemed realistic and within normal ranges of variability for sediments. The data presented on Figures 2-7 and 2-9 and in Table 2-6 represents the highest value obtained from either the parent, field duplicate, or laboratory duplicate samples for each sample interval.

All subsurface analytical results from the RI, PDI-1, PDI-2, and SDI are shown on Figure 2-9. The data bars in this figure show the interval results as elevations, adjusted to account for the depth of water atop each boring location. Table 2-6 also presents all subsurface analytical results as elevations.

The validated analytical SDI data, shown in Tables 2-4 and 2-6, provides quality assurance that the data collected are usable. The SDI analytical laboratory reports and data validation reports are included as part of Appendix A.

2.3.7.2 SDI Waste Characterization Sampling

Consistent with the results from waste characterization sampling performed as part of the PDI-1 and PDI-2 Treatability Testing, all six samples collected during the SDI for analysis of waste characterization parameters were below the thresholds to be classified as RCRA hazardous waste. Notably, the dioxins results from three of the six samples were significantly elevated (4,400 ng/kg $TEQ_{DF,M}$ at SJSB083 [8 to 10 ft bgs], 52,000 ng/kg $TEQ_{DF,M}$ at SJSB101 [0 to 2 ft bgs], and 47,000 ng/kg $TEQ_{DF,M}$ at SJSB101 [2 to 4 ft bgs]) indicating that these samples targeted locations with high dioxins concentrations. Waste characterization results are included in Table 2-5. Analytical laboratory reports and data validation reports are included as part of Appendix A. Conclusions of the waste characterization testing are further discussed in Section 3.3.

2.3.7.3 SDI Geotechnical and Hydrogeological Sampling

Additional geotechnical sampling was conducted during the SDI, including Shelby tube and SPT testing at SJMW-016 and SJMW-017. PMT was also completed at these locations. Results were within expected ranges, with alluvium being underlain by the Beaumont Clay, which was underlain by the deep Beaumont Sand. The CPT soundings indicated that the compressible clay strata consisted predominantly of one layer on the west side of the Northern Impoundment but on the east side, this layer may be interlayered by thin occasional granular lenses. The CPTs also provided a continuous profile of the undrained shear strength of the Beaumont Clay to the termination depth of the tests. The SDI geotechnical results are included in Appendix B. Further analysis and discussion of the geotechnical data as it relates to the RD of the BMP are included in Section 5.3.3.

Single well response aquifer tests (slug tests) were conducted at the newly installed piezometers at SJMW-014, SJMW-015, SJMW-016, and SJMW-017 on August 13, 2021. The test results were evaluated with the aquifer testing software AQTESOLV version 4.50 and can be viewed in Appendix A.

The shallow alluvium piezometer SJMW-014, which was screened through the waste material, yielded a hydraulic conductivity value of 0.000127 centimeters per second (cm/s), which is appropriate for a silty material. The deeper alluvium piezometer SJSMW-015 screened in the more permeable zone directly below the waste material, yielded a hydraulic conductivity value of 0.001175 cm/s, which is within expectations for a fine-grained sand.

The deep Beaumont Sand piezometers SJMW-016 and SJMW-017 were installed and screened in the ten-foot interval below the Beaumont Clay. The confined Beaumont Sand was found to have a relatively gradual hydraulic gradient sloping to the east. The two measurement points obtained from SJMW-016 and SJMW-017 were compared to each other and available historical well measurements to confirm the gradual hydraulic gradient. This low gradient allowed the water levels taken at SJMW-016 and SJMW-017 to be extrapolated to approximate water levels across the entire excavation area. The two deep piezometers yielded hydraulic conductivity values of 0.000170 cm/s and 0.000313 cm/s, which are appropriate for a silty sand.

Hydraulic conductivity data was used to verify and refine assumptions for water storage and treatment during the RA, as further described in Section 5.2.

2.3.7.4 SDI Surficial Sediments Geotechnical Properties Sampling

Surficial sediments/alluvium deposits consisting of clay, silt and sand with organic matter contents ranging from 0.7 percent to 9.7 percent were encountered at the surface at all boreholes and CPT locations. The alluvium deposit is black to grey in color with specific gravity ranging from 2.58 to 2.79 and dry bulk density ranging from 45.3 pounds per cubic foot (PCF) to 95.0 PCF. Further details regarding geotechnical conditions are included in Appendix B.

2.4 PDI and SDI Conclusions and Recommendations

When the ROD was issued, only eight subsurface borings had been installed in the Northern Impoundment. As part of PDI and SDI activities, an additional 71 subsurface borings were installed, providing additional horizontal and vertical (to as deep as -36 feet NAVD88) characterization. Analytical results from these samples indicate that the vertical impact of material with $TEQ_{DF,M}$ exceeding 30 ng/kg extends much deeper than initially determined. As shown in Table 2-6 and on Figure 2-9, data from the PDI and SDI indicate that the excavation elevations during the RA range up to an elevation of -28.36 feet NAVD88 with an average depth of -12.8 feet NAVD88. The average depth of waste referenced in the ROD was -8 feet NAVD88. The corresponding volume of waste material was found to be approximately 50 percent greater than what was known at the time of the ROD. The horizontal and vertical waste extents were used as part of this RD to determine the type of BMP necessary to implement the selected remedy and the appropriate removal methodology. The data from the PDI and SDI was also used to determine the area of the Northern Impoundment that will require remediation and the alignment of the BMP. Data analysis, civil excavation contouring, and BMP design are further discussed in Section 5.

Understanding the geotechnical characteristics of the soils beneath the Northern Impoundment is a critical component of the RD. Given the significantly deep elevations of waste material encountered during the SDI, a detailed evaluation was conducted to examine the potential for hydraulic heave during excavation activities. The evaluation examined the thicknesses of the underlying strata beneath the Northern Impoundment including the alluvium and underlying Beaumont Clay and the interface between the Beaumont Clay and Beaumont Sand. The evaluation also examined the pore pressures of the Beaumont Sand, as measured by the deep piezometers to determine the hydraulic head level. Finally, the evaluation examined the properties of the soils including the unit weight of the clay and overlying alluvium and the presence of sand lenses in some parts of the clay layer. This evaluation was intended to assess whether the pore pressures within the Beaumont Sand and/or sand layers within the clay would be sufficient to overcome the weight of the overburden considering the planned excavation depths.

Based on this evaluation, it was determined that there are several areas across the Northern Impoundment (primarily in and throughout the northwest corner) in which there would be significant risk of hydraulic heave if material is removed to the currently known elevations presented in this document (See Table 5-1). The evaluation indicated a total stress analysis safety factor (SF) below 1.25 for removal of material to the depths of deepest impact in these areas. A total stress analysis SF of 1.25 is considered protective of hydraulic heave and is in accordance with USACE guidance. Based upon the results of this evaluation, it is not safe to excavate the material in the northwest corner to the currently known depths in the manner required by the ROD. The results of this evaluation were detailed in a Hydraulic Heave Analysis Report submitted to the EPA on December 9, 2021, (GHD, 2021i) and in a follow-up letter submitted to the EPA on December 22, 2021 (GHD, 2021j). Based upon this evaluation, excavation of the northwest corner is technically impracticable as prescribed by the ROD (i.e., "in the dry") and that area will have to be addressed using a different remedial approach. Thus, the design for removal of the material in the northwest corner is not included in this 90% RD and will be addressed in a future RD submission.

A detailed analysis of the geotechnical conditions at the Northern Impoundment, as they relate to the RD, are included in Appendix B and are discussed in Section 5. The Hydraulic Heave Analysis Report is also included as an attachment to the Geotechnical Engineering Report included in Appendix B.

3. Treatability Studies

3.1 2019 Treatability Study Overview

As part of the PDI-2 field activities in October 2019, waste material, porewater, and armored cap material samples were collected and contact water was generated from the Northern Impoundment for treatability testing, as specified in the *Treatability Study Work Plan* (TSWP) (GHD, 2019c) submitted to the EPA on May 20, 2019, and approved on August 27, 2019 (EPA, 2019d). Treatability testing was conducted in the GHD Treatability Laboratory in Niagara Falls, New York (GHD Treatability Lab). Analytical testing was completed by Eurofins TestAmerica Laboratories.

Four composite waste material samples were collected from the four quadrants of the Northern Impoundment for additional waste characterization sampling to determine eligibility for Texas Class I and/or Class II non-hazardous industrial waste disposal and evaluation of solidification mix design, as necessary. Three composite samples of armored cap material were collected for characterization and evaluation for reuse.

As described in the TSWP, two water management approaches were evaluated, as part of the Treatability Study: traditional treatment through clarification and filtration, and thermal evaporation.

To assess the traditional treatment approach, contact water was generated in an excavation on the southwest quadrant of the Northern Impoundment and a field pilot test which involved on-site clarification and filtration was performed. Effluent from the on-site treatment was also utilized in bench-scale treatability testing at the GHD Treatability Lab, to evaluate particle size and the effectiveness of filtration to remove Constituents of Potential Concern (COPCs) for water discharge criteria.

Concurrently, a pilot study was conducted to evaluate the proposed thermal evaporation treatment approach using the clarified contact water. The fate of dioxins and furans was evaluated at different steps of the evaporation treatment process.

3.2 2019 Treatability Study Objectives

As outlined in the TSWP, the objectives of the Northern Impoundment treatability testing included:

- Evaluation of optimum solidification mix designs to solidify the waste material for transportation and disposal.
- Evaluation of optimum solidification mix designs to meet requirements for Texas Class I and/or Class II non-hazardous industrial waste disposal, in accordance with 30 TAC 335.505-506 and 335.508.
- Evaluation of evaporation technology, including processing capacities, fuel consumption, evaluation of the characteristics of the brine produced by the evaporation process, and air emissions.
- Evaluation of traditional water treatment technology.
- Determination of optimum treatment alternatives for contact water to comply with ARARs.
- Evaluation of the armored cap materials at the Northern Impoundment to determine whether such materials can be reused on-site during or post-remedy implementation.

3.3 2019 Waste Material Treatability Testing

Based on the origin of waste material in the Northern Impoundment, the waste material is not listed as hazardous under 40 CFR Part 261, Subpart D. Further, waste characterization samples collected during the PDI-1 were analyzed for ignitability, corrosivity, reactivity, and toxicity, as defined in Title 40 of CFR Part 261, Subpart C, to determine if the material is characteristically hazardous. The results indicate that the material is not a characteristic hazardous waste under RCRA or EPA or TCEQ regulations. Validated PDI-1 waste characterization data are included in Table 2-2.

Additional testing was conducted during the Treatability Study to further classify the non-hazardous waste under applicable Title 30 of the TAC, (Industrial Solid Waste and Municipal Hazardous Waste) (30 TAC 335). The material was also tested in accordance with EPA Method SW-846 Test Method 9095B (i.e., paint filter test), to determine whether free liquids were present which would prevent the material from being disposed of without solidification. Solidification tests were also performed on the waste material to determine the level of solidification necessary to achieve a target unconfined compressive strength (UCS) that may be required for off-site disposal.

Additional waste characterization testing was also performed on six samples collected during the 2021 SDI to supplement the previous dataset.

3.3.1 Treatability Testing Sample Collection

As part of the Northern Impoundment PDI-2 activities conducted from September to December 2019, four approximately 30-gallon composite samples of waste material were collected from the southwest, northwest, northeast, and southeast quadrants of the Northern Impoundment to utilize for treatability testing, as shown on Figure 3-1. Composite Sample 1 in the southwest quadrant was composited from waste material removed from the excavation to create contact water for water treatability testing. The samples were containerized in 5-gallon buckets, sealed, and transported via freight to the GHD Treatability Lab on September 19, 2019. The remaining three samples were composited from cuttings in the first 20 feet from the geotechnical borings in each quadrant (Composite Sample 2 from the northwest quadrant, Composite Sample 3 from the northeast quadrant, and Composite Sample 4 from the southeast quadrant). The samples were containerized in 5-gallon buckets and transported via freight to the GHD Treatability Lab on December 17, 2019.

3.3.2 Baseline Characterization

An initial baseline characterization was performed to determine if there was significant variation of the chemical and physical properties between the four quadrant waste material samples collected within the Northern Impoundment and to provide data for further waste characterization.

Each waste material sample was analyzed for the following parameters to determine whether it met TCEQ Class I or Class II non-hazardous waste landfill disposal requirements:

- Percent Solids - SM for the Examination of Water and Wastewater 2540G.
- TCLP Dioxins and Furans - EPA 1613B.
- TCLP Volatile Organic Compounds (VOCs) - EPA 8260C.
- TCLP Semi-volatile Organic Compounds (SVOCs) - EPA 8270D.
- TCLP Organochlorine Pesticides - EPA 8081B.
- TCLP Polychlorinated Biphenyls (PCBs) - EPA 8082A.
- TCLP Herbicides - EPA 8151A.
- TCLP Glycols - EPA 8015D Direct Injection.
- TCLP Metals - EPA 6010C.
- TCLP Mercury - EPA 7470A.
- TCLP Methomyl - EPA 8321A.
- Total Cyanide - EPA 9014.
- Sulfide - EPA 9034.
- Ignitability - EPA 1020B.
- pH - EPA 9045D.
- Paint Filter - EPA 9095B.

3.3.3 Waste Material Treatability Results and Conclusions

Consistent with the results obtained during PDI-1 and PDI-2, results from the SDI testing characterization indicated that all waste material samples are expected to meet disposal criteria for a Class II landfill and that the material is a non-hazardous waste under RCRA. The basis for this classification is discussed in the sections below.

The results from the PDI-1 waste characterization testing are shown in Table 2-2, the results of the SDI waste characterization testing are shown in Table 2-5, and the results from the PDI-2 Treatability waste characterization testing are shown in Table 3-1. Analytical laboratory reports for the PDI-1 and SDI testing are included as part of Appendix A and analytical laboratory reports for the PDI-2 Treatability Testing are included as part of Appendix C.

3.3.4 Waste Characterization Conclusions

The EPA's guidance regarding the management of remediation waste states that "contaminated environmental media, of itself, is not hazardous waste and, generally, is not subject to regulation under RCRA." (*Management of Remediation Waste under RCRA*, EPA, 1998). The material to be excavated during the Northern Impoundment RA for disposal off-site is the environmental media to be evaluated, and it is subject to regulation under RCRA as hazardous waste only if one of the following two conditions exists:

1. The media is impacted with a listed hazardous waste at concentrations that are above the health-based risk levels.

2. Any constituent in the media exhibits one of the characteristics of hazardous waste.

GHD submitted a waste characterization evaluation for the Northern Impoundment to the EPA on October 20, 2020 (Waste Characterization Letter; GHD, 2020g). The purpose of the evaluation was to describe how pulp and paper mill waste, proposed to be excavated as part of the Northern Impoundment RA, has been characterized and classified in accordance with the RCRA regulations as non-hazardous waste. EPA subsequently concurred with the conclusions contained in the Waste Characterization Letter in a letter to GHD dated November 19, 2020 (EPA, 2020h).

As part of this evaluation, the following sections of Title 40 of the CFR Part 261 - *Identification and Listing of Hazardous Waste*, were evaluated:

– Subpart A - Definition of Solid Waste, Hazardous Waste & Exclusions (261.1-.9).
– Subpart B - Criteria for Identifying the Characteristics and Listing of Hazardous Wastes (261.10-.11).
– Subpart C - Characteristics of Hazardous Waste (261.20-.24).
– Subpart D - Lists of Hazardous Wastes (261.30-.33).

3.3.4.1 Listed Waste Evaluation

The listed waste evaluation involved determining whether the material contains a “listed” hazardous waste at concentrations above regulatory thresholds. The categories of listed hazardous wastes, using the codes assigned to each category, are:

– “F” codes = Non-Specific Sources.
– “K” codes = Specific Sources.
– “P” codes = Commercial Chemical Products (acutely hazardous).
– “U” codes = Commercial Chemical Products (non-acutely hazardous).

According to EPA guidance, information about the source of the waste is to be used in making the determination. Information about the waste material was summarized in the Waste Characterization Letter. The evaluation concluded that the material did not meet any of the listed descriptions.

3.3.4.2 Characteristic Waste Evaluation

Under RCRA, a solid waste is a hazardous waste if it exhibits any of the following characteristics:

– Ignitability (D001).
– Corrosivity (D002).
– Reactivity (D003).
– Toxicity (D004 - D043).

The evaluation involved a review of available waste characterization data from PDI-1 and PDI-2 and information from the RI about the material deposited in the Northern Impoundment. It concluded that the excavated material at the point of generation (when it is excavated) would not exhibit the characteristics of a RCRA hazardous waste (i.e., ignitability, corrosivity, reactivity, or toxicity).

In its letter to GHD dated November 19, 2020, the EPA stated that “based upon information provided in the October 20, 2020 evaluation, EPA agrees with GHD’s determination that the initially generated waste would not be a listed hazardous waste meeting the current definitions of an F, K, P or U waste. From review of the analytical testing results, the samples are all non-hazardous” (EPA, 2020h). Additional waste characterization sampling was conducted during the 2021 SDI, the results of which further support the conclusions summarized in GHD’s October 2020 letter. Additional sampling may be required to further characterize excavated material to determine whether it meets the definition of Class 1 or Class 2 non-hazardous waste under the regulations governing classification of non-hazardous industrial solid waste in Texas. If additional characterization is conducted it will be done so in accordance with the guidance provided in Chapter Nine “Sampling Plan” of the *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods* (EPA, 1986) and in *RCRA Waste Sampling Draft Technical Guidance* (EPA, 2002). If at any time a hazardous waste, as defined in 40 CFR Part 261, is identified, it will be managed and disposed of in accordance with RCRA regulations.

3.3.5 Solidification Testing

Solidification testing was conducted to determine the appropriate reagent dosages to solidify the waste material for transportation to an off-site disposal facility. Off-site disposal facilities typically require incoming waste to pass paint filter testing (an indicator of moisture content) and meet a minimum UCS criteria. A series of tests were performed on material with various levels of the following parameters:

1. Moisture content - to simulate a wide range of site conditions.
2. Reagent concentration - to develop optimal dosage percentage to address paint filter and UCS disposal requirements.
3. Reagent mix - to develop optimal reagent blend for cost analysis.

The solidification testing methodology and results are summarized in the sections to follow.

3.3.5.1 Solidification Testing Methodology

Waste material composite Sample 3 and composite Sample 4 from the Northern Impoundment were utilized for solidification testing. The testing mixtures were prepared by placing 400 grams (g) of waste material with the predetermined amount of reagent in a mechanical mixer. Waste material and reagent were mechanically mixed for five minutes and then placed into a mold for curing. Reagent doses and blends tested are summarized in Table 3-A, as follows:

Table 3-A Solidification Testing Parameter Matrix

Percent Solids Tested (%)	Reagent Type Tested	Reagent Dosage(s) Tested (%)
35 ,45, 55, 70	Portland Cement	2, 5, 10, 20
	Lime	5, 10, 20
	Portland / Lime	5/5, 10/10, 10/20, 15/20

Notes:
(1) Portland/Lime reagent blends were utilized to evaluate cost effective substitutes.
(2) "5/5" indicates percentage of Portland cement and lime used (i.e., 5% Portland + 5% lime).

Curing was monitored using a pocket penetrometer and samples were monitored for the presence of free water which would be a leading indicator of not passing a Paint Filter Test. Pocket penetrometer testing was conducted on molds starting from two days after mixing up to 14 days. Results of solidification testing is summarized in Section 3.3.5.2.

3.3.5.2 Solidification Results and Conclusions

The results of the solidification testing indicated that free water (Paint Filter testing) and UCS requirements of an off-site disposal facility can be met across a range of waste material percent solid scenarios (35 to 70 percent) utilizing Portland cement and/or lime. In general, Portland cement was more effective at achieving both disposal requirements. Lime dosages did not result in significant strength (UCS) or free water reduction. In addition, combining lime with Portland cement did not result in the ability to lower the percentage of Portland cement utilized.

Based on these solidification tests, the required dose of Portland cement increases with decreasing percent solids and ranges from a dose of two percent for waste material with 70 percent solids to 10 to 20 percent (depending on potential landfill strength requirements) for material with 35 percent solids. Material with 45 percent solids or less has the potential to fail the Paint Filter test without adequate treatment. The selected Remedial Contractor (RC) may perform their own testing at the time of the RA. The specifics of the off-site disposal facility requirements will be worked out between the RC and the selected off-site disposal facility at the time of the RA. More detailed data for these solidification treatability tests can be made available upon request.

3.4 2019 Water Treatability Testing

During the RA, as specified in the ROD, as sections of the armored cap are removed, water will come into contact with the waste material through seepage or stormwater and will require management. Additionally, water generated from equipment decontamination and the water treatment system (WTS) containment area will need to be managed. Water treatability testing was performed to evaluate two water management options: (1) traditional treatment and (2) discharge using clarification and filtration and thermal evaporation.

To generate a sufficient quantity of representative contact water for all necessary testing, an open excavation area was constructed in the waste material in the southwestern quadrant, as shown on Figure 3-1, and filled with potable water to simulate potential stormwater or seepage that may come into contact with the impacted waste material. A sample of the raw contact water was collected and sent to the GHD Treatability Lab for baseline characterization and filtration testing.

The remaining generated contact water was processed on-site through a modular filtration treatment system, including polymer addition with inline mixing followed by clarification, sand filtration, and bag filtration. Samples were collected at each step of the treatment process to evaluate the concentration of dioxins and furans. Additional focused filtration testing was performed on a sample of the final clarified and filtered effluent to further evaluate dioxin and furan concentrations using different filter sizes. Treatability testing was also conducted on the clarifier underflow (solids that settle out during the clarification process) to evaluate the level of settling and solidification necessary to prepare the waste stream for off-site disposal.

A batch of clarified water, prior to filtration, was sent to the Purestream pilot test facility in Logan, Utah for a thermal evaporation pilot test to evaluate air emissions.

All water testing results were evaluated against calculated water discharge criteria, as discussed below.

3.4.1 Water Discharge Criteria

So that discharge of treated water during the RA meets water quality standards, COPC discharge criteria were developed by conducting a water quality-based effluent limitation (WQBEL) assessment. The Texas Surface Water Quality Standards (TSWQS) are specific to water bodies, not to discharges, so WQBELs take into account the load that the site-specific discharge would add to the water body as a whole to determine the necessary limits to maintain protection of human health and aquatic life.

The TCEQ utilizes the Texas Toxicity Screening (TexTox) Menus to determine WQBELs. TexTox Menus include all relevant formulas and inputs found in the *Procedures to Implement the Texas Surface Water Quality Standards* (Implementation Procedures), June 2010 (TCEQ, 2010). Depending on the type of receiving water body, different TexTox Menus would be assigned. During the RA, treated water from the Northern Impoundment will likely discharge to either Segment 1005 (Houston Ship Channel/San Jacinto River Tidal, south of I-10) or Segment 1001 (San Jacinto River Tidal, north of I-10) of the San Jacinto River, which is classified as a bay/wide tidal river.

For discharges into Segments 1005 or 1001, TCEQ would assign the TexTox Menu #5 to calculate WQBELs. This TexTox Menu requires inputs for Total Suspended Solids (TSS), effluent flow, and effluent fractions for chronic and acute aquatic life and human health. Based on the estimated location of the outfall and the type of water body, the following default dilution fractions were used, per TCEQ guidance: 30 percent for Zone of Initial Dilution (Acute), eight percent for Aquatic Life Mixing Zone (Chronic), and four percent for Human Health Mixing Zone. Since Segments 1005 and 1001 are tidal water bodies, they are dominated by the ebb and flow of tides rather than from upstream flow. These effluent fractions, along with an estimated effluent flow, serve as main inputs for the discharge information required by the TexTox Menu to calculate WQBELs. The estimated discharge flow rate for the RA ranges from 300 to 1,000 gpm (0.432 to 1.44 million gallons per day [gpd]). The default dilution factors are recommended for any discharge into a bay/tidal river greater than 400 ft wide with a flow rate less than 10 million gpd.

Using default dilution factors, river segment specific inputs, and expected TSS and discharge flow rates from the anticipated Northern Impoundment WTS discharge, preliminary discharge concentrations were determined. These preliminary calculated discharge criteria were used to evaluate water treatability testing results and can be found in Table 3-2.

3.4.1.1 Compliance with the Texas Surface Water Quality Standard - Dioxins and Furans

The EPA has made a determination regarding compliance with the TSWQS for dioxins and furans as an ARAR, based on the substantive requirements of the TCEQ's regulation for surface water discharge, as detailed in e-mail correspondence dated February 18, 2020 (EPA, 2020b; included in Appendix D).

EPA has determined that compliance with the TSWQS ARAR will be attained as follows:

1. *The state surface water quality standard for Dioxins/Furans is 7.97 x 10^{-8} micrograms per liter (μg/L)[1] [0.0797 picograms per liter (pg/L)[2]] (as TCDD equivalents).*
2. *Compliance with the TSWQS will be determined using the minimum level of the EPA approved method (1613B), cited in 40 CFR Part 136 (Guidelines Establishing Test Procedures for the Analysis of Pollutants), in sampling of surface water discharges during the Site remedial action.*
3. *If an effluent sample analyzed for dioxin is below the minimum level using the EPA approved method, the sample result would be identified as non-detect and the discharge would be determined to be in compliance with the ARAR.*
4. *The Minimum Level (ML) for each analyte is defined as the level at which the entire analytical system must give a recognizable signal and acceptable calibration point. It is equivalent to the concentration of the lowest calibration standard, assuming that all method-specified sample weights, volumes, and clean-up procedures have been employed.*
5. *This approach is consistent with the state's guidance and other permits issued by the TCEQ. EPA's determination is contingent on the water treatment facility using a 1 micron final filtration step in the water treatment process.*

3.4.2 Contact Water Pilot Testing

3.4.2.1 Contact Water Creation

Contact water for pilot testing was generated from the Northern Impoundment by creating an open excavation in the southwestern portion of the Northern Impoundment, with approximate dimensions of 20 ft by 20 ft and a depth of 10 ft. The excavated material was temporarily stored in roll-off containers. The excavation remained open overnight, and water that seeped into the excavation was collected and submitted for analysis. Approximately 20,000 gallons of potable water was then transferred into the excavation and mixed using an excavator bucket to generate a worst-case sediment and water mixture that may be encountered during the RA. This simulated contact water was then pumped into two storage tanks and the contents of the two tanks were homogenized prior to treatment.

3.4.2.2 Pilot Test Overview

Once the contact water was created and removed for treatment testing, as described above, the excavation was backfilled with the stockpiled waste material, the geomembrane cover was replaced and sealed, and the armored cap material was replaced. A sample of contact water created from the on-site excavation was shipped to Evoqua Water Technologies LLC (Evoqua), to determine the optimum polymers for addition during the on-site field filtration pilot testing. The modular filtration treatment system included polymer addition with inline mixing followed by clarification, sand filtration, and bag filtration, as depicted on Process Flow Diagram (PFD) shown on Figure 3-2. During the treatment system operations, the storage tanks were continuously mixed, while the water was recirculated between the two tanks to homogenize the feed to the treatment system.

One batch of contact water was treated through clarification only, and one batch was treated through both clarification and sand filtration. The batch of clarification-only water was sent to the Purestream pilot test facility in Logan, Utah, and used to evaluate thermal evaporation technology for water management. The batch of clarified and filtered water was sampled and used to evaluate traditional pump-and-treat technology through on-site field and bench-scale testing, as described in the subsequent sections.

The pilot test treatment system was operated at a flow rate of approximately 30 gpm. The system was initially flooded with contact water, which was directed to an off-specification wastewater storage tank. Clarifier effluent turbidity was monitored as the polymer dosage rates were adjusted. Once the clarifier effluent turbidity dropped below 10 Nephelometric Turbidity Units (NTUs), the clarified water was directed to a separate holding tank. After 7,500 gallons were collected, the clarified effluent was directed to the sand and bag filters, and the effluent to the off-specification tank. Once turbidity levels remained at a consistent value of 10 NTUs in the effluent out of the clarifier, and at approximately one NTU in the filtrate from the filters, the filtered effluent water was discharged to a separate holding tank. Clarifier underflow solids were discharged to a holding tank and allowed to further settle. Photographs from the water treatment pilot test activities are included in the photographic log included in Appendix C.

3.4.2.3 Filtration Pilot Test Water Samples

As discussed previously, contact water was generated in the southwestern part of the Northern Impoundment by placing potable water in an open excavation. This simulated contact water was then processed through an on-site pilot treatment system which included polymer addition with inline mixing followed by clarification, sand filtration, and bag filtration. Water samples were collected and analyzed at different steps in the process, as depicted in the PFD included as Figure 3-2.

A contact water sample taken from the storage tank prior to homogenization was sent to the GHD Treatability Lab for bench-scale testing. This sample and the excavation seepage water were analyzed for the following parameters:

- Total and Dissolved Dioxins and Furans - EPA Method 1613B.
- VOCs - EPA Method 8260C.
- SVOCs - EPA Method 8270D.
- Organochlorine Pesticides - EPA Method 8081B.
- Herbicides - EPA Method 8151A.
- PCBs - EPA Method 8082A.
- Anions - EPA Method 300.0R2.1.
- Total and Dissolved Metals - EPA Method 6010C.
- Total and Dissolved Mercury - EPA Method 7470A.
- Alkalinity - SM 2320B.
- Ammonia Nitrogen - EPA Method 350.1.
- Biochemical Oxygen Demand - SM 5210B.
- Chemical Oxygen Demand (COD) - EPA Method 410.4.
- Cyanide - EPA Method 9012B.
- Ferrous iron - SM 3500.
- Hydrogen sulfide - EPA Method 15.
- pH - EPA Method 9040C.
- Phosphorus - EPA Method 6010C.
- Sulfide - EPA Method 9034.
- Total Dissolved Solids (TDS) - SM 2540C.
- Total Organic Carbon (TOC) - SM 5310C.
- TSS - SM 2540D.

The two homogenized contact water samples, the clarified effluent sample, and the filtered effluent sample were analyzed for any COPC that had a detection in the results of the previous non-homogenized contact water sample.

Based on those results, these samples were analyzed for all of the same constituents listed above, except the following which were found to be non-detect: VOCs, SVOCs, Organochlorine Pesticides, Herbicides, and PCBs.

In addition, samples were collected from the clarifier underflow and settling tank for treatability testing and TSS analysis.

3.4.2.3.1 Filtration Pilot Test Results

Results of the water samples from each step of the on-site pilot testing are summarized in Table 3-2 and were compared to the estimated discharge criteria established by the EPA (ML), as described in Section 3.4.1. Analytical laboratory reports are included as part of Appendix C.

The homogenized contact water initially exhibited levels of dioxins and furans, TSS, and some metals (including copper, lead, and zinc) above the estimated discharge criteria. Following clarification, the metal concentrations in the clarified effluent sample were below the estimated discharge criteria. Following filtration, dioxins and furans concentrations were also below the ML. The table on Figure 3-2 shows the stepwise decrease in dioxins, metals, and TSS levels at each step in the treatment process. This treatment process is being used as the basis for the RD with additional proposed unit processes, as discussed in Section 5.7.

Turbidity was monitored online at both the clarifier effluent and the filtered effluent. Turbidity results are presented on Figure 3-3. Clarifier turbidity was typically at 10 NTUs or less, while filtered effluent turbidity was typically at one NTU or below. The clarifier effluent TSS concentration was 10 milligrams per liter (mg/L), while the filtered/clarified effluent TSS was 2 mg/L. Based on the observed relationship between turbidity and TSS, turbidity levels can be used as an indication of the TSS concentration. One dioxin congener was above the ML in the clarified effluent, but below the ML in the filtered effluent. For the RA, TSS and turbidity levels can be used to indicate if the dioxin and furan level is below the ML based on these pilot testing results, as well as the bench-scale filtration results.

A turbidity spike occurred at the 19:30 hour mark during the filtration pilot test as a result of the loss of polymer feed. Once this issue was observed, the polymer feed was changed from automatic to manual then restarted, and turbidity dropped to the pre-spike levels. This result supports the benefit of polymer, as well as the ability to monitor performance using turbidity as an indicator.

3.4.2.4 Thermal Evaporation Pilot Test

For the thermal evaporation evaluation, approximately 5,000 gallons of clarified contact water were transported to the Purestream pilot test facility in Logan, Utah, for a three-day pilot test. The pilot test facility utilized a 1/10 scale replica pilot test model of a Flash thermal evaporation unit, which utilizes a direct flame to evaporate influent water to the atmosphere, creating a brine byproduct only (that would need to be disposed) with no effluent water stream for river discharge. The pilot test included three days of stack testing to evaluate emissions of COPCs. Results of the stack testing indicated that none of the COPC emissions were above the levels of the applicable air emissions ARAR (the Permit by Rule [PBR] 30 TAC §106.261(a)(3)). This indicates that most of the COPCs remain in the brine byproduct generated by thermal evaporation.

As part of the RD evaluation, water treatment rates and storage requirements were evaluated for both water management alternatives. The treatment flowrate for the traditional pump-and-treat option is proposed to be 300 gpm. In order to achieve a 300-gpm flowrate using the thermal evaporation option, 25 thermal evaporation units would be needed. It was determined that it would not be feasible to stage and operate this large a number of units at the Northern Impoundment during the RA. As a result, contact water would need to be stored and evaporated at a lower flow rate, resulting in storage of larger volumes of water over a longer duration as compared to the treat-and-discharge option. As a result, traditional treatment through clarification and filtration was selected for use in the 90% RD and thermal evaporation was not further evaluated. Thus, results of the thermal evaporation evaluation are not included in this 90% RD.

3.4.3 GHD Treatability Bench-Scale Testing

The bench-scale testing of the non-homogenized contact water is described in Section 3.4.2.3. In addition to the initial analysis and characterization of the contact water, bench-scale filtration tests were performed on the generated contact water (Section 3.4.3.1, below). Bench-scale testing was also performed on the clarified and filtered effluent from the pilot test (Section 3.4.3.2, below) to evaluate additional filtration steps.

As part of the clarification process, solids settle out of the water into a sludge. This clarifier underflow sludge will likely be disposed off-site as a separate waste stream. Because the sludge will have a very high moisture content, it will need to be solidified prior to off-site transport. Treatability testing was performed to evaluate options for solidification of the sludge. To optimize the amount of reagent necessary for solidification, additional settling treatability testing was performed to evaluate the effectiveness prior to solidification (Section 3.4.3.3, below).

3.4.3.1 Contact Water Filtration Testing

A serial filtration test was performed on the non-homogenized contact water during the bench-scale testing in order to determine the size distribution of the particles present in the contact water and any relationship between particle size and the concentration of dioxins and furans in the sample.

The test was performed on a 7-liter sample of non-homogenized contact water. The entire sample was filtered through a pre-weighed 100-micron (µm) filter paper. A one-liter sample of the filtrate was then collected for analysis of dioxins and furans. This process was repeated using the remaining filtrate water and pre-weighed 10, 1, 0.45 and 0.1 µm filter papers, with collection of a filtrate sample after each filtration. After the filtration test was complete, each filter paper was dried and then weighed to determine the amount of particulate captured on the filter, and the filtrate samples were analyzed for dioxins and furans.

Testing of other water treatment technologies identified in the TSWP, such as those for metals and ammonia removal, were not required as these compounds did not exceed discharge criteria in the baseline characterization.

Contact Water Filtration Test Results

The results of the filtration test showed more than 90 percent of the particulates were larger than 10 µm in size. Concentrations of dioxins and furans that exceeded the MLs were observed in the filtrate that had passed through the 100 µm and 10 µm filters; however, after filtration with a 1 µm filter, concentrations of all dioxins and furans were below their MLs. These results are summarized in Table 3-3 and shown graphically on Figure 3-4. Analytical laboratory reports are included as part of Appendix C.

3.4.3.2 Focused Filtration Testing

The on-site filtration pilot test water treatment included clarification, followed by sand filtration and nominal bag filtration. In order to determine the effect of additional filtration on the already filtered effluent from the pilot study, the pilot study filtrate water was filtered through 1 µm, 0.45 µm, 0.1 µm, 0.05 µm and 0.025 µm filters. The filtrate from each filter was collected and analyzed for dioxins and furans.

Further testing on the effluent included coagulation/flocculation testing and testing of granular activated carbon (GAC) for polishing.

Focused Filtration Testing Results

The filtrate from the 1 µm, 0.45 µm, 0.1 µm, 0.05 µm and 0.025 µm filters was analyzed for dioxins and furans. These results are summarized in Table 3-4 and shown graphically on Figure 3-4. Analytical laboratory reports are included as part of Appendix C. Consistent with the results obtained from the initial effluent bench-scale filtration testing, none of the filtrate samples contained dioxins and furans above the MLs. This confirms that a 1 µm filter is sufficient for removal of the dioxins and furans from the water. This and the contact water filtration testing data (Section 3.4.3.1) were presented and discussed with members of the TWG on January 27, 2020. Based upon the results and the TWG discussion, the EPA sent correspondence to the Respondents on February 18, 2020 (EPA, 2020b), stating that “compliance with the TSWQS will be determined using the minimum level of the EPA approved method (1613B).” The correspondence further specified that this determination would be “contingent on the water treatment facility using a 1 μm final filtration step in the water treatment process.”

Coagulation/flocculation jar testing was performed on the non-homogenized contact water by Evoqua, and the results were used to inform the polymer dose utilized during the pilot test discussed in Section 3.4.2.

Further testing of the effluent included polishing with GAC. As dioxins and furans were not present above their MLs prior to GAC treatment, removal of dioxins and furans by GAC could not be quantified. However, GAC treatment will be included in the RD to provide a final polishing step to the effluent discharge.

3.4.3.3 Clarifier Underflow Solids Testing

As previously discussed, bench-scale treatability testing was performed to evaluate the effectiveness of additional settling of the clarifier underflow prior to solidification for off-site disposal. As part of the settling test, a sample of the clarifier underflow was agitated to resuspend solids and an initial sample was analyzed for TSS. A subsample of the material was poured into a 500 mL graduated cylinder and allowed to settle. The height of the sediment/water interface was recorded every five minutes and a sample of the supernatant was analyzed for turbidity every ten minutes. After settling was complete (i.e., no change in the sediment/water interface was observed), a sample of the supernatant was analyzed for TSS.

Solidification tests were also performed on both the raw clarifier underflow and the clarifier settled solid samples that were generated, as described above. The solidification tests were conducted by placing 400 grams of waste material with the amounts of solidification agent, stated below, and water in a mechanical mixer. The waste, water, and solidification agent were mixed for five minutes and then placed in a plastic mold. The samples were allowed to cure for two weeks. During curing, the hardness of the sample was evaluated using a pocket penetrometer three times per week. After curing, the samples were analyzed for UCS.

For the raw clarifier underflow sample, solidification was tested using the sample alone and the sample mixed in a 1:1 ratio with a sample of waste material composite. Cement doses between 15 percent and 85 percent were tested with and without the addition of lime at doses between 20 percent and 70 percent.

For the settled solids sample, solidification was tested using the sample alone and the sample mixed in a 1:1 ratio with a sample of waste material composite. Cement doses between 10 percent and 30 percent were tested with and without the addition of lime at doses between 20 percent and 30 percent.

Similar solidification testing was performed with the brine from the evaporation pilot test. Since evaporation is no longer being considered as an option for water treatment, these results will not be discussed in this 90% RD.

Clarifier Underflow Solids Test Results

Settling of the clarifier underflow solids occurred quickly; the bulk of the solids settled within four minutes and the supernatant gradually cleared to produce a low turbidity, low TSS liquid within two hours. These results indicate that settling is useful in removing suspended solids. Photographs of the settling tests are shown in the photographic log included in Appendix C.

For the raw clarifier underflow solidification tests in which lower Portland cement and lime doses were used, even though good solidification of the solids was achieved, standing water remained on top of the solidified mass. This showed that the water had not been incorporated into the solidified material.

To eliminate standing water in the samples, a dose of 35 percent Portland cement and 60 percent lime was required for the raw clarifier underflow sample and a dose of 70 percent Portland cement was required for the clarifier underflow sample mixed at a 1:1 ratio. A pocket penetrometer hardness of >64 pounds per square inch (psi) was achieved for these samples.

These data show that a large dose of Portland cement and lime would be required to solidify the clarifier underflow on its own and that mixing with the waste material at a ratio of less than one part underflow per part of waste material would be recommended in order to minimize the reagent dose for solidification.

For the solidification test using the settled solids, standing water was observed initially in some tests with lower doses of cement and lime. However, after two days, the standing water had been absorbed by the solidified solids. The minimum reagent doses to achieve a pocket penetrometer hardness of >64 psi and a UCS of >50 psi were 25 percent Portland cement with 30 percent lime or 20 percent Portland cement with a 1:1 mixture of waste material and settled solids.

These data show that the settled solids can be solidified on their own but that mixing with waste material at a 1:1 ratio can reduce the required reagent dose. The selected RC may perform its own testing at the time of the RA. The specifics of the off-site disposal facility requirements will be worked out between the RC and the selected off-site disposal facility at the time of the RA. More detailed data for these solidification treatability tests can be made available upon request.

3.5 2019 Armored Cap Material Treatability Testing

The TSWP scope of work included generation and testing of an elutriate to characterize the armored cap material and evaluate the potential for reuse as part of the RA. During the December 17, 2019 TWG Meeting, the EPA requested that the scope be revised to include additional analyses of the sediment that is generated from the rinsing of the armored cap material, as well as analysis of the crushed rock itself. The revised scope was documented in a *Treatability Study Work Plan Refinement Notice*, submitted January 10, 2020, (GHD, 2020a) and approved by the EPA on January 17, 2020 (EPA, 2020a).

Composite samples of the armored cap material were collected from three different locations in the Northern Impoundment (the west side of the impoundment, the east side of the impoundment and the bermed areas). The sample locations included submerged and non-submerged areas, and the samples were collected only from areas in which a geotextile and/or geosynthetic liner separates the rock from the waste material. Two five-gallon buckets of armored cap material were collected per composite sample area. All treatability activities were performed at the GHD Treatability Lab. Approximate locations of the armored cap material samples are shown on Figure 3-5.

The elutriate was generated by mixing the armor rock with deionized (DI) water at a ratio of 1:5, agitating the mix for 30 minutes before removal of rock, settling the solids in the supernatant water for one hour, and finally, centrifugation of the supernatant water. The resulting elutriate water was then analyzed for dioxins and furans using EPA Method 1613B.

The settled solids from the containers comprising the same armored cap material sample, as well as any solids that resulted from centrifugation of the respective rock water, were combined and sent to the laboratory for analysis of dioxins and furans.

The armored cap material that was washed during the elutriate testing was crushed using a rock crusher and the crushed material from the three separate armored cap locations was analyzed for dioxins and furans.

Armored Cap Treatability Testing Results

No dioxins or furans were detected in any of the elutriate samples above their MLs. Similarly, all $TEQ_{DF, M}$ results from the solids that were washed from the rocks and of the crushed rocks, themselves were below the 30 ng/kg clean-up level. These data are shown in Table 3-5. Analytical laboratory reports are included as part of Appendix C.

3.6 Additional Treatability Testing

Treatability activities performed prior to the submittal of the 30% RD and summarized in the previous sections of this 90% RD, were designed to evaluate the water treatment process for the pump-and-treat approach where water generated from the RA would be stored in aboveground tank(s) and then treated. The 30% RD described an alternate remediation approach (Approach B) that was being considered for the Northern Impoundment. Water treatment under this approach would have included water treatment technology similar to that of the pump-and-treat approach except that water would be treated in-situ in a flooded excavation cell via a recirculation and filtration process. The feasibility of the Approach B excavation methodology hinged on the success of the Approach B water treatment methodology.

As described in the 30% RD, additional treatability testing was proposed to evaluate the effectiveness of the Approach B water treatment methodology. In addition, a field filtration test was proposed to evaluate operation of an absolute filter for the reduction of dioxin and furan concentrations in the clarified and sand-filtered contact water that remained on-site following the 2019 field pilot testing.

The planned treatability testing was summarized in an *Additional Treatability Testing Notice* submitted to the EPA on April 16, 2020 (GHD, 2020b). Comments were received from the EPA on May 5, 2020 (EPA, 2020c). The EPA's comments were addressed in the *Revised Additional Treatability Testing Notice* (Revised Notice; GHD, 2020c), submitted to the EPA on June 4, 2020. The Revised Notice was approved by the EPA on June 11, 2020 (EPA, 2020d). In response to revisions that were requested by the EPA during a call on October 9, 2020, a *Refinement Notice - Revised Additional Treatability Testing Notice* was submitted to the EPA on October 15, 2020 (GHD, 2020f)

The two treatability testing scopes included in the Revised Notice were conducted in 2020. In addition, some supplemental filtration confirmation testing was performed in October 2021. The results of these three treatability scopes are presented in the following sections.

3.6.1 Field Filtration Testing

As described in the Revised Notice, a field filtration testing was conducted on May 28, 2020, at the Northern Impoundment to further refine the filtration design requirements (specifically the use of nominal versus absolute filters) evaluated in the initial October 2019 field pilot testing. Absolute filters provide a higher removal efficiency than nominal filters at the same pore size. Therefore, the use of absolute filters was expected to provide more efficient removal of dioxins and furans than the nominal filters.

The May 2020 field filtration testing consisted of filtration of contact water that had previously been clarified and sand filtered during the October 2019 field pilot testing through absolute filters.

The primary objectives of the field filtration testing were to:

– Evaluate water quality using 1 µm and 0.5 µm absolute filters.
– Evaluate the operating costs of 1 µm and 0.5 µm absolute filters.
– Evaluate which pore size filter is more appropriate for the application, based on operational efficiency.

3.6.1.1 Field Filtration Testing Process

The field filtration tests were conducted in May 2020.

ProAct, a subsidiary to Evoqua, provided a modular filtration system containing both 1 µm and 0.5 µm absolute filters with a design flow of 80 to 100 gpm. Filtration tests were conducted in one day over the course of ten hours. Prior to filtration, turbidity was measured in the filter feed tank while mixing until readings stabilized, indicating that tank contents were sufficiently mixed and solids were adequately suspended. Flow was then passed through the filter housing with no bag filters so that influent samples could be collected.

The 0.5 µm absolute bag filter was placed inside the housing and then flow was passed through the filter, during which time flow and differential pressure across the filter were continuously monitored. After approximately 35 minutes, flow through the 0.5 µm filter was stopped, and the test was repeated with the 1 µm absolute filter. Again flow and differential pressure were continuously monitoring across the filter. The 1 µm filter test ran for approximately 25 minutes before the volume of water available was expended.

Samples of influent (i.e., the previously sand filtered and clarified contact water), filtrate through 0.5 µm filter, and filtrate through 1.0 µm filter were analyzed for water quality parameters. Parameters of interest were total dioxins and furans, TSS, total metals, and dissolved metals (field filtered).

3.6.1.2 Field Filtration Test Results

Flow and differential pressure measurements for the 0.5 µm and 1 µm absolute filters were plotted versus time and then extrapolated over a longer duration as shown on Figure 3-6.

Figure 3-6 shows that flow decreased rapidly, especially through the 0.5 µm filter, which dropped to nearly 0 gpm after 40 minutes of operation. Flow through the 1 µm filter was projected to drop by almost 20 percent after operating for 50 minutes, although this is based on limited data (due to only a limited volume of water being available to use in the testing). Differential pressure variations appear to correlate with flow variations, increasing significantly even after short operational durations. Differential pressures through the 0.5 µm filter were projected to increase to almost 30 psi after only 40 minutes of operation. Differential pressures through the 1 µm filter show a more gradual increase, but projections are based on fewer data points.

Analytical results from the influent, 1 µm filtrate, and 0.5 µm filtrate samples for parameters of interest are presented in Table 3-6.

Results show that concentrations of TSS and dioxins and furans were low in the influent water, with TCDD levels already below the MLs. As expected, filtration further reduced TSS and dioxins and furans to levels below the MLs after the 1 µm filter, with additional reduction after the 0.5 µm filter. Both filters achieved dioxins and furans concentrations below MLs. Finally, results for both total and dissolved metals showed no concentrations above the discharge criteria.

3.6.1.3 Field Filtration Testing Conclusions

Analytical results indicate that the 0.5 µm and 1 µm absolute filters achieve very low concentrations of dioxins and furans below the MLs however, the data shown on Figure 3.6 indicate that operations using absolute filters at the small pore sizes evaluated (0.5 µm and 1 µm) may cause operational difficulties, such as rapid increase in differential pressures due to filter fouling, that would require frequent filter changeout. These difficulties are addressed in the WTS design by providing a two-step filtration process after the media filters using a 10-µm filter system before the 1 µm filter system. In addition, the WTS design includes redundant 10 µm and 1 µm filtration systems in parallel, which will allow rapid change over from the duty to the standby system to reduce downtime. Subsequent filtration tests (summarized in Section 3.6.3) indicate that filters provide effective removal of dioxins and furans to below the MLs; therefore, the WTS described in this 90% RD prescribes the use of 95% efficient 10 µm and 1 µm filter cartridges or bags. Actual filtration during treatment may improve based on refining chemical addition and filter feed rates during operation.

3.6.2 Approach B Water Filtration Testing

Approach B excavation methodology considered in the 30% RD included removal of soils through a water column. Approach B in-situ water treatment would have involved adding chemicals to the water column within the barrier wall and then sending the water through a recirculating filtration system (with filter pore sizes down to 1 µm) to reduce TSS concentrations below the target level which is also expected to remove dioxins and furans.

The primary objectives of the Approach B water filtration testing were to:

- Quantify volume of soil particles that become suspended in the water after excavation.
- Determine particle size distribution and dioxin load of the suspended soil particles.
- Determine settling properties of the suspended soil particles.
- Determine time needed for the filtration system to reduce TSS of the water column to acceptable levels.
- Evaluate effects of adding polymer to the water column containing suspended soil particles.
- Evaluate polymer/coagulant mix required to condition soil for filtration and the design parameters for this filtration.

3.6.2.1 Approach B Water Filtration Testing Process

The Approach B water filtration tests were conducted in the GHD Treatability Lab in Niagara Falls, New York from October 2020 through January 2021. Test activities included the following steps:

- Two (2) tanks with sampling ports were constructed to simulate the water column in the excavation cell. The two tanks were used to run parallel tests as follows:
  - Tank #1 tests evaluated treatment effectiveness with the addition of coagulant and polymer.
  - Tank #2 tests evaluated treatment effectiveness without any chemical addition.
- A slurry was prepared with simulated river water and waste materials collected from the Site.
- The slurry was added to each tank and then solids were allowed to settle to mimic an in-situ water column.
- Excavation was simulated in the tanks to reagitate the solids.
- Chemicals, including coagulant and polymer, were added to facilitate setting and filtration.
- After chemical addition, solids were allowed to settle in the tank. Supernatant was sampled for TSS.
- Solids were resuspended then recirculated through a series of filters with decreasing pore sizes down to 1 µm. For this test, Geotube® fabric was used for initial filtration to remove larger particles of TSS and mitigate clogging of the subsequent finer filters.
- Filtrate was then collected for analysis of general chemistry parameters, specifically dioxins and furans.

3.6.2.2 Approach B Water Filtration Testing Results

After simulating the excavation within the water column in the tanks, settling tests showed that the chemical addition increased the rate of solids settling, reaching low levels of TSS and turbidity within three hours of settling as compared to more than 24 hours of settling that was required without chemical addition. However, results from both tests produced supernatant with dioxins and furans still above the MLs.

Geotube filtration tests showed that chemical addition improved TSS removal, reducing TSS in settled supernatant by 90 percent as compared to 50 percent without chemical addition. Recirculation filtration of Geotube filtrate did not remove TSS as much as expected based on calculations using Geotube filtrate particle size distribution. Figure 3-7 shows the actual versus expected TSS values over the time of the recirculation filtration.

After recirculation tests were completed, the solids were mixed to simulate the full-scale operation excavation that would be conducted while recirculating the water column through filters. Particle size distribution was evaluated on samples from both tanks after completion of the recirculation tests and after simulating excavation.

Results showed that there was some decrease in solids particle sizes after excavation simulation, suggesting that excavation activities along with recirculation breaks down particles to sizes that may pass through filtration, even after chemical addition. Additionally, larger particle sizes were observed in the tank where chemicals were added, indicating that chemical addition effectively increases particle sizes of the solids.

Water in the tanks after recirculation testing was analyzed for dioxins and furans. Data show that a series of recirculating filters did not reduce dioxins and furans as expected/calculated. Analysis of dioxins and furans in the filtrate water from each filter size showed significant reduction in dioxin/furan concentrations. However, filtrate through even the smallest 0.1 µm filter did not achieve dioxins and furans below the MLs, compared with previous tests on the pump-and-treat methodology that achieved dioxins and furans below the MLs after a 1 µm filter (Section 3.4.3.). Analytical results from these tests are shown in Table 3-7.

Further review of the particle size distribution test results showed that the majority of particulates containing dioxins and furans are between the sizes of 10 and 41 µm; therefore, it was expected that the filtration through the 10 µm should have produced filtrate with dioxins and furans close to or below the MLs. Inadequate removal of dioxins and furans observed during recirculation testing suggests that the mixing energy imparted from recirculation may break down solids into smaller sizes that can pass through a 0.1 µm filter and allow breakthrough of dioxins and furans in the filtrate.

3.6.2.3 Approach B Water Filtration Testing Conclusions

Treatability testing showed that the Approach B in-situ water treatment approach is not effective. This is due to challenges in mixing in order to keep solids in suspension to allow for effective removal via filtration.

Based on these results, this approach was eliminated as an option for the WTS and was not carried forward in this 90% RD.

3.6.3 Additional WTS Treatability Testing

Following the Approach B water filtration testing which demonstrated that in-situ filtration methodology was not effective, the design shifted to focus on a dry excavation and pump-and-treat aboveground WTS.

The WTS design included herein includes pumping contact water from the excavation area to a separate aboveground WTS utilizing chemical treatment (i.e., coagulation/flocculation) followed by filtration and activated carbon treatment to reduce the TSS below the target level, which would be expected to also remove dioxins and furans. Previous filtration testing of contact water from the site showed that filtration through a 1 µm filter reduced solids to achieve dioxins and furans concentrations below MLs (Section 3.4.3).

Certain tests that had been conducted in previous testing (including polymer addition and settling) were not applicable to the design of the WTS process, as they had been conducted to evaluate the Approach B methodology. As such, to verify the effectiveness of the treatment process included in this 90% RD and to evaluate its operational feasibility, additional WTS treatability testing was conducted.

The primary objectives of the additional WTS treatability testing were:

- Determine particle size distribution and dioxin load of the suspended soil particles.
- Determine settling properties of the suspended soil particles.
- Evaluate polymer/coagulant dosages required for effective setting and filtration.
- Develop design parameters for the chemical addition and filtration processes.

3.6.3.1 Additional WTS Treatability Testing Process

The additional WTS treatability testing was conducted at the GHD Treatability Lab in Niagara Falls, New York in October 2021. Test activities included the following steps:

- Contact water was prepared using simulated precipitation water and waste material collected from the site during the SDI activities.
- The contact water was added to a tank and then solids were allowed to settle.
- Chemicals were added to facilitate setting and filtration.
- After chemical addition, solids were allowed to settle in the tank. Supernatant was pumped to a separate tank and sampled for TSS.
- Supernatant was then sent through a series of filters with decreasing pore sizes to simulate the filtration included in the design of the WTS.
- Filtrate was then collected for analysis of general chemistry parameters, specifically dioxins and furans.

3.6.3.2 Additional WTS Treatability Testing Results

Supernatant from initial one-hour settling tests had high TSS and concentrations of dioxins and furans well above the MLs. Chemicals were added to facilitate solids settling; 100 mg/L of polyaluminum chloride coagulant and 25 mg/L of polymer were added. After chemical addition, settling times decreased, with the majority of solids settling after five minutes. Supernatant from settling after chemical addition was then filtered through 5 µm and 1 µm filters. TSS and dioxins and furans were analyzed after each treatment step with results shown in Table 3-8.

Results showed that filtration achieves very low concentrations of dioxins and furans, with concentrations of all congeners below the MLs, using a 5 µm filter with chemical addition.

Because dioxins and furans are organic compounds, GAC is being included in the treatment process downstream of the 1 µm filter to remove residual dioxins and furans prior to discharge. TOC concentrations were measured in the

5 µm and 1 µm filtrates at 21 mg/L and 19 mg/L, respectively. These are relatively low concentrations that maintain the ability of the GAC to adsorb residual dioxins and furans prior to discharge.

3.6.3.3 Additional WTS Treatability Testing Conclusions

The additional WTS treatability testing confirmed that the pump-and-treat WTS process included in the RD will successfully remove dioxins and furans to levels below MLs and will meet all TSWQS for discharge. This testing also indicated that chemical addition followed by the use of a 5 µm filter is effective in removing an adequate amount of solids to achieve the target dioxin and furan concentrations, with 1 µm filtration and GAC provided as an additional SF for water treatment prior to discharge. Settling tests indicated that the addition of 100 mg/L of coagulant followed by 25 mg/L of polymer was the most effective at achieving solids settlement prior to filtration.

Based on these results, the design of the optimized WTS is further outlined in Section 5.8.

3.7 Treatability Study Conclusions

Waste Material

– Characterization results for the Northern Impoundment waste material samples collected during PDI-1, PDI-2, and SDI indicate that the waste material is non-hazardous and is not subject to regulation under RCRA. This position was detailed in a Waste Characterization Letter, submitted to the EPA on October 20, 2020 (GHD, 2020g) and approved by the EPA in a letter dated November 19, 2020 (EPA, 2020h). In addition, the characterization results from the SDI suggest that the waste material should meet criteria for disposal in a Texas Class II landfill.

– Solidification testing on waste material samples indicates that an addition of a low dose (2 to 10 percent) of Portland cement will allow the removed waste material to meet landfill paint filter and compressive strength requirements.

Water

– Results of the particle size analysis and filtration testing of both simulated contact water and filtered effluent indicate that dioxins and furans in water are primarily associated with the level of TSS in the water. TSS and turbidity demonstrated potential to serve as an indicator parameter for dioxins and furans that can be measured real-time in the field.

– The results of the 2019 bench-scale testing show that filtration with a 1 µm filter can reduce concentrations of dioxins and furans in the contact water to below the ML. Further testing in the 2021 Additional WTS Treatability Testing suggest that filtration with a 5 µm filter with chemical addition can reduce concentrations of dioxins and furans to levels below the ML. Further evaluation of the use of a 5 µm filter in lieu of a 1 µm filter may be warranted depending upon the long-term operational performance of the 1 µm filter.

– Treatment of simulated contact water by clarification and filtration resulted in an effluent that meets the discharge criteria established by the EPA. The success of the treatment process and methodology was corroborated through the implementation of parallel bench-scale tests conducted in 2019 and 2021. This technology has been selected to be advanced in the RD for water treatment. The treatment process will be designed in accordance with EPA correspondence to Respondents dated February 18, 2020, (EPA, 2020b) which stated that "if an effluent sample analyzed for dioxin is below the ML using the EPA approved method, the sample result would be identified as non-detect and the discharge would be determined to be in compliance with the ARAR."

– In-situ recirculation water treatment methodology (Approach B) was unsuccessful at achieving an effluent that met the TSWQS. This methodology has not been carried forward in the RD.

– Solids in the clarifier underflow will likely require further settlement to produce a concentrated stream for solidification. The settled solids from the clarifier can be solidified with doses as low as 20 percent Portland cement if mixed with waste material in a 1:1 waste material to settled solids ratio.

Armored Cap Material

– No dioxins or furans were detected in any of the armored cap elutriate samples above their MLs. Similarly, all $TEQ_{DF, M}$ results from the sediment that was washed from the rocks and the crushed rock samples themselves were below the 30 ng/kg $TEQ_{DF, M}$ clean-up level. These results support the proposed reuse of the existing armored cap material during or after execution of the Northern Impoundment RA.

4. Applicable or Relevant and Appropriate Requirements (ARARs)

Compliance with ARARs does not include formal submission of permit applications to the agencies for permits or approvals. Instead, information sufficient to demonstrate compliance at the Site with the relevant ARARs will be presented to the EPA and coordinated with other agencies.

The EPA recognizes the following three types of ARARs:

– ***Chemical-Specific ARARs***: Chemical-specific ARARs include health- or risk-based numeric limits or methods that establish the acceptable amount or concentration of a chemical that may be found in or discharged to the environment.
– ***Location-Specific ARARs***: Location-specific ARARs include limits on allowable concentrations or on activities associated with hazardous substances solely because they occur in special locations.
– ***Action-Specific ARARs***: Action-specific ARARs include technology- or activity-based requirements or limitations on actions involving the management of hazardous substance.

As part of the RD, and since the submittal of the 30% RD, focused efforts have been made to engage with the relevant regulatory stakeholders that may have interest in the Northern Impoundment RA to make them aware of the anticipated scope of the RD and to ensure that all substantive permit requirements are identified for purposes of this 90% RD. These efforts at engagement included meetings between the Respondents and the EPA with the following agencies: TCEQ, USACE, United States Coast Guard (USCG), TxDOT, Port of Houston Authority (POHA), Harris County Flood Control District (HCFCD), Harris County Pollution Control, and the Coastal Water Authority (CWA). Applicable regulatory requirements along with project-specific comments that explain how these regulations apply to the project, and how the RD and RA will comply with the regulations are summarized in Table 4-1. Table 4-1 addresses each of the ARARs identified in the ROD and certain additional ARARs applicable to the Northern Impoundment RD. In addition, several supporting documents are included in Appendix D, as referenced in Table 4-1.

5. Remedial Design

This Section provides an overview of the remedial approach for the Northern Impoundment to implement the remedy selected in the ROD and outlines the corresponding RD components, including the following:

– Excavation.
– Engineered Barrier BMP.
– Water Management.
– Transportation and Disposal.
– Monitoring and Controls.
– Technical Uncertainties that remain.

5.1 Remedial Design Background

The remedy selected for the Northern Impoundment, as outlined in the ROD, includes the excavation and off-site disposal of waste material located beneath the TCRA armored cap such that the resulting surface is below the prescribed clean-up concentration of 30 ng/kg $TEQ_{DF,M}$. As described in the ROD, the selected remedy is to utilize a BMP, such as a cofferdam, to isolate the excavation area from the river.

At the time that remedial alternative was selected, the only subsurface data available had been collected during the RI in 2011 and 2012. At the time the ROD was issued, eight soil borings had been installed from elevations ranging from -7.6 ft to -22.7 ft NAVD88. As part of the RD process, 71 additional subsurface soil borings were installed in the Northern Impoundment at deeper elevations up to -35 feet NAVD88. Analytical results from these borings have further defined the vertical and horizontal extent of material located beneath the TCRA armored cap and have significantly increased the volume of waste material to be excavated from the volume and depth estimates that was the basis for the ROD.

The selected remedial alternative in the ROD was based on an expected excavation with an average depth of approximately -8 ft NAVD88. However, results from the PDI and SDI indicate that the actual excavations necessary to remove materials exceeding 30 ng/kg $TEQ_{DF,M}$ are significantly deeper, ranging up to an elevation of -28 ft NAVD88. Furthermore, based on geological and geotechnical data collected during the SDI and not available at the time the ROD was selected, some of the deeper excavation elevations pose a significant risk of hydraulic heave if the remedy is conducted as stated in the ROD (i.e., in the dry).

The following summary provides context to the transition in the RD from the 30% RD submitted in May 2020 (GHD, 2020d) to the RD included in this 90% RD and the need for the northwest corner to be addressed in a subsequent submission.

Approach B Water Treatability Testing

During a TWG Meeting in February 2020, newly obtained PDI-2 data was discussed which showed that material exceeding the ROD clean-up level extended to depths that were significantly deeper than were previously understood. It was further explained that utilizing traditional excavation methodology in dry conditions (referred to as “Approach A” in the 30% RD) would pose significant risk and technical challenges for the deeper areas within the Northern Impoundment, as excavating within the confines of a BMP, to the required depth could undermine the structural integrity of the BMP. Therefore, when the 30% RD was submitted, it included an alternative for excavation (referred to as “Approach B”) in areas of deeper waste depths. This approach included installing the BMP and then removing material exceeding the clean-up level through a column of water using barge-mounted excavation equipment. As described in the 30% RD, this approach would require that prior to the end of an excavation season, the water within the BMP would be recirculated through a treatment system until it achieved the TSWQS (as demonstrated through compliance with the ML). In order to evaluate the practicality and effectiveness of this conceptual approach, additional treatability testing was proposed. This additional treatability testing was summarized in the *Revised Additional Treatability Testing Notice*, submitted to the EPA on June 4, 2020 (GHD, 2020c), and approved by the EPA on June 11, 2020 (EPA, 2020d).

The additional treatability testing, as described in the approved notice, included a bench-scale simulation of the recirculation process through a bench-scale filtration system to determine if the ML could be met. The recirculation testing was conducted by the GHD Treatability Laboratory in Niagara Falls, New York from November 2020 to January 2021. As summarized in Section 3.6.2, treatability data indicated that after 16 days of recirculation the TSS reduction had plateaued at around 500 mg/L and the resulting dioxin and furan concentrations remained above the ML.

As presented during a TWG Meeting in December 2020, based on the results of the recirculation testing, Approach B water treatment was deemed technically infeasible for full-scale application during the RA. Since the water treatment for Approach B was shown to be technically infeasible, Approach B excavation methodology was also deemed technically infeasible. As a result, the design process was again significantly altered to focus on performing all excavation work “in the dry.” As such, additional data, including full vertical delineation and geotechnical data along the revised BMP alignment, was required to evaluate the feasibility of excavating the deeper areas “in the dry.”

Supplemental Design Investigation

A major uncertainty identified in the 30% RD was the constructability of the BMP wall. Even with the assumption that the majority of the Northern Impoundment would be excavated through a column of water, the required BMP design included in the 30% RD was extremely robust and was arguably technically infeasible. The pile types necessary would have been 5.5-ft diameter tubular pipe piles and double I-beam piles, driven to tip depths as deep as -93 ft NAVD88 into Beaumont Sand layer. Significant concerns were identified in the Northern Impoundment 30% RD about the ability to successfully drive and/or remove the piles. Given these concerns and the poor performance of the Approach B water treatability testing, following the submittal of the 30% RD, the design team began evaluating other BMP types and excavation methodologies that could overcome these limitations. An optimized BMP design was identified. The optimized BMP design includes a double wall system that allows for shallower embedment depths than the single cantilever wall proposed in the 30% RD. The double wall in this optimized design is further offset, except in limited circumstances, by a minimum of 30-ft from the area of excavation than the BMP described in the 30% RD to increase the structural stability of the BMP system.

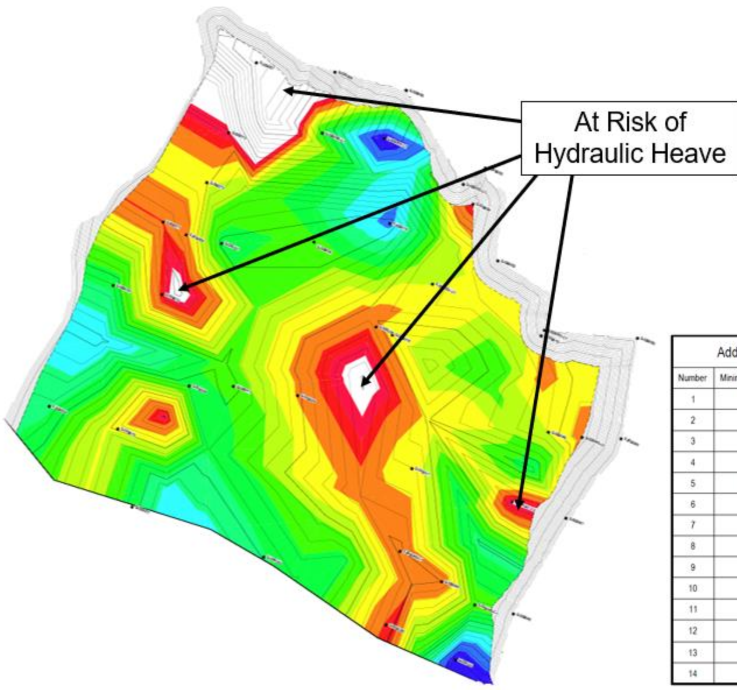
Previous investigations had not included collection of data regarding soil properties and stratigraphy in the areas of the new BMP wall. Given the modified alignment of the BMP, the Respondents and EPA agreed that it was necessary to collect additional analytical data to more fully delineate the waste material and geotechnical data to better understand the soil properties and thickness of the shallow stratigraphy in locations in and near the proposed conceptual BMP alignment. With the change in excavation methodology, an additional risk that needed to be evaluated was the potential for hydraulic heave.

The SDI was performed in the summer of 2021 to supplement the delineation of the vertical extent of material requiring excavation and to provide information to aid in designing a structurally robust BMP, potentially capable of withstanding forces associated with excavation in the deeper areas of the Northern Impoundment.

Risk of Hydraulic Heave

The SDI was conducted from June through September 2021 in accordance with the Revised SDI Work Plan, submitted to the EPA on May 21, 2021 (GHD, 2021c) and approved by the EPA on June 4, 2021 (EPA, 2021c). The investigation included the installation of 35 analytical soil borings, 17 geotechnical borings (13 CPT soundings and four instrumented boreholes). Data from the SDI indicated that impacted material above the clean-up level was at deeper elevations than previously understood, with impacts as deep as -28 ft NAVD88 in the northwest corner. Based on these deeper impacts, a focused evaluation was conducted to assess the potential for hydraulic heave while excavating to target depths of known impact. The technical evaluation regarding hydraulic heave was discussed with the EPA, USACE, and TCEQ in detail during the October 19, 2021, November 16, 2021, and December 14, 2021, TWG Meetings. It was documented in the Hydraulic Heave Analysis Report submitted to the EPA on December 9, 2021, (GHD, 2021i) and written correspondence to EPA dated December 22, 2021 (GHD, 2021j). The Hydraulic Heave Analysis Report is included as part of Appendix B.

Based on this evaluation, it was determined that there are several areas across the Northern Impoundment in which there would be significant risk of hydraulic heave if material were to be removed to the currently estimated elevations of impact. Figure 5-A, below, shows the areas across the Northern Impoundment that are at risk of hydraulic heave. The figure has been color-coded to indicate how many additional feet (if any) could be excavated before hydraulic heave becomes a significant risk (SF < 1.25). Areas shown in white indicate areas that would be at risk of hydraulic heave if waste material is removed to the elevations of deepest impact. Red shading indicates areas in which an additional one foot of excavation (as could be required based upon post-excavation confirmation sampling) would put the area at risk of hydraulic heave. Red-orange shading indicates areas in which excavating an additional one to two feet would put the area at risk, and so on.



Additional Feet of Excavation			
Number	Minimum Elevation	Maximum Elevation	Color
1	-25.96	-22.00	
2	-22.00	-20.00	
3	-20.00	-18.00	
4	-18.00	-16.00	
5	-16.00	-14.00	
6	-14.00	-12.00	
7	-12.00	-10.00	
8	-10.00	-8.00	
9	-8.00	-6.00	
10	-6.00	-4.00	
11	-4.00	-2.00	
12	-2.00	-1.00	
13	-1.00	0.00	
14	0.00	0.00	

Figure 5-A Risk of Hydraulic Heave

Based upon the results of this evaluation, it was determined that it is not technically feasible to excavate the material in the northwest corner to the currently known depths in the manner required by the ROD. As previously mentioned, due to the risk of hydraulic heave, if excavation is performed “in the dry,” the design of the northwest corner of the Northern Impoundment is technically impracticable and has not been included in this RD package. Respondents have requested an extension with respect to the submission of a 90% RD for the northwest corner and anticipate that the details of the RD for that area will be addressed separately. The challenges associated with the northwest corner are further detailed in Section 5.11.

5.2 Remedial Approach

The remedial approach based on a double-wall BMP is described below. As previously mentioned, due to the risk of hydraulic heave if excavation is performed “in the dry,” the design of the northwest corner of the Northern Impoundment is technically impracticable and has not been included in this RD package.

There are a number of significant outstanding technical uncertainties associated with the implementation of the RD as it is presented in this 90% RD, as detailed in the discussion of Uncertainties in Section 5.11. Some of the key challenges and potential impediments to the implementation of the 90% RD are noted in the paragraphs, below.

One challenge associated with the Northern Impoundment design is the lack of usable land from which to perform the work. A remediation effort of this magnitude requires significant space for site operations, truck staging, materials laydown, and water storage and treatment. In addition, as the RA progresses over time, the limited upland area available (on the western side of the impoundment itself) will be removed. Despite ongoing efforts over the last few years, access to a property to utilize during the RA has not yet been secured. The RA, as designed, cannot be implemented without a separate property to use as a logistical support area.

Another challenge, and potential impediment to implementation, is that the only land access to the Northern Impoundment is through the approximately 60-foot wide TxDOT right of way (ROW). The 90% RD is premised on TxDOT allowing the construction of the southern extent of the BMP wall on the ROW and for it to occupy a significant portion of the ROW for the duration of the RA. In addition, trucks used to haul the excavated waste must have unrestricted access into the BMP via the ROW, which will include the construction of a ramp up and over the BMP to allow the trucks to enter and leave the Northern Impoundment. TxDOT is currently planning a project to replace the I-10 Bridge that would take place during the period of implementation of the RA. Given TxDOT's plans, it is unknown whether or to what extent TxDOT will provide access to the ROW or allow the southern wall of the BMP to be placed on its ROW.

It also is unknown whether the BMP's southern wall can be constructed as designed given the presence in that area of both pipelines and bridge structures (existing or planned).

Further discussion of the technical uncertainties associated with the RD is provided in Section 5.11.

Notwithstanding the above, GHD has, as required by the AOC, developed a pre-final design for the Northern Impoundment RD in order to meet the approved schedule for submission of the 90% design package for the Northern Impoundment. An overall remedial approach has been developed, in coordination with members of the TWG, and includes several fundamental elements. These elements are discussed below.

BMP Alignment and Lateral Excavation Extent

The lateral extent of the excavation for purposes of the RD is defined by the lateral extent of waste material above the 30 ng/kg $TEQ_{DF,M}$ dioxin clean-up level underneath the armored cap. The lateral extent of the planned removal is shown in green shading on Figure 5-B, below.

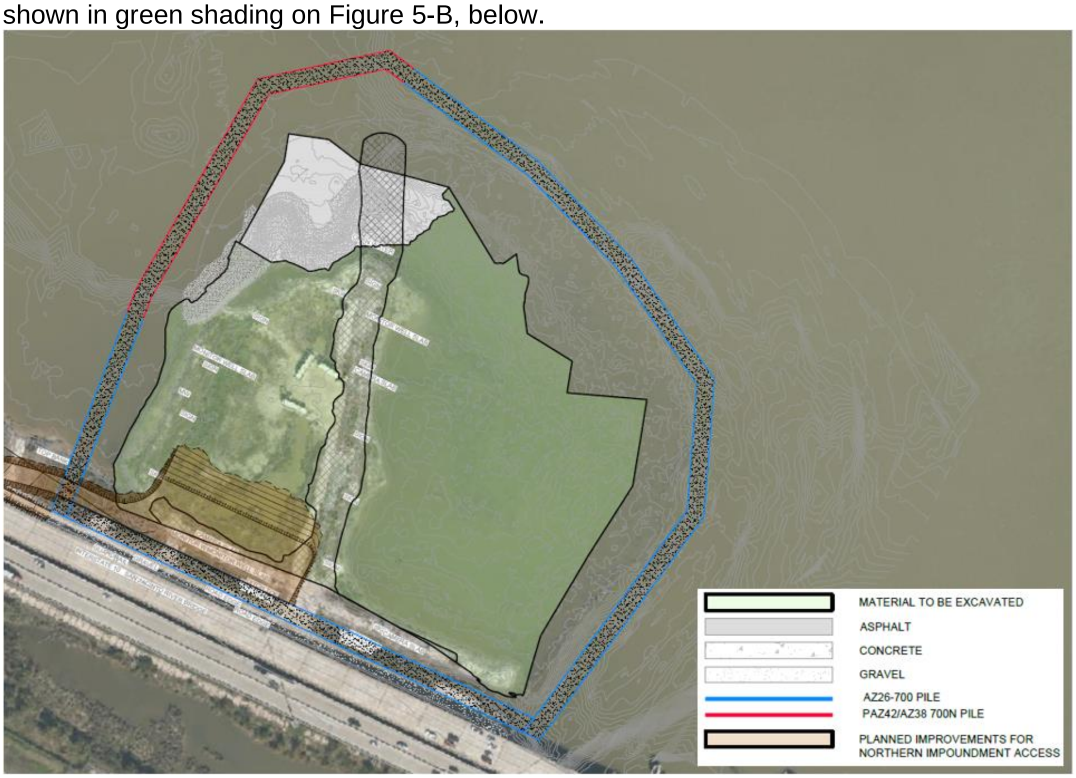


*Figure 5-B BMP Alignment and Excavation **Extent***

The lateral limits of the planned removal area also define the corresponding outer alignment of the BMP. The optimized double wall BMP system includes two parallel single cantilever walls spaced approximately 30-ft apart, connected with tie-rods and walers, and filled with aggregate.

In the 90% BMP wall design, the existing riverbed between the BMP (interior wall) and the excavation area is referred to as the "Soil Buttress." This Soil Buttress is essential to the stability of the wall and the ability to excavate to the target elevations "in the dry." In some instances, additional fill material is added to the Soil Buttress to raise the riverbed elevation and reduce the exposed height of the BMP above riverbed elevation. That additional fill is referred to as a "Raised Bench."

Along the west, north, and east sides of the BMP, the system includes at least a 30-ft wide Soil Buttress between the inner wall and the top edge of any excavation inside the BMP to support the wall system and in one section on the west side, a Raised Bench. Along the south side of the BMP, the Soil Buttress in some locations is less than 30-ft wide, due to space constraints.

This optimized wall system pushed the alignment of the BMP further out from the excavation area than the alignment considered in the 30% RD. The alignment of the BMP is shown on Figure 5-B, above. A conceptual depiction of the BMP and a conceptual cross-section of the BMP system are shown below on Figure 5-C.

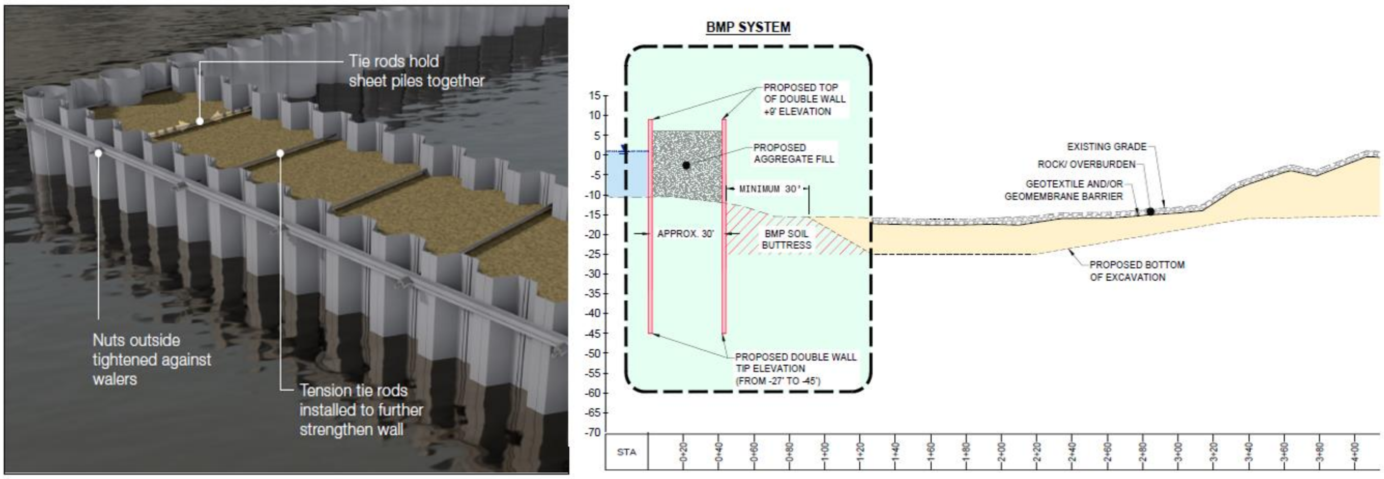


Figure 5-C ***BMP Alignment and Excavation Extent***

Seasonal Excavation, and Top of Wall Elevation

The ROD states that performing the removal of the waste material using a BMP would reduce short-term impacts, prevent any material release to the San Jacinto River during removal, and ensure compliance with ARARs. As such, to design the BMP, historical San Jacinto River water surface elevation data, dating back to 1994, was obtained and evaluated. Based upon an evaluation of that historical data, the San Jacinto River seasonally has experienced high water levels between May and October. Therefore, as a risk management measure, an excavation period of November to April was selected for use in the RD and approved by the EPA and members of the TWG during the February 19, 2020 TWG Meeting. This same excavation season had been used as the basis for the 30% RD. See Section 5.3.2 for further detail.

The historical San Jacinto River elevation data were also used to identify a top elevation for the BMP assuming that any high-water events during the planned excavation months of November to April would not exceed historical levels. Based upon the historical data, since 1994 there were no high-water events that exceeded an elevation of +9 ft NAVD88 during the period of November to April. This information is contained on Figure 5-1. Therefore, for design purposes, the top of pile elevation for the BMP was established as +9 feet NAVD88. As further detailed in Section 5.11, the use of this design top elevation will not eliminate the risk of overtopping during any of the excavation seasons, and the protectiveness of this design top elevation will need to be confirmed following receipt of modeled flow data from the CWA in relation to its planned improvement project for the Lake Houston Flood Control structure located upriver of the Northern Impoundment.

With the excavation period being limited to November through April, the excavation of the Northern Impoundment would be approached as seasonal cells - with a single cell being excavated each excavation season. The exact shape and size of the seasonal cells will not be pre-defined but will be based upon production efficiency each season. This is different than the plan proposed in the 30% RD which included pre-defined seasonal cells divided by interior barrier walls. Instead, during an excavation season, only the portion of the TCRA armored cap covering the area targeted for excavation during that season will be removed, with the rest of the TCRA armored cap remaining intact. At the end of each excavation season, the bottom of the seasonal cell will be confirmed clean and the exposed slope between that seasonal cell and the remaining TCRA armored cap will be covered with a cap, consistent with the design used during the TCRA. Following capping of the exposed slope, the Northern Impoundment may be intentionally flooded with river water to off-set the forces acting on the BMP and to prevent uncontrolled overtopping during the off-season in the event of a high-water event. At the start of the next excavation season and prior to the initial excavation season, the river water inside the Northern Impoundment BMP will be returned to the river and the process will start again.

A conceptual visualization of the overall project sequencing, including a potential seasonal cell layout is included on Figure 5-D, below. Although the design for the northwest corner is not included in this 90% RD and will be addressed separately, it is important to note that the early completion of the RA in the northwest corner is critical to the overall sequencing of the project. This 90% RD has been prepared to be “implementable” as designed excluding the northwest corner, but in reality, the northwest corner would likely need to be completed in the first excavation season due to access issues and bathymetric conditions. If the other areas of the Northern Impoundment were completed first, it would eliminate land access to the northwest corner and make it very difficult to complete a remedy in that area. Completing the northwest corner first would also be appropriate due to the deep bathymetry in that area and the implications of that deep bathymetry on water management. The Final 100% RD will combine the separate plans for the northwest corner with the RD for the remainder of the Northern Impoundment.

Including the northwest corner, it is anticipated that the RA excavation activities could be completed in 5 seasons, however this is subject to EPA’s approval of the use of area-based average concentrations to define the excavation bottom, as discussed below under Excavation Approach and in Sections 5.3.4, along with complexities of the required confirmation sampling program. The planned number, size, and configuration of the cells are flexible and may change based upon the following factors:

– ***Volume and Removal Rates*** -The tentative cell sizes ensure that the volume of planned removal from within each cell could be achieved within the excavation period of November through April.
– ***Excavation Depth*** - Depending upon the results of post-excavation confirmation sampling, the depths of the seasonal excavations could increase, which may, in turn, limit the area effectively excavated in that season.
– ***Access and Implementability*** - The tentative seasonal cells assume sustained access to each area for necessary excavation equipment and trucks.
– ***Transportation and Disposal*** - The target seasonal production rate used to define the tentative cell sizes is dependent on the ability to efficiently and consistently load out waste material and transport it to an offsite landfill, an activity which, as addressed above, requires full access to the TxDOT ROW and I-10.

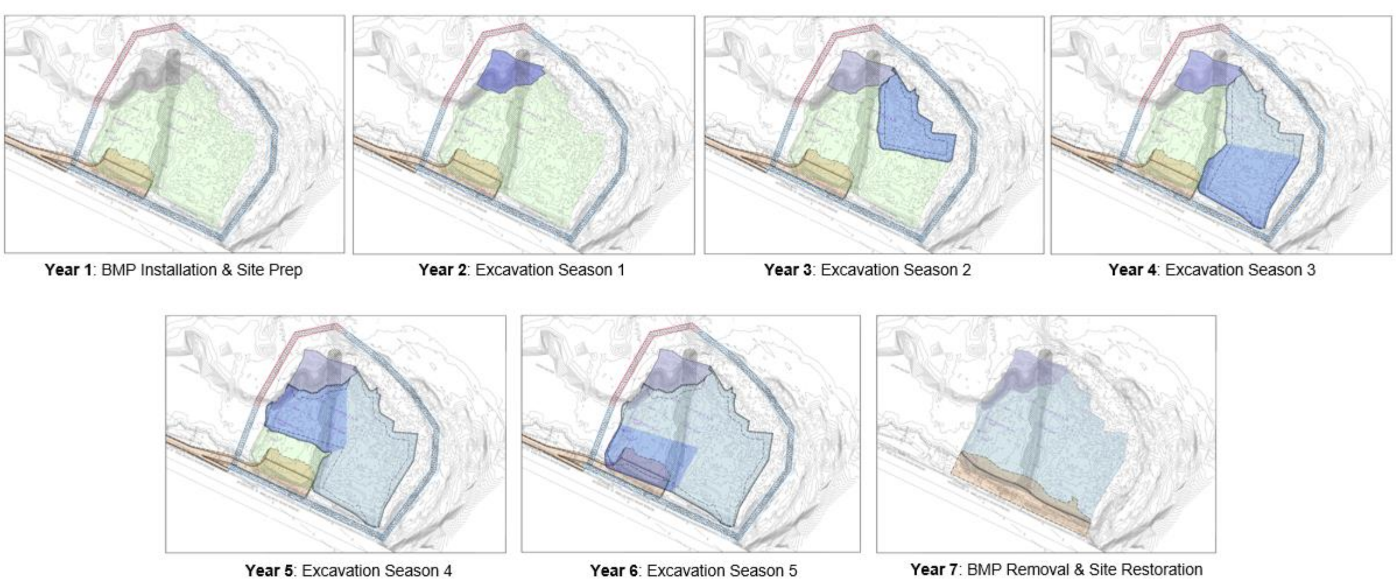


Figure 5-D Conceptual Project Sequencing

Excavation Approach

As discussed above, results from the PDI and SDI indicate that the extent of waste material is significantly deeper in many parts of the Northern Impoundment than was known at the time the ROD was issued. This results in many areas of the Northern Impoundment being at risk of hydraulic heave if they are excavated (as shown on Figure 5-A). While this risk is most pronounced in the northwest corner, there are several other areas outside the northwest corner that are also at risk of or are sensitive to hydraulic heave if further excavation is necessary based upon post-excavation confirmation sampling results. As an attempt to overcome this limitation, the target excavation elevations included in this RD are based on implementing the target clean-up level (30 ng/kg $TEQ_{DF,M}$) on an area-based average concentration rather than a point-by-point basis.

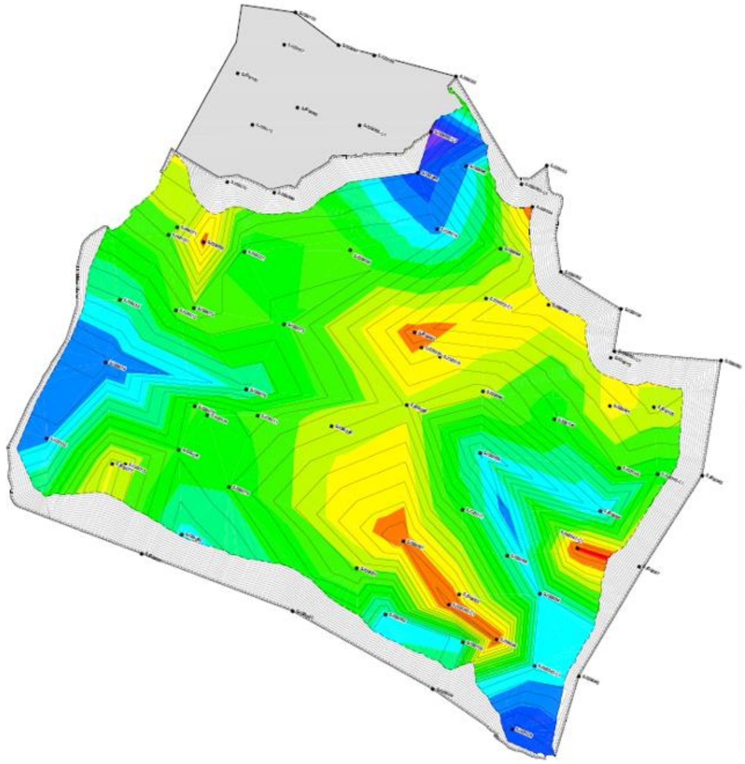
The general premise underlying the use of average concentrations is that estimates of risk, which are the basis of action for the ROD, are based on exposures to conservative estimates of the average concentrations of a chemical. When human health risk assessments are conducted, risk is not characterized based on exposure to a single concentration of a chemical. It is instead assessed based on exposure to a concentration that represents an average of the concentrations to which an individual is exposed over time. This is a fundamental principle of risk assessment and risk management. As such, it is technically appropriate to apply the excavation clean-up level for the Northern Impoundment on an area-based average concentration and not on a point-by-point basis.

A detailed risk analysis that supports the use of area-based average concentrations is included as Appendix E. A presentation regarding this approach was made during a TWG Meeting on November 16, 2021. The same methodology used to establish the target excavation elevations that are detailed in the FSP (Appendix J, Attachment 3) and in Section 5.3.4 are summarized, below.

Using the abundant analytical data that has been collected at the Northern Impoundment over the years, a target excavation surface has been developed using calculated area-based average concentrations for all of the Northern Impoundment (excluding the northwest corner). The excavation surface was developed utilizing several guiding principles:

– Material cannot be removed below the elevation with a SF protective of hydraulic heave (1.25), no matter what the concentration.
– Target excavation depths/elevations were identified across the Northern Impoundment such that the resulting surface will meet the clean-up level of 30 ng/kg $TEQ_{DF,M}$ on a site-based average basis.
– A not-to-exceed threshold value of 300 ng/kg was applied (unless there is a risk of hydraulic heave). The concentration of 300 ng/kg was identified in the ROD as the Principal Threat Waste (PTW) concentration - ten times the 30 ng/kg clean-up level.

Applying these principles, an excavation surface was developed across the Northern Impoundment that should be implementable, mitigates hydraulic heave risk (except in the northwest corner), is protective of human health and the environment, is consistent with the methodology used to develop the clean-up standard outlined in the ROD, and would result in an exposed surface that is below the clean-up level on an area-based average basis. Figure 5-E, below illustrates the benefits of this excavation approach relative to the risk of hydraulic heave. In comparison to Figure 5-A, when the design excavation surface is compared to the hydraulic heave risk elevations, the “hot spots” of hydraulic heave sensitivity are eliminated or greatly reduced in size (with the exception of the northwest corner which will require a different remedial approach).



Additional Feet of Excavation			
Number	Minimum Elevation	Maximum Elevation	Color
1	-25.96	-22.00	
2	-22.00	-20.00	
3	-20.00	-18.00	
4	-18.00	-16.00	
5	-16.00	-14.00	
6	-14.00	-12.00	
7	-12.00	-10.00	
8	-10.00	-8.00	
9	-8.00	-6.00	
10	-6.00	-4.00	
11	-4.00	-2.00	
12	-2.00	-1.00	
13	-1.00	0.00	
14	0.00	0.00	

Figure 5-E   Hydraulic Heave Sensitivity

Table 5-1 presents the design excavation elevations at all the borings (other than those located in the northwest corner) using the area-based average approach and Table 5-2 presents the rationale for these elevations. This excavation surface (which does not include the northwest corner) results in approximately 168,000 CY of total volume removed, which accounts for an estimated 99.82 percent of the total mass of dioxins above the clean-up level calculated to be present beneath the TCRA cap (excluding dioxins present in the northwest corner). This excavation surface is intended to provide an indication of where the initial excavation ends (i.e., design elevations) and where the post-excavation confirmation sampling begins (i.e., base of design excavation surface); the data collected during the PDI and SDI has been used to inform this. Whether the clean-up level has been achieved would be confirmed using post-excavation confirmation sampling, as detailed in the FSP (Appendix J, Attachment 3) and in Section 5.6.4.

Excavation Methodology

The approach would include (1) installation of a physical BMP around the perimeter of the Northern Impoundment, (2) return of river water back to the river prior to removal of the TCRA armored cap, (3) removal of the waste material with land-based excavation equipment working within a seasonal cell, removing the TCRA armored cap as work progresses (while leaving in place the portions of the TCRA armored cap not being excavated), (4) placing an engineered cap over the exposed slope of the seasonal cell excavation at the end of each excavation season, and (5) flooding the impoundment with river water for the duration of the off-season. A conceptual illustration of the excavation methodology is shown on Figure 5-F.

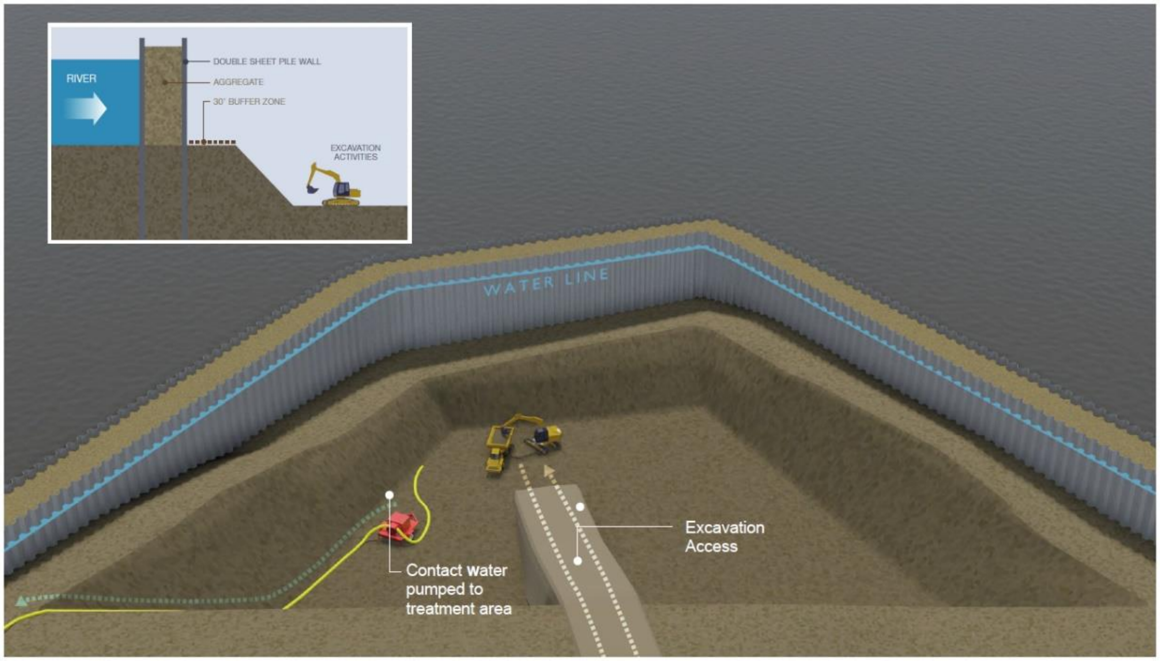


Figure 5-F *Conceptual Excavation Methodology*

Water Management

Following installation of the BMP, and at the beginning of each excavation season, river water trapped behind the BMP wall will be returned to the river. During the RA, any infiltration or stormwater that accumulates in an open excavation will be pumped to on-site water storage tanks, treated through clarification and filtration, and then discharged to the river.

Re-Use of TCRA Armored Cap and Historic Berm Material

The Northern Impoundment is currently covered by an armored cap comprised of 6- to12-inch diameter rock on top of a low-permeability geomembrane and/or geotextile barrier, and/or ACBM. As described in Section 3.5, treatability testing was performed on the TCRA armored cap material and results demonstrated that the rock, its elutriate, and sediment generated from its elutriate did not exhibit dioxin concentrations above the ML (as defined in Section 3.4.1) or the clean-up level of 30 ng/kg $TEQ_{DF,M}$.

Prior to removal of the waste material, the TCRA armored cap rock would be removed. The TCRA armored cap rock would be stockpiled at or near the Northern Impoundment for potential reuse during or after execution of the Northern Impoundment RA.

It is anticipated that during the RA approximately 25,000 CY of unimpacted material from the historic central and southern berms at the Northern Impoundment will be excavated. Based upon characterization data from the PDI (see Figure 2-9), these berms contain native material with dioxin concentrations below the clean-up level. During the RA, this unimpacted material will be considered for reuse for various site activities, construction of site features, cover material, etc. The material will be segregated from the waste material during excavation activities, stockpiled, and sampled prior to reuse, as detailed in the FSP (Appendix J, Attachment 3).

The locations of the historic berm and the TCRA armored cap rock planned for re-use are shown on Figure 3-5.

Preliminary RA Schedule

Based on the current remedial approach, it is anticipated that the implementation of the Northern Impoundment remedy following EPA final approval of the RD would require a period of at least 7 years to complete. This 7-year period would be preceded by an initial period in which parties undertaking the RA would select an RC and engage in steps to procure necessary materials and other resources needed to begin construction of the BMP. Following that initial period, it will then take one year to construct the BMP, followed by an estimated 5 years of waste removal (one cell per excavation season plus 1 year for the northwest corner), and concluding with an additional and final year for BMP removal, site restoration, and project demobilization. The estimated five years of waste removal is based on the assumptions described above (including with respect to EPA's approval of area-based averaging to define the excavation limits) and the ability to achieve the assumed volume and excavation rates). This schedule assumes full access to the TxDOT ROW during the entire implementation period, both to construct the BMP wall and also for purposes of ingress and egress. Limitations on the use of the ROW, which is needed for the 4,000 truck trips required each excavation season to transport the excavated material off-site and reduced production due to traffic and access issues related to an I-10 Bridge replacement project, could extend the overall project schedule.

5.3 Basis of Design

5.3.1 Historic River Level Evaluation

To design the BMP and plan for the RA, all available historical San Jacinto River elevation data dating back to 1994 was evaluated. Data evaluated included continuous monitoring data from the Sheldon gage (described below) and a United States Geological Survey (USGS) Fact Sheet which reported a major flood event in October 1994. The Northern Impoundment is subject to both tidal fluctuations, as well as increases in river level from rainfall and tropical storm events. As such, installation of BMPs requires an understanding of both the vertical range of typical water surface elevations, as well as the temporal variation in water surface elevations, based on available historical data, that would be encountered during the RA.

To evaluate these influences, GHD developed a model to create a history of water surface elevations at the Northern Impoundment by hindcasting historical water level data from an upriver USGS gage in the San Jacinto River near Sheldon, Texas (i.e., Sheldon gage). This was required as historical routine water level readings had not been collected at the Northern Impoundment, whereas the Sheldon gage has a historical record dating back to 1996. This gage is upstream of the Northern Impoundment and is subject to large increases in surface elevation due to major rainfall events in the area. Although the Sheldon gage data are indicative of trends at the Northern Impoundment, the data are not appropriate for understanding the full pattern of water surface elevations at the Northern Impoundment. Historical water surface elevations for the USGS Sheldon gage are shown on Figure 5-1.

To understand the pattern of local variation in water surface elevations, a transducer gage was installed at the Northern Impoundment during the PDI-2 (see Section 2.2.5). Data collected from the transducer provided a direct understanding of water levels at the Northern Impoundment, which could be correlated with the Sheldon gage data thereby allowing for the hindcasting of the long history of data at the Sheldon gage to the Northern Impoundment.

To hindcast the Sheldon gage data to the Northern Impoundment, synchronous observations from the Sheldon gage and the Northern Impoundment were subjected to a machine-learning model. The Multivariate Adaptive Regression Splines (MARS) algorithm was used to correlate Northern Impoundment data with the Sheldon gage. MARS is an advanced form of linear regression that allows varying relationships between dependent and independent variables across the range of the independent variable. For example, in this case the model has the flexibility to predict different correlations between the Northern Impoundment and Sheldon gage depending on the water surface elevation at the Sheldon gage. The model selects relationship terms using a generalized cross validation (GCV) method which takes the form of:

$$GCV = RSS/(N \times (1-N_e)/N^2)$$

Where RSS is the residual sum of squares of the model, N is the number of observations, and N_e is the effective number of parameters. Thus, the GCV algorithm balances minimization of RSS (which may result in an overfitted model) with parameter number (which allows more flexibility in the model).

The form of the hindcasting model for the Northern Impoundment is:

$$WSE_{SJ,t} = WSE_{SH,t} \times L_{SH,t}$$

Where, $WSE_{SJ,t}$ is the water surface elevation at the Northern Impoundment at time *t*, $WSE_{SH,t}$ is the water surface elevation at the Sheldon gage at time *t*, and $L_{SH,t}$ is the either rising or falling limb of the hydrograph at the Sheldon gage at time *t*. The model selected three first order terms (or correlations), and also found an interaction with limb, indicating that the water level at the Northern Impoundment scales differently with the Sheldon gage depending on whether the hydrographic limb is rising or falling.

The hindcasting model was then used to hindcast water surface elevations at the Northern Impoundment using the Sheldon gage record. Figure 5-2 shows the 24-year hydrograph for the Sheldon gage and the 24-year hindcasted water surface elevations for the Northern Impoundment.

Results of the model and surface water elevations were evaluated and discussed during the December 2019, January 2020, and February 2020 TWG Meetings. Based on the evaluations and discussions, the TWG agreed on the need to complete removal activities during a specified "excavation season," and also agreed on the proposed design elevation for the top of the BMP. Both of these topics as they relate to the 90% RD for the Northern Impoundment are further discussed below.

5.3.2 Excavation Season and BMP Height

Based on the historic river elevations, the San Jacinto River seasonally experiences high water levels between May and October due to rainfall and tropical storm events. Therefore, an excavation season of November to April was selected for the RD. To allow for the removal of waste material during the low water season (between November and April), the Northern Impoundment RA work will likely be divided into five cells - with a single cell being remediated each excavation season. During the non-excavation season months (May to October) of the RA, any necessary work will be conducted to prepare for the upcoming excavation season (procurement, work area staging, and access, etc.).

The historical San Jacinto River elevation data was also used to determine a top elevation for the BMP that would be protective of high-water events (based on the available historical data) during the planned excavation season. High-water events have historically occurred between the months of May and October, as shown on Figures 5-1 and 5-2. For example, in August 2017, Hurricane Harvey made landfall in the Galveston Bay area. During this event, water surface elevation peaked at 14.28 ft NAVD88 at the Northern Impoundment. More recently, Tropical Storm Imelda caused significant flooding in September 2019, with water surface elevation peaking at 8.9 ft NAVD88 at the Northern Impoundment. For reference, the typical river stage for September at the Northern Impoundment fluctuates between 1 to 3 feet NAVD88.

Comparison of the Sheldon gage and Northern Impoundment hydrographs for both the full year (shown on Figure 5-2) and for the November to April excavation season (shown on Figure 5-3) show that excluding the months of May to October would substantially reduce the number of high-water events that could be expected, based on the available historical data. These data were reviewed with the members of the TWG during the February 19, 2020, TWG Meeting and it was agreed that excavation activities should only take place between November and April.

A comparison of the Sheldon gage and Northern Impoundment hydrographs from 1996 through 2019 show that there were no high-water events that exceeded an elevation of +9 ft NAVD88 during the proposed excavation season. The members of the TWG agreed that an excavation season of November through April each year and a top of BMP elevation of +9 ft NAVD88 would reduce the risks of water overtopping and should be protective of all events in the hydrographic record dating back to 1996 and the October 1994 flood event. As further detailed in Section 5.11, the protectiveness of this design top elevation will need to be confirmed following receipt of modeled flow data from the CWA in relation to the CWA's planned improvement project involving the Lake Houston Flood Control structure located upriver of the Site.

5.3.3 Geotechnical Conditions

A primary objective of the SDI was to collect additional geotechnical data to provide a better understanding of the geotechnical properties of the underlying substrata to support the design of the double wall BMP system. A Geotechnical Engineering Report was prepared by Ardaman & Associates Inc. and GHD, and is included as Appendix B. A brief summary of the geotechnical subsoil conditions and the BMP design is presented, below.

The results of the SDI CPT investigation confirmed PDI-2 results and showed that the subsoils in the Northern impoundment, and particularly along the BMP footprint, are principally composed of the three following stratigraphic units:

1. Fairly heterogenous alluvium sediments consisting of a mixture of sand, silt, and clay in varying proportions, present from the riverbed to elevations ranging from -20 to -35 ft NAVD88.
2. Stiff-to-very-stiff high plasticity clay formation (Beaumont Clay) encountered starting at elevations ranging between -20 to -35 ft NAVD88.
3. Compact-to-dense sandy formation (Beaumont Sand) encountered beneath the clayey deposit at elevations ranging between -50 to -70 ft NAVD88.

Continuous profiles of different geotechnical parameters were defined from the CPT results using robust published correlations (undrained shear strength, the pre-consolidation pressure, undrained modulus, hydraulic conductivity, friction angles etc.). All CPT defined parameters were compared and validated with those measured in previous investigations.

The Northern Impoundment characteristics vary across the impoundment and necessitate evaluation of multiple sections using soil-structure interaction. The presence of the thick cohesive formation that behaves in a drained or undrained state, requires consideration of both quick and slow loading cases (Q and S cases respectively).

The soft heterogeneous alluvium deposit on the riverbed may temporarily develop pore pressure upon backfilling between the sheet piles and will increase the loads against these sheet piles. Although the design for the northwest corner is not included in this 90% RD, the design of the BMP wall includes the full extent of the wall encircling the Northern Impoundment, including the portions of the wall surrounding the northwest corner. Due to deeper mudline depth in the northwest corner, dewatering within the BMP causes a large load differential between the interior and exterior sides of the BMP. In order to mitigate these challenges, design features such as additional buttressing on the interior and staged construction of the BMP such as installing fill in multiple layers with intentional delay between layers, and selecting appropriate fill height before installing tie-rods, will be required.

Since the BMP will be driven in the alluvium and Beaumont Clay with tip depths at elevations of approximately -40 ft NAVD88, no excessive vibrations and no detrimental impact on the stability of the existing slope on the riverbed are anticipated during installation.

5.3.4 Excavation Extent and BMP Alignment

Analytical data obtained from the RI, the PDI, and the SDI were used to inform the RD and determine excavation extents and volumes and the alignment of the BMP.

Lateral Extent

As described in the EPA-approved PDI-2 Work Plan (GHD, 2019d), the lateral extent of excavation is based on analytical data. Areas with $TEQ_{DF,M}$ levels below the clean-up level of 30 ng/kg will not require excavation, as depicted on Figure 2-9. The historic central and southern berms depicted on Figure 2-9 have been shown to have levels of dioxins and furans below the clean-up level. To allow for efficient waste removal, the berm material may be excavated in conjunction with but separated from the waste material, but it is anticipated that that unimpacted berm material may be reused on-site, pending analysis, as described in the FSP (Appendix J, Attachment 3).

The double wall BMP design requires a significant lateral footprint, in addition to the 30-ft width of the wall itself. A Soil Buttress with a minimum width of 30 ft is also necessary between the inner wall and the top of the excavation slope to support the wall. To accommodate the footprint of the BMP wall and to avoid installation of the BMP wall through the TCRA armored cap, the alignment of the BMP was moved outward to fully encircle the Northern Impoundment area.

On the south side of the Northern Impoundment, SDI results indicated that waste material was much deeper than previously understood (as deep as -20 ft NAVD88 while the ROD had assumed that area was -5 ft NAVD88). As the south side of the Northern Impoundment abuts the TxDOT ROW property, there is not sufficient space to accommodate a double wall system (including a slope out of the excavation, 30-ft Soil Buttress, and double wall) without encroaching on the TxDOT ROW property. As further detailed in Section 5.5.6, several different wall types and alignments were evaluated as part of an effort to identify a structurally sound wall with a thinner profile than the double wall system. Ultimately, the only wall-type that proved to be structurally sound for installation on the south side of the Northern Impoundment was the double-wall system, the majority of which will need to be placed on the TxDOT ROW property. Figure 5-B shows the alignment of the BMP and the extent of the excavation area.

Vertical Extent

Analytical data from the RI, PDI, and SDI were also utilized to determine the vertical extent of the waste material requiring removal. As previously mentioned, results from the PDI and SDI indicated that waste material is present at elevations significantly deeper than was known at the time the ROD was issued. During the SDI, the elevation of waste material in the Northern Impoundment was found to be as deep as -28.3 ft NAVD88 with an average depth of -12.8 ft NAVD88.

As discussed in Section 5.2 and detailed in Section 5.3.3, due to the deeper elevations of waste material and the goal to design a remedy that includes excavation “in the dry,” a detailed hydraulic heave evaluation was conducted. This evaluation indicated that there are significant hydraulic heave risks in certain areas, with the most pronounced risk in the northwest corner and along the western side and in the center of the Northern Impoundment, as shown on Figure 5-D. Based on this evaluation, it was determined that the northwest corner is technically impracticable to excavate in the dry, and will need to be addressed with a separate remedial approach.

To address the hydraulic heave sensitivity in the remainder of the Northern Impoundment and to implement an approach that utilizes the same risk-based approach used to develop the clean-up standard as the basis to demonstrate compliance with it, an area-based average concentration approach was used as the design basis for the excavation contours presented in this 90% RD.

As discussed in Section 5.2, the excavation surface was developed utilizing several guiding principles:

– Material cannot be removed below the elevation with a SF protective of hydraulic heave (1.25), no matter the concentration.
– Target excavation depths/elevations were identified across the Northern Impoundment such that the resulting surface will meet the clean-up level of 30 ng/kg $TEQ_{DF,M}$ on a site-based average basis.
– A not-to-exceed threshold value of 300 ng/kg was applied (unless in locations at risk of hydraulic heave). The concentration of 300 ng/kg was identified in the ROD as the PTW concentration - ten times the 30 ng/kg clean-up level.

Table 5-1 presents the analytical data at all borings based on elevations (rounded to the nearest foot), with concentrations greater than 30 ng/kg $TEQ_{DF,M}$ indicated by bold text. In Table 5-1 a red line identifies the elevation at each boring at which there is a calculated risk of hydraulic heave, with a SF of 1.25. A green line indicates the design excavation elevation at each boring based on the criteria listed above. Table 5-2 presents the rationale for the design excavation elevations. Data from borings located within the northwest corner is included in Table 5-1 but the cells in that area have been greyed out. Data from these borings were not included in the calculations described, below.

The area-based average concentration for the post-excavation surface was calculated by assigning a polygon area to each boring (with the polygon extending approximately halfway to adjacent borings), then multiplying that area by the post-excavation surface concentration at that boring (concentration immediately below the green line in Table 5-1). The area-weighted concentrations for each polygon are reported at the bottom of Table 5-1 (shaded orange). The calculated total surface concentration was then divided by the sum of the individual polygon areas (10.64 acres) to arrive at an area-based average concentration of 23.31 ng/kg for the whole excavation area (shown in blue in the top left corner), which is below the 30 ng/kg $TEQ_{DF,M}$ clean-up level. The design excavation contours can be seen in Design Drawings C-08, C-13, C-17, C-21, and C-27 in Appendix G. As noted in Section 5.2, these design excavation elevations indicate the initial excavation depths that will be verified through post-excavation confirmation sampling. All borings located within the northwest corner, where there is a significant hydraulic heave concern, are marked with a grey tone and were excluded from the evaluation for determination of the area-based average concentration calculation.

As seen in Table 5-1, three boring locations (SJGB010, SJGB012, and SJSB046-C1) had results above 30 ng/kg $TEQ_{DF,M}$ in the deepest sample interval collected, as seen on Figure 2-9. At these locations, the design considered the adjacent co-located borings to determine the appropriate excavation elevations to complete the excavation bottom contours.

Based on the updated area-based average excavation limits, the approximate volume of waste material in the Northern Impoundment (excluding the northwest corner) is estimated at 168,000 CY. To facilitate a seasonal excavation approach, the total volume of material will be divided into multiple cells, with a single cell excavated each excavation season.

5.4 Pre-RA Activities

5.4.1 Property Access

To implement the RA, it will be necessary to have access to approximately 8 to 9 acres of dry land to utilize for lay-down storage of equipment, water storage and treatment, office trailers and parking. It is preferred that the property(ies) be located as close as possible to the Northern Impoundment to minimize the distance over which water requiring treatment needs to be conveyed. Property access will also need to be secured for the duration of the RA, which is expected to require at least 7 years and additional time to procure and mobilize equipment and personnel. Currently, several properties located in the vicinity of the Northern Impoundment are being evaluated. The general layout of the WTS is depicted in Drawings P-04 and P-08 (Appendix G). These layouts will need to be updated with site-specific detail in future design submittals once access to a property for laydown/staging has been secured.

Implementation of the Northern Impoundment RA will also require access to and utilization of the TxDOT ROW that runs parallel to I-10. As previously mentioned, in addition to providing the only land access route to the Northern Impoundment, the southern extent of the BMP will need to be installed on the TxDOT property. Executing the Northern Impoundment RA will require that an agreement be reached with TxDOT to allow for use of the TxDOT ROW both for access and purposes of construction of the BMP. In addition, as is discussed in more detail in Section 5.11.3, TxDOT plans to replace the I-10 Bridge beginning in the next 4 to 5 years. It is currently unknown as to how TxDOT's plans may impact its ability to allow access to its ROW for purposes of the Northern Impoundment RA, but it is expected that two large construction projects taking place at the same time in such a confined area will result in additional delays.

As part of RD efforts, the Respondents have engaged with the POHA and the HCFCD to inform these stakeholders about the planned alignment and design of the BMP wall that will be present in the San Jacinto River for at least 7 years. As requested by the HCFCD, a Floodplain Drainage Impact Analysis was conducted to evaluate the effect that the BMP could have on the surrounding floodplain. Water levels in the vicinity of the Northern Impoundment were evaluated with and without the BMP present under 2-year, 10-year, and 100-year flood scenarios. Modelling results indicated that the effects of the BMP on the surrounding floodplain would not be significant under all three scenarios. The evaluation was submitted to the HCFCD in a letter dated March 30, 2022 (GHD, 2022a). Comments were received from the HCFCD via e-mail on April 8, 2022 (HCFCD, 2022) and a revised letter was submitted on May 6, 2022 (GHD, 2022b). This letter is included in Appendix D and all hydrodynamic modeling performed to date is summarized in a Hydrodynamic Modeling Report, included as Appendix F. The hydrodynamic modeling data was also provided to TxDOT on April 4, 2022, to allow TxDOT to begin evaluating the effects of the BMP on its bridge structures.

5.4.2 Northern Impoundment Preparation and Layout

In order to facilitate waste material removal, solidification, and water treatment, the RC will be required to complete several activities to prepare to implement the Northern Impoundment RA.

Assuming that access can be obtained to use the existing TxDOT ROW to implement the RA, the existing TxDOT ROW cannot accommodate two-way traffic for haul trucks; therefore, the TxDOT ROW would need to be enhanced/widened in order to make Northern Impoundment RA operations efficient and safe. Widening the ROW may necessitate installation of a bulkhead along the north side of the TxDOT ROW to bolster and protect the roadway. This access road will also need to be built up as it approaches the south side of the Northern Impoundment, such that the elevation of the access road at the entrance of the Northern Impoundment will be at or above the BMP top elevation of +9 ft NAVD88. This access ramp will be constructed to allow truck traffic to traverse in and out of the Northern Impoundment, over the BMP wall, while maintaining a protective BMP height to prevent overtopping during the excavation season. In addition, the elevated roadway would need to be constructed in a manner that will accommodate TxDOT's need for its vehicles to have access to the ROW for purposes of maintenance of the existing I-10 Bridge structure and future construction of a replacement bridge structure. The area immediately north of the TxDOT ROW is owned by a third-party landowner and access to it will be required to improve the access road.

Working and staging areas on the Northern Impoundment are limited due to the existing topography and tidal conditions. On the west side of the impoundment, the existing TCRA armored cap rock creates uneven terrain that is not suitable for truck traffic. The east side of the impoundment is consistently covered in water during high tides. Therefore, access roads to and within the Northern Impoundment may need to be constructed in different areas of the Northern Impoundment, depending on which cell is being addressed, in order to allow for truck access and turnarounds. The exact nature and extents of these access roads will be determined by the RC as part of its initial work plan submittals.

Staging and laydown pads may need to be constructed on the selected off-site property for materials staging and water storage and treatment equipment. The RC will also provide power, communications, and water utilities for the water treatment equipment, as necessary.

The RC may need to construct mixing areas for soil solidification. The exact location of the mixing areas may vary from excavation season to excavation season. For each excavation season, the RC will determine the exact nature and location of mixing areas to be used during that season. It is anticipated that these mixing areas will be constructed in areas adjacent to active cells to mitigate excessive handling and transport of wet material.

5.5 BMP Wall

The following guidelines, standards, and technical manuals are the primary sources used to develop the design of the BMP:

- American Society of Civil Engineers (ASCE) 7-16, Minimum Design Loads and Associated Criteria for Building and Other Structures.
- USACE Engineer Manual (EM) 1110-2-2504, Design of Sheet Pile Walls by USACE.
- American Institute of Steel Construction (AISC) 360-16, Steel Construction Manual 15th Edition.
- USACE Hurricane and Storm Damage Risk Reduction System Design Guidelines, updated June 2012.
- American Association of State Highway and Transportation Officials (AASHTO) LRFD Bridge Design Specifications, = 2012.
- Nucor Skyline Technical Product Manual, 2021 Edition.
- Arcelor Mittal Impervious Steel Sheet Pile Walls Design & Practical Approach.

5.5.1 Structural Definitions

ASCE 7-16 categorizes structures into four Risk Categories (I through IV). During an excavation season, the BMP may be considered to be similar to structures or facilities that process, handle, or store toxic substances. ASCE 7-16 categorizes such structures or facilities as being in Risk Category IV, in which the failure of such structures or facilities may pose a significant hazard to the public.

EM 1110-2-2504 defines the following load case conditions based on severity and probability of occurrences during the design life of the structure:

- *Usual:* Service level loading experienced frequently such as static earth pressure, hydrostatic pressures after installation of the BMP and during excavation with normal water levels in the river.
- *Unusual:* Loads larger than those considered usual and experienced less frequently, such as 100-year probability storm events and flood levels in the river.
- *Extreme:* Worst-case scenario loads, rarely experienced during the design life of the structure, such as hurricane level winds and flood levels in the river.

5.5.2 Material

Material grades for the various structural components are summarized below:

- ***Sheet Piles*** ASTM A572 Grade 60 (Yield stress, F_y = 60 kilopounds per square inch [ksi])
- ***Tie rods*** ASTM A615 Grade 120 (F_y = 120 ksi))
- ***Walers*** ASTM A36 Grade 36 (F_y = 36 ksi)

For purposes of the design, the standard sections for sheet pile and tie-rods were selected from the Nucor Skyline Technical Product Manual. The manual also included the section properties used for design calculations. Alternative sections with equivalent properties are available from other manufacturers and may be used in construction.

5.5.3 Design Loads

5.5.3.1 In-Situ Soil

The soil parameters specific to the Northern Impoundment are discussed in detail in Appendix B and Appendix I. The subsurface soils include fine grained material that is expected to behave differently in drained (long-term) and undrained (short-term) condition. Both drained and undrained loading conditions were considered. The designations for soil parameters are in accordance with the Unified Soil Classification System (USCS).

Drained and undrained clays and silts behave differently under loading and have different strengths with respect to time and duration of the applied load. Submerged clays loaded rapidly and for short duration behave the same as an undrained soil since drainage cannot occur through the clay particles in a short time, a condition which is referred to as the Q-case (EM 1110-2-2504). Over longer time frames, clay will drain, and the apparent strength will change. This condition represents the S-case loading (EM 1110-2-2504). Results of the stability analysis include strength from both cases, Q-case and S-case.

5.5.3.2 River Water

The loading from the river water with a density of 62.4-pound per cubic feet (lb/ft^3) would be applied as hydrostatic pressure to the exterior and interior BMP faces. Water elevations for various load case conditions are as follows:

- ***Usual*** +5 ft NAVD88
- ***Unusual*** +9 ft NAVD88
- ***Extreme*** +9 ft NAVD88

5.5.3.3 River Flooding

Based on the Federal Emergency Management Agency (FEMA) Flood Map (effective on January 16, 2017), the Northern Impoundment is designated as a special flood hazard area referred to as Zone AE. Since the excavation is planned to be completed seasonally (November to April) outside the period during which there is a greater risk of flooding events and it is anticipated that the structure will be flooded with river water during the non-excavation season, FEMA flood loads were not considered for the design of the BMP. Refer to Section 5.3.1 for discussion of river elevations and selection of the design water level.

5.5.3.4 Scour

The presence of the BMP will affect the natural flow state of the San Jacinto River in the vicinity of the Northern Impoundment. The scour potential of the river flow around the BMP installation was evaluated using the Hydrodynamic Model developed for the Northern Impoundment. The analysis methods and results are provided in Appendix F. The evaluation indicated that the BMP diverted flow to the north side of the Northern Impoundment, decreasing velocities adjacent to I-10 Bridge. The increased flow also corresponded with increased shear stress at the southwest and north side of the BMP.

The 95th percentile shear stress for the BMP conditions have a maximum value of 2.3 pascals (Pa) and an average value of 0.11 Pa. The maximum value of the 95th percentile shear stress difference is 1.84 Pa with an average value difference of less than 0.01 Pa. Shear stress differences around the BMP are maximum in two spots with a larger value and difference at the southwest corner of the BMP, and the other at the north side of the BMP. The shear stress values are large compared to the critical shear stress value of 0.15 Pa for the sediment in the area, indicating that the soil particles are mobile and there is potential for scour and/or sediment deposition along the outside perimeter of the BMP.

The relatively small value of the average 95th percentile shear stress indicates that, except for the two locations discussed above, the conditions overall remain similar to the existing conditions (without the BMP in place). The pattern is similar for all the three modelled storm conditions (2-year, 10-year, and 100-year storm events) with only differences in magnitude.

As changes in the riverbed elevation will affect the design of the BMP, scour protection measures such as rock or rip-rap may be required around the outside perimeter of the wall.

5.5.3.5 Wind

The 3-second gust design wind speeds and hurricane exposure are defined in ASCE 7-16 Chapter 26. The web-based hazard tool by ASCE (**https://asce7hazardtool.online**) provides site-specific information. The standard design wind speeds relate to a maximum recurrence interval (MRI) of 100-years. The wind speeds for Risk Category IV structure in hurricane exposure areas correspond to MRI of 3000-years. All wind speeds are defined at 33-ft above ground level.

- Design wind velocity, 3-second gust, MRI 100-years, V_{100} = 116 miles per hour (mph).
- Design wind velocity, 3-second gust, MRI 3000-years, V_{3000} = 154 mph.
- Exposure Category C.
- Wind directionality, K_d = 0.85 (solid freestanding wall).
- Topographic Factor, K_{zt} = 1.0.
- Ground Elevation Factor, K_e = 1.0.
- Velocity Pressure Exposure Coefficient, K_z = 0.85.

Velocity Pressure, $q_z = 0.00256\ K_z\ K_{zt}\ K_d\ K_e\ V^2$.

Using $V = V_{100}$, qz_{100} = 24.89 pounds per square foot (lb/ft^2) (Unusual load condition).

Using $V = V_{3000}$, qz_{3000} = 43.87 lb/ft^2 (Extreme load condition).

Velocity pressure from wind (q_z) was applied as uniformly distributed load on the exterior of the BMP.

5.5.3.6 Barge Impact

Given the heavy barge traffic in the San Jacinto River, there is a potential that the BMP will be struck by a barge. An impact could be the result of a barge coming off its mooring and drifting toward the BMP during a storm or it could be the result of a towed barge veering off course. The segment of the river around the BMP actively used by barges is shown on Figure 5-G. The barges traveling in the navigational waterway, either empty or loaded, would be likely to make contact with the BMP at an angle. The barges moored directly north of the BMP would be likely to make head-on contact with the BMP.

Impact Force

The kinetic energy from impact can be determined as follows, where velocity may be either the flow velocity or the navigation speed. The energy of impact will be lower for any impact angle other than head-on collision.

Kinetic Energy of Impact = 0.5 x Mass x (Velocity x cosine (α))^{2}.

Where:

cosine (α) = directional factor for impact angle relative to the velocity vector

= 1 for Head-on impact, i.e., 0 degrees relative to velocity vector

The kinetic energy will be absorbed by the structure but the barge itself will absorb some energy and suffer damage. The AASHTO[1] method to determine impact force absorbed by bridge piers is being used for evaluating the BMP. This method is conservative since the BMP has a larger profile area than the typical bridge piers to absorb impact and distribute the energy.

Figure 5-G *Navigational Waterway - Northern Impoundment*

USACE developed design guidelines outlining minimum impact forces for hurricane protection structures.[2] These include structures in protected waterways not exposed to tidal surge (Zone 1A), similar to the conditions at the

[1] AASHTO LRFD Bridge Design Specifications, Section 3.14.
[2] USACE Hurricane and Storm Damage Risk Reduction System Design Guidelines, Section 5.2.1.

Northern Impoundment. The extreme load condition criterion for Zone 1A corresponds to an impact force of 400 kilopounds (kips) from a light (empty or ballast condition) barge applied at the top of the wall with hydrostatic pressure induced by the 100-year still water level and wind load applied on any exposed portion of the wall. It should be noted that heavier (loaded or laden condition) vessels did not govern the design as the velocities of these vessels were considerably less.

AASHTO requires all bridge piers located in navigable waterway crossings to be designed for ship and barge impact. The required minimum impact load corresponds to a 195-ft long, 35-ft wide and 12-ft tall empty hopper barge (displacement = 200-ton), drifting toward the structure. This barge size is representative of the barges in the area.

TxDOT's design criteria for the dolphin and fender system protecting the I-10 Bridge piers includes impact from a 30,000-barrel (BBL) barge, one of the larger barges in the area. A typical 30,000 BBL barge is 300-ft long, 54-ft wide, and 12-ft tall. In laden condition, the barge is loaded to full capacity and displaces 30,000 BBL equivalent or approximately 168,500 cubic feet (ft^3) of water. Thus, the barge weighs approximately 5,250 US-tons or 10,500 kips in laden condition. In ballasted condition, the barge carries only fuel and ballast water, and weighs approximately 910 US-tons or 1,820 kips.

The head-on impact from the 54-ft wide, 30,000 BBL barge was evaluated. A contact width of 50-ft was assumed to account for variations in barge bow shapes.

Impact Velocity

The hydrodynamic model (Appendix F) evaluated the flow velocities for three storm conditions at 2-year, 10-year, and 100-year recurrence intervals, both with and without the BMP present. The 95th percentile velocities for the river flow from the hydrodynamic analysis report are summarized in Table 5-A.

Based upon this data, the barge impact for the BMP was evaluated for flow velocity of 2.20 feet per second (ft/s).

Table 5-A 95th Percentile Velocity - Hydrodynamic Model

95th Percentile Velocity (ft/s)	Existing Conditions (No BMP)			With BMP in Place		
	2-Year	10-Year	100-Year	2-Year	10-Year	100-Year
Maximum	2.21	1.45	0.73	2.16	2.20	1.04
Average	0.51	0.50	0.35	0.46	0.50	0.36

5.5.4 Load Combinations

The following load combinations (LC) are appropriate for the structural design in accordance with Allowable Stress Design in ASCE 7-16, Section 2.4.

LC#1 D + H + F

LC#1A D + H + F + I

LC#5 D + H + F + 0.6W

Where:

D = Dead load

F = Fluid load (hydrostatic pressure)

H = Lateral earth pressures (active and passive)

W = Wind Load on exposed surfaces (interior and/or exterior)

I = Barge Impact

LC#1 was evaluated for both Usual and Unusual load conditions. LC#1A was used to evaluate the barge impact as extreme load condition with water level at +9 ft NAVD88. An impact at lower water levels will cause less rotation in the structure.

LC#5 combines wind load with other loads acting on the BMP. It is noted that wind load is applicable only to the exposed height of BMP above ground or water level. At the design water level for Unusual or Extreme conditions (+9 ft NAVD88), the BMP exterior would not be exposed to wind.

A parametric evaluation was performed for the effect of wind loads on the design of BMP using LC#5. The 0.6 reduction factor for wind load was conservatively ignored for the evaluation. The net load ($F + W_{Exterior} - W_{Interior}$) on the BMP, calculated as sum of the hydrostatic load and the wind load applied to both interior (above ground) and exterior (above water level), was compared to the hydrostatic load with water level at +9 ft NAVD88 acting alone. The net load was determined to be lower. Given that D + H are common to both load cases, LC#5 did not govern over LC#1 and was not evaluated further.

ASCE 7-16 recommends reduction in the load factor for resisting (passive) lateral earth pressure to 0.6. The intent of the reduction is to design structures resistant to overturning by reducing the resistance. Since the BMP wall was designed for overturning (rotational) stability with adequate embedment as described in Section 5.5.6, a reduction for lateral earth pressure was not considered.

5.5.5 Design Criteria

5.5.5.1 Failure Modes

EM 1110-2-2504 describes the following three primary failure modes for sheet pile wall systems:

1. The unstable slopes may cause a deep-seated rotational failure of the entire soil mass. The slope failures are independent of the sheet pile embedment and location of the anchor system. This type of failure can be addressed by changing the geometry of the retained material or improving the soil strength.
2. The sheet piles with inadequate embedment depth can be subjected to rigid-body rotational failure due to the lateral pressures exerted by the retained material. The classical design procedures such as the “free earth” Limit Equilibrium Method calculate the sheet pile embedment depths by balancing the active pressures behind the wall against the passive pressures provided by soil in front of the sheet piles. Adequate embedment depth is achieved at depth where the sum of horizontal forces and sum of moments is zero. Rigid-body rotational failure can be prevented, according to EM 1110-2-2504, by incorporating safety factors to decrease the passive pressures as appropriate for different loading conditions.
3. The sheet pile systems with stable slopes and adequate embedment may fail if the sheet pile sections, tie-rods, and/or the anchor components are overstressed or inadequately sized. Such failures can be prevented, according to EM 1110-2-2504, by incorporating safety factors in the design by limiting the allowable stress as appropriate for different loading conditions.

5.5.5.2 Safety Factors

The following safety factors and allowable stress limits were adopted in the design of the BMP with respect to the failure modes described in Section 5.5.5.1, consistent with EM 111-2-2504.

Embedment Depth

EM 1110-2-2504 recommends the minimum safety factors provided in Table 5-B to determine embedment depth for cantilever or anchored sheet pile wall systems. It should be noted that the safety factors are suitable for the “free earth” Limit Equilibrium Method where the sheet pile is considered a rigid body allowed to rotate about a point below ground level, and the active and passive pressures are balanced to determine the embedment depth. Adequate embedment depth is achieved at depth where the sum of horizontal forces and sum of moments is zero. The pressures, and resulting forces in the system, are considered independent of the wall displacement in the Limit Equilibrium Method.

The cantilever wall BMP presented in the 30% RD acted as both a floodwall and a retaining wall by maintaining differential water (higher water in the river) and soil elevations (excavation below riverbed elevation). However, the current BMP system in the new alignment primarily serves as a floodwall by maintaining a different water elevation between the excavation area and the San Jacinto River. The sheet piles are terminated in the fine grain soils of the Beaumont Clay layer. Hence, both the undrained (Q-Case) and drained (S-Case) conditions were evaluated to determine the stability of the BMP.

Table 5-B Safety Factors for Passive Pressures - EM 1110-2-2504

Loading Case	Floodwalls		Retaining Walls	
	Fine-Grain Soils	Free-Draining Soils	Fine-Grain Soils	Free-Draining Soils
Usual	1.50 Q-Case 1.10 S-Case	1.50 S-Case	2.00 Q-Case 1.50 S-Case	1.50 S-Case
Unusual	1.25 Q-Case 1.10 S-Case	1.25 S-Case	1.75 Q-Case 1.25 S-Case	1.25 S-Case
Extreme	1.10 Q-Case 1.10 S-Case	1.10 S-Case	1.50 Q-Case 1.10 S-Case	1.10 S-Case

Sheet Pile Sections

EM 1110-2-2504 recommends the maximum allowable stresses provided in Table 5-C for the sheet piles subject to different load case conditions. By definition of the various load case conditions (Section 5.5.3), the BMP is subject to Unusual and Extreme load case conditions less frequently than the Usual load case conditions. Hence, the allowable stresses are relatively higher for the more severe loading scenarios to provide design solutions appropriate for Unusual and Extreme load case events.

Table 5-C Allowable Stresses for Sheet Piles - EM 1110-2-2504

Load Case Conditions	Combined Bending and Axial Stress	Shear Stress
Usual	$0.50\ F_y$	$0.33\ F_y$
Unusual	$0.67\ F_y$	$0.44\ F_y$
Extreme	$0.88\ F_y$	$0.58\ F_y$

Tie-Rod Sections

The tie-rod sections, included in Table 5-D, are designed using allowable stress design methods in accordance with AISC 360. The tie-rods are critical to balance the forces and displacements of the BMP.

Table 5-D Allowable Stresses for Sheet Piles - EM 1110-2-2504

Limit State	Overstrength Factors
Tensile Yielding	1.67
Tensile Rupture	2.00
Tensile Rupture of Threaded Parts	2.00

If one tie-rod fails, the loads will be redistributed to the adjacent tie-rods. The individual tie-rods are designed for 150 percent of the demand loads, accounting for a tie-rod failure event where the loads are redistributed to adjacent tie-rods and preventing progressive failure and thereby, increasing the safety factor.

Walers

The walers are longitudinal beams connected to the tie-rods on the exterior face of the sheet piles. The walers distribute the loads from the sheet piles to the tie-rods and minimize variations in displacement along the BMP. In order to provide a continuous longitudinal beam, the individual waler beams will be spliced using bolted connections.

The waler are evaluated as simply supported multi-span beams with tie-rods providing the support reactions. The walers are also evaluated for condition with a longer span (150 percent) accounting for a tie-rod failure thus able to redistribute loads to the adjacent tie-rods. The walers are designed using allowable stress design method in accordance with AISC 360, provided in Table 5-E.

Table 5-E   Overstrength Factor for Walers - AISC 360

Limit State	Overstrength Factors
Flexure or Bending Stress	1.67
Shear	1.67

5.5.5.3 Deflection

Total system displacement comprised of structural steel deformation, rotation and translation of the entire BMP and soil system was evaluated for the proposed BMP.

Neither EM 1110-2-2504 nor ASCE 7-16 provide guidance on limiting system deflection. For a cantilever sheet pile system, structural steel can deform significantly before structural failure occurs; hence, structural steel deformation could not be used as a limiting parameter in the previous submittal (30% RD).

The combination of tie-rod anchors and adequate embedment of sheet piles restrain the deflection in the sheet piles. The deflection at the top of the sheet pile translate to local deformations in the structure. These deformations are accounted for by the bending stress in the sheet piles and tensile stress in the tie-rods. The stresses will be limited within the allowable stress (Section 5.5.5.2) and within the elastic range (less than F_y) to avoid structural failure of the BMP.

5.5.5.4 Corrosion Protection & Maintenance

The Northern Impoundment BMP structures were designed for temporary, short-term use. It was assumed that the sheet piles would remain in place for a period of approximately 7 years after installation. Figure 5-H shows the five exposure zones typically considered for corrosion. It also shows a schematic for varying thickness loss along the height of the steel sheet piles exposed to a marine environment.

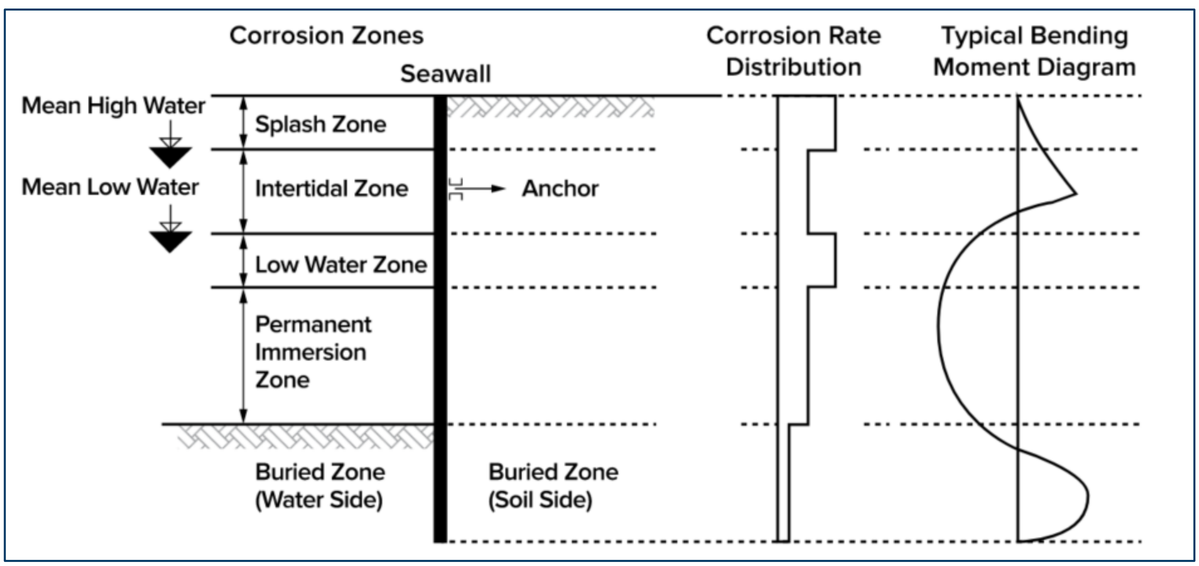


Figure 5-H   Typical Thickness Loss - Nucor Skyline Catalog, Ports & Marine Construction

The loss of thickness due to corrosion relative to different exposure conditions are listed in Table 5-F. The corrosion rates are representative of industry-wide accepted rates where site-specific data is unavailable. Since the Northern Impoundment is located in brackish water, an average of total thickness loss for river (0.008 inches) and seawater (0.027 inches) exposure is appropriate (these two values are indicated in bold font in Table 5-F, below). The duration of exposure to each zone varies significantly on the exterior and interior face of the BMP. It is conservative to assume the same thickness loss on both sides of the sheet pile. A uniform sacrificial thickness of 0.035-inches (2 x 0.0175 inches) was included for each side of the sheet pile for the entire height of the wall. No additional maintenance should be required for the assumed 7-year RA period.

Table 5-F Loss of Thickness due to Corrosion

Description of Exposure[1]	Loss in 5 Years[1] (inches)	Loss in 25 Years[1] (inches)	Loss in 7 Years[2] (inches)
Common fresh water (river, ship canal) in the zone of high attack (water line).	0.006	0.022	**0.008**
Very polluted fresh water (sewage, industrial effluent) in the zone of high attack (water line).	0.012	0.051	0.016
Sea water in temperate climate in the zone of high attack (low water and splash zone).	0.022	0.074	**0.027**
Sea water in temperate climate in the zone of permanent immersion or in the intertidal zone.	0.010	0.035	0.013

Notes:

1 Eurocode 3 - Design of Steel Structures, Part 5: Piling, BS EN 1993-5:2007.

2 Interpolated between 5 Years and 25 Years.

5.5.6 BMP Wall Analysis

The BMP cross-sections were analyzed for stability and determining stress in the structural components using Plaxis 2D, a finite element software program developed by Bentley Systems, Inc. The program can model complex soil profiles, structural sections and perform soil-structure interaction analysis to achieve a solution with compatible forces and displacements. The analysis also incorporates a time variable simulating the various stages of construction, such as end of sheet pile installation, adding fill between the walls, installing tie-rods, dewatering the excavation area after BMP is installed, and excavation to allow for consolidation or dissipation of porewater pressures. Additional details of the analyses for all cross-sections are provided in Appendix I.

The finite element analyses using soil-structure interaction incorporate the non-linear behavior of the soil, wall displacements and flexibilities of the sheet pile and anchors. The active and passive pressures vary as the system flexes to achieve a solution by balancing the forces and displacements in the entire system. By inherently balancing the forces and displacements, the system achieves a larger safety factor against rotational failure than the “free earth” Limit Equilibrium Method. Thus, the safety factors (Section 5.5.5.2) are not applied to determine effective soil parameters for calculating passive pressures.

The behavior of the BMP varies with the height of the sheet piles above riverbed and the subsurface strata. Hence, multiple cross-sections were evaluated to account for the variations in riverbed elevations, cross-slope of the riverbed along the BMP alignment, thickness of Alluvium Sediments, anticipated top of Beaumont Clay layers, and distance from the BMP to the excavation. Figure 5-I, below, shows the approximate extent of each cross-section selected for the analyses and the summary of results are provided in Table 5-H. These extents are approximate and may change in the final design to accommodate design optimizations, and other considerations related to standardizing construction practices.

Additional considerations were applied to Cross-Sections C2, C6, and C7 due to reasons described, below.

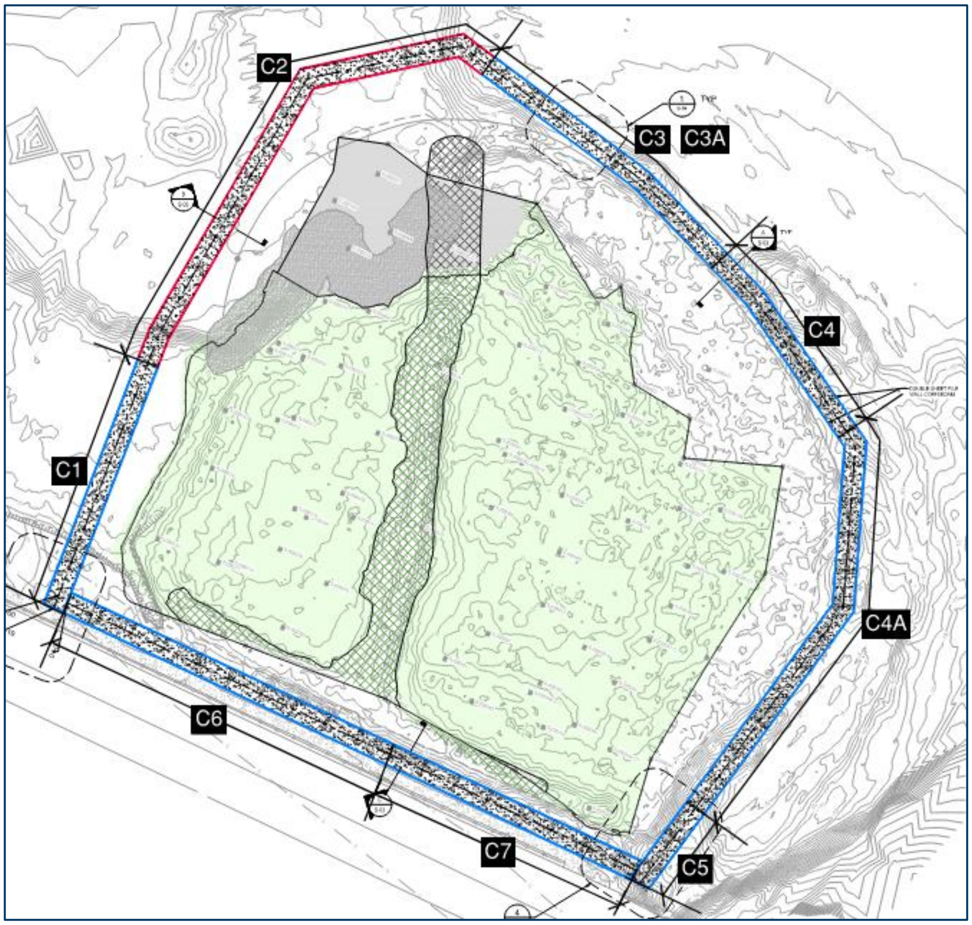


Figure 5-I *BMP - Limits of Cross-Sections C1 to C7*

5.5.6.1 Cross-Section C2

Cross-Section C2 represents the extent of the tallest height of the BMP above riverbed elevation (approximately -15 ft NAVD88). The approximate retained height on both the exterior and interior sides is 24 ft. The large height above the riverbed overstressed the sheet piles and tie-rods. Hence, a 30 ft wide Raised Bench (imported fill material) constructed above the Soil Buttress, to elevation -10 ft NAVD88 is required on the interior side to reduce the stresses. The sheet piles and tie-rods required to meet the demand loads are the among the largest standard sections available. The tie-rods are required to be installed at elevation -5 ft NAVD88, significantly below the normal water levels in the river, which has the potential to pose a safety hazard during construction.

This cross-section was analyzed and determined to be adequately designed assuming use of excavation methodology similar to that used in other areas in the Northern Impoundment as well as for other remedial alternatives. However, it should be noted that the areas in the northwest corner are subject to pronounced risk of hydraulic heave as described in the Geotechnical Engineering Report (Appendix B), and a different excavation methodology will need to be identified for the northwest corner.

5.5.6.2 Cross-Sections C6 and C7

Cross-Sections C6 and C7 represent the BMP along the alignment parallel to the I-10 Bridge. In the alignment previously presented in 30% RD, the BMP was placed directly at the edge of the existing berm and excavation limits extended to the sheet pile. The existing ground elevation varies between elevation 0 ft and Elevation +5 ft NAVD8S. The BMP design elevation at bottom of excavation is -14 ft NAVD88 and -20 ft NAVD88 for Cross-Section C6 and Cross-Section C7, respectively. The TxDOT ROW runs between the elevated portion of the freeway and the southern boundary of the Northern Impoundment.

Several concepts for the BMP, as described in the BMP Design Structural Report (Appendix I), were evaluated to determine if there an implementable solution along the original alignment. The significantly large height retained above the anticipated excavation bottom, the inability due to space constraints to include a Soil Buttress, and the need for active excavation along the face of the BMP resulted in the BMP (and the anchor system, where applicable) extending into the deeper sand layers. Due to concerns with pile driveability and associated vibrations in the vicinity of the I-10 Bridge, the ExxonMobil pipeline assets, and other underground utilities and other considerations, these concepts were considered unfeasible.

The only workable solution was a double-wall system, approximately 30-ft wide, similar to the double-wall around the balance of the Northern Impoundment. This required moving the BMP alignment farther south into the TxDOT ROW to allow for a sloped Soil Buttress beginning at Elevation 0 ft NAVD88 and extending into the excavation area. This placed the double wall within the TxDOT ROW, with the outer wall being approximately 20 ft from the I-10 Bridge guardrails on the TxDOT ROW.

Additional details are provided in Appendix I.

5.5.7 Barge Impact

Two cross-sections, C2 and C4 were analyzed with barge impact loads in Plaxis. These cross-sections have the largest retained height above the riverbed and are considered to be the most critical cross-sections for evaluating a potential impact at the top of the wall.

A 400 feet long three-dimensional model was created with the same stratigraphy, material properties and stages as the analysis sections described in Section 5.5.56. The linear elastic plates representing the sheet piles were assigned orthotropic parameters to capture the difference in stiffness of the vertical and horizontal directions. The barge impact load was applied as a static uniformly distributed load over a 50-ft x 1-ft area at top of the wall. Due to the instantaneous nature of the impact, the loads are evaluated using the undrained soil parameters and considered an Extreme load condition, with the impact at top of the wall with the water levels at +9 ft NAVD88.

The following two scenarios, which took into account multiple impact velocities and two barge displacement conditions (ballasted or laden), were evaluated. The loads correspond to higher velocities of flow for impact, than as summarized in Table 5-A, with a barge in ballasted condition, hence conservative for the analysis. However, for the laden condition, the loads represent the limiting loads.

Case 1: 20 kip/ft x 50 ft = 1000 kip:

- Corresponds to contact with 54 ft barge in ballasted condition at impact velocity of 3.8 ft/s or,
- Contact with 54 ft barge in laden condition at impact velocity of 1.6 ft/s

Case 2: 28 kip/ft x 50 ft = 1400 kip:

- Corresponds to contact with 54 ft barge in ballasted condition at impact velocity of 5.3 ft/s or,
- Contact with 54 ft barge in laden condition at impact velocity of 2.2 ft/s

The barge impact loads caused localized deformation of the wall along with increase in soil shear strains. However, the strains did not indicate a global failure would occur. In this scenario, there would be localized damage to the BMP due to limiting flexural capacity. The analysis results are summarized in Table 5-G.

Table 5-G Barge Impact Analysis Output

Analysis Cross-Sections	Design Load (kip/ft)	Total Applied Force (kip)	Analysis Demands per LF			DCR - Moment	DCR - Shear
			Moment (kip-ft)	Shear (kip)	Deflection (ft)		
C2, AZ 40-700N	20	1000	342.4	64.5	1.4	1.11	0.19
	28	1400	465.9	68.5	2.8	1.51	0.21
C4, AZ 26-700	20	1000	159.6	39.6	0.8	0.81	0.14
	28	1400	251.2	39.6	1.6	1.28	0.14

Detailed analyses, results, and plots are provided in Appendix I.

As Cross-Section C2 is not near the navigational waterway, it was evaluated for impact with barge in ballasted condition only, under the assumption that any impact would be from moored barges. Under this scenario, the sheet piles would be overstressed by 11 percent (moment capacity) at an impact velocity of 3.8 ft/s, greater than the 95^{th} percentile maximum velocity expected in the river (Table 5-A). Hence, Cross-Section C2 is considered adequate for impact loads from a 30,000 BBL, 54-ft wide barge in ballasted condition traveling at 2.2 ft/s.

Cross-Section C4 is closer to the navigational waterway and would be expected to potentially encounter impact with barges, ballasted or laden, as they are towed. Cross-Section C4 is considered adequate for impacts at velocity of 3.8 ft/s and 1.6 ft/s for barges in ballasted and laden condition, respectively.

The impact loads also reduce significantly at lower velocity of impact. The barges and tugboats typically slow down as the width of the navigational waterway reduces closer to the I-10 Bridge. Navigational signs could be posted on the exterior face of the BMP to require marine vessels to reduce speeds along the eastern side of the BMP.

5.5.8 Summary of Results

The summary of the structural sections required for the BMP is provided in Table 5-H. As extents of Cross-Sections 3 and 3A overlap, the BMP will be conservatively built as evaluated for Cross-Section 3.

Table 5-H Summary of Analysis Results

Analysis Section	Sheet Pile Section		Tie Rod Section		Waler Section
	Nucor Skyline	Length (ft)	Diameter (inches)	Spacing (ft)	
C1, C3, C3A, C4, C4A	AZ26-700	50	2.25	5	MC 12X35
C2	AZ40-700	55	3.00	5	MC 18X45.8
C5, C6, C7	AZ26-700	60	2.25	5	MC 12X35

5.5.9 Pile Driveability and Vibration Analysis

During the March 25, 2020, TWG Meeting, the design team was asked to perform an evaluation to quantify the risks associated with pile driving-induced vibrations and potential releases from the Northern Impoundment that may result from these vibrations. A vibration analysis for driving large diameter steel pipe piles into deep sands was performed and included in the 30% RD. Since the submittal of the 30% RD, the BMP concept has changed from cantilever (large diameter pipe piles) to a double wall system with Z-shaped steel sheet piles. The alignment of the BMP has been revised to install the sheet piles outside the perimeter of the TCRA armored cap and beyond the edges of the steep slopes present near both the northwest corner and east side adjacent to the I-10 Bridge. The sheet piles will also be terminated in the Beaumont Clay layer instead of driving into the stiffer sand layers, thereby, reducing the potential for vibrations significantly.

The vibration analysis performed for the cantilever wall design from the 30% RD is included in Appendix I. The analysis provided the limits of acceptable vibrations for the soil and ground slope for installation of the large sections. The installation method, equipment size, type, and energy required to install the smaller sections, such as the Z-shaped sheet piles will be within such limits.

5.6 Excavation Procedures

5.6.1 Excavation Sequencing

To allow for the removal of waste material during the excavation season (between November and April), the Northern Impoundment RA work will likely be divided into five cells (one of which would include the northwest corner), with a single cell being remediated each excavation season. Prior to commencing any excavation activities, the initial season will involve site preparation activities and installation of the BMP around the entire excavation area, as detailed in Section 5.5. The order of cell excavation will likely include a sequence that allows the cell containing the northwest corner to be remedied first and the cell containing the upland working area (southwest corner) to be excavated last, although the excavation volume for each season will be determined by the RC and optimized based on weather conditions and productivity achieved during each season. The conceptual project sequencing is shown on Figure 5-D.

5.6.2 Excavation Methodology

Following BMP installation and water removal, the material in a seasonal cell will be excavated. For the cells other than the one encompassing the northwest corner, excavation will be performed utilizing standard track-mounted excavators located on dry land. The excavator would be positioned where it can reach into the excavation and swing around to load trucks or place material directly into a mixing pad. Where required, the excavator could track down to a ledge or bench to reach deeper or further, but generally, the excavator would operate from upland locations. Excavation methodology is detailed below. The details provided below are for excavation of the cells other than the cell encompassing the northwest corner.

5.6.2.1 Cell Dewatering

Following the installation of the BMP around the entire excavation area, river water will become trapped behind the BMP. At the beginning of each excavation season (and prior to removal of any portion of the TCRA armored cap to be removed during that excavation season), the river water located behind the BMP would be pumped back into the river to allow waste material removal activities within each cell to be conducted using land-based equipment in relatively dry conditions. At the end of each excavation season, the exposed slope of the excavation will be capped, and the area within the BMP wall may be intentionally flooded. At the start of the next excavation season, the river water trapped behind the BMP will again be returned to the river to allow the seasonal excavation to be reinitiated.

5.6.2.2 TCRA Armored Cap Removal

During each excavation season, after the cell to be excavated during that season is dewatered, the portions of the TCRA armored cap within that cell will be removed to expose the waste material for excavation. It is anticipated that only the portion of the TCRA armored cap in the specific I area in which waste material is being excavated will be removed (and the waste material exposed) at any given time. The rock may be salvaged for re-use during or after the RA. Depending on the space available on the Northern Impoundment, the rock removed during each excavation season may be stockpiled on the impoundment itself or at a nearby location. As part of TCRA armored cap removal, the geotextile and geomembrane barrier of the TCRA armored cap will be disposed of off-site.

5.6.2.3 Excavation Procedures

For each area in which the TCRA armored cap has been removed, excavation of the waste material to the target excavation elevations will take place using excavators. Any waste material that does not contain free liquids and/or does not require solidification may be loaded directly in haul trucks for off-site disposal. Waste material that contains free liquids and/or requires solidification will not be directly loaded into the haul trucks for off-site disposal and may be managed as described in Section 5.6.3.

As excavation activities advance below grade, dewatering sumps may be required to remove water in advance so the waste material can be dried out as much as possible prior to it being excavated. Following dewatering, the waste material may still be too wet (i.e., would not pass the paint filter test) to be directly loaded into haul trucks. This material would need to be temporarily staged and allowed to dry naturally and/or be solidified for off-site disposal. An earthen ramp will be constructed over the lip of the BMP to allow truck traffic into and out of the Northern Impoundment. Interior berms will be constructed seasonally to convey stormwater such that non-contact stormwater that falls directly onto the TCRA armored cap or areas of the excavation that have been confirmed clean can be segregated from contact stormwater that falls directly onto waste material. Non-contact water may be returned directly to the river, untreated. Contact water that accumulates in the excavation area during the excavation season will be pumped out, as needed to maintain excavation operations, to a WTS where it will be treated and discharged to the river, as described in Section 5.8.

5.6.2.4 Excavation Season Production Rates

The approximate volume of waste material removal within the Northern Impoundment is estimated at 168,000 CY (excluding the northwest corner), using the area-based average concentrations described in Section 5.3.4. To facilitate a seasonal excavation approach, the total volume of material would be divided into multiple cells, with a single cell excavated during each excavation season. Seasonal cell sizes will not be prescribed, but instead a target production rate will be maintained that should accomplish the full excavation over the course of five excavation seasons (including the northwest corner). The volume of waste that can be removed, transported, and disposed of during an excavation season (i.e., production rate) is based upon the following factors, and will continue to be analyzed/optimized throughout the RA:

– ***Volume and Removal Rates*** -The tentative cell sizes have been established so that the volume of planned removal from within each cell could be achieved within the excavation period of November through April.
– ***Excavation Depth*** - Depending upon the results of post-excavation confirmation sampling, the depths of the seasonal excavations could increase, which may, in turn, limit the area that can excavated in that season.
– ***Access and Implementability*** - The tentative seasonal cells assume sustained access to each area for necessary excavation equipment and trucks. To the extent that such access is not available, or there are limits on access (i.e., restrictions on access to the highway due to activities associated with the I-10 Bridge replacement project), it may reduce the volume that can be excavated during a single excavation season.
– ***Transportation and Disposal*** - The target seasonal production rate that the tentative cell sizes are based on is dependent on the ability to efficiently and consistently load out and transport waste material to an off-site landfill.

The assumptions and limitations of waste transport and disposal as a basis of the design are further discussed in Section 5.7.2.

5.6.3 Solidification and Load-Out

If the waste material does not pass the paint filter test for direct load out, it may need to be solidified prior to transport to the off-site disposal facility. This may be achieved by mixing in drier material, either from the excavation or using a solidifying reagent, such as Portland cement or lime. Solidification activities will likely be conducted on a designated mixing pad inside the confines of the BMP, or at a nearby location as space becomes limited within the BMP, prior to load out in the haul trucks.

5.6.4 Post-Excavation Confirmation Sampling

Post-excavation confirmation sampling will be implemented concurrently with excavation activities as the design elevations are achieved. As detailed in the FSP (Appendix J, Attachment 3), composite sampling across decision units (DUs) within each seasonal excavation cell will be used to demonstrate compliance with the clean-up level. Following excavation of an approximately 1/2-acre DU, six to eight (6 to 8) discrete samples will be collected from sample locations evenly spaced across the DU excavation bottom. A composite sample of these discrete samples will be prepared for laboratory analysis. A portion of each discrete sample will also be held by the laboratory pending the results of the composite sample analysis so that potential areas of over-excavation within each DU (areas in which additional excavation is necessary if clean-up levels are not met) can be targeted, if necessary.

Following laboratory analysis of the composite sample, the result would be compared to the clean-up level. Results will be evaluated as described below.

- If the result of a composite sample is below the clean-up level, the excavation of that DU is complete.
- If the result of a composite sample is above the clean-up level, the discrete samples that the laboratory is holding may be analyzed to better pinpoint the location(s) within the DU at which the exceedances may be located. This will allow for targeted over-excavation.
- If discrete samples are analyzed, and if one or more of the discrete samples yields a result that would cause the calculated average of the discrete samples in that DU to be above the clean-up level, that portion of the DU may be over-excavated. Prior to over-excavation, the health and safety risks associated with over-excavation in that location would be evaluated:
  - If there is no health and safety risk associated with over-excavation, that portion of the DU would be over-excavated by up to one additional foot (delineated using locations which are halfway between sample locations).
  - Following over-excavation of that portion of the DU, a new discrete sample representing that portion would be collected and a new mathematical average would be calculated using the results from the original discrete samples but replacing the result of that portion with the new post-excavation result. This process would continue until the calculated average of the discrete samples in the DU is below the clean-up level. At that point, the excavation of that DU would be complete.
  - If it is deemed that over-excavation may compromise the BMP or excavation integrity (as in the case of hydraulic heave) or poses risks to worker safety, a risk management decision for that area will be made in coordination with the EPA.

Although the design excavation elevation contours are based on an area-based average concentration less than the clean-up level, as presented in Table 5-1, those elevations are only a starting point for the design. The post-excavation confirmation sampling results will be used to define whether the clean-up level has been achieved for each DU.

5.6.5 Excavation Area Restoration

There are no post-excavation restoration measures identified or required as part of the ROD. However, restoration activities may utilize the recycled TCRA armored cap rock, clean berm material, and/or clean imported sand or aggregate for restoration activities in lieu of disposing of these clean materials. These post-excavation restoration measures may be employed during the work, at the end of a working season, or after the completion of all excavation activities. After excavation along the south edge of the impoundment has been completed, a soil embankment would be constructed at an approximate 4-foot horizontal to one-foot vertical (4:1) slope along the vertical excavation face to support the exposed bank.

5.7 Characterization, Loading, Transportation, and Disposal

The RD elements related to the loading, transportation and off-site disposal of waste material from the Northern Impoundment are outlined in the TODP, included as Appendix J Attachment 8 to this 90% RD.

5.7.1 Waste Characterization

As summarized in Section 3.3, the waste material in the Northern Impoundment is not a listed hazardous waste under 40 CFR Part 261, Subpart D. Furthermore, waste characterization samples collected during the PDI-1, PDI-2, and SDI were analyzed for ignitability, corrosivity, reactivity, and toxicity, as defined in Title 40 of CFR Part 261, Subpart C, to determine if the material was a characteristically hazardous waste. The results indicated that the material is not a characteristic hazardous waste under RCRA or TCEQ regulations.

GHD submitted a Waste Characterization Letter for the Northern Impoundment to the EPA on October 20, 2020 (GHD, 2020g). The evaluation described the detailed characterization evaluation and concluded that the waste has been characterized and classified in accordance with the RCRA regulations as non-hazardous waste. EPA concurred with the conclusions in a letter to GHD dated November 19, 2020 (EPA, 2020h). Additional testing was conducted during the Treatability Study to further classify the non-hazardous waste under applicable TCEQ regulations, 30 TAC §335.505, 335.506, and 335.508. The material was tested for leachability using TCLP. The results of the treatability testing indicate that the waste material from the Northern Impoundment is non-hazardous and should be eligible for disposal as a Class II non-hazardous waste per 30 TAC §335.505, 335.506, and 335.508.

Solidification testing, in accordance with EPA Method SW-846 Test Method 9095B (i.e., paint filter test), was also conducted to determine the appropriate reagent dosages to solidify the waste material for transportation to an off-site disposal facility. Off-site disposal facilities typically require incoming waste to pass paint filter testing and sometimes meet a minimum UCS criteria. The results of the solidification testing indicated that these criteria can be met across a range of waste material percent solid scenarios utilizing Portland cement and/or lime with doses typically ranging from 0 to 20 percent solidification reagent depending on the actual percent solids present. The RC may conduct additional tests to determine the appropriate reagent dose at the time of the RA.

5.7.2 Loading, Transportation, and Disposal

The total in-ground volume of waste material anticipated to be removed and disposed of from the Northern Impoundment using the area-based average approach is approximately 168,000 CY (excluding the northwest corner). Removal will likely be completed over a minimum of five excavation seasons (November to April each year including the northwest corner). Approximately 39,000 to 44,000 CY of impacted material would be excavated, transported, and disposed of off-site over the course of each excavation season. The tentative seasonal cells have been sized based on the amount of waste material that could reasonably be excavated and transported for disposal during one excavation season, although there will be many factors during implementation, including weather and access issues involving the TxDOT ROW, that will determine the actual productivity rate and volumes removed during each excavation season. It should also be noted that the actual volume sent for disposal may be larger due to the addition of solidification reagent if the waste material is too wet (i.e., cannot pass the paint filter test) for transport to the disposal facilities. Based on solidification testing discussed in Section 3.3.5, it is estimated that the use of reagent could increase the total volume for disposal by approximately 10 percent or 16,800 CY. This would increase the total volume for disposal to approximately 184,800 CY (excluding the northwest corner), or approximately 45,000 to 48,000 CY per season.

Because of limited access and staging area at the Northern Impoundment, the transportation and off-site disposal of waste material may be a limiting factor to the overall volume that can be successfully removed in an excavation season. The single-entry point onto the Northern Impoundment is the existing road within the shared TxDOT ROW. An agreement will need to be reached with TxDOT for the use of that road during the Northern Impoundment RA. TxDOT currently uses that road to access the San Jacinto River I-10 Bridge for maintenance, but as previously referenced in Section 5.4 and discussed in detail in Section 5.11.3, TxDOT is planning to replace the bridge within the next four to five years. The 90% RD assumes that there would be land access to the Northern Impoundment using the TxDOT ROW and that TxDOT will permit improvements to the existing access road, such as grading and widening, to allow for two-way traffic on that road. Even with these improvements, there will still be only a single land access point to the Northern Impoundment. The limited working areas, both on and adjacent to the Northern Impoundment, restrict the space available for truck staging, loading, and turnarounds. These factors will likely limit truck loadout and transportation efficiency, which will in turn limit excavation production rates.

One of the major factors influencing cell sizing is the ability to successfully transport and dispose of all removed waste material within an excavation season. Several off-site disposal facilities are currently under evaluation as disposal sites for the RA waste. These facilities are varying distances from the Northern Impoundment, ranging from 60 to 120 miles away. The transport distance to the furthest of these facilities was used as the design basis to influence the target cell size and excavation volume that can be completed in one excavation season. Based on the longest expected distance (120 miles, one way), it is estimated that haul trucks could complete a maximum of two roundtrips, or “turns,” per working day. Additional factors that were considered when determining the anticipated transportation production rates and cell sizing were based on experience with similar projects, and included anticipated downtime related to mechanical issues, traffic delays, bridge or roadway closures, and other factors. Altogether, the RA may require approximately 13,200 truck trips (accounting for bulking and excluding the truck trips required to haul material from the northwest corner). The limited number of truck turns, limited area for staging and loading haul trucks, and anticipated delays all influence the estimated volume of waste material that can be transported and disposed of during an excavation season.

The assumed production rates do not account for on-site delays or overall increased traffic that would result from the TxDOT bridge replacement project, if it is takes place simultaneously with the RD. If access to the TxDOT ROW is available, but TxDOT construction activities related to the I-10 Bridge replacement project impact traffic in the vicinity (such as the ability of the trucks to enter and leave I-10), that could have a major impact on the volume of material that could be excavated and transported off-site for disposal during an excavation season.

5.8 Water Management

Following installation of the BMP, river water behind the BMP will be returned to the river, untreated, prior to commencement of the first excavation season. At the conclusion of each excavation season, the exposed areas of the excavation will be covered, and the area within the BMP may be intentionally flooded with river water for the duration of the non-excavation season. This would both provide support for the BMP wall and would prevent scour, etc. that could be caused by overtopping during a storm event during the non-excavation season. At the start of the next excavation season, the river water trapped behind the BMP will be returned to the river, untreated.

During excavation activities, measures will be taken to segregate stormwater that comes into contact with waste material from clean stormwater that falls on the TCRA armored cap or confirmed clean excavation areas. Non-contact water will be returned untreated to the river. Contact water will be treated through a WTS.

The water treatment process will include removal, treatment, and discharge of contact water generated during the RA to allow excavation to continue. The water will be pumped from the excavation area to storage tank(s), treated to remove dioxins and metals below discharge criteria, and then discharged to the river. This section describes the basis of design and design elements for the WTS.

5.8.1 WTS Basis of Design

5.8.1.1 Contact Water Characterization

As described in Section 3.4, water treatability testing was performed in accordance with the TSWP (GHD, 2019b) to inform the RD of the WTS. The results from treatability testing indicated that the average TSS concentration for the simulated Northern Impoundment contact water sample could be as high as 4,600 mg/L. This represents a maximum expected value since waste solids were actively mixed with water in the pilot test excavation to increase TSS concentrations to create this contact water. This worst-case TSS value was used as the basis of design for water treatment.

Treatability testing results indicated that the majority of metals and dioxins found in contact water were associated with the suspended solids and were not found in the dissolved phase.

Seepage water that entered the pilot test excavation during the PDI-2 was characterized to determine the required treatment if a sufficient volume accumulates in the excavation during the RA.

Water characterization results from PDI-2 are presented in Table 3-2.

5.8.1.2 Parameters Requiring Treatment

As described in Section 3.4, discharge criteria were estimated for COPCs in the Northern Impoundment; those discharge limits are presented in Table 3-2. Dioxins and several metals, including copper, lead, and zinc, were detected in the simulated contact water sample above estimated discharge criteria. Dioxins were detected in the seepage water at levels above the ML, but no other COPCs were above discharge criteria. Treatability test results indicate that metals and dioxins are primarily associated with solids, demonstrating that a treatment system that removes solids should reduce COPCs to levels below the discharge criteria.

5.8.1.3 Treatment Process

The WTS is proposed to treat contact water generated during the RA at the Northern Impoundment. Contact water may be generated from the excavation, stormwater, seepage, dewatering sumps, overburden stockpiles, dewatering activities, WTS containment, and equipment decontamination. Contact water will be pumped to large, aboveground storage tanks. Water from the storage tanks will be processed through the WTS. WTS treatment processes will include chemically enhanced solids precipitation/flocculation, gravity settling, multimedia filtration, cartridge/bag filtration, and GAC adsorption. Treated water will be discharged to the river. Based upon water treatability testing results, described in Sections 3.4 and 3.6, the process described herein has been proven effective in laboratory and pilot testing at reducing concentrations of COPCs in water to levels below their respective discharge limits.

5.8.1.4 Water Volume and Storage

For the Northern Impoundment, contact water may be generated from the following sources:

1. ***Stormwater:*** water from storm events that will accumulate in the excavation and containment areas (e.g., WTS, overburden storage, dewatering) during a rain event, and will be the vast majority of contact water generated and treated during the RA.
2. ***Equipment Decontamination Water:*** water that will be associated with the washing/rinsing of equipment (e.g., truck wash).
3. ***Mounded Water:*** water that will drain into excavation from surrounding soils when the bottom of the exaction is lower than the groundwater level.
4. ***Persistent Infiltration:*** water that will infiltrate through the soil from the river when the base of the excavation is below the average mean sea level (AMSL) of the river (i.e., 1.5 ft-AMSL), but since the BMP wall will be driven into the underlying Beaumont Clay, such persistent infiltration is assumed to be insignificant.
5. ***Miscellaneous Contact Water:*** other water that will come into contact with waste material not associated with water types listed above.

Contact Water generated by each of the abovementioned contact water sources was estimated by the following methods:

1. **Rainfall:**
   a. Rainfall will comprise a majority of the contact water that will be generated.
   b. Although measures will be taken to segregate contact water from non-contact water, the storage and treatment capacities included herein were designed to account for a worst-case assumption that all stormwater that falls within the BMP area is considered to be contact water. The area inside the BMP is ~730,000 square feet (ft^2).
   c. All rainfall collected inside the WTS containment area will be treated by the WTS system. The WTS containment area is ~73,000 ft^2
   d. Each area is multiplied by the largest 24-hour storm event recorded in Houston during the construction season from November to April, which is 6.2 inches.
   e. The maximum expected 24-hr contact water generation during the excavation season is ~415,000 ft^3 or ~3.1 million gallons.
   f. The estimated volume of contact water generate by rainfall during the excavation season (November to April) is 11 million gallons. This based on the average total rainfall during the excavation season from 1880 to the present.
2. **Mounded Water:**

a. This was assumed to be primarily an issue at the start of each excavation season.

b. Mounded water will primarily be generated at the start of the season as the mounded water drains into the excavation.

c. Flowrate of mounded water into the excavation will decline over time as soil is dewatered.

d. The following assumptions were used to model the steady state flow of mounded water into the excavation.

   – Mounded Water is in a cube/block above the low point of the excavation (-15 ft AMSL)
   – Groundwater level is assumed to start at 1.5 ft AMSL across the block
   – Block is 750 ft long, 600 ft wide, and has 16.5 ft of water column height above the river bottom
   – All water will flow to the side of the cubic block facing this low point
   – No base flow from stored water below the river (i.e., cofferdam is watertight)
   – Homogeneous hydraulic conductivity of 3 ft per day (ft/day) across the block

e. Modelling predicts the highest flowrate of mounded water into the excavation will be ~90,000 gpd.

f. The estimated volume of mounded water that will flow into excavation during the excavation season is 18 million gallons.

g. Daily and annual mounded water discharge will be reevaluated after the first excavation season.

3. **Persistent Infiltration:**

   a. The BMP is assumed to be watertight and is keyed into the Beaumont Clay.

   a. Therefore, persistent infiltration is assumed to be insignificant.

4. **Equipment Decontamination Water:**

   a. This area is assumed to be within the BMP and is accounted for in the above rainfall assumptions.

5. **Overburden Storage and Dewatering Areas:**

   b. These areas are assumed to be within the BMP and are accounted for in the above rainfall assumptions.

6. **Miscellaneous Contact Water:**

   a. Assumed to be insignificant compared to other sources of contact water.

A summary of the maximum expected contact water generated, shown in gpd, from each source is provided in Table 5-I, below.

Table 5-I Summary of Maximum Expected Contact Water Generated

Influent Sources	Maximum 24-Hour Contact Water Generation	Notes
BMP Area	2.8 million GPD	Assumes all rain that falls within the BMP could be contact water. Area = 730,000 ft^2. Maximum 24-hour rain event (1930 to 2019) = 6.2 inches.
Rain Collection - WTS Containment Area	282,000 GPD	24-hr rain event, 73,000 ft^2. Maximum 24-hour rain event (1930 to 2019) = 6.2 inches.
Mounded Water (gpd)	90,000 GPD	See assumption above.
Rain Collection in Overburden/ Dewatering Areas (gpd)		Assumed to be accounted for in the BMP area contact water.
Truck Wash		Assumed to be accounted for in the BMP area contact water.

Design Treatment Capacity of WTS

The design treatment rate for the WTS is 300 gpm with an influent storage capacity of 1.8 million gallons. The WTS was designed with treatment and storage capacity to dewater the entire BMP area in approximately three days after the end of the worst-case rain event (6.2 inches). Since the most likely 24-hour rain events will be less than two inches, the entire BMP area can be dewatered in less than 24 hours for most rain events. At the start of the excavation season, the maximum mounded water flowrate into the excavation is predicted to be 90,000 gpd. The large equalization capacity will allow the mounded water to be stored and treated on a batch basis.

5.8.2 Treatment System Design

A treatment system with multiple processes will be employed to reduce concentrations of suspended solids, dioxins and furans, and metals in the contact water to meet discharge criteria. The treatment process is anticipated to include the following unit processes:

- ***Bulk Water Removal*** - The treatment system will use pumps to rapidly remove water generated during the RA and deliver the water to storage tanks.
- ***Storage*** - Two (2) B-24 Lake Tanks (1 million gallons of working capacity each) are proposed to store water prior to treatment. Storage tanks will allow for water to be removed from the excavation area and stored prior to treatment. No mixing is proposed for these tanks. Some TSS settling will occur in these tanks and will be removed at the end of each construction season.
- ***Chemical Addition*** - Coagulant and flocculant will be used to precipitate and flocculate TSS and contaminants of concern. Organosulfide, acid and/or caustic may be used if needed for metals removal. Chemicals will be added to mixing tanks using metering pumps. The mixing tanks will have adequate residence time to allow for adequate solids and floc formation.
- ***Bulk Solids Removal Using an Inclined Plate Clarifier*** - Conditioned solids out of the flocculation tank will be settled in an inclined plate clarifier. An inclined plate clarifier is a vessel which includes multiple parallel plates at an angle greater than 45 degrees. As solid particles settle and contact the plates, the particles will be directed by gravity to the bottom of the clarifier, where the solids stream will be continuously removed. Because of the high surface area provided by the plates, an inclined plate clarifier requires a smaller footprint compared to a circular clarifier.
- ***Sludge Dewatering* -** Settled solids from the inclined plate clarification (underflow) will be pumped into a sludge dewatering box where solids will be dewatered by gravity. The liquid that drains out of the solids will be pumped back to the storage tank for reprocessing. The dewatered solids will be moved to the excavation solids dewatering area, solidified, and disposed of with other solids from the excavation.
- ***Sludge Recycle* -** If needed, a side stream of the settled solids from the inclined plate clarifier may be returned to the rapid mix tank to facilitate floc formation.
- ***Multimedia Filtration*** - Clarified water from the inclined plate clarifier (overflow) will be pumped through the multimedia filtration system, which is a series of pressure vessels filled with media of different densities and particle sizes. Typically, anthracite, sand, and garnet are used. Larger solids will be captured by the largest media (anthracite). Smaller particles will be captured further into the bed by intermediate media (sand), with the smallest solids captured by the smallest media (garnet). As solids build up in the filter, the pressure across the filter will increase, which requires backwashing to remove the collected particles. The backwashing process will use a forward feed process that does not require a backwash tank or backwash pump.
- ***Bag/Cartridge Filtration*** - Filtrate from multimedia filters will then enter bag filters to remove residual solids. Bag filters use fabric to collect solids as water is pumped through the filter. The filter is designed to collect particles larger than the specified opening in the filter. Filtrate will enter the two sets of filters, the first with a filtration size of 10 µm, followed by the second with a filtration size of 1 µm. Both filters will be specified to have a minimum of 95% removal efficiency for particles at the given micron rating. Higher removal efficiencies are obtained for larger sized particles. As discussed in Section 3.6, the results of bench-scale testing completed in October 2021demonstrated that filtration with a 5 µm achieve compliance with all COPCs. During the operation of the WTS, 5 µm bag filters may be tested on a side-stream to evaluate if they can be used in place of the 1 µm filters.
- ***GAC Filtration*** - GAC is a form of carbon that is processed to have small pores that increase the surface area available for adsorption. Residual dissolved organic compounds (e.g., dioxins, furans) in the filtrate from the bag filters will be removed with GAC.

Details of the basis of design of the WTS are provided below. Note, that the WTS design is subject to changes based on field performance.

5.8.2.1 Major Equipment List and Sizing Basis

The major WTS components and basis of sizing are detailed in Table 5-3. This includes sizing criteria assumptions, design value, and notes for each major equipment and process component.

5.8.2.2 Water Treatment Equipment Layout

The WTS, including the two (2) 1.0-million-gallon water storage tanks and water treatment equipment, will be staged within a lined containment area of approximately 73,000 ft^2. The containment area will be surrounded by an earthen berm covered with an impermeable geomembrane. The layout of temporary water treatment equipment is shown in Drawing P-04 and a PFD is shown on Drawings P-02 and P-03.

At the time of the 90% RD submittal, property access negotiations are ongoing, so the location of the WTS has not yet been determined.

5.8.2.3 Specification and Equipment Data Sheet List

Detailed design drawings associated with the WTS, technical specifications detailing the potential water treatment equipment, consumables, staging/sequencing, and operation are included in Appendices G and H, respectively.

5.8.3 Operations and Maintenance Requirements

The WTS associated with the Northern Impoundment RA will operate intermittently primarily based on need to treat contact water resulting from precipitation. A preliminary discussion of the Operations and Maintenance (O&M) requirements (including consumables and utilities) associated with the WTS is provided, below.

5.8.3.1 Consumables

Effective treatment of contact water will require the use of several water treatment chemicals to facilitate solids separation, metals precipitation, and pH adjustment. A brief discussion of the water treatment chemicals is provided, below.

Coagulant - Coagulants (poly aluminum chloride or equivalent) will be dosed to facilitate enhanced removal of metals (through co-precipitation) and suspended solids in the inclined plate clarifier of the WTS. Required type and dosages will be confirmed based on on-site jar testing. It is anticipated that coagulant will be delivered to the work site in intermediate bulk container (IBC) totes (~300 gallons).

Polymer - It is anticipated that liquid polymers will be utilized to enhance the settling of suspended solids and precipitated metals in the inclined plate clarifier of the WTS. Polymer may also be required to enhance the dewatering of chemical sludge in the sludge dewatering boxes. Polymer will be activated/diluted prior to dosing into the water treatment process. Required type and dosages will be confirmed based on on-site jar testing. It is anticipated that polymer will be delivered to the work site in drums or IBC totes.

Organosulfide - Organosulfide is a flocculant that is a commonly used water treatment additive for removal of metals (via sulfide precipitation). Organosulfide may be added if influent soluble metals concentrations exceed the discharge criteria. Precipitated metals may be removed in the inclined plate clarifier and filtration processes of the WTS. It is anticipated that organosulfide would be delivered to the work site in IBC totes (~300 gallons).

Acid/Caustic - Acid and/or caustic may be added to the water to adjust the water pH to optimize metals removal, enhance the effectiveness of the added coagulants, and/or return the treated water pH to within the discharge criteria range. It is anticipated that acid/caustic would be delivered to the work site in IBC totes (~300 gallons).

Bag/Cartridge Filters - Bag and cartridge filters with minimum 95% removal efficiency will be used. As the bag and cartridge filters are fouled (with captured solids), they will need to be removed and replaced.

GAC - The proposed GAC treatment vessels will be filled with bitumen-based GAC media. The GAC vessels will be configured in a lead- lag arrangement. Effluent quality of the lead GAC vessel will be monitored for chemical breakthrough (i.e., detection of COPCs in effluent) to identify the need for media replacement.

5.8.3.2 Power

The WTS (in addition to the other facilities) in the Northern Impoundment will require temporary source(s) of electricity for operation. The power requirements will be confirmed by the selected RC and will be obtained by temporary power connections from the local utility and/or by portable generators.

5.8.3.3 Labor

The WTS is expected to operate in a semi-automatic mode on an intermittent basis (i.e., after a rain event). The WTS will operate primarily during the initial phase of an excavation season to dewater the excavation cell and during precipitation events; thus, there may be periods of time in which the WTS is idle and treatment system operators are not required. Key process decisions and operations will be executed with oversight by the RC's treatment system operators. When the system is being operated, it is expected to require one to three operators, depending on the activities being performed.

5.8.3.4 Residuals

The operation of the WTS will result in the generation of a number of residuals.

Tank Liners: The liners from the Lake Tanks will need to be disposed of at the conclusion of each excavation season. The liners will be characterized and disposed of as indicated in the TODP (Appendix J, Attachment 8), which references the applicable federal and state requirements.

Solids in Lake Tanks: Solids that collect in the Lake Tanks will need to be disposed of at the conclusion of each excavation season. The solids will be characterized and disposed of as indicated in the TODP, which references the applicable federal and state requirements.

Chemical Sludge: The contact water is expected to contain solids from the waste material in the excavation. It is anticipated that coagulants, organosulfide, and/or polymers will result in the precipitation of metals and removal of suspended solids. The resulting sludge will be withdrawn as the underflow of the inclined plate clarifier. The settled solids will be directed to sludge dewatering boxes where it is estimated that it will be gravity-thickened to a solids concentration of up to 6 to 8 percent (mass basis). Treatability testing showed that the clarifier underflow can be thickened easily. However, provisions for polymer addition are being included in the design to provide enhanced thickening. During operation of the WTS, thickened chemical sludge may be generated at a rate of almost 700 pounds (lbs) per hour (dry solids basis). Once dewatered, the sludge dewatering boxes will be transported to the impacted solids dewatering pad for solidification and off-site disposal.

Spent Filter Bags: Filter bags will become fouled with solids as the treatment system operates. These fouled filters will need to be removed and replaced. The spent filter bags will be characterized and disposed of as indicated in the TODP, which references the applicable federal and state requirements.

Exhausted GAC Media: GAC media has a finite capacity to remove dissolved constituents (including metals and dioxins and furans) from water. As previously noted, the GAC vessels will be operated in a lead-lag configuration. The discharges of both the lead and lag GAC vessels will be monitored to identify when the GAC media is exhausted. When concentrations of COPCs are detected at elevated levels in the water in the lead GAC vessel, the media in this vessel will be removed and replaced. Once back in service, this vessel will become the lag vessel, and the previous lag vessel will be operated as the lead vessel. The spent media will either be regenerated or will be characterized and disposed of as indicated in the TODP, which references the applicable federal and state requirements.

5.8.4 Compliance Monitoring

Routine effluent compliance monitoring requirements associated with the WTS are expected to include pH, TSS, metals, and dioxins and furans. Treated effluent samples from the WTS will need to be collected from a specified compliance monitoring point on the effluent line to the San Jacinto River. In accordance with 30 TAC Part 1 Chapter 319 Subchapter A Rule 319.5, Section A, (30 TAC 319.5 (a)), samples and measurements of the effluent will be taken at a location following the last treatment unit. Monitoring frequencies and sample types from 30 TAC 319.9 (c) Table 3 (for treatment units with effluent flow from 0.50 million gpd to less than 2.00 million gpd) are identified in Table 5-J, below:

Table 5-J Monitoring Frequencies and Sample Type

Parameter	Minimum Frequency of Measurement [3]	Standard Analytical TAT (business days)[4]	Sample Type
Flow	1 per operating shift	---	Instantaneous
pH	1 per day	---	Grab
TSS	2 per week	10 days	Composite
Metals[1]	1 per week	10 days	Composite
Dioxin/Furans[2]	1 per week	15 days	Composite

Notes:

1 The most conservative frequency for metals included in 30 TAC 319.9 (c) Table 3 (Copper, Lead, Nickel, Silver, Zinc) is twice per week, but based on characterization, dissolved metals in the untreated contact water were significantly less than discharge criteria. Therefore, the collection of weekly samples is proposed.

2 Monitoring frequency for dioxin/furans is not specified in 30 TAC 319.9 (c) Table 3. Due to the lag in receiving results due to long turnaround times for dioxins and furans analysis, a sampling frequency of once per week is proposed.

3 Based on the pilot testing results as well as the bench-scale filtration results, TSS of 2 mg/L or less can be used to indicate if the dioxins and furans level is below the ML.

4 Samples will be collected only while discharging.

5 Flow rate and pH data will be collected on-site using real-time in-line monitors.

Process monitoring samples will also be collected within the treatment process to inform necessary operational adjustments, such as chemical dose refinement. During pilot testing, clarifier effluent and filter effluent turbidity were measured to evaluate performance of the system and adjust chemical dosage rates. In addition, a direct correlation was established between turbidity, TSS, and $TEQ_{DF,M}$ concentrations. Based on the strong correlation between turbidity and dioxin and furan concentrations, it is anticipated that during the RA, real-time turbidity readings (post clarifier, post filtration, post GAC) will be used as an indicator for operational performance as related to TSS and dioxin and furans. TSS may also be used as a performance indicator. In addition, process monitoring samples will be collected within the treatment process (e.g., influent, post clarifier, post filtration, post lead GAC column) to inform necessary operational adjustments, such as chemical dose optimization and GAC change out. As discussed, turbidity will be monitored through online instrumentation to evaluate treatment system performance and adjust operations as needed. Actions to be taken in response to operational parameter monitoring may be incorporated into a future treatment system monitoring plan.

Determination of discharge criteria is discussed in Section 3.4.1, with specific criteria specified in Table 3-2.

5.9 Monitoring and Controls

Monitoring and controls may be implemented during the RA at the Northern Impoundment to prevent releases of impacted material to the surrounding land, water, or air. The specific controls will be developed and/or refined in conjunction with the RC and will be included in revisions or modifications to the SWMP (Appendix J; Attachment 5) and CQA/QCP (Appendix J; Attachment 6). A summary is included in the following sections.

5.9.1 Dust Control

During implementation, the RC will be required to use methods that minimize production of dust from construction operations. The RC may be instructed to use potable water for potential misting operations to prevent airborne dust from dispersing into the atmosphere. Further detail is included in the SWMP (Appendix J; Attachment 5).

5.9.2 Stormwater Pollution Prevention Plan and Controls (SWPPP) and BMPs

Prior to beginning construction activities on the Northern Impoundment, soil erosion and sediment controls may be implemented. These structures would either be put and remain in place and be maintained throughout the implementation of the RA or may be put in place and maintained for a given work season.

When removing waste material, the excavation will need to be maintained to be free of water as much as possible. Within the confines of the BMP around the seasonal cell, measures that may be taken to keep water out of the open excavation include grading the excavation to drain stormwater water away from the excavation and/or berm construction to prevent water from entering the excavation. To the extent possible, measures will be put in place to segregate non-contact water (water that falls on the TCRA armored cap, BMP Soil Buttress area, and/or areas that have been confirmed clean) from contact water (water that has come into direct contact with waste material). In addition to stormwater controls outside of the excavation limits, the RC will provide, operate, and maintain dewatering equipment appropriately sized to maintain an excavation to be free of water, to the extent possible. The RC may be required to ensure that the pumping equipment, machinery, and tankage be in good working condition for potential emergencies, including power outages, and that appropriately trained workers be employed to operate the pumping equipment. All contact water will be pumped to the water storage tanks for eventual treatment and discharge.

The RC will also be responsible for managing any stormwater that may come into contact with temporarily staged and stockpiled excavated material. The dewatering pads and decontamination pads will be maintained by the RC to contain, collect, and transfer contact water to the water storage tanks for treatment. Stormwater that has not been in contact with impacted material would be discharged in accordance with the SWPPP that the RC will be required to develop. Details of the dewatering pads, overburden stockpiles, and decontamination pads are shown on Drawings C-24 through C-26 in Appendix G.

Excavation dewatering may employ methods such as sheeting and shoring; groundwater control systems; surface or free water control systems employing ditches, diversions, drains, pipes and/or pumps; and any other measures necessary to enable the removal of waste material in as dry of a condition, as possible. The RC will be required to use best management practices for the provision of all dewatering and water removal activities. A SWPPP will be developed for the Northern Impoundment excavation program prior to commencement of any waste material removal work. Further detail is included in the SWMP (Appendix J; Attachment 5)

5.9.3 Odors

There is potential for odors resulting from the Northern Impoundment RA or associated activities. Odors are most likely to occur during excavation activities when previously buried material are unearthed and exposed to air. As needed, the RC will implement odor mitigation and suppression measures during the implementation of the Northern Impoundment RA. Further detail is included in the SWMP (Appendix J; Attachment 5)

5.9.4 Turbidity Controls and Monitoring

The BMP will be placed outside the TCRA armored cap, and thus will not be installed through waste material. Turbidity controls (e.g., turbidity curtains) are planned to be utilized during installation and removal of the BMP wall as a construction best practice to limit the potential for off-site migration of turbidity. Turbidity monitoring is also planned to be utilized during installation and removal of the sheet piles as a construction best practice to compare downstream turbidity values with upstream values to monitor any significant contribution from BMP wall installation and removal to downstream turbidity.

It is anticipated that BMP installation would proceed incrementally in segments from upstream to downstream locations so that vessel movement is aided by the downstream currents. The turbidity curtains would be employed at locations where water flow is away from the work and has the potential for turbidity to be transported with the flow away from the work site. This would be the case for much of the area around the Northern Impoundment, from the northwest corner, along the north and down on the eastern side. On the western side of the Northern Impoundment, flow appears to be towards the impoundment at the corner furthest from I-10. Flow then decreases in location closer to I-10 where water depths are low and a backwater condition exists. The configuration of the turbidity curtain would be such that turbidity migration is mitigated and flow is parallel to the curtain to the extent possible.

During the SDI, and as required by the EPA, turbidity curtains were deployed in the northwest corner of the Northern Impoundment while soil borings were being installed. The initial plan was to utilize impermeable curtains that spanned the full extent of the water column (6 to 14 ft), but due to higher-than-expected water velocities in that area, it was not possible to maintain that configuration and the curtains had to be realigned to use shorter curtains across the deeper areas (ones that did not extend to the river bottom). In light of these challenges, a single layer, permeable Type III curtain extending to one-half the water column depth is being proposed for use during BMP installation and removal. The Type III silt curtain is the most robust class that is commercially available. The use of a permeable curtain of manageable length is expected to help maintain placement and alignment of the curtain.

In addition to the use of silt curtains, monitoring will be performed to confirm that elevated levels of turbidity are not being generated during installation and removal of the sheet piles. Details of this monitoring are provided in the SWMP (Appendix J; Attachment 5). The turbidity monitoring equipment will consist of a buoy with solar charging capabilities, a water quality sonde for collecting turbidity readings, and a dual anchor to the riverbed. Turbidity measurements will be collected in NTUs using a data logger and transmitted in intervals to a database using cellular telemetry. The equipment will also contain a built-in GPS to record and transmit its location.

One turbidity monitoring buoy would be placed upstream of the work to collect background turbidity levels and another one would be placed downstream. Turbidity levels from both monitors would be compared to determine whether the downstream values exceed the upstream by a set threshold. If levels above the thresholds persist, the RC will investigate the source of the turbidity and address it as appropriate (if within RC’s control). Another monitor would be utilized as an early warning monitor that will be maintained in close proximity to the work as it progresses. The data will be used internally by the RC to provide an early indication of changes in typical turbidity readings as part of an adaptive management approach. Turbidity monitoring data would be collected twice per day at the start of work. if turbidity levels are below the thresholds included in the SWMP (Appendix J; Attachment 5), the monitoring frequency will be reduced to once per day thereafter.

5.10 Site Restoration

5.10.1 Removal of the BMP

Prior to removal of the BMP, the recently excavated and exposed bank along the southern extent of the impoundment will need to be supported. A soil embankment will be placed along the southern edge of the excavation limit by sloping back into the river at an approximate 4:1 slope. Once the buttress is established, erosion and scour protection (i.e., rip rap) will be placed at specified locations to protect the buttressed shoreline and prevent washout. Hydrodynamic modelling was performed to evaluate the potential scour along the end-state southern edge of the excavation to support the design of the armament of the backfilled slope. The results of the modelling are included in a Hydrodynamic Modelling Report, included as Appendix F.

Following backfill of the southern slope, the BMP wall would be removed. The BMP will be disassembled in a similar but inverse sequence to how it was installed (further explained in Section 5.5.7). If a pile cannot be removed, additional measures for removal such as cutting or driving the pile below the mudline will be considered. Discussions may continue with stakeholders or interested parties regarding potential beneficial end use involving leaving all or portions of the BMP in place.

5.10.2 TxDOT Access Road

Upon completion of the RA activities and removal of the BMP, the TxDOT access road would be restored to pre-construction conditions. This would include removing the access ramp over the BMP, removing additional aggregate fill used to raise the grade of the access road, and grading areas adjacent to the access road. Any modifications to the end-state of the access road will be coordinated through TxDOT.

5.11 Uncertainties Associated with Design and Implementation

The remedial alternative for the Northern Impoundment outlined in the ROD was based upon data collected during the RI in 2011 and 2012. At the time the ROD was issued, a limited amount of subsurface data had been collected from the Northern Impoundment. Analytical results from the post-ROD PDI and SDI demonstrate that the remedial alternatives considered in the Feasibility Study (FS) and the ROD were not informed by the actual conditions that have since been determined to exist at the Northern Impoundment. Those actual conditions include dioxins and furans at concentrations greater than the 30 ng/kg $TEQ_{DF,M}$ clean-up level that extend further vertically and to a much deeper elevations than was understood at the time the ROD was issued. The actual conditions have in turn had a significant impact on a number of elements of the RD, including: (1) the type and alignment of the BMP wall required to enclose the Northern Impoundment; (2) the inability to safely excavate impacted material “in the dry” without the risk of hydraulic heave in locations across the Northern Impoundment and particularly in the northwest corner; and (3) a significant extension of the time required to implement the RD from the two years stated in the ROD to a minimum of 7 years.

For areas of the Northern Impoundment other than the northwest corner, efforts have been made to address these technical challenges, as detailed in the preceding sections. Even so, significant technical uncertainties remain that could render the remedial alternative outlined in the ROD technically impracticable and not implementable. For the northwest corner, additional design considerations need to be addressed for an implementable design.

In addition, there are uncertainties and potential obstacles to implement the 90% RD associated with external factors that are outside the control of the RD process. The most significant of those external factors relates to TxDOT’s willingness to allow use of its ROW for the Northern Impoundment RA, given its plans to replace and widen the I-10 Bridge during the same period that the RA is anticipated to be completed and the need for the southern wall of the BMP to be constructed on the ROW. The ROW will be needed over a minimum 7-year RA implementation period to access the Northern Impoundment, as well as to serve as the location of the southern portion of the BMP wall.

The major elements of uncertainty associated with the RD are summarized in the sections below.

5.11.1 Technical Uncertainties

5.11.1.1 Use of the TxDOT ROW

There are two aspects of site access involving the TxDOT ROW that create technical uncertainties with respect to the implementation of the 90% RD. One involves whether the TxDOT ROW road that borders the Northern Impoundment to the south and is essential to the execution of the RA, as designed, will be available to provide access for vehicles into the Northern Impoundment. This issue involves whether TxDOT will grant the necessary access and the impact of TxDOT’s current plans to replace the I-10 Bridge on the timing and scope of that access. The second involves whether TxDOT will allow the southern extent of the BMP wall to be constructed on its ROW.

Use of TxDOT ROW to Access the Site

The TxDOT ROW road is the only route to access the Northern Impoundment by land. During the RA, an estimated 13,2,000 haul trucks (accounting for bulking and not including the additional truck trips required to haul material from the northwest corner) will be required to drive onto the Northern Impoundment to transport the waste material off-site for disposal. This is in addition to access and egress of general site equipment and personnel. To support these activities, the TxDOT ROW road will need to be widened, and the elevation will be increased such that the road will serve as a ramp up over the +9 ft NAVD88 BMP wall into the Northern Impoundment to allow trucks to drive in and out. Even if TxDOT were to provide alternative access (i.e., from the south and under the 1-10 Bridge), it is not clear that there would be sufficient space for trucks to travel and to accommodate the access ramp.

Plans by TxDOT to replace and widen the 1-10 Bridge were not known or addressed in the ROD. TxDOT has not completed its design of the replacement bridge or established a construction schedule. Over the course of the RD, the Respondents have been in regular contact with TxDOT about plans for the Northern Impoundment RD, and learned from TxDOT's design engineers in late February 2022 that construction of a replacement bridge could begin as soon as late 2024 or 2025 and could last three to 5 years (depending on the specific design selected).[3] Given the minimum 7-year period for the RA, the implementation of the two projects will likely overlap. Until TxDOT better defines timing for its bridge replacement project, the location of the replacement bridge, and how much the ROW it will utilize during construction of the new bridge and whether it will allow use of the ROW for access and for the construction of the southern portion of the BMP wall, a fundamental uncertainty exists as to the implementability of the 90% RD.

Even if TxDOT can provide the Respondents with access to the ROW during the time its bridge replacement project is taking place, TxDOT's replacement of the I-10 Bridge will create logistical issues for the remedy, due to changes in access routes to I-10, closures of I-10 and the like. In addition, there would be an increased safety risk to personnel and equipment with two major construction projects taking place in such close proximity concurrently. Concurrent implementation of the two projects would require extensive coordination, changes to current plans for the implementation of the remedy and would result in a loss of efficiency in RA activities. The congestion and simultaneous operations of the two major projects being conducted in tandem may limit the size of haul trucks, and with the increased traffic and detours that will result from the bridge replacement project, traffic on the I-10 Bridge itself and on all surrounding roadways will be significantly impacted and slowed throughout the duration of the project. The 90% RD is premised on a production rate of approximately 600 CY per day; that production rate is in turn the basis for the 90% RD's identification of the amount of material that can be excavated in a given construction season (a season that is limited to the period from November to April to reduce risk of storm events that could result in overtopping of the BMP) and the estimated 7-year period for implementation of the RD. That production rate is based on unrestricted access to the Northern lmpoundment using the TxDOT ROW, and the absence of any significant impacts from concurrent work on the TxDOT Bridge replacement project. A loss of efficiency from either on-site congestion or constant heavy traffic on the roads to and from the landfills may result in additional working seasons to complete the RA, extending its length beyond 7 years. Until TxDOT's plans are further developed, it is unknown whether the currently estimated production rate on which the 90% RD timeframe is based, can be achieved.

Use of TxDOT ROW to Anchor Southern Extent of the BMP Wall

Along its southern boundary, the Northern Impoundment shares a border with the TxDOT ROW road and conditions along that border significantly restrict the type of BMP that can be installed along that stretch. Sampling during the PDI and SDI identified impacted material along the southern edge of the Northern Impoundment at elevations as deep as -20 ft NAVD88. This is four times deeper than the excavation elevation for that area that was known at the time of the ROD. As detailed in in the BMP Design Structural Report (Appendix I), multiple BMP wall types were evaluated in an attempt to design a structurally sound BMP wall in that area that would minimize the necessary encroachment onto the TxDOT ROW. The wall types evaluated included:

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[3] GHD participated in a call with TxDOT and LJA on February 23, 2022, that was scheduled to answer questions from TxDOT about some design drawings GHD provided to TxDOT, but turned into a discussion of TxDOT's bridge replacement plans. GHD then notified EPA of the information provided by TxDOT, and TxDOT was invited to attend a TWG Meeting on March 10, 2022. Following the TWG Meeting, GHD made submissions to TxDOT of preliminary structural drawings of the southern wall BMP and hydrodynamic modelling files.

- Single cantilever wall (proposed in the 30% RD and shown to be technically impracticable).
- Combination wall with tieback anchors.
- Cantilever concrete secant pile wall.
- Concrete secant pile wall with tieback anchors.
- Combination wall with brace piles.
- Double wall system with no bench.
- Double wall system with a bench/slope.

Ultimately, the only wall type that proved to be structurally sound and to meet the target SFs was a double wall system that is the same as the wall proposed for the remainder of the BMP. This system on the southern extent includes a gradual slope out of the excavation and a double sheet pile wall. Due to space constraints, the entirety of the BMP wall along the southern extent will need to be installed on the TxDOT ROW, as shown on Figure 5-J, below. The BMP wall would occupy the majority of the ROW along the length of the southern BMP segment. To date, no other solution has been identified that is structurally sound and allows sufficient access (assuming full use of the ROW) to excavate the waste material.

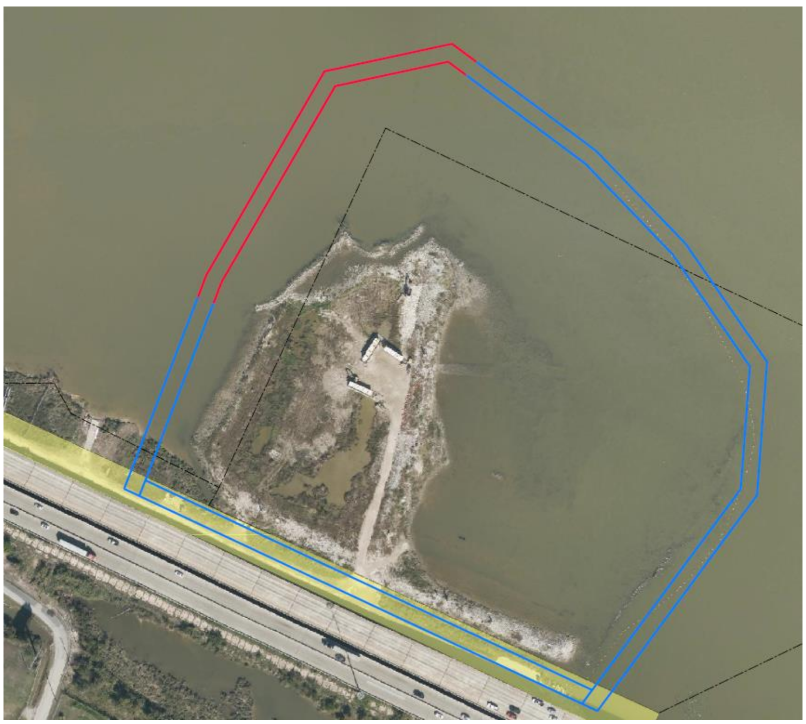

Figure 5-J South BMP Wall Alignment

Prior discussions with TxDOT about the BMP design for the southern boundary did not include this final wall design and placement. TxDOT will have the opportunity, as part of its evaluation and comments on this 90% RD package, to address whether it will permit construction of the BMP on its ROW. TxDOT may have concerns about the placement of the BMP relative to the current bridge alignment as well as with respect to the design of the replacement I-10 Bridge.

In addition, the BMP wall on the TxDOT ROW will be a double-walled structure 30 ft in width and with pile depths of up to -52 ft NAVD88 that will run for approximately 1,000 ft along the TxDOT ROW. The proposed location and alignment of the BMP (assuming it is acceptable to TxDOT) will need to be reviewed with ExxonMobil Pipeline, which owns pipelines in the vicinity of the ROW, and other stakeholders to ensure that the proposed BMP wall's construction would not pose any concerns with respect to the pipelines or other utilities.

5.11.1.2 Excavation Limits

The absence of pre-defined excavation bottom elevations present uncertainties in relation to the BMP design and the schedule. Undefined and deeper excavation limits also present significant risk of hydraulic heave across the impoundment. This risk is most pronounced in the northwest corner, in which there are also other implementation challenges associated with the BMP design. All uncertainties presented herein would be more significant in the event that the excavation elevations are deeper than those included in this 90% RD. Critical to the 90% RD is the identification of excavation bottoms and post-excavation confirmation sampling using area-based average concentrations, as is detailed in Section 5.3.4 and the FSP (Appendix J, Attachment 3).

Effects of Undefined Excavation Limits on BMP Design

The absence of a pre-defined excavation bottom elevation, due to the requirement to conduct post-excavation confirmation sampling, remains a technical uncertainty in relation to the BMP design.

The elevation (or depth) of the required excavation has a direct effect on the design of the BMP and dictates the type, size, and tip elevations of the pilings. While the double wall system included in the 90% RD can better accommodate variable excavation elevations than the single cantilever wall proposed in the 30% RD, there is still a limit to how many feet of additional excavation it can support without creating conditions (such as hydraulic heave) that could impair the structural integrity of the BMP. This is particularly true along the southern side of the Northern Impoundment, where waste material was identified at an elevation of approximately -20 ft NAVD88 versus -5 ft NAVD88 originally identified in the ROD. Due to the space constraints of the abutting TxDOT ROW property, there is limited room along this stretch of the BMP to accommodate deeper excavations. That said, the entire BMP has been designed to accommodate at least two feet of over-excavation past the deepest elevations of material above 30 ng/kg $TEQ_{DF,M}$, though over-excavation may not be possible in many places due to the risk of hydraulic heave.

Effects of Undefined Excavation Limits on Schedule

The absence of a pre-defined excavation bottom elevation also presents a technical uncertainty in relation to the schedule.

The tentative five-excavation-season schedule proposed for the RA is dependent upon maintaining a certain production rate each excavation season, which in turn is based on an excavation bottom elevation based upon area-based average concentrations. In the absence of an area-based average excavation bottom elevation, there could be an increase in the volume of the material to be excavated, such that the projected production rates for each excavation season could not be achieved. In addition, if post-excavation confirmation sampling requires significant over-excavation each season, that additional excavation work (and further confirmation sampling), assuming it can safely be completed given the considerations addressed above, will have the potential to extend the schedule for completing work beyond the currently estimated number of excavation seasons. The schedule could be further extended if the excavated material has a higher than expected moisture content and requires more reagent than has been assumed in this RD. This could increase the volume and time required for excavation, solidification, and load-out.

Risk of Hydraulic Heave Associated with Deeper and Undefined Excavation Limits

As described in Section 5.1, following the receipt of unfavorable results from the Approach B Filtration Treatability Testing, the RD shifted to a design that would allow for excavation in the dry, even in the areas of deepest impacts. With that shift in focus, one of the main objectives of the SDI was to evaluate the potential for hydraulic heave.

Based on data from the SDI (combined with RI and PDI data), it was found that waste material extends to much deeper depths than was known at the time of the ROD (see Section 5.3.4). Considering these deeper impacts, significant geotechnical evaluation work was conducted to better understand the stratigraphy and geological conditions and how they could affect implementation of the remedy during excavation in the dry, as it is prescribed by the ROD. Specifically, the potential for hydraulic heave during excavation in the dry was evaluated across the entire Northern Impoundment, focusing on the northwest corner where the areas of deepest impact are found. In the northwest corner, the excavation would have to be designed to reach a target elevation of at least -28.4 ft NAVD88.

Hydraulic heave was identified as a significant concern throughout the northwest corner, exacerbated by the fact that the work would be performed immediately adjacent to the San Jacinto River, which could be at an elevation as high as +9 ft NAVD88, resulting in as much as 37 ft of differential hydraulic head between the bottom of the excavation and the adjacent river. Additional excavation areas located outside the northwest corner were also identified as being at risk of or sensitive to hydraulic heave (See Figure 5-A).

The concern Is that removal of the soils and water during excavation in the deeper areas would reduce the downward forces to the extent that the upward hydraulic pressures in the underlying strata caused by the differential in hydraulic head would cause a failure of the excavation bottom. Failure of the excavation due to hydraulic heave, also referred to as hydrostatic "blowout," would cause the bottom of the excavation to become "quick" and unable to support any personnel or equipment in the excavation. There is significant risk in putting personnel and equipment in the bottom of an excavation with a high risk of hydraulic heave and a differential head of up to 37 ft between the bottom of the excavation and the river. Failure of the excavation could lead to serious injury or death of remediation workers. It could also lead to creating an interconnection between the waste material and the lower sands.

Northwest Corner

As previously stated, the risk of hydraulic heave in the northwest corner is significant. It is so significant, in fact, that just by dewatering the excavation to the elevation of the existing mudline in that area may put the area at risk of hydraulic heave, let alone, after an additional 15 ft of excavation. In addition to the risk of hydraulic heave in the northwest corner, the BMP wall design along that section of the BMP (Cross-Section C2 shown on Figure 5-I in Section 5.5) proved to be problematic under the assumption that the excavation would be completed in the dry. The design of the BMP along Cross-Section C2 must be constructed of a thicker steel (AZ-40 piles), as opposed to the AZ-26 piles specified for the remainder of the BMP wall. In addition, in Cross-Section C2, a Raised Bench must be constructed on the inside of the wall along that extent to an elevation of -10 ft NAVD88 to further buttress the BMP and the tie-rods would have to be installed at an elevation of -5 ft NAVD88, which would likely involve risky diving operations to complete.

Due to the significant risk of hydraulic heave and the inability to identify a remedy that satisfies the requirements of the ROD (to complete the work in the dry and to remove all material greater than 30 ng/kg $TEQ_{DF,M}$), a detailed description of the excavation methodology for the areas in the northwest corner has not been included in this 90% RD package, and as reflected in Respondents' extension request dated June 21, 2022 (IPC and MIMC, 2022b), will be addressed separately.

As noted in Section 5.2, the early completion of the RA in the northwest corner is critical to the overall sequencing of the project. This 90% RD has been prepared to be "implementable" as designed excluding the northwest corner, but in reality, the northwest corner would likely be completed in the first excavation season due to access issues and bathymetric conditions. It will be critical to eventually combine the RD for the northwest corner with the RD for the remainder of the Northern Impoundment in the 100% RD submittal. Certain elements of the 90% RD, such as the civil excavation contouring transitioning into the northwest corner will need to be revised once a RD for the northwest corner is selected and a wholistic design is presented in the 100% RD submittal.

Acceptance of the Design Excavation Surface

As detailed in Section 5.3.4, to address the hydraulic heave risk and/or sensitivity in the Northern Impoundment (outside the northwest corner), an area-based average concentration approach has been used as the basis to demonstrate compliance with the clean-up standard. This approach utilizes the same risk-based approach used to develop the clean-up standard as the basis to demonstrate compliance with it (see Appendix E) and to present the excavation contours presented in this 90% RD. A major uncertainty in the success of the RD, as set forth in the 90% RD, is the acceptance of this excavation methodology. Many of the uncertainties presented in this Section 5.11 are applicable specifically to the design excavation elevations included in this RD. If the target excavation elevations were to become deeper (through application of the clean-up standard on a point-by-point basis, both for purposes of establishing excavation elevations or post-confirmation sampling), the uncertainties discussed in this Section 5.11 would become more significant. The volume of material for removal and target excavation elevations would increase significantly, and as a result, the risk of hydraulic heave would become more pronounced in areas outside the northwest corner. This can be seen visually by comparing the heat maps showing hydraulic heave risk for the area-based average approach (figure on the left) and the point-by-point excavation approach (figure on the right) shown on Figure 5-K, below. For the area outside of the northwest corner, excavation using area-based average concentrations will result in removal of an estimated 99.82 of the total mass of dioxins and furans above the clean-up level. For that same area, implementation of a point-by-point excavation approach would result in excavation of an estimated additional 46,000 CY of waste material, but would only account for the removal of an estimated 0.18 percent of the total mass of dioxins and furans above the clean-up level.

The duration and cost of the project would also increase and the impact on the community would be greater, due to an increase in truck traffic and a likely longer duration for the RA activities.

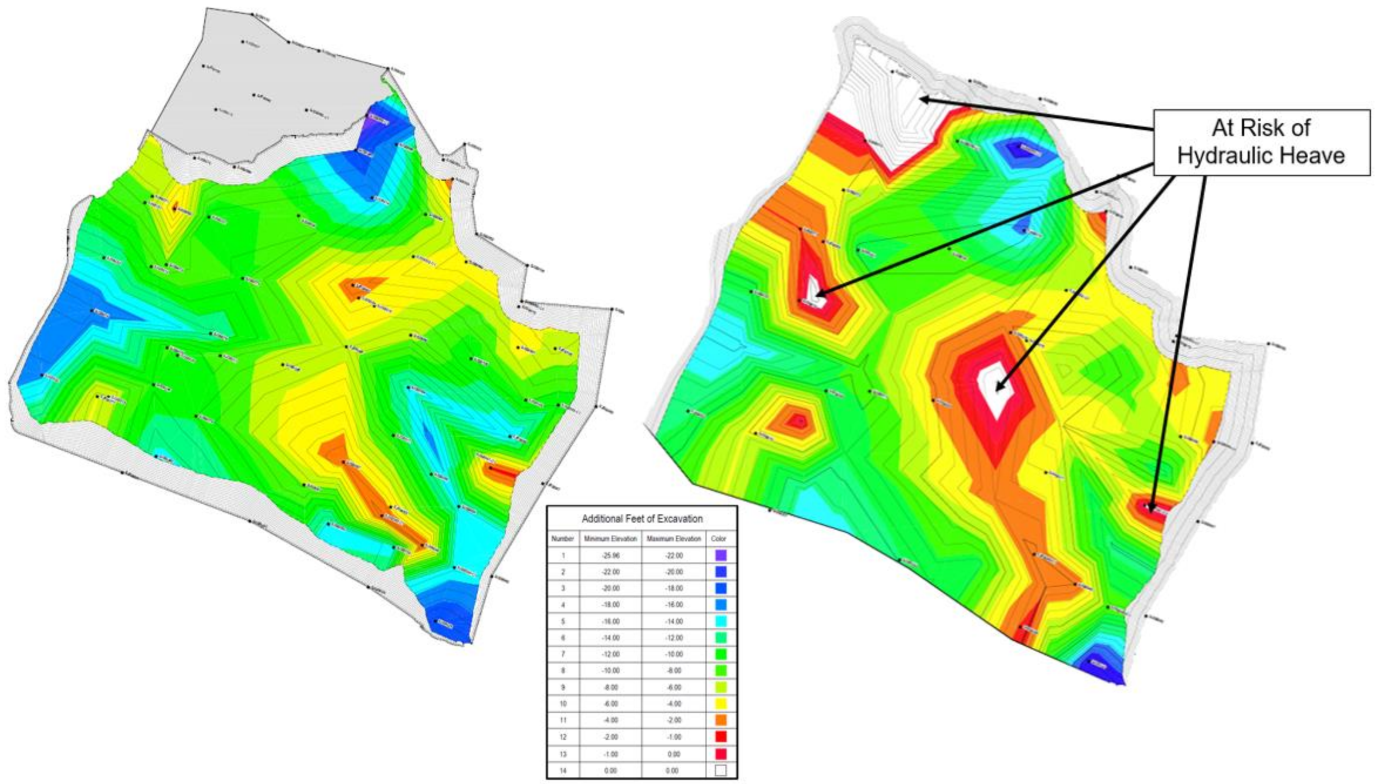

Figure 5-K ***Comparison of Hydraulic Heave Risk***

5.11.2 BMP

There are significant uncertainties related to the BMP including the risk of overtopping during high water events, the larger footprint in the river associated with the revised BMP alignment, the risk of barge strikes, and the availability of materials.

Risk of Overtopping and Release During Excavation

The proposed top elevation of the BMP is +9 ft NAVD88, an elevation which exceeds historical water levels since 1994 during the excavation season. Even using this top elevation for the BMP, there is an inherent risk of a flooding event during excavation which could cause overtopping of the BMP and result in a release of waste material into the river and/or potentially put worker safety at risk. Simply put, when digging in and working below the river surface, the dynamics of the weather and associated river levels create an inherent risk of releases to the river, and there is no guarantee that future river levels during the excavation season will not exceed historical levels.

This risk is even more significant in light of the CWA's currently ongoing design to increase flow rate capacity (gates) of the Lake Houston control structure upriver of the Northern Impoundment. Despite multiple attempts made by the

EPA and GHD to obtain the modelled flow data associated with this project, the CWA has yet to provide any definitive information and this remains an uncertainty in the design top elevations of the BMP wall.

BMP Alignment

The current plans for the installation of the BMP place it outside the perimeter of the Northern Impoundment and TCRA armored cap that covers the Northern Impoundment. In that location, installation and removal of the BMP is not anticipated to result in any releases of dioxin-impacted material, consistent with RAO 1 of the ROD, which states that the remedy must “prevent releases of dioxins and furans above clean-up levels from the former waste impoundments to sediments and surface water of the San Jacinto River.” Placing the BMP outside the footprint of the TCRA armored cap also alleviates challenges with controlling turbidity that were encountered while deploying turbidity curtains in the northwest corner during the SDI, as outlined in a letter to the EPA dated September 28, 2021 (GHD, 2021e). Studies and analyses performed since the ROD was issued show that resuspension of sediments containing background levels of various contaminants may occur during installation and removal of the BMP and that measures such as turbidity curtains may be ineffective to control them when water and wind velocities are elevated.

TxDOT has raised specific concerns about the size and placement of the BMP in the river channel on river velocities that could impact the stability of its bridge structures. These concerns extend to the proposed installation of structures to protect the BMP from barge strikes. Per TxDOT's request, hydrodynamic modelling was performed to evaluate the effects of the BMP structure in the river on the velocity and shear stress of the river on the current system protecting the bridge piers. TxDOT requested and on April 11, 2022, was provided with the results of this modelling. The modelling indicated that effects of the BMP structure should be minimal (see Appendix F), but TxDOT has not indicated whether it agrees with that conclusion.

TxDOT has also raised concerns about possible effects to the current and/or future I-10 Bridge caused by the end-state condition of the Northern Impoundment area following completion of the RA and removal of the BMP. A deep hole will remain where the Northern Impoundment once was, which could affect the flow of the river in that area and the potential for scour along the bank of the river north of I-10. TxDOT requested and was provide with hydrodynamic modelling performed for the 90% RD in order to evaluate the potential for scour of the end-state condition. The detail and results of that modelling, as provided to TxDOT, are included in Appendix F. TxDOT is expected to further address its concerns in its comments on the 90% RD package.

Barge Impact Analysis

The increased depth and horizontal extent of waste material has required a more robust BMP design with an expanded footprint that projects further into the channel of the San Jacinto River than was contemplated in the ROD. This new alignment of the BMP will require extensive coordination with the USCG and will increase the risk of barge strikes that could cause BMP failure. In 2019, flooding associated with Tropical Storm Imelda caused 11 barges upstream of the Northern Impoundment to break free. Six of the barges struck the pier columns supporting the I-10 Bridge resulting in over $5 MM in damages. One of the barges also struck the berm on the northeast side of the Northern Impoundment. To the extent extreme weather events become more common, the likelihood of a barge impacting the BMP structure protruding into the river channel over the projected 7-year minimum duration of the project is high.

As described in Section 5.5.8, a barge impact analysis was performed for purposes of the 90% RD. The analysis was performed using ASHTO guidance to inform the level of protection to be put in place to protect the BMP wall, given that a breach or damage to the wall could result in potential releases to the river or loss of life of workers inside the excavation. The analysis concluded that the current BMP wall design could withstand contact with a 54 ft barge in laden condition at an impact velocity of 2.2 ft/s without sustaining global failure. The velocity assumptions used in this barge strike analysis were based upon modeled velocities in the vicinity of the Northern Impoundment obtained from the hydrodynamic model (see Appendix F). These velocities should be protective of typical marine vessel activity in the vicinity of the Northern Impoundment, which is off-set to the west of the highest river flows in the main channel, however, damage requiring repairs and work stoppage could still occur. Although not required, any additional protective structures that may be considered would likely further expand the footprint of the BMP and will encroach upon the main channel of the river.

The risk of barge strikes remains an uncertainty in the RD and a risk with respect to the safe implementation of the RA.

Availability of Materials

While the types of pilings proposed in the current BMP design are more readily available than those considered in the 30% RD, the RA will still require a significant amount of steel sheet piles and other materials for construction of the BMP. Since the beginning of the COVID-19 Pandemic, there have been challenges worldwide associated with supply chain and availability and shipping of goods and materials. Assuming this trend continues, the schedule of the RA could be affected. Variables such as international tariffs and steel prices will also have significant effects on the availability, schedule, and feasibility of acquiring the BMP materials.

5.11.2.1 Water Treatment

There are significant uncertainties with respect to water treatment, including how well bench-scale treatability testing will translate to the RA and the unresolved location of the WTS.

Translation of Laboratory Testing to Field Implementation

It remains uncertain how well the laboratory-controlled treatability testing for water treatment will translate to field-scale implementation during the RA. The water treatment methodology included in this RD is established, proven technology, and the treatability testing performed to date (summarized in Sections 3.4 and 3.6), has yielded favorable results, but these tests were completed in much smaller, controlled settings that may not translate to full-scale implementation. Further, the significant volume of water requiring treatment and the long turn-around-time for dioxins and furans analysis will necessitate continuous discharge of effluent water. Though start-up testing will be performed, and real-time operational and quality assurance parameters will be constantly monitored, there is not expected to be sufficient retention capacity that would allow for sampling prior to discharge. Consistently meeting the water quality standards will also be challenging due to the extremely low dioxins and furans water quality standard (even using the ML to demonstrate compliance).

Access to Property for Water Treatment System

Due to lack of usable land in the vicinity of the Northern Impoundment, the WTS will have to be located off-site on a separate piece of property. All told, approximately 8 to 9 acres of upland property will be necessary to support RA activities, including water storage and treatment, materials storage, office trailers and parking, truck staging and scales, and sheet pile load-out to marine vessels. Though several properties are being evaluated for long-term access and extensive discussions with property owners have occurred, an agreement for use of such an upland property has not yet been secured. Ideally, the off-site property would be located as close to RA activities as possible (and north of the I-10 Bridge), to minimize the distance that contact water would need to be conveyed for treatment and to minimize the travel distance between the Northern Impoundment and the WTS for site personnel. The details of the future TxDOT bridge replacement project will also affect the options available, as TxDOT's use of its ROW may cut off access to properties located to the west and TxDOT's bridge construction activities could eliminate any option of conveying impacted water to the south under the I-10 Bridge.

5.11.3 Other Uncertainties

5.11.3.1 Stakeholders

Impacts on the Community and Environment

Execution of a project of this magnitude and duration will have a significant impact on the surrounding community. Activities associated with construction and removal of the BMP wall, and excavation and transport of 184,800 CY of waste material (accounting for bulking and excluding material from the northwest corner), will require a significant number of truck trips with associated impacts on the surrounding area extending over the minimum 7-year duration of the RA. Even without included additional truck trips associated with excavation of material from the northwest corner, it is estimated that 13,200 truck trips and approximately 3.1 million miles will need to be driven to complete the RA. This truck traffic will not only have a significant effect on the traffic and congestion in the surrounding residential and commercial areas, but will have an impact on greenhouse gas (GHG) emissions and the potential for traffic accidents. These impacts will only be further exacerbated if the TxDOT bridge replacement work is performed in tandem with the remedy, as it could result in additional congestion and delays which would increase GHG emissions and impacts on local communities.

The adjusted alignment of the southern extent of the BMP wall places work within 50 ft horizontally of the current I-10 Bridge structure, and within 10 feet vertically, as the TxDOT ROW road will need to be built up to ramp over the BMP wall at an elevation of +9 ft NAVD88. Work in such close proximity to the I-10 freeway could create a physical safety hazard and/or a distraction hazard for drivers in passing vehicles on nearby I-10, potentially necessitating the closure of the outer westbound lane of traffic during installation of that portion of the BMP.

Obstruction in the Floodway

As part of the RA, an approximately 3,000 ft long +9 foot NAVD88 BMP will be present in the San Jacinto River for a minimum of approximately 7 years. The presence of an impermeable steel structure in the waterway could impede maritime activities in a heavily utilized industrial river. Hydrodynamic modelling was performed at the behest of the HCFCD to evaluate the effect of the BMP wall on the course of flood waters in the proximity of the Northern Impoundment (see Appendix F). While modelling results indicated that the effects would not be significant, this modelling did not take into account any increase in the flows of the river associated with the CWA Lake Houston Dam expansion project discussed above.

5.11.3.2 Cost

The 90% RD detailed in this document was developed in response to significant changes in understanding of site conditions since the ROD was issued. Those changes include the presence of material requiring removal at much deeper elevations, which has impacted nearly every element of the 90% RD. This 90% RD is also subject to significant uncertainties, as detailed in this Section (Section 5.11). In light of those uncertainties, the impact of these changes in the understanding of site conditions on the overall remedy costs has not yet been defined, but the increase in costs above the EPA estimate included in the ROD could be significant.

6. Sand Separation Area (SSA)

6.1 2019 Sediment Sampling Program

The ROD identifies MNR as the preferred remedial alternative for San Jacinto River sediments in the SSA. The rationale for selection of MNR as the preferred alternative was that the $TEQ_{DF,M}$ concentrations in the SSA are relatively low and there are data indicating that the area is subject to sediment deposition. Modelling of hydrodynamics and sediment transport conducted as part of the Remedial Investigation/Feasibility Study (RI/FS) suggests that the reach of the river adjacent to the SSA is an area of sediment deposition.

In accordance with the PDI-2 Work Plan (GHD, 2019d), sediment samples were collected during PDI-2 field activities from the SSA to meet the following objectives:

– Provide further characterization of the dioxin and furan concentrations in sediment of the SSA.
– Provide a radioisotope analysis of ^{210}Pb and ^{137}Cs to estimate the natural rate of sediment deposition.

^{137}Cs was released into the environment as a result of atmospheric testing of nuclear devices beginning in 1954 with a peak in 1963. Because natural occurrence is extremely rare and its presence can be related to a specific period of time, ^{137}Cs detections are useful in dating sediments. ^{210}Pb is used to calculate deposition rates because it occurs naturally.

Samples were collected from the locations shown on Figure 2-4 using Vibracore sampling devices and a dive team. Collection and analysis of samples were carried out in accordance with the PDI-2 Work Plan (GHD, 2019d).

6.1.1 SSA Analytical Sampling

Thirty-six sediment samples were collected for analysis of dioxins and furans. Samples were collected at the nine locations identified on Figure 2-4. At each location, samples were collected at depth intervals of 0 to 1 foot, 1 to 2 ft, 2 to 4 ft, and 4 to 6 ft below the sediment/surface water interface. Eurofins TestAmerica analyzed the samples for dioxins and furans by EPA Method 1613B and for percent solids by ASTM D2216.

6.1.2 SSA Isotope Sampling

Ninety-nine sediment samples were collected for analysis of ^{137}Cs and ^{210}Pb. Samples were collected at the same nine locations sampled for analysis of dioxins and furans. Samples were collected at depth intervals of 2.5 cm (0.98 inches) from the sediment/surface water interface to a depth of 82.5 cm (32.5 inches). Eleven intervals were sampled at each location. Teledyne Brown Engineering, Inc. analyzed all of the sediment samples for ^{137}Cs and ^{210}Pb by EPA Method 901.1.

6.1.3 SSA Investigation Results

6.1.3.1 SSA Analytical Results

Concentrations of $TEQ_{DF, M}$ are below the risk-based protective level of 30 ng/kg (as determined by the EPA in the ROD) in the top 24 inches of all but one of the SSA sampling locations - SJSSA06 (see Table 6-1 and Figure 2-4).

The laboratory report and data validation report for dioxins and furans are provided in Appendix K.

6.1.3.2 SSA Isotope Results

Cesium-137

^{137}Cs was not detected in any of the 99 samples. Because it was not detected, it can be concluded that sediment to a depth of 82.5 cm (2.71 feet) has been deposited in all areas of the SSA since the mid-1960s. This corresponds to an overall deposition rate of approximately 1.5 cm per year (cm/year).

The laboratory report and data validation report for ^{137}Cs are provided in Appendix K.

Lead-210

Radioactivity of ^{210}Pb decreases with depth at SJSSA01, SJSSA04, SJSSA07, and SJSSA02. The decrease in activity indicates that deposition is occurring at estimated rates ranging from 0.77 cm/year to 3.5 cm/year.

Radioactivity of ^{210}Pb at near shore location SJSSA05 increases with depth, indicating that erosion has occurred at this location. Radioactivity of ^{210}Pb at SJSSA08, SJSSA03, SJSSA06, and SJSSA09 is variable. This variability could be due to alternating periods of erosion and deposition caused by boat traffic, storm events, and/or natural river flows.

Table 6-1 summarizes the results for ^{210}Pb. The laboratory report and data validation report for ^{210}Pb are provided in Appendix K.

6.1.4 SSA Conclusions

Results of the 2019 sampling event indicate that, due to no radioactivity of ^{137}Cs above detection limits, the SSA has generally been depositional since the mid-1960s. Radioactivity of ^{210}Pb indicates that deposition is occurring in four locations at estimated rates of approximately 0.77 cm/year to 3.5 cm/year but that activities may be occurring in the SSA that are affecting deposition in other locations in the area. Concentrations of $TEQ_{DF, M}$ are below the risk-based protective level of 30 ng/kg (as determined by the EPA in the ROD) in the top 24 inches of all but one of the SSA sampling locations - SJSSA06 (see Table 6-1 and Figure 2-4).

6.2 Monitored Natural Recovery

The ROD selected MNR as the remedy for sediments in the SSA. The EPA selected MNR on the basis of the relatively low concentrations of dioxins and furans in sediment, low potential for risk to human and ecological receptors, and evidence of net deposition of sediment. Data generated from the PDI-2 sampling event indicate that varying degrees of deposition are occurring in most of the mid shore and far shore areas. With the exception of the one near shore area (location SJSSA06), concentrations of $TEQ_{DF, M}$ at depths less than 24 inches are at or below the level that EPA identified in the ROD as being protective of human and ecological receptors. In one of the mid shore sample locations (SJSSA05), erosion appears to be occurring, however concentrations of $TEQ_{DF, M}$ at all depths at this location are below EPA's protective level of 30 ng/kg. In summary, eight out of nine total sample locations at depths less than 24 inches have $TEQ_{DF, M}$ concentrations below 30 ng/kg. This is consistent with the results observed during the RI. MNR activities moving forward include additional monitoring at the nine locations sampled for PDI-2 to (1) confirm that concentrations of $TEQ_{DF,M}$ remain below 30 ng/kg at depths less than 24 inches at the eight locations identified in PDI-2 and (2) and further monitoring of concentrations at sample location SJSSA06.

The MNR Plan is included as Attachment 9 in Appendix J. The MNR Plan discusses the processes of MNR as related to dioxins and furans, the site-specific characteristics considered in further development of the plan, parameters for monitoring MNR, sampling frequency, and the decision rule for evaluating the effectiveness of MNR. The implementation of ICs will also be considered for the area around SJSSA06 (Appendix J, Attachment 7).

7. Environmental Footprint (Greener Clean-Ups)

EPA's *Principals for Greener Clean-Ups* (EPA, 2009) have been considered in the development of the Northern Impoundment RD. The EPA and state agencies have developed a framework outlining the desired outcomes of a potential standard for greener clean-ups. The framework focuses on five principals associated with a clean-up project's environmental footprint. These principals are listed below along with the potential methods by which they may be incorporated into the Northern Impoundment RA.

Minimizing Total Energy Use and Maximizing Use of Renewable Energy. This includes reducing total energy use while also identifying means to increase the use of renewable energies throughout the clean-up. The selected RC may incorporate this principle into the RD by:

– Limiting traffic at the Northern Impoundment by requiring workers to carpool.
– Requiring the RC to, if appropriate, to use energy efficient equipment or vehicles.

Minimizing Air Pollutants and Greenhouse Gas Emissions. This includes reducing total air emissions, including emissions of air pollutants and GHGs, throughout the RA. The selected RC may incorporate this principle into the RD by:

– Implementing an Air Monitoring Plan to control dust in and around the Northern Impoundment.
– Requiring air emission control devices on equipment that deliver solidification agents.
– Specifying the use of electricity at the laydown and staging areas, where available, rather than portable diesel generators.

Minimizing Water Use and Impacts to Water Resources. This includes minimizing the use of water and impacts to water resources throughout the RA. The selected RC may incorporate this principle into the RD by:

– Employing best management practices for stormwater, erosion, and sedimentation control, as detailed in a SWPPP to be developed prior to the RA.

Reduce, Reuse, and Recycle Materials and Waste. This includes minimizing the use of virgin materials and generation of waste throughout the RA as well as maximizing the use of recycled materials. The selected RC may incorporate this principle into the RD by:

– Using recycled rock from the TCRA armored cap for restoration of the Northern Impoundment area.
– Using recycled non-impacted material from the historic central and southern berms on-site to construct site features and/or SWPPP controls.
– Using recycled aggregate from inside the two walls of the BMP as cover at the completion of the RA.
– Implementing a recycling program for workers.
– Considering recycled material when purchasing material for the RA.
– Reuse of SWPPP controls, where possible.

Protect Land and the Environment. This includes reducing impacts to land and the environment throughout the clean-up. The selected RC may incorporate this principle into the RD by:

– Minimizing the footprint of disturbed areas at the laydown and support areas, to the extent practicable.

8. Drawings and Specifications

8.1 Design Drawings

The 90% RD design drawings are presented in Appendix G and include the following:

– Drawing G-01 - Cover Sheet.
– Drawing C-01 - Overall Plan.
– Drawing C-02 - Existing Conditions.
– Drawing C-03 - SSA Area and Northern Impoundment Works.
– Drawing C-04 - Soil Erosion and Sediment Control Plan - Overall.
– Drawing C-05 - Soil Erosion and Sediment Control Plan - Seasonal.
– Drawing C-06 - Soil Erosion and Sediment Control Details.
– Drawing C-07 - Project Traffic Control Plan.
– Drawing C-08 - Excavation Plan - Overall.
– Drawing C-09 - Excavation Plan Northwest.
– Drawing C-10 - Excavation Plan Northeast.
– Drawing C-11 - Excavation Plan Southeast.
– Drawing C-12 - Excavation Plan Southwest.
– Drawing C-13 - Excavation Section - 1 of 6.
– Drawing C-14 - Excavation Section - 2 of 6.
– Drawing C-15 - Excavation Section - 3 of 6.
– Drawing C-16 - Excavation Section - 4 of 6.
– Drawing C-17 - Excavation Section - 5 of 6.

– Drawing C-18 - Excavation Section - 6 of 6.
– Drawing C-19 - Typical Seasonal Excavation Sequencing.
– Drawing C-20 - Typical Excavation Sequencing - 1 of 2.
– Drawing C-21 - Typical Excavation Sequencing - 2 of 2.
– Drawing C-22 - Restoration Plan.
– Drawing C-23 - Typical Construction Sequencing - 1 of 2.
– Drawing C-24 - Typical Construction Sequencing - 2 of 2.
– Drawing C-25 - Typical Details - 1 of 3.
– Drawing C-26 - Typical Details - 2 of 3.
– Drawing C-27 - Typical Details - 3 of 3.
– Drawing C-28 - Pile Wall Layout Plan.
– Drawing C-29 - Double Pile Wall Plan and Profile - 1 of 4.
– Drawing C-30 - Double Pile Wall Plan and Profile - 2 of 4.
– Drawing C-31 - Double Pile Wall Plan and Profile - 3 of 4.
– Drawing C-32 - Double Pile Wall Plan and Profile - 4 of 4.
– Drawing C-33 - South Wall Plan and Profile - 1 of 2.
– Drawing C-34 - South Wall Plan and Profile - 2 of 2.
– Drawing C-35 - Double Pile Wall Sections - 1 of 7.
– Drawing C-36 - Double Pile Wall Sections - 2 of 7.
– Drawing C-37 - Double Pile Wall Sections - 3 of 7.
– Drawing C-38 - Double Pile Wall Sections - 4 of 7.
– Drawing C-39 - Double Pile Wall Sections - 5 of 7.
– Drawing C-40 - Double Pile Wall Sections - 6 of 7.
– Drawing C-41 - Double Pile Wall Sections - 7 of 7.
– Drawing C-42 - South Wall Sections - 1 of 3.
– Drawing C-43 - South Wall Sections - 2 of 3.
– Drawing C-44 - South Wall Sections - 3 of 3.
– Drawing S-01 - Structural Notes.
– Drawing S-02 - Structural Layout Plan.
– Drawing S-03 - Structural Sections.
– Drawing S-04 - Structural Details 1 of 2.
– Drawing S-05 - Structural Details 2 of 2.
– Drawing P-00A - Water Treatment System Process Flow Diagram Symbols.
– Drawing P-00B - Water Treatment System Process Flow Diagram Schedules.
– Drawing P-01 - Water Treatment System Process Flow Diagram/Mass Balance.
– Drawing P-02 - Water Treatment System P&ID (1 of 4).
– Drawing P-03 - Water Treatment System P&ID (2 of 4).
– Drawing P-04 - Water Treatment System P&ID (3 of 4).
– Drawing P-05 - Water Treatment System P&ID (4 of 4).
– Drawing P-06 - Site Plan Water Treatment System Season 3-6.

These drawings, insofar as they reflect use of specific means and methods for carrying out the Northern Impoundment remedy selected in the ROD, may be modified as the means and methods for performing the Northern Impoundment remedy selected in the ROD are further defined.

8.2 Technical Specifications

To supplement the Northern Impoundment 90% RD design drawings, technical specifications are presented in Appendix H and include the following:

- Section 00 01 10 - Table of Contents.
- Section 00 01 20 - Seals.
- Section 01 10 00 - Summary.
- Section 01 30 00 - Administrative Requirements.
- Section 01 33 00 - Submittal Procedures.
- Section 01 35 00 - Temporary Traffic Controls.
- Section 01 35 29 - Health and Safety Requirements.
- Section 01 40 00 - Quality Requirements.
- Section 01 50 00 - Temporary Facilities and Controls.
- Section 01 57 13 - Temporary Soil Erosion and Sediment Controls.
- Section 01 57 19 - Temporary Environmental Controls.
- Section 01 60 00 - Product Requirements.
- Section 01 70 00 - Execution and Closeout Requirements.
- Section 01 91 00 - Water Treatment Consumables.
- Section 01 91 20 - Facility Testing and Commissioning.
- Section 02 55 00 - Waste Material Solidification.
- Section 02 61 14 - Material Handling and Transportation.
- Section 02 61 16 - Off-Site Transportation and Disposal.
- Section 22 05 03 - Pipe Data Sheet-PVDF Tubing and Carrier Piping.
- Section 23 05 53 - Identification for Piping and Equipment.
- Section 31 05 19.13 - Geotextiles for Earthwork.
- Section 31 10 00 - Site Clearing.
- Section 31 23 16 - Excavation.
- Section 31 23 19 - Dewatering.
- Section 31 23 23 - Fill.
- Section 31 35 26.16 - Geomembranes.
- Section 31 37 00 - Riprap.
- Section 31 41 16 - Sheet Piles.
- Section 32 31 13 - Chain Link Fences and Gates.
- Section 32 92 19 - Seeding.
- Section 35 49 25 - Turbidity Curtain.
- Section 40 05 13 - Common Work Results for Process Piping.
- Section 40 05 33 - High Density Polyethylene Process Pipe.
- Section 40 05 51 - Common Requirements for Process Valves.
- Section 40 70 00 - Instrumentation for Process Systems.

– Section 46 07 01 - Water Treatment System (WTS).
– Attachment A - Process Control Narrative.

9. Supporting Deliverables

Pursuant to the SOW, supporting deliverables have been prepared as part of the 90% RD, as summarized below. As required in the January 12, 2022, letter from the EPA (EPA, 2022a), seven of supporting deliverables (identified below) have already been submitted to the EPA.

– ***HASP*** - submitted to the EPA January 17, 2022.
– ***ERP*** - submitted to the EPA January 17, 2022.
– ***TODP*** - submitted to the EPA January 17, 2022.
– ***MNR Plan*** - submitted to the EPA January 17, 2022.
– ***QAPP*** - submitted to the EPA March 31, 2022.
– ***FSP*** - submitted to the EPA May 31, 2022.
– ***SWMP*** - submitted to the EPA May 31, 2022.

Most of these plans consider that the RC will be required to prepare its own plans that address the topics covered by these plans and detail the means and measures to be implemented to accomplish the objectives of such plans.

9.1 Health and Safety Plan

The Construction HASP (Attachment 1 in Appendix J) has been prepared in accordance with 29 CFR 1910 and 1926 to provide protection of human health and the environment during activities performed to implement the Northern Impoundment RA. It includes all physical, chemical and all other hazards posed by the work required to perform the Northern Impoundment RA.

9.2 Emergency Response Plan

The ERP (Attachment 2 in Appendix J) describes procedures to be used in the event that there is an emergency while work to implement the Northern Impoundment RA is being performed. The ERP includes procedures with respect to the entity(ies) responsible for responding to an emergency, the plan for meeting with those involved in the response, contingency plans for spills, and release reporting and response. The ERP also includes a High-Water Preparedness Plan that describes the weather monitoring procedures and the emergency actions that will be taken during a potential high-water event.

9.3 Field Sampling Plan

The FSP (Attachment 3 in Appendix J) describes the sampling activities for all media to be sampled during work to implement the Northern Impoundment RA. The FSP provides the rationale for sample collection and describe the protocol for sample handling and analysis.

9.4 Quality Assurance Project Plan

The QAPP (Attachment 4 in Appendix J) provides an explanation of the quality assurance and quality control procedures and chain-of-custody procedures for all sampling to implement the Northern Impoundment RA. This includes quality assurance during data generation and acquisition and during data validation and review.

9.5 Site-Wide Monitoring Plan

The SWMP (Attachment 5 in Appendix J) describes the procedures for monitoring to prevent the potential spread or off-site migration of contaminated media from the Northern Impoundment during and following implementation of the Northern Impoundment RA.

9.6 Construction Quality Assurance/Quality Control Plan

The CQA/QCP (Attachment 6 in Appendix J) describes the planned and systematic activities that verify that the remedial construction to implement the Northern Impoundment RA will meet requirements consistent with clean-up goals and performance requirements set forth in the ROD.

9.7 Institutional Controls Implementation and Assurance Plan

The ICIAP (Attachment 7 in Appendix J) describes the institutional controls expected to be applicable to the SSA and the process for developing and implementing them.

9.8 Transportation and Off-Site Disposal Plan

The TODP (Attachment 8 in Appendix J) details, for the Northern Impoundment RA, waste characterization activities and disposal options. It addresses the transportation routes for off-site shipments of waste material during implementation of the Northern Impoundment RA, identifies procedures to protect any communities that may be affected by such truck shipments, and describes the procedures for on-site management and loading of the waste materials.

9.9 Monitored Natural Recovery Plan (Operations & Maintenance Plan)

The MNR Plan (Attachment 9 in Appendix J), describes for the SSA the routine monitoring and testing to be conducted and procedures for data collection and evaluation, record keeping and reporting of data to be followed, after completion of the Northern Impoundment RA. As discussed with the EPA on May 7, 2020, the MNR Plan takes the place of the O&M Plan referred to in the SOW.

9.10 Operations & Maintenance Manual

Per discussion with the EPA, this plan is not anticipated to be necessary.

10. References

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Table 1

Response to EPA Comments on 30% Remedial Design
Pre-Final 90% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Item No.	Reference	Comment	Response
General Comments from the EPA			
1		The acronym list identifies $TEQ_{DF,M}$ as TCDD Toxicity Equivalent for Mammals. The analytical tables (Tables 2-1, 2-3 and 6-1) present various TEQ values in addition to the $TEQ_{DF,M}$ values. Please verify that the Total WHO Dioxin TEQ (Human/Mammal)(ND=0.5) is the TEQ value being used for comparison to the 30 ng/kg DWA dioxin cleanup level in the ROD. The 90% Design should clearly identify the TEQ value being used to determine areas of excavation to meet the ROD cleanup value for the southern impoundment. In addition, all figures should include the TEQ acronym ($TEQ_{DF,M}$) when presenting dioxin concentrations.	The Total WHO Dioxin TEQ (Human/Mammal)(ND=0.5) is the TEQ value being used for comparison. All figures have been revised to include the TEQ acronym ($TEQ_{DF,M}$) when presenting dioxin concentrations.
Specific Comments from the EPA			
1	Page 24 Clarifier Underflow Solids Test Results	Photographs of the settling tests are showing in the photographic log included in Appendix C. Appendix D is the vibratory analysis.	Section 3.4.3.3 of the main text of the Pre-Final Northern Impoundment 90% Remedial Design (90% RD) Package has been revised to state the photographic log is included in Appendix C.
2	Page 29 3rd Full Paragraph	The first sentence states: *Notwithstanding the above, GHD has, as directed by EPA, developed a preliminary design for the remedy as it is outlined in the ROD in order to meet the approved schedule for submission of the 30% design package for the Northern Impoundment.* The sentence should be revised as follows: *Notwithstanding the above, GHD has, as required by the Administrative Settlement Agreement and Order on Consent for Remedial Design ~~directed by EPA~~, developed a preliminary design for the remedy as it is outlined in the ROD in order to meet the approved schedule for submission of the 30% design package for the Northern Impoundment.*	Section 5.2 of the main text of the 90% RD has been revised as requested.
3	Page 32 1st Paragraph	The first sentence says Approach A is technically impracticable due to the engineering limitation of the BMP. Approach A could be technically practicable, but due to safety issues, removal difficulties, and schedule issues, the Agency agreed during the Technical Working Group meetings that the design could consider an alternative approach for excavation of waste from cells 1, 2 and 3. The text should be revised to more clearly explain why Alternative B is the design approach for cells 1, 2 and 3.	This comment is not applicable as the 90% RD does not include Approach B excavation methodology.
4	Page 40 Section 5.3.5.3	The last sentence states that the geotextile and geomembrane barrier of the armored cap may be disposed of off-Site. Please clarify where the geotextile and geomembrane barrier will be disposed of if it is not disposed of off-Site.	Section 5.6.2.2 of the main text of the 90% RD has been revised to state that the geotextile and geomembrane will be disposed of off-site.

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Harris County, Texas

Item No.	Reference	Comment	Response
5	Page 40 Section 5.3.5.4	The pre-final design should provide the criteria that will determine whether the waste will require solidification.	Following dewatering (and natural draining), if the waste material is still too wet for off-site transport (i.e., does not pass the paint filter test), the material will be staged on-site and mixed with either drier material or a solidification reagent to further reduce the water content. This is discussed in Sections 3.3.5 and 5.6.3 of the main text of the 90% RD. In addition, Section 5.7.1 of the main text of the 90% RD states that the remedial contractor (RC) may conduct additional tests to determine the appropriate reagent dose at the time of the RA. In generally, the paint filter test will determine whether solidification is necessary or not.
6	Page 41 Section 5.3.6	The pre-final design should provide details about whether the waste material will need to be solidified prior to transport to an off-Site disposal facility. The 30% design only uses a general condition of waste not being dry enough for direct load out.	The 90% RD includes a specification for soil solidification. The intent is not to solidify the waste material into a hard mass, but simply to add enough reagent to reduce the water content so the material passes the paint filter test and can be loaded into trucks for transport to the disposal facilities. A treatability study was performed to demonstrate how much reagent might be required and these results are included in Sections 3.3.5 and 5.6.3 of the main text of the 90% RD. In addition, Section 5.7.1 of the main text of the 90% RD states that the RC may conduct additional tests to determine the appropriate reagent dose at the time of the RA.
7	Page 41 Section 5.3.7.2:	The design states that rock that is readily accessible and can be segregated without disturbing the underlying liner may be salvaged for re-use. Under Approach B the operator will not be able to see the rock. The design should provide additional detail on how the operator of the excavator will know how much rock to excavate without disturbing the liner.	This comment is not applicable as the 90% RD does not include Approach B excavation methodology.
8	Page 43 Section 5.3.8:	Post-excavation confirmation sampling is an essential step in the Superfund cleanup process that provides EPA the ability to verify that the remedial action objectives have been achieved. The pre-final design needs to include a post-excavation confirmation sampling program. Discussions about the confirmation sampling program needs to be included as part of future TWG meetings.	The post-excavation confirmation sampling program for the Northern Impoundment (excluding the northwest corner) has been discussed during multiple Technical Working Group (TWG) meetings and is included in the Field Sampling Plan (FSP; Appendix J, Attachment 3) and also is discussed in Section 5.6.4 of the main text of the 90% RD.
9	Page 45 Section 5.4.1.1	The design states that no special considerations for corrosion protection are being considered since the BMP structure is expected to be for temporary, short-term use. However, Section 5.3.9.1 states that the BMP will be removed or abandoned in place. Further discussion regarding corrosion protection is warranted since the BMP may be left in place following completion of the RA.	The in-water best management practice (BMP), a double wall, will be removed following completion of the remedial action (RA). The wall along the southern extent of the impoundment may be left in place at or slightly below the existing ground surface elevation. A soil embankment will be placed on the water side of the southern wall sloping back into the river, along with riprap for mitigating erosion. This soil embankment will provide structural stability to the southern wall: therefore, the minor corrosion of the in-place southern wall will be irrelevant once the soil buttress is in place.
10	Page 60 Section 5.6.3.4:	The sections discussing “Spent Filter Elements” and “Exhausted GAC Media” need to provide additional detail regarding the applicable federal and state requirements that will be followed for disposal.	Section 5.8.3.4 of the main text of the 90% RD discusses the WTS residuals and references the Transportation and Off-Site Disposal Plan (TODP; Appendix J, Attachment 8) that outlines how spent materials from the system will be handled.
11	Page 60 Section 5.6.4	The design states that TSS may also be used as a performance indicator. Further information about the potential use of TSS as a performance indicator needs to be expanded and discussed with the Agency during future TWG meetings.	Treatability testing overall has repeatedly shown that the levels of dioxins and furans in water generated from the excavation activities are associated with solids. Specifically, results from both the initial 2019 contact water pilot testing (Section 3.4.3 of the main text of the 90% RD) and the 2021 additional treatment treatability testing (Section 3.6.3 of the main text of the 90% RD) showed that total suspended solids (TSS) concentrations less than 2 mg/L correspond to dioxins and furans levels below Minimum Levels (MLs).
12	Page 75 Section 6.2	The last sentence of the first paragraph states that MNR activities moving forward will focus on the half acre surrounding sample SJSSA06. The remedy for the Sand Separation Area (SSA) in the Record of Decision was monitored natural recovery. Although the Phase 2 PDI indicated a large area of the SSA had dioxin levels below the ROD cleanup goal in the upper 24 inches, ongoing monitoring of the SSA needs to include the entire SSA as described in the ROD.	Monitored Natural Recovery (MNR) activities planned for the Sand Separation Area (SSA) are discussed in the Monitored Natural Recovery Plan - Sand Separation Area, included as Attachment 9 in Appendix J (MNR Plan) and in Section 6 of the main text of the 90% RD. The text in both has been updated to include future monitoring at all nine locations within the SSA.

Table 1

Response to EPA Comments on 30% Remedial Design
Pre-Final 90% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Item No.	Reference	Comment	Response
13	Attachment 2 Emergency Response Plan Page 1 Section 2.1	Other authorities that may need to be contacted include the National Response Center and the Local Emergency Planning Committee.	Section 2.1 of the Emergency Response Plan (ERP; Appendix J, Attachment 2) was revised to include the National Response Center and the Harris County Hazardous Materials Response Team.
14	Attachment 2 Emergency Response Plan Page 2 Section 2.3, Table 1	The table should include contact information for all of the parties identified in Section 2.1.	Section 2.3, Table 1 of the ERP (Appendix J, Attachment 2) has been revised to include contact information for all of the parties identified in Section 2.1.
15	Attachment 2 Emergency Response Plan Page 5 Section 4.3	The plan says the Site Supervisor may be responsible for directing the on-site personnel in emergency response operations. If the Site Supervisor is not responsible for these activities, the plan should identify who is responsible for implementing the emergency response operations.	The text of the ERP (Appendix J, Attachment 2) has been revised to state "The Site Supervisor will be responsible for directing the on-site personnel in emergency response operations."
16	Attachment 2 Emergency Response Plan Page 8 Section 6	Table 2 should be referenced rather than Table 1.	The text in Section 6 of the ERP (Appendix J, Attachment 2) has been revised to reference Table 2.
17	Attachment 3 Field Sampling Plan Page 1 Section 3.1	The first sentence states: *This section will provide a general overview of the soil and sediment sampling during the Northern Impoundment RA, if necessary. It will present a rationale for choosing each sampling location or sampling area and the depths at which the samples are to be collected, if relevant.* Soil and sediment sampling will be necessary and relevant during the Northern Impoundment RA. As discussed above, post-excavation confirmation sampling is an essential step in the Superfund cleanup process that provides EPA the ability to verify that the remedial action objectives have been achieved. The pre-final design needs to include a post-excavation confirmation sampling program. Discussions about the confirmation sampling program need to be included as part of future TWG meetings.	The FSP (Appendix J, Attachment 3) has been revised to include a post-excavation confirmation sampling program for the Northern Impoundment (excluding the northwest corner), as discussed in multiple TWG meetings. This is also discussed in Section 5.4.6 in the main text of the 90% RD.

Table 1

Response to EPA Comments on 30% Remedial Design
Pre-Final 90% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Item No.	Reference	Comment	Response
18	Attachment 3 Field Sampling Plan Page 2 Section 3.2	The plan only gives a general overview of the contact water sampling rationale. In addition to sampling contact water, the plan needs to describe the sampling approach for discharging treated water to the San Jacinto River.	The FSP (Appendix J, Attachment 3) has been revised to describe the sampling approach for sampling treated effluent water that will be discharged to the river.
19	Attachment 5 Site Wide Monitoring Plan Page 1 Section 2.2	The plan discusses the monitoring of waste, air, storm water and post- construction that will be implemented during construction. In addition, monitoring of treated effluent to the San Jacinto River needs to be included in the plan. The design may need to consider monitoring of noise levels given the potential use impact hammers to drive pilings.	The FSP (Appendix J, Attachment 3) has been revised to describe the sampling approach for sampling of treated effluent water that will be discharged to the river. The Site-Wide Monitoring Plan (SWMP; Appendix J, Attachment 5) includes a discussion about noise monitoring.
20	Attachment 5 Site Wide Monitoring Plan Page 2 Section 2.2.4	As discussed above, post-excavation confirmation sampling is an essential step in the Superfund cleanup process that provides EPA the ability to verify that the remedial action objectives have been achieved. The pre-final design needs to include a post-excavation confirmation sampling program. Discussions about the confirmation sampling program need to be included as part of future TWG meetings.	The FSP (Appendix J, Attachment 3) has been revised to include a post-excavation confirmation sampling program for the Northern Impoundment (excluding the northwest corner), as discussed in multiple TWG meetings. Post-excavation confirmation sampling is also discussed in Section 5.6.4 of the main text of the 90% RD.
21	Attachment 7 Transportation and Off-Site Disposal Plan Page 2 Section 6.2	The plan should also discuss decontamination of trucks following loading before the trucks leave the Site.	The TODP (Appendix J, Attachment 8), has been revised to include a section discussing measures to control and mitigate tracking of waste beyond work areas.
22	Attachment 9 Monitored Natural Recovery Plan-Sand Separation Area Page 4, 2nd Full Paragraph Section 5.1	The plan states that monitoring and possible institutional controls (ICs) will focus on the area surrounding sample SJSSA06. The remedy for the Sand Separation Area (SSA) in the Record of Decision was monitored natural recovery. Although the Phase 2 PDI indicated a large area of the SSA had dioxin levels below the ROD cleanup goal in the upper 24 inches, ongoing monitoring of the SSA and placement of ICs needs to include the entire SSA as described in the ROD.	The MNR Plan (Appendix J, Attachment 9) and the Institutional Controls Implementation and Assurance Plan (ICIAP; Appendix J, Attachment 7), have been revised to include institutional controls for the entire SSA.
Comments from the TCEQ			
1	Page iii	The abbreviation µg/L is defined as nanograms per liter. It should be micrograms per liter.	The abbreviation in the "List of Acronyms" Section has been revised to reflect that µg/L is defined as micrograms per liter.
2	Section 2.2.4 Sand Separation Area Sampling	Please explain why EPA Method 8290 was used for Dioxin analysis in SSA sampling while the method 1613B was used in both Northern and Southern impoundments sampling during PDI-2.	The reference was incorrect. EPA Method 1613B was also used for dioxins analysis in the SSA sampling. This has been corrected in Section 6.1.1 of the main text of the 90% RD.
3	Section 3.3.1 Treatability Testing Sampling Collection	Please verify the volume of composite samples, 20 gallons or 30 gallons per sample? The volumes of composite water samples mentioned in Figure 3-1 and this section are not consistent.	The text in Section 3.3.1 of the main text of the 90% RD has been revised to be consistent with Figure 3-1 and to state that the volume is approximately 30-gallons.

Table 1

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4	Section 3.4.1 Water Discharge Criteria	A small inaccuracy in the middle of page 18 of the report referring to mixing zones. The report states "...and 4% for Human Health Mixing Zone (Chronic)." The "(Chronic)" part is not correct, and should either be deleted, or it could be replaced with "(Fish Tissue)."	The word "(Chronic)" has been removed and the text now reads "4 percent for Human Health Mixing Zone."
5	Section 5.1 BMP Alignment and Excavation Extent	Please clarify that while the excavation depth has increased by an average of 6 feet compared to the ROD estimations, the area of the impoundments to be excavated is now smaller than in the ROD based on additional PDI sampling results.	The horizontal and vertical extents of impacted material have been better defined through data collection in the Pre-Design Investigation (PDI) and Supplemental Design Investigation (SDI) sampling events. Based on the information gathered during these sampling events, the excavation depth has greatly increased from what was known at the time of the Record of Decision (ROD). The horizontal extent has reduced marginally due to clean boring samples collected, particularly along the east side.
6	Section 5.1	This section states that based on PDI-2 data, it appears that construction of BMP may be infeasible and technically impracticable. Please contrast this site construction with large coffer dams successfully constructed in other parts of the US and the world.	This comment is not applicable as the 90% RD includes a different BMP design than what was discussed in the Preliminary (30%) Remedial Design (30% RD).
7	Section 5.1 Removal Approaches A and B	It appears that there is a potential for small portions of waste material to be deposited on to the public roads via tires of the vehicles (esp. the trucks that haul the waste material) and tracks of the track-mounted equipment. Please consider installing a decontamination station for washing the tires and tracks of the vehicles before they leave the site or provide an explanation.	A typical equipment decontamination pad is shown on the 90% RD drawings. Activities involving the decontamination pad will be performed in accordance with 29 CFR 1910.120 (k) and 29 CFR 1926.65 (k) regulations. The TODP (Appendix J, Attachment 8) also discusses vehicle decontamination.
8	Section 5.1 Approach B	A very large volume of water is expected to be contained within the BMP for an extended period in Approach B. Please consider using interlocking sealants at sheet pile joints or explain why sealants are not necessary.	This comment is not applicable as the 90% RD does not include Approach B.
9	Section 5.2.3 Geotechnical Conditions	Regarding the potential for sloughing of the waste material due to vibration from driving sheet piles: please evaluate if the risk could be reduced to acceptable levels by a combination of: (a) moving the BMP (esp. in the northwestern and southeastern portions) away from the toe of the slope, (b) using commercially available bentonite-based sealant material to create a low-permeability seal over the waste material, (c) applying sorbent mats to the slope, and (d) installing two or three layers of concentric silt curtains.	This comment is not applicable as the 90% RD does not include installation of sheet piles through waste material.
10	Section 5.2.4 Vertical Extent	Please discuss how the overburden material and interbedded material with dioxin $TEQ_{DF,M}$ below 30 ng/kg will be treated during excavation. This Section mentioned of four boring locations with >30 ng/kg in the deepest intervals. Please add more details of how the preliminary excavation bottom contours were chosen in these locations. It is noted that two of the four borings, SJGB012 and SJSB046-C1, had high dioxin concentrations at the bottom of the boring; underestimating the excavation bottom at these locations could miss significant mass of contaminants.	Section 5.3.4 of the main text of the 90% RD discusses the vertical extent of excavation. At the referenced locations where the deepest sample collected had concentrations in excess of the 30 ng/kg $TEQ_{DF,M}$ clean-up level, the design considered the adjacent co-located borings to determine the appropriate excavation elevations to complete the excavation bottom contours. For example, SJGB012 was sampled to a depth of 8 feet below ground surface (elevation - 7.57), with the bottom sample having a dioxin concentration of 17,740 ng/kg. However, SJSB072 is co-located with SJGB012 and this boring reported a dioxin concentration of 1.3 ng/kg at the 12-14 feet depth range (elevation -10.58). Therefore, excavation at SJGB012 would be conducted to a depth of approximately 13 feet, for a similar bottom elevation to SJSB072.

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11	Section 5.3.6 Solidification and Load out	Please explain how it will be determined if the waste material is dry enough and how much reagent is needed to make it qualify for load out if not dry (e.g. visual observation or by on site measurements).	The intent of waste solidification is to simply add enough reagent to reduce the water content so the waste material passes the paint filter test (administered in the field) before it can be loaded into trucks for transport to the disposal facilities. A treatability study was performed to demonstrate how much reagent might be required and these results are included in Section 3.3.5 of the main text of the 90% RD. The soil solidification specification will simply be used as a guideline for the RC to estimate the volume of reagent required during bidding, while the actual volume of reagent would be determined in the field (i.e., sufficient to pass the paint filter test). This is discussed in Sections 3.3 and 5.6.3 of the main text of the 90% RD. In addition, Section 5.7.1 of the main text of the 90% RD states the RC may conduct additional tests to determine the appropriate reagent dose at the time of the RA.
12	Section 5.3.7.3 Excavation Procedures	In this subsection, it stated that for approach B, the volume of water inside the cell will be pumped out of the cell, and through the WTS, and then pumped back into the cell. However, it was stated in previous sections that water will be treated in-situ in the cell via a recirculation and filtration system. Please clarify how the water will be treated for approach B, and where water treatment system and geotubes will be located.	This comment is not applicable as the 90% RD does not include Approach B.
13	Section 5.3.8	This Section listed the following constraints for post-excavation sampling. a. *Excavation beyond the design depth could cause BMP failure - please quantify the risk;* b. *If additional excavation becomes necessary, schedule could extend into non-excavation season* – please determine if this can be addressed by a combination of using larger trucks (within the weight limit) and extended workdays and work hours; c. *Volume increase may become too large to handle during the excavation season* – please determine if this can be addressed through longer work hours and workdays. Also, consider whether barge transport is feasible (we understand that multiple loads and unloads could increase costs); d. *If additional excavation is involved, there may not be enough time for water treatment during the excavation season* – determine if this constraint can be overcome by designing a larger treatment system; e. This section identified the constraints associated with post-excavation confirmation sampling. Please discuss the procedures proposed to ensure that waste material with dioxin TEQDF,M concentration greater than 30 ng/kg is adequately removed.	A post-excavation confirmation sampling program for the Northern Impoundment (excluding the northwest corner) is included in the FSP (Appendix J, Attachment 3), and is discussed in Sections 5.2 and 5.6.4 of the main text of the 90% RD. Many of the noted constraints are still applicable: a) This is less of a concern than it was with the approach included in the 30% RD, but significant over-excavation (the BMP is designed to accommodate an additional two feet of over-excavation) along the perimeter of the excavation area due to post-excavation confirmation sampling could cause the excavation slope to start encroaching on the 30-ft bench of soil necessary to support the double-wall system. b) The 90% RD does not pre-define seasonal cells as did the 30% RD. This makes it less likely that excavation would extend into the non-excavation season, as the work can be terminated and capped at any time. However, significant over-excavation due to post-excavation confirmation sampling could increase the overall volume of waste and constraints on off-site disposal of waste could result in extensions into additional excavation seasons. The size and number of trucks available for the RA will be limited due to the size of the site. Work schedule (days and hours) will be up to RC discretion and availability of personnel, etc. c) See the response to b) above. Barging was considered in the preliminary stage of design but was not pursued due to complicated logistics, scarcity of offloading terminals, and risk of loss of material or release during transit. d) With the changes in the design methodology included in the 90% RD, this should no longer be an issue. e) A program for post-excavation confirmation sampling was designed to address removal of waste material with TEQ concentrations greater than the cleanup level. See Section 5.6.4 of the text and the FSP (Appendix J, Attachment 3).
14	Section 5.3.9 Excavation Area Restoration	Please clarify if excavation area restoration will be conducted when the excavation of the whole cell is completed or will be restored sequentially before the next section is uncovered.	Excavation area restoration may be performed during the excavation, at the end of a working season, or after the completion of all excavation activities as discussed in Section 5.6.5 of the main text of the 90% RD.
15	Section 5.4.1.3 Design load for Wind	Please explain the selection basis for the wind velocity of 115 miles per hour.	The design wind velocity of 115 mph represents the 100-year wind speed for the approximate location of the Northern Impoundment per ASCE 7-16. The wind velocity has been updated to include a site-specific value using ASCE's web based tool. A hurricane level wind speed of 154 mph has also been evaluated.

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16	Section 5.4.1.4 Load Combinations	Please add a brief description of the scenarios behind each of the four listed loading combinations.	The number of load combinations have been revised since the 30% RD and descriptions have been added.
17	Section 5.4.2.5 Deflection & Section 5.4.3 BMP Wall Analysis	It is stated that structural steel deformation cannot be used as a limiting parameter for the design; please clarify how design decisions will be made if deflection exceeds the highest allowable limit while stability and strength requirements are met? Will the deflection exceedance alone trigger the change of the sheet pile design?	Deflection exceedance alone will not trigger a change in sheet pile design for the BMP presented in the 90% RD. Overturning is not a failure mode for the new BMP (double wall) so deflection for stability is not a concern. With regards to structural strength, larger deflections induce larger stresses. The total allowable stress is limited to section capacity. Sections are chosen such that stress component from deflections are within allowable section capacity.
18	Section 5.5.2 Loading, Transportation and Disposal	Please note that if the 212,000 CY does not include the volume of the amendment that may be needed for solidification, adding solidification reagents will increase the volume of waste that needs be disposed and increase the loadings for transportation.	It is understood that the actual volume sent for disposal may be larger than the in-place volume of waste material due to bulking caused by the addition of solidification agents. As discussed in Section 5.7.2 of the main text of the 90% RD, an estimated 10% bulking factor has been included in the total volume of material for disposal.
19	Section 5.6.1.4 Water Volume and Storage	Has it been considered to use a covered storage tank to prevent catching rainwater in the tank and reduce the total volume that needs be treated?	The water storage tanks are shown as being located inside the secondary containment area to mitigate potential leaks. All rainfall into the containment area (in or outside of the tanks) will be processed through the WTS. Rainfall falling on top of tank covers would still flow into the containment area and be managed through the WTS. Because of this, no covers are proposed. Moreover, the water volumes generated by rainfall inside the tanks will comprise a small fraction of the total flow to be treated. Finally, the lake tanks being proposed for water storage have a large diameter that does not support the installation of a cover.
20	Section 5.6.4 Monitoring	Please specify the monitoring frequency for each listed parameter.	Table 5-J has been added to Section 5.8.4 of the main text of the 90% RD to show monitoring parameters and frequencies.
21	Section 5.7.1.3 Water Volume and Treatment Process	Please clarify if the estimated maximum water volume of six million gallons accounted for the total seasonal accumulated rainwater.	All water captured behind the BMP and within the WTS containment area was included in estimated surface areas for contact water calculations. The BMP area is approximately 730,000 ft^2, and the WTS containment is approximately 53,000 ft^2. Total area is 783,000 ft^2. The average total rainfall from November through April for the years 1888 to present is 22.16 inches. The expected rainfall volume for the season is 17.4 million gallons. This is a significantly higher volume than the six million gallons included in the 30% RD. This is due to the fact that the BMP wall has been pushed out to encircle the entire Northern Impoundment and there are no longer interior partition walls. All other flows (e.g., equipment decontamination, pore water) are insignificant compared to rainfall volume.
22	Section 5.9.1.1 Excavation Limits	The TCEQ recommends conducting a sensitivity analysis on elevation of excavation bottoms to evaluate how the required wall depth or tip elevation and stability would change based on adjustments to the excavation depth.	This comment is no longer relevant to the BMP presented in the 90% RD. The BMP (double wall) alignment presented in the 90% RD is offset by a minimum bench width of 30-ft from the excavation area. If the bench width and slope at toe is maintained, a change in excavation bottoms will not affect the design or stability. If significant over-excavation is required based upon post-excavation confirmation sampling, the slope could begin to encroach upon that 30-ft bench.
23a	Appendix E Design Drawing Package Sheet C-03 SSA Area and Northern Impoundment Works	Please clarify if the proposed locations for dewatering facility and overburden stockpile are for cell 5 only or for the other cells as well. For cell 5, please explain how the waste material under the surface of the proposed areas will be treated within the cell during excavation?	The 90% RD no longer includes predefined cells. The RC will propose locations for the dewatering facility and overburden stockpile area as part of its identification of means and methods for completing the excavation activities. The locations will likely be temporary and will change each excavation season in order to better address the work being completed. A conceptual layout is included in Drawing C-03.

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23b	Appendix E Design Drawing Package Sheet C-04 Soil Erosion and Sediment Control	Please explain why the proposed turbidity curtain around the eastern cell will be installed around the perimeter of the cap not close to the boundary of the BMP?	The BMP alignment has been revised since the 30% RD and the current alignment in the 90% RD places the BMP outside of the perimeter of the TCRA cap. Turbidity controls will likely be installed in a manner that "follows" the work as the BMP is installed/removed.
23c	Appendix E Design Drawing Package Sheet C-06 Soil Erosion and Sediment Control Details	Please clarify in the text why a gap of a approximately 12" is maintained between the turbidity curtain bottom and the riverbed (e.g. pressure relief).	The text on the drawing has been revised to state that a gap of at least 12" is maintained to allow some flow below the curtain (i.e. pressure relief) and to prevent the bottom of the curtain from interacting with the riverbed thus causing sediment resuspension.
23d	Appendix E Design Drawing Package Sheet P-01	At the end of the treatment train, before discharging to the river, include a block to specify that the treated water will be tested prior to its discharge.	Both the Process Flow Diagram (Sheet P-01) and the P&ID (Sheet P-04) show a discharge compliance sampling point for testing prior to discharge.
24	Appendix G Attachment 7	No details are provided on off-site transportation and disposal. The TCEQ realizes that specifics of the design elements will be provided in the detailed design. Information such as the basis for waste material haul times and estimated production rates for waste removal will aid in the evaluation of constraints involved in post- excavation sampling. Will the 30% design be revised to include this information?	Section 5.7.2 of the main text of the 90% RD provides greater detail on the various constraints related to production rates and efficient excavation, loading, and transport of the waste materials. Due to the expected distance from the Northern Impoundment to potential disposal facilities, the design assumes a maximum of two roundtrips, or "turns", per working day. As such, the actual volume of waste moved each day will be dependent upon the number of trucks available. The 90% RD assumes a maximum of 15 trucks may be available, but also recognizes that there will be breakdowns, weather delays, traffic problems, etc., so the production rate was based on only 20 truck loads per day (average 10 trucks making two turns). Other constraints to efficient productivity include the limitations on site access along the Texas Department of Transportation (TxDOT) right-of-way (ROW) access road where one-way traffic is all that is possible and the potential impact of any concurrent TxDOT bridge replacement project.
General Comments from the Port of Houston			
1		The information in the Preliminary 30% Remedial Design for the Northern Impoundment (P30RD-NI) is generally consistent with our understanding of site conditions and substantially advances the remedial design. Key issues that should require clarification are: • No quantification of the anticipated leakage rate through the BMP Wall are provided or integrated into the discussions.	The BMP wall design presented in the 90% RD includes a double wall system filled with aggregate that should not be subject to significant leakage. The sheet pile surfaces are impervious and only the interlocks are viable means of any flow. The interlocks of the sheet pile are generally considered watertight with insignificant permeability even at high pressure gradients across the interlocks. Any potential leakage would be from the river into the excavation area where all water will be treated. This is discussed in the Northern Impoundment BMP Structural Design Report (Appendix I).
Specific Comments from the Port of Houston			
1	Section 2.2.7.2 p. 14, top paragraph	Section 2.2.7.2, p. 14, top paragraph refers to the interpretation that sands may not be continuous. Similarly, other interpretations are not definitive on leakage anticipated if the deep sand layers are not cut off by the BMP Wall.	The walls of the BMP system presented in the 90% RD will be terminated in the Beaumont Clay layer above the anticipated sand layers. Hydraulic heave has been thoroughly explored and limitations on excavation elevation have been established.

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2	Section 5.1 p. 32	Approach B describes a wet removal alternative to the dry removal required by the ROD. While dry removal from all areas would be very challenging, use of Approach B should be refined. For example, where dry removal is not feasible, when using Approach B, water treatment and discharge should be initiated at the outset to maintain water levels in the cell below ambient river levels to minimize possible releases through the BMP or via groundwater. If the intake for water treatment is near the removal area, the most contaminated water will be treated, saving treatment time at the end of the season.	This comment is not applicable as the 90% RD does not include Approach B excavation or water treatment methodology.
3	Section 5.5.2 p. 54, 4th paragraph	Section 5.5.2, p. 54, 4th paragraph assumes that only two trucks would be used for transport. The design should consider more intensive trucking possibilities.	Section 5.7.2 of the main text of the 90% RD states that based on the varying distances of potential off-site disposal facilities from the Northern Impoundment, ranging from 60 to 120 miles, it is estimated each haul truck can only make up to two roundtrips, or turns, per day. The number of haul trucks is not specified and will be determined by the RC. It should be noted that the 90% RD assumes a production rate based on 20 truck loads per day (i.e., 10 trucks making two turns). This does not account for potential restrictions and delays that could be imposed due to TxDOT's proposed bridge replacement project.
4	Section 5.6.4 p. 60, 2nd paragraph	Section 5.6.4, p. 60, 2nd paragraph suggests only TSS for routine monitoring since it is correlated to TEQ, but TSS is a secondary variable. Routine effluent compliance monitoring requires a rigorous and ongoing validation of TEQ levels associate with continuous TSS monitoring.	Table 5-J has been added to Section 5.8.4 of the main text of the 90% RD to show monitoring parameters and frequencies; TSS would be monitored twice per week, and metals and dioxins and furans will be monitored once per week.
Specific Comments from the U.S. Army Corps of Engineers			
1	Section 5.2.1	The San Jacinto River Elevation measured on site should be presented as well as the gauge location. How many observations, over what interval, were recorded at the Northern Impoundment site? What type of sensor was used and where was it located? Is the sensor still collecting data? How does the recorded data, other than that used in the hindcasting, compare to the hindcasting results? It would be beneficial to include this type of information so that the accuracy of the hindcasting can be interpreted.	GHD has installed and is maintaining a transducer (In-Situ Aqua Troll 200) staged in the staff gauge recording the San Jacinto River water level, temperature, Specific Conductivity, and salinity once every 15 minutes. The sensor is housed in the staff gauge driven into the river sediment and is connected to a telemetry system. The location of the transducer can be seen on Figure 2-3. The transducer is still collecting data. The data is evaluated periodically to confirm that the established correlation is still accurate. The data was particularly useful during 2019 Tropical Storm Imelda - site personnel were able to better anticipate localized flood water levels by examining the real-time water levels reported at the Sheldon gauge upriver. In addition, the data has also been used to observe the connectivity between alluvial and Beaumont Sand aquifers and the river by matching tidal fluctuations.
2	Section 5.2.3 Second paragraph	A description of the soils lithology are presented but no cross-section. It would add transparency to show a cross-section of the site with the interpreted soil stratigraphy including the borings used to make the interpretation.	Soil stratigraphy borings are included as Figures 2 and 3 of the Hydraulic Heave Analysis Report, which is attached to the Geotechnical Engineering Report as Appendix B.

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3	Section 5.2.4 Vertical Extent Page 37	The four borings listed (SGGB010, SJGB012, SJSB046-C1, SJSB071) reported that the sample collected from the bottom of the boring had contaminate levels greater than acceptable. The text mentions that the nearest boring was used to estimate the appropriate excavation elevation. For SJSB071, SJSB036, and SJSB046- C1 the surrounding borings indicate a shallower contamination depth; how was this taken into account? A better description for the excavation extents needs to be provided for this boring and others similar to it. In general this is a key component to the design, more effort needs to be put forth in the description of the methods used to reach the reported excavation depths. • SJSB046-C1 depth of bogging -20.4, closest boring SJSB046 depth of contaminant -20 • SJSB036 depth -10.75ft closest borings SJGB0101 bottom of boring -6.3 and boring SJGB011 depth of contaminant -9.6 ft • SJSB071 depth -18.8, closest borings SJSB058 depth of contaminant -17.4ft and SJSB070 depth of containment -17.4 ft	Following submittal of the 30% RD, the SDI was completed in 2021 to further delineate impacted material horizontally and vertically across the Northern Impoundment, reducing uncertainty between boring locations. Collocated borings were installed at the four locations noted to fully delineate the vertical extent of impact at those locations. The SDI field event is discussed in Section 2.3 of the main text of the 90% RD and the excavation extent is discussed in Section 5.3.4 of the main text of the 90% RD.
4	Section 5.7.1.1 Page 61	The contact waters for Approach A and Approach B are likely to be rather different in terms of suspended solids and may be dependent on the withdrawal method.	The 90% RD does not include Approach B. What was previously referred to as Approach A is the water treatment approach basis that is provided in this 90% RD.
5	Section 5.9.1.2 BMP Removal Page 68	It is unclear why the BMP walls could not be cut off if they cannot be removed. As such, this does not appear to be a large uncertainty with the feasibility of utilizing this BMP.	This comment is no longer relevant to the BMP presented in the 90% RD. The revised BMP in the 90% RD specifies removal of the BMP wall.
6	Section 5.9.1.2 Risk of Overtopping and Release Page 68	Releases from overtopping would be minimal due to water depth within BMP and the BMP would limit resuspension of residuals and prevent erosion within the cell.	Section 5.3.2 of the text discusses how historic peak water surface elevations were used in the selection of the BMP height to mitigate the risks of overtopping. This risk is now discussed in Section 5.11.2 of the main text of the 90% RD. Not only could overtopping cause a release but it could put worker safety at risk and cause scour along the inside of the BMP.
7	Appendix B Geotechnical Report Section 1.3 Geology	According to figure 2 the foundation is Holocene Alluvium but was listed as Pleistocene Beaumont Formation in the text.	Figure 2 displays surface materials, which are holcene alluvium. The holocene alluvium is underlain by the Pleistocene Beaumont formation.
8	Appendix B Geotechnical Report Section 6.2.3 Design Strength Parameters	How were the values assigned in Tables 7 - 11 arrived at? How do they compare to the UU and CU triaxial and the drained direct shear tests? A plot of measured values versus depth as well as assumed values would be appropriate? For a project this size and with the amount of data available plots of lab results versus elevation or depth as well as water contents, Altenburg limits, and SPT values should be shown. A comparison of assumed shear strengths with those measured would then be easily ascertained. In addition, geologic cross-sections with boring locations would provide transparency. Note: UU testing show that samples were not fully saturated during testing which may overestimate shear strength. GeoTesting Express lab sheets.	The values assigned in Tables 7-11 were arrived at by plotting the data graphically with respect to depth, using the UU data and CU triaxial data and drained direct shear tests. These plots which included water content, Atterberg limits and SPT values have been superseded by CPTs taken along the new BMP alignment. The BMP presented in the 90% RD has been developed based on the data gathered during the SDI and accounts for revised geotechnical design parameters that are contained within the SDI Geotechnical Report (Appendix B; Attachment C). Geologic cross-sections are included in the Geotechnical Engineering Report (Appendix B).

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9	Appendix B Geotechnical Report Section 6.2.4	Summary tables of sheet pile tip elevations and stratigraphy should be included. Additionally, the assumed excavation depth on the protected side should be reported	The sheet pile tip elevations and associated stratigraphy are included in the Northern Impoundment BMP Structural Design Report (Appendix I). The revised BMP presented in the 90% RD will be terminated in the Beaumont Clay layers.
10	Appendix B Geotechnical Report Section 6.2.6	The horizontal accelerations greater than 0.1g should be further researched and justification provided.	A range of horizontal acceleration (0 to 0.3) were used for a parametric study evaluating the potential impact of pile driving activities. However, 0.1-g is considered representative of accelerations from pile driving in stiff clays. Since sheet pile tips will not penetrate into Beaumont sands, additional evaluation of accelerations greater than 0.1-g will not be necessary.
11	Appendix B Geotechnical Report General Pile Analysis Comment	All failure modes should be listed and if they are not considered proper justification should be made, worst condition analyzed and if it exhibits a high factor of safety then that would justify not analyzing further. For example bottom heave and global stability.	The 90% RD Geotechnical Report (Appendix B) addresses failure modes and the conditions under which they were analyzed.
12	Appendix B Geotechnical Report Section 6.2.6	Stability figures need to identify what borings were used to build the stratigraphy, this can be shown on the figure. (Figures 13-20). It appears that the capping layer was neglected? It is unclear on the stage when the capping layer is to be removed.	This comment is no longer relevant. The revised BMP presented in the 90% RD will be terminated in the Beaumont Clay layer and vibrations are no longer identified as an uncertainty with respect to the BMP's implementability.
13	Appendix B Geotechnical Report Tables 7 -11	The minimum cohesion listed in Tables 7 -11 for near surface material is 200 psf. The soft soils shear strength in the stability analysis is listed as 100 psf, this should be justified. If this is unconsolidated sediments then why is it discontinuous at the Station 22 + 00 section (Figures 17 – 20)?	This comment is no longer relevant. The revised BMP presented in the 90% RD will be terminated in the Beaumont Clay layer and vibrations are no longer identified as an uncertainty with respect to the BMP's implementability.
14	Appendix D Preliminary Vibration Analysis Section 4.1 Analysis Approach	The cap material nor the geotextile or geomembrane were included in the analysis. There seems to be ambiguity as to the extents of the cap material, if it extends down the slope it would also provide a confining pressure and increase the vertical stress which would be beneficial to the factor of safety. The limits of the capping material should be better defined and included in the analysis with the addition of the geotextile or geomembrane. This will have an impact on the analysis and should be modeled accordingly.	The BMP presented in the 90% RD is realigned farther away from edges of steep slopes. The Z-shaped sheet piles are smaller than the large diameter pipe piles evaluated in the 30% RD and will be terminated in the Beaumont Clay layer. They are therefore not expected to result in significant vibration.
15	Appendix D Preliminary Vibration Analysis Figure 2 Effects of Sediment Properties	Why weren't the locations and stratigraphies from borings SJGB058 and SJGB037 included in cross-section A-A'? There is a wealth of stratigraphy data available, cross-sections should be considered that rely on available data and not extrapolated when data exists. SJGB019 is referenced in this figure, a separate interpretation should be made at SJGB019and boring SJGB013 should be used to interpret the data.	The BMP presented in the 90% RD is realigned farther away from edges of steep slopes. The Z shaped sheet piles are smaller than the large diameter pipe piles evaluated in the 30% RD and will be terminated in the Beaumont Clay layer and will not result in significant vibration.
16	Appendix D Preliminary Vibration Analysis Figure 3	The 10 ft thick layer reports a FS of 1.01 with a 10' layer of surface material and a friction angle of 20 degrees. This is not marginally stable but indicates shallow failure and should be reflected as such in the text.	The FS 1.01 in Figure 3 relates to the parametric evaluation of soil slopes with cohesionless soils of varying friction angles but same thickness of material. The report concludes that "if a low friction angle cohesionless material is on the slope in the northwest portion of the Northern Impoundment (at any thickness), the slope would be marginally stable for a shallow slip failure under static conditions." The reviewer's comment is only applicable to a specific case of 20-degree material. The report, however, is intended to present a broader conclusion that slope stability correlates to the friction angles of the material independent of the thickness.

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17	Appendix D Preliminary Vibration Analysis Figure 6	Figure 6 shows the thickness of waste material to be 5 ft thick, in the text it is referred to being 10 ft thick. Please clarify the apparent discrepancy.	The text has been revised to match the figure.
18	Appendix D Preliminary Vibration Analysis Figure 6	Previously a factor of safety of 1.1 (and 1.01) were referred to as marginally stable in the paragraph following Figure 6 there is the potential for a factor of safety of 1.13 causing slope failure. Interpretations should be made in a consistent manner.	Figure 6 is another parametric study to evaluate the effect of change in Excess Pore Pressure (EPP). Comparing the results for increasing the EPP from 0.33rumax to 0.38rumax, the SF was reduced from 1.36 to 1.13. This shows that increasing EPP increases the potential for slope failure. Thus, the stated interpretation that "there is a potential that the generation of EPP could cause slope failure" is correct.
19	Appendix E Design Drawing Package	Limits of capping material and geotextile should be shown in drawings C-01 to C-05, C-08.	Figure 3-5 shows the approximate area for TCRA cap reuse which is the approximate extent of geotextile and/or geomembrane.
20	Appendix E Design Drawing Package	Drawing C-09 does not appear to have an accurate ground surface near station 05+00.	This comment is not applicable due to the change in design from 30% RD to 90% RD.
21	Appendix E Design Drawing Package	It is difficult to identify where the Pile Profiles (drawing C-12, C-16, C-20, and C-24) are located with reference to the Pile Layout Plan drawings (C-11, C-15, C-19, and C-23)). These profiles should be better identified in the pile layout plan drawings.	This comment is not applicable due to the change in design from 30% RD to 90% RD.
22	Appendix E Design Drawing Package	Drawing C-18, is the ground surface elevation correct. It does not appear to match drawing C-17. Is the location of the capping material shown correctly?	This comment is not applicable due to the change in design from 30% RD to 90% RD. The ground surface elevations presented in the 30% RD drawings were correct and are currently shown in revised cross-sections provided in the 90% RD drawings.
23	Appendix E Design Drawing Package	It would be beneficial to have an accurate cross-section cut at the steepest slope in the northwest portion of cell 1.	Revised excavation cross-sections have been included in the 90% RD drawing package. Section D cuts through the northwest corner of the impoundment from north to south, although the 90% RD does not include a remedial design and excavation for the northwest corner.
24	Appendix F BMP Wall-Type Analysis	It would be beneficial to have summary tables of design stratigraphy referenced to borings and material properties referenced to lab testing. This would provide justification for stratigraphy and property assumptions, as it stands this is not provided.	The information requested can be found in the Geotechnical Engineering Report, included as Appendix B.
25	Appendix F BMP Wall-Type Analysis	Rotational stability was basis for design but global stability and bottom heave should be investigated, as part of due diligence.	Hydraulic heave has been evaluated and limitations on dry excavation elevations have been established. The Hydraulic Heave Analysis Report is included in the Geotechnical Engineering Report (Appendix B).
Specific Comments from the Harris County Technical Review Team			
1a	Waste Handling	40 CFR §261.24 requires that the determination of toxicity characteristic is based on the extract from “a representative sample of the waste.” As they were collected primarily around the periphery of the site, only four of the fourteen borings used in the composite treatability samples contained dioxin-contaminated wastes. Thus, the composite samples are not representative of wastes that will be excavated and requiring disposal. We suggest that these tests need to be repeated with samples better representing waste materials that will be excavated.	During the 2021 SDI, six additional waste characterization discrete samples were collected from targeted locations in the Northern Impoundment that were known to have high concentrations of dioxins (as high as 47,000 ng/k and 52,000 ng/kg TEQDF,M). Waste characterization results from the sampled collected during the SDI support the conclusions of the PDI-1 and PDI-2 characterization sampling (that the waste can be classified as RCRA non-hazardous).

Table 1

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Item No.	Reference	Comment	Response
1b	Waste Handling	While the wastes are not a listed hazardous waste under RCRA subtitle C, we suggest that they should be handled in a manner largely consistent with such wastes to prevent releases. The design needs to describe measures to prevent losses of liquid and solid waste materials and leachates thereof during handling and transportation to the landfill.	The Health and Safety specification states the parameters for how waste material is to be handled and transported. The ERP (Appendix J, Attachment 2) addresses any spills or releases that may occur during transport. All of the waste handling procedures will be performed in accordance with 29 CFR 1910.120 (k) and 29 CFR 1926.65 (k) regulations, which are intended for hazardous waste operations and emergency response.
1c	Waste Handling	Please explain why it is reasonable to assume that wastes must be transported 120 miles to a disposal facility. There are a number of closer facilities.	The 90% RD does not assume a specific off-site disposal facility but provides an estimated range of 60-120 miles one-way based on the location of potential approved disposal facilities that may be utilized during the RA.
2a	Spatial Uncertainty in Extent of Waste Materials	The observed soil borings (and dioxin analyses thereof) are irregularly spaced both horizontally and with depth. This produces substantial spatial uncertainties regarding the location of the boundaries of waste material deposits. The design drawings apply linear interpolation between observed waste depths in borings. The linear interpolations require assumptions about the distribution of wastes that we do not have sufficient data or historical information to confirm.	The 2021 SDI included the installation of an additional 35 analytical chemistry soil borings to provide better spatial coverage (vertically and horizontally) for delineation of impacted material. The 90% RD incorporates reasonable interpolations of the extent of impacted material between boring locations, which is an industry standard and accepted practice for defining the limits of remedial excavations. In addition, a post-confirmation sampling program for the Northern Impoundment (excluding the northwest corner) is included as part of the 90% RD (FSP - Appendix J, Attachment 3) to confirm analytical levels upon completion of the excavation.
2b	Spatial Uncertainty in Extent of Waste Materials	The extent of exceedances of cleanup levels on the western side has not been delineated. An assumption has been made that the western extent of the capped area defines the western extent of removal. Consistent with prior comments, further delineation of the extent of contamination, even if it extends beyond the capped area should be completed, or a technical valid discussion regarding why they do not believe there is contamination beyond the extent of the cap should be provided. Data shows some extremely high levels in this area and should be removed.	The remedy, as described in the EPA ROD, only requires excavation of material within the TCRA cap.
2c	Spatial Uncertainty in Extent of Waste Materials	In many borings, dioxin levels > 30 ng/kg were observed at multiple depth intervals, with relatively clean layers in between. Some examples include SJSB071, SJSB032, SJSB037, SJSB036, SJSB054, SJSB028, SJSB047-C1, and SJSB048-C1. It appears there was some mixing or layering of dioxin-containing wastes and non-dioxin containing materials, which is common in landfills. Thus, it is insufficient to extend the dioxin analysis of a boring only to the first depth interval where dioxin levels fall below 30 ng/kg TEQ and assume that dioxin-containing wastes do not occur below that depth. If borings are used to delineate the lower extent of waste, the dioxin analyses of those cores should extend to at least -25 ft, where waste materials have been observed. In addition, removal action should take place in these deeper areas as well.	The 2021 SDI was completed after PDI-2 to further refine the horizontal and vertical extent of impact. The sampling methodology conducted in accordance with the EPA-approved SDI Work Plan (and detailed in Section 2.3.2 of the main text of the 90% RD) included installation of soil borings from 0 to 24 ft bgs. The intervals from 0 to 18 ft bgs were first sampled and the intervals from 18 to 24 were held by the analytical laboratory pending results of the 16-18 ft interval. If that interval result was above the cleanup level, it triggered the analysis of the deeper intervals. Thus, the additional 35 analytical borings installed during the SDI effectively covered the suggested depths. During the RA, target excavation elevations would be verified through post-excavation confirmation sampling.
2d	Spatial Uncertainty in Extent of Waste Materials	Systematic sampling on a regular grid to a uniform depth would have controlled the spatial uncertainty in determining the extent of wastes. To reduce the uncertainty, as well as to ensure the management of dredging residuals where "in-the-wet" excavation is performed, we re-emphasize the need for confirmation sampling along the sides and bottom of excavated areas to confirm that wastes exceeding cleanup levels are not left in place. After excavation, at least one multi-part composite sample should be collected from the bottom and each side of excavated 0.25-acre certification units (CUs). It should be possible to procure expedited analysis with turnaround times of 10 days or less, thus reducing the impacts on schedule, especially if CUs are sampled as they are completed.	A post-excavation confirmation sampling program for the Northern Impoundment (excluding the northwest corner) is included in the FSP (Appendix J, Attachment 3), and is discussed in Sections 5.2 and 5.6.4 of the main text of the 90% RD. The intent will be to collect composite samples over up to 1/2-acre Decision Units (DUs) to compare to the clean-up level.

Table 1

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Item No.	Reference	Comment	Response
2e	Spatial Uncertainty in Extent of Waste Materials	The 30% RD argues that due to the limitations of the cofferdam, it will not be possible to excavate deeper than the design depth if post-excavation confirmation sampling reveals high levels of dioxins below the excavated volume. If the cofferdam cannot be designed with a factor to permit minor adjustments to excavation depth, then the uncertainties in the spatial distribution of wastes should be reduced prior to cofferdam design through higher-resolution systematic sampling to a depth of -25'.	As stated in the response to Item No. 2c, the 2021 SDI included installation of 35 additional analytical borings to further delineate the vertical extent of impacted material. Further, the BMP design included in the 90% RD is designed to accommodate excavation of soils to the deepest interval exceeding the cleanup level plus an additional two feet. That said, significant over-excavation at locations around the perimeter of the Northern Impoundment has the potential to push the excavation slope out and cut into the 30-ft bench of soil necessary to support the wall. This is an uncertainty in the implementation of the design.
3	Spatial Uncertainty in Extent of Waste Materials	It is assumed that removal of the armored cap will be required along the sheet pile alignment to allow driving of the sheet pile. Details should be provided regarding how this will be accomplished without release of contamination from the underlying material, as well as providing whether the sheet piles will be driven from land-based or water-based equipment.	The BMP alignment included in the 90% RD has been amended to remain outside of the limits of the TCRA Cap, to address the potential for a release during installation and removal of the BMP. Based on the design of the BMP and existing conditions in the Northern Impoundment, it is anticipated that sheet piles will be driven from both land-based and water-based equipment.
4	Spatial Uncertainty in Extent of Waste Materials	A significant potential restriction identified relates to temporary road access and potential conflicts related to TxDOT bridge upgrades. Has loading of materials into barges and transport to an alternative shoreline unloading and processing area been considered to alleviate these concerns and potential significant schedule impacts?	GHD has been engaged in discussions with EPA, and TxDOT regarding the TxDOT bridge replacement project and its potential impacts on the RA. Barging was considered in the preliminary stage of design but was not pursued due to complicated logistics, scarcity of offloading terminals, and risk of loss of material or release during transit. Congestion of marine vessels in the vicinity of the Northern Impoundment due to the TxDOT bridge construction would further preclude barging as an option.
5	Spatial Uncertainty in Extent of Waste Materials	Regarding the Sand Separation MNR program, ICs should be required for the entire area, not just the area around SJSSA06, to ensure future activities such as dredging do not expose buried contamination.	The MNR Plan (Appendix J, Attachment 9) and the ICIAP (Appendix J, Attachment 7), have been revised to include institutional controls for the entire SSA.
6	Geotechnical comments Summary	The Geotechnical report provided in Appendix B and the 30% Remedial Design Report (30% RDR) were reviewed to provide the following specific comments. It is our general impression that additional backup material is warranted to support the geotechnical analysis in terms of basis for the selected design parameters and loading conditions. A distinction should be made between short-term and long-term construction conditions while developing the design criteria along with desired factor of safety values. The design conclusion of wall analysis and slope stability focus on the worst case scenarios applicable in isolated areas and apply them globally for the entire site.	Since the 30% RD, and as part of the SDI, additional cone penetrating tests (CPTs) have been taken along the revised alignment of the BMP. The analyses conducted used both drained and undrained conditions, with consideration for construction sequence and time delays. The additional geotechnical data obtained during the SDI is provided in Appendix B of the 90% RD.
7	Geotechnical comments Appendix B	In Appendix B, the seismic site class was reported as Class E per Table 20.3-1 of IBC. However, additional details on the basis for this conclusion should be provided.	The Geotechnical Engineering Report (Appendix B) has been revised to include any profile with more than 10 feet of soil having the following characteristics: Plasticity index PI >20, Moisture > 40%, and Undrained Shear Strength < 500 psf.
8	Geotechnical comments Appendix B Table 7 - 11	Appendix B Tables 7 to 11 summarize the design strength parameters used in the analysis for each Cell. The relevant test borings used to create the generic subsurface profile for each Cell should be summarized. Additionally, Figure 8 should include labeling for all 5 cells to allow the reader to know their locations and be able to identify relevant test borings. This will also allow checking the generalized profile presented in Tables 7 to 11 for each cell.	This comment is no longer relevant to the BMP presented in the 90% RD. Since the 30% RD, as part of the SDI, additional CPTs have been taken along the revised alignment of the BMP. The data used in the analysis is provided in the Northern Impoundment BMP Structural Design Report (Appendix I).

Table 1

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Item No.	Reference	Comment	Response
9	Geotechnical comments Table 6	Appendix B Table 6 summarizes the water surface levels considered on both sides of the BMP for analyses. However, the ground level on both sides which determines the cantilevered height of the wall should also be included. This will allow determining the earth pressures acting on the wall.	The analysis cross-section for each section along the BMP alignment is provided in the Northern Impoundment BMP Structural Design Report (Appendix I).
10	Geotechnical comments Appendix B Table 7 - 11	What is the basis for the design strength parameters summarized in Appendix B Tables 7 to 11? Is this based on engineering experience or a combination of SPT N values and lab results? Based on a quick review of the test borings, some of the selected values seem very conservative considering the SPT N values observed at test borings. The selected parameters directly impact the wall design and if better parameters can be justified then the design can be optimized.	This comment is no longer relevant to the BMP presented in the 90% RD. Since the 30% RD, as part of the SDI, additional CPTs have been taken along the revised alignment of the BMP. The data used in the analysis is provided in the Northern Impoundment BMP Structural Design Report (Appendix I).
11	Geotechnical comments	Very stiff to hard cohesive soils or medium dense granular soils were encountered in several test borings at depths as shallow as 25 feet. It is difficult to determine the elevations corresponding to these depths as many test borings did not include the surface elevation on the logs. The height of the cantilevered portion of the wall is variable based on excavation depth. However, the presence of these very stiff to hard cohesive and medium granular soils should have a significant impact on the wall embedment determination. The geotechnical report seems to indicate that the primary layer which determines embedment is below El. -50 feet. However, considering the excavation depths the piles could be potentially embedded within the very stiff to hard cohesive and medium dense granular soils and the report should indicate that piles could be tipped in either of these soils.	This comment is no longer relevant to the BMP presented in the 90% RD. The revised BMP will be terminated in the Beaumont Clay layer.
12	Geotechnical comments	The vibration analysis which provided the acceleration inputs for slope stability analysis assumed the user of an impact hammer. Why was the use of a vibratory hammer not considered in evaluation as it tends to generate lower PPV values based on published literature? The use of vibratory hammer and other means to minimize the vibrations resulting from pile driving operation could change the input, output, and conclusions of the slope stability analysis.	This comment is no longer relevant to the BMP presented in the 90% RD. The revised BMP will be terminated in the Beaumont Clay layer and vibrations are not a concern.
13	Geotechnical comments Appendix B Figure 12	Based on the cross-sections provided in Appendix B Figure 12, the existing slope at Sta. 5+00 is between 2.5H:1V and 3H:1V and at Sta. 22+00 is about 7H:1V. Sta. 5+00 is the steepest slope on the site based on a quick review of Figure 5E shown in the 30 percent Remedial Design report (30%RDR). It also extends for a relatively small portion of the BMP alignment when compared with the overall length of the BMP wall. Similarly, Sta. 22+00 represents potentially the next steepest slope on site and also represents a very small portion of the alignment of BMP wall. However, the 30%RDR identifies the potential instability during pile driving as an inherent risk to the implementation of selected remedy in ROD based on these two isolated areas. The report could explore alternate means to prevent slope instability in these isolated areas to allow the implementation of the selected remedy.	This comment is no longer relevant to the BMP presented in the 90% RD. The revised BMP will be terminated in the Beaumont Clay layer.

Table 1

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Item No.	Reference	Comment	Response
14	Geotechnical comments	The geotechnical report recommends additional efforts to evaluate the correlation between pile driving energy, PPV, and horizontal acceleration and also indicates that 0.1g as a representative value for horizontal forces due to pile driving. The reported low factor of safety values are based on a 0.3g horizontal force which can be anticipated at a distance of 20 feet from the pile driving per Appendix D. The anticipated slope instability seems like a localized issue which can be contained with some precautionary measures.	This comment is no longer relevant to the BMP presented in the 90% RD. The revised BMP will be terminated in the Beaumont Clay layer.
15	Geotechnical comments	The slope stability analysis applies 0.3g horizontal force globally, however it should be noted that the initial few feet of the sheet pile is driven under its own weight and the full use of impact energy is only anticipated in deeper depths which should result in attenuated peak particle velocities and horizontal forces for soils along the slope that are reported to potentially slide into the river. The analyzed condition may not be true representation of conditions in field during pile driving and therefore the analysis conclusions may not be reliable.	This comment is no longer relevant to the BMP presented in the 90% RD. The revised BMP will be terminated in the Beaumont Clay layer.
16	Geotechnical comments	The reported failure surface for Sta. 22+00 with 0.3g horizontal force is deep seated and extends up to 75 feet from the BMP wall. Per vibration analysis report the peak ground acceleration attenuates to 0.01g at a distance of 100 feet from the location of pile driving. The slope stability analysis does not account for attenuation with distance and applies 0.3g for the entire cross-section. Therefore, the reported failure surface is unrealistic and should be re-evaluated.	This comment is no longer relevant to the BMP presented in the 90% RD. The revised BMP will be terminated in the Beaumont Clay layer.
17	Geotechnical comments Section 5.4.2.5	The allowable deflection discussed in Section 5.4.2.5 of 30% RDR should be re-evaluated considering the project construction sequencing and impacts. Rather than using a rule of thumb for setting the maximum deflection criterion, a serviceability approach could be implemented. What are the potential hazards from a wall deflecting more than the reported allowable limit of 4.4 inches? The wall will be at its maximum height of 37 feet for a relatively short period of time prior to backfilling. Additionally, the walls are deflecting towards the excavation due to the high-water level outside the cell. It is unclear how this could impact its desired performance. Setting a reasonable tolerable deflection and modeling the wall and excavation accurately may yield more favorable analysis results.	The deflection criteria / limitation of 30% RD is no longer relevant to the design presented in the 90% RD. The revised BMP double wall system will not be limited by the deflection in the sheet piles. By use of a soil-structure interaction method of analysis, the deflections are translated to bending stresses in sheet pile and tensile stresses in the tie-rod. The stresses will be the governing criteria, limited to allowable stress within elastic range.
18	Geotechnical comments Table 5-A	The reported deflections in Table 5-A of up to 20 inches are considering highest water level on outside of the cell (flood condition) and the lowest water level on the inside of the cell (after dewatering) and using drained properties. Please provide justifications for using drained properties.	The comment is no longer relevant to the current design presented in the 90% RD. The revised BMP double wall system is evaluated for both drained and undrained conditions. The deflection criteria is revised as noted in Item No. 17 above.
19	Geotechnical comments	Considering the variable height of wall along its alignment and the nature of the analyzed conditions, it seems like the construction of wall in isolated portions with heights resulting in excessive deflections could be controlled by better planning the construction activities (dewatering and immediate backfilling for example). Therefore, the conclusion of BMP wall being technically infeasible is premature.	This comment is no longer relevant as the conclusion of the 30% RD is superseded by the revised design of the BMP as a double wall system presented in the 90% RD. The analyses evaluated stresses and stability for different stages of the BMP construction and excavation within the impoundment.

Table 1

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Item No.	Reference	Comment	Response
20	Geotechnical comments Section 5.4.4	Section 5.4.4 of 30% RDR quotes that piles would need to be advanced 15-25 feet of sand with SPT N values up to 100 blows per foot. Additional details should be provided on what loading and excavation conditions were provided in the model to determine the embedment depths.	This comment is no longer relevant. The revised BMP presented in the 90% RD will be terminated in the Beaumont Clay layer.
21	Geotechnical comments Section 5.9.1.2	Section 5.9.1.2 of 30% RDR indicates presence of steep slopes within Northern impoundment. Based on Figure 5E, the steepest slope is between 2.5H:1V to 3H:1V. Need further clarification on the reported steep slopes.	This comment is no longer relevant. The revised BMP presented in the 90% RD will be terminated in the Beaumont Clay layer.
22	Geotechnical comments	Based on Figures 2-5 and 2-6 of 30% RDR the bottom elevation of material with > 30 ng/kg varies between El. -4 and El. -25. However, the deepest excavation analyzed in Appendix B is El. -28 feet. How was this excavation elevation selected for DEEPEX analysis?	The -28 ft elevation was chosen to allow for some over-excavation.
23	Geotechnical comments	Upstream protection of the barrier wall from impact loading due to potential barge strikes and other objects in the river was not included in the considered design loading and should seriously be considered. Please add a discussion on this topic and add appropriate barrier protection system.	Barge impact is considered in the 90% RD and is discussed in the BMP Structural Design Report (Appendix I) and in Section 5.5.7 of the main text of the 90% RD.
24	Geotechnical comments	Were other wall types such as Open Cell Wall considered for this site?	Following the submittal of the 30% RD which included an optimized cantilever wall system with significant challenges, the design pivoted to evaluate other BMP options. Based upon the suggestion from the USACE, the next wall type considered was a double wall system. The double wall proved to be successful, so no further wall types were considered (apart from the southern extent of the wall where several different wall types including combination walls and secant walls were considered before deciding upon the double wall system). An open cell wall was not considered.

Table 2-1

First Phase Pre-Design Investigation Analytical Results - Northern Impoundment
Pre- Final 90% Remedial Design - Northern Impoundment
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Area:	Units	Northern Impoundment - Waste Pits	Northern Impoundment - Waste Pits	Northern Impoundment - Waste Pits	Northern Impoundment - Waste Pits	Northern Impoundment - Waste Pits	Northern Impoundment - Waste Pits	Northern Impoundment - Waste Pits	Northern Impoundment - Waste Pits	Northern Impoundment - Waste Pits	Northern Impoundment - Waste Pits	Northern Impoundment - Waste Pits	Northern Impoundment - Waste Pits	Northern Impoundment - Waste Pits	Northern Impoundment - Waste Pits	Northern Impoundment - Waste Pits
Sample Location:		SJSB028	SJSB028	SJSB028	SJSB028	SJSB028	SJSB028	SJSB028	SJSB028	SJSB028	SJSB028	SJSB029	SJSB029	SJSB029	SJSB029	SJSB029
Sample Identification:		SL0580	SL0581	SL0582	SL0583	SL0584	SL0589	SL0585	SL0586	SL0587	SL0588	SL0500	SL0501	SL0502	SL0503	SL0504
Sample Date:		11/19/2018	11/19/2018	11/19/2018	11/19/2018	11/19/2018	11/19/2018	11/19/2018	11/19/2018	11/19/2018	11/19/2018	11/6/2018	11/6/2018	11/6/2018	11/6/2018	11/6/2018
Sample Type:							Duplicate									
Sample Depth:		(0-2) ft bgs	(2-4) ft bgs	(4-6) ft bgs	(6-8) ft bgs	(8-10) ft bgs	(8-10) ft bgs	(10-12) ft bgs	(12-14) ft bgs	(14-16) ft bgs	(16-18) ft bgs	(0-2) ft bgs	(2-4) ft bgs	(4-6) ft bgs	(6-8) ft bgs	(8-10) ft bgs
Integral Sample ID:		SJSB028-C1	SJSB028-C2	SJSB028-C3	SJSB028-C4	SJSB028-C5	SJSB028-C10	SJSB028-C6	SJSB028-C7	SJSB028-C8	SJSB028-C9	SJSB029-C1	SJSB029-C2	SJSB029-C3	SJSB029-C4	SJSB029-C5
Dioxins/Furans																
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	ng/kg	28.1	1.24 J	64	4.82 J	2.4 J	5.86 J	2.19 J	1.34 U	1.2 U	0.349 U	44.1	5.19 U	2.95 J	1.45 J	2 U
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	ng/kg	2130	1680	2570	2260	948	3270	683	1070	856	985	4720	2750	2110	690	791
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	ng/kg	19.2	0.34 J	6.55	1.33 U	0.94 J	2.1 U	0.183 U	0.26 U	0.333 U	0.072 U	9.89	1.25 J	0.39 J	0.349 U	0.46 J
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	ng/kg	46	23.5	38.6	32	13	39.9	9.57	16.8	16.3	20.9	104	42.5	37.5	11.3	20.1
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	ng/kg	2.14 J	3.07 U	0.798 U	0.181 U	0.19 J	0.261 U	3.32 U	3.27 U	3.32 U	3.23 U	0.706 U	3.21 U	3.23 U	3.86 U	3.17 U
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	ng/kg	5.9 U	0.144 U	3.37 U	0.93 J	0.993 U	1.71 U	0.288 U	0.243 U	0.262 U	3.23 U	1.89 J	0.208 U	3.23 U	0.22 J	3.17 U
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	ng/kg	2.97 U	0.352 U	3.32 U	3.33 U	3.34 U	0.605 U	0.26 J	0.284 U	0.192 U	0.26 J	0.845 U	0.486 U	0.504 U	3.86 U	0.286 U
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	ng/kg	2.83 J	0.09 J	1.27 U	0.259 U	0.214 U	0.7 J	0.0887 U	3.27 U	0.0543 U	3.23 U	0.78 J	3.21 U	3.23 U	0.137 U	3.17 U
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	ng/kg	1.72 J	0.582 U	0.94 U	0.93 J	3.34 U	1.2 U	0.399 U	0.439 U	0.53 J	0.582 U	2.46 J	0.752 U	0.804 U	3.86 U	0.67 J
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	ng/kg	0.933 U	0.1 J	0.435 U	0.203 U	0.112 U	0.0976 U	0.075 U	0.0823 U	3.32 U	3.23 U	0.59 J	3.21 U	3.23 U	3.86 U	0.082 U
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	ng/kg	1.47 J	1.08 U	1.31 J	1.48 J	0.358 U	1.89 J	0.6 J	0.766 U	0.71 J	0.674 U	3 J	1.78 U	1.84 J	0.57 J	0.96 J
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	ng/kg	3.06	3.07 U	1.87 U	0.62 J	0.495 U	1.26 J	0.21 J	3.27 U	0.16 J	3.23 U	1.09 U	3.21 U	3.23 U	3.86 U	3.17 U
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	ng/kg	0.75 J	0.28 J	0.384 U	0.39 U	0.23 J	0.229 U	0.164 U	3.27 U	0.0787 U	0.153 U	0.542 U	0.341 U	0.33 J	3.86 U	3.17 U
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	ng/kg	3.72	3.07 U	0.46 U	0.23 J	0.2 J	0.42 J	3.32 U	3.27 U	3.32 U	3.23 U	1.05 J	3.21 U	3.23 U	3.86 U	3.17 U
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	ng/kg	4.55	0.094 U	1.63 U	0.397 U	0.63 J	1.17 U	0.177 U	3.27 U	0.179 U	3.23 U	1.4 U	3.21 U	3.23 U	3.86 U	3.17 U
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	ng/kg	124	4.51	74.1	21.6	16	40.8	4.49	7.04	6.74	1.84	45.9	5.03	1.81 U	2.81 U	2.26
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	ng/kg	41.9	1.64 U	26.3	8.45	4.55	14.9	2.36	2.4 UJ	2.16 U	0.647 U	12.5 U	1.55 U	0.749 U	1.37 U	0.648 U
Octachlorodibenzofuran (OCDF) 13C12	ng/kg	28.1	1.24 J	64	4.82 J	2.4 J	5.86 J	2.19 J	1.34 U	1.2 U	0.349 U	44.1	5.19 U	2.95 J	1.45 J	2 U
Total dioxin/furan	pg/g	2410	1710	2780	2330	986	3380	703	1090	880	1010	4930	2800	2150	704	815
Total dioxin/furan (ND*0.5)	pg/g	2410	1710	2790	2330	987	3380	703	1100	883	1010	4940	2800	2160	707	817
Total dioxin/furan (ND*1)	pg/g	2420	1710	2790	2330	989	3380	704	1100	885	1010	4950	2810	2160	710	819
Total heptachlorodibenzofuran (HpCDF)	ng/kg	36.8	0.71 J	14	1.71 J	2.29 J	3.5	0.31 J	3.27 U	0.66 J	3.23 U	31.2	2.3 J	0.38 J	3.86 U	0.71 J
Total heptachlorodibenzo-p-dioxin (HpCDD)	ng/kg	132	69.4	119	90	38.4	120	27.3	52.3	54	68.7	466	121	106	32.1	68.6
Total hexachlorodibenzofuran (HxCDF)	ng/kg	21.1	0.19 J	4.64	1.68 J	0.66 J	1.91 J	0.19 J	3.27 U	0.16 J	3.23 U	13	0.65 J	3.23 U	0.35 J	0.12 J
Total hexachlorodibenzo-p-dioxin (HxCDD)	ng/kg	27.8	14.6	15	23.3	7.62	19.3	4.85	12.4	15.5	20.5	59.5	15.4	22.4	6.35	18.8
Total pentachlorodibenzofuran (PeCDF)	ng/kg	19.4	3.07 U	1.67 J	0.62 J	0.63 J	4.12	0.21 J	3.27 U	0.16 J	3.23 U	6.09	3.21 U	3.23 U	3.86 U	3.17 U
Total pentachlorodibenzo-p-dioxin (PeCDD)	ng/kg	3.51	1.24 J	1.34 J	3.33 U	0.71 J	1.57 J	0.24 J	3.27 U	0.88 J	2.51 J	3.47	3.16 J	1.74 J	3.86 U	2.72 J
Total TEQ 1998 (Avian) (ND*0.5)	ng/kg	173	6	102	31.1	21.7	57.3	7.21	8.6	8.16	2.45	54.6	6.63	2.22	2.59	3.06
Total TEQ 1998 (Fish) (ND*0.5)	ng/kg	52.9	2	31.4	10.3	6.17	18.2	2.96	1.89	1.69	0.77	10.6	1.79	1.24	1.2	0.829
Total TEQ Dioxin 1998 (Bird) (ND=0)	ng/kg	173	5	101	30.6	21.5	56.5	7.02	7.16	6.93	1.97	47.3	5.36	0.767	0.159	2.47
Total TEQ Dioxin 1998 (Bird) (ND=1)	ng/kg	174	6.9	104	31.5	21.8	58.1	7.41	10	9.39	2.93	61.9	7.9	3.68	5.02	3.64
Total TEQ Dioxin 1998 (Fish) (ND=0)	ng/kg	52.4	0.7	30.4	9.96	6.03	17.5	2.81	0.476	0.459	0.341	3.46	0.582	0.601	0.108	0.233
Total TEQ Dioxin 1998 (Fish) (ND=1)	ng/kg	53.3	3	32.3	10.7	6.3	18.8	3.11	3.31	2.91	1.2	17.7	2.99	1.88	2.29	1.43
Total TEQ Dioxin Texas TEF (ND=0)	ng/kg	58.1	0.6	33.8	11	6.6	19.3	2.91	0.704	0.806	0.21	5.57	0.503	0.349	0.079	0.389
Total TEQ Dioxin Texas TEF (ND=0.5)	ng/kg	58.4	2	34.7	11.2	6.72	19.9	3.03	2.08	1.97	0.657	12.4	1.64	0.969	1.11	0.859
Total TEQ Dioxin Texas TEF (ND=1)	ng/kg	58.8	2.5	35.6	11.4	6.83	20.4	3.16	3.46	3.14	1.1	19.2	2.78	1.59	2.15	1.33
Total tetrachlorodibenzofuran (TCDF)	ng/kg	222	6.2	124	39.2	24.4	70.6	6.89	9.89	8.48	1.84	72.1	6.94	0.647 U	0.771 U	2.74
Total tetrachlorodibenzo-p-dioxin (TCDD)	ng/kg	46.7	0.615 U	29.9	8.45	0.669 U	16.1	2.36	0.779 U	0.56 J	0.647 U	1.22	0.73 U	0.749 U	1.37 U	0.71
Total WHO Dioxin TEQ(Human/Mammal)(ND=0)	ng/kg	58.8	1.5	35.1	12	7.02	20.7	3.2	1.19	1.22	0.714	8.14	1.77	1.53	0.399	0.832
Total WHO Dioxin TEQ(Human/Mammal)(ND=0.5)	ng/kg	59.2	2.4	35.9	12.3	7.13	21.2	3.35	2.59	2.39	1.19	14.9	2.95	2.12	1.48	1.35
Total WHO Dioxin TEQ(Human/Mammal)(ND=1)	ng/kg	59.5	3.4	36.7	12.6	7.24	21.7	3.5	3.99	3.57	1.67	21.7	4.14	2.71	2.56	1.87
Asbestos																
Asbestos	%	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
PCBs																
Aroclor (unspecified)	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Aroclor-1016 (PCB-1016)	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Aroclor-1221 (PCB-1221)	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Aroclor-1232 (PCB-1232)	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Aroclor-1242 (PCB-1242)	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Aroclor-1248 (PCB-1248)	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Aroclor-1254 (PCB-1254)	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Aroclor-1260 (PCB-1260)	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Aroclor-1262 (PCB-1262)	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Aroclor-1268 (PCB-1268)	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Total PCBs	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Total PCBs (7)	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Total PCBs (ND*0)	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Total PCBs (ND*0.5)	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Total Petroleum Hydrocarbons (TPH)																
Total Petroleum Hydrocarbons	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Total Petroleum Hydrocarbons (C12-C28)	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Total Petroleum Hydrocarbons (C25-C36) ORO	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Total Petroleum Hydrocarbons (C28-C35)	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Total Petroleum Hydrocarbons (C6-C12)	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
General Chemistry																
Cyanide (total)	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Flash point (closed cup)	Deg C	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Moisture	%	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Percent solids	%	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
pH, lab	s.u.	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Reactive cyanide	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Sulfate	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Sulfide	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Sulfur	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Total solids	%	80.2	76.6	71.7	69.4	71.6	70.4	72.9	72.2	75.1	72.1	76	72.1	70.7	62.2	75.8

Notes:
- ng/kg - nanograms per kilogram
- ug/kg - microgram per kilogram
- pg/kg - picogram per kilogram
- mg/kg - milligram per kilogram
- Deg C - Degrees in Celsius
- s.u. - standard unit
- U - Not detected at the associated reporting limit.
- J - Estimated concentration.
- UJ - Not detected; associated reporting limit is estimated.
- Dup - indicates the result from a duplicate sample
- -- Data not available

Table 2-1

First Phase Pre-Design Investigation Analytical Results - Northern Impoundment
Pre- Final 90% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Area: Sample Location: Sample Identification: Sample Date: Sample Type: Sample Depth: Integral Sample ID:	Units	Northern Impoundment - Waste Pits SJSB029 SL0505 11/6/2018 (10-12) ft bgs SJSB029-C6	Northern Impoundment - Waste Pits SJSB029 SL0506 11/6/2018 (12-14) ft bgs SJSB029-C7	Northern Impoundment - Waste Pits SJSB029 SL0507 11/6/2018 (14-16) ft bgs SJSB029-C8	Northern Impoundment - Waste Pits SJSB029 SL0508 11/6/2018 (16-18) ft bgs SJSB029-C9	Northern Impoundment - Waste Pits SJSB030 SL0571 11/18/2018 (0-2) ft bgs SJSB030-C1	Northern Impoundment - Waste Pits SJSB030 SL0572 11/18/2018 (2-4) ft bgs SJSB030-C2	Northern Impoundment - Waste Pits SJSB030 SL0573 11/18/2018 (4-6) ft bgs SJSB030-C3	Northern Impoundment - Waste Pits SJSB030 SL0574 11/18/2018 (6-8) ft bgs SJSB030-C4	Northern Impoundment - Waste Pits SJSB030 SL0575 11/18/2018 (8-10) ft bgs SJSB030-C5	Northern Impoundment - Waste Pits SJSB030 SL0576 11/18/2018 (10-12) ft bgs SJSB030-C6	Northern Impoundment - Waste Pits SJSB030 SL0577 11/18/2018 (12-14) ft bgs SJSB030-C7	Northern Impoundment - Waste Pits SJSB030 SL0578 11/18/2018 (14-16) ft bgs SJSB030-C8	Northern Impoundment - Waste Pits SJSB030 SL0579 11/18/2018 (16-18) ft bgs SJSB030-C9	Northern Impoundment - Waste Pits SJSB031 SL0509 11/8/2018 (0-2) ft bgs SJSB031-C1	Northern Impoundment - Waste Pits SJSB031 SL0518 11/8/2018 Duplicate (0-2) ft bgs SJSB031-C10
Dioxins/Furans																
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	ng/kg	2 J	15.7	0.505 J	13.1	55.7	2.84 U	0.822 J	9.54	5.66 U	0.293 J	9.72	0.976 U	1.27 J	2.98 UJ	8.35
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	ng/kg	3470	1040	296	1320	1290	2130	329	744	175	108	163	195	424	155 J	168
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	ng/kg	0.25 J	0.86 J	3.09 U	3.21	9.23	0.71 J	0.154 U	2.06 J	0.0432 U	0.044 U	1.01 J	0.13 U	0.545 U	0.65 J	0.917 U
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	ng/kg	49.3	21.8	12	30.5	68.1	28.2	6.45	15	3.31	2.19 J	2.85 J	5.33	14.5	5.77	6.03
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	ng/kg	3.83 U	3.22 U	3.09 U	0.299 U	0.87 J	2.83 U	3.04 U	0.171 U	2.83 U	2.86 U	0.113 U	3.02 U	0.0813 U	0.102 U	2.7 U
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	ng/kg	3.83 U	0.125 U	0.0639 U	1.2 U	1.6 J	0.23 U	0.0628 U	0.424 U	0.0231 U	0.03 U	0.34 J	3.02 U	0.26 J	0.66 J	0.45 J
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	ng/kg	0.641 U	0.311 U	3.09 U	3.12 U	0.261 U	2.83 U	3.04 U	0.28 J	0.1 J	0.12 J	0.124 U	0.176 U	0.303 U	2.6 U	0.07 J
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	ng/kg	3.83 U	0.13 J	3.09 U	0.508 U	0.82 J	0.119 U	0.0429 U	0.124 U	0.0181 U	0.0299 U	0.0872 U	3.02 U	0.0909 U	0.0948 U	0.159 U
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	ng/kg	1.38 J	0.538 U	0.324 U	3.12 U	2.04 J	0.91 J	0.257 U	0.45 J	0.16 J	0.1 J	0.2 U	0.3 U	0.65 J	0.239 U	0.22 J
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	ng/kg	3.83 U	3.22 U	3.09 U	3.12 U	0.178 U	0.0854 U	0.0674 U	0.135 U	0.0215 U	2.86 U	2.95 U	3.02 U	3.21 U	0.071 U	0.0935 U
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	ng/kg	1.98 J	1.14 J	0.372 U	1.1 J	1.12 J	1.23 U	0.38 J	0.65 J	0.134 U	0.31 J	0.3 J	0.372 U	1.08 J	0.23 J	0.35 J
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	ng/kg	3.83 U	3.22 U	3.09 U	0.708 U	1.08 J	0.202 U	3.04 U	0.193 U	2.83 U	2.86 U	2.95 U	3.02 U	3.21 U	0.292 U	0.193 U
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	ng/kg	3.83 U	0.308 U	3.09 U	0.131 U	0.269 U	0.184 U	3.04 U	0.188 U	2.83 U	2.86 U	2.95 U	3.02 U	0.201 U	0.125 U	0.104 U
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	ng/kg	3.83 U	3.22 U	3.09 U	0.328 U	0.68 J	0.13 U	0.0353 U	0.16 J	2.83 U	2.86 U	2.95 U	3.02 U	0.109 U	2.6 U	0.0789 U
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	ng/kg	3.83 U	3.22 U	3.09 U	0.528 U	1.44 J	2.83 U	3.04 U	0.14 U	2.83 U	2.86 U	0.128 U	3.02 U	3.21 U	0.285 U	0.144 U
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	ng/kg	1.21 U	0.89	0.644 U	21	11.1	2.34	1.13	2.83	0.966 U	0.65	0.59 U	0.604 U	0.641 U	5.34	3.4
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	ng/kg	0.766 U	0.728 U	0.834 U	5.87	4.01 U	0.867 U	0.607 U	1.83	0.453 U	0.59	0.59 U	0.604 U	0.641 U	1.59	1.06
Octachlorodibenzofuran (OCDF) 13C12	ng/kg	2 J	15.7	0.5 J	13.1	55.7	2.84 U	0.82 J	9.54	0.115 U	0.29 J	9.72	0.976 U	1.27 J	2.98 UJ	8.35
Total dioxin/furan	pg/g	3520	1080	308	1390	1440	2160	338	777	200	110	177	200	442	169	188
Total dioxin/furan (ND*0.5)	pg/g	3530	1080	310	1400	1450	2170	339	777	200	110	178	202	443	171	189
Total dioxin/furan (ND*1)	pg/g	3530	1080	311	1400	1450	2170	340	778	200	110	179	204	445	174	190
Total heptachlorodibenzofuran (HpCDF)	ng/kg	0.49 J	0.86 J	3.09 U	9.05	35.5	1.94 J	0.27 J	4.96	2.83 U	0.05 J	1.01 J	3.02 U	0.2 J	0.65 J	1.39 J
Total heptachlorodibenzo-p-dioxin (HpCDD)	ng/kg	139	60.8	25.3	103	160	86.7	24.1	44.6	12.5	8.71	11	24.7	49.6	19.1	19.7
Total hexachlorodibenzofuran (HxCDF)	ng/kg	0.24 J	0.13 J	3.09 U	2.02 J	12.9	0.5 J	3.04 U	1.12 J	2.83 U	2.86 U	0.34 J	3.02 U	0.26 J	0.66 J	0.86 J
Total hexachlorodibenzo-p-dioxin (HxCDD)	ng/kg	28.7	13.8	2.12 J	16.1	20.1	17	7.72	11.1	2.32 J	2.15 J	0.62 J	2.28 J	16.4	3.58	3.89
Total pentachlorodibenzofuran (PeCDF)	ng/kg	3.83 U	3.22 U	3.09 U	2.71 J	7.36	2.83 U	3.04 U	2.82 U	2.83 U	2.86 U	2.95 U	3.02 U	3.21 U	0.39 J	2.7 U
Total pentachlorodibenzo-p-dioxin (PeCDD)	ng/kg	3.08 J	0.78 J	0.72 J	0.73 J	1.43 J	0.53 J	0.63 J	1.29 J	0.08 J	2.86 U	2.95 U	2.27 J	3.21 U	2.6 U	2.7 U
Total TEQ 1998 (Avian) (ND*0.5)	ng/kg	1.77	1.79	0.921	27.7	15.5	3.29	1.66	5.07	0.812	1.4	0.489	0.803	1.05	7.28	4.72
Total TEQ 1998 (Fish) (ND*0.5)	ng/kg	1.12	0.862	0.588	7.56	4.18	1.05	0.545	2.41	0.38	0.762	0.39	0.507	0.673	2.12	1.45
Total TEQ Dioxin 1998 (Bird) (ND=0)	ng/kg	0.611	1.15	0.0416	27.2	13.4	2.6	1.21	4.87	0.027	1.3	0.0942	0.0248	0.198	7.05	4.57
Total TEQ Dioxin 1998 (Bird) (ND=1)	ng/kg	2.93	2.43	1.8	28.1	17.7	3.99	2.12	5.28	1.6	1.46	0.883	1.58	1.91	7.5	4.87
Total TEQ Dioxin 1998 (Fish) (ND=0)	ng/kg	0.433	0.205	0.0416	7.13	1.97	0.374	0.0997	2.25	0.07	0.7	0.0672	0.0248	0.1	1.95	1.34
Total TEQ Dioxin 1998 (Fish) (ND=1)	ng/kg	1.81	1.52	1.13	8	6.39	1.72	0.99	2.58	0.68	0.824	0.713	0.989	1.25	2.29	1.56
Total TEQ Dioxin Texas TEF (ND=0)	ng/kg	0.336	0.216	0	8.08	2.51	0.325	0.151	2.27	0.03	0.7	0.064	0	0.199	2.21	1.51
Total TEQ Dioxin Texas TEF (ND=0.5)	ng/kg	0.899	0.759	1.1	8.41	4.6	0.943	0.55	2.39	0.34	0.8	0.341	0.919	0.675	2.35	1.59
Total TEQ Dioxin Texas TEF (ND=1)	ng/kg	1.46	1.3	1.1	8.75	6.69	1.56	0.948	2.5	0.66	0.8	0.619	0.919	1.15	2.48	1.67
Total tetrachlorodibenzofuran (TCDF)	ng/kg	2.61	0.42 J	0.619 U	31	22.2	3.86	1.6	3.99	0.45 J	0.39 J	0.59 U	0.604 U	0.45 J	7.97	5.57
Total tetrachlorodibenzo-p-dioxin (TCDD)	ng/kg	0.766 U	0.728 U	0.834 U	5.87	0.586 U	0.8	0.607 U	2.38	0.566 U	0.59	0.59 U	3.31	0.641 U	1.95	1.06
Total WHO Dioxin TEQ(Human/Mammal)(ND=0)	ng/kg	1.87	0.759	0.209	8.82	3.39	1.25	0.314	2.66	0.11	0.76	0.154	0.112	0.472	2.32	1.62
Total WHO Dioxin TEQ(Human/Mammal)(ND=0.5)	ng/kg	2.45	1.36	0.769	9.13	5.54	1.9	0.735	2.81	0.44	0.82	0.453	0.592	0.982	2.46	1.72
Total WHO Dioxin TEQ(Human/Mammal)(ND=1)	ng/kg	3.02	1.96	1.33	9.44	7.7	2.55	1.16	2.96	0.77	0.87	0.751	1.07	1.49	2.59	1.81
Asbestos																
Asbestos	%	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
PCBs																
Aroclor (unspecified)	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Aroclor-1016 (PCB-1016)	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Aroclor-1221 (PCB-1221)	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Aroclor-1232 (PCB-1232)	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Aroclor-1242 (PCB-1242)	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Aroclor-1248 (PCB-1248)	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Aroclor-1254 (PCB-1254)	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Aroclor-1260 (PCB-1260)	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Aroclor-1262 (PCB-1262)	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Aroclor-1268 (PCB-1268)	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Total PCBs	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Total PCBs (7)	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Total PCBs (ND*0)	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Total PCBs (ND*0.5)	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Total Petroleum Hydrocarbons (TPH)																
Total Petroleum Hydrocarbons	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Total Petroleum Hydrocarbons (C12-C28)	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Total Petroleum Hydrocarbons (C25-C36) ORO	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Total Petroleum Hydrocarbons (C28-C35)	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Total Petroleum Hydrocarbons (C6-C12)	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
General Chemistry																
Cyanide (total)	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Flash point (closed cup)	Deg C	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Moisture	%	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Percent solids	%	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
pH, lab	s.u.	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Reactive cyanide	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Sulfate	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Sulfide	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Sulfur	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Total solids	%	62.3	74.6	76.8	76.2	85	86.5	81.8	82.9	81.7	82.4	81.1	80.6	74	88.5	88.4

Notes:
ng/kg - nanograms per kilogram
ug/kg - microgram per kilogram
pg/kg - picogram per kilogram
mg/kg - milligram per kilogram
Deg C - Degrees in Celsius
s.u. - standard unit
U - Not detected at the associated reporting limit.
J - Estimated concentration.
UJ - Not detected; associated reporting limit is estimated.
Dup - indicates the result from a duplicate sample
-- Data not available

Table 2-1

First Phase Pre-Design Investigation Analytical Results - Northern Impoundment
Pre- Final 90% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Area:	Units	Northern Impoundment - Waste Pits	Northern Impoundment - Waste Pits	Northern Impoundment - Waste Pits	Northern Impoundment - Waste Pits	Northern Impoundment - Waste Pits	Northern Impoundment - Waste Pits	Northern Impoundment - Waste Pits	Northern Impoundment - Waste Pits	Northern Impoundment - Waste Pits	Northern Impoundment - Waste Pits	Northern Impoundment - Waste Pits	Northern Impoundment - Waste Pits	Northern Impoundment - Waste Pits	Northern Impoundment - Waste Pits	Northern Impoundment - Waste Pits
Sample Location:		SJSB031	SJSB031	SJSB031	SJSB031	SJSB031	SJSB031	SJSB031	SJSB031	SJSB032	SJSB032	SJSB032	SJSB032	SJSB032	SJSB032	SJSB032
Sample Identification:		SL0510	SL0511	SL0512	SL0513	SL0514	SL0515	SL0516	SL0517	SL0561	SL0562	SL0563	SL0570	SL0564	SL0565	SL0566
Sample Date:		11/8/2018	11/8/2018	11/8/2018	11/8/2018	11/8/2018	11/9/2018	11/9/2018	11/9/2018	11/17/2018	11/17/2018	11/17/2018	11/17/2018	11/17/2018	11/17/2018	11/17/2018
Sample Type:													Duplicate			
Sample Depth:		(2-4) ft bgs	(4-6) ft bgs	(6-8) ft bgs	(8-10) ft bgs	(10-12) ft bgs	(12-14) ft bgs	(14-16) ft bgs	(16-18) ft bgs	(0-2) ft bgs	(2-4) ft bgs	(4-6) ft bgs	(4-6) ft bgs	(6-8) ft bgs	(8-10) ft bgs	(10-12) ft bgs
Integral Sample ID:		SJSB031-C2	SJSB031-C3	SJSB031-C4	SJSB031-C5	SJSB031-C6	SJSB031-C7	SJSB031-C8	SJSB031-C9	SJSB032-C1	SJSB032-C2	SJSB032-C3	SJSB032-C10	SJSB032-C4	SJSB032-C5	SJSB032-C6
Dioxins/Furans																
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	ng/kg	1.17 U	1.88 U	1.84 U	2.9 U	4.65 J	1.58 J	2.9 J	0.801 J	56.7	102	31.4	21.5	2.21 J	3.22 J	0.521 U
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	ng/kg	650	449	331	375	416	113	239	165	1630	2730	1090	839	432	496	97.4
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	ng/kg	0.161 U	0.27 J	0.25 J	0.449 U	1.07 U	0.42 J	0.7 J	0.16 U	79	134	46.7	29.6	0.66 J	2.6 J	0.722 U
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	ng/kg	9.75	7.96	6.85	7.86	11.4	3.98	6.96	6.29	69.6	134	40.8	31.7	9.37	12.1	2.59 J
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	ng/kg	2.76 U	3.01 U	2.88 U	2.89 UJ	3 U	2.83 U	0.136 U	3.25 U	25.4	40.7	16	9.94	0.0833 U	0.81 J	0.26 J
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	ng/kg	0.1 J	0.0778 U	0.0583 U	2.89 U	0.213 U	0.147 U	0.131 U	3.25 U	236	400	159	87.8	0.6 J	6.84	1.95 U
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	ng/kg	2.76 U	3.01 U	0.21 J	2.89 U	0.188 U	0.0841 U	2.99 U	0.11 J	0.48 J	0.66 J	2.86 UJ	0.24 J	0.151 U	0.4 J	2.93 U
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	ng/kg	2.76 U	3.01 U	2.88 U	2.89 U	0.143 U	0.0677 U	0.0986 U	3.25 U	57.2	94.9	40.1	21	0.24 J	1.72 J	0.66 J
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	ng/kg	0.43 J	0.23 J	0.243 U	0.262 U	0.53 J	0.139 U	0.26 J	0.32 J	2.58 J	4.16	1.43 J	1.19 J	0.36 U	0.391 U	0.106 U
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	ng/kg	0.125 U	3.01 U	0.105 U	2.89 U	3 U	2.83 U	0.128 U	0.0837 U	15.7	24.6	14.8	5.72	3.05 U	0.513 U	0.203 U
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	ng/kg	0.431 U	0.342 U	0.42 J	0.62 J	0.449 U	0.199 U	0.29 J	0.374 U	0.813 U	1.25 U	0.701 U	0.578 U	0.418 U	0.69 J	0.101 U
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	ng/kg	2.76 U	3.01 U	2.88 U	2.89 U	0.17 J	0.12 U	0.105 U	3.25 U	141	233	92.4	48	0.27 J	3.96	1.28 J
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	ng/kg	2.76 U	3.01 U	0.13 J	0.177 U	0.152 U	0.0601 U	0.141 U	0.104 U	14.3	28.1	6.72	6.25	0.174 U	0.68 J	0.239 U
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	ng/kg	2.76 U	3.01 U	0.0634 U	2.89 U	0.11 J	0.0743 U	0.16 J	3.25 U	9.79	16.9	8.72	3.61	0.1 U	0.49 J	0.12 J
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	ng/kg	2.76 U	3.01 U	2.88 U	2.89 U	3 U	2.83 U	0.116 U	3.25 U	123	226	79.6	46.6	0.267 U	4.05	1.14 J
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	ng/kg	0.553 U	0.602 U	0.576 U	1.35 U	0.99	0.97	0.546 U	0.65 U	5210	10500	4620	2450	8.96	157	43.9
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	ng/kg	0.553 U	0.602 U	0.576 U	0.501 U	0.41 J	0.163 U	0.598 U	0.65 U	2800	6450	2650 J	1460	4.79	66.7	21.4
Octachlorodibenzofuran (OCDF) 13C12	ng/kg	1.17 U	1.88 U	1.84 U	2.9 U	4.65 J	1.58 J	2.9 J	0.8 J	56.7	102	31.4	21.5	2.21 J	3.22 J	0.52 U
Total dioxin/furan	pg/g	700	457	339	383	434	120	250	173	10500	21100	8900	5060	459	757	169
Total dioxin/furan (ND*0.5)	pg/g	700	460	341	387	436	121	251	173	10500	21100	8900	5060	460	758	171
Total dioxin/furan (ND*1)	pg/g	700	462	343	390	437	121	252	174	10500	21100	8900	5060	461	758	173
Total heptachlorodibenzofuran (HpCDF)	ng/kg	2.76 U	0.46 J	0.46 J	0.4 J	1.96 J	1.16 J	1.91 J	3.25 U	146	245	83.4	53.5	0.66 J	4.94	0.26 J
Total heptachlorodibenzo-p-dioxin (HpCDD)	ng/kg	40.9	31	28.1	33.8	41.1	12.5	24	22.2	156	258	91.2	71.8	30.5	37.4	10.7
Total hexachlorodibenzofuran (HxCDF)	ng/kg	0.1 J	3.01 U	2.88 U	2.89 U	1.07 J	0.12 J	0.61 J	0.05 J	350	589	241	127	1.51 J	9.25	0.96 J
Total hexachlorodibenzo-p-dioxin (HxCDD)	ng/kg	11.6	7.81	7.43	8.94	7.5	2.74 J	4.67	8.36	18.2	27.9	16.6	15.1	6.04	10.7	2.69 J
Total pentachlorodibenzofuran (PeCDF)	ng/kg	2.76 U	3.01 U	2.88 U	2.89 U	0.17 J	2.83 U	2.99 U	3.25 U	388	686	260	2.98 U	0.8 J	12.2	2.42 J
Total pentachlorodibenzo-p-dioxin (PeCDD)	ng/kg	0.71 J	0.62 J	0.44 J	1.01 J	0.56 J	0.06 J	0.49 J	0.95 J	19.9	31.6	7.65	8.48	1.06 J	0.89 J	0.42 J
Total TEQ 1998 (Avian) (ND*0.5)	ng/kg	0.8	0.786	0.864	1.23	1.68	1.17	0.801	0.323	8190	17300	7390	3980	14.2	230	66.9
Total TEQ 1998 (Fish) (ND*0.5)	ng/kg	0.54	0.487	0.623	0.522	0.718	0.235	0.511	0.276	3180	7180	2960	1630	5.59	78.7	24.6
Total TEQ Dioxin 1998 (Bird) (ND=0)	ng/kg	0.09	0.0579	0.225	0.107	1.49	0.99	0.0858	0.0316	8190	17300	7390	3980	13.9	230	66.7
Total TEQ Dioxin 1998 (Bird) (ND=1)	ng/kg	1.51	1.51	1.5	2.35	1.87	1.35	1.52	0.615	8190	17300	7390	3980	14.4	230	67.1
Total TEQ Dioxin 1998 (Fish) (ND=0)	ng/kg	0.09	0.0579	0.282	0.0516	0.538	0.0681	0.0596	0.0811	3180	7180	2960	1630	5.39	78.7	24.3
Total TEQ Dioxin 1998 (Fish) (ND=1)	ng/kg	0.99	0.917	0.965	0.993	0.898	0.403	0.961	0.472	3180	7180	2960	1630	5.79	78.7	24.8
Total TEQ Dioxin Texas TEF (ND=0)	ng/kg	0.05	0.023	0.128	0.062	0.582	0.097	0.071	0.043	3430	7690	3180	1750	5.78	86	26.5
Total TEQ Dioxin Texas TEF (ND=0.5)	ng/kg	0.46	0.437	0.494	0.505	0.702	0.247	0.48	0.232	3430	7690	3180	1750	5.94	86	26.7
Total TEQ Dioxin Texas TEF (ND=1)	ng/kg	0.87	0.851	0.86	0.949	0.823	0.398	0.889	0.421	3430	7690	3180	1750	6.11	86.1	26.9
Total tetrachlorodibenzofuran (TCDF)	ng/kg	0.553 U	0.602 U	0.576 U	0.577 U	0.99	1.38	0.598 U	0.65 U	8180	15500	4270	3300	15.3	282	85.6
Total tetrachlorodibenzo-p-dioxin (TCDD)	ng/kg	0.553 U	0.602 U	0.576 U	0.577 U	0.41 J	0.566 U	0.598 U	0.78	2130	4430	1200	893	4.79	67.9	21.4
Total WHO Dioxin TEQ(Human/Mammal)(ND=0)	ng/kg	0.35	0.24	0.363	0.253	0.818	0.175	0.22	0.156	3410	7660	3170	1740	6.01	85.7	26.3
Total WHO Dioxin TEQ(Human/Mammal)(ND=0.5)	ng/kg	0.77	0.666	0.719	0.726	0.97	0.333	0.653	0.362	3410	7660	3170	1740	6.19	85.8	26.5
Total WHO Dioxin TEQ(Human/Mammal)(ND=1)	ng/kg	1.2	1.09	1.07	1.2	1.12	0.49	1.09	0.568	3410	7660	3170	1740	6.36	85.8	26.8
Asbestos																
Asbestos	%	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
PCBs																
Aroclor (unspecified)	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Aroclor-1016 (PCB-1016)	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Aroclor-1221 (PCB-1221)	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Aroclor-1232 (PCB-1232)	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Aroclor-1242 (PCB-1242)	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Aroclor-1248 (PCB-1248)	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Aroclor-1254 (PCB-1254)	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Aroclor-1260 (PCB-1260)	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Aroclor-1262 (PCB-1262)	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Aroclor-1268 (PCB-1268)	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Total PCBs	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Total PCBs (7)	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Total PCBs (ND*0)	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Total PCBs (ND*0.5)	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Total Petroleum Hydrocarbons (TPH)																
Total Petroleum Hydrocarbons	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Total Petroleum Hydrocarbons (C12-C28)	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Total Petroleum Hydrocarbons (C25-C36) ORO	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Total Petroleum Hydrocarbons (C28-C35)	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Total Petroleum Hydrocarbons (C6-C12)	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
General Chemistry																
Cyanide (total)	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Flash point (closed cup)	Deg C	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Moisture	%	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Percent solids	%	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
pH, lab	s.u.	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Reactive cyanide	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Sulfate	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Sulfide	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Sulfur	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Total solids	%	84.3	79.6	84.4	84.4	82.6	82.2	81.9	75.9	84.4	81.4	82.9	83	77	80.5	82.5

Notes:
- ng/kg - nanograms per kilogram
- ug/kg - microgram per kilogram
- pg/kg - picogram per kilogram
- mg/kg - milligram per kilogram
- Deg C - Degrees in Celsius
- s.u. - standard unit
- U - Not detected at the associated reporting limit.
- J - Estimated concentration.
- UJ - Not detected; associated reporting limit is estimated.
- Dup - indicates the result from a duplicate sample
- -- Data not available

Table 2-1

First Phase Pre-Design Investigation Analytical Results - Northern Impoundment
Pre- Final 90% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Area:	Units	Northern Impoundment - Waste Pits	Northern Impoundment - Waste Pits	Northern Impoundment - Waste Pits	Northern Impoundment - Waste Pits	Northern Impoundment - Waste Pits	Northern Impoundment - Waste Pits	Northern Impoundment - Waste Pits	Northern Impoundment - Waste Pits	Northern Impoundment - Waste Pits	Northern Impoundment - Waste Pits	Northern Impoundment - Waste Pits	Northern Impoundment - Waste Pits	Northern Impoundment - Waste Pits	Northern Impoundment - Waste Pits	Northern Impoundment - Waste Pits
Sample Location:		SJSB032	SJSB032	SJSB032	SJSB033	SJSB033	SJSB033	SJSB033	SJSB033	SJSB033	SJSB033	SJSB033	SJSB033	SJSB034	SJSB034	SJSB034
Sample Identification:		SL0567	SL0568	SL0569	SL0539	SL0540	SL0541	SL0542	SL0543	SL0544	SL0545	SL0546	SL0538	SL0519	SL0520	SL0521
Sample Date:		11/17/2018	11/17/2018	11/17/2018	11/12/2018	11/12/2018	11/12/2018	11/12/2018	11/12/2018	11/12/2018	11/14/2018	11/14/2018	11/15/2018	11/10/2018	11/10/2018	11/10/2018
Sample Type:																
Sample Depth:		(12-14) ft bgs	(14-16) ft bgs	(16-18) ft bgs	(2-4) ft bgs	(4-6) ft bgs	(6-8) ft bgs	(8-10) ft bgs	(10-12) ft bgs	(12-14) ft bgs	(14-16) ft bgs	(16-18) ft bgs	(0-2) ft bgs	(0-2) ft bgs	(2-4) ft bgs	(4-6) ft bgs
Integral Sample ID:		SJSB032-C7	SJSB032-C8	SJSB032-C9	SJSB033-C2	SJSB033-C3	SJSB033-C4	SJSB033-C5	SJSB033-C6	SJSB033-C7	SJSB033-C8	SJSB033-C9	SJSB033-C1	SJSB034-C1	SJSB034-C2	SJSB034-C3
Dioxins/Furans																
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	ng/kg	5.79 U	0.333 J	0.77 U	105	133	112	44.3	5.59	0.815 J	1.23 J	0.583 U	17.4	1.01 U	0.646 J	1.96 U
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	ng/kg	80.9	49.2	32.9	481	1720	2180	829	200	90.1	127	109	588	272	319	180
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	ng/kg	0.39 J	0.06 J	0.322 U	41.1	197	201	71.5	7.5	1.05 J	0.92 J	0.51 J	6.85	0.344 U	0.0608 U	0.253 U
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	ng/kg	2.42 J	1.7 J	1.31 J	19.8	62.5	71.5	24.7	5.79	2.19 J	3.87	4.09	22.7	5.69	5.85	4.3
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	ng/kg	0.111 U	3.1 U	0.133 U	17.2	81.3	71.4	31.6	2.92	0.45 J	0.24 J	0.2 J	1.73 J	0.0928 U	0.06 J	2.93 U
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	ng/kg	1.38 J	0.159 U	1.32 J	109	651	584	241	26.3	3.21	2 J	1.65 J	12.9	0.62 J	0.158 U	0.278 U
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	ng/kg	2.89 U	3.1 U	3.08 U	0.258 U	0.57 J	0.633 U	0.257 U	2.78 U	2.94 U	0.109 U	0.21 J	0.192 U	2.79 U	2.74 U	2.93 U
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	ng/kg	0.34 J	0.03 J	0.295 U	24.2	144	138	54.8	6	0.743 U	0.57 J	0.361 U	3.33	0.106 U	2.74 U	0.178 U
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	ng/kg	0.0632 U	3.1 U	0.11 J	0.728 U	2.24 U	2.96 J	0.783 U	2.78 U	0.113 U	0.187 U	0.31 J	0.821 U	0.216 U	2.74 U	2.93 U
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	ng/kg	0.0691 U	0.0388 U	0.0667 U	6.5	41.5	35.5	13.5	2.27 J	0.27 J	0.15 J	0.145 U	1.18 J	2.79 U	0.0571 U	2.93 U
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	ng/kg	0.0782 U	0.201 U	3.08 U	0.487 U	1.03 U	1.7 U	0.717 U	0.238 U	0.13 J	0.34 J	0.26 J	0.58 U	0.279 U	0.4 J	0.19 J
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	ng/kg	0.88 J	3.1 U	0.522 U	33.3	268	230	76.8	12.1	1.63 J	1.03 J	0.73 J	8.87	0.46 J	2.74 U	2.93 U
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	ng/kg	0.156 U	0.133 U	0.17 U	3.5 U	23.8	21.9	6.89	0.975 U	0.179 U	0.3 J	3.02 U	0.805 U	2.79 U	2.74 U	2.93 U
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	ng/kg	0.0505 U	3.1 U	3.08 U	4.3	26	22.3	7.67 U	1.42 J	0.102 U	2.95 U	3.02 U	0.785 U	0.0489 U	2.74 U	0.07 J
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	ng/kg	0.731 U	3.1 U	0.512 U	26.8	214	186	60.7	9.37	1.14 U	0.87 J	0.53 J	6.45	0.32 J	2.74 U	2.93 U
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	ng/kg	27.3	2.98	21.8	1420	10600	8340	2510	274	39.6	26.2	20.2	184	11.8	3.27 UJ	6.07
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	ng/kg	12.7	1.69	10.2 J	879	5870	4740	1390	122	19.3	14	9.83	72.2	3.53	1.35 UJ	2.09
Octachlorodibenzofuran (OCDF) 13C12	ng/kg	0.0841 U	0.33 J	0.77 U	105	133	112	44.3	5.59	0.81 J	1.23 J	0.583 U	17.4	1.01 U	0.646 J	1.96 U
Total dioxin/furan	pg/g	126	56	67.6	3170	20000	16900	5350	675	159	179	148	926	294	326	193
Total dioxin/furan (ND*0.5)	pg/g	127	56.4	69.1	3170	20000	16900	5360	676	160	179	148	927	296	329	195
Total dioxin/furan (ND*1)	pg/g	128	56.9	70.6	3170	20000	16900	5360	677	161	179	149	929	297	332	197
Total heptachlorodibenzofuran (HpCDF)	ng/kg	2.89 U	0.06 J	3.08 U	71.5	338	326	124	12.5	2.94 U	1.17 J	0.71 J	15.9	2.79 U	0.06 J	0.17 J
Total heptachlorodibenzo-p-dioxin (HpCDD)	ng/kg	9.98	6.26	4.14	47.5	147	183	64.1	17.4	8.14	13.2	12.6	56	20.7	22.6	17.3
Total hexachlorodibenzofuran (HxCDF)	ng/kg	1.72 J	0.03 J	1.44 J	148	928	834	330	39.1	3.48	2.74 J	1.65 J	22	0.62 J	2.74 U	0.07 J
Total hexachlorodibenzo-p-dioxin (HxCDD)	ng/kg	3.05	3.19	0.56 J	5.1	20.4	30.8	11.9	4.11	0.13 J	1.93 J	4.05	6.97	0.86 J	3.91	1.15 J
Total pentachlorodibenzofuran (PeCDF)	ng/kg	1.66 J	3.1 U	0.28 J	90.1	727	628	206	30.9	2.29 J	1.9 J	1.27 J	22.8	0.79 J	2.74 U	2.93 U
Total pentachlorodibenzo-p-dioxin (PeCDD)	ng/kg	0.64 J	0.64 J	0.36 J	2.96 U	29.4	28.6	8.2	2.78 U	0.3 J	1.16 J	0.59 J	0.2 J	2.79 U	2.74 U	2.93 U
Total TEQ 1998 (Avian) (ND*0.5)	ng/kg	40.7	4.81	32.5	2350	16800	13400	4010	411	60.1	41.8	31	266	15.9	2.59	8.52
Total TEQ 1998 (Fish) (ND*0.5)	ng/kg	14.6	1.96	11.7	982	6630	5360	1590	145	22.2	16.4	11.5	87.5	4.5	0.984	2.69
Total TEQ Dioxin 1998 (Bird) (ND=0)	ng/kg	40.3	4.68	32.1	2340	16800	13400	4010	410	59.5	41.8	30.9	265	15.8	0.0784	8.21
Total TEQ Dioxin 1998 (Bird) (ND=1)	ng/kg	41.2	4.95	32.9	2350	16800	13400	4010	411	60.8	41.8	31.1	266	16	5.1	8.82
Total TEQ Dioxin 1998 (Fish) (ND=0)	ng/kg	14.3	1.85	11.4	980	6630	5360	1590	145	21.7	16.4	11.4	87	4.4	0.0424	2.42
Total TEQ Dioxin 1998 (Fish) (ND=1)	ng/kg	14.8	2.08	12	984	6630	5360	1590	146	22.6	16.5	11.7	88	4.6	1.93	2.96
Total TEQ Dioxin Texas TEF (ND=0)	ng/kg	15.6	1.99	12.5	1050	7150	5770	1710	158	23.7	17.6	12.4	96	4.96	0.04	2.72
Total TEQ Dioxin Texas TEF (ND=0.5)	ng/kg	15.9	2.07	12.7	1050	7150	5770	1710	159	24.1	17.6	12.5	96.3	5.02	1	2.9
Total TEQ Dioxin Texas TEF (ND=1)	ng/kg	16.1	2.15	12.9	1050	7150	5770	1710	159	24.5	17.6	12.5	96.6	5.09	1.96	3.08
Total tetrachlorodibenzofuran (TCDF)	ng/kg	46.2	3.28	33.5	1620	13300	12100	3430	450	61.8	38	31.7	311	17.7	0.548 U	6.63
Total tetrachlorodibenzo-p-dioxin (TCDD)	ng/kg	18.7	3.44	10.2	517	3660	3450	954	133	19.3	14	9.83	79	3.53	0.761 U	2.09
Total WHO Dioxin TEQ(Human/Mammal)(ND=0)	ng/kg	15.7	2.02	12.5	1050	7120	5740	1700	156	23.7	17.6	12.4	95	5.02	0.195	2.82
Total WHO Dioxin TEQ(Human/Mammal)(ND=0.5)	ng/kg	15.9	2.13	12.7	1050	7120	5740	1700	157	24	17.6	12.5	95.6	5.12	1.17	3.04
Total WHO Dioxin TEQ(Human/Mammal)(ND=1)	ng/kg	16.1	2.23	12.9	1050	7120	5740	1700	157	24.3	17.6	12.6	96.1	5.22	2.15	3.26
Asbestos																
Asbestos	%	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
PCBs																
Aroclor (unspecified)	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Aroclor-1016 (PCB-1016)	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Aroclor-1221 (PCB-1221)	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Aroclor-1232 (PCB-1232)	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Aroclor-1242 (PCB-1242)	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Aroclor-1248 (PCB-1248)	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Aroclor-1254 (PCB-1254)	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Aroclor-1260 (PCB-1260)	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Aroclor-1262 (PCB-1262)	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Aroclor-1268 (PCB-1268)	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Total PCBs	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Total PCBs (7)	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Total PCBs (ND*0)	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Total PCBs (ND*0.5)	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Total Petroleum Hydrocarbons (TPH)																
Total Petroleum Hydrocarbons	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Total Petroleum Hydrocarbons (C12-C28)	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Total Petroleum Hydrocarbons (C25-C36) ORO	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Total Petroleum Hydrocarbons (C28-C35)	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Total Petroleum Hydrocarbons (C6-C12)	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
General Chemistry																
Cyanide (total)	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Flash point (closed cup)	Deg C	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Moisture	%	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Percent solids	%	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
pH, lab	s.u.	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Reactive cyanide	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Sulfate	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Sulfide	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Sulfur	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Total solids	%	80.6	74.5	79.5	81	77	74.6	78.3	82.6	79.1	80.1	80	89.7	86.5	84.2	81.9

Notes:
ng/kg - nanograms per kilogram
ug/kg - microgram per kilogram
pg/kg - picogram per kilogram
mg/kg - milligram per kilogram
Deg C - Degrees in Celsius
s.u. - standard unit
U - Not detected at the associated reporting limit.
J - Estimated concentration.
UJ - Not detected; associated reporting limit is estimated.
Dup - indicates the result from a duplicate sample
-- Data not available

Table 2-1

First Phase Pre-Design Investigation Analytical Results - Northern Impoundment
Pre- Final 90% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Area:	Units	Northern Impoundment - Waste Pits	Northern Impoundment - Waste Pits	Northern Impoundment - Waste Pits	Northern Impoundment - Waste Pits	Northern Impoundment - Waste Pits	Northern Impoundment - Waste Pits	Northern Impoundment - Waste Pits
Sample Location:		SJSB034	SJSB034	SJSB034	SJSB034	SJSB034	SJSB034	SJSB035
Sample Identification:		SL0522	SL0523	SL0524	SL0525	SL0526	SL0527	SL0528
Sample Date:		11/10/2018	11/10/2018	11/10/2018	11/10/2018	11/10/2018	11/10/2018	11/11/2018
Sample Type:								
Sample Depth:		(6-8) ft bgs	(8-10) ft bgs	(10-12) ft bgs	(12-14) ft bgs	(14-16) ft bgs	(16-18) ft bgs	(0-2) ft bgs
Integral Sample ID:		SJSB034-C4	SJSB034-C5	SJSB034-C6	SJSB034-C7	SJSB034-C8	SJSB034-C9	SJSB035-C1
Dioxins/Furans								
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	ng/kg	2.73 U	18.8 J	0.729 U	0.441 U	0.377 U	0.362 U	12.1 U
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	ng/kg	787	170	159	229	121	315	481
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	ng/kg	0.6 J	2.78 J	0.26 J	0.13 J	0.0427 U	0.11 J	2.9
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	ng/kg	12.6	4.77	2.68 J	3.48 U	2.36 J	5.03	20.7
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	ng/kg	3.1 U	0.303 U	0.185 U	3.09 U	2.86 U	2.85 U	2.79 U
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	ng/kg	0.166 U	0.42 J	0.145 U	0.0637 U	0.0756 U	0.0751 U	0.546 U
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	ng/kg	0.184 U	3.03 U	0.199 U	0.071 U	2.86 U	2.85 U	0.12 J
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	ng/kg	0.16 J	0.18 J	0.12 J	3.09 U	2.86 U	0.032 U	0.29 J
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	ng/kg	0.393 U	0.152 U	0.116 U	0.121 U	0.177 U	0.21 J	0.65 J
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	ng/kg	0.11 U	0.1 U	0.25 J	3.09 U	2.86 U	2.85 U	0.107 U
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	ng/kg	0.638 U	0.131 U	0.24 U	0.227 U	0.278 U	0.41 J	0.43 J
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	ng/kg	3.1 U	0.108 U	0.126 U	3.09 U	0.114 U	2.85 U	0.35 J
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	ng/kg	3.1 U	3.03 U	2.97 U	3.09 U	2.86 U	2.85 U	2.79 U
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	ng/kg	3.1 U	0.0639 U	0.128 U	0.0537 U	2.86 U	2.85 U	0.108 U
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	ng/kg	3.1 U	3.03 U	0.204 U	3.09 U	2.86 U	2.85 U	2.79 U
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	ng/kg	2.49 U	1.55	1.87	2.01 U	1.97 J	1.34	2.41
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	ng/kg	0.619 U	0.54 J	0.79 U	0.618 U	1.12 J	0.48 J	0.847 U
Octachlorodibenzofuran (OCDF) 13C12	ng/kg	2.73 U	18.8 J	0.729 U	0.441 U	0.377 U	0.362 U	12.1 U
Total dioxin/furan	pg/g	800	199	164	229	126	323	509
Total dioxin/furan (ND*0.5)	pg/g	804	200	166	233	127	323	516
Total dioxin/furan (ND*1)	pg/g	808	200	167	237	128	324	523
Total heptachlorodibenzofuran (HpCDF)	ng/kg	1.27 J	5	0.26 J	0.2 J	2.86 U	0.11 J	11.6
Total heptachlorodibenzo-p-dioxin (HpCDD)	ng/kg	41.4	16.4	9.7	11.9	9.44	21.7	56
Total hexachlorodibenzofuran (HxCDF)	ng/kg	0.16 J	1.19 J	0.38 J	0.17 J	2.86 U	2.85 U	3.71
Total hexachlorodibenzo-p-dioxin (HxCDD)	ng/kg	8.22	2.37 J	1.4 J	3.1	0.55 J	7.1	9.06
Total pentachlorodibenzofuran (PeCDF)	ng/kg	3.1 U	3.03 U	2.97 U	3.09 U	2.86 U	2.85 U	1.84 J
Total pentachlorodibenzo-p-dioxin (PeCDD)	ng/kg	0.37 J	3.03 U	2.97 U	3.09 U	2.86 U	0.32 J	0.15 J
Total TEQ 1998 (Avian) (ND*0.5)	ng/kg	1.87	2.32	2.5	1.49	3.24	2.02	3.23
Total TEQ 1998 (Fish) (ND*0.5)	ng/kg	0.659	0.827	0.706	0.495	1.35	0.701	0.889
Total TEQ Dioxin 1998 (Bird) (ND=0)	ng/kg	0.113	2.2	1.93	0.0242	3.1	1.9	2.63
Total TEQ Dioxin 1998 (Bird) (ND=1)	ng/kg	3.62	2.44	3.08	2.95	3.38	2.14	3.82
Total TEQ Dioxin 1998 (Fish) (ND=0)	ng/kg	0.113	0.729	0.152	0.0242	1.23	0.591	0.336
Total TEQ Dioxin 1998 (Fish) (ND=1)	ng/kg	1.21	0.925	1.26	0.966	1.47	0.811	1.44
Total TEQ Dioxin Texas TEF (ND=0)	ng/kg	0.016	0.755	0.224	0	1.32	0.676	0.407
Total TEQ Dioxin Texas TEF (ND=0.5)	ng/kg	0.597	0.829	0.733	0.997	1.41	0.743	0.934
Total TEQ Dioxin Texas TEF (ND=1)	ng/kg	1.18	0.903	1.24	0.997	1.5	0.81	1.46
Total tetrachlorodibenzofuran (TCDF)	ng/kg	1	2.43	1.87	1.01	1.97	1.34	3.5
Total tetrachlorodibenzo-p-dioxin (TCDD)	ng/kg	0.619 U	0.605 U	0.594 U	0.618 U	1.12	0.57 U	0.559 U
Total WHO Dioxin TEQ(Human/Mammal)(ND=0)	ng/kg	0.384	0.887	0.301	0.07	1.38	0.822	0.781
Total WHO Dioxin TEQ(Human/Mammal)(ND=0.5)	ng/kg	0.988	0.98	0.812	0.592	1.5	0.897	1.32
Total WHO Dioxin TEQ(Human/Mammal)(ND=1)	ng/kg	1.59	1.07	1.32	1.11	1.62	0.972	1.85
Asbestos								
Asbestos	%	--	--	--	--	--	--	--
PCBs								
Aroclor (unspecified)	ug/kg	--	--	--	--	--	--	--
Aroclor-1016 (PCB-1016)	ug/kg	--	--	--	--	--	--	--
Aroclor-1221 (PCB-1221)	ug/kg	--	--	--	--	--	--	--
Aroclor-1232 (PCB-1232)	ug/kg	--	--	--	--	--	--	--
Aroclor-1242 (PCB-1242)	ug/kg	--	--	--	--	--	--	--
Aroclor-1248 (PCB-1248)	ug/kg	--	--	--	--	--	--	--
Aroclor-1254 (PCB-1254)	ug/kg	--	--	--	--	--	--	--
Aroclor-1260 (PCB-1260)	ug/kg	--	--	--	--	--	--	--
Aroclor-1262 (PCB-1262)	ug/kg	--	--	--	--	--	--	--
Aroclor-1268 (PCB-1268)	ug/kg	--	--	--	--	--	--	--
Total PCBs	ug/kg	--	--	--	--	--	--	--
Total PCBs (7)	ug/kg	--	--	--	--	--	--	--
Total PCBs (ND*0)	ug/kg	--	--	--	--	--	--	--
Total PCBs (ND*0.5)	ug/kg	--	--	--	--	--	--	--
Total Petroleum Hydrocarbons (TPH)								
Total Petroleum Hydrocarbons	mg/kg	--	--	--	--	--	--	--
Total Petroleum Hydrocarbons (C12-C28)	mg/kg	--	--	--	--	--	--	--
Total Petroleum Hydrocarbons (C25-C36) ORO	mg/kg	--	--	--	--	--	--	--
Total Petroleum Hydrocarbons (C28-C35)	mg/kg	--	--	--	--	--	--	--
Total Petroleum Hydrocarbons (C6-C12)	mg/kg	--	--	--	--	--	--	--
General Chemistry								
Cyanide (total)	mg/kg	--	--	--	--	--	--	--
Flash point (closed cup)	Deg C	--	--	--	--	--	--	--
Moisture	%	--	--	--	--	--	--	--
Percent solids	%	--	--	--	--	--	--	--
pH, lab	s.u.	--	--	--	--	--	--	--
Reactive cyanide	mg/kg	--	--	--	--	--	--	--
Sulfate	mg/kg	--	--	--	--	--	--	--
Sulfide	mg/kg	--	--	--	--	--	--	--
Sulfur	mg/kg	--	--	--	--	--	--	--
Total solids	%	79.9	77.8	81.2	75.3	84.1	81.8	87.6

Area:	Units	Northern Impoundment - Waste Pits	Northern Impoundment - Waste Pits	Northern Impoundment - Waste Pits	Northern Impoundment - Waste Pits	Northern Impoundment - Waste Pits	Northern Impoundment - Waste Pits	Northern Impoundment - Waste Pits	Northern Impoundment - Waste Pits
Sample Location:		SJSB035	SJSB035	SJSB035	SJSB035	SJSB035	SJSB035	SJSB035	SJSB035
Sample Identification:		SL0529	SL0530	SL0531	SL0532	SL0533	SL0534	SL0537	SL0535
Sample Date:		11/11/2018	11/11/2018	11/11/2018	11/11/2018	11/11/2018	11/11/2018	11/11/2018	11/11/2018
Sample Type:								Duplicate	
Sample Depth:		(2-4) ft bgs	(4-6) ft bgs	(6-8) ft bgs	(8-10) ft bgs	(10-12) ft bgs	(12-14) ft bgs	(12-14) ft bgs	(14-16) ft bgs
Integral Sample ID:		SJSB035-C2	SJSB035-C3	SJSB035-C4	SJSB035-C5	SJSB035-C6	SJSB035-C7	SJSB035-C10	SJSB035-C8
Dioxins/Furans									
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	ng/kg	0.564 U	0.337 U	1.46 U	1.18 U	0.299 J	1.08 J	0.544 J	0.789 J
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	ng/kg	120	141	213	173	99.7	140	144	157
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	ng/kg	0.137 U	0.148 U	0.166 U	0.166 U	0.0489 U	0.22 J	0.0688 U	0.09 J
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	ng/kg	3.54	3.45	5.89	5.92	2.05 J	3.02	2.49 J	3.85
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	ng/kg	2.82 U	2.9 U	2.84 U	2.97 U	2.98 U	2.78 U	0.0462 U	0.07 J
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	ng/kg	0.137 U	0.104 U	0.0955 U	2.97 U	0.0894 U	0.276 U	2.93 U	0.147 U
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	ng/kg	2.82 U	2.9 U	2.84 U	2.97 U	2.98 U	2.78 U	0.0534 U	0.195 U
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	ng/kg	2.82 U	2.9 U	0.05 J	2.97 U	2.98 U	2.78 UJ	2.93 U	2.86 U
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	ng/kg	2.82 U	2.9 U	0.28 J	2.97 U	2.98 U	0.0899 U	0.0844 U	0.193 U
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	ng/kg	2.82 U	2.9 U	2.84 U	2.97 U	2.98 U	2.78 U	0.06 J	2.86 U
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	ng/kg	0.239 U	0.132 U	0.428 U	0.33 J	0.2 J	0.33 U	0.282 U	0.3 J
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	ng/kg	2.82 U	2.9 U	2.84 U	2.97 U	2.98 U	0.202 U	2.93 U	2.86 U
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	ng/kg	2.82 U	2.9 U	0.0834 U	2.97 U	2.98 U	2.78 U	0.0961 U	0.144 U
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	ng/kg	2.82 U	2.9 U	2.84 U	2.97 U	2.98 U	2.78 U	0.0274 U	2.86 U
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	ng/kg	2.82 U	2.9 U	2.84 U	2.97 U	2.98 U	2.78 U	2.93 U	2.86 U
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	ng/kg	2.72 UJ	1.43	2.6 J	1.53	2.3 UJ	3.18 J	0.585 U	2.81
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	ng/kg	0.564 U	0.66	0.778 U	0.511 U	1.07 U	1.49 U	0.585 U	0.882 U
Octachlorodibenzofuran (OCDF) 13C12	ng/kg	0.564 U	0.337 U	1.46 U	1.18 U	0.299 J	1.08 J	0.54 J	0.789 J
Total dioxin/furan	pg/g	124	147	222	181	102	148	147	165
Total dioxin/furan (ND*0.5)	pg/g	126	147	224	182	104	149	148	166
Total dioxin/furan (ND*1)	pg/g	129	148	225	183	106	150	149	167
Total heptachlorodibenzofuran (HpCDF)	ng/kg	2.82 U	2.9 U	0.59 J	2.97 U	2.98 U	0.22 J	2.93 U	0.07 J
Total heptachlorodibenzo-p-dioxin (HpCDD)	ng/kg	13.2	13.8	26.3	23	8.48	12.6	10.5	14.3
Total hexachlorodibenzofuran (HxCDF)	ng/kg	0.13 J	0.03 J	0.16 J	2.97 U	2.98 U	2.78 U	0.06 J	0.14 J
Total hexachlorodibenzo-p-dioxin (HxCDD)	ng/kg	2.82 U	2.34 J	4.96	4.08	0.2 J	1.92 J	1.61 J	0.37 J
Total pentachlorodibenzofuran (PeCDF)	ng/kg	2.82 U	2.9 U	2.84 U	2.97 U	2.98 U	2.78 U	2.93 U	2.86 U
Total pentachlorodibenzo-p-dioxin (PeCDD)	ng/kg	2.82 U	2.9 U	0.35 J	2.97 U	2.98 U	2.78 U	0.07 J	2.86 U
Total TEQ 1998 (Avian) (ND*0.5)	ng/kg	1.8	2.27	3.15	1.94	1.83	4.11	0.696	3.45
Total TEQ 1998 (Fish) (ND*0.5)	ng/kg	0.474	0.884	0.667	0.468	0.708	1.05	0.405	0.768
Total TEQ Dioxin 1998 (Bird) (ND=0)	ng/kg	0.0155	2.11	2.63	1.59	0.032	3.2	0.0229	2.86
Total TEQ Dioxin 1998 (Bird) (ND=1)	ng/kg	3.59	2.43	3.67	2.3	3.63	5.01	1.37	4.03
Total TEQ Dioxin 1998 (Fish) (ND=0)	ng/kg	0.0155	0.749	0.165	0.103	0.014	0.178	0.0229	0.165
Total TEQ Dioxin 1998 (Fish) (ND=1)	ng/kg	0.933	1.02	1.17	0.833	1.4	1.92	0.787	1.37
Total TEQ Dioxin Texas TEF (ND=0)	ng/kg	0	0.803	0.293	0.186	0.02	0.318	0.006	0.311
Total TEQ Dioxin Texas TEF (ND=0.5)	ng/kg	1.01	0.898	0.763	0.505	0.738	1.17	0.386	0.85
Total TEQ Dioxin Texas TEF (ND=1)	ng/kg	1.01	0.992	1.23	0.824	1.46	2.03	0.766	1.39
Total tetrachlorodibenzofuran (TCDF)	ng/kg	0.564 U	1.43	2.6	1.68	1.21	4.57	0.585 U	4.15
Total tetrachlorodibenzo-p-dioxin (TCDD)	ng/kg	0.564 U	0.66	0.567 U	1.01	0.595 U	0.746 U	0.585 U	0.572 U
Total WHO Dioxin TEQ(Human/Mammal)(ND=0)	ng/kg	0.0714	0.88	0.416	0.297	0.0705	0.393	0.0743	0.398
Total WHO Dioxin TEQ(Human/Mammal)(ND=0.5)	ng/kg	0.585	0.995	0.896	0.64	0.801	1.26	0.471	0.962
Total WHO Dioxin TEQ(Human/Mammal)(ND=1)	ng/kg	1.1	1.11	1.38	0.983	1.53	2.13	0.869	1.53
Asbestos									
Asbestos	%	--	--	--	--	--	--	--	--
PCBs									
Aroclor (unspecified)	ug/kg	--	--	--	--	--	--	--	--
Aroclor-1016 (PCB-1016)	ug/kg	--	--	--	--	--	--	--	--
Aroclor-1221 (PCB-1221)	ug/kg	--	--	--	--	--	--	--	--
Aroclor-1232 (PCB-1232)	ug/kg	--	--	--	--	--	--	--	--
Aroclor-1242 (PCB-1242)	ug/kg	--	--	--	--	--	--	--	--
Aroclor-1248 (PCB-1248)	ug/kg	--	--	--	--	--	--	--	--
Aroclor-1254 (PCB-1254)	ug/kg	--	--	--	--	--	--	--	--
Aroclor-1260 (PCB-1260)	ug/kg	--	--	--	--	--	--	--	--
Aroclor-1262 (PCB-1262)	ug/kg	--	--	--	--	--	--	--	--
Aroclor-1268 (PCB-1268)	ug/kg	--	--	--	--	--	--	--	--
Total PCBs	ug/kg	--	--	--	--	--	--	--	--
Total PCBs (7)	ug/kg	--	--	--	--	--	--	--	--
Total PCBs (ND*0)	ug/kg	--	--	--	--	--	--	--	--
Total PCBs (ND*0.5)	ug/kg	--	--	--	--	--	--	--	--
Total Petroleum Hydrocarbons (TPH)									
Total Petroleum Hydrocarbons	mg/kg	--	--	--	--	--	--	--	--
Total Petroleum Hydrocarbons (C12-C28)	mg/kg	--	--	--	--	--	--	--	--
Total Petroleum Hydrocarbons (C25-C36) ORO	mg/kg	--	--	--	--	--	--	--	--
Total Petroleum Hydrocarbons (C28-C35)	mg/kg	--	--	--	--	--	--	--	--
Total Petroleum Hydrocarbons (C6-C12)	mg/kg	--	--	--	--	--	--	--	--
General Chemistry									
Cyanide (total)	mg/kg	--	--	--	--	--	--	--	--
Flash point (closed cup)	Deg C	--	--	--	--	--	--	--	--
Moisture	%	--	--	--	--	--	--	--	--
Percent solids	%	--	--	--	--	--	--	--	--
pH, lab	s.u.	--	--	--	--	--	--	--	--
Reactive cyanide	mg/kg	--	--	--	--	--	--	--	--
Sulfate	mg/kg	--	--	--	--	--	--	--	--
Sulfide	mg/kg	--	--	--	--	--	--	--	--
Sulfur	mg/kg	--	--	--	--	--	--	--	--
Total solids	%	85.8	82.1	83	80.3	81.8	83.2	83	81.6

Notes:
- ng/kg - nanograms per kilogram
- ug/kg - microgram per kilogram
- pg/kg - picogram per kilogram
- mg/kg - milligram per kilogram
- Deg C - Degrees in Celsius
- s.u. - standard unit
- U - Not detected at the associated reporting limit.
- J - Estimated concentration.
- UJ - Not detected; associated reporting limit is estimated.
- Dup - indicates the result from a duplicate sample
- -- Data not available

Table 2-1

First Phase Pre-Design Investigation Analytical Results - Northern Impoundment
Pre- Final 90% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Area:	Units	Northern Impoundment - Waste Pits	Northern Impoundment - Waste Pits	Northern Impoundment - Waste Pits	Northern Impoundment - Waste Pits	Northern Impoundment - Waste Pits	Northern Impoundment - Waste Pits	Northern Impoundment - Waste Pits	Northern Impoundment - Waste Pits	Northern Impoundment - Waste Pits	Northern Impoundment - Waste Pits	Northern Impoundment - Waste Pits	Northern Impoundment - Waste Pits	Northern Impoundment - Waste Pits	Northern Impoundment - Waste Pits	Northern Impoundment - Waste Pits
Sample Location:		SJSB035	SJSB036	SJSB036	SJSB036	SJSB036	SJSB036	SJSB037	SJSB037	SJSB037	SJSB037	SJSB037	SJSB038	SJSB038	SJSB038	SJSB038
Sample Identification:		SL0536	SL0559	SL0560	SL0556	SL0557	SL0558	SL0552	SL0549	SL0550	SL0551	SL0553	SL0590	SL0591	SL0592	SL0593
Sample Date:		11/11/2018	11/16/2018	11/16/2018	11/16/2018	11/16/2018	11/16/2018	11/15/2018	11/15/2018	11/15/2018	11/15/2018	11/16/2018	12/9/2018	12/9/2018	12/9/2018	12/9/2018
Sample Type:																
Sample Depth:		(16-18) ft bgs	(3.5-4.5) ft bgs	(6-8) ft bgs	(10-11) ft bgs	(11-12) ft bgs	(12-13) ft bgs	(6.3-8) ft bgs	(10-11) ft bgs	(11-12) ft bgs	(12-13) ft bgs	(4-5.8) ft bgs	(8-9) ft bgs	(9-10) ft bgs	(10-11) ft bgs	(11-12) ft bgs
Integral Sample ID:		SJSB035-C9	SJSB036-C2	SJSB036-C3	SJSB036-C11	SJSB036-C12	SJSB036-C13	SJSB037-C2	SJSB037-C11	SJSB037-C12	SJSB037-C13	SJSB037-C3	SJSB038-C6	SJSB038-C7	SJSB038-C8	SJSB038-C9
Dioxins/Furans																
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	ng/kg	1.06 U	369	18.4	38.6	0.403 J	2.9 J	1.6 J	14.8	0.841 J	0.769 J	384	1720	2.56 U	2.13 U	1.63 U
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	ng/kg	127	5460	357	106 Dup 433	21.1 Dup 86.3	46.2 Dup 221	800	545	163	153	5550	1730	675	793	987
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	ng/kg	0.165 U	654	9.65	22.2 Dup 68.8	0.35 U Dup 0.551 U	4.51 Dup 1.1 J	0.31 U	22.6	0.53 J	0.445 UJ	741	3430	5.46	3.3 J	0.33 J
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	ng/kg	5.25	188	8.23	11.1 Dup 2.78 J	0.6 J Dup 2.2 J	5.54 Dup 1.43 J	10.7	15.2	5.21	6.19	182	97.8	19.4	20.8	25.7
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	ng/kg	0.0912 U	240	3.05 U	8.56 Dup 33.1	0.14 J Dup 0.244 U	1.45 U Dup 0.389 J	2.8 U	9.89	3.26 U	3.01 U	265	972	1.63 U	0.97 J	0.133 U
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	ng/kg	0.0663 U	2540	29.7	160 Dup 57.2	0.543 J Dup 2.16 J	3.56 Dup 17.3	2.8 U	72.5	0.33 J	0.77 U	2580	10500	15.5	7.77	0.23 J
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	ng/kg	2.96 U	1.97 J	0.135 U	0.0911 U Dup 2.97 U	0.104 U Dup 0.0689 U	0.0435 U Dup 0.19 J	0.155 U	0.4 J	3.26 U	3.01 U	2.12 U	2.6 U	0.44 J	0.49 J	0.408 U
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	ng/kg	2.96 U	596	7.44	14.1 Dup 28.1	0.141 U Dup 0.428 U	0.801 J Dup 3.97 U	2.8 U	16.5	0.0895 U	0.3 J	628	2590	4.04	2.37 J	0.124 U
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	ng/kg	0.255 U	12.1	0.4 J	0.174 J Dup 0.494 U	0.0765 U Dup 0.0997 U	0.288 U Dup 0.0911 U	0.202 U	0.612 U	0.3 J	3.01 U	11.2	9.86 U	0.692 U	0.71 J	0.668 U
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	ng/kg	0.07 J	195	2.62 J	4.05 Dup 3.93	0.123 U Dup 0.0568 U	0.307 U Dup 1.18 J	2.8 U	4.45 U	3.26 U	3.01 U	184	611	1.18 U	0.82 J	0.123 U
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	ng/kg	0.33 U	3.91 J	0.442 U	0.197 U Dup 0.47 J	0.0709 U Dup 0.141 U	0.4 J Dup 0.137 U	0.393 U	0.71 J	0.274 U	0.259 U	4.82	5.44	1.09 J	1.04 J	1.32 J
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	ng/kg	2.96 U	1510	14.2	25.8 Dup 8.58	1.22 J Dup 0.212 U	1.62 J Dup 10.5	0.088 U	24.3	3.26 U	0.444 U	1430	2660	11.5	6.03	0.23 J
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	ng/kg	2.96 U	129	1.6 J	2.57 J Dup 0.876 J	0.11 U Dup 0.27 J	0.221 J Dup 1.28 J	0.115 U	3.02	3.26 U	3.01 U	118	284	2.68 J	1.36 U	0.54 J
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	ng/kg	2.96 U	112	1.19 U	1.92 J Dup 2.38 J	0.139 U Dup 0.176 J	0.134 U Dup 0.683 U	2.8 U	2.86 J	3.26 U	0.0877 U	120	631	0.92 J	0.538 U	0.0816 U
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	ng/kg	2.96 U	1240	12.5	22.8 Dup 6.91	0.37 U Dup 0.79 J	9.83 Dup 1.65 J	2.8 U	21	0.174 U	0.314 U	1130	2120	12.2	6.5	0.14 U
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	ng/kg	0.24 J	62400	591	1240 Dup 217	33.2 Dup 5.51	358 Dup 51.7	1.35	2330	3.83	20.9	45500	136000	1210	313	4.88
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	ng/kg	0.592 U	43400	207	88 Dup 376	14.8 Dup 2.43	146 Dup 20.9	0.559 U	365	1.93	9.1	35000	80600	234	116	2.87
Octachlorodibenzofuran (OCDF) 13C12	ng/kg	1.06 U	369	18.4	14 Dup 38.6	0.4 J Dup 0.523 U	2.9 J Dup 0.881 U	1.6 J	14.8	0.84 J	0.76 J	384	1720	2.56 U	2.13 U	1.63 U
Total dioxin/furan	pg/g	133	119000	1260	2230 Dup 765	30.5 Dup 141	779 Dup 130	814	3440	176	190	93800	244000	2190	1270	1020
Total dioxin/furan (ND*0.5)	pg/g	134	119000	1260	2230 Dup 765	31.5 Dup 142	782 Dup 130	815	3450	177	192	93800	244000	2200	1270	1020
Total dioxin/furan (ND*1)	pg/g	135	119000	1260	2230 Dup 765	32.5 Dup 143	785 Dup 131	816	3450	177	193	93800	244000	2200	1280	1030
Total heptachlorodibenzofuran (HpCDF)	ng/kg	0.17 J	1180	13.6	118 Dup 36.6	2.77 U Dup 0.14 J	6.31 Dup 1.98 J	0.17 J	40	0.96 J	0.41 J	1250	5270	5.52	5.52	0.55 J
Total heptachlorodibenzo-p-dioxin (HpCDD)	ng/kg	20.6	467	27.6	9.41 Dup 36.2	10.3 Dup 2.86 J	4.76 Dup 14.1	32.6	47.4	17.3	17.6	438	227	60.5	73.4	88.9
Total hexachlorodibenzofuran (HxCDF)	ng/kg	0.23 J	3740	42.3	194 Dup 83.1	2.16 J Dup 0.838 J	4.53 Dup 18.5	2.8 U	99.2	0.52 J	0.47 J	3780	11600	22.2	11.1	0.23 J
Total hexachlorodibenzo-p-dioxin (HxCDD)	ng/kg	5.25	55.4	4.77	5.18 Dup 1.5 J	4.15 Dup 0.879 J	5.93 Dup 1.11 J	3.29	9.69	3.12 J	1.71 J	79.5	56.6	19	25.2	33.6
Total pentachlorodibenzofuran (PeCDF)	ng/kg	2.96 U	4080	40	23.6 Dup 72.7	0.37 J Dup 2.52 J	4.03 Dup 25.3	2.8 U	65.5	3.26 U	3.01 U	3760	7320	34.4	16.2	0.23 J
Total pentachlorodibenzo-p-dioxin (PeCDD)	ng/kg	1.19 J	142	1.91 J	3.06 Dup 1.03 J	0.71 J Dup 0.0937 U	0.221 J Dup 1.28 J	0.17 J	3.02	0.12 J	3.01 U	131	323	4.27	1.32 J	4.88
Total TEQ 1998 (Avian) (ND*0.5)	ng/kg	0.676	108000	818	1650 Dup 334	8.28 Dup 49.5	75.1 Dup 518	1.84	2730	5.99	30.4	82300	221000	1460	438	8.7
Total TEQ 1998 (Fish) (ND*0.5)	ng/kg	0.426	47700	249	461 Dup 124	2.96 Dup 17.5	173 Dup 25.1	0.559	506	2.33	10.4	38400	90400	306	137	3.98
Total TEQ Dioxin 1998 (Bird) (ND=0)	ng/kg	0.265	108000	818	334 Dup 1650	8.02 Dup 49.4	518 Dup 75.1	1.44	2730	5.82	30.1	82300	221000	1460	437	8.6
Total TEQ Dioxin 1998 (Bird) (ND=1)	ng/kg	1.09	108000	818	334 Dup 1650	49.5 Dup 8.55	519 Dup 75.2	2.24	2730	6.17	30.7	82300	221000	1460	439	8.8
Total TEQ Dioxin 1998 (Fish) (ND=0)	ng/kg	0.0369	47700	249	124 Dup 461	2.78 Dup 17.4	25.1 Dup 173	0.158	506	2.18	10.2	38400	90400	306	137	3.83
Total TEQ Dioxin 1998 (Fish) (ND=1)	ng/kg	0.815	47700	249	462 Dup 124	17.5 Dup 3.15	25.1 Dup 173	0.96	506	2.48	10.7	38400	90400	306	138	4.14
Total TEQ Dioxin Texas TEF (ND=0)	ng/kg	0.031	50700	278	133 Dup 522	3.05 Dup 18.9	27.5 Dup 190	0.135	621	2.38	11.2	40600	97000	365	152	3.79
Total TEQ Dioxin Texas TEF (ND=0.5)	ng/kg	0.409	50700	278	522 Dup 133	3.2 Dup 19	27.6 Dup 190	0.503	621	2.48	11.4	40600	97000	365	153	3.9
Total TEQ Dioxin Texas TEF (ND=1)	ng/kg	0.788	50700	278	522 Dup 133	19 Dup 3.34	190 Dup 27.6	0.871	621	2.58	11.6	40600	97000	365	153	4
Total tetrachlorodibenzofuran (TCDF)	ng/kg	0.24 J	80400	837	1570 Dup 404	58.2 Dup 9.42	638 Dup 96.7	1.88	1460	3.83	34.5	75800	159000	1220	566	3.3
Total tetrachlorodibenzo-p-dioxin (TCDD)	ng/kg	1.05	22900	230	99.4 Dup 416	2.43 Dup 18.1	23.5 Dup 164	0.559 U	401	3.1	9.1	21900	38000	257	127	4.19
Total WHO Dioxin TEQ(Human/Mammal)(ND=0)	ng/kg	0.122	50500	276	519 Dup 133	3.07 Dup 18.9	188 Dup 27.3	0.482	618	2.48	11.3	40400	96700	364	151	4.62
Total WHO Dioxin TEQ(Human/Mammal)(ND=0.5)	ng/kg	0.516	50500	276	519 Dup 133	3.2 Dup 19	27.3 Dup 189	0.873	618	2.59	11.5	40400	96700	364	152	4.71
Total WHO Dioxin TEQ(Human/Mammal)(ND=1)	ng/kg	0.911	50500	276	519 Dup 133	3.34 Dup 19	189 Dup 27.4	1.26	618	2.71	11.7	40400	96700	365	153	4.8
Asbestos																
Asbestos	%	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
PCBs																
Aroclor (unspecified)	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Aroclor-1016 (PCB-1016)	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Aroclor-1221 (PCB-1221)	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Aroclor-1232 (PCB-1232)	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Aroclor-1242 (PCB-1242)	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Aroclor-1248 (PCB-1248)	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Aroclor-1254 (PCB-1254)	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Aroclor-1260 (PCB-1260)	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Aroclor-1262 (PCB-1262)	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Aroclor-1268 (PCB-1268)	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Total PCBs	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Total PCBs (7)	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Total PCBs (ND*0)	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Total PCBs (ND*0.5)	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Total Petroleum Hydrocarbons (TPH)																
Total Petroleum Hydrocarbons	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Total Petroleum Hydrocarbons (C12-C28)	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Total Petroleum Hydrocarbons (C25-C36) ORO	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Total Petroleum Hydrocarbons (C28-C35)	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Total Petroleum Hydrocarbons (C6-C12)	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
General Chemistry																
Cyanide (total)	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Flash point (closed cup)	Deg C	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Moisture	%	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Percent solids	%	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
pH, lab	s.u.	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Reactive cyanide	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Sulfate	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Sulfide	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Sulfur	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Total solids	%	79.5	58.8	80.5	79.2 Dup 79.3	83 Dup 82.5	80.4 Dup 78.9	83.7	79.2	74.6	75.8	54	47.3 Dup 47.3	71.1 Dup 71.1	63.3 Dup 63.3	70.3 Dup 70.3

Notes:
- ng/kg - nanograms per kilogram
- ug/kg - microgram per kilogram
- pg/kg - picogram per kilogram
- mg/kg - milligram per kilogram
- Deg C - Degrees in Celsius
- s.u. - standard unit
- U - Not detected at the associated reporting limit.
- J - Estimated concentration.
- UJ - Not detected; associated reporting limit is estimated.
- Dup - indicates the result from a duplicate sample
- -- Data not available

Table 2-2

First Phase Pre-Design Investigation Waste Characterization Results
Pre-Final 90% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Parameters			Area:	Northern Impoundment - East	Northern Impoundment - West	Northern Impoundment - West
			Sample Location:	SJSB038	SJSB037	SJSB036
			Sample Identification:	SL0594	SL0547	SL0554
			Sample Date:	12/18/2018	11/15/18	11/16/18
	Units	TCLP Regulatory Levels[1]	Method Detection Limits[2]	-	-	-
TCLP-Volatile Organic Compounds (VOCs)						
1,1-Dichloroethene	mg/L	0.7	0.00008	0.20 U	0.032 U	0.032 U
1,2-Dichloroethane	mg/L	0.5	0.00008	0.20 U	0.032 U	0.032 U
1,4-Dichlorobenzene	mg/L	7.5	0.00032	0.20 U	0.048 U	0.048 U
2-Butanone (Methyl ethyl ketone) (MEK)	mg/L	200.0	0.0019	8.0 U	0.76 U	0.76 U
Benzene	mg/L	0.5	0.000062	0.20 U	0.025 U	0.025 U
Carbon tetrachloride	mg/L	0.5	0.000096	0.20 U	0.039 U	0.039 U
Chlorobenzene	mg/L	100.0	0.00011	0.20 U	0.044 U	0.044 U
Chloroform (Trichloromethane)	mg/L	6.0	0.000072	0.20 U	0.029 U	0.029 U
Tetrachloroethene	mg/L	0.7	0.000099	0.20 U	0.040 U	0.040 U
Trichloroethene	mg/L	0.5	0.0001	0.20 U	0.040 U	0.040 U
Vinyl chloride	mg/L	0.2	0.000075	0.080 U	0.030 U	0.030 U
TCLP-Semi-Volatile Organic Compounds (SVOCs)						
2,4,5-Trichlorophenol	mg/L	400.0	0.000018	0.10 U	0.013 U	0.013 U
2,4,6-Trichlorophenol	mg/L	2.0	0.000014	0.10 U	0.011 U	0.0099 U
2,4-Dinitrotoluene	mg/L	0.13	0.00027	0.10 U	0.020 U	0.019 U
2-Methylphenol	mg/L	200.0	0.00033	0.10 U	0.013 U	0.013 U
4-Methylphenol	mg/L	200.0	0.00048	0.10 U	0.0070 U	0.0067 U
Hexachlorobenzene	mg/L	0.13	0.00063	0.10 U	0.014 U	0.014 U
Hexachlorobutadiene	mg/L	0.5	0.00029	0.10 U	0.0095 U	0.0091 U
Hexachloroethane	mg/L	3.0	0.00029	0.10 U	0.0071 U	0.0068 U
Nitrobenzene	mg/L	2.0	0.00057	0.10 U	0.012 U	0.012 U
Pentachlorophenol	mg/L	100.0	0.0024	0.25 U	0.016 U	0.016 U
Pyridine	mg/L	5.0	0.0075	0.50 U	0.38 U	0.36 U
TCLP-Pesticides						
Chlordane	mg/L	0.03	0.0001	0.0010 U	0.0010 U	0.0010 U
Endrin	mg/L	0.02	0.00000069	0.00010 U	0.00010 U	0.00010 U
gamma-BHC (lindane)	mg/L	0.3	0.00000036	0.00010 U	0.00010 U	0.00010 U
Heptachlor	mg/L	0.008	0.00000068	0.00010 U	0.00010 U	0.00010 U
Heptachlor epoxide	mg/L	0.04	0.00000084	0.00010 U	0.00010 U	0.00010 U
Methoxychlor	mg/L	10.0	0.0000001	0.00010 U	0.00010 U	0.00010 U
Toxaphene	mg/L	0.5	0.0002	0.0020 U	0.0020 U	0.0020 U
TCLP-Metals						
Arsenic	mg/L	5.0	0.005	0.020 U	0.021 J	0.020 U
Barium	mg/L	100.0	0.0006	0.9 J	1.6	1.4
Cadmium	mg/L	1.0	0.0005	0.050 U	0.002 J	0.001 J
Chromium	mg/L	5.0	0.0009	0.050 U	0.010 U	0.010 U
Lead	mg/L	5.0	0.005	0.050 U	0.015 U	0.015 U
Mercury	mg/L	0.2	0.00002	0.0010 U	0.0001 U	0.0001 U
Selenium	mg/L	1.0	0.009	0.10 U	0.02 U	0.02 J
Silver	mg/L	5.0	0.002	0.050 U	0.004 U	0.004 U
TCLP-Herbicides						
2,4,5-TP (Silvex)	mg/L	1.0	0.000036	0.020 U	0.030 U	0.029 U
2,4-Dichlorophenoxyacetic acid (2,4-D)	mg/L	10.0	0.000045	0.100 U	0.150 U	0.150 U
General Chemistry						
Flash point (closed cup)	°C	> 60	NA	> 110	> 110	> 110
Percent solids	%	NA	NA	45.9 J	67.1 J	70.0 J
pH, lab	s.u.	>2 or <12	NA	7.84	8.09 J	8.54 J
Reactive cyanide	mg/kg	NA	17.4	17 U	100 U	100 U
Reactive sulfide	mg/kg	NA	0.2	70 U	48 U	46 U
Sulfur	mg/kg	NA	0.46	---	---	---
Total Petroleum Hydrocarbons (TPH)						
Gasoline Range Organics (GRO)	mg/kg	>1500[3]	0.62	---	---	---
Diesel Range Organics (DRO)	mg/kg	>1500[3]	0.79	---	---	---
Residual Range Organics (RRO)	mg/kg	>1500[3]	2.9	---	---	---
Polychlorinated Biphenyls (PCBs)						
Aroclor 1016	mg/kg	NA	2.1	---	---	---
Aroclor 1221	mg/kg	NA	2.1	---	---	---
Aroclor 1232	mg/kg	NA	2.1	---	---	---
Aroclor 1242	mg/kg	NA	2.1	---	---	---
Aroclor 1248	mg/kg	NA	2.1	---	---	---
Aroclor 1254	mg/kg	NA	2.1	---	---	---
Aroclor 1260	mg/kg	NA	2.1	---	---	---
Aroclor 1262	mg/kg	NA	2.1	---	---	---
Aroclor 1268	mg/kg	NA	2.1	---	---	---

Notes:

TCLP - Toxicity Characteristic Leaching Procedure
mg/L - milligrams per Liter
ug/L - microgram per Liter
mg/kg - milligram per kilogram
Deg C - Degrees in Celsius
TCLP - Toxicity Characteristic Leaching Procedure

NA - Not Applicable
s.u. - standard unit
U - Not detected at the associated reporting limit.
J - Estimated concentration.
UJ - Not detected; associated reporting limit is estimated.
--- - Not analyzed

[1] - TCLP Regulatory Levels from the *Guidelines for the Classification and Coding of Industrial and Hazardous Wastes*, November 2014, and Table 1 - Maximum Concentrations.

[2] - Method Detection Limits were taken from *Table 9 Analyte, Method Reporting Limits, and Method Detection Limits for Waste Characterization Samples* from the First Phase Pre-Design Investigation Report.

[3] - TPH Regulatory Standard is a Total value, not a TCLP.

Table 2-3

Second Phase Pre-Design Investigation Analytical Results
Pre-Final 90% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Sample Location: Sample Identification: Sample Date: Sample Depth: Sample Type:	Units	SJSB045 11187072-090719-SS-SJSB045-S- (8-10) 9/7/2019 (8-10) ft bgs	SJSB045 11187072-090719-SS-SJSB045-S- (10-12) 9/7/2019 (10-12) ft bgs	SJSB045 11187072-090719-SS-SJSB045-S- (12-14) 9/7/2019 (12-14) ft bgs	SJSB045 11187072-090719-SS-SJSB045-S- (14-16) 9/7/2019 (14-16) ft bgs	SJSB045 11187072-090719-SS-SJSB045-S- (16-18) 9/7/2019 (16-18) ft bgs	SJSB045 11187072-091119-SS-SJSB045-S (0-2) 9/11/2019 (0-2) ft bgs	SJSB045 11187072-091119-SS-DUP-2 9/11/2019 (2-4) ft bgs Duplicate
Dioxins/Furans								
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	pg/g	1.6 J	0.28 U	0.30 U	1.4 J	0.93 J	1.8 J	0.87 J
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	pg/g	350	240	950	1900	350 J	410	230
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	pg/g	0.57 J	0.37 U	0.38 U	0.44 U	0.37 U	0.26 U	0.23 U
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	11	6.9	33	70	11	10	6.1 J
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	pg/g	1.2 J	0.52 J	0.81 J	0.95 J	0.67 J	1.3 U	0.93 U
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.37 J	0.19 U	0.22 U	0.25 J	0.27 J	0.53 J	0.38 J
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.53 J	0.25 U	0.43 U	0.76 U	0.31 U	0.26 U	0.22 U
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.32 J	0.20 U	0.23 U	0.22 U	0.20 U	0.27 J	0.26 J
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.57 J	0.24 U	0.44 U	0.80 U	0.31 U	0.27 U	0.22 U
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	pg/g	2.3 U	1.6 U	1.7 U	1.8 U	1.7 U	1.9 U	1.9 U
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.80 J	0.67 J	1.3 J	3.2 J	0.77 J	0.62 J	0.21 U
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	0.36 U	0.29 U	0.37 U	0.39 U	0.44 J	0.85 U	0.54 U
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	0.49 U	0.36 U	0.61 U	0.51 U	0.46 U	0.37 U	0.36 U
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.26 J	0.15 U	0.18 U	0.17 U	0.15 U	0.17 U	0.15 U
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	0.39 U	0.33 U	0.39 U	0.42 U	0.36 U	0.34 U	0.27 U
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	pg/g	7.1	0.32 J	1.0 J	0.97 J	13 J	31	16
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	1.6	0.21 U	0.27 U	0.25 U	2.9	6.4	3.1
Total heptachlorodibenzofuran (HpCDF)	pg/g	1.8 J	0.52 J	0.81 J	0.95 J	0.67 J	1.3 J	0.93 J
Total heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	36 J	29 J	110 J	250 J	41 J	44 J	22 J
Total hexachlorodibenzofuran (HxCDF)	pg/g	4.4 J	3.0 J	2.1 J	3.6 J	3.0 J	3.4 J	3.4 J
Total hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	8.8 J	7.0 J	20 J	47 J	8.2 J	9.8 J	4.1 J
Total pentachlorodibenzofuran (PeCDF)	pg/g	0.42 U	0.34 U	0.45 U	0.46 U	0.44 J	0.85 J	0.54 J
Total pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	0.64 J	0.55 J	1.9 J	7.9 J	0.66 J	0.37 U	0.36 U
Total tetrachlorodibenzofuran (TCDF)	pg/g	9.0 J	0.32 J	1.6 J	1.9 J	16 J	47 J	25 J
Total tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	2.1 J	0.21 U	1.4 J	4.2 J	3.5 J	6.8 J	3.1 J
Total WHO Dioxin TEQ(Human/Mammal)(ND=0)	pg/g	2.83	0.245	0.853	1.72	4.54	9.87	4.89
Total WHO Dioxin TEQ(Human/Mammal)(ND=0.5)	pg/g	3.25	0.717	1.52	2.36	4.96	10.3	5.26

Notes:
pg/g - picogram per gram
U - Not detected at the associated reporting limit.
J - Estimated concentration.
UJ - Not detected; associated reporting limit is estimated.

Table 2-3

Second Phase Pre-Design Investigation Analytical Results
Pre-Final 90% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Sample Location:	Units	SJSB045	SJSB045	SJSB045	SJSB045	SJSB045-C1	SJSB045-C1	SJSB045-C1
Sample Identification:		11187072-091119-SS-SJSB045-S (2-4)	11187072-091119-SS-SJSB045-S (4-6)	11187072-091119-SS-DUP-3	11187072-091119-SS-SJSB045-S (6-8)	11187072-11719-KW-SJSB045-C1-S (0-2)	11187072-11719-KW-SJSB045-C1-S (2-4)	11187072-11719-KW-SJSB045-C1-S (4-6)
Sample Date:		9/11/2019	9/11/2019	9/11/2019	9/11/2019	11/9/2019	11/9/2019	11/9/2019
Sample Depth:		(2-4) ft bgs	(4-6) ft bgs	(6-8) ft bgs	(6-8) ft bgs	(0-2) ft bgs	(2-4) ft bgs	(4-6) ft bgs
Sample Type:				Duplicate				
Dioxins/Furans								
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	pg/g	0.29 U	0.89 J	0.38 U	0.28 U	9.7 J	7.4 J	11 J
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	pg/g	120	170	350	740	360	250	1000
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	pg/g	0.25 U	0.26 U	0.27 U	0.19 U	7.6	5.6	9.8
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	3.3 J	5.3 J	11	23	13	10	34
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	pg/g	0.79 U	1.1 U	0.99 U	0.95 U	3.3 J	2.0 J	3.3 J
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.27 J	0.21 U	0.20 U	0.37 J	27	17	27
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.22 U	0.25 U	0.24 U	0.47 J	0.26 J	0.15 J	0.62 J
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.18 U	0.34 J	0.21 U	0.16 U	6.8	3.8 J	7.1
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.23 U	0.26 U	0.25 U	0.49 J	0.38 J	0.31 J	0.84 J
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	pg/g	1.5 U	2.2 U	1.9 U	1.9 U	0.64 J	0.37 J	0.52 J
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.21 U	0.24 U	0.70 J	1.0 J	0.62 J	0.44 J	1.9 J
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	0.29 U	0.28 U	0.32 U	0.21 U	17	10	17
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	0.31 U	0.44 U	0.36 U	0.32 U	2.0 J	1.2 J	2.5 J
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.14 U	0.17 U	0.16 U	0.12 U	0.75 J	0.46 J	0.94 J
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	0.31 U	0.31 U	0.34 U	0.22 U	13	9.2	13
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	pg/g	8.9	18	12 J	2.8 J	760	530	740
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	2.1	3.2	3.0	0.88 J	200	130	200
Total heptachlorodibenzofuran (HpCDF)	pg/g	0.79 J	1.1 J	0.99 J	0.95 J	14 J	9.9 J	16 J
Total heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	12 J	18 J	35 J	63 J	40 J	30 J	97 J
Total hexachlorodibenzofuran (HxCDF)	pg/g	2.3 J	3.3 J	2.5 J	2.9 J	42 J	26 J	42 J
Total hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	2.7 J	4.0 J	6.9 J	11 J	9.1 J	6.8 J	20 J
Total pentachlorodibenzofuran (PeCDF)	pg/g	0.31 U	0.31 U	0.34 U	0.27 U	52 J	34 J	53 J
Total pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	0.31 U	0.44 U	0.36 U	0.32 U	3.7 J	1.5 J	3.2 J
Total tetrachlorodibenzofuran (TCDF)	pg/g	12 J	33 J	18 J	4.0 J	1600 J	1100 J	1500 J
Total tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	2.1 J	3.2 J	3.5 J	1.5 J	220 J	150 J	220 J
Total WHO Dioxin TEQ(Human/Mammal)(ND=0)	pg/g	3.09	5.14	4.49	1.85	286	190	286
Total WHO Dioxin TEQ(Human/Mammal)(ND=0.5)	pg/g	3.42	5.58	4.88	2.16	286	190	286

Notes:
pg/g - picogram per gram
U - Not detected at the associated reporting limit.
J - Estimated concentration.
UJ - Not detected; associated reporting limit is estimated

Table 2-3

Second Phase Pre-Design Investigation Analytical Results
Pre-Final 90% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Sample Location: Sample Identification: Sample Date: Sample Depth: Sample Type:	Units	SJSB045-C1 11187072-11719-KW-SJSB045-C1-S (6-8) 11/9/2019 (6-8) ft bgs	SJSB045-C1 11187072-11719-KW-SJSB045-C1-S (8-10) 11/9/2019 (8-10) ft bgs	SJSB045-C1 11187072-11719-KW-SJSB045-C1-S (10-12) 11/9/2019 (10-12) ft bgs	SJSB045-C1 11187072-11719-KW-SJSB045-C1-S (12-14) 11/9/2019 (12-14) ft bgs	SJSB045-C1 11187072-11719-KW-SJSB045-C1-S (14-16) 11/9/2019 (14-16) ft bgs	SJSB045-C1 11187072-11719-KW-SJSB045-C1-S (16-18) 11/9/2019 (16-18) ft bgs
Dioxins/Furans							
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	pg/g	3.4 U	2.4 U	1.6 U	0.20 U	0.83 U	0.25 U
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	pg/g	1200	590	1600	2400	2900	3400
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	pg/g	1.6 J	1.6 J	1.5 J	0.072 U	0.46 U	0.087 U
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	40	21	64	100	110	130
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	pg/g	0.50 J	0.56 J	0.32 U	0.033 U	0.24 U	0.040 U
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	4.1 J	5.4 J	3.6 J	0.059 U	1.6 J	0.17 J
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.46 J	0.31 J	0.67 J	1.4 J	1.1 J	1.3 J
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.94 J	1.3 J	0.89 J	0.056 U	0.45 J	0.091 J
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.80 J	0.38 J	1.6 J	3.0 J	2.2 J	3.3 J
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	pg/g	0.096 U	0.15 J	0.16 U	0.077 U	0.14 U	0.096 U
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	1.8 J	1.0 J	2.9 J	5.1 J	5.2 J	6.5 J
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	2.4 J	4.1 J	2.3 J	0.094 J	0.84 J	0.17 J
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	0.51 J	0.32 J	0.58 J	0.37 J	0.46 J	0.58 J
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.079 U	0.17 J	0.13 U	0.064 U	0.11 U	0.078 U
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	2.1 J	2.9 J	2.2 J	0.030 U	0.89 J	0.098 J
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	pg/g	130	110	150	1.6	56	4.3
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	31	41	32	0.56 J	13	1.3 J
Total heptachlorodibenzofuran (HpCDF)	pg/g	2.8 J	2.8 J	2.2 J	0.15 J	0.93 J	0.17 J
Total heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	100 J	69 J	200 J	300 J	330 J	380 J
Total hexachlorodibenzofuran (HxCDF)	pg/g	5.5 J	8.3 J	4.9 J	0.077 U	2.1 J	0.26 J
Total hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	20 J	16 J	48 J	72 J	82 J	93 J
Total pentachlorodibenzofuran (PeCDF)	pg/g	7.8 J	10 J	7.2 J	0.19 J	2.9 J	0.26 J
Total pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	3.3 J	2.2 J	6.6 J	12 J	14 J	17 J
Total tetrachlorodibenzofuran (TCDF)	pg/g	230 J	330 J	270 J	5.2 J	100 J	9.8 J
Total tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	36 J	47 J	39 J	7.0 J	23 J	12 J
Total WHO Dioxin TEQ(Human/Mammal)(ND=0)	pg/g	46.8	54.6	50.4	3.76	22.4	5.80
Total WHO Dioxin TEQ(Human/Mammal)(ND=0.5)	pg/g	46.8	54.6	50.4	3.79	22.4	5.81

Notes:
- pg/g - picogram per gram
- U - Not detected at the associated reporting limit.
- J - Estimated concentration.
- UJ - Not detected; associated reporting limit is estimated

Table 2-3

Second Phase Pre-Design Investigation Analytical Results
Pre-Final 90% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Sample Location: / Sample Identification: / Sample Date: / Sample Depth: / Sample Type:	Units	SJSB046 11187072-100719-SS-SJSB046 (0-2) 10/7/2019 (0-2) ft bgs	SJSB046 11187072-100719-SS-SJSB046 (2-4) 10/7/2019 (2-4) ft bgs	SJSB046 11187072-100719-SS-SJSB046 (4-6) 10/7/2019 (4-6) ft bgs	SJSB046 11187072-100719-SS-SJSB046 (6-8) 10/7/2019 (6-8) ft bgs	SJSB046 11187072-100719-SS-SJSB046 (8-10) 10/7/2019 (8-10) ft bgs	SJSB046 11187072-100719-SS-SJSB046 (10-12) 10/7/2019 (10-12) ft bgs	SJSB046 11187072-100719-DUP-6 10/7/2019 (12-14) ft bgs Duplicate
Dioxins/Furans								
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	pg/g	9.7 J	98	470	780	410	6.4 J	290
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	pg/g	400	3800	4900	2900	5100	800	3300
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	pg/g	8.7	78	240	1800	180	3.5 J	130
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	22	130	190	190 J	210	29	120
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	pg/g	2.4 J	23	85	660	61	1.7 J	38
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	31	210	820	5700	600	12	340
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.44 U	1.9 J	2.7 J	4.5 U	3.1 J	0.67 U	1.6 J
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	7.8	54	210	1400	150	3.1 J	87
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.80 J	3.7 J	7.2 J	13 J	7.4 J	0.79 J	4.0 J
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	pg/g	0.53 J	3.5 J	14	76 J	11	0.44 J	5.8 J
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.76 J	4.8 J	7.1 J	7.5 J	7.1 J	1.8 J	4.0 J
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	28	160	590	2800	450	7.6	230
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	3.4 J	17	62	200 J	46	0.94 J	23
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	1.2 J	6.6 J	24	140 J	18	0.61 J	10
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	25	110	380	1500	290	4.4 J	140
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	pg/g	2600	8700	19000	30000	18000	310	8500
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	360	1700	6400	24000 J	4900	75	2400
Total heptachlorodibenzofuran (HpCDF)	pg/g	15 J	130 J	410 J	2800 J	310 J	6.5 J	210 J
Total heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	63 J	380 J	520 J	470 J	590 J	110 J	330 J
Total hexachlorodibenzofuran (HxCDF)	pg/g	48 J	320 J	1200 J	8300 J	920 J	19 J	520 J
Total hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	13 J	68 J	92 J	90 J	100 J	30 J	56 J
Total pentachlorodibenzofuran (PeCDF)	pg/g	88 J	450 J	1600 J	6800 J	1200 J	19 J	600 J
Total pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	9.2 J	30 J	83 J	230 J	67 J	7.7 J	34 J
Total tetrachlorodibenzofuran (TCDF)	pg/g	4100 J	14000 J	41000 J	140000 J	31000 J	490 J	15000 J
Total tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	420 J	1900 J	7000 J	27000 J	5300 J	84 J	2600 J
Total WHO Dioxin TEQ(Human/Mammal)(ND=0)	pg/g	636	2660	8610	28500	6930	111	3370
Total WHO Dioxin TEQ(Human/Mammal)(ND=0.5)	pg/g	636	2660	8610	28500	6930	111	3370

Notes:
pg/g - picogram per gram
U - Not detected at the associated reporting limit.
J - Estimated concentration.
UJ - Not detected; associated reporting limit is estimated

Table 2-3

Second Phase Pre-Design Investigation Analytical Results
Pre-Final 90% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Sample Location: Sample Identification: Sample Date: Sample Depth: Sample Type:	Units	SJSB046 11187072-100719-SS-SJSB046 (12-14) 10/7/2019 (12-14) ft bgs	SJSB046 11187072-100719-SS-SJSB046 (14-16) 10/7/2019 (14-16) ft bgs	SJSB046 11187072-100719-SS-SJSB046 (16-18) 10/7/2019 (16-18) ft bgs	SJSB046 11187072-111119-KW-SJSB046-S(18-20) 11/11/2019 (18-20) ft bgs	SJSB046-C1 11187072-120919-BN-SJSB046-C1(0-2) 12/9/2019 (0-2) ft bgs	SJSB046-C1 11187072-120919-BN-SJSB046-C1(2-4) 12/9/2019 (2-4) ft bgs	SJSB046-C1 11187072-120919-BN-SJSB046-C1(4-6) 12/9/2019 (4-6) ft bgs
Dioxins/Furans								
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	pg/g	320	270	230	1.9 J	30	45	65
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	pg/g	2000	1800	2500	1800	1000 J	1600 J	1900 J
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	pg/g	110	59	98	0.44 U	26	54	55
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	74	63	95	76	38	49	69
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	pg/g	35	18	31	0.17 U	8.1	16	17
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	360	170	310	0.35 U	100	200	180
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	1.3 J	0.99 U	1.3 J	1.3 U	0.66 U	0.97 J	1.2 U
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	91	41	77	0.34 U	25	48	45
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	2.9 J	2.2 J	3.2 J	2.2 J	1.2 J	1.7 J	2.4 J
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	pg/g	6.1 J	2.6 J	5.0 J	0.39 J	1.7 J	2.9 J	3.0 J
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	2.8 J	2.4 J	3.5 J	4.0 J	1.2 J	1.9 J	2.6 J
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	260	110	220	0.59 U	85	170	150
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	22	11	22	0.44 J	7.4	18	14
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	12	4.9 J	9.1	0.24 U	3.2 J	5.7 J	5.4 J
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	150	70	140	0.28 J	61	130	110
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	pg/g	7900	4500	8900	9.1	5100	8600	8400
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	2500	1200	2400	2.6 U	1000	2400	1900
Total heptachlorodibenzofuran (HpCDF)	pg/g	180 J	97 J	160 J	0.44 J	44 J	84 J	96 J
Total heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	200 J	180 J	260 J	220 J	130 J	150 J	200 J
Total hexachlorodibenzofuran (HxCDF)	pg/g	540 J	250 J	460 J	0.39 J	150 J	280 J	270 J
Total hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	40 J	37 J	48 J	54 J	21 J	29 J	38 J
Total pentachlorodibenzofuran (PeCDF)	pg/g	660 J	300 J	580 J	0.88 J	240 J	480 J	420 J
Total pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	30 J	17 J	31 J	11 J	12 J	24 J	23 J
Total tetrachlorodibenzofuran (TCDF)	pg/g	14000 J	7300 J	15000 J	15 J	11000 J	25000 J	19000 J
Total tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	2600 J	1200 J	2500 J	8.8 J	1100 J	2700 J	2200 J
Total WHO Dioxin TEQ(Human/Mammal)(ND=0)	pg/g	3420	1710	3400	3.39	1550	3350	2820
Total WHO Dioxin TEQ(Human/Mammal)(ND=0.5)	pg/g	3420	1710	3400	4.82	1550	3350	2820

Notes:
pg/g - picogram per gram
U - Not detected at the associated reporting limit.
J - Estimated concentration.
UJ - Not detected; associated reporting limit is estimated

Table 2-3

Second Phase Pre-Design Investigation Analytical Results
Pre-Final 90% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Sample Location: Sample Identification: Sample Date: Sample Depth: Sample Type:	Units	SJSB046-C1 11187072-120919-BN-SJSB046-C1(6-8) 12/9/2019 (6-8) ft bgs	SJSB046-C1 11187072-120919-BN-SJSB046-C1(8-10) 12/9/2019 (8-10) ft bgs	SJSB046-C1 11187072-120919-BN-SJSB046-C1(10-12) 12/9/2019 (10-12) ft bgs	SJSB046-C1 11187072-120919-BN-SJSB046-C1(12-14) 12/9/2019 (12-14) ft bgs	SJSB046-C1 11187072-120919-BN-SJSB046-C1(14-16) 12/9/2019 (14-16) ft bgs	SJSB046-C1 11187072-120919-BN-DUP3 12/9/2019 (16-18) ft bgs Duplicate	SJSB046-C1 11187072-120919-BN-SJSB046-C1(16-18) 12/9/2019 (16-18) ft bgs
Dioxins/Furans								
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	pg/g	370	270	2.6 U	50	4.9 U	180	93
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	pg/g	2400 J	2100 J	1200 J	1800 J	1600 J	4100 J	1600 J
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	pg/g	290	540	1.5 J	60	3.2 J	120	160
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	130	120	41	72	68	150	67
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	pg/g	120	180	0.56 J	24	1.4 J	38	45
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	1400	2000	4.7 J	180	10	390	470
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	2.4 J	2.3 J	0.64 U	3.5 J	0.93 U	2.0 J	1.1 J
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	390	510	1.6 J	46	3.1 J	94	120
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	6.2 J	6.6 J	0.92 J	4.6 J	2.0 J	4.7 J	2.8 J
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	pg/g	25	34	0.28 U	6.2 J	0.56 U	5.6 J	7.8
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	5.6 J	4.6 J	2.2 J	6.3 J	3.7 J	4.6 J	2.3 J
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	1100	1400	3.7 J	140	9.5	280	340
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	70	89	0.48 J	13	1.3 J	25	39
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	46	56	0.24 J	7.4 J	0.59 J	11	13
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	590	710	2.3 J	93	7.3 J	180	240
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	pg/g	21000	13000	160	5600	680	8400	12000
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	9100	13000	36	1600	130	3000	4300
Total heptachlorodibenzofuran (HpCDF)	pg/g	500 J	850 J	2.8 J	98 J	5.8 J	210 J	240 J
Total heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	350 J	250 J	140 J	210 J	190 J	420 J	170 J
Total hexachlorodibenzofuran (HxCDF)	pg/g	2200 J	2900 J	7.2 J	270 J	17 J	570 J	680 J
Total hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	77 J	56 J	37 J	60 J	49 J	71 J	34 J
Total pentachlorodibenzofuran (PeCDF)	pg/g	2700 J	3300 J	9.4 J	370 J	28 J	710 J	910 J
Total pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	89 J	100 J	6.6 J	20 J	9.7 J	35 J	84 J
Total tetrachlorodibenzofuran (TCDF)	pg/g	70000 J	74000 J	270 J	12000 J	1300 J	24000 J	35000 J
Total tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	9900 J	15000 J	43 J	1800 J	150 J	3300 J	4800 J
Total WHO Dioxin TEQ(Human/Mammal)(ND=0)	pg/g	11700	14900	55.0	2230	205	3980	5690
Total WHO Dioxin TEQ(Human/Mammal)(ND=0.5)	pg/g	11700	14900	55.1	2230	205	3980	5690

Notes:
pg/g - picogram per gram
U - Not detected at the associated reporting limit.
J - Estimated concentration.
UJ - Not detected; associated reporting limit is estimated

Table 2-3

Second Phase Pre-Design Investigation Analytical Results
Pre-Final 90% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Sample Location:	Units	SJSB047	SJSB047	SJSB047	SJSB047	SJSB047	SJSB047	SJSB047
Sample Identification:		11187072-100919-SS-SJSB047(8-10)	11187072-100919-SS-SJSB047(10-12)	11187072-100919-SS-SJSB047(12-14)	11187072-100919-SS-SJSB047(14-16)	11187072-100919-SS-SJSB047(16-18)	11187072-101019-SS-SJSB047(0-2)	11187072-101019-SS-SJSB047(2-4)
Sample Date:		10/9/2019	10/9/2019	10/9/2019	10/9/2019	10/9/2019	10/10/2019	10/10/2019
Sample Depth:		(8-10) ft bgs	(10-12) ft bgs	(12-14) ft bgs	(14-16) ft bgs	(16-18) ft bgs	(0-2) ft bgs	(2-4) ft bgs
Sample Type:								
Dioxins/Furans								
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	pg/g	0.83 U	1.4 U	1.5 U	0.33 U	0.29 U	2.5 U	0.91 U
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	pg/g	1700	930	1000	1400	1100	500	1100
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	pg/g	0.29 U	0.22 U	0.65 J	0.27 U	0.29 U	0.57 J	0.17 J
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	49	34	48	65	46	22	43
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	pg/g	0.052 U	0.22 J	0.33 U	0.29 U	0.34 U	0.13 J	0.16 J
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.20 J	0.084 U	0.24 U	0.21 U	0.25 U	0.11 J	0.098 J
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.62 U	0.60 U	0.75 U	0.70 U	0.82 U	0.38 J	0.47 J
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.10 J	0.083 U	0.26 U	0.22 U	0.27 U	0.064 U	0.11 J
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	1.1 J	0.81 J	1.3 J	1.5 J	1.2 J	0.65 J	0.95 J
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	pg/g	0.19 J	0.21 J	0.23 J	0.11 U	0.27 J	0.13 J	0.24 J
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	2.6 J	1.8 J	3.0 J	3.2 J	2.7 J	1.6 J	2.1 J
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	0.17 J	0.070 U	0.23 U	0.20 U	0.18 U	0.054 U	0.043 U
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	0.25 J	0.20 J	0.36 U	0.38 U	0.39 U	0.11 U	0.097 U
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.059 U	0.066 U	0.16 U	0.14 U	0.16 U	0.048 U	0.094 J
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	0.067 U	0.077 U	0.24 U	0.22 U	0.19 U	0.056 U	0.043 U
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	pg/g	0.42 J	0.31 J	0.27 J	0.13 U	0.20 J	1.0 J	0.27 J
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	0.27 J	0.22 J	0.27 U	0.28 U	0.28 U	0.36 J	0.10 J
Total heptachlorodibenzofuran (HpCDF)	pg/g	0.29 J	0.44 J	0.65 J	0.29 U	0.34 U	1.6 J	0.52 J
Total heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	210 J	120 J	160 J	200 J	160 J	85 J	150 J
Total hexachlorodibenzofuran (HxCDF)	pg/g	0.48 J	0.28 J	0.23 J	0.22 U	0.27 J	0.24 J	0.55 J
Total hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	47 J	30 J	43 J	47 J	45 J	17 J	35 J
Total pentachlorodibenzofuran (PeCDF)	pg/g	0.31 J	0.10 U	0.24 U	0.22 U	0.20 U	0.066 U	0.053 U
Total pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	7.9 J	5.6 J	9.5 J	7.6 J	9.3 J	1.9 J	6.6 J
Total tetrachlorodibenzofuran (TCDF)	pg/g	1.0 J	1.1 J	0.96 J	0.50 J	0.82 J	1.8 J	0.93 J
Total tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	4.0 J	2.9 J	5.1 J	4.3 J	5.2 J	2.0 J	4.1 J
Total WHO Dioxin TEQ(Human/Mammal)(ND=0)	pg/g	1.99	1.35	1.27	1.54	1.23	1.12	1.30
Total WHO Dioxin TEQ(Human/Mammal)(ND=0.5)	pg/g	2.03	1.41	1.69	1.98	1.67	1.19	1.35

Notes:
pg/g - picogram per gram
U - Not detected at the associated reporting limit.
J - Estimated concentration.
UJ - Not detected; associated reporting limit is estimated

Table 2-3

Second Phase Pre-Design Investigation Analytical Results
Pre-Final 90% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Sample Location:	Units	SJSB047	SJSB047	SJSB047-C1	SJSB047-C1	SJSB047-C1	SJSB047-C1	SJSB047-C1
Sample Identification:		11187072-101019-SS-SJSB047(4-6)	11187072-101019-SS-SJSB047(6-8)	11187072-101719-SS-SJSB047-C1-(0-2)	11187072-101719-SS-SJSB047-C1-(2-4)	11187072-101719-SS-SJSB047-C1-(4-6)	11187072-101719-SS-SJSB047-C1-(6-8)	11187072-101719-SS-SJSB047-C1-(8-10)
Sample Date:		10/10/2019	10/10/2019	10/17/2019	10/17/2019	10/17/2019	10/17/2019	10/17/2019
Sample Depth:		(4-6) ft bgs	(6-8) ft bgs	(0-2) ft bgs	(2-4) ft bgs	(4-6) ft bgs	(6-8) ft bgs	(8-10) ft bgs
Sample Type:								
Dioxins/Furans								
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	pg/g	0.48 U	27	390	410	5.5 J	1.8 U	45
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	pg/g	830	2300	4300	2400	1300	1200	1200
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	pg/g	0.14 J	3.5 J	190	150	3.6 J	0.83 J	25
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	27	79	190	110	50	53	44
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	pg/g	0.15 J	0.33 J	63	52	1.2 J	0.27 J	7.3
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.085 J	0.067 U	690	530	11	1.8 J	75
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.50 J	0.86 J	3.4 J	2.1 J	0.79 U	0.71 U	0.62 U
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.075 J	0.16 J	180	140	3.1 J	0.57 J	19
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.60 J	1.6 J	7.6 J	5.4 J	1.2 J	1.4 J	1.2 J
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	pg/g	0.18 J	0.15 J	11	8.8 J	0.26 J	0.18 J	1.2 J
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	1.5 J	3.6 J	7.3 J	5.4 J	2.7 J	3.1 J	1.8 J
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	0.14 J	0.064 U	510	400	8.2 J	1.8 J	51
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	0.18 J	0.30 J	58	49	1.3 J	0.26 U	6.3 J
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.063 J	0.055 U	20	16	0.43 J	0.095 U	2.2 J
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	0.047 U	0.066 U	330	260	5.5 J	1.1 J	34
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	pg/g	1.7	0.17 J	14000 J	13000	380	82	2000
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	0.35 J	0.23 J	5800	4800	95	19	540
Total heptachlorodibenzofuran (HpCDF)	pg/g	0.43 J	12 J	330 J	260 J	6.0 J	1.3 J	40 J
Total heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	110 J	250 J	550 J	330 J	180 J	170 J	140 J
Total hexachlorodibenzofuran (HxCDF)	pg/g	0.40 J	1.3 J	1000 J	780 J	17 J	2.7 J	110 J
Total hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	28 J	52 J	95 J	70 J	43 J	48 J	28 J
Total pentachlorodibenzofuran (PeCDF)	pg/g	0.14 J	0.080 U	1300 J	1000 J	22 J	4.1 J	130 J
Total pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	5.8 J	11 J	64 J	54 J	10 J	12 J	10 J
Total tetrachlorodibenzofuran (TCDF)	pg/g	3.2 J	0.93 J	39000 J	30000 J	630 J	130 J	3900 J
Total tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	4.1 J	5.0 J	6300 J	5300 J	110 J	26 J	590 J
Total WHO Dioxin TEQ(Human/Mammal)(ND=0)	pg/g	1.53	2.71	7470	6310	139	29.2	769
Total WHO Dioxin TEQ(Human/Mammal)(ND=0.5)	pg/g	1.53	2.73	7470	6310	139	29.4	769

Notes:
pg/g - picogram per gram
U - Not detected at the associated reporting limit.
J - Estimated concentration.
UJ - Not detected; associated reporting limit is estimated

Table 2-3

Second Phase Pre-Design Investigation Analytical Results
Pre-Final 90% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Sample Location:	Units	SJSB047-C1	SJSB047-C1	SJSB047-C1	SJSB047-C1	SJSB048	SJSB048	SJSB048
Sample Identification:		11187072-101719-SS-SJSB047-C1-(10-12)	11187072-101719-SS-SJSB047-C1-(12-14)	11187072-101719-SS-SJSB047-C1-(14-16)	11187072-101719-SS-SJSB047-C1-(16-18)	11187072-090819-SS-SJSB048-S- (0-2)	11187072-090819-SS-SJSB048-S- (2-4)	11187072-090819-SS-SJSB048-S- (4-6)
Sample Date:		10/17/2019	10/17/2019	10/17/2019	10/17/2019	9/8/2019	9/8/2019	9/8/2019
Sample Depth:		(10-12) ft bgs	(12-14) ft bgs	(14-16) ft bgs	(16-18) ft bgs	(0-2) ft bgs	(2-4) ft bgs	(4-6) ft bgs
Sample Type:								
Dioxins/Furans								
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	pg/g	31	17	9.0 J	1.1 U	1.4 J	1.5 J	0.35 U
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	pg/g	1300	1100	930	1400	400	280	1100
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	pg/g	19	25	9.4	0.27 J	0.45 U	0.94 J	0.41 U
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	43	40	34	60	9.5	8.0	42
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	pg/g	6.1 J	7.6	3.1 J	0.093 U	1.1 J	0.73 J	0.71 J
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	61	76	29	0.49 J	0.37 J	0.53 J	0.23 U
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.59 U	0.68 U	0.52 U	1.0 U	0.31 U	0.27 U	0.61 J
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	16	20	7.6	0.15 U	0.34 J	0.16 U	0.24 U
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	1.2 J	1.0 J	0.74 J	1.3 J	0.32 U	0.29 U	1.3 J
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	pg/g	0.95 J	1.2 J	0.53 J	0.10 U	1.9 U	1.4 U	1.4 U
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	1.8 J	1.6 J	1.5 J	4.1 J	1.0 J	0.91 J	2.1 J
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	43	50	19	0.46 J	0.39 U	0.30 U	0.41 U
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	5.5 J	7.3	2.7 J	0.47 J	0.57 U	0.46 U	0.47 U
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	2.0 J	2.3 J	0.97 J	0.10 U	0.17 U	0.13 U	0.18 U
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	30	37	13	0.29 J	0.43 U	0.34 U	0.43 U
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	pg/g	1700	1900	950	16	1.7	1.8	0.26 J
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	490	600	220	3.5	0.64 J	0.24 U	0.26 U
Total heptachlorodibenzofuran (HpCDF)	pg/g	32 J	39 J	15 J	0.27 J	1.1 J	2.2 J	0.71 J
Total heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	140 J	120 J	100 J	220 J	33 J	27 J	120 J
Total hexachlorodibenzofuran (HxCDF)	pg/g	91 J	110 J	42 J	0.49 J	4.2 J	3.5 J	2.0 J
Total hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	31 J	25 J	22 J	55 J	6.9 J	6.2 J	21 J
Total pentachlorodibenzofuran (PeCDF)	pg/g	120 J	140 J	51 J	0.95 J	0.51 U	0.34 U	0.43 U
Total pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	10 J	11 J	6.5 J	13 J	0.57 U	0.46 U	2.0 J
Total tetrachlorodibenzofuran (TCDF)	pg/g	3500 J	4300 J	1500 J	23 J	2.7 J	2.6 J	0.84 J
Total tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	530 J	650 J	240 J	10 J	0.64 J	0.31 J	2.5 J
Total WHO Dioxin TEQ(Human/Mammal)(ND=0)	pg/g	685	821	327	7.28	1.21	0.505	1.18
Total WHO Dioxin TEQ(Human/Mammal)(ND=0.5)	pg/g	685	821	327	7.35	1.70	1.02	1.72

Notes:
pg/g - picogram per gram
U - Not detected at the associated reporting limit.
J - Estimated concentration.
UJ - Not detected; associated reporting limit is estimated

Table 2-3

Second Phase Pre-Design Investigation Analytical Results
Pre-Final 90% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Sample Location: / Sample Identification: / Sample Date: / Sample Depth: / Sample Type:	Units	SJSB048 / 11187072-090819-SS-SJSB048-S- (6-8) / 9/8/2019 / (6-8) ft bgs	SJSB048 / 11187072-090819-SS-SJSB048-S- (8-10) / 9/8/2019 / (8-10) ft bgs	SJSB048 / 11187072-090819-SS-SJSB048-S- (10-12) / 9/8/2019 / (10-12) ft bgs	SJSB048 / 11187072-090819-SS-SJSB048-S- (12-14) / 9/8/2019 / (12-14) ft bgs	SJSB048 / 11187072-090819-SS-SJSB048-S- (14-16) / 9/8/2019 / (14-16) ft bgs	SJSB048 / 11187072-090819-SS-SJSB048-S- (16-18) / 9/8/2019 / (106-18) ft bgs	SJSB048-C1 / 11187072-11719-KW-SJSB048-C1-S (0-2) / 11/7/2019 / (0-2) ft bgs
Dioxins/Furans								
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	pg/g	1.3 J	1.2 J	0.34 U	1.2 J	0.31 U	1.3 J	7.9 J
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	pg/g	1800	1700	1200	1300	920	1900	780
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	pg/g	0.75 J	0.45 U	0.41 U	0.40 U	0.62 J	0.38 U	16
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	74	66	44	45	36	69	35
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	pg/g	0.51 U	0.79 J	0.69 J	0.41 U	0.45 U	0.55 J	5.4 J
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.20 U	0.22 U	0.22 U	0.17 U	0.21 U	0.25 U	53
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.77 J	0.86 J	0.60 J	0.63 J	0.56 J	0.83 J	0.40 J
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.22 U	0.24 U	0.24 U	0.18 U	0.23 U	0.27 U	13
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	1.7 J	1.7 J	1.2 J	1.0 J	0.93 J	1.6 J	1.0 J
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	pg/g	1.5 U	2.0 U	1.3 U	0.90 U	1.3 U	1.4 U	1.1 J
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	3.4 J	3.5 J	2.4 J	2.1 J	2.2 J	3.6 J	1.9 J
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	0.38 U	0.43 U	0.36 U	0.35 U	0.38 U	0.38 U	35
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	0.55 U	0.63 U	0.49 U	0.48 U	0.58 U	0.58 U	5.4 J
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.18 U	0.18 U	0.19 U	0.14 U	0.18 U	0.20 U	1.8 J
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	0.42 U	0.46 U	0.39 U	0.36 U	0.41 U	0.42 U	30
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	pg/g	0.17 U	0.42 J	0.16 U	0.59 J	0.65 J	0.62 J	1400
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	0.25 U	0.34 U	0.26 U	0.38 J	0.26 U	0.32 U	460
Total heptachlorodibenzofuran (HpCDF)	pg/g	0.75 J	0.79 J	0.69 J	0.41 U	0.62 J	0.55 J	26 J
Total heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	210 J	280 J	160 J	150 J	130 J	250 J	89 J
Total hexachlorodibenzofuran (HxCDF)	pg/g	2.0 J	2.5 J	2.2 J	0.90 J	1.8 J	1.4 J	80 J
Total hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	40 J	60 J	35 J	30 J	32 J	53 J	20 J
Total pentachlorodibenzofuran (PeCDF)	pg/g	0.50 U	0.47 U	0.39 U	0.36 U	0.41 U	0.45 U	110 J
Total pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	6.3 J	9.1 J	5.1 J	5.9 J	6.8 J	8.2 J	5.4 J
Total tetrachlorodibenzofuran (TCDF)	pg/g	0.52 J	1.1 J	0.66 J	1.4 J	1.7 J	1.6 J	3300 J
Total tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	3.8 J	2.6 J	3.9 J	3.7 J	4.7 J	5.8 J	510 J
Total WHO Dioxin TEQ(Human/Mammal)(ND=0)	pg/g	1.87	1.83	1.23	1.65	1.08	1.93	623
Total WHO Dioxin TEQ(Human/Mammal)(ND=0.5)	pg/g	2.46	2.52	1.77	2.03	1.66	2.56	623

Notes:
- pg/g - picogram per gram
- U - Not detected at the associated reporting limit.
- J - Estimated concentration.
- UJ - Not detected; associated reporting limit is estimated

Table 2-3

Second Phase Pre-Design Investigation Analytical Results
Pre-Final 90% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Sample Location:		SJSB048-C1	SJSB048-C1	SJSB048-C1	SJSB048-C1	SJSB048-C1	SJSB048-C1
Sample Identification:	Units	11187072-11719-KW-SJSB048-C1-S (2-4)	11187072-11719-KW-SJSB048-C1-S (4-6)	11187072-11719-KW-SJSB048-C1-S (6-8)	11187072-11719-KW-SJSB048-C1-S (8-10)	11187072-11719-KW-SJSB048-C1-S (10-12)	11187072-11719-KW-SJSB048-C1-S (12-14)
Sample Date:		11/7/2019	11/7/2019	11/7/2019	11/7/2019	11/7/2019	11/7/2019
Sample Depth:		(2-4) ft bgs	(4-6) ft bgs	(6-8) ft bgs	(8-10) ft bgs	(10-12) ft bgs	(12-14) ft bgs
Sample Type:							
Dioxins/Furans							
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	pg/g	1.1 U	9.2 J	0.37 U	3.4 U	0.24 U	1.5 U
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	pg/g	490	380	1300	150	2000	2200
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	pg/g	2.0 J	20	0.33 U	7.2	0.25 U	3.1 J
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	19	16	48	6.4	91	98
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	pg/g	0.70 J	7.8	0.22 U	2.6 J	0.031 U	1.3 J
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	5.7 J	55	0.63 J	25	0.41 J	11
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.23 J	0.28 J	0.51 J	0.13 J	0.86 J	1.1 J
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	1.5 J	13	0.15 J	6.1	0.18 J	2.6 J
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.54 J	0.38 J	0.93 J	0.22 J	2.2 J	2.5 J
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	pg/g	0.16 J	1.0 J	0.069 U	0.44 J	0.073 U	0.25 J
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	1.1 J	0.96 J	2.8 J	0.36 J	4.9 J	5.3 J
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	3.5 J	33	0.26 J	16	0.31 J	6.8 J
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	0.59 J	5.3 J	0.24 J	2.8 J	0.33 J	1.4 J
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.13 J	1.6 J	0.058 U	0.86 J	0.062 U	0.35 J
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	3.1 J	28	0.24 J	15	0.26 J	6.4 J
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	pg/g	42	1400	5.5	820	6.6	390
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	48	430	2.7	230	2.9	100
Total heptachlorodibenzofuran (HpCDF)	pg/g	3.2 J	32 J	0.55 J	12 J	0.34 J	5.1 J
Total heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	53 J	42 J	150 J	20 J	290 J	300 J
Total hexachlorodibenzofuran (HxCDF)	pg/g	8.4 J	81 J	0.78 J	37 J	0.60 J	16 J
Total hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	13 J	11 J	39 J	5.7 J	66 J	78 J
Total pentachlorodibenzofuran (PeCDF)	pg/g	11 J	93 J	0.50 J	49 J	0.67 J	23 J
Total pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	2.3 J	7.9 J	6.5 J	3.0 J	10 J	13 J
Total tetrachlorodibenzofuran (TCDF)	pg/g	340 J	3000 J	21 J	1700 J	22 J	790 J
Total tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	54 J	480 J	7.0 J	260 J	9.6 J	120 J
Total WHO Dioxin TEQ(Human/Mammal)(ND=0)	pg/g	55.1	592	4.94	323	6.34	147
Total WHO Dioxin TEQ(Human/Mammal)(ND=0.5)	pg/g	55.1	592	4.95	323	6.35	147

Notes:
pg/g - picogram per gram
U - Not detected at the associated reporting limit.
J - Estimated concentration.
UJ - Not detected; associated reporting limit is estimated

Table 2-3

Second Phase Pre-Design Investigation Analytical Results
Pre-Final 90% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Sample Location: / Sample Identification: / Sample Date: / Sample Depth: / Sample Type:	Units	SJSB048-C1 11187072-11719-KW-SJSB048-C1-S (14-16) 11/7/2019 (14-16) ft bgs	SJSB048-C1 11187072-11719-KW-SJSB048-C1-S (16-18) 11/7/2019 (16-18) ft bgs	SJSB048-C1 1187072-120519-SS-SJSB048-C1(18-20) 12/5/2019 (18-20) ft bgs	SJSB048-C1 1187072-120519-SS-DUP-1 12/5/2019 (20-22) ft bgs	SJSB049 11187072-091119-SS-SJSB049-S (0-2) 9/11/2019 (0-2) ft bgs	SJSB049 11187072-091119-SS-SJSB049-S (2-4) 9/11/2019 (2-4) ft bgs	SJSB049 11187072-091119-SS-SJSB049-S (4-6) 9/11/2019 (4-6) ft bgs
Dioxins/Furans								
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	pg/g	1.5 U	2.3 U	2.5 U	1.9 U	490	240	82
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	pg/g	2600	710	1200 J	62	5200	3200	1600
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	pg/g	3.2 J	5.3 J	0.63 J	0.13 U	830	190	94
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	87	30	47	2.3 J	260	120	60
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	pg/g	1.1 J	1.9 J	0.20 U	0.17 U	260	56	30
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	9.7	18	0.92 J	0.19 J	2400	550	240
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.86 J	0.30 J	0.86 J	0.32 J	3.2 J	1.7 J	0.94 J
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	2.4 J	4.3 J	0.44 J	0.14 J	680	150	65
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	1.9 J	0.67 J	1.3 J	0.27 J	14	4.6 J	1.7 J
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	pg/g	0.30 J	0.39 J	0.55 J	0.28 J	43	10 U	5.6 U
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	3.9 J	1.3 J	4.0 J	0.42 J	7.7 J	4.3 J	2.5 J
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	6.6 J	11	0.20 U	0.11 U	1600	430	150
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	1.5 J	2.0 J	0.60 J	0.17 U	150	46	12 J
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.38 J	0.49 J	0.23 J	0.11 J	76	16	6.1 J
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	6.0 J	9.9	0.47 J	0.11 U	1100	330	100
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	pg/g	400	510	25 J	1.9	27000 J	14000 J	5700 J
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	96	160	6.9	0.56 J	20000 J	5000 J	1700 J
Total heptachlorodibenzofuran (HpCDF)	pg/g	5.1 J	8.6 J	0.63 J	0.17 U	1400 J	300 J	140 J
Total heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	240 J	77 J	170 J	6.6 J	620 J	320 J	180 J
Total hexachlorodibenzofuran (HxCDF)	pg/g	15 J	26 J	2.1 J	0.73 J	3600 J	820 J	350 J
Total hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	54 J	19 J	47 J	2.9 J	110 J	61 J	33 J
Total pentachlorodibenzofuran (PeCDF)	pg/g	22 J	36 J	0.47 J	0.12 U	4400 J	1200 J	380 J
Total pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	8.9 J	3.0 J	7.9 J	0.17 U	160 J	61 J	14 J
Total tetrachlorodibenzofuran (TCDF)	pg/g	750 J	1100 J	44 J	2.1 J	100000 J	35000 J	11000 J
Total tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	110 J	170 J	11 J	1.1 J	21000 J	5500 J	1800 J
Total WHO Dioxin TEQ(Human/Mammal)(ND=0)	pg/g	143	219	11.8	0.965	23600	6640	2350
Total WHO Dioxin TEQ(Human/Mammal)(ND=0.5)	pg/g	143	219	11.8	1.07	23600	6640	2350

Notes:
pg/g - picogram per gram
U - Not detected at the associated reporting limit.
J - Estimated concentration.
UJ - Not detected; associated reporting limit is estimated

Table 2-3

Second Phase Pre-Design Investigation Analytical Results
Pre-Final 90% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Sample Location: Sample Identification: Sample Date: Sample Depth: Sample Type:	Units	SJSB049 11187072-091119-SS-SJSB049-S (6-8) 9/11/2019 (6-8) ft bgs	SJSB049 11187072-091119-SS-SJSB049-S (8-10) 9/11/2019 (8-10) ft bgs	SJSB049 11187072-091119-SS-SJSB049-S (10-12) 9/11/2019 (10-12) ft bgs	SJSB049 11187072-091119-SS-SJSB049-S (12-14) 9/11/2019 (12-14) ft bgs	SJSB049 11187072-091119-SS-SJSB049-S (14-16) 9/11/2019 (14-16) ft bgs	SJSB049 11187072-091119-SS-SJSB049-S (16-18) 9/11/2019 (16-18) ft bgs	SJSB050 11187072-091619-SS-SJSB050-(0-2) 9/16/2019 (0-2) ft bgs
Dioxins/Furans								
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	pg/g	5.1 J	9.7 J	3.2 J	4.5 J	1.8 J	0.47 U	7.2 J
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	pg/g	1700	1600	1700	2600	2000	2000	2600
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	pg/g	3.0 J	6.6 J	2.2 J	2.8 J	0.49 U	0.37 U	1.1 J
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	64	59	75	99	75	77	91
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	pg/g	2.9 U	3.6 U	2.5 U	3.0 U	1.5 U	1.6 U	0.42 U
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	8.1	18	6.5 J	8.4	1.7 J	0.24 U	0.27 U
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.57 J	0.62 J	1.0 J	1.0 J	1.4 J	0.83 J	1.1 J
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	2.4 J	4.6 J	2.1 J	2.6 J	0.67 J	0.25 U	0.27 U
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	1.3 J	1.4 J	2.0 J	2.3 J	2.2 J	1.5 J	2.5 J
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	pg/g	3.6 U	3.1 U	2.4 U	3.5 U	2.8 U	3.2 U	0.70 U
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	2.8 J	2.6 J	4.1 J	5.5 J	6.3 J	5.0 J	4.7 J
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	6.4 J	14	5.8 J	7.4 J	1.9 J	0.39 U	0.38 U
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	1.1 J	1.6 J	1.1 J	0.89 J	0.52 U	0.60 U	0.47 U
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.22 U	0.63 J	0.19 U	0.48 J	0.18 U	0.20 U	0.21 U
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	4.2 J	9.4	4.1 J	4.5 J	1.1 J	0.41 U	0.42 U
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	pg/g	320	720 J	330	340	77	11 J	11
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	73	170	74	77	17	2.1 J	3.4
Total heptachlorodibenzofuran (HpCDF)	pg/g	5.9 J	12 J	4.7 J	7.0 J	1.5 J	1.6 J	1.1 J
Total heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	190 J	190 J	220 J	290 J	260 J	240 J	220 J
Total hexachlorodibenzofuran (HxCDF)	pg/g	18 J	31 J	13 J	18 J	6.5 J	4.7 J	0.70 J
Total hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	39 J	42 J	58 J	68 J	67 J	62 J	44 J
Total pentachlorodibenzofuran (PeCDF)	pg/g	17 J	37 J	16 J	19 J	2.9 J	0.41 U	0.42 U
Total pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	6.3 J	7.9 J	15 J	10 J	5.5 J	9.6 J	6.1 J
Total tetrachlorodibenzofuran (TCDF)	pg/g	520 J	1200 J	530 J	530 J	110 J	17 J	13 J
Total tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	80 J	190 J	84 J	88 J	22 J	7.5 J	6.4 J
Total WHO Dioxin TEQ(Human/Mammal)(ND=0)	pg/g	110	251	112	117	27.7	5.30	7.03
Total WHO Dioxin TEQ(Human/Mammal)(ND=0.5)	pg/g	110	251	112	117	28.1	5.87	7.41

Notes:
pg/g - picogram per gram
U - Not detected at the associated reporting limit.
J - Estimated concentration.
UJ - Not detected; associated reporting limit is estimated

Table 2-3

Second Phase Pre-Design Investigation Analytical Results
Pre-Final 90% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Sample Location:		SJSB050	SJSB050	SJSB050	SJSB050	SJSB050	SJSB050	SJSB050
Sample Identification:		11187072-091619-SS-DUP-5	11187072-091619-SS-SJSB050-(2-4)	11187072-091619-SS-SJSB050-(4-6)	11187072-091619-SS-SJSB050-(6-8)	11187072-091619-SS-SJSB050-(8-10)	11187072-091619-SS-SJSB050-(10-12)	11187072-091619-SS-SJSB050-(12-14)
Sample Date:	Units	9/16/2019	9/16/2019	9/16/2019	9/16/2019	9/16/2019	9/16/2019	9/16/2019
Sample Depth:		(2-4) ft bgs	(2-4) ft bgs	(4-6) ft bgs	(6-8) ft bgs	(8-10) ft bgs	(10-12) ft bgs	(12-14) ft bgs
Sample Type:		Duplicate						
Dioxins/Furans								
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	pg/g	1.8 J	1.7 J	0.46 U	0.39 U	1.0 J	0.45 U	0.34 U
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	pg/g	1400	2300	850	1300	2500	2000	1400
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	pg/g	0.27 U	0.34 U	0.27 U	0.23 U	0.22 U	0.24 U	0.19 U
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	50	62	31	38	110	85	50
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	pg/g	0.32 U	0.38 U	0.32 U	0.26 U	0.24 U	0.28 U	0.20 U
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.20 U	0.20 U	0.17 U	0.16 U	0.18 U	0.15 U	0.13 U
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.76 J	1.2 J	0.51 J	0.42 J	1.1 J	1.0 J	0.44 J
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.20 U	0.21 U	0.18 U	0.17 U	0.18 U	0.16 U	0.14 U
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	1.3 J	1.3 J	0.62 J	0.78 J	2.4 J	2.1 J	0.97 J
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	pg/g	0.53 U	0.30 U	0.23 U	0.23 U	0.35 U	0.32 U	0.27 U
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	2.7 J	3.1 J	1.9 J	2.0 J	5.6 J	4.7 J	2.4 J
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	0.30 U	0.54 J	0.23 U	0.23 U	0.24 U	0.22 U	0.20 U
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	0.48 U	0.52 U	0.48 U	0.41 U	0.45 U	0.47 U	0.36 U
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.16 U	0.16 U	0.14 U	0.12 U	0.14 U	0.12 U	0.10 U
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	0.31 U	0.36 U	0.25 U	0.25 U	0.26 U	0.25 U	0.22 U
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	pg/g	3.9	0.97 J	0.20 U	0.14 U	0.19 U	0.21 U	0.15 U
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	1.0 J	0.71 J	0.27 U	0.21 U	0.30 J	0.31 U	0.25 J
Total heptachlorodibenzofuran (HpCDF)	pg/g	0.32 U	0.38 U	0.32 U	0.26 U	0.24 U	0.28 U	0.20 U
Total heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	120 J	160 J	120 J	150 J	280 J	230 J	140 J
Total hexachlorodibenzofuran (HxCDF)	pg/g	0.53 J	0.30 J	0.23 J	0.23 J	0.35 J	0.32 J	0.27 J
Total hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	24 J	30 J	34 J	36 J	78 J	66 J	33 J
Total pentachlorodibenzofuran (PeCDF)	pg/g	0.36 U	1.5 J	0.28 U	0.25 U	0.26 U	0.26 U	0.22 U
Total pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	4.2 J	5.4 J	7.3 J	6.2 J	17 J	13 J	5.6 J
Total tetrachlorodibenzofuran (TCDF)	pg/g	5.9 J	2.8 J	0.20 U	0.14 U	0.47 J	1.4 J	0.37 J
Total tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	2.0 J	4.1 J	3.2 J	1.6 J	8.4 J	8.1 J	2.8 J
Total WHO Dioxin TEQ(Human/Mammal)(ND=0)	pg/g	2.79	2.69	0.868	1.09	3.06	2.23	1.55
Total WHO Dioxin TEQ(Human/Mammal)(ND=0.5)	pg/g	3.13	3.05	1.33	1.48	3.38	2.71	1.81

Notes:
pg/g - picogram per gram
U - Not detected at the associated reporting limit.
J - Estimated concentration.
UJ - Not detected; associated reporting limit is estimated.

Table 2-3

Second Phase Pre-Design Investigation Analytical Results
Pre-Final 90% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Sample Location: Sample Identification: Sample Date: Sample Depth: Sample Type:	Units	SJSB050 11187072-091619-SS-SJSB050-(14-16) 9/16/2019 (14-16) ft bgs	SJSB050 11187072-091619-SS-SJSB050-(16-18) 9/16/2019 (16-18) ft bgs	SJSB050-C1 11187072-100919-SS-SJSB050C1(0-2) 10/10/2019 (0-2) ft bgs	SJSB050-C1 11187072-100919-SS-SJSB050C1(2-4) 10/10/2019 (2-4) ft bgs	SJSB050-C1 11187072-100919-SS-SJSB050C1(4-6) 10/10/2019 (4-6) ft bgs	SJSB050-C1 11187072-100919-SS-SJSB050C1(6-8) 10/10/2019 (6-8) ft bgs	SJSB050-C1 11187072-100919-SS-SJSB050C1(8-10) 10/10/2019 (8-10) ft bgs
Dioxins/Furans								
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	pg/g	0.41 U	0.31 U	0.18 U	0.83 U	0.26 U	1.4 U	0.52 U
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	pg/g	1200	40	450	750	1500	2300	130
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	pg/g	0.23 U	0.16 U	0.17 U	0.20 U	0.24 U	0.22 U	0.15 U
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	45	0.94 J	16	33	58	97	6.0 J
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	pg/g	0.26 U	0.20 U	0.20 U	0.23 U	0.25 U	0.26 U	0.18 U
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.21 U	0.13 U	0.14 U	0.18 U	0.17 U	0.19 U	0.14 U
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.61 J	0.15 U	0.33 U	0.44 U	0.62 U	1.0 U	0.15 U
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.21 U	0.13 U	0.15 U	0.20 U	0.18 U	0.22 U	0.15 U
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	1.3 J	0.16 U	0.39 J	0.77 J	1.2 J	2.0 J	0.16 U
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	pg/g	0.36 U	0.26 U	0.11 J	0.25 J	0.094 U	0.27 J	0.076 U
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	2.9 J	0.14 U	0.79 J	1.5 J	2.6 J	4.5 J	0.34 J
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	0.27 U	0.22 U	0.16 U	0.16 U	0.17 U	0.17 U	0.22 J
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	0.48 U	0.29 U	0.27 U	0.29 U	0.33 U	0.36 U	0.21 U
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.16 U	0.098 U	0.092 U	0.12 U	0.11 U	0.13 U	0.090 U
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	0.29 U	0.23 U	0.17 U	0.17 U	0.18 U	0.18 U	0.14 U
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	pg/g	0.19 U	0.13 U	3.5	0.86 J	0.44 J	0.31 J	3.0
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	0.27 U	0.17 U	1.3 J	0.85 J	0.51 J	0.44 J	0.70 J
Total heptachlorodibenzofuran (HpCDF)	pg/g	0.26 U	0.20 U	0.20 U	0.23 U	0.25 U	0.26 U	0.18 U
Total heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	130 J	3.8 J	51 J	110 J	180 J	320 J	15 J
Total hexachlorodibenzofuran (HxCDF)	pg/g	0.36 J	0.26 J	0.11 U	0.25 J	0.18 U	0.27 J	0.15 U
Total hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	38 J	0.78 J	9.2 J	20 J	40 J	72 J	2.2 J
Total pentachlorodibenzofuran (PeCDF)	pg/g	0.29 U	0.23 U	0.17 U	0.19 U	0.18 U	0.18 U	0.22 J
Total pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	7.5 J	0.29 U	0.49 J	1.5 J	6.6 J	12 J	0.21 U
Total tetrachlorodibenzofuran (TCDF)	pg/g	0.80 J	0.13 U	4.6 J	1.7 J	0.88 J	0.89 J	4.4 J
Total tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	4.1 J	0.17 U	2.1 J	3.1 J	4.1 J	7.5 J	0.91 J
Total WHO Dioxin TEQ(Human/Mammal)(ND=0)	pg/g	1.29	0.0214	2.07	1.74	1.96	2.81	1.14
Total WHO Dioxin TEQ(Human/Mammal)(ND=0.5)	pg/g	1.77	0.351	2.27	1.97	2.22	3.10	1.31

Notes:
pg/g - picogram per gram
U - Not detected at the associated reporting limit.
J - Estimated concentration.
UJ - Not detected; associated reporting limit is estimated

Table 2-3

Second Phase Pre-Design Investigation Analytical Results
Pre-Final 90% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Sample Location: Sample Identification: Sample Date: Sample Depth: Sample Type:	Units	SJSB050-C1 11187072-100919-SS-SJSB050C1(10-12) 10/10/2019 (10-12) ft bgs	SJSB050-C1 11187072-100919-SS-SJSB050C1(12-14) 10/10/2019 (12-14) ft bgs	SJSB050-C1 11187072-100919-SS-SJSB050C1(14-16) 10/10/2019 (14-16) ft bgs	SJSB050-C1 11187072-100919-SS-SJSB050C1(16-18) 10/10/2019 (16-18) ft bgs	SJSB050-C1 11187072-101019-SS-DUP-7 10/10/2019 (16-18) ft bgs Duplicate	SJSB051 11187072-091019-SS-SJSB051-S (0-2) 9/10/2019 (0-2) ft bgs	SJSB051 11187072-091019-SS-SJSB051-S (2-4) 9/10/2019 (2-4) ft bgs
Dioxins/Furans								
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	pg/g	0.24 U	0.32 U	1.1 U	0.24 U	0.19 U	2.5 J	4.0 J
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	pg/g	340	2000	1800	960 J	250 J	2300	5500
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	pg/g	0.19 U	0.24 U	0.21 U	0.19 U	0.13 U	0.28 U	0.53 U
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	14	100	96	41 J	8.7 J	60	130
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	pg/g	0.21 U	0.27 U	0.24 U	0.21 U	0.16 U	0.35 U	0.67 U
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.15 U	0.21 U	0.19 U	0.16 U	0.13 U	0.19 U	0.33 U
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.38 U	0.97 U	0.88 U	0.51 U	0.17 U	0.62 J	1.3 J
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.17 U	0.23 U	0.21 U	0.18 U	0.14 U	0.19 U	0.32 U
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.35 J	2.6 J	2.7 J	0.92 J	0.17 U	1.4 J	3.1 J
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	pg/g	0.085 U	0.33 J	0.24 J	0.088 U	0.11 J	1.5 U	2.3 U
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.71 J	5.7 J	5.4 J	2.0 J	0.39 J	3.2 J	6.1 J
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	0.15 U	0.18 U	0.19 U	0.18 U	0.11 U	0.29 U	0.58 U
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	0.24 U	0.41 U	0.38 U	0.30 U	0.23 U	0.45 U	0.94 U
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.10 U	0.15 U	0.13 U	0.11 U	0.087 U	0.15 U	0.25 U
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	0.17 U	0.20 U	0.21 U	0.18 U	0.12 U	0.33 U	0.67 U
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	pg/g	2.4	0.15 U	0.12 U	0.14 U	0.097 U	1.4 J	0.30 U
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	0.76 J	0.59 J	0.24 J	0.19 U	0.17 U	0.67 J	0.43 U
Total heptachlorodibenzofuran (HpCDF)	pg/g	0.21 U	0.27 U	0.24 U	0.21 U	0.16 U	0.35 U	0.67 U
Total heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	40 J	260 J	240 J	110 J	25 J	160 J	330 J
Total hexachlorodibenzofuran (HxCDF)	pg/g	0.17 U	0.33 J	0.24 J	0.18 U	0.11 U	1.9 J	2.6 J
Total hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	8.1 J	67 J	59 J	22 J	5.2 J	31 J	53 J
Total pentachlorodibenzofuran (PeCDF)	pg/g	0.17 U	0.20 U	0.21 U	0.18 U	0.15 U	0.33 U	0.67 U
Total pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	0.57 J	9.7 J	8.8 J	2.2 J	0.46 J	2.4 J	1.8 J
Total tetrachlorodibenzofuran (TCDF)	pg/g	2.7 J	0.70 J	0.99 J	0.14 U	0.097 U	2.6 J	1.2 J
Total tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	1.2 J	6.4 J	5.3 J	1.2 J	0.18 J	2.4 J	3.1 J
Total WHO Dioxin TEQ(Human/Mammal)(ND=0)	pg/g	1.35	3.05	2.57	0.99	0.212	2.62	4.00
Total WHO Dioxin TEQ(Human/Mammal)(ND=0.5)	pg/g	1.54	3.38	2.88	1.33	0.473	3.02	4.98

Notes:
pg/g - picogram per gram
U - Not detected at the associated reporting limit.
J - Estimated concentration.
UJ - Not detected; associated reporting limit is estimated

Table 2-3

Second Phase Pre-Design Investigation Analytical Results
Pre-Final 90% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Sample Location:	Units	SJSB051	SJSB051	SJSB051	SJSB051	SJSB051	SJSB051	SJSB051
Sample Identification:		11187072-091019-SS-SJSB051-S (4-6)	11187072-091019-SS-SJSB051-S (6-8)	11187072-091019-SS-SJSB051-S (8-10)	11187072-091019-SS-SJSB051-S (10-12)	11187072-091019-SS-SJSB051-S (12-14)	11187072-091019-SS-SJSB051-S (14-16)	11187072-091019-SS-DUP-1
Sample Date:		9/10/2019	9/10/2019	9/10/2019	9/10/2019	9/10/2019	9/10/2019	9/10/2019
Sample Depth:		(4-6) ft bgs	(6-8) ft bgs	(8-10) ft bgs	(10-12) ft bgs	(12-14) ft bgs	(14-16) ft bgs	(16-18) ft bgs
Sample Type:								Duplicate
Dioxins/Furans								
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	pg/g	0.38 U	1.2 J	2.6 J	0.58 J	0.85 J	0.74 J	0.61 J
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	pg/g	1600	2200	1400	1400	2600	1500	850
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	pg/g	0.40 U	0.34 J	0.50 J	0.14 J	0.25 J	0.22 J	0.15 J
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	62	81	49	51	70	66	40
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	pg/g	0.48 U	0.76 J	0.76 J	0.71 J	0.75 J	0.74 J	0.56 J
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.23 U	0.24 J	0.17 J	0.15 J	0.27 J	0.18 J	0.19 J
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.73 J	1.2 J	0.95 J	0.79 J	1.1 J	0.90 J	0.74 J
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.22 U	0.17 J	0.15 J	0.12 J	0.17 J	0.14 J	0.032 U
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	1.3 J	1.5 J	1.2 J	1.0 J	1.5 J	1.3 J	1.1 J
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	pg/g	1.5 U	1.6 U	1.5 U	1.4 U	1.5 U	1.5 U	1.3 U
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	3.6 J	4.4 J	2.9 J	2.7 J	3.1 J	3.6 J	3.3 J
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	0.32 U	0.29 J	0.28 J	0.22 J	0.28 J	0.17 J	0.19 J
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	0.60 U	0.080 U	0.28 J	0.060 U	0.37 J	0.33 J	0.24 J
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.17 U	0.024 U	0.021 U	0.019 U	0.026 U	0.019 U	0.027 U
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	0.34 U	0.13 J	0.18 J	0.13 J	0.15 J	0.083 J	0.058 U
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	pg/g	0.21 U	0.13 J	2.2	0.11 J	0.56 J	0.11 J	0.096 J
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	0.34 J	0.23 J	0.93 J	0.14 J	0.25 J	0.17 J	0.17 J
Total heptachlorodibenzofuran (HpCDF)	pg/g	0.48 U	1.5 J	1.9 J	1.1 J	1.3 J	1.3 J	0.98 J
Total heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	220 J	290 J	150 J	180 J	210 J	220 J	140 J
Total hexachlorodibenzofuran (HxCDF)	pg/g	1.5 J	2.9 J	3.1 J	2.5 J	2.9 J	2.7 J	2.4 J
Total hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	49 J	76 J	44 J	51 J	42 J	65 J	41 J
Total pentachlorodibenzofuran (PeCDF)	pg/g	0.34 U	0.92 J	1.3 J	0.86 J	1.1 J	0.69 J	0.82 J
Total pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	7.9 J	13 J	9.2 J	7.6 J	8.0 J	12 J	6.9 J
Total tetrachlorodibenzofuran (TCDF)	pg/g	0.21 U	0.92 J	3.9 J	0.49 J	3.0 J	1.0 J	1.2 J
Total tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	4.2 J	8.2 J	5.8 J	4.1 J	6.0 J	5.5 J	3.9 J
Total WHO Dioxin TEQ(Human/Mammal)(ND=0)	pg/g	2.00	2.52	2.95	1.61	2.83	2.27	1.62
Total WHO Dioxin TEQ(Human/Mammal)(ND=0.5)	pg/g	2.48	2.64	3.03	1.71	2.91	2.35	1.70

Notes:
pg/g - picogram per gram
U - Not detected at the associated reporting limit.
J - Estimated concentration.
UJ - Not detected; associated reporting limit is estimated

Table 2-3

Second Phase Pre-Design Investigation Analytical Results
Pre-Final 90% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Sample Location: Sample Identification: Sample Date: Sample Depth: Sample Type:	Units	SJSB051 11187072-091019-SS-SJSB051-S (16-18) 9/10/2019 (16-18) ft bgs	SJSB052 11187072-091219-SS-SJSB052-S (0-2) 9/12/2019 (0-2) ft bgs	SJSB052 11187072-091219-SS-SJSB052-S (2-4) 9/12/2019 (2-4) ft bgs	SJSB052 11187072-091219-SS-SJSB052-S (4-6) 9/12/2019 (4-6) ft bgs	SJSB052 11187072-091219-SS-SJSB052-S (6-8) 9/12/2019 (6-8) ft bgs	SJSB052 11187072-091219-SS-SJSB052-S (8-10) 9/12/2019 (8-10) ft bgs	SJSB052 11187072-091219-SS-SJSB052-S (10-12) 9/12/2019 (10-12) ft bgs
Dioxins/Furans								
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	pg/g	0.75 J	1.3 J	0.33 U	0.30 U	0.58 U	0.46 U	1.6 J
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	pg/g	1500	440	280	610	1200	640	1700
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	pg/g	0.19 J	0.29 U	0.25 U	0.26 U	0.38 U	0.33 U	0.25 U
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	67	31	13	23	48	29	74
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	pg/g	0.67 J	2.0 U	1.6 U	1.5 U	1.6 U	1.7 U	2.1 U
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.11 J	0.44 J	0.26 J	0.16 U	0.20 U	0.23 U	0.22 J
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	1.1 J	0.70 J	0.25 U	0.25 U	0.67 J	0.62 J	0.97 J
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.15 J	0.33 J	0.38 J	0.17 U	0.22 U	0.23 U	0.38 J
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	1.5 J	0.90 J	0.26 U	0.46 J	1.1 J	0.66 J	1.6 J
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	pg/g	1.4 U	2.6 U	2.7 U	2.1 U	3.4 U	3.0 U	3.2 U
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	4.5 J	1.5 J	0.72 J	1.0 J	2.7 J	1.8 J	3.7 J
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	0.25 J	0.57 J	0.76 J	0.23 U	0.36 U	0.28 U	0.28 U
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	0.33 J	0.36 U	0.38 U	0.33 U	0.47 U	0.48 U	0.37 U
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.023 U	0.13 U	0.16 U	0.13 U	0.16 U	0.19 U	0.14 U
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	0.045 U	0.25 U	0.29 U	0.25 U	0.38 U	0.31 U	0.32 U
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	pg/g	0.11 J	2.8	3.8	3.2	0.43 J	1.8	0.46 J
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	0.19 J	0.58 J	0.78 J	0.76 J	0.30 U	0.56 J	0.40 J
Total heptachlorodibenzofuran (HpCDF)	pg/g	1.3 J	2.0 J	1.6 J	1.5 J	1.6 J	1.7 J	2.1 J
Total heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	240 J	58 J	38 J	79 J	170 J	100 J	210 J
Total hexachlorodibenzofuran (HxCDF)	pg/g	2.1 J	4.4 J	4.5 J	2.9 J	4.7 J	4.2 J	5.1 J
Total hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	66 J	11 J	7.6 J	17 J	41 J	30 J	48 J
Total pentachlorodibenzofuran (PeCDF)	pg/g	0.68 J	0.57 J	0.76 J	0.25 U	0.38 U	0.31 U	0.32 U
Total pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	9.7 J	0.39 J	0.38 U	0.95 J	4.6 J	4.7 J	8.7 J
Total tetrachlorodibenzofuran (TCDF)	pg/g	0.70 J	3.8 J	4.3 J	4.6 J	0.43 J	2.6 J	1.2 J
Total tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	5.2 J	0.80 J	0.78 J	1.3 J	1.9 J	2.3 J	5.2 J
Total WHO Dioxin TEQ(Human/Mammal)(ND=0)	pg/g	2.40	1.71	1.53	1.64	1.33	1.53	2.38
Total WHO Dioxin TEQ(Human/Mammal)(ND=0.5)	pg/g	2.48	2.07	1.94	1.99	1.99	2.01	2.80

Notes:
pg/g - picogram per gram
U - Not detected at the associated reporting limit.
J - Estimated concentration.
UJ - Not detected; associated reporting limit is estimated

Table 2-3

Second Phase Pre-Design Investigation Analytical Results
Pre-Final 90% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Sample Location: Sample Identification: Sample Date: Sample Depth: Sample Type:	Units	SJSB052 11187072-091219-SS-SJSB052-S (12-14) 9/12/2019 (12-14) ft bgs	SJSB052 11187072-091219-SS-SJSB052-S (14-16) 9/12/2019 (14-16) ft bgs	SJSB052 11187072-091219-SS-DUP-4 9/12/2019 (16-18) ft bgs Duplicate	SJSB052 11187072-091219-SS-SJSB052-S (16-18) 9/12/2019 (16-18) ft bgs	SJSB052-C1 11187072-100819-SS-SJSB052-C1 (0-2) 10/8/2019 (0-2) ft bgs	SJSB052-C1 11187072-100819-SS-SJSB052-C1 (2-4) 10/8/2019 (2-4) ft bgs	SJSB052-C1 11187072-100819-SS-SJSB052-C1 (4-6) 10/8/2019 (4-6) ft bgs
Dioxins/Furans								
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	pg/g	0.30 U	0.32 U	0.34 U	0.38 U	1.4 J	0.31 J	0.53 J
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	pg/g	1500	140	1400	1000	1300	460	100
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	pg/g	0.25 U	0.27 U	0.32 U	0.31 U	0.47 J	0.12 J	0.12 J
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	53	4.4 J	55	46	39	33	3.0 J
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	pg/g	1.7 U	2.5 U	2.0 U	2.5 U	0.26 J	0.075 J	0.027 U
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.20 U	0.21 U	0.21 U	0.25 U	0.75 J	0.066 J	0.10 J
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.61 J	0.25 U	0.90 J	0.59 J	0.86 U	0.51 U	0.22 U
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.19 U	0.44 J	0.23 U	0.26 U	0.28 J	0.040 J	0.038 U
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	1.1 J	0.26 U	2.2 J	1.1 J	1.1 J	0.98 J	0.13 J
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	pg/g	3.0 U	3.8 U	3.0 U	4.1 U	0.30 J	0.15 J	0.088 J
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	3.1 J	0.24 U	3.1 J	3.0 J	2.3 J	2.0 J	0.18 J
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	0.24 U	0.67 U	0.54 U	1.1 U	0.75 J	0.15 J	0.041 U
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	0.36 U	0.29 U	5.2 J	0.39 U	0.44 J	0.21 J	0.071 U
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.16 U	0.17 U	0.18 U	0.20 U	0.13 J	0.044 J	0.030 U
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	0.26 U	0.31 U	0.31 U	0.33 U	0.47 J	0.043 U	0.042 U
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	pg/g	0.44 J	0.15 U	1.0 J	49 J	23	0.41 J	0.85 J
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	0.33 J	0.19 U	3.0	5.5	5.0	0.11 J	0.24 J
Total heptachlorodibenzofuran (HpCDF)	pg/g	1.7 J	2.5 J	2.0 J	2.5 J	0.96 J	0.25 J	0.16 J
Total heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	170 J	14 J	170 J	140 J	120 J	68 J	8.4 J
Total hexachlorodibenzofuran (HxCDF)	pg/g	4.7 J	6.3 J	5.7 J	6.1 J	1.5 J	0.30 J	0.19 J
Total hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	38 J	2.8 J	52 J	37 J	21 J	15 J	1.7 J
Total pentachlorodibenzofuran (PeCDF)	pg/g	0.27 U	0.67 J	7.7 J	1.9 J	2.8 J	0.33 J	0.061 U
Total pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	3.0 J	0.29 U	19 J	5.9 J	10 J	2.8 J	0.29 J
Total tetrachlorodibenzofuran (TCDF)	pg/g	0.93 J	0.15 U	1.9 J	88 J	47 J	1.8 J	1.7 J
Total tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	2.3 J	0.19 U	8.0 J	8.5 J	13 J	1.8 J	0.57 J
Total WHO Dioxin TEQ(Human/Mammal)(ND=0)	pg/g	1.84	0.130	9.89	11.6	9.18	1.16	0.436
Total WHO Dioxin TEQ(Human/Mammal)(ND=0.5)	pg/g	2.24	0.694	10.1	12.1	9.22	1.20	0.493

Notes:
pg/g - picogram per gram
U - Not detected at the associated reporting limit.
J - Estimated concentration.
UJ - Not detected; associated reporting limit is estimated

Table 2-3

Second Phase Pre-Design Investigation Analytical Results
Pre-Final 90% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Sample Location: / Sample Identification: / Sample Date: / Sample Depth: / Sample Type:	Units	SJSB052-C1 / 11187072-100819-SS-SJSB052-C1 (6-8) / 10/8/2019 / (6-8) ft bgs	SJSB052-C1 / 11187072-100819-SS-SJSB052-C1 (8-10) / 10/8/2019 / (8-10) ft bgs	SJSB052-C1 / 11187072-100819-SS-SJSB052-C1 (10-12) / 10/8/2019 / (10-12) ft bgs	SJSB052-C1 / 11187072-100819-SS-SJSB052-C1 (12-14) / 10/8/2019 / (12-14) ft bgs	SJSB052-C1 / 11187072-100819-SS-SJSB052-C1 (14-16) / 10/8/2019 / (14-16) ft bgs	SJSB052-C1 / 11187072-100819-SS-SJSB052-C1 (16-18) / 10/8/2019 / (16-18) ft bgs	SJSB053 / 11187072-101319-SS-SJSB053 (0-2) / 10/13/2019 / (0-2) ft bgs
Dioxins/Furans								
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	pg/g	0.25 J	0.37 U	0.17 U	0.69 U	0.26 U	0.24 U	10 U
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	pg/g	790	1400	740 J	1100	900	1300	720
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	pg/g	0.13 J	0.13 U	0.079 U	0.25 U	0.13 U	0.13 U	2.1 J
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	31	60	31	43	39	56	36
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	pg/g	0.072 J	0.12 J	0.037 U	0.055 U	0.076 J	0.087 J	0.32 U
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.035 U	0.12 J	0.059 U	0.057 U	0.088 J	0.048 U	0.27 U
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.50 U	0.73 U	0.67 U	0.72 U	0.83 U	0.78 U	0.57 J
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.093 J	0.13 J	0.060 U	0.099 J	0.092 J	0.087 J	0.32 U
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.83 J	1.5 J	0.91 J	1.1 J	1.1 J	1.5 J	1.1 J
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	pg/g	0.17 J	0.26 U	0.13 U	0.21 U	0.17 U	0.18 U	0.17 U
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	2.0 J	3.8 J	2.1 J	3.0 J	3.2 J	4.0 J	2.1 J
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	0.11 J	0.077 U	0.055 U	0.060 U	0.058 U	0.051 U	0.16 U
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	0.20 J	0.33 J	0.24 J	0.31 J	0.42 J	0.33 J	0.34 U
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.028 U	0.049 U	0.047 U	0.078 J	0.083 J	0.065 J	0.18 U
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	0.041 U	0.081 U	0.059 U	0.064 U	0.059 U	0.052 U	0.18 U
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	pg/g	0.74 J	0.28 J	0.11 J	0.056 U	0.22 J	0.044 U	0.33 J
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	0.30 J	0.32 J	0.25 J	0.15 J	0.17 J	0.17 J	0.53 J
Total heptachlorodibenzofuran (HpCDF)	pg/g	0.20 J	0.25 J	0.079 J	0.25 J	0.21 J	0.22 J	5.8 J
Total heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	100 J	180 J	120 J	150 J	140 J	180 J	120 J
Total hexachlorodibenzofuran (HxCDF)	pg/g	0.26 J	0.51 J	0.13 J	0.39 J	0.43 J	0.33 J	0.55 J
Total hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	26 J	40 J	29 J	44 J	43 J	49 J	26 J
Total pentachlorodibenzofuran (PeCDF)	pg/g	0.11 J	0.094 U	0.073 U	0.071 U	0.067 U	0.059 U	0.18 U
Total pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	6.2 J	7.0 J	5.0 J	10 J	9.0 J	11 J	3.7 J
Total tetrachlorodibenzofuran (TCDF)	pg/g	2.1 J	1.4 J	1.3 J	0.85 J	1.1 J	1.5 J	0.76 J
Total tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	3.9 J	4.4 J	3.6 J	5.4 J	3.9 J	6.6 J	2.8 J
Total WHO Dioxin TEQ(Human/Mammal)(ND=0)	pg/g	1.44	2.25	1.33	1.65	1.73	2.02	1.54
Total WHO Dioxin TEQ(Human/Mammal)(ND=0.5)	pg/g	1.47	2.32	1.39	1.71	1.79	2.08	1.79

Notes:
pg/g - picogram per gram
U - Not detected at the associated reporting limit.
J - Estimated concentration.
UJ - Not detected; associated reporting limit is estimated

Table 2-3

Second Phase Pre-Design Investigation Analytical Results
Pre-Final 90% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Sample Location: Sample Identification: Sample Date: Sample Depth: Sample Type:	Units	SJSB053 11187072-101319-SS-SJSB053 (2-4) 10/13/2019 (2-4) ft bgs	SJSB053 11187072-101319-SS-SJSB053 (4-6) 10/13/2019 (4-6) ft bgs	SJSB053 11187072-101319-SS-SJSB053 (6-8) 10/13/2019 (6-8) ft bgs	SJSB053 11187072-101319-SS-SJSB053 (8-10) 10/13/2019 (8-10) ft bgs	SJSB053 11187072-101319-SS-SJSB053 (10-12) 10/13/2019 (10-12) ft bgs	SJSB053 11187072-101319-SS-SJSB053 (12-14) 10/13/2019 (12-14) ft bgs	SJSB053 11187072-101319-SS-SJSB053 (14-15) 10/13/2019 (14-15) ft bgs
Dioxins/Furans								
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	pg/g	0.57 U	1.1 U	2.0 U	2.8 U	0.50 U	0.29 U	120
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	pg/g	570	640	800	810	1300	21 U	2100
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	pg/g	0.050 U	0.15 J	0.43 J	0.69 J	0.11 J	0.14 J	17
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	22	22	32	34	53	0.97 J	110 J
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	pg/g	0.053 U	0.050 U	0.073 U	0.067 U	0.060 U	0.048 U	1.4 J
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.096 U	0.095 U	0.096 U	0.12 U	0.086 U	0.10 U	0.28 J
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.42 J	0.42 J	0.62 J	0.42 J	0.51 J	0.25 J	0.75 J
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.097 U	0.093 U	0.095 U	0.12 U	0.087 U	0.099 U	0.44 J
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.52 J	0.54 J	0.79 J	0.80 J	1.1 J	0.12 J	2.3 J
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	pg/g	0.10 J	0.067 U	0.094 J	0.089 U	0.16 J	0.077 U	0.14 J
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	1.3 J	1.3 J	2.1 J	2.3 J	3.3 J	0.18 J	5.1 J
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	0.063 U	0.087 U	0.099 U	0.093 U	0.088 U	0.066 U	0.062 U
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	0.13 U	0.17 U	0.19 U	0.14 U	0.25 J	0.12 U	0.21 J
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.075 U	0.074 U	0.072 U	0.099 U	0.071 U	0.081 U	0.19 J
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	0.065 U	0.088 U	0.099 U	0.096 U	0.087 U	0.068 U	0.063 U
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	pg/g	0.22 J	1.3 J	0.98 J	0.23 J	0.14 U	0.13 U	0.057 U
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	0.18 J	0.55 J	0.29 J	0.21 J	0.15 U	0.11 U	0.24 J
Total heptachlorodibenzofuran (HpCDF)	pg/g	0.053 U	0.33 J	1.0 J	1.7 J	0.11 J	0.14 J	58 J
Total heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	81 J	79 J	110 J	130 J	180 J	3.2 J	250 J
Total hexachlorodibenzofuran (HxCDF)	pg/g	0.10 J	0.095 U	0.094 J	0.12 U	0.16 J	0.10 U	6.3 J
Total hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	20 J	18 J	28 J	31 J	38 J	1.2 J	41 J
Total pentachlorodibenzofuran (PeCDF)	pg/g	0.086 U	0.11 U	0.13 U	0.14 U	0.097 U	0.092 U	0.19 J
Total pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	3.8 J	3.2 J	4.0 J	4.7 J	5.7 J	0.12 U	8.3 J
Total tetrachlorodibenzofuran (TCDF)	pg/g	0.55 J	1.7 J	1.7 J	0.64 J	0.55 J	0.13 U	0.18 J
Total tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	2.3 J	1.7 J	2.6 J	2.9 J	2.6 J	0.11 U	2.9 J
Total WHO Dioxin TEQ(Human/Mammal)(ND=0)	pg/g	0.827	1.32	1.31	1.17	1.68	0.0660	3.32
Total WHO Dioxin TEQ(Human/Mammal)(ND=0.5)	pg/g	0.917	1.44	1.44	1.28	1.79	0.220	3.33

Notes:
- pg/g - picogram per gram
- U - Not detected at the associated reporting limit.
- J - Estimated concentration.
- UJ - Not detected; associated reporting limit is estimated.

Table 2-3

Second Phase Pre-Design Investigation Analytical Results
Pre-Final 90% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Sample Location: Sample Identification: Sample Date: Sample Depth: Sample Type:	Units	SJSB053 11187072-111019-KW-SJSB053-S(14-16) 11/10/2019 (14-16) ft bgs	SJSB053 11187072-111019-KW-SJSB053-S(16-18) 11/10/2019 (16-18) ft bgs	SJSB053-C1 11187072-110919-KW-SJSB053-C1-S (0-2) 11/9/2019 (0-2) ft bgs	SJSB053-C1 11187072-110919-KW-SJSB053-C1-S (2-4) 11/9/2019 (2-4) ft bgs	SJSB053-C1 11187072-110919-KW-SJSB053-C1-S (4-6) 11/9/2019 (4-6) ft bgs	SJSB053-C1 11187072-110919-KW-SJSB053-C1-S (6-8) 11/9/2019 (6-8) ft bgs
Dioxins/Furans							
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	pg/g	1.5 U	0.59 U	1.8 U	3.4 U	3.3 U	9.3 U
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	pg/g	92	130	150	600	940	1000
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	pg/g	0.25 U	0.14 U	0.19 U	0.40 U	0.47 U	0.71 U
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	2.8 J	4.0 J	7.1	24	38	42
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	pg/g	0.12 U	0.073 U	0.12 U	0.21 U	0.25 U	0.35 U
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.068 U	0.059 U	0.066 U	0.074 U	0.15 U	0.14 J
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.31 U	0.27 U	0.31 U	0.41 U	0.57 U	0.60 U
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.067 U	0.058 U	0.063 U	0.070 U	0.15 U	0.14 J
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.25 J	0.19 J	0.22 J	0.65 J	0.80 J	1.0 J
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	pg/g	0.13 U	0.12 U	0.14 U	0.054 U	0.20 U	0.27 U
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.33 U	0.41 U	0.35 U	1.5 J	1.9 J	2.4 J
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	0.13 U	0.14 U	0.047 U	0.16 U	0.17 U	0.14 U
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	0.16 J	0.16 J	0.13 J	0.099 U	0.23 J	0.14 U
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.049 U	0.069 J	0.048 U	0.052 U	0.11 U	0.074 J
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	0.058 U	0.050 U	0.047 U	0.050 U	0.061 U	0.084 J
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	pg/g	0.068 J	0.057 J	1.1 J	0.14 J	0.15 J	0.094 J
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	0.062 U	0.046 U	0.37 J	0.11 J	0.092 J	0.15 J
Total heptachlorodibenzofuran (HpCDF)	pg/g	0.37 J	0.21 J	0.39 J	0.77 J	0.72 J	1.5 J
Total heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	10 J	17 J	26 J	86 J	130 J	160 J
Total hexachlorodibenzofuran (HxCDF)	pg/g	0.13 J	0.19 J	0.14 J	0.074 U	0.20 J	0.63 J
Total hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	3.5 J	6.6 J	5.8 J	21 J	29 J	39 J
Total pentachlorodibenzofuran (PeCDF)	pg/g	0.13 J	0.14 J	0.048 U	0.16 J	0.17 J	0.31 J
Total pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	0.67 J	2.0 J	0.84 J	4.8 J	5.4 J	6.0 J
Total tetrachlorodibenzofuran (TCDF)	pg/g	0.068 J	0.12 J	1.8 J	0.34 J	0.44 J	0.27 J
Total tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	1.1 J	2.6 J	0.83 J	2.9 J	2.9 J	3.3 J
Total WHO Dioxin TEQ(Human/Mammal)(ND=0)	pg/g	0.247	0.271	0.748	0.759	1.27	1.28
Total WHO Dioxin TEQ(Human/Mammal)(ND=0.5)	pg/g	0.339	0.350	0.806	0.855	1.34	1.40

Notes:
pg/g - picogram per gram
U - Not detected at the associated reporting limit.
J - Estimated concentration.
UJ - Not detected; associated reporting limit is estimated.

Table 2-3

Second Phase Pre-Design Investigation Analytical Results
Pre-Final 90% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Sample Location:	Units	SJSB053-C1	SJSB053-C1	SJSB053-C1	SJSB053-C1	SJSB054	SJSB054	SJSB054
Sample Identification:		11187072-110919-KW-SJSB053-C1-S (8-10)	11187072-110919-KW-SJSB053-C1-S (10-12)	11187072-110919-KW-SJSB053-C1-S (12-14)	11187072-110919-KW-SJSB053-C1-S (14-16)	11187072-101319-SS-SJSB054 (0-2)	11187072-101319-SS-SJSB054 (2-4)	11187072-101319-SS-SJSB054 (4-6)
Sample Date:		11/9/2019	11/9/2019	11/9/2019	11/9/2019	10/13/2019	10/13/2019	10/13/2019
Sample Depth:		(8-10) ft bgs	(10-12) ft bgs	(12-14) ft bgs	(14-16) ft bgs	(0-2) ft bgs	(2-4) ft bgs	(4-6) ft bgs
Sample Type:								
Dioxins/Furans								
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	pg/g	0.82 U	0.80 U	0.82 U	1.1 U	130 J	29 U	0.36 U
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	pg/g	510	1300	410	1300	690	310	1400
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	pg/g	0.13 U	0.13 U	0.12 U	0.23 U	370	66 J	0.23 U
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	18	50	15	57	49 J	15 J	53
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	pg/g	0.033 U	0.087 U	0.028 U	0.053 U	150 J	29 J	0.092 U
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.056 U	0.062 U	0.067 J	0.091 U	1300	180	0.59 J
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.35 U	0.76 U	0.35 U	0.80 U	1.5 U	0.51 UJ	0.57 J
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.055 U	0.060 U	0.050 U	0.090 U	340	47 J	0.17 J
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.35 J	1.0 J	0.35 J	1.6 J	4.6 J	1.5 J	1.0 J
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	pg/g	0.12 U	0.22 U	0.14 U	0.24 U	20 J	2.5 J	0.081 U
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.91 J	2.6 J	0.87 J	4.5 J	1.5 U	0.48 U	3.1 J
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	0.15 U	0.14 U	0.042 U	0.20 U	850	88	0.28 J
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	0.097 U	0.25 J	0.14 J	0.31 J	140 J	13 J	0.35 J
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.068 J	0.048 J	0.056 J	0.062 U	42 J	5.1 J	0.064 U
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	0.047 U	0.047 U	0.078 J	0.056 U	730	78	0.24 J
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	pg/g	0.92 J	0.10 J	1.6	0.18 J	50000 J	2900	13
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	0.29 J	0.18 J	0.39 J	0.22 J	11000	1200	3.2
Total heptachlorodibenzofuran (HpCDF)	pg/g	0.13 J	0.29 J	0.12 J	0.23 J	620 J	110 J	0.38 J
Total heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	61 J	170 J	53 J	190 J	110 J	50 J	180 J
Total hexachlorodibenzofuran (HxCDF)	pg/g	0.19 J	0.27 J	0.26 J	0.24 J	1900 J	260 J	0.76 J
Total hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	14 J	39 J	12 J	49 J	26 J	15 J	49 J
Total pentachlorodibenzofuran (PeCDF)	pg/g	0.15 J	0.14 J	0.078 J	0.20 J	2600 J	280 J	0.52 J
Total pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	2.2 J	6.8 J	2.4 J	10 J	140 J	15 J	9.8 J
Total tetrachlorodibenzofuran (TCDF)	pg/g	1.6 J	0.25 J	2.2 J	0.92 J	89000 J	8800 J	24 J
Total tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	1.7 J	3.4 J	1.6 J	6.7 J	12000 J	1300 J	10 J
Total WHO Dioxin TEQ(Human/Mammal)(ND=0)	pg/g	0.848	1.69	1.12	2.12	16600	1550	6.42
Total WHO Dioxin TEQ(Human/Mammal)(ND=0.5)	pg/g	0.936	1.76	1.15	2.20	16600	1550	6.43

Notes:
pg/g - picogram per gram
U - Not detected at the associated reporting limit.
J - Estimated concentration.
UJ - Not detected; associated reporting limit is estimated

Table 2-3

Second Phase Pre-Design Investigation Analytical Results
Pre-Final 90% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Sample Location: Sample Identification: Sample Date: Sample Depth: Sample Type:	Units	SJSB054 11187072-101319-SS-SJSB054 (6-8) 10/13/2019 (6-8) ft bgs	SJSB054 11187072-101319-SS-SJSB054 (8-10) 10/13/2019 (8-10) ft bgs	SJSB054 11187072-101319-SS-SJSB054 (10-12) 10/13/2019 (10-12) ft bgs	SJSB054 11187072-101319-SS-SJSB054 (12-14) 10/13/2019 (12-14) ft bgs	SJSB054 11187072-101319-SS-SJSB054 (14-16) 10/13/2019 (14-16) ft bgs	SJSB054 11187072-101319-SS-SJSB054 (16-18) 10/13/2019 (16-18) ft bgs	SJSB055 11187072-091019-SS-SJSB055-S (0-2) 9/10/2019 (0-2) ft bgs
Dioxins/Furans								
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	pg/g	0.24 U	0.28 U	0.19 U	4.2 U	0.63 U	0.25 U	0.61 J
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	pg/g	1900	1700	1300	550	310	2000	410 J
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	pg/g	0.19 U	0.52 U	0.15 U	8.0	0.98 J	0.18 U	0.25 J
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	70	67	61	25	12	82	20
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	pg/g	0.052 U	0.15 U	0.061 U	3.0 J	0.52 J	0.097 U	0.70 J
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.38 J	1.0 J	0.27 J	29	3.0 J	0.34 J	0.23 J
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.93 J	0.56 J	0.68 J	0.44 J	0.15 J	0.90 J	0.85 J
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.068 U	0.29 J	0.058 U	7.5	0.80 J	0.21 J	0.15 J
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	1.4 J	1.5 J	1.3 J	0.69 J	0.21 J	1.7 J	0.037 U
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	pg/g	0.14 J	0.086 U	0.074 U	0.56 J	0.099 U	0.087 U	1.5 U
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	3.5 J	4.0 J	3.3 J	1.3 J	0.12 U	5.8 J	1.7 J
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	0.24 J	1.0 J	0.18 J	19	1.8 J	0.12 J	0.63 J
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	0.27 J	0.47 J	0.38 J	3.4 J	0.30 J	0.43 J	0.30 J
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.071 U	0.066 U	0.059 U	1.0 J	0.079 U	0.070 U	0.020 U
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	0.087 U	0.78 J	0.072 U	17	1.6 J	0.20 J	0.051 U
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	pg/g	9.4	39	9.2	850	82	11	1.1 J
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	2.8 J	11	2.4	270	23	2.6	0.22 J
Total heptachlorodibenzofuran (HpCDF)	pg/g	0.33 J	0.84 J	0.15 J	13 J	1.7 J	0.28 J	1.2 J
Total heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	230 J	200 J	210 J	81 J	43 J	250 J	63 J
Total hexachlorodibenzofuran (HxCDF)	pg/g	0.52 J	1.3 J	0.27 J	43 J	4.3 J	0.55 J	2.9 J
Total hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	55 J	43 J	53 J	21 J	11 J	68 J	20 J
Total pentachlorodibenzofuran (PeCDF)	pg/g	0.24 J	2.6 J	0.18 J	58 J	5.1 J	0.32 J	3.4 J
Total pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	9.1 J	7.3 J	8.2 J	6.3 J	2.0 J	13 J	7.5 J
Total tetrachlorodibenzofuran (TCDF)	pg/g	21 J	79 J	18 J	2000 J	160 J	19 J	7.0 J
Total tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	10 J	16 J	8.2 J	300 J	27 J	9.6 J	8.8 J
Total WHO Dioxin TEQ(Human/Mammal)(ND=0)	pg/g	5.92	17.5	5.26	369	32.7	6.51	1.27
Total WHO Dioxin TEQ(Human/Mammal)(ND=0.5)	pg/g	5.94	17.6	5.28	369	32.7	6.52	1.36

Notes:
pg/g - picogram per gram
U - Not detected at the associated reporting limit.
J - Estimated concentration.
UJ - Not detected; associated reporting limit is estimated

Table 2-3

Second Phase Pre-Design Investigation Analytical Results
Pre-Final 90% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Sample Location: / Sample Identification: / Sample Date: / Sample Depth: / Sample Type:	Units	SJSB055 11187072-091019-SS-SJSB055-S (2-4) 9/10/2019 (2-4) ft bgs	SJSB055 11187072-091019-SS-SJSB055-S (4-6) 9/10/2019 (4-6) ft bgs	SJSB055 11187072-091019-SS-SJSB055-S (6-8) 9/10/2019 (6-8) ft bgs	SJSB055 11187072-091019-SS-SJSB055-S (8-10) 9/10/2019 (8-10) ft bgs	SJSB055 11187072-091019-SS-SJSB055-S (10-12) 9/10/2019 (10-12) ft bgs	SJSB055 11187072-091019-SS-SJSB055-S (12-14) 9/10/2019 (12-14) ft bgs	SJSB055 11187072-091019-SS-SJSB055-S (14-16) 9/10/2019 (14-16) ft bgs
Dioxins/Furans								
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	pg/g	0.72 J	0.57 J	0.79 J	1.4 J	1.5 J	0.72 J	1.6 J
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	pg/g	280	240	720	260	110	300	630
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	pg/g	0.26 J	0.19 J	0.29 J	0.28 J	0.32 J	0.21 J	0.41 J
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	24	11	27	9.0	4.3 J	16	29
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	pg/g	0.69 J	0.79 J	0.83 J	0.69 J	0.88 J	0.61 J	1.2 J
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.16 J	0.16 J	0.17 J	0.29 J	0.28 J	0.17 J	0.25 J
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.51 J	0.31 J	0.62 J	0.37 J	0.41 J	0.46 J	0.84 J
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.15 J	0.022 U	0.14 J	0.15 J	0.25 J	0.15 J	0.20 J
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.63 J	0.35 J	0.64 J	0.32 J	0.33 J	0.41 J	0.63 J
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	pg/g	1.2 U	1.4 U	1.8 U	1.4 U	1.4 U	1.1 U	2.0 U
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	1.2 J	0.74 J	1.7 J	0.57 J	0.45 J	1.3 J	2.3 J
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	0.22 J	0.24 J	0.27 J	0.43 J	0.30 J	0.25 J	0.29 J
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	0.21 J	0.12 J	0.17 J	0.12 J	0.17 J	0.16 J	0.26 J
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.13 J	0.019 U	0.019 U	0.020 U	0.016 U	0.015 U	0.021 U
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	0.089 J	0.091 J	0.14 J	0.21 J	0.17 J	0.11 J	0.15 J
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	pg/g	0.38 J	0.19 J	0.13 J	5.1	0.69 J	0.79 J	0.15 J
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	0.12 J	0.22 J	0.13 J	1.4	0.26 J	0.25 J	0.075 J
Total heptachlorodibenzofuran (HpCDF)	pg/g	1.2 J	1.2 J	1.6 J	1.4 J	1.6 J	1.0 J	2.0 J
Total heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	58 J	44 J	110 J	30 J	13 J	70 J	130 J
Total hexachlorodibenzofuran (HxCDF)	pg/g	2.3 J	2.4 J	3.3 J	2.7 J	2.9 J	2.0 J	3.9 J
Total hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	13 J	11 J	29 J	8.3 J	3.5 J	22 J	36 J
Total pentachlorodibenzofuran (PeCDF)	pg/g	0.66 J	0.85 J	1.1 J	1.5 J	0.88 J	0.75 J	1.3 J
Total pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	1.9 J	1.2 J	5.1 J	1.6 J	0.76 J	4.3 J	6.0 J
Total tetrachlorodibenzofuran (TCDF)	pg/g	1.0 J	0.69 J	0.83 J	9.2 J	1.3 J	1.8 J	0.56 J
Total tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	1.5 J	2.0 J	4.0 J	2.8 J	0.86 J	3.1 J	3.5 J
Total WHO Dioxin TEQ(Human/Mammal)(ND=0)	pg/g	1.01	0.741	1.19	2.45	0.819	1.04	1.32
Total WHO Dioxin TEQ(Human/Mammal)(ND=0.5)	pg/g	1.07	0.814	1.28	2.53	0.890	1.09	1.42

Notes:
pg/g - picogram per gram
U - Not detected at the associated reporting limit.
J - Estimated concentration.
UJ - Not detected; associated reporting limit is estimated.

Table 2-3

Second Phase Pre-Design Investigation Analytical Results
Pre-Final 90% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Sample Location:		SJSB055	SJSB055	SJSB055	SJSB055	SJSB055	SJSB055	SJSB055
Sample Identification:		11187072-091019-SS-SJSB055-S (16-18)	11187072-101419-SS-SJSB055 C1 (0-2)	11187072-101419-SS-SJSB055 C1 (2-4)	11187072-101419-SS-SJSB055 C1 (4-6)	11187072-101419-SS-SJSB055 C1 (6-8)	11187072-101419-SS-SJSB055 C1 (8-10)	11187072-101419-SS-SJSB055 C1 (10-12)
Sample Date:	Units	9/10/2019	10/14/2019	10/14/2019	10/14/2019	10/14/2019	10/14/2019	10/14/2019
Sample Depth:		(16-18) ft bgs	(0-2) ft bgs	(2-4) ft bgs	(4-6) ft bgs	(6-8) ft bgs	(8-10) ft bgs	(10-12) ft bgs
Sample Type:								
Dioxins/Furans								
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	pg/g	0.60 J	2.7 J	1.3 J	0.14 U	0.35 J	0.43 J	0.50 J
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	pg/g	400	860	600	430	250	670	500
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	pg/g	0.16 J	1.2 J	0.61 U	0.12 U	0.12 U	0.12 U	0.068 U
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	19	34	24	19	12	31	23
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	pg/g	0.58 J	0.48 J	0.33 J	0.071 J	0.094 J	0.044 U	0.083 J
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.12 J	1.9 J	1.6 J	0.11 U	0.075 U	0.088 U	0.078 U
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.49 J	0.77 U	0.49 U	0.33 U	0.35 U	0.54 U	0.44 U
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.12 J	0.58 J	0.58 J	0.10 U	0.070 U	0.083 U	0.073 U
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.47 J	0.88 J	0.65 J	0.48 J	0.31 J	0.59 J	0.41 J
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	pg/g	1.4 U	0.24 J	0.17 J	0.067 U	0.092 J	0.15 J	0.12 J
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	1.9 J	2.3 J	1.7 J	1.5 J	1.3 J	2.7 J	1.9 J
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	0.19 J	1.4 J	1.3 J	0.062 U	0.052 U	0.078 U	0.052 U
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	0.17 J	0.61 J	0.43 J	0.15 U	0.13 U	0.15 U	0.21 J
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.018 U	0.25 J	0.098 J	0.072 U	0.045 U	0.058 U	0.048 U
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	0.085 J	1.3 J	1.2 J	0.064 U	0.055 U	0.084 U	0.053 U
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	pg/g	0.12 J	110	93	2.1	0.39 J	0.26 J	0.62 J
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	0.025 U	21	20	0.49 J	0.19 J	0.12 U	0.22 J
Total heptachlorodibenzofuran (HpCDF)	pg/g	0.97 J	2.5 J	1.3 J	0.20 J	0.21 J	0.12 J	0.15 J
Total heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	89 J	140 J	100 J	84 J	55 J	150 J	110 J
Total hexachlorodibenzofuran (HxCDF)	pg/g	2.5 J	3.3 J	2.7 J	0.11 U	0.092 J	0.15 J	0.12 J
Total hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	29 J	29 J	24 J	21 J	18 J	35 J	29 J
Total pentachlorodibenzofuran (PeCDF)	pg/g	0.81 J	3.3 J	3.9 J	0.064 U	0.055 U	0.084 U	0.061 U
Total pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	5.4 J	4.7 J	4.0 J	3.9 J	3.6 J	6.4 J	5.8 J
Total tetrachlorodibenzofuran (TCDF)	pg/g	0.55 J	190 J	160 J	3.7 J	0.71 J	0.81 J	1.1 J
Total tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	3.7 J	26 J	23 J	2.4 J	2.2 J	3.0 J	3.1 J
Total WHO Dioxin TEQ(Human/Mammal)(ND=0)	pg/g	0.841	34.3	31.0	1.22	0.595	0.881	1.12
Total WHO Dioxin TEQ(Human/Mammal)(ND=0.5)	pg/g	0.920	34.3	31.1	1.34	0.697	1.07	1.16

Notes:
pg/g - picogram per gram
U - Not detected at the associated reporting limit.
J - Estimated concentration.
UJ - Not detected; associated reporting limit is estimated.

Table 2-3

Second Phase Pre-Design Investigation Analytical Results
Pre-Final 90% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Sample Location:	Units	SJSB055	SJSB055	SJSB055	SJSB056	SJSB056	SJSB056	SJSB056
Sample Identification:		11187072-101419-SS-SJSB055 C1 (12-14)	11187072-101419-SS-SJSB055 C1 (14-16)	11187072-101419-SS-SJSB055 C1 (16-18)	11187072-111119-SS-SJSB056 (0-2)	11187072-111119-SS-SJSB056 (2-4)	11187072-111119-SS-SJSB056 (4-6)	11187072-111119-SS-SJSB056 (6-8)
Sample Date:		10/14/2019	10/14/2019	10/14/2019	11/11/2019	11/11/2019	11/11/2019	11/11/2019
Sample Depth:		(12-14) ft bgs	(14-16) ft bgs	(16-18) ft bgs	(0-2) ft bgs	(2-4) ft bgs	(4-6) ft bgs	(6-8) ft bgs
Sample Type:								
Dioxins/Furans								
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	pg/g	0.092 U	0.49 J	0.42 J	2.5 J	0.83 J	0.19 U	0.19 U
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	pg/g	210	500	51	480	340	220	390
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	pg/g	0.031 U	0.058 U	0.18 U	0.47 J	0.14 U	0.13 U	0.13 U
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	11	24	2.7 J	24	14	10	17
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	pg/g	0.036 U	0.056 J	0.073 J	0.16 U	0.14 U	0.14 U	0.14 U
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.066 U	0.092 U	0.35 J	0.17 U	0.15 U	0.12 U	0.14 U
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.37 U	0.54 U	0.25 U	0.62 J	0.36 J	0.33 J	0.37 J
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.060 U	0.086 U	0.11 J	0.20 U	0.17 U	0.14 U	0.16 U
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.36 J	0.56 J	0.14 J	0.87 J	0.45 J	0.39 J	0.32 J
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	pg/g	0.074 J	0.18 J	0.078 J	0.35 J	0.14 J	0.14 J	0.081 U
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.67 J	2.4 J	0.26 J	1.9 J	1.1 J	0.92 J	1.4 J
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	0.050 U	0.075 U	0.28 J	0.19 U	0.14 U	0.14 U	0.13 U
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	0.12 U	0.17 U	0.11 U	0.56 J	0.26 U	0.27 J	0.23 U
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.040 U	0.057 U	0.037 U	0.13 U	0.11 U	0.087 U	0.11 U
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	0.052 U	0.079 U	0.26 J	0.21 U	0.15 U	0.15 U	0.14 U
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	pg/g	0.52 J	0.55 J	15	4.7	2.2	0.46 J	0.32 J
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	0.24 J	0.22 J	3.7	1.5	0.81 J	0.20 U	0.18 U
Total heptachlorodibenzofuran (HpCDF)	pg/g	0.036 U	0.11 J	0.33 J	0.47 J	0.14 U	0.14 U	0.14 U
Total heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	52 J	140 J	10 J	96 J	65 J	45 J	72 J
Total hexachlorodibenzofuran (HxCDF)	pg/g	0.074 J	0.18 J	0.58 J	0.35 J	0.14 J	0.14 J	0.16 U
Total hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	19 J	41 J	2.7 J	27 J	16 J	13 J	20 J
Total pentachlorodibenzofuran (PeCDF)	pg/g	0.085 U	0.079 U	0.75 J	0.21 U	0.15 U	0.15 U	0.16 U
Total pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	4.9 J	8.6 J	0.28 J	4.9 J	1.6 J	3.1 J	2.9 J
Total tetrachlorodibenzofuran (TCDF)	pg/g	0.90 J	1.2 J	28 J	6.8 J	2.7 J	0.46 J	0.32 J
Total tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	2.9 J	5.9 J	4.4 J	3.8 J	2.1 J	0.49 J	0.18 U
Total WHO Dioxin TEQ(Human/Mammal)(ND=0)	pg/g	0.575	0.980	5.42	3.29	1.48	0.660	0.528
Total WHO Dioxin TEQ(Human/Mammal)(ND=0.5)	pg/g	0.671	1.12	5.49	3.35	1.65	0.803	0.782

Notes:
pg/g - picogram per gram
U - Not detected at the associated reporting limit.
J - Estimated concentration.
UJ - Not detected; associated reporting limit is estimated

Table 2-3

Second Phase Pre-Design Investigation Analytical Results
Pre-Final 90% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Sample Location: Sample Identification: Sample Date: Sample Depth: Sample Type:	Units	SJSB056 11187072-111119-SS-SJSB056 (8-10) 11/11/2019 (8-10) ft bgs	SJSB056 11187072-111119-SS-SJSB056 (10-12) 11/11/2019 (10-12) ft bgs	SJSB056 11187072-111119-SS-SJSB056 (12-14) 11/11/2019 (12-14) ft bgs	SJSB056 11187072-111119-SS-SJSB056 (14-16) 11/11/2019 (14-16) ft bgs	SJSB056 11187072-111119-SS-SJSB056 (16-18) 11/11/2019 (16-18) ft bgs	SJSB056-C1 11187072-120319-SS-SJSB056-C1(0-2) 12/3/2019 (0-0) ft bgs	SJSB056-C1 11187072-120319-SS-SJSB056-C1(2-4) 12/3/2019 (2-4) ft bgs
Dioxins/Furans								
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	pg/g	1.0 J	0.35 J	4.0 J	1.5 J	1.1 J	7.1 U	11 U
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	pg/g	81	17	350	190	59	140 U	150 U
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	pg/g	0.15 U	0.13 U	0.53 J	0.14 U	0.55 J	0.17 U	0.98 U
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	2.9 J	0.89 J	14	8.2	3.0 J	2.5 U	4.8 J
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	pg/g	0.15 U	0.14 U	0.54 J	0.13 U	0.14 U	0.11 U	0.31 J
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.36 J	0.12 U	0.31 J	0.13 U	0.31 J	0.10 U	0.12 U
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.16 U	0.30 J	0.48 J	0.32 J	0.43 J	0.25 U	0.27 U
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.15 U	0.14 U	0.17 U	0.15 U	0.16 U	0.11 U	0.13 U
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.17 U	0.14 U	0.25 U	0.26 J	0.28 J	0.14 J	0.15 J
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	pg/g	0.075 U	0.12 J	0.24 J	0.074 U	0.078 U	0.15 U	0.14 U
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.16 U	0.13 U	1.2 J	0.71 J	0.45 J	0.22 J	0.33 J
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	0.15 U	0.10 U	0.14 U	0.34 J	0.14 U	0.094 U	0.11 U
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	0.20 U	0.20 U	0.27 U	0.17 U	0.25 U	0.16 U	0.15 U
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.10 U	0.093 U	0.29 J	0.093 U	0.10 U	0.086 U	0.11 U
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	0.16 U	0.12 U	0.16 U	0.19 J	0.16 U	0.094 U	0.11 U
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	pg/g	10	1.5	5.2	11	0.16 U	1.1 J	1.6
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	2.5 J	0.57 J	1.7	2.9	0.16 U	0.48 J	0.72 J
Total heptachlorodibenzofuran (HpCDF)	pg/g	0.15 U	0.14 U	1.1 J	0.14 U	0.55 J	0.45 J	2.6 J
Total heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	11 J	2.7 J	64 J	33 J	8.8 J	10 J	13 J
Total hexachlorodibenzofuran (HxCDF)	pg/g	0.36 J	0.12 J	0.84 J	0.15 U	0.31 J	0.15 J	0.14 J
Total hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	1.9 J	0.30 J	15 J	9.4 J	1.9 J	2.3 J	2.4 J
Total pentachlorodibenzofuran (PeCDF)	pg/g	0.16 U	0.15 U	0.18 U	0.53 J	0.24 U	0.094 U	0.11 U
Total pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	0.20 U	0.20 U	2.1 J	1.2 J	0.25 U	0.16 U	0.15 U
Total tetrachlorodibenzofuran (TCDF)	pg/g	16 J	2.1 J	9.1 J	18 J	0.16 U	1.6 J	2.2 J
Total tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	2.5 J	0.57 J	2.4 J	2.9 J	0.19 J	0.48 J	0.72 J
Total WHO Dioxin TEQ(Human/Mammal)(ND=0)	pg/g	3.59	0.776	2.73	4.34	0.201	0.626	0.980
Total WHO Dioxin TEQ(Human/Mammal)(ND=0.5)	pg/g	3.76	0.928	2.91	4.44	0.457	0.792	1.14

Notes:
pg/g - picogram per gram
U - Not detected at the associated reporting limit.
J - Estimated concentration.
UJ - Not detected; associated reporting limit is estimated

Table 2-3

Second Phase Pre-Design Investigation Analytical Results
Pre-Final 90% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Sample Location: Sample Identification: Sample Date: Sample Depth: Sample Type:	Units	SJSB056-C1 11187072-120319-SS-SJSB056-C1(4-6) 12/3/2019 (4-6) ft bgs	SJSB056-C1 11187072-120319-SS-SJSB056-C1(6-8) 12/3/2019 (6-8) ft bgs	SJSB056-C1 11187072-120319-SS-SJSB056-C1(8-10) 12/3/2019 (8-10) ft bgs	SJSB056-C1 11187072-120319-SS-SJSB056-C1(10-12) 12/3/2019 (10-12) ft bgs	SJSB056-C1 11187072-120319-SS-SJSB056-C1(12-14) 12/3/2019 (12-14) ft bgs	SJSB056-C1 11187072-120319-SS-DUP-1 12/3/2019 (14-16) ft bgs Duplicate	SJSB056-C1 11187072-120319-SS-SJSB056-C1(14-16) 12/3/2019 (14-16) ft bgs
Dioxins/Furans								
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	pg/g	4.8 U	35	2.4 U	3.3 U	2.5 U	4.3 U	2.6 U
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	pg/g	120 U	260	88 U	160 U	320	370	270
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	pg/g	0.19 U	1.9 J	0.33 U	0.94 U	0.31 U	0.55 U	0.62 U
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	3.3 U	14	2.7 U	6.8	15	17	10
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	pg/g	0.087 U	0.20 J	0.16 J	0.90 J	0.13 J	0.064 U	0.10 J
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.12 U	0.094 U	0.11 U	0.53 J	0.064 U	0.075 U	0.34 J
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.079 U	0.23 U	0.25 U	0.83 J	0.40 U	0.44 U	0.26 U
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.14 U	0.11 U	0.11 U	0.60 J	0.068 U	0.078 U	0.13 J
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.082 U	0.30 J	0.18 J	0.79 J	0.46 J	0.46 J	0.26 J
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	pg/g	0.090 U	0.13 U	0.081 U	0.81 U	0.16 U	0.13 U	0.16 U
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.26 J	0.40 J	0.36 J	1.1 J	1.3 J	1.3 J	0.98 J
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	0.094 U	0.17 U	0.13 U	0.36 U	0.067 U	0.067 U	0.054 U
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	0.16 U	0.18 U	0.12 U	0.39 J	0.12 U	0.12 U	0.097 U
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.10 U	0.081 U	0.088 U	0.61 J	0.050 U	0.063 U	0.070 U
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	0.091 U	0.080 U	0.081 U	0.35 J	0.070 U	0.067 U	0.055 U
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	pg/g	0.45 U	0.86 J	2.9	0.20 U	0.14 U	0.050 U	0.086 U
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	0.099 U	0.11 U	0.92 J	0.23 J	0.11 U	0.10 U	0.15 J
Total heptachlorodibenzofuran (HpCDF)	pg/g	0.47 J	11 J	0.77 J	2.0 J	0.73 J	1.2 J	0.93 J
Total heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	11 J	29 J	8.9 J	24 J	62 J	69 J	45 J
Total hexachlorodibenzofuran (HxCDF)	pg/g	0.14 U	0.13 J	0.11 U	2.6 J	0.16 J	0.13 J	0.63 J
Total hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	1.8 J	5.1 J	2.7 J	8.0 J	19 J	20 J	14 J
Total pentachlorodibenzofuran (PeCDF)	pg/g	0.094 U	0.17 J	0.13 J	0.72 J	0.087 U	0.067 U	0.063 U
Total pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	0.16 U	0.29 J	0.29 J	1.3 J	3.2 J	3.4 J	2.2 J
Total tetrachlorodibenzofuran (TCDF)	pg/g	0.63 J	1.4 J	4.0 J	0.41 J	0.59 J	0.31 J	0.16 J
Total tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	0.099 U	0.91 J	1.1 J	0.55 J	2.3 J	2.3 J	1.4 J
Total WHO Dioxin TEQ(Human/Mammal)(ND=0)	pg/g	0.0260	0.406	1.27	1.25	0.423	0.457	0.503
Total WHO Dioxin TEQ(Human/Mammal)(ND=0.5)	pg/g	0.260	0.597	1.40	1.33	0.596	0.624	0.593

Notes:
pg/g - picogram per gram
U - Not detected at the associated reporting limit.
J - Estimated concentration.
UJ - Not detected; associated reporting limit is estimated

Table 2-3

Second Phase Pre-Design Investigation Analytical Results
Pre-Final 90% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Sample Location: Sample Identification: Sample Date: Sample Depth: Sample Type:	Units	SJSB056-C1 11187072-120319-SS-SJSB056-C1(16-18) 12/3/2019 (16-18) ft bgs	SJSB057 11187072-110519-SS-SJSB057 (0-2) 11/5/2019 (0-2) ft bgs	SJSB057 11187072-110519-SS-SJSB057 (2-4) 11/5/2019 (2-4) ft bgs	SJSB057 11187072-110519-SS-SJSB057 (4-6) 11/5/2019 (4-6) ft bgs	SJSB057 11187072-110519-SS-SJSB057 (6-8) 11/5/2019 (6-8) ft bgs	SJSB057 11187072-110519-SS-SJSB057 (8-10) 11/5/2019 (8-10) ft bgs	SJSB057 11187072-110519-SS-SJSB057 (10-12) 11/5/2019 (10-12) ft bgs
Dioxins/Furans								
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	pg/g	3.2 U	490 J	520 J	55	6.8 J	0.94 U	6.1 J
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	pg/g	440	5200	2400	670	94	48	85
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	pg/g	0.45 U	990	1300	110	13	0.36 U	2.0 J
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	18	310	190 J	43	4.7 J	4.0 J	6.1
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	pg/g	0.058 U	300	410 J	34	4.0 J	0.27 U	1.9 J
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.090 U	3000	4400	350	39	0.71 J	0.75 J
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.41 U	3.6 U	5.6 U	0.64 U	0.25 U	0.35 U	1.2 J
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.097 U	740	1100	92	10	0.25 U	0.59 J
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.44 J	21 J	16 U	1.9 J	0.27 U	0.28 U	1.3 J
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	pg/g	0.21 U	45 J	56 J	5.0 J	0.64 J	0.21 U	1.1 J
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	1.7 J	8.7 J	9.0 J	1.1 J	0.25 J	0.42 J	1.5 J
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	0.069 U	2000	2900	230	26	0.53 J	0.21 J
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	0.19 J	200 J	300 J	21	2.3 J	0.26 J	0.45 J
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.076 U	90 J	120 J	9.1	1.1 J	0.15 U	1.2 J
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	0.071 U	1300	1900	140	15	0.31 J	0.32 J
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	pg/g	0.15 U	31000 J	51000 J	8200	890	18	2.9
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	0.18 J	20000	31000	2600	270	5.2	1.2
Total heptachlorodibenzofuran (HpCDF)	pg/g	1.5 J	1600 J	2100 J	180 J	20 J	0.63 J	4.1 J
Total heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	80 J	700 J	410 J	99 J	13 J	11 J	13 J
Total hexachlorodibenzofuran (HxCDF)	pg/g	0.44 J	4400 J	6400 J	510 J	58 J	1.3 J	3.6 J
Total hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	24 J	110 J	83 J	18 J	3.0 J	3.3 J	6.1 J
Total pentachlorodibenzofuran (PeCDF)	pg/g	0.073 U	5200 J	7400 J	570 J	64 J	1.1 J	0.53 J
Total pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	4.5 J	230 J	330 J	27 J	2.7 J	0.71 J	0.91 J
Total tetrachlorodibenzofuran (TCDF)	pg/g	0.44 J	130000 J	210000 J	13000 J	1500 J	29 J	5.0 J
Total tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	2.5 J	22000 J	34000 J	2800 J	290 J	5.8 J	1.5 J
Total WHO Dioxin TEQ(Human/Mammal)(ND=0)	pg/g	0.896	24200	37600	3540	372	7.54	2.93
Total WHO Dioxin TEQ(Human/Mammal)(ND=0.5)	pg/g	0.962	24200	37600	3540	372	7.60	2.93

Notes:
pg/g - picogram per gram
U - Not detected at the associated reporting limit.
J - Estimated concentration.
UJ - Not detected; associated reporting limit is estimated

Table 2-3

Second Phase Pre-Design Investigation Analytical Results
Pre-Final 90% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Sample Location: Sample Identification: Sample Date: Sample Depth: Sample Type:	Units	SJSB057 11187072-110519-SS-SJSB057 (12-14) 11/5/2019 (12-14) ft bgs	SJSB057 11187072-110519-SS-SJSB057 (14-16) 11/5/2019 (14-16) ft bgs	SJSB057 11187072-110519-SS-SJSB057 (16-18) 11/5/2019 (16-18) ft bgs	SJSB058 11187072-101419-BN-SJSB058-S (0-2) 10/14/2019 (0-2) ft bgs	SJSB058 11187072-101419-BN-SJSB058-S (2-4) 10/14/2019 (2-4) ft bgs	SJSB058 11187072-101419-BN-SJSB058-S (4-6) 10/14/2019 (4-6) ft bgs	SJSB058 11187072-101419-BN-SJSB058-S (6-8) 10/14/2019 (6-8) ft bgs
Dioxins/Furans								
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	pg/g	2.2 U	0.53 U	0.34 U	13	690	1100	8.4 J
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	pg/g	99	85	69	520	6600	13000	400
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	pg/g	0.65 U	0.11 U	0.096 U	4.7 J	1900	2100	14
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	4.0 J	3.5 J	3.1 J	35	540	620	18
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	pg/g	0.36 U	0.081 U	0.032 U	0.62 J	780	820	5.6 J
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	1.4 J	0.15 J	0.12 J	2.2 J	8200	7200	44
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.27 U	0.33 U	0.25 U	0.25 J	6.3 J	6.3 J	0.38 J
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.42 J	0.083 U	0.062 U	0.78 J	2000 J	1800 J	11
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.26 U	0.21 U	0.23 U	0.83 J	30 J	41 J	0.62 J
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	pg/g	0.26 U	0.077 U	0.091 U	0.15 U	110 J	120 J	0.90 J
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.47 J	0.36 J	0.32 J	0.92 J	11 J	14 J	1.7 J
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	1.1 J	0.13 J	0.098 J	1.4 J	4200	3900	23
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	0.19 J	0.21 J	0.24 J	0.28 U	260	430	2.6 J
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.18 U	0.040 U	0.047 U	0.32 J	200 J	210 J	1.4 J
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	0.64 J	0.11 J	0.058 U	0.87 J	2200	2900	15
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	pg/g	41	2.7	2.5	25	100000 J	150000 J	800
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	11	0.92 J	0.87 J	8.0	24000 J	31000 J	230
Total heptachlorodibenzofuran (HpCDF)	pg/g	1.2 J	0.23 J	0.096 J	14 J	3200 J	3800 J	24 J
Total heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	13 J	10 J	8.6 J	83 J	1100 J	1400 J	67 J
Total hexachlorodibenzofuran (HxCDF)	pg/g	2.4 J	0.35 J	0.21 J	9.9 J	12000 J	11000 J	66 J
Total hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	3.8 J	2.8 J	2.5 J	11 J	220 J	230 J	17 J
Total pentachlorodibenzofuran (PeCDF)	pg/g	2.6 J	0.29 J	0.098 J	9.2 J	10000 J	11000 J	60 J
Total pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	0.86 J	0.73 J	0.58 J	1.0 J	310 J	510 J	3.4 J
Total tetrachlorodibenzofuran (TCDF)	pg/g	66 J	5.2 J	3.8 J	55 J	180000 J	270000 J	1400 J
Total tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	13 J	1.4 J	1.2 J	9.4 J	27000 J	34000 J	250 J
Total WHO Dioxin TEQ(Human/Mammal)(ND=0)	pg/g	15.8	1.55	1.46	11.9	36100	48400	324
Total WHO Dioxin TEQ(Human/Mammal)(ND=0.5)	pg/g	15.9	1.59	1.50	12.0	36100	48400	324

Notes:
pg/g - picogram per gram
U - Not detected at the associated reporting limit.
J - Estimated concentration.
UJ - Not detected; associated reporting limit is estimated

Table 2-3

Second Phase Pre-Design Investigation Analytical Results
Pre-Final 90% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Sample Location: / Sample Identification: / Sample Date: / Sample Depth: / Sample Type:	Units	SJSB058 11187072-101419-BN-SJSB058-S (8-10) 10/14/2019 (8-10) ft bgs	SJSB058 11187072-101419-BN-SJSB058-S (10-12) 10/14/2019 (10-12) ft bgs	SJSB058 11187072-101419-BN-SJSB058-S (12-14) 10/14/2019 (12-14) ft bgs	SJSB058 11187072-101419-BN-SJSB058-S (14-16) 10/14/2019 (14-16) ft bgs	SJSB058 11187072-101419-BN-SJSB058-S (16-18) 10/14/2019 (16-18) ft bgs	SJSB058 11187072-111219-SS-SJSB058 (18-20) 11/12/2019 (18-20) ft bgs	SJSB070 11187072-111219-SS-SJSB070 (0-2) 11/12/2019 (0-2) ft bgs
Dioxins/Furans								
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	pg/g	25 J	6.4 J	270 J	3.0 U	20 U	0.37 U	710
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	pg/g	670	360	3400	140	410	120	2000
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	pg/g	47	14	590	5.7 J	35	0.15 U	1900
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	28 J	20	160	8.0	22 J	5.6 J	190
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	pg/g	17 J	5.3 J	200	2.1 J	15 J	0.16 U	610
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	150	50	1700	18	120	0.12 U	6700
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.18 U	0.55 J	0.82 U	0.13 J	0.40 J	0.16 U	4.7 J
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	37	13	440	4.9 J	31 J	0.14 U	1700
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.95 J	0.94 J	9.0 J	0.23 J	0.94 J	0.17 U	14
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	pg/g	3.0 J	0.92 J	26 J	0.30 J	1.7 J	0.23 J	46 J
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.17 U	2.0 J	3.2 J	0.38 J	1.2 J	0.38 J	5.9 J
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	88	29	940	9.2	70	0.18 U	4200
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	8.7 J	3.0 J	96 J	0.66 J	6.2 J	0.35 U	390
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	4.3 J	1.6 J	51 J	0.61 J	3.3 J	0.10 U	170 J
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	59	19	630	6.7	42	0.18 U	2700
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	pg/g	1900	790	6400	310	1500	0.60 U	27000 J
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	920	280	8700	99	600	0.20 U	39000 J
Total heptachlorodibenzofuran (HpCDF)	pg/g	81 J	24 J	990 J	9.9 J	61 J	0.16 U	2900 J
Total heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	80 J	77 J	370 J	27 J	68 J	23 J	370 J
Total hexachlorodibenzofuran (HxCDF)	pg/g	220 J	74 J	2500 J	28 J	180 J	0.23 J	9600 J
Total hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	14 J	23 J	60 J	9.1 J	16 J	6.9 J	98 J
Total pentachlorodibenzofuran (PeCDF)	pg/g	240 J	78 J	2600 J	26 J	180 J	0.18 U	11000 J
Total pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	8.7 J	5.4 J	96 J	1.8 J	6.2 J	0.35 U	410 J
Total tetrachlorodibenzofuran (TCDF)	pg/g	5800 J	1600 J	62000 J	630 J	3800 J	0.96 J	300000 J
Total tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	1000 J	310 J	9700 J	110 J	670 J	0.70 J	44000 J
Total WHO Dioxin TEQ(Human/Mammal)(ND=0)	pg/g	1160	376	9890	136	788	0.153	43900
Total WHO Dioxin TEQ(Human/Mammal)(ND=0.5)	pg/g	1160	376	9890	136	788	0.524	43900

Notes:
pg/g - picogram per gram
U - Not detected at the associated reporting limit.
J - Estimated concentration.
UJ - Not detected; associated reporting limit is estimated

Table 2-3

Second Phase Pre-Design Investigation Analytical Results
Pre-Final 90% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Sample Location: Sample Identification: Sample Date: Sample Depth: Sample Type:	Units	SJSB070 11187072-111219-SS-SJSB070 (2-4) 11/12/2019 (2-4) ft bgs	SJSB070 11187072-111219-SS-SJSB070 (4-6) 11/12/2019 (4-6) ft bgs	SJSB070 11187072-111219-SS-SJSB070 (6-8) 11/12/2019 (6-8) ft bgs	SJSB070 11187072-111219-SS-SJSB070 (8-10) 11/12/2019 (8-10) ft bgs	SJSB070 11187072-111219-SS-SJSB070 (10-12) 11/12/2019 (10-12) ft bgs	SJSB070 11187072-111219-SS-SJSB070 (12-14) 11/12/2019 (12-14) ft bgs
Dioxins/Furans							
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	pg/g	1400	920	480	370	14	7.8 J
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	pg/g	15000 J	11000 J	6000 J	4500	300	410 J
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	pg/g	2800	1900	980	790	29	16
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	960	630	330	260	15	19
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	pg/g	860	550	290	240	9.6	5.2 J
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	9100	5800	3100	2200	97	51
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	7.8 J	6.1 J	3.2 J	2.0 J	0.38 U	0.47 U
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	2300	1500	780	570	24	13
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	55	39	20	14	0.61 U	0.72 J
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	pg/g	110 J	61 J	37 J	33	0.45 J	0.85 J
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	15	11 J	6.1	4.4 J	0.73 J	1.0 J
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	6500	4300	2100	1400	65	36
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	550	410	200	130	6.0 J	3.6 J
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	250 J	170 J	78 J	57	2.8 J	1.6 J
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	3800	2800	1500	920	40	23
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	pg/g	35000 J	24000	12000	9700	2400	1600
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	62000 J	41000 J	22000 J	15000 J	730	430
Total heptachlorodibenzofuran (HpCDF)	pg/g	4900 J	3200 J	1700 J	1300 J	48 J	26 J
Total heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	2000 J	1300 J	710 J	560 J	44 J	63 J
Total hexachlorodibenzofuran (HxCDF)	pg/g	13000 J	8600 J	4300 J	3200 J	140 J	75 J
Total hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	320 J	220 J	110 J	75 J	8.8 J	14 J
Total pentachlorodibenzofuran (PeCDF)	pg/g	17000 J	12000 J	5600 J	3800 J	170 J	94 J
Total pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	640 J	410 J	230 J	150 J	6.4 J	5.1 J
Total tetrachlorodibenzofuran (TCDF)	pg/g	350000 J	280000 J	130000 J	86000 J	5100 J	2600 J
Total tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	70000 J	45000 J	25000 J	17000 J	800 J	470 J
Total WHO Dioxin TEQ(Human/Mammal)(ND=0)	pg/g	68600	45600	24300	16700	1000	609
Total WHO Dioxin TEQ(Human/Mammal)(ND=0.5)	pg/g	68600	45600	24300	16700	1000	609

Notes:
pg/g - picogram per gram
U - Not detected at the associated reporting limit.
J - Estimated concentration.
UJ - Not detected; associated reporting limit is estimated

Table 2-3

Second Phase Pre-Design Investigation Analytical Results
Pre-Final 90% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Sample Location: / Sample Identification: / Sample Date: / Sample Depth: / Sample Type:	Units	SJSB070 / 11187072-111219-SS-SJSB070 (14-16) / 11/12/2019 / (14-16) ft bgs	SJSB070 / 11187072-111219-SS-SJSB070 (16-18) / 11/12/2019 / (16-18) ft bgs	SJSB071 / 11187072-111219-SS-SJSB071 (0-2) / 11/12/2019 / (0-2) ft bgs	SJSB071 / 11187072-111219-SS-SJSB071 (2-4) / 11/12/2019 / (2-4) ft bgs	SJSB071 / 11187072-111219-SS-SJSB071 (4-6) / 11/12/2019 / (4-6) ft bgs	SJSB071 / 11187072-111219-SS-SJSB071 (6-8) / 11/12/2019 / (6-8) ft bgs	SJSB071 / 11187072-111219-SS-SJSB071 (8-10) / 11/12/2019 / (8-10) ft bgs
Dioxins/Furans								
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	pg/g	0.52 J	0.41 J	820 J	1200 J	1.2 J	1.1 J	0.39 J
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	pg/g	110 J	310 J	8100 J	11000 J	110 J	38 J	46 J
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	pg/g	0.35 U	0.22 U	1600	2500	0.97 U	0.70 U	0.20 U
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	5.0 J	13	460	650	3.5 J	1.7 J	1.7 J
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	pg/g	0.094 J	0.054 U	460	770	0.37 J	0.15 J	0.089 J
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.81 J	0.52 J	4200	8300	2.7 J	0.73 J	0.089 U
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.30 U	0.37 U	5.3 U	6.6 J	0.24 U	0.24 U	0.20 U
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.065 U	0.090 U	1100	2100	1.0 J	0.19 U	0.085 U
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.19 U	0.39 U	32 J	36	0.20 U	0.12 U	0.13 U
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	pg/g	0.12 J	0.19 J	56	100 J	0.10 U	0.13 U	0.16 J
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.41 J	1.0 J	10 J	13	0.23 J	0.20 J	0.23 J
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	0.64 U	0.65 U	3200	5000	1.8 J	0.38 U	0.24 U
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	0.13 J	0.11 U	320 J	380 J	0.24 J	0.13 U	0.098 U
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.047 U	0.072 U	120	200 J	0.11 U	0.14 U	0.063 U
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	0.38 J	0.29 J	2200	3000	1.1 J	0.090 U	0.058 U
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	pg/g	17	11	20000	24000	67	7.9	3.3 U
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	4.7	3.0	31000 J	41000 J	19	2.4 U	1.4 U
Total heptachlorodibenzofuran (HpCDF)	pg/g	0.54 J	0.22 J	2600 J	4200 J	1.8 J	0.85 J	0.29 J
Total heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	22 J	61 J	1000 J	1400 J	12 J	5.3 J	6.6 J
Total hexachlorodibenzofuran (HxCDF)	pg/g	0.93 J	0.70 J	6300 J	14000 J	3.7 J	0.73 J	0.16 J
Total hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	6.4 J	16 J	140 J	220 J	2.3 J	2.4 J	4.4 J
Total pentachlorodibenzofuran (PeCDF)	pg/g	1.2 J	1.1 J	8500 J	13000 J	4.5 J	0.56 J	0.24 J
Total pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	1.2 J	2.7 J	320 J	400 J	0.24 J	0.28 J	0.91 J
Total tetrachlorodibenzofuran (TCDF)	pg/g	31 J	20 J	220000 J	260000 J	110 J	14 J	5.0 J
Total tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	5.6 J	4.8 J	34000 J	46000 J	21 J	3.6 J	3.4 J
Total WHO Dioxin TEQ(Human/Mammal)(ND=0)	pg/g	6.86	4.58	34700	45900	26.8	0.913	0.0710
Total WHO Dioxin TEQ(Human/Mammal)(ND=0.5)	pg/g	6.90	4.69	34700	45900	26.8	2.24	1.03

Notes:
pg/g - picogram per gram
U - Not detected at the associated reporting limit.
J - Estimated concentration.
UJ - Not detected; associated reporting limit is estimated.

Table 2-3

Second Phase Pre-Design Investigation Analytical Results
Pre-Final 90% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Sample Location: Sample Identification: Sample Date: Sample Depth: Sample Type:	Units	SJSB071 11187072-111219-SS-SJSB071 (10-12) 11/12/2019 (10-12) ft bgs	SJSB071 11187072-111219-SS-SJSB071 (12-14) 11/12/2019 (12-14) ft bgs	SJSB071 11187072-111219-SS-SJSB071 (14-16) 11/12/2019 (14-16) ft bgs	SJSB071 11187072-111219-SS-SJSB071 (16-18) 11/12/2019 (16-18) ft bgs
Dioxins/Furans					
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	pg/g	0.11 UJ	0.24 J	1.7 J	1.8 J
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	pg/g	98 J	130 J	59	63
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	pg/g	0.23 U	0.11 U	1.9 J	1.7 J
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	5.7 J	5.9 J	3.0 J	2.6 J
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	pg/g	0.053 U	0.038 U	0.52 J	0.47 J
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.30 J	0.071 U	4.6 J	4.6 J
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.30 U	0.32 U	0.14 U	0.14 U
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.095 U	0.067 U	1.3 J	1.3 J
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.29 U	0.24 U	0.14 U	0.15 U
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	pg/g	0.23 J	0.089 J	0.27 J	0.43 J
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.38 J	0.48 J	0.13 U	0.14 U
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	0.30 U	0.23 U	3.3 J	2.4 J
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	0.12 U	0.094 U	0.35 U	0.31 U
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.079 U	0.051 U	0.21 J	0.12 U
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	0.15 J	0.063 U	2.0 J	1.6 J
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	pg/g	6.1 U	1.1 U	110	110
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	1.7 U	0.43 U	32	33
Total heptachlorodibenzofuran (HpCDF)	pg/g	0.23 J	0.11 J	3.0 J	2.8 J
Total heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	17 J	21 J	8.5 J	7.3 J
Total hexachlorodibenzofuran (HxCDF)	pg/g	0.53 J	0.089 J	6.8 J	6.3 J
Total hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	7.2 J	7.0 J	1.6 J	1.4 J
Total pentachlorodibenzofuran (PeCDF)	pg/g	0.45 J	0.23 J	8.5 J	6.4 J
Total pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	1.6 J	1.3 J	0.35 U	0.31 U
Total tetrachlorodibenzofuran (TCDF)	pg/g	10 J	1.8 J	190 J	180 J
Total tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	2.7 J	1.2 J	34 J	35 J
Total WHO Dioxin TEQ(Human/Mammal)(ND=0)	pg/g	0.222	0.155	44.4	45.3
Total WHO Dioxin TEQ(Human/Mammal)(ND=0.5)	pg/g	1.48	0.523	44.6	45.4

Notes:
pg/g - picogram per gram
U - Not detected at the associated reporting limit.
J - Estimated concentration.
UJ - Not detected; associated reporting limit is estimated

Table 2-4

Supplemental Design Investigation Analytical Results - Northern Impoundment
Pre- Final 90% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Sample Location: Sample Identification: Sample Date: Sample Depth: Parameters	Units	SJSB072 11215702-072021-SS-SJSB072(8-10) 07/20/2021 (8-10) ft bgs	SJSB072 11215702-072021-SS-SJSB072(10-12) 07/20/2021 (10-12) ft bgs	SJSB072 11215702-072021-SS-SJSB072(12-14) 07/20/2021 (12-14) ft bgs	SJSB072 11215702-072021-SS-SJSB072(14-16) 07/20/2021 (14-16) ft bgs	SJSB072 11215702-072021-SS-SJSB072(16-18) 07/20/2021 (16-18) ft bgs	SJSB072 11215702-072021-SS-SJSB072(18-20) 07/20/2021 (18-20) ft bgs	SJSB072 11215702-072021-SS-SJSB072(20-22) 07/20/2021 (20-22) ft bgs	SJSB072 11215702-072021-SS-SJSB072 (20-22)-R 07/20/2021 (20-22) ft bgs Lab Duplicate	SJSB072 11215702-072021-SS-SJSB072(22-24) 07/20/2021 (22-24) ft bgs	SJSB073 11215702-072021-SS-SJSB073(0-2) 07/20/2021 (0-2) ft bgs	SJSB073 11215702-072021-SS-SJSB073(2-4) 07/20/2021 (2-4) ft bgs
Dioxins/Furans												
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	pg/g	0.49 U	5.3 U	0.046 U	0.49 U	2.3 U	0.88 U	1.3 U	2.6 U	0.88 U	20	440
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	pg/g	72	190	42	38	89	190	120	130	43	550	3500
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	pg/g	0.32 J	10	0.050 U	0.11 U	1.7 J	0.35 U	2.7 J	4.1 J	0.032 U	6.4 J	1000
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	2.6 J	8.2	1.8 J	1.9 J	4.1 J	8.4	7.7	5.5 J	1.8 U	33	260
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	pg/g	0.14 J	3.4 J	0.056 U	0.13 U	0.85 J	0.033 U	0.92 U	1.3 U	0.037 U	1.5 U	330
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.96 J	33	0.083 J	0.16 J	5.0 J	0.024 U	8.3	12	0.072 J	16	3300
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.22 J	0.26 J	0.20 J	0.16 U	0.32 J	0.31 U	0.31 U	0.25 U	0.31 U	0.092 U	2.7 J
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.29 J	8.7	0.039 U	0.081 U	1.4 J	0.025 U	2.1 J	3.3 J	0.036 J	3.4 J	820
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.14 J	0.36 J	0.088 U	0.16 U	0.28 J	0.27 J	0.18 J	0.26 U	0.088 J	1.1 J	12
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	pg/g	0.89 U	1.3 U	0.85 U	0.77 U	0.84 U	0.050 J	0.039 U	0.25 U	0.053 J	2.8 U	57
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.28 J	0.21 J	0.17 J	0.14 U	0.44 J	0.70 J	0.32 J	0.32 U	0.21 J	0.56 U	5.1 J
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	1.1 J	24	0.30 J	0.41 J	3.1 J	0.028 U	5.6 J	8.8	0.081 J	7.0	1900
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	0.13 J	1.9 J	0.061 U	0.12 U	0.075 U	0.057 U	0.44 J	0.70 J	0.050 U	0.068 U	190
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.049 J	0.98 J	0.030 U	0.063 U	0.20 J	0.019 U	0.26 U	0.45 J	0.11 U	0.44 J	83
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	0.50 J	14	0.073 J	0.10 U	1.5 J	0.028 U	3.1 J	4.7 J	0.035 U	0.98 J	1200
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	pg/g	25	710	2.7	2.6	70	0.40 J	180	270	1.7	13	77000
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	8.4	260	0.85 J	1.2	25	0.18 J	53	87	0.52 J	4.9	22000
Total heptachlorodibenzofuran (HpCDF)	pg/g	0.57 J	17 J	0.056 U	0.13 U	3.1 J	0.091 J	4.5 J	7.0 J	0.037 U	19 J	1600 J
Total heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	11 J	28 J	8.0 J	6.5 J	15 J	38 J	21 J	18 J	7.3 J	88 J	550 J
Total hexachlorodibenzofuran (HxCDF)	pg/g	2.3 J	51 J	0.94 J	0.94 J	8.2 J	0.050 J	12 J	18 J	0.19 J	29 J	4700 J
Total hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	2.6 J	3.9 J	5.3 J	2.2 J	5.6 J	13 J	5.7 J	5.7 J	3.1 J	8.7 J	68 J
Total pentachlorodibenzofuran (PeCDF)	pg/g	2.3 J	60 J	0.38 J	0.41 J	7.0 J	0.031 U	14 J	22 J	0.081 J	13 J	4700 J
Total pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	0.39 J	2.2 J	2.0 J	0.19 U	0.82 J	2.4 J	1.7 J	1.8 J	0.56 J	0.52 J	220 J
Total tetrachlorodibenzofuran (TCDF)	pg/g	50 J	1400 J	5.4 J	4.9 J	140 J	0.66 J	320 J	510 J	2.4 J	30 J	120000 J
Total tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	9.4 J	280 J	4.1 J	1.2 J	28 J	1.8 J	59 J	96 J	0.96 J	4.9 J	24000 J
TEQ												
Total WHO Dioxin TEQ(Human/Mammal)(ND=0)	pg/g	12 J	340 J	1.2 J	1.5 J	33 J	0.46 J	74 J	120 J	0.75 J	9.4 J	31000 J
Total WHO Dioxin TEQ(Human/Mammal)(ND=0.5)	pg/g	12 J	340 J	1.3 J	1.7 J	34 J	0.52 J	74 J	120 J	0.81 J	9.6 J	31000 J

Notes:
- U - Not detected at the associated reporting limit
- J - Estimated concentration
- UJ - Not detected; associated reporting limit is estimated
- J- - Estimated concentration, result may be biased low
- J+ - Estimated concentration, result may be biased high
- TEQ - Toxicity Equivalent Quotient
- ft bgs - Feet below ground surface
- pg/g - picogram per grams

Table 2-4

Supplemental Design Investigation Analytical Results - Northern Impoundment
Pre- Final 90% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Sample Location: Sample Identification: Sample Date: Sample Depth: Parameters	Units	SJSB073 11215702-072021-SS-SJSB073(4-6) 07/20/2021 (4-6) ft bgs	SJSB073 11215702-072021-SS-SJSB073(6-8) 07/20/2021 (6-8) ft bgs	SJSB073 11215702-072021-SS-SJSB073(8-10) 07/20/2021 (8-10) ft bgs	SJSB073 11215702-072021-SS-SJSB073(10-12) 07/20/2021 (10-12) ft bgs	SJSB073 11215702-072021-SS-SJSB073(12-14) 07/20/2021 (12-14) ft bgs	SJSB073 11215702-072021-SS-SJSB073(14-16) 07/20/2021 (14-16) ft bgs	SJSB073 11215702-072021-SS-SJSB073(16-18) 07/20/2021 (16-18) ft bgs	SJSB074 11215702-072221-SS-SJSB074(0-2) 07/22/2021 (0-2) ft bgs	SJSB074 11215702-072221-SS-SJSB074(2-4) 07/22/2021 (2-4) ft bgs	SJSB074 11215702-072221-DUP-5 07/22/2021 (2-4) ft bgs Field Duplicate	SJSB074 11215702-072221-SS-SJSB074(4-6) 07/22/2021 (4-6) ft bgs
Dioxins/Furans												
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	pg/g	350	780 J	1300 J	1.8 U	0.32 U	1.5 U	0.15 U	140	1600	950	600
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	pg/g	2400	10000	19000	160 U	200 U	390	220	2200	41000 J	21000 J	17000 J
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	pg/g	770	1700	2800 J+	2.2 U	0.64 U	0.92 U	0.11 U	280	4200 J	1900	1200
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	170	590 J	950 J	9.4	19	24	11	110	4000 J	1800	1700
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	pg/g	240	520 J	850 J	0.85 U	0.17 U	0.51 U	0.13 U	85	1100	610	420
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	2400	5600	8400	6.0	0.82 J	1.8 J	0.97 J	910	9900 J	5900 J	5100 J
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	2.2 J	5.4 U	12 U	0.30 U	0.19 U	0.21 U	0.17 U	1.3 J	8.7 J	6.5 J	4.0 J
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	620	1500	2200	1.3 J	0.46 U	0.64 U	0.38 U	240	2700	1600	1400
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	7.2 J	41 J	52 J	0.30 U	0.23 U	0.24 U	0.20 U	3.6 J	80	45	32
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	pg/g	42	100 U	140 U	3.0 U	2.3 U	2.5 U	2.3 U	13	130	86	110
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	4.2 J	17 U	10 U	0.28 U	1.3 U	1.9 U	0.17 U	2.7 J	25	16	8.6 J
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	1400	4500	5000	4.5 U	1.9 U	2.7 U	1.6 U	680	5300 J	3900 J	3600 J
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	130	400 J	460 J	0.24 U	0.25 U	0.15 U	0.13 U	49	480	390	190
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	66	170 J	210 J	0.37 U	0.16 U	0.11 U	0.093 U	28	250	160	160
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	820	2700	2900	2.2 J	0.14 U	0.99 J	0.13 U	370	3300	2600	1500
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	pg/g	91000	160000	200000	90	3.4	28	5.9	19000 J	180000 J	160000 J	63000 J
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	16000	50000	60000	30	4.1	11	4.5	5600 J	49000 J	41000 J	22000 J
Total heptachlorodibenzofuran (HpCDF)	pg/g	1200 J	2800 J	4600 J	3.0 J	1.1 J	2.4 J	0.13 U	440 J	6300 J	3200 J	2000 J
Total heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	350 J	1300 J	2100 J	60 J	77 J	82 J	48 J	230 J	6600 J	3200 J	2700 J
Total hexachlorodibenzofuran (HxCDF)	pg/g	3500 J	8500 J	12000 J	10 J	3.6 J	4.9 J	3.6 J	1300 J	15000 J	8800 J	7800 J
Total hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	49 J	160 J	210 J	19 J	20 J	23 J	14 J	32 J	450 J	250 J	350 J
Total pentachlorodibenzofuran (PeCDF)	pg/g	3300 J	11000 J	13000 J	7.9 J	1.9 J	3.7 J	1.6 J	1600 J	13000 J	10000 J	7600 J
Total pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	150 J	400 J	460 J	0.45 U	0.25 U	0.15 U	0.13 U	52 J	600 J	480 J	240 J
Total tetrachlorodibenzofuran (TCDF)	pg/g	78000 J	290000 J	350000 J	210 J	24 J	63 J	24 J	34000 J	210000 J	160000 J	110000 J
Total tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	17000 J	55000 J	66000 J	36 J	5.1 J	11 J	4.5 J	6100 J	54000 J	46000 J	24000 J
TEQ												
Total WHO Dioxin TEQ(Human/Mammal)(ND=0)	pg/g	26000 J	68000 J	83000 J	41 J	4.7 J	15 J	5.4 J	7800 J	70000 J	59000 J	30000 J
Total WHO Dioxin TEQ(Human/Mammal)(ND=0.5)	pg/g	26000 J	68000 J	83000 J	41 J	5.2 J	15 J	5.6 J	7800 J	70000 J	59000 J	30000 J

Notes:
- U - Not detected at the associated reporting limit
- J - Estimated concentration
- UJ - Not detected; associated reporting limit is estimated
- J- - Estimated concentration, result may be biased low
- J+ - Estimated concentration, result may be biased high
- TEQ - Toxicity Equivalent Quotient
- ft bgs - Feet below ground surface
- pg/g - picogram per grams

Table 2-4

Supplemental Design Investigation Analytical Results - Northern Impoundment
Pre- Final 90% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Sample Location: Sample Identification: Sample Date: Sample Depth: Parameters	Units	SJSB074 11215702-072221-SS-SJSB074(6-8) 07/22/2021 (6-8) ft bgs	SJSB074 11215702-072221-SS-SJSB074(8-10) 07/22/2021 (8-10) ft bgs	SJSB074 11215702-072221-SS-SJSB074(10-12) 07/22/2021 (10-12) ft bgs	SJSB074 11215702-072221-SS-SJSB074(12-14) 07/22/2021 (12-14) ft bgs	SJSB074 11215702-072221-SS-SJSB074(14-16) 07/22/2021 (14-16) ft bgs	SJSB074 11215702-072221-SS-SJSB074(16-18) 07/22/2021 (16-18) ft bgs	SJSB075 11215702-072021-SS-SJSB075(4-6) 07/20/2021 (4-6) ft bgs	SJSB075 11215702-072021-SS-SJSB075(10-12) 07/20/2021 (10-12) ft bgs	SJSB075 11215702-072021-SS-SJSB075(12-14) 07/20/2021 (12-14) ft bgs	SJSB075 11215702-072021-SS-SJSB075(14-16) 07/20/2021 (14-16) ft bgs	SJSB075 11215702-072021-SS-SJSB075(16-18) 07/20/2021 (16-18) ft bgs
Dioxins/Furans												
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	pg/g	7.1 J	0.38 U	0.32 U	0.32 U	0.34 U	0.14 U	970 U	3.0 U	0.11 U	1.1 U	0.10 U
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	pg/g	1200	82	58	55	51	200	11000 U	130 U	52 U	240 U	190 U
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	pg/g	4.3 J	0.22 U	0.16 U	0.13 U	0.42 U	0.14 U	2300	5.4 J	0.096 U	0.48 U	0.48 U
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	34	2.9 J	1.8 J	2.2 J	2.2 J	9.6	660	7.0 U	1.9 U	15 U	10
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	pg/g	0.87 J	0.063 U	0.059 U	0.099 U	0.12 U	0.027 U	710	2.5 J	0.10 U	0.19 U	0.30 U
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	7.8	0.44 J	0.28 U	0.13 U	0.38 J	0.067 J	8400	25	0.33 J	0.41 J	0.90 J
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.55 U	0.20 U	0.19 U	0.11 U	0.25 U	0.26 U	6.3 U	0.30 U	0.25 U	0.28 U	0.37 U
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	2.3 J	0.12 U	0.13 U	0.054 U	0.20 U	0.019 U	2100	6.3	0.32 U	0.14 U	0.34 U
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.98 J	0.082 U	0.074 J	0.11 U	0.19 J	0.27 J	34 J	0.39 J	0.10 U	0.62 J	0.43 J
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	pg/g	0.085 U	0.036 U	0.11 U	0.11 U	0.19 U	0.22 U	110 U	2.1 U	2.9 U	1.9 U	1.9 U
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	1.4 J	0.19 U	0.061 U	0.22 U	0.24 U	0.67 J	9.6 U	0.43 U	0.36 U	1.1 U	0.72 U
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	5.6 J	0.33 J	0.17 J	0.033 U	0.30 J	0.18 J	5500	22	1.7 U	1.4 U	1.4 U
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	0.64 J	0.065 U	0.043 U	0.11 J	0.054 U	0.12 J	330 J	1.8 J	0.069 U	0.23 U	0.066 U
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.32 J	0.035 U	0.024 U	0.056 J	0.10 J	0.016 U	230 J	1.0 J	0.065 U	0.11 U	0.12 U
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	3.6 J	0.20 J	0.12 J	0.032 U	0.16 J	0.056 J	2800	12	0.065 U	0.19 U	0.33 J
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	pg/g	200	12	6.2	0.76 U	5.7	0.66 U	130000	690	1.3 U	5.9 U	13
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	63	3.7	2.3	0.26 U	1.8	0.38 J	40000	190	0.98 U	1.8 U	5.0
Total heptachlorodibenzofuran (HpCDF)	pg/g	7.3 J	0.35 J	0.16 J	0.34 J	0.74 J	0.096 J	3800 J	10 J	0.10 U	0.28 J	0.56 J
Total heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	110 J	13 J	7.1 J	9.6 J	7.6 J	37 J	1500 J	18 J	11 J	43 J	36 J
Total hexachlorodibenzofuran (HxCDF)	pg/g	14 J	0.56 J	0.47 J	0.35 J	0.88 J	0.28 J	12000 J	40 J	4.2 J	2.3 J	3.5 J
Total hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	21 J	2.7 J	1.4 J	7.9 J	6.8 J	11 J	170 J	5.1 J	4.8 J	15 J	13 J
Total pentachlorodibenzofuran (PeCDF)	pg/g	17 J	0.69 J	0.36 J	0.033 U	0.55 J	0.29 J	13000 J	55 J	2.2 J	1.4 J	2.6 J
Total pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	4.1 J	0.17 J	0.18 J	2.9 J	1.8 J	2.4 J	350 J	1.8 J	0.71 J	3.1 J	2.4 J
Total tetrachlorodibenzofuran (TCDF)	pg/g	370 J	22 J	10 J	1.1 J	7.7 J	1.3 J	230000 J	1300 J	5.0 J	10 J	29 J
Total tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	69 J	4.0 J	2.7 J	7.9 J	4.6 J	2.0 J	44000 J	220 J	3.7 J	3.2 J	6.6 J
TEQ												
Total WHO Dioxin TEQ(Human/Mammal)(ND=0)	pg/g	87 J	5.1 J	3.0 J	0.15 J	2.5 J	0.78 J	55000 J	270 J	0.033 J	0.10 J	6.6 J
Total WHO Dioxin TEQ(Human/Mammal)(ND=0.5)	pg/g	87 J	5.1 J	3.1 J	0.37 J	2.6 J	0.84 J	55000 J	270 J	0.88 J	1.8 J	6.7 J

Notes:
- U - Not detected at the associated reporting limit
- J - Estimated concentration
- UJ - Not detected; associated reporting limit is estimated
- J- - Estimated concentration, result may be biased low
- J+ - Estimated concentration, result may be biased high
- TEQ - Toxicity Equivalent Quotient
- ft bgs - Feet below ground surface
- pg/g - picogram per grams

Table 2-4

Supplemental Design Investigation Analytical Results - Northern Impoundment
Pre- Final 90% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Sample Location: Sample Identification: Sample Date: Sample Depth: Parameters	Units	SJSB076 11215702-072221-SS-SJSB076(0-2) 07/22/2021 (0-2) ft bgs	SJSB076 11215702-072221-SS-SJSB076(2-4) 07/22/2021 (2-4) ft bgs	SJSB076 11215702-072221-SS-SJSB076(4-6) 07/22/2021 (4-6) ft bgs	SJSB076 11215702-072221-SS-SJSB076(6-8) 07/22/2021 (6-8) ft bgs	SJSB076 11215702-072221-SS-SJSB076(8-10) 07/22/2021 (8-10) ft bgs	SJSB076 11215702-072221-SS-SJSB076(10-12) 07/22/2021 (10-12) ft bgs	SJSB076 11215702-072221-SS-SJSB076 (10-12)-R 07/22/2021 (10-12) ft bgs Lab Duplicate	SJSB076 11215702-072221-SS-SJSB076(12-14) 07/22/2021 (12-14) ft bgs	SJSB076 11215702-072221-SS-SJSB076(14-16) 07/22/2021 (14-16) ft bgs	SJSB076 11215702-072221-SS-SJSB076(16-18) 07/22/2021 (16-18) ft bgs	SJSB077 11215702-072121-SS-SJSB077(6-8) 07/21/2021 (6-8) ft bgs
Dioxins/Furans												
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	pg/g	72	910	1400	3.6 J	0.35 J	2.7 J	1.7 U	0.58 J	0.81 J	0.24 U	1300
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	pg/g	1200	4500	16000 J	150	84	200	170	350	130	400	8900
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	pg/g	150	2300	2900	6.6 J	0.43 J	5.2 J	3.1 J	1.0 J	0.70 J	0.21 U	2400
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	51 J	350	1200	6.4 J	3.4 J	8.9	8.7	19	10	18	550
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	pg/g	46	780	1000	2.5 J	0.16 J	1.8 J	0.96 U	0.42 J	0.084 J	0.027 U	770
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	500	8400 J	11000 J	24	1.1 J	19	11	3.0 J	1.1 J	0.39 J	7100
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.96 J	3.6 J	7.0 J	0.051 U	0.28 J	0.071 U	0.24 U	0.61 J	0.31 J	0.45 U	7.4 J
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	130	2300	3000	6.8	0.30 J	4.4 J	3.0 J	0.87 J	0.31 J	0.13 J	1800
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	1.8 J	18	35	0.054 U	0.19 J	0.082 U	0.24 U	0.85 J	0.34 J	0.53 J	41 J
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	pg/g	8.1	140	210	0.14 U	0.13 J	0.35 J	0.26 U	0.046 U	0.065 J	0.23 U	120
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	2.0 J	9.1 J	13	0.24 J	0.28 J	0.29 J	0.35 U	1.5 J	0.56 J	1.4 J	18 J
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	310	6000 J	6400 J	17	0.96 J	14	13	2.1 J	0.72 J	0.41 J	4600
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	20	270	420	1.5 J	0.19 J	0.98 J	0.61 J	0.21 U	0.15 J	0.22 J	400
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	16	260	360	0.15 U	0.073 U	0.59 J	0.51 J	0.044 U	0.029 U	0.019 U	220
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	160	2600	3200	9.7	0.54 J	7.5	6.4	0.95 J	0.31 J	0.16 J	2800
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	pg/g	7600 J	110000 J	150000 J	540	28	360	260	43	9.8	6.5	170000 J
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	2100 J	36000 J	45000 J	150	7.9	110	82	15	3.5	2.2	44000 J
Total heptachlorodibenzofuran (HpCDF)	pg/g	230 J	3600 J	4600 J	11 J	0.72 J	8.5 J	5.1 J	1.7 J	0.90 J	0.32 J	3900 J
Total heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	120 J	690 J	2200 J	19 J	12 J	24 J	22 J	69 J	26 J	77 J	1100 J
Total hexachlorodibenzofuran (HxCDF)	pg/g	740 J	13000 J	16000 J	31 J	1.5 J	27 J	17 J	3.8 J	1.7 J	0.76 J	10000 J
Total hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	22 J	110 J	260 J	3.6 J	3.9 J	3.4 J	3.7 J	17 J	7.5 J	21 J	190 J
Total pentachlorodibenzofuran (PeCDF)	pg/g	720 J	13000 J	16000 J	38 J	2.1 J	32 J	33 J	4.0 J	1.5 J	0.81 J	11000 J
Total pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	22 J	300 J	420 J	1.5 J	0.40 J	0.98 J	0.87 J	0.68 J	0.66 J	4.2 J	400 J
Total tetrachlorodibenzofuran (TCDF)	pg/g	13000 J	160000 J	230000 J	930 J	51 J	640 J	490 J	78 J	19 J	11 J	240000 J
Total tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	2300 J	40000 J	50000 J	160 J	8.8 J	120 J	92 J	17 J	4.5 J	5.7 J	48000 J
TEQ												
Total WHO Dioxin TEQ(Human/Mammal)(ND=0)	pg/g	3000 J	49000 J	63000 J	210 J	11 J	150 J	110 J	21 J	5.2 J	3.7 J	63000 J
Total WHO Dioxin TEQ(Human/Mammal)(ND=0.5)	pg/g	3000 J	49000 J	63000 J	210 J	11 J	150 J	110 J	21 J	5.2 J	3.7 J	63000 J

Notes:
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- J- - Estimated concentration, result may be biased low
- J+ - Estimated concentration, result may be biased high
- TEQ - Toxicity Equivalent Quotient
- ft bgs - Feet below ground surface
- pg/g - picogram per grams

Table 2-4

Supplemental Design Investigation Analytical Results - Northern Impoundment
Pre- Final 90% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Sample Location: Sample Identification: Sample Date: Sample Depth: Parameters	Units	SJSB077 11215702-072121-DUP-3 07/21/2021 (6-8) ft bgs Field Duplicate	SJSB077 11215702-072121-SS-SJSB077(8-10) 07/21/2021 (8-10) ft bgs	SJSB077 11215702-072121-SS-SJSB077(10-12) 07/21/2021 (10-12) ft bgs	SJSB077 11215702-072121-SS-SJSB077 (10-12)-R 07/21/2021 (10-12) ft bgs Lab Duplicate	SJSB077 11215702-072121-SS-SJSB077(12-14) 07/21/2021 (12-14) ft bgs	SJSB077 11215702-072121-SS-SJSB077 (12-14)-R 07/21/2021 (12-14) ft bgs Lab Duplicate	SJSB077 11215702-072121-SS-SJSB077(14-16) 07/21/2021 (14-16) ft bgs	SJSB077 11215702-072121-SS-SJSB077 (14-16)-R 07/21/2021 (14-16) ft bgs Lab Duplicate	SJSB077 11215702-072121-SS-SJSB077(16-18) 07/21/2021 (16-18) ft bgs	SJSB078 11215702-072121-SS-SJSB078(0-2) 07/21/2021 (0-2) ft bgs	SJSB078 11215702-072121-SS-SJSB078(2-4) 07/21/2021 (2-4) ft bgs
Dioxins/Furans												
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	pg/g	1400	1700	1.4 J	2.0 U	0.95 J	0.87 U	8.3 J	5.4 J	0.83 J	560 J	1100 J
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	pg/g	9700	10000	100	150	73	120	480	480	89	5600	15000
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	pg/g	2500	3900	2.1 J	3.4 J	0.84 J	1.0 U	14	11	0.32 J	1300	2300
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	610	720	4.4 J	8.7	2.7 J	5.7 J	21	27	3.9 J	440 J	1100
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	pg/g	760	1000	0.67 J	1.3 U	0.33 J	0.41 U	4.5 J	3.6 J	0.18 J	480 J	730 J
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	8700	9800	6.9	14	2.2 J	3.5 J	41	36	0.033 U	4700	7100
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	4.6 J	5.2 J	0.32 J	0.31 U	0.17 U	0.26 U	0.24 U	0.41 U	0.077 U	38 J	5.8 U
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	2300	2500	1.8 J	3.3 J	0.74 J	0.98 J	11	8.1	0.032 U	1200	1800
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	48 J	37 J	0.13 U	0.20 U	0.18 U	0.15 U	0.27 U	0.48 J	0.088 U	4.5 U	6.4 U
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	pg/g	140	160	0.075 U	0.31 U	0.050 U	0.14 U	0.25 U	0.57 J	0.031 U	22 U	37 U
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	13 J	12 J	0.11 U	0.27 U	0.16 U	0.21 U	0.24 U	0.39 U	0.076 U	4.0 U	5.7 U
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	5400	5900	5.1 J	9.5	1.6 J	2.1 J	27	22	0.038 U	3100	3300
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	460	530	0.091 U	0.98 J	0.077 U	0.23 J	2.4 J	1.9 J	0.069 U	170 J	260 J
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	280	280	0.077 U	0.42 J	0.050 U	0.18 U	1.4 J	1.0 J	0.031 U	170 J	170 J
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	3200	3500	2.5 J	6.4	1.1 J	1.2 J	16	15	0.040 U	1700	1800
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	pg/g	140000 J	200000 J	100	340	48	51	730 J	690 J	1.0 U	80000	190000 J
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	44000 J	54000 J	38	110	18	17	260	250	0.058 U	24000	26000
Total heptachlorodibenzofuran (HpCDF)	pg/g	4000 J	5900 J	3.3 J	6.1 J	1.2 J	1.8 J	23 J	18 J	0.65 J	2100 J	3700 J
Total heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	1300 J	1500 J	17 J	23 J	9.9 J	19 J	74 J	66 J	16 J	820 J	2300 J
Total hexachlorodibenzofuran (HxCDF)	pg/g	13000 J	14000 J	8.7 J	21 J	3.0 J	5.6 J	58 J	51 J	0.033 U	6500 J	9500 J
Total hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	200 J	190 J	8.4 J	9.6 J	3.3 J	5.9 J	23 J	14 J	5.2 J	93 J	150 J
Total pentachlorodibenzofuran (PeCDF)	pg/g	13000 J	14000 J	7.6 J	25 J	2.7 J	5.0 J	62 J	56 J	0.072 U	7600 J	7800 J
Total pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	460 J	530 J	0.14 U	3.9 J	0.077 U	1.5 J	6.0 J	4.2 J	0.34 U	170 J	260 J
Total tetrachlorodibenzofuran (TCDF)	pg/g	250000 J	300000 J	200 J	640 J	100 J	96 J	1400 J	1300 J	1.0 J	160000 J	160000 J
Total tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	48000 J	59000 J	43 J	130 J	20 J	22 J	290 J	270 J	0.74 U	27000 J	28000 J
TEQ												
Total WHO Dioxin TEQ(Human/Mammal)(ND=0)	pg/g	61000 J	77000 J	50 J	150 J	24 J	23 J	350 J	330 J	0.071 J	33000 J	47000 J
Total WHO Dioxin TEQ(Human/Mammal)(ND=0.5)	pg/g	61000 J	77000 J	50 J	150 J	24 J	23 J	350 J	330 J	0.21 J	33000 J	47000 J

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Pre- Final 90% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Sample Location: Sample Identification: Sample Date: Sample Depth: Parameters	Units	SJSB078 11215702-072121-SS-SJSB078(4-6) 07/21/2021 (4-6) ft bgs	SJSB078 11215702-072121-SS-SJSB078(6-8) 07/21/2021 (6-8) ft bgs	SJSB078 11215702-072121-SS-SJSB078 (6-8)-R 07/21/2021 (6-8) ft bgs Lab Duplicate	SJSB078 11215702-072121-SS-SJSB078(8-10) 07/21/2021 (8-10) ft bgs	SJSB078 11215702-072121-SS-SJSB078 (8-10)-R 07/21/2021 (8-10) ft bgs Lab Duplicate	SJSB078 11215702-072121-SS-SJSB078(10-12) 07/21/2021 (10-12) ft bgs	SJSB078 11215702-072121-SS-SJSB078 (10-12)-R 07/21/2021 (10-12) ft bgs Lab Duplicate	SJSB078 11215702-072121-SS-SJSB078(12-14) 07/21/2021 (12-14) ft bgs	SJSB078 11215702-072121-SS-SJSB078(14-16) 07/21/2021 (14-16) ft bgs	SJSB078 11215702-072121-DUP-2 07/21/2021 (14-16) ft bgs Field Duplicate	SJSB078 11215702-072121-SS-SJSB078(16-18) 07/21/2021 (16-18) ft bgs
Dioxins/Furans												
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	pg/g	1200	0.74 J	2.1 U	1.7 J	1.5 U	3.1 J	1.5 U	0.073 U	0.069 U	0.33 U	4.4 J
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	pg/g	12000	91 J	200 J	92	130	320	280	89	100	130	240
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	pg/g	2300	0.33 J	3.3 J	1.6 J	2.2 U	2.5 J	2.0 U	0.69 J	0.21 J	0.19 U	4.5 J
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	710	3.1 J	6.4 J	4.4 J	8.0	9.1	9.4	2.7 J	4.9 J	6.3	10
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	pg/g	730	0.050 U	0.85 U	0.64 J	0.65 U	0.94 J	0.73 U	0.21 J	0.047 U	0.18 U	1.1 J
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	8200	1.6 J	8.8	5.1 J	6.2	9.9	7.6	1.7 J	0.58 J	0.89 J	13
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	6.2 J	0.093 U	0.35 U	0.056 U	0.22 U	0.17 U	0.28 U	0.090 U	0.081 U	0.28 U	0.10 U
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	2100	0.50 J	2.7 J	1.5 J	1.8 J	2.3 J	2.3 J	0.52 J	0.030 U	0.12 U	3.4 J
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	45 J	0.11 U	0.29 U	0.065 U	0.26 U	0.20 U	0.29 U	0.11 U	0.088 U	0.29 U	0.11 U
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	pg/g	160	0.033 U	0.27 U	0.063 U	0.13 U	0.092 U	0.19 U	0.033 U	0.029 U	0.11 U	0.38 J
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	14 J	0.093 U	0.45 U	0.056 U	0.26 U	0.17 U	0.37 U	0.090 U	0.078 U	0.26 U	0.098 U
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	5300	1.8 J	8.0	4.4 J	5.6 J	7.1	7.4	1.3 J	0.48 J	0.17 U	8.1
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	440	0.071 U	0.97 J	0.51 J	0.56 J	0.076 U	0.62 J	0.068 U	0.089 U	0.41 UJ	1.1 J
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	270	0.029 U	0.42 J	0.061 U	0.21 J	0.082 U	0.28 J	0.031 U	0.028 U	0.11 U	0.32 J
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	3300	1.0 J	4.8 J	2.6 J	3.4 J	3.7 J	3.8 J	0.071 U	0.032 U	0.17 U	4.8 J
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	pg/g	250000	66 J	290 J	150	250	200	250	32	15	22	230
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	58000	25 J	110 J	47	74	68	83	12	5.6	9.6	92
Total heptachlorodibenzofuran (HpCDF)	pg/g	4000 J	0.64 J	5.7 J	2.8 J	3.8 J	4.5 J	3.8 J	1.1 J	0.21 J	0.19 U	7.7 J
Total heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	1600 J	13 J	25 J	13 J	22 J	34 J	32 J	15 J	19 J	27 J	31 J
Total hexachlorodibenzofuran (HxCDF)	pg/g	12000 J	2.1 J	14 J	6.6 J	9.3 J	13 J	11 J	2.2 J	0.58 J	0.89 J	20 J
Total hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	220 J	3.0 J	6.4 J	3.5 J	4.8 J	5.8 J	6.8 J	2.0 J	8.8 J	11 J	7.3 J
Total pentachlorodibenzofuran (PeCDF)	pg/g	13000 J	4.4 J	20 J	9.3 J	14 J	15 J	17 J	1.3 J	0.48 J	0.29 U	20 J
Total pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	440 J	0.51 U	2.1 J	0.51 J	1.5 J	0.58 U	1.8 J	0.34 U	2.3 J	0.60 U	2.1 J
Total tetrachlorodibenzofuran (TCDF)	pg/g	320000 J	130 J	570 J	300 J	500 J	380 J	490 J	64 J	26 J	38 J	460 J
Total tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	63000 J	25 J	120 J	47 J	81 J	68 J	92 J	12 J	8.0 J	9.6 J	100 J
TEQ												
Total WHO Dioxin TEQ(Human/Mammal)(ND=0)	pg/g	86000 J	32 J	140 J	64 J	100 J	91 J	110 J	16 J	7.3 J	12 J	120 J
Total WHO Dioxin TEQ(Human/Mammal)(ND=0.5)	pg/g	86000 J	32 J	140 J	64 J	100 J	91 J	110 J	16 J	7.3 J	12 J	120 J

Notes:
- U - Not detected at the associated reporting limit
- J - Estimated concentration
- UJ - Not detected; associated reporting limit is estimated
- J- - Estimated concentration, result may be biased low
- J+ - Estimated concentration, result may be biased high
- TEQ - Toxicity Equivalent Quotient
- ft bgs - Feet below ground surface
- pg/g - picogram per grams

Table 2-4

Supplemental Design Investigation Analytical Results - Northern Impoundment
Pre- Final 90% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Sample Location: Sample Identification: Sample Date: Sample Depth: Parameters	Units	SJSB078 11215702-072121-SS-SJSB078 (16-18)-R 07/21/2021 (16-18) ft bgs Lab Duplicate	SJSB078 11215702-072121-SS-SJSB078(18-20) 07/21/2021 (18-20) ft bgs	SJSB078 11215702-072121-SS-SJSB078(20-22) 07/21/2021 (20-22) ft bgs	SJSB078 11215702-072121-SS-SJSB078 (20-22)-R 07/21/2021 (20-22) ft bgs Lab Duplicate	SJSB078 11215702-072121-SS-SJSB078(22-24) 07/21/2021 (22-24) ft bgs	SJSB079 11215702-072521-SS-SJSB079(0-2) 07/25/2021 (0-2) ft bgs	SJSB079 11215702-072521-SS-SJSB079(2-4) 07/25/2021 (2-4) ft bgs	SJSB079 11215702-072521-SS-SJSB079(4-6) 07/25/2021 (4-6) ft bgs	SJSB079 11215702-072521-SS-SJSB079(6-8) 07/25/2021 (6-8) ft bgs	SJSB079 11215702-072521-SS-SJSB079(8-10) 07/25/2021 (8-10) ft bgs	SJSB079 11215702-072521-DUP-7 07/25/2021 (8-10) ft bgs Field Duplicate
Dioxins/Furans												
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	pg/g	3.7 U	0.88 U	4.5 J	4.1 J	0.88 U	620	1500	950	1200	1200	1700
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	pg/g	240	130	240	230	63	5100	12000	5600	6500	9000	11000
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	pg/g	4.1 J	0.35 U	7.3	6.4	0.35 U	1200	2800	1900	2000	2100	2800
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	8.8	6.3	12	10	2.6 U	410	880	340	470	570	850
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	pg/g	1.2 U	0.034 U	2.3 J	2.2 U	0.036 U	420	1000	620	650	640	1300
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	10	0.22 J	22	23	0.070 J	4800	10000	6500	6500	7000	20000
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.25 U	0.31 U	0.31 U	0.32 U	0.045 U	2.0 U	6.4 J	2.2 U	7.0 J	4.9 J	3.8 J
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	3.2 J	0.028 U	5.6 J	5.3 J	0.030 U	1200	2500	1700	1700	1900	4400
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.30 U	0.25 J	0.37 J	0.34 J	0.049 U	13 J	27 J	15 J	31 J	32 J	39 J
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	pg/g	0.20 U	0.043 J	0.46 J	0.47 J	0.057 J	84 J	130	87 J	100	97 J	300
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.39 U	0.51 J	0.41 J	0.39 U	0.27 J	7.9 J	15 J	2.1 U	9.0 J	9.9 J	12 J
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	9.1	0.19 J	16	13	0.034 U	3600	5200	4100	4200	4500 J	26000 J
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	0.89 J	0.10 J	1.6 J	1.3 J	0.050 U	210	340	200	330	290	320 J
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.42 J	0.11 U	0.73 J	0.68 J	0.024 U	170	260	210	190	230 J	780 J
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	5.1 J	0.096 J	9.5	8.4	0.033 U	2000	2600	1800	2400	2400 J	11000 J
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	pg/g	280	5.0	570 J	450	0.57 J	77000 J	120000 J	70000 J	130000 J	120000 J	120000 J
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	110	1.8	190	150	0.25 J	23000 J	37000 J	19000 J	35000 J	31000 J	31000 J
Total heptachlorodibenzofuran (HpCDF)	pg/g	7.9 J	0.14 J	13 J	11 J	0.10 J	1900 J	4500 J	3000 J	3300 J	3400 J	5300 J
Total heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	28 J	25 J	32 J	32 J	12 J	750 J	1600 J	720 J	1000 J	1200 J	1800 J
Total hexachlorodibenzofuran (HxCDF)	pg/g	16 J	0.28 J	33 J	33 J	0.13 J	7100 J	15000 J	9400 J	9700 J	10000 J	30000 J
Total hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	7.2 J	8.8 J	7.4 J	8.1 J	5.0 J	80 J	160 J	80 J	140 J	140 J	170 J
Total pentachlorodibenzofuran (PeCDF)	pg/g	23 J	0.37 J	41 J	34 J	0.034 U	8900 J	12000 J	9200 J	10000 J	11000 J	60000 J
Total pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	2.3 J	1.6 J	3.3 J	2.8 J	1.2 J	210 J	340 J	200 J	330 J	290 J	320 J
Total tetrachlorodibenzofuran (TCDF)	pg/g	580 J	8.2 J	1100 J	840 J	0.92 J	130000 J	220000 J	140000 J	240000 J	210000 J	240000 J
Total tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	120 J	2.9 J	210 J	170 J	1.4 J	25000 J	41000 J	21000 J	38000 J	33000 J	34000 J
TEQ												
Total WHO Dioxin TEQ(Human/Mammal)(ND=0)	pg/g	140 J	2.6 J	260 J	200 J	0.37 J	32000 J	52000 J	28000 J	50000 J	45000 J	50000 J
Total WHO Dioxin TEQ(Human/Mammal)(ND=0.5)	pg/g	140 J	2.7 J	260 J	200 J	0.42 J	32000 J	52000 J	28000 J	50000 J	45000 J	50000 J

Notes:
- U - Not detected at the associated reporting limit
- J - Estimated concentration
- UJ - Not detected; associated reporting limit is estimated
- J- - Estimated concentration, result may be biased low
- J+ - Estimated concentration, result may be biased high
- TEQ - Toxicity Equivalent Quotient
- ft bgs - Feet below ground surface
- pg/g - picogram per grams

Table 2-4

Supplemental Design Investigation Analytical Results - Northern Impoundment
Pre- Final 90% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Sample Location:		SJSB079	SJSB079	SJSB079	SJSB079	SJSB080	SJSB080	SJSB080	SJSB080	SJSB080	SJSB080	SJSB080
Sample Identification:		11215702-072521-SS-SJSB079(10-12)	11215702-072521-SS-SJSB079(12-14)	11215702-072521-SS-SJSB079(14-16)	11215702-072521-SS-SJSB079(16-18)	11215702-072221-SS-SJSB080(0-2)	11215702-072221-SS-SJSB080(2-4)	11215702-072221-SS-SJSB080(4-6)	11215702-072221-SS-SJSB080(6-8)	11215702-072221-SS-SJSB080(8-10)	11215702-072221-SS-SJSB080(10-12)	11215702-072221-SS-SJSB080(12-14)
Sample Date:	Units	07/25/2021	07/25/2021	07/25/2021	07/25/2021	07/22/2021	07/22/2021	07/22/2021	07/22/2021	07/22/2021	07/22/2021	07/22/2021
Sample Depth:		(10-12) ft bgs	(12-14) ft bgs	(14-16) ft bgs	(16-18) ft bgs	(0-2) ft bgs	(2-4) ft bgs	(4-6) ft bgs	(6-8) ft bgs	(8-10) ft bgs	(10-12) ft bgs	(12-14) ft bgs
Parameters												
Dioxins/Furans												
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	pg/g	4.5 J	0.10 U	0.88 J	0.15 U	370	370	220	68	25	0.37 U	0.32 U
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	pg/g	100	100	460	240	7000 J	3900	3100	1500	750	57	58
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	pg/g	6.9	0.24 J	0.68 J	0.068 U	990	710	660	150	57	0.58 U	0.16 U
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	5.2 J	4.1 J	21	14	530	280	210	120	57	1.9 J	2.9 J
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	pg/g	2.3 J	0.11 J	0.35 J	0.060 U	300	210	170	50	16	0.13 U	0.061 U
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	23	1.4 J	2.0 J	0.049 U	3100	2100	1700	610	160	1.5 J	0.23 U
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.070 U	0.11 U	0.19 U	0.18 U	3.0 J	2.0 J	1.3 J	0.79 J	0.49 U	0.20 U	0.17 U
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	6.8	0.36 J	0.65 J	0.045 U	840	590	460	150	44	0.42 J	0.092 U
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.075 U	0.12 U	0.23 U	0.21 U	14	8.0 J	5.7 J	3.3 J	1.4 J	0.070 U	0.073 U
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	pg/g	0.61 U	0.038 U	0.11 U	0.042 U	45	32	21	10	2.4 J	0.11 U	0.028 U
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.067 U	0.11 U	1.4 J	0.18 U	6.3 J	4.3 J	3.3 J	0.24 U	0.81 J	0.062 U	0.22 U
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	14	1.8 J	1.7 J	0.16 U	1900	1300	810	360	110	0.98 J	0.13 J
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	1.4 J	0.11 U	0.16 U	0.37 U	140	94	58	23	9.0	0.055 U	0.055 U
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.58 J	0.042 U	0.10 U	0.044 U	92	66	38	19	4.7 J	0.038 U	0.027 U
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	8.1	0.70 J	1.1 J	0.16 U	1000	690	420	180	59	0.46 J	0.042 U
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	pg/g	380	6.4	30	1.1 J	47000 J	28000 J	19000 J	7500 J	3300 J	26	2.7
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	140	1.9	12	0.14 U	17000 J	11000 J	6900 J	2300 J	1100 J	9.0	1.1 J
Total heptachlorodibenzofuran (HpCDF)	pg/g	12 J	0.35 J	1.0 J	0.27 U	1500 J	1100 J	930 J	240 J	90 J	0.89 J	0.16 J
Total heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	13 J	19 J	80 J	54 J	1000 J	540 J	420 J	230 J	140 J	8.9 J	11 J
Total hexachlorodibenzofuran (HxCDF)	pg/g	35 J	1.7 J	2.6 J	0.19 U	4600 J	3200 J	2500 J	900 J	240 J	2.2 J	0.32 J
Total hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	3.6 J	12 J	27 J	15 J	99 J	58 J	44 J	25 J	19 J	6.0 J	5.8 J
Total pentachlorodibenzofuran (PeCDF)	pg/g	33 J	3.8 J	2.8 J	0.56 U	4500 J	3000 J	1900 J	830 J	260 J	2.2 J	0.13 J
Total pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	1.8 J	0.11 U	3.5 U	2.4 U	170 J	110 J	67 J	27 J	12 J	1.6 J	1.3 J
Total tetrachlorodibenzofuran (TCDF)	pg/g	730 J	9.7 J	53 J	1.1 J	71000 J	51000 J	33000 J	13000 J	6200 J	48 J	4.5 J
Total tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	150 J	4.5 J	12 J	1.0 U	19000 J	12000 J	7600 J	2500 J	1300 J	14 J	2.2 J
TEQ												
Total WHO Dioxin TEQ(Human/Mammal)(ND=0)	pg/g	190 J	3.1 J	16 J	0.32 J	23000 J	14000 J	9200 J	3200 J	1500 J	12 J	1.4 J
Total WHO Dioxin TEQ(Human/Mammal)(ND=0.5)	pg/g	190 J	3.1 J	16 J	0.64 J	23000 J	14000 J	9200 J	3200 J	1500 J	12 J	1.5 J

Notes:
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- J - Estimated concentration
- UJ - Not detected; associated reporting limit is estimated
- J- - Estimated concentration, result may be biased low
- J+ - Estimated concentration, result may be biased high
- TEQ - Toxicity Equivalent Quotient
- ft bgs - Feet below ground surface
- pg/g - picogram per grams

Table 2-4

Supplemental Design Investigation Analytical Results - Northern Impoundment
Pre- Final 90% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Sample Location: Sample Identification: Sample Date: Sample Depth: Parameters	Units	SJSB080 11215702-072221-SS-SJSB080(14-16) 07/22/2021 (14-16) ft bgs	SJSB080 11215702-072221-SS-SJSB080(16-18) 07/22/2021 (16-18) ft bgs	SJSB080 11215702-072221-DUP-4 07/22/2021 (16-18) ft bgs Field Duplicate	SJSB081 11215702-080521-BN-SJSB081(0-2) 08/05/2021 (0-2) ft bgs	SJSB081 11215702-080521-BN-SJSB081(2-4) 08/05/2021 (2-4) ft bgs	SJSB081 11215702-080521-BN-SJSB081(4-6) 08/05/2021 (4-6) ft bgs	SJSB081 11215702-080521-BN-SJSB081(6-8) 08/05/2021 (6-8) ft bgs	SJSB081 11215702-080521-BN-DUP-13 08/05/2021 (6-8) ft bgs Field Duplicate	SJSB081 11215702-080521-BN-SJSB081(8-10) 08/05/2021 (8-10) ft bgs	SJSB081 11215702-080521-BN-SJSB081 (8-10)-R 08/05/2021 (8-10) ft bgs Lab Duplicate	SJSB081 11215702-080521-BN-SJSB081(10-12) 08/05/2021 (10-12) ft bgs
Dioxins/Furans												
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	pg/g	0.32 U	0.89 U	0.32 U	110 J	730 J+	460	0.85 U	0.72 U	510	320	3.4 J
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	pg/g	120	72	72	2700	2500	2600	340	320	2400	2300	240
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	pg/g	0.13 U	0.55 U	0.18 U	66 J	1600	830	0.35 J	0.30 U	1000 J	560 J	7.4
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	6.4	3.5 J	3.5 J	110	230	180	15	14	130	110	12
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	pg/g	0.055 U	0.22 J	0.051 U	19 J	530 J+	310	0.10 U	0.063 U	400 J	230 J	2.8 J
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.096 U	1.3 J	0.35 J	220	4700	3100 J	0.60 J	0.29 J	3500 J	1900 J	41 J
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.12 U	0.28 U	0.22 U	0.99 U	4.9 J	1.8 U	0.38 J	0.33 U	1.2 U	3.9 U	0.27 J
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.035 U	0.42 J	0.10 U	67 J	1500	850	0.20 J	0.086 J	920 J	400 J	10
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.12 U	0.18 J	0.077 U	1.1 U	14 J	13 J	0.46 J	0.41 U	1.3 U	5.6 J	0.54 J
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	pg/g	0.11 U	0.31 U	0.023 U	1.4 U	84 J	42	0.16 J	0.11 U	56 J	27 J	0.87 J
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.46 J	0.27 U	0.27 U	0.97 U	7.1 J	9.3 J	0.86 J	0.80 U	4.5 J	4.8 U	1.1 J
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	0.038 U	1.1 J	0.27 J	180	4200	2200	0.52 J	0.27 J	2300 J	800 J	38 J
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	0.073 U	0.20 J	0.055 U	14 J	290	260	0.12 U	0.085 U	110	54 J	1.5 J
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.028 U	0.059 J	0.022 U	8.1 J	180 J	94	0.089 J	0.040 U	96 J	45 J	1.2 J
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	0.038 U	0.66 J	0.10 J	110	2200	1400	0.28 J	0.056 U	1000 J	450 J	14
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	pg/g	1.1 U	27 J	6.3 J	5600	93000 J	92000 J	8.0	3.2	45000 J	23000 J	530 J
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	0.34 U	9.1 J	2.1 J	1700	36000 J	37000 J	3.8	1.4	13000 J	7700 J	210
Total heptachlorodibenzofuran (HpCDF)	pg/g	0.095 J	1.0 J	0.29 J	110 J	2500 J	1300 J	0.35 J	0.73 J	1700 J	930 J	12 J
Total heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	24 J	12 J	13 J	360 J	470 J	380 J	52 J	58 J	310 J	290 J	48 J
Total hexachlorodibenzofuran (HxCDF)	pg/g	0.17 J	2.3 J	0.45 J	350 J	7400 J	4700 J	1.1 J	0.45 J	5200 J	2600 J	61 J
Total hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	8.7 J	3.6 J	4.5 J	59 J	99 J	79 J	14 J	16 J	57 J	63 J	16 J
Total pentachlorodibenzofuran (PeCDF)	pg/g	0.038 U	2.4 J	0.49 J	430 J	10000 J	5700 J	0.88 J	0.33 J	5100 J	2000 J	72 J
Total pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	2.1 J	0.81 J	0.93 J	14 J	290 J	260 J	0.68 J	2.7 J	110 J	64 J	1.5 J
Total tetrachlorodibenzofuran (TCDF)	pg/g	1.9 J	50 J	11 J	12000 J	170000 J	150000 J	13 J	5.4 J	70000 J	39000 J	1100 J
Total tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	2.6 J	10 J	2.6 J	1900 J	40000 J	41000 J	3.8 J	3.5 J	14000 J	8400 J	230 J
TEQ												
Total WHO Dioxin TEQ(Human/Mammal)(ND=0)	pg/g	0.15 J	13 J	2.9 J	2300 J	47000 J	47000 J	5.2 J	2.0 J	19000 J	11000 J	280 J
Total WHO Dioxin TEQ(Human/Mammal)(ND=0.5)	pg/g	0.44 J	13 J	3.0 J	2300 J	47000 J	47000 J	5.3 J	2.1 J	19000 J	11000 J	280 J

Notes:
- U - Not detected at the associated reporting limit
- J - Estimated concentration
- UJ - Not detected; associated reporting limit is estimated
- J- - Estimated concentration, result may be biased low
- J+ - Estimated concentration, result may be biased high
- TEQ - Toxicity Equivalent Quotient
- ft bgs - Feet below ground surface
- pg/g - picogram per grams

Table 2-4

Supplemental Design Investigation Analytical Results - Northern Impoundment
Pre- Final 90% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Sample Location: Sample Identification: Sample Date: Sample Depth: Parameters	Units	SJSB081 11215702-080521-BN-SJSB081 (10-12)-R 08/05/2021 (10-12) ft bgs Lab Duplicate	SJSB081 11215702-080521-BN-SJSB081(12-14) 08/05/2021 (12-14) ft bgs	SJSB081 11215702-080521-BN-SJSB081(14-16) 08/05/2021 (14-16) ft bgs	SJSB081 11215702-080521-BN-SJSB081(16-18) 08/05/2021 (16-18) ft bgs	SJSB082 11215702-080921-BN-SJSB082(0-2) 08/09/2021 (0-2) ft bgs	SJSB082 11215702-080921-BN-SJSB082(2-4) 08/09/2021 (2-4) ft bgs	SJSB082 11215702-080921-BN-SJSB082(4-6) 08/09/2021 (4-6) ft bgs	SJSB082 11215702-080921-BN-SJSB082(6-8) 08/09/2021 (6-8) ft bgs	SJSB082 11215702-080921-DUP-16 08/09/2021 (6-8) ft bgs Field Duplicate	SJSB082 11215702-080921-BN-SJSB082(8-10) 08/09/2021 (8-10) ft bgs	SJSB082 11215702-080921-BN-SJSB082 (8-10)-R 08/09/2021 (8-10) ft bgs Lab Duplicate
Dioxins/Furans												
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	pg/g	2.3 U	0.45 U	0.52 U	0.45 U	220 J	8.3 J	17	0.30 U	0.29 U	3.8 J	2.2 U
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	pg/g	160	620	690	210	3100	230	350	300	210	940	630
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	pg/g	4.4 J	0.20 U	0.30 U	0.18 U	300	19	43	0.33 U	0.28 U	2.8 J	0.93 U
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	8.2	31	35	11	160	7.0	15	16	8.6	30	25
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	pg/g	1.9 U	0.062 U	0.068 U	0.071 U	84 J	7.9	16	0.15 U	0.15 U	0.86 U	0.36 U
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	18 J	0.25 J	0.16 J	0.12 J	960	69 J	170	0.70 J	0.58 J	8.5	2.9 J
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.35 U	0.64 U	0.61 U	0.29 U	3.0 U	0.33 U	0.44 U	0.40 U	0.33 U	0.48 U	0.50 U
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	4.2 J	0.17 J	0.10 J	0.052 U	260	17	43	0.24 J	0.20 J	2.3 J	0.67 J
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.36 J	0.82 J	0.71 J	0.26 U	7.1 J	0.40 J	0.74 J	0.43 J	0.27 J	0.76 J	0.64 J
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	pg/g	0.41 U	0.20 U	0.18 U	0.11 U	15 J	1.4 J	3.0 J	0.15 U	0.083 U	0.25 U	0.14 U
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.76 U	2.7 J	3.1 J	1.1 J	5.0 U	0.50 U	0.60 U	0.87 J	0.50 U	1.7 J	1.5 J
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	12 J	0.22 J	0.068 U	0.17 J	1100	47	130	0.53 J	0.39 J	6.9	2.1 J
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	1.0 J	0.31 J	0.15 U	0.096 U	93 J	3.1 J	9.3	0.22 J	0.15 J	0.95 J	0.37 J
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.57 J	0.052 U	0.040 U	0.036 U	34 J	2.0 J	4.8 J	0.096 J	0.077 J	0.31 J	0.10 U
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	7.0	0.068 U	0.069 U	0.052 U	1200	22	71	0.31 J	0.24 J	4.6 J	1.5 J
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	pg/g	410	4.3	0.85 J	0.87 J	44000 J	1300 J	3900 J	14	9.7	320 J	110 J
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	150	1.1 J	0.47 J	0.39 J	10000	520 J	1500 J	5.5	3.9	84 J	29 J
Total heptachlorodibenzofuran (HpCDF)	pg/g	7.5 J	0.20 J	0.30 J	0.14 J	450 J	31 J	70 J	0.54 J	0.49 J	4.7 J	1.8 J
Total heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	32 J	140 J	150 J	56 J	390 J	35 J	51 J	49 J	33 J	100 J	80 J
Total hexachlorodibenzofuran (HxCDF)	pg/g	26 J	0.61 J	0.44 J	0.20 J	1500 J	100 J	250 J	1.2 J	0.94 J	13 J	4.4 J
Total hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	12 J	40 J	48 J	20 J	70 J	14 J	16 J	12 J	8.9 J	23 J	20 J
Total pentachlorodibenzofuran (PeCDF)	pg/g	29 J	0.22 J	0.069 U	0.17 J	3500 J	110 J	320 J	1.2 J	0.63 J	19 J	5.7 J
Total pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	3.3 J	6.4 J	8.7 J	3.7 J	110 J	6.0 J	14 J	2.0 J	1.5 J	5.4 J	3.7 J
Total tetrachlorodibenzofuran (TCDF)	pg/g	740 J	4.6 J	1.8 J	1.6 J	90000 J	2600 J	8200 J	26 J	18 J	610 J	210 J
Total tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	170 J	7.1 J	8.2 J	3.1 J	11000 J	570 J	1700 J	7.3 J	5.6 J	94 J	34 J
TEQ												
Total WHO Dioxin TEQ(Human/Mammal)(ND=0)	pg/g	200 J	2.7 J	1.5 J	0.78 J	15000 J	670 J	2000 J	7.7 J	5.4 J	120 J	42 J
Total WHO Dioxin TEQ(Human/Mammal)(ND=0.5)	pg/g	200 J	2.8 J	1.7 J	0.87 J	15000 J	670 J	2000 J	7.7 J	5.4 J	120 J	42 J

Notes:
U - Not detected at the associated reporting limit
J - Estimated concentration
UJ - Not detected; associated reporting limit is estimated
J- - Estimated concentration, result may be biased low
J+ - Estimated concentration, result may be biased high
TEQ - Toxicity Equivalent Quotient
ft bgs - Feet below ground surface
pg/g - picogram per grams

Table 2-4

Supplemental Design Investigation Analytical Results - Northern Impoundment
Pre- Final 90% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Sample Location: Sample Identification: Sample Date: Sample Depth: Parameters	Units	SJSB082 11215702-080921-BN-SJSB082(10-12) 08/09/2021 (10-12) ft bgs	SJSB082 11215702-080921-BN-SJSB082(12-14) 08/09/2021 (12-14) ft bgs	SJSB082 11215702-080921-BN-SJSB082(14-16) 08/09/2021 (14-16) ft bgs	SJSB082 11215702-080921-BN-SJSB082(16-18) 08/09/2021 (16-18) ft bgs	SJSB083 11215702-072221-BN-SJSB083(0-2) 07/22/2021 (0-2) ft bgs	SJSB083 11215702-072221-BN-SJSB083(2-4) 07/22/2021 (2-4) ft bgs	SJSB083 11215702-072221-BN-SJSB083(4-6) 07/22/2021 (4-6) ft bgs	SJSB083 11215702-072221-BN-SJSB083(6-8) 07/22/2021 (6-8) ft bgs	SJSB083 11215702-072221-BN-SJSB083(8-10) 07/22/2021 (8-10) ft bgs	SJSB083-Waste 11215702-072221-BN-SJSB083(8-10)-WC 07/22/21 (8-10) ft bgs	SJSB083 11215702-072221-BN-SJSB083(10-12) 07/22/2021 (10-12) ft bgs
Dioxins/Furans												
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	pg/g	0.26 U	0.55 U	0.32 U	0.28 J	510	35	3.3 J	0.078 U	530	370	6.5 J
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	pg/g	980	600	1000	190	2400	1700	1700	1000	3800	4100	1600
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	pg/g	0.22 U	0.43 U	0.28 U	0.27 J	750	69	0.44 J	0.23 J	450	140	12
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	36	23	42	6.8	160	71	77	51	160	180	62
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	pg/g	0.033 U	0.058 U	0.15 U	0.16 J	250	23	0.051 U	0.059 U	160	46	5.2 J
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.30 J	0.24 U	0.29 U	0.40 J	2800	280	1.0 J	0.64 J	1700	500	44
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.53 U	0.49 U	0.69 U	0.29 J	3.2 J	0.31 U	0.93 J	0.78 J	0.70 U	2.1 J	0.89 J
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.13 J	0.047 U	0.12 J	0.13 J	760	75	0.36 J	0.041 U	410	140	12
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.74 J	0.57 J	0.87 J	0.20 J	11 J	0.39 U	1.9 J	1.4 J	8.0 J	7.2 J	1.1 J
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	pg/g	0.086 U	0.092 U	0.12 U	0.073 J	49 J	5.0 J	0.024 U	0.038 U	28 J	9.8 J	0.29 U
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	2.0 J	1.7 J	2.2 J	0.67 J	5.5 J	3.2 J	4.3 J	3.2 J	5.7 J	8.8 J	3.2 J
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	0.23 J	0.051 U	0.20 J	0.12 J	2100	200	0.62 J	0.74 J	980	330	16
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	0.25 J	0.21 J	0.30 J	0.054 U	210	12	0.15 U	0.15 U	91	31	1.2 J
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.033 J	0.032 U	0.061 J	0.018 U	87 J	9.0	0.024 U	0.042 U	44	16	0.30 U
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	0.15 J	0.053 U	0.16 J	0.034 U	1300	98	0.34 J	0.079 U	560	190	8.1
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	pg/g	6.0	0.50 U	5.4	1.5	220000	4400	16	29	38000	11000	430
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	2.2	0.26 U	1.7 J	0.50 J	23000	1700	5.9	9.7	11000	3100	140
Total heptachlorodibenzofuran (HpCDF)	pg/g	0.18 J	0.43 J	0.50 J	0.49 J	1200 J	110 J	0.44 J	0.23 J	740 J	240 J	20 J
Total heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	130 J	91 J	180 J	31 J	380 J	190 J	220 J	120 J	460 J	490 J	180 J
Total hexachlorodibenzofuran (HxCDF)	pg/g	0.55 J	0.33 J	0.65 J	0.60 J	4200 J	420 J	1.4 J	0.64 J	2400 J	740 J	59 J
Total hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	28 J	24 J	50 J	12 J	72 J	28 J	67 J	37 J	71 J	92 J	42 J
Total pentachlorodibenzofuran (PeCDF)	pg/g	0.55 J	0.054 U	0.51 J	0.12 J	5200 J	460 J	0.96 J	0.74 J	2400 J	770 J	34 J
Total pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	5.4 J	4.2 J	8.7 J	2.7 J	210 J	14 J	11 J	6.5 J	91 J	37 J	7.6 J
Total tetrachlorodibenzofuran (TCDF)	pg/g	12 J	0.87 J	10 J	2.7 J	160000 J	8200 J	29 J	57 J	67000 J	21000 J	820 J
Total tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	6.1 J	2.8 J	7.4 J	2.5 J	25000 J	1800 J	7.8 J	9.7 J	12000 J	3400 J	160 J
TEQ												
Total WHO Dioxin TEQ(Human/Mammal)(ND=0)	pg/g	4.1 J	0.85 J	3.6 J	0.96 J	46000 J	2200 J	9.8 J	14 J	15000 J	4400 J	200 J
Total WHO Dioxin TEQ(Human/Mammal)(ND=0.5)	pg/g	4.1 J	1.1 J	3.7 J	0.99 J	46000 J	2200 J	9.8 J	14 J	15000 J	4400 J	200 J

Notes:
- U - Not detected at the associated reporting limit
- J - Estimated concentration
- UJ - Not detected; associated reporting limit is estimated
- J- - Estimated concentration, result may be biased low
- J+ - Estimated concentration, result may be biased high
- TEQ - Toxicity Equivalent Quotient
- ft bgs - Feet below ground surface
- pg/g - picogram per grams

Table 2-4

Supplemental Design Investigation Analytical Results - Northern Impoundment
Pre- Final 90% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Sample Location:	Units	SJSB083-Waste	SJSB083	SJSB083	SJSB083	SJSB083	SJSB084	SJSB084	SJSB084	SJSB084	SJSB084	SJSB084
Sample Identification:		11215702-072221-BN-SJSB083(10-12)-WC	11215702-072221-BN-SJSB083(12-14)	11215702-072221-BN-SJSB083(14-16)	11215702-072221-BN-SJSB083(16-18)	11215702-072221-BN-SJSB083(18-20)	11215702-072021-BN-SJSB084(0-2)	11215702-072021-BN-SJSB084(2-4)	11215702-072021-BN-SJSB084(4-6)	11215702-072021-BN-SJSB084(6-8)	11215702-072021-BN-SJSB084(8-10)	11215702-072021-BN-SJSB084(10-12)
Sample Date:		07/22/21	07/22/2021	07/22/2021	07/22/2021	07/22/2021	07/20/2021	07/20/2021	07/20/2021	07/20/2021	07/20/2021	07/20/2021
Sample Depth:		(10-12) ft bgs	(12-14) ft bgs	(14-16) ft bgs	(16-18) ft bgs	(18-20) ft bgs	(0-2) ft bgs	(2-4) ft bgs	(4-6) ft bgs	(6-8) ft bgs	(8-10) ft bgs	(10-12) ft bgs
Parameters												
Dioxins/Furans												
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	pg/g	0.14 U	2.3 J	0.080 U	7.3 J	0.34 U	570	100	6.7 U	1.0 U	6.9 U	1.4 U
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	pg/g	1100	1300	980	360	19 J	7000	2500	2300	1600	1900	1400
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	pg/g	1.6 J	1.6 J	0.40 J	0.30 J	0.29 U	320	65	1.2 J	0.45 J	0.27 J	0.23 J
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	39	51	40	19	1.1 U	270	77	84	63	71	52
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	pg/g	0.68 J	0.32 J	0.049 U	0.036 U	0.11 U	110	19	0.46 J	0.076 U	0.080 U	0.062 U
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	5.5 J	3.1 J	0.88 J	0.029 U	0.75 J	1100	200	2.8 J	1.4 J	0.25 J	0.24 J
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.26 U	0.54 J	0.42 J	0.35 J	0.073 U	4.3 J	1.2 J	0.85 J	0.92 J	0.78 J	0.88 J
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	1.3 J	0.76 J	0.27 J	0.029 U	0.23 U	300	52	0.85 J	0.57 J	0.15 J	0.055 U
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.30 U	1.1 J	0.93 J	0.099 U	0.12 U	11	2.4 J	2.0 J	1.6 J	1.7 J	1.1 J
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	pg/g	0.29 J	0.053 U	0.034 U	0.028 U	0.16 U	20	4.6 U	1.2 U	1.1 U	1.0 U	1.1 U
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	2.2 J	2.7 J	2.4 J	1.3 J	0.13 U	8.6 J	2.9 J	4.2 J	3.1 J	3.6 J	2.8 J
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	3.4 J	1.9 J	0.53 J	0.039 U	0.49 J	860	220	2.4 J	1.6 J	0.63 J	0.64 J
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	0.58 J	0.14 U	0.16 U	0.11 U	0.14 U	82	21	0.52 J	0.14 U	0.34 J	0.40 J
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.079 U	0.053 U	0.034 U	0.028 U	0.082 U	35 J	6.7 J	0.092 J	0.098 J	0.049 U	0.042 U
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	2.0 J	0.97 J	0.37 J	0.043 U	0.38 J	530	200	1.6 J	0.89 J	0.21 J	0.21 J
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	pg/g	95	50	16	1.2 J	12	18000	8100	120	52	8.4	18
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	34	17	6.0	0.11 U	3.3	9600	2300	29	15	2.8	4.0
Total heptachlorodibenzofuran (HpCDF)	pg/g	2.3 J	2.3 J	0.40 J	0.82 J	0.51 J	530 J	110 J	2.5 J	0.67 J	1.0 J	0.44 J
Total heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	120 J	170 J	130 J	54 J	3.3 J	770 J	270 J	240 J	200 J	210 J	190 J
Total hexachlorodibenzofuran (HxCDF)	pg/g	7.1 J	3.8 J	1.1 J	0.029 U	1.4 J	1600 J	300 J	5.8 J	3.4 J	1.4 J	1.4 J
Total hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	30 J	39 J	38 J	12 J	1.5 J	130 J	48 J	63 J	47 J	53 J	50 J
Total pentachlorodibenzofuran (PeCDF)	pg/g	6.6 J	2.9 J	0.90 J	0.043 U	1.4 J	2200 J	630 J	6.2 J	3.1 J	1.1 J	1.1 J
Total pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	6.0 J	6.2 J	7.6 J	1.6 J	0.56 J	100 J	29 J	11 J	8.4 J	11 J	8.9 J
Total tetrachlorodibenzofuran (TCDF)	pg/g	180 J	99 J	31 J	1.3 J	24 J	62000 J	22000 J	230 J	100 J	17 J	33 J
Total tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	38 J	17 J	8.5 J	0.32 U	3.8 J	11000 J	2600 J	38 J	22 J	9.0 J	10 J
TEQ												
Total WHO Dioxin TEQ(Human/Mammal)(ND=0)	pg/g	47 J	24 J	8.9 J	0.59 J	4.7 J	12000 J	3200 J	45 J	22 J	6.0 J	7.7 J
Total WHO Dioxin TEQ(Human/Mammal)(ND=0.5)	pg/g	47 J	24 J	9.0 J	0.72 J	4.8 J	12000 J	3200 J	45 J	23 J	6.1 J	7.8 J

Notes:
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- UJ - Not detected; associated reporting limit is estimated
- J- - Estimated concentration, result may be biased low
- J+ - Estimated concentration, result may be biased high
- TEQ - Toxicity Equivalent Quotient
- ft bgs - Feet below ground surface
- pg/g - picogram per grams

Table 2-4

Supplemental Design Investigation Analytical Results - Northern Impoundment
Pre- Final 90% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Sample Location: Sample Identification: Sample Date: Sample Depth: Parameters	Units	SJSB084 11215702-072021-BN-SJSB084(12-14) 07/20/2021 (12-14) ft bgs	SJSB084 11215702-072021-BN-SJSB084(14-16) 07/20/2021 (14-16) ft bgs	SJSB084 11215702-072021-BN-SJSB084(16-18) 07/20/2021 (16-18) ft bgs	SJSB085 11215702-072321-BN-SJSB085(0-2) 07/23/2021 (0-2) ft bgs	SJSB085 11215702-072321-BN-SJSB085(2-4) 07/23/2021 (2-4) ft bgs	SJSB085 11215702-072321-BN-SJSB085(4-6) 07/23/2021 (4-6) ft bgs	SJSB085 11215702-072321-BN-SJSB085(6-8) 07/23/2021 (6-8) ft bgs	SJSB085 11215702-072321-BN-SJSB085 (6-8)-R 07/23/2021 (6-8) ft bgs Lab Duplicate	SJSB085 11215702-072321-BN-SJSB085(8-10) 07/23/2021 (8-10) ft bgs	SJSB085 11215702-072321-BN-SJSB085(10-12) 07/23/2021 (10-12) ft bgs	SJSB085 11215702-072321-BN-SJSB085(12-14) 07/23/2021 (12-14) ft bgs
Dioxins/Furans												
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	pg/g	0.84 U	1.7 U	2.8 U	770	13 J	0.88 U	2.5 J	0.31 U	1.1 U	0.66 U	0.64 U
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	pg/g	1700	1300	1800	5300	1600	1000	2500 J	810 J	750	2100	1700
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	pg/g	0.11 U	0.24 J	0.72 J	1200	16	0.64 U	1.3 J	0.49 U	1.0 J	0.24 U	0.20 U
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	62	56	72	300	59	34	72 J	30 J	24	82	73
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	pg/g	0.12 U	0.087 U	0.10 U	380	5.4 J	0.20 U	0.40 U	0.065 U	0.26 U	0.048 U	0.10 U
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.40 J	0.19 J	0.44 J	3600	54	2.0 J	3.5 J	0.37 U	2.5 J	0.28 J	0.37 J
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.98 J	1.0 J	0.66 J	4.5 J	0.82 U	0.44 U	0.68 U	0.47 U	0.42 U	1.1 U	0.87 U
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.21 J	0.12 J	0.25 J	960	14	0.59 J	1.0 J	0.14 U	0.77 J	0.11 U	0.12 U
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	1.5 J	1.2 J	1.4 J	16	1.7 J	0.68 J	1.5 J	0.80 J	0.53 J	1.7 J	1.9 J
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	pg/g	1.4 U	1.2 U	1.2 U	49	1.1 J	0.12 U	0.044 U	0.10 U	0.12 U	0.20 U	0.12 U
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	3.5 J	3.4 J	3.9 J	9.4 J	2.8 J	1.5 J	3.1 J	1.4 U	0.98 J	3.8 J	3.6 J
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	0.73 J	0.55 J	0.62 J	2400	45	1.5 J	2.5 J	0.35 J	1.7 J	0.17 J	0.30 J
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	0.54 J	0.16 U	0.14 U	240	4.4 J	0.21 J	0.49 J	0.15 J	0.27 J	0.35 J	0.29 J
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.078 U	0.052 U	0.050 U	100	1.8 J	0.092 J	0.12 J	0.031 U	0.090 J	0.033 U	0.026 U
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	0.23 J	0.11 J	0.15 J	1600	26	0.97 J	1.6 J	0.24 J	0.95 J	0.083 J	0.14 J
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	pg/g	8.1	4.7	3.9	98000 J	1700 J	65	97 J	17 J	55	3.4	12
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	2.8	1.5 J	1.4 J	31000 J	530	19	31 J	4.6 J	18	1.5 J	3.6
Total heptachlorodibenzofuran (HpCDF)	pg/g	0.12 U	0.52 J	1.1 J	1900 J	27 J	1.0 J	2.2 J	0.16 J	1.5 J	0.24 J	0.27 J
Total heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	220 J	200 J	230 J	710 J	150 J	110 J	200 J	83 J	79 J	240 J	200 J
Total hexachlorodibenzofuran (HxCDF)	pg/g	2.0 J	1.7 J	1.9 J	5300 J	82 J	3.1 J	5.2 J	0.61 J	3.9 J	0.59 J	0.62 J
Total hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	58 J	58 J	60 J	130 J	27 J	28 J	45 J	26 J	19 J	57 J	47 J
Total pentachlorodibenzofuran (PeCDF)	pg/g	1.2 J	0.79 J	1.1 J	6200 J	110 J	3.7 J	6.4 J	0.86 J	4.1 J	0.35 J	0.69 J
Total pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	10 J	11 J	13 J	260 J	9.1 J	6.0 J	8.7 J	6.8 J	4.1 J	11 J	9.7 J
Total tetrachlorodibenzofuran (TCDF)	pg/g	16 J	9.8 J	7.9 J	170000 J	2900 J	120 J	180 J	29 J	100 J	5.4 J	21 J
Total tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	12 J	12 J	11 J	34000 J	580 J	24 J	38 J	8.9 J	23 J	7.0 J	9.8 J
TEQ												
Total WHO Dioxin TEQ(Human/Mammal)(ND=0)	pg/g	6.0 J	3.6 J	3.8 J	42000 J	720 J	27 J	44 J	7.4 J	25 J	4.2 J	7.0 J
Total WHO Dioxin TEQ(Human/Mammal)(ND=0.5)	pg/g	6.1 J	3.7 J	3.9 J	42000 J	720 J	27 J	44 J	7.4 J	25 J	4.3 J	7.0 J

Notes:
- U - Not detected at the associated reporting limit
- J - Estimated concentration
- UJ - Not detected; associated reporting limit is estimated
- J- - Estimated concentration, result may be biased low
- J+ - Estimated concentration, result may be biased high
- TEQ - Toxicity Equivalent Quotient
- ft bgs - Feet below ground surface
- pg/g - picogram per grams

Table 2-4

Supplemental Design Investigation Analytical Results - Northern Impoundment
Pre- Final 90% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Sample Location: / Sample Identification: / Sample Date: / Sample Depth:	Units	SJSB085 11215702-072321-BN-SJSB085(14-16) 07/23/2021 (14-16) ft bgs	SJSB085 11215702-072321-BN-SJSB085(16-18) 07/23/2021 (16-18) ft bgs	SJSB086 11215702-080421-BN-SJSB086(0-2) 08/04/2021 (0-2) ft bgs	SJSB086 11215702-080421-BN-SJSB086(2-4) 08/04/2021 (2-4) ft bgs	SJSB086 11215702-080421-BN-SJSB086(4-6) 08/04/2021 (4-6) ft bgs	SJSB086 11215702-080421-BN-SJSB086(6-8) 08/04/2021 (6-8) ft bgs	SJSB086 11215702-080421-BN-DUP-12 08/04/2021 (6-8) ft bgs Field Duplicate	SJSB086 11215702-080421-BN-SJSB086(8-10) 08/04/2021 (8-10) ft bgs	SJSB086 11215702-080421-BN-SJSB086(10-12) 08/04/2021 (10-12) ft bgs	SJSB086 11215702-080421-BN-SJSB086(12-14) 08/04/2021 (12-14) ft bgs	SJSB086 11215702-080421-BN-SJSB086(14-16) 08/04/2021 (14-16) ft bgs
Parameters												
Dioxins/Furans												
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	pg/g	1.8 U	0.52 U	0.45 U	1.9 U	0.48 U	0.45 U	0.45 U	0.45 U	0.45 U	0.45 U	0.45 U
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	pg/g	1600	1300	580	1300	700	880	490	1700	1400	760	1800
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	pg/g	0.85 U	0.28 U	0.31 U	1.0 U	0.18 U	0.18 U	0.27 U	0.18 U	0.25 U	0.27 U	0.18 U
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	66	51	25	69	38	30	17	70	66	35	72
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	pg/g	0.20 U	0.071 U	0.075 U	0.43 J	0.058 U	0.069 U	0.053 U	0.063 U	0.062 U	0.057 U	0.045 U
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.86 J	0.67 J	0.32 J	0.52 J	0.054 J	0.040 U	0.18 J	0.049 U	0.065 U	0.43 J	0.23 J
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.73 U	0.82 U	0.60 U	0.61 U	0.55 U	0.45 U	0.37 U	0.92 U	1.0 U	0.42 U	0.99 U
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.26 U	0.27 J	0.17 J	0.38 J	0.084 J	0.040 U	0.084 J	0.080 J	0.067 U	0.21 J	0.11 J
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	1.6 J	1.2 J	0.94 J	1.4 J	0.97 J	0.67 J	0.48 U	1.8 J	1.8 J	0.78 J	1.7 J
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	pg/g	0.16 U	0.13 U	0.20 U	0.25 U	0.13 U	0.13 U	0.12 U	0.13 U	0.16 U	0.11 U	0.13 U
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	3.6 J	2.8 J	1.9 J	2.9 J	2.0 J	1.3 J	0.89 J	3.9 J	4.2 J	1.7 J	3.6 J
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	0.70 J	0.58 J	0.47 J	0.51 J	0.042 U	0.069 J	0.36 J	0.052 U	0.070 U	0.30 J	0.14 J
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	0.37 J	0.39 J	0.27 J	0.27 J	0.19 J	0.17 J	0.14 J	0.14 U	0.32 J	0.21 J	0.32 J
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.10 J	0.048 U	0.089 U	0.10 U	0.069 U	0.069 U	0.069 U	0.035 U	0.076 U	0.045 U	0.031 U
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	0.33 J	0.31 J	0.21 J	0.18 J	0.042 U	0.051 U	0.11 J	0.050 U	0.072 U	0.18 J	0.053 U
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	pg/g	21	16	11	0.89 J	0.35 U	0.40 U	1.0 J	0.30 U	0.23 U	6.5	1.7
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	6.3	5.2	2.7	0.24 J	0.13 J	0.21 J	0.29 J	0.24 J	0.25 J	1.4 J	0.54 J
Total heptachlorodibenzofuran (HpCDF)	pg/g	1.1 J	0.28 J	0.31 J	2.0 J	0.17 J	0.14 J	0.27 J	0.15 J	0.25 J	0.27 J	0.11 J
Total heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	190 J	170 J	64 J	140 J	83 J	89 J	61 J	230 J	210 J	83 J	200 J
Total hexachlorodibenzofuran (HxCDF)	pg/g	1.4 J	1.1 J	0.78 J	1.5 J	0.32 J	0.19 J	0.45 J	0.26 J	0.23 J	0.72 J	0.48 J
Total hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	46 J	43 J	17 J	24 J	17 J	18 J	14 J	54 J	58 J	17 J	48 J
Total pentachlorodibenzofuran (PeCDF)	pg/g	1.5 J	1.4 J	1.1 J	1.5 J	0.14 J	0.069 J	0.46 J	0.052 U	0.073 U	0.48 J	0.14 J
Total pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	9.3 J	10 J	2.8 J	2.8 J	2.2 J	2.3 J	1.8 J	8.3 J	9.6 J	2.6 J	7.5 J
Total tetrachlorodibenzofuran (TCDF)	pg/g	38 J	29 J	19 J	3.1 J	1.0 J	0.88 J	1.6 J	1.0 J	0.73 J	13 J	3.8 J
Total tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	13 J	12 J	6.1 J	3.5 J	2.4 J	2.3 J	2.3 J	6.7 J	7.9 J	3.5 J	7.4 J
TEQ												
Total WHO Dioxin TEQ(Human/Mammal)(ND=0)	pg/g	11 J	8.7 J	4.9 J	2.3 J	1.2 J	1.1 J	1.0 J	2.0 J	2.3 J	3.2 J	2.9 J
Total WHO Dioxin TEQ(Human/Mammal)(ND=0.5)	pg/g	11 J	7.6 J	5.0 J	2.3 J	1.3 J	1.2 J	1.1 J	2.2 J	2.3 J	3.2 J	2.9 J

Notes:

U - Not detected at the associated reporting limit
J - Estimated concentration
UJ - Not detected; associated reporting limit is estimated
J- - Estimated concentration, result may be biased low
J+ - Estimated concentration, result may be biased high
TEQ - Toxicity Equivalent Quotient
ft bgs - Feet below ground surface
pg/g - picogram per grams

Table 2-4

Supplemental Design Investigation Analytical Results - Northern Impoundment
Pre- Final 90% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Sample Location: Sample Identification: Sample Date: Sample Depth: Parameters	Units	SJSB086 11215702-080421-BN-SJSB086(16-18) 08/04/2021 (16-18) ft bgs	SJSB087 11215702-081021-BN-SJSB087(0-2) 08/10/2021 (0-2) ft bgs	SJSB087 11215702-081021-BN-SJSB087(2-4) 08/10/2021 (2-4) ft bgs	SJSB087 11215702-081021-BN-SJSB087(4-6) 08/10/2021 (4-6) ft bgs	SJSB087 11215702-081021-BN-SJSB087(6-8) 08/10/2021 (6-8) ft bgs	SJSB087 11215702-081021-BN-DUP-17 08/10/2021 (6-8) ft bgs Field Duplicate	SJSB087 11215702-081021-BN-SJSB087(8-10) 08/10/2021 (8-10) ft bgs	SJSB087 11215702-081021-BN-SJSB087(10-12) 08/10/2021 (10-12) ft bgs	SJSB087 11215702-081021-BN-SJSB087(12-14) 08/10/2021 (12-14) ft bgs	SJSB087 11215702-081021-BN-SJSB087 (12-14)-R 08/10/2021 (12-14) ft bgs Lab Duplicate	SJSB087 11215702-081021-BN-SJSB087(14-16) 08/10/2021 (14-16) ft bgs
Dioxins/Furans												
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	pg/g	0.58 U	90	330	48	3.3 U	0.88 U	14	0.88 U	1.9 U	2.6 U	9.9 U
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	pg/g	1100	2000	4300	2600	830	520	990	1100	300	420	930
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	pg/g	0.18 U	150	810	89	0.92 U	0.35 U	24	0.35 U	3.0 J	2.9 J	20 J
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	45	89	220	82	29	21	45	40	11	14	36
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	pg/g	0.042 U	54	270 J+	30	0.30 U	0.036 U	8.2	0.061 U	0.98 U	0.94 U	9.2
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.064 J	1100	2800	370	0.98 J	0.17 J	66	0.30 J	9.5	8.4	74 J
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.83 U	1.2 U	2.3 U	1.0 U	0.49 U	0.42 U	0.63 U	0.60 U	0.31 U	0.28 U	0.59 U
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.034 U	260	710	95	0.33 J	0.068 J	17	0.11 J	2.8 J	2.8 J	18 J
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.97 J	3.0 J	11 J	2.3 J	0.76 J	0.56 J	1.2 J	1.1 J	0.29 J	0.39 J	0.95 J
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	pg/g	0.11 U	19	46 J	6.2 J	0.081 J	0.065 J	1.1 J	0.16 J	0.20 J	0.20 U	1.3 J
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	2.4 J	2.9 J	6.5 J	3.2 J	1.5 J	1.4 J	2.3 J	2.8 J	0.57 J	0.70 U	2.6 J
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	0.065 J	1200	1800	250	0.58 J	0.13 J	40	0.18 J	7.4	6.7	42 J
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	0.23 J	23	130	11	0.086 U	0.13 J	3.1 J	0.15 U	0.64 J	0.64 J	3.1 J
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.025 U	37	71 J	12	0.046 U	0.024 U	1.8 J	0.045 U	0.39 U	0.39 J	1.9 J
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	0.045 U	440	930	100	0.35 J	0.030 U	20	0.084 U	4.3 J	3.8 J	21 J
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	pg/g	0.17 U	12000 J	48000 J	4200 J	22 J	3.3 J	1200 J	5.0	280	270	1100 J
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	0.17 J	3100 J	19000 J	1800 J	6.8 J	1.3 J	430	1.7 J	80	75	440 J
Total heptachlorodibenzofuran (HpCDF)	pg/g	0.28 J	250 J	1300 J	140 J	1.5 J	0.12 J	37 J	0.14 J	4.7 J	4.8 J	35 J
Total heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	160 J	250 J	490 J	210 J	88 J	74 J	130 J	150 J	33 J	45 J	150 J
Total hexachlorodibenzofuran (HxCDF)	pg/g	0.15 J	1600 J	4000 J	550 J	1.4 J	0.30 J	96 J	0.57 J	15 J	13 J	110 J
Total hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	46 J	44 J	83 J	39 J	21 J	18 J	27 J	40 J	8.1 J	10 J	39 J
Total pentachlorodibenzofuran (PeCDF)	pg/g	0.065 J	2600 J	4100 J	530 J	1.7 J	0.22 J	90 J	0.18 J	17 J	16 J	96 J
Total pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	8.1 J	31 J	140 J	18 J	3.8 J	3.7 J	7.7 J	4.3 J	1.7 J	2.5 J	9.2 J
Total tetrachlorodibenzofuran (TCDF)	pg/g	0.51 J	21000 J	91000 J	7900 J	35 J	6.5 J	2300 J	8.6 J	540 J	540 J	2100 J
Total tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	6.9 J	3400 J	21000 J	1900 J	9.7 J	3.6 J	470 J	4.8 J	88 J	83 J	480 J
TEQ												
Total WHO Dioxin TEQ(Human/Mammal)(ND=0)	pg/g	1.5 J	4600 J	25000 J	2300 J	10 J	2.4 J	570 J	3.4 J	110 J	110 J	570 J
Total WHO Dioxin TEQ(Human/Mammal)(ND=0.5)	pg/g	1.6 J	4600 J	25000 J	2300 J	10 J	2.4 J	570 J	3.5 J	110 J	110 J	570 J

Notes:
- U - Not detected at the associated reporting limit
- J - Estimated concentration
- UJ - Not detected; associated reporting limit is estimated
- J- - Estimated concentration, result may be biased low
- J+ - Estimated concentration, result may be biased high
- TEQ - Toxicity Equivalent Quotient
- ft bgs - Feet below ground surface
- pg/g - picogram per grams

Table 2-4

Supplemental Design Investigation Analytical Results - Northern Impoundment
Pre- Final 90% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Sample Location: Sample Identification: Sample Date: Sample Depth: Parameters	Units	SJSB087 11215702-081021-BN-SJSB087 (14-16)-R 08/10/2021 (14-16) ft bgs Lab Duplicate	SJSB087 11215702-081021-BN-SJSB087(16-18) 08/10/2021 (16-18) ft bgs	SJSB088 11215702-080621-BN-SJSB088(0-2) 08/06/2021 (0-2) ft bgs	SJSB088 11215702-080621-BN-SJSB088(2-4) 08/06/2021 (2-4) ft bgs	SJSB088 11215702-080621-BN-SJSB088(4-6) 08/06/2021 (4-6) ft bgs	SJSB088 11215702-080621-BN-SJSB088(6-8) 08/06/2021 (6-8) ft bgs	SJSB088 11215702-080621-BN-SJSB088 (6-8)-R 08/06/2021 (6-8) ft bgs Lab Duplicate	SJSB088 11215702-080621-BN-DUP-14 08/06/2021 (6-8) ft bgs Field Duplicate	SJSB088 11215702-080621-BN-SJSB088(8-10) 08/06/2021 (8-10) ft bgs	SJSB088 11215702-080621-BN-SJSB088(10-12) 08/06/2021 (10-12) ft bgs	SJSB088 11215702-080621-BN-SJSB088(12-14) 08/06/2021 (12-14) ft bgs
Dioxins/Furans												
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	pg/g	27	2.6 U	400	420	970	960	860	1200	1200	0.54 U	0.071 U
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	pg/g	1400	210	1600	1400 J-	3900	4600	5700	6000	6300	170	150
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	pg/g	52 J	0.68 U	890	940	2100	2200	2000	2700	2400	0.33 J	0.051 U
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	52	10	120 J	120 J	300	340	370	420	420	9.5	7.0
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	pg/g	18	0.26 U	310	300 J+	820	700	760	970	770	0.060 U	0.062 U
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	180 J	0.50 J	2900	2900	7700	7300	9400	9800	7700	0.75 J	0.047 U
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.86 U	0.35 U	5.5 J	1.6 U	7.0 J	2.9 U	9.2 U	5.5 J	5.4 J	0.11 U	0.34 J
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	49 J	0.24 U	770	800	2100	1900	2100	2500	2000	0.18 J	0.048 U
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	1.6 J	0.38 U	12 J	8.7 J	20 J	30 J	25 J	28 J	29 J	0.12 U	0.28 J
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	pg/g	3.2 J	0.17 U	38 J	32 J	110 J	98 J	140	150 J	91 J	0.022 U	0.10 U
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	3.4 J	0.90 J	2.0 U	1.4 U	8.2 J	2.6 U	15 U	12 U	12 J	0.10 U	0.57 U
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	120 J	0.31 U	2100	2300	4900	4500	5800	7000	5200	0.45 J	0.071 U
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	7.4 J	0.43 U	300	300 J+	330	320	380	290	300	0.13 U	0.093 U
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	5.6 J	0.17 U	81 J	95 J	210 J	210 J	220	290	200 J	0.023 U	0.034 U
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	54 J	0.32 U	1700	1800	2400	2300	2800	2900	2400	0.18 J	0.075 U
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	pg/g	2600 J	5.8	130000 J	170000 J	130000 J	120000 J	130000 J	110000 J	130000 J	10	0.79 J
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	1200 J	1.8 J	25000 J	25000 J	35000 J	40000 J	55000 J	49000 J	36000 J	3.9	0.32 J
Total heptachlorodibenzofuran (HpCDF)	pg/g	83 J	0.56 J	1400 J	1400 J	3400 J	3400 J	3300 J	4400 J	3700 J	0.49 J	0.062 U
Total heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	190 J	44 J	250 J	250 J	640 J	700 J	750 J	910 J	850 J	35 J	33 J
Total hexachlorodibenzofuran (HxCDF)	pg/g	260 J	0.50 J	4300 J	4300 J	11000 J	10000 J	13000 J	14000 J	11000 J	0.93 J	0.10 J
Total hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	45 J	15 J	59 J	31 J	110 J	140 J	160 J	150 J	140 J	11 J	11 J
Total pentachlorodibenzofuran (PeCDF)	pg/g	260 J	0.35 U	6000 J	6400 J	92000 J	11000 J	14000 J	15000 J	12000 J	0.78 J	0.075 U
Total pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	13 J	2.1 J	300 J	300 J	330 J	320 J	430 J	320 J	300 J	0.13 U	2.3 J
Total tetrachlorodibenzofuran (TCDF)	pg/g	5500 J	7.8 J	160000 J	200000 J	190000 J	180000 J	320000 J	200000 J	190000 J	17 J	1.2 J
Total tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	1300 J	3.1 J	28000 J	27000 J	39000 J	45000 J	62000 J	53000 J	39000 J	3.9 J	2.0 J
TEQ												
Total WHO Dioxin TEQ(Human/Mammal)(ND=0)	pg/g	1500 J	2.7 J	39000 J	43000 J	50000 J	54000 J	71000 J	63000 J	51000 J	5.2 J	0.58 J
Total WHO Dioxin TEQ(Human/Mammal)(ND=0.5)	pg/g	1500 J	3.0 J	39000 J	43000 J	50000 J	54000 J	71000 J	63000 J	51000 J	5.3 J	0.68 J

Notes:

U - Not detected at the associated reporting limit
J - Estimated concentration
UJ - Not detected; associated reporting limit is estimated
J- - Estimated concentration, result may be biased low
J+ - Estimated concentration, result may be biased high
TEQ - Toxicity Equivalent Quotient
ft bgs - Feet below ground surface
pg/g - picogram per grams

Table 2-4

Supplemental Design Investigation Analytical Results - Northern Impoundment
Pre- Final 90% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Sample Location: Sample Identification: Sample Date: Sample Depth: Parameters	Units	SJSB088 11215702-080621-BN-SJSB088(14-16) 08/06/2021 (14-16) ft bgs	SJSB088 11215702-080621-BN-SJSB088(16-18) 08/06/2021 (16-18) ft bgs	SJSB088 11215702-080621-BN-SJSB088 (16-18)-R 08/06/2021 (16-18) ft bgs Lab Duplicate	SJSB088 11215702-080621-BN-SJSB088(18-20) 08/06/2021 (18-20) ft bgs	SJSB088 11215702-080621-BN-SJSB088(20-22) 08/06/2021 (20-22) ft bgs	SJSB088 11215702-080621-BN-SJSB088(22-24) 08/06/2021 (22-24) ft bgs	SJSB089 11215702-080721-BN-SJSB089(0-2) 08/07/2021 (0-2) ft bgs	SJSB089 11215702-080721-BN-SJSB089(2-4) 08/07/2021 (2-4) ft bgs	SJSB089 11215702-080721-BN-SJSB089(4-6) 08/07/2021 (4-6) ft bgs	SJSB089 11215702-080721-BN-SJSB089(6-8) 08/07/2021 (6-8) ft bgs	SJSB089 11215702-080721-BN-DUP-19 08/07/2021 (6-8) ft bgs Field Duplicate
Dioxins/Furans												
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	pg/g	0.39 U	9.2 U	20	0.40 U	0.17 U	0.20 U	28	1.3 U	0.39 U	0.39 U	0.39 U
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	pg/g	390	150 J	280 J	220	290	210	1900	480	910	1100	1600 J
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	pg/g	0.13 U	17 J	57	0.26 U	0.26 U	0.21 U	41	2.1 J	0.35 U	0.16 U	0.14 U
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	20	8.4 J	16	11	16	11	55	17	41	48	72
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	pg/g	0.061 U	6.6 J	23	0.14 U	0.077 U	0.0030 U	13	0.74 J	0.16 J	0.072 U	0.081 U
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.14 U	64 J	260 J	0.64 J	0.28 J	0.23 U	100	7.6	0.99 J	0.087 U	0.18 U
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.36 J	0.43 U	0.39 U	0.040 U	0.70 J	0.34 J	0.85 J	0.43 J	0.58 J	0.74 J	0.84 J
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.049 U	16 J	54	0.18 U	0.0075 U	0.21 U	27	2.0 J	0.28 J	0.11 J	0.11 J
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.44 J	0.44 U	0.79 J	0.38 J	0.66 J	0.035 U	1.5 J	0.52 J	0.85 J	1.4 J	1.8 J
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	pg/g	0.094 U	1.5 U	3.2 J	0.14 U	0.14 U	0.0030 U	1.8 J	0.17 U	0.11 U	0.18 U	0.11 U
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	2.1 J	0.40 U	0.82 U	0.042 U	0.84 J	0.52 J	2.3 J	1.1 J	2.4 J	3.0 J	3.7 J
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	0.054 U	40 J	130 J	0.90 J	0.28 U	0.32 U	62	4.3 J	0.96 J	0.063 U	0.072 U
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	0.098 U	2.9 J	7.8	0.14 J	0.11 J	0.33 J	4.6 J	0.45 J	0.23 J	0.36 J	0.31 J
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.035 U	1.8 J	5.3 J	0.083 U	0.086 U	0.0025 U	3.0 J	0.22 U	0.064 U	0.037 U	0.042 U
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	0.056 U	19 J	75	0.66 J	0.22 U	0.25 U	32	2.0 J	0.64 J	0.065 U	0.075 U
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	pg/g	1.2 J	930 J	3600 J	2.6	3.5	0.77 J	1600 J	110	37	1.0 J	2.4
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	0.51 J	410 J	1400 J	1.6	1.2 J	0.36 J	630 J	39	13	0.71 J	1.1 J
Total heptachlorodibenzofuran (HpCDF)	pg/g	0.11 J	28 J	95 J	0.55 J	0.42 J	0.32 J	63 J	3.4 J	0.66 J	0.16 J	0.14 J
Total heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	96 J	29 J	47 J	49 J	81 J	54 J	170 J	68 J	120 J	150 J	220 J
Total hexachlorodibenzofuran (HxCDF)	pg/g	0.24 J	90 J	360 J	1.2 J	0.65 J	0.60 J	160 J	11 J	1.6 J	0.38 J	0.41 J
Total hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	35 J	9.5 J	13 J	20 J	30 J	19 J	37 J	21 J	33 J	39 J	47 J
Total pentachlorodibenzofuran (PeCDF)	pg/g	0.060 U	94 J	320 J	2.6 J	0.79 J	0.66 J	160 J	9.8 J	2.3 J	0.066 U	0.079 U
Total pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	6.4 J	3.8 J	9.5 J	2.8 J	8.7 J	6.3 J	10 J	5.0 J	7.4 J	8.1 J	7.4 J
Total tetrachlorodibenzofuran (TCDF)	pg/g	2.1 J	2000 J	6700 J	13 J	7.9 J	1.4 J	3600 J	210 J	70 J	2.2 J	4.2 J
Total tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	4.8 J	440 J	1600 J	3.1 J	4.4 J	5.2 J	690 J	45 J	18 J	5.0 J	5.4 J
TEQ												
Total WHO Dioxin TEQ(Human/Mammal)(ND=0)	pg/g	1.2 J	520 J	1800 J	2.5 J	2.2 J	1.0 J	820 J	53 J	18 J	2.5 J	3.5 J
Total WHO Dioxin TEQ(Human/Mammal)(ND=0.5)	pg/g	1.3 J	520 J	1800 J	2.5 J	2.2 J	1.1 J	820 J	53 J	18 J	2.5 J	3.5 J

Notes:
- U - Not detected at the associated reporting limit
- J - Estimated concentration
- UJ - Not detected; associated reporting limit is estimated
- J- - Estimated concentration, result may be biased low
- J+ - Estimated concentration, result may be biased high
- TEQ - Toxicity Equivalent Quotient
- ft bgs - Feet below ground surface
- pg/g - picogram per grams

Table 2-4

Supplemental Design Investigation Analytical Results - Northern Impoundment
Pre- Final 90% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Sample Location:		SJSB089	SJSB089	SJSB089	SJSB089	SJSB089	SJSB089	SJSB089	SJSB089	SJSB090	SJSB090	SJSB090
Sample Identification:		11215702-080721-BN-DUP-19-R	11215702-080721-BN-SJSB089(8-10)	11215702-080721-BN-SJSB089 (8-10)-R	11215702-080721-BN-SJSB089(10-12)	11215702-080721-BN-SJSB089 (10-12)-R	11215702-080721-BN-SJSB089(12-14)	11215702-080721-BN-SJSB089(14-16)	11215702-080721-BN-SJSB089(16-18)	11215702-080221-BN-SJSB090(0-2)	11215702-080221-BN-SJSB090(2-4)	11215702-080221-BN-SJSB090(4-6)
Sample Date:	Units	08/07/2021	08/07/2021	08/07/2021	08/07/2021	08/07/2021	08/07/2021	08/07/2021	08/07/2021	08/02/2021	08/02/2021	08/02/2021
Sample Depth:		(6-8) ft bgs	(8-10) ft bgs	(8-10) ft bgs	(10-12) ft bgs	(10-12) ft bgs	(12-14) ft bgs	(14-16) ft bgs	(16-18) ft bgs	(0-2) ft bgs	(2-4) ft bgs	(4-6) ft bgs
Parameters		Lab Duplicate		Lab Duplicate		Lab Duplicate						
Dioxins/Furans												
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	pg/g	0.38 U	0.92 U	0.92 U	1.2 U	0.45 U	0.067 U	0.11 U	0.39 U	820	170 J-	11 J
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	pg/g	940 J	770	740	390 J	210 J	66	940	25	5100	1600	850
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	pg/g	0.49 U	1.6 J	1.4 U	1.9 J	0.56 U	0.13 U	0.069 U	0.041 U	2000	390 J-	20
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	48	27	32	14	8.1	2.5 J	40	0.94 U	360	83	54
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	pg/g	0.36 U	0.51 J	0.54 U	0.64 J	0.36 U	0.056 U	0.085 U	0.053 U	650	130 J-	7.4
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.20 U	5.5 J	5.3 J	5.1 J	2.0 J	0.25 U	0.066 U	0.056 U	6800	1000	73
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.93 U	0.38 J	0.45 U	0.26 J	0.28 U	0.24 J	0.61 J	0.24 J	4.8 J	0.84 J	0.68 J
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.13 U	1.5 J	1.2 J	1.4 J	0.48 J	0.050 J	0.065 U	0.054 U	1800	240 J-	18
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	1.6 J	0.65 J	0.89 J	0.35 J	0.24 U	0.098 J	1.2 J	0.060 U	25	4.0 J	1.5 J
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	pg/g	0.16 U	0.17 U	0.16 U	0.14 U	0.11 U	0.032 U	0.13 U	0.039 U	110 J	9.6	1.4 J
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	3.4 J	1.5 J	1.8 J	0.81 J	0.53 U	0.21 U	4.4 J	0.12 U	9.5 J	2.4 J	2.6 J
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	0.14 J	4.9 J	3.0 J	2.6 J	1.2 J	0.15 J	0.076 U	0.055 U	5000	410 J-	57
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	0.35 J	0.34 J	0.44 J	0.34 J	0.20 J	0.069 U	0.29 J	0.075 U	320	35	5.3 J
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.060 U	0.22 U	0.18 U	0.14 U	0.11 U	0.033 U	0.048 U	0.040 U	200	18	2.1 J
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	0.090 J	2.1 J	1.7 J	1.3 J	0.68 J	0.050 U	0.079 U	0.057 U	2600	230 J-	34
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	pg/g	2.7	100	84	70 J	38 J	3.7	1.1 J	0.60 J	110000 J	12000 J	2000 J
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	1.0 J	39	32	25 J	14 J	1.5	0.60 J	0.24 J	49000 J	5100 J	700 J
Total heptachlorodibenzofuran (HpCDF)	pg/g	0.30 J	2.6 J	2.4 J	3.1 J	0.98 J	0.13 J	0.085 U	0.053 U	3100 J	610 J	36 J
Total heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	150 J	90 J	98 J	49 J	28 J	8.9 J	160 J	3.0 J	740 J	190 J	120 J
Total hexachlorodibenzofuran (HxCDF)	pg/g	0.55 J	8.3 J	7.6 J	7.6 J	3.0 J	0.30 J	0.13 J	0.056 U	9800 J	1400 J	100 J
Total hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	43 J	21 J	27 J	13 J	7.5 J	3.1 J	47 J	1.5 J	180 J	40 J	26 J
Total pentachlorodibenzofuran (PeCDF)	pg/g	0.23 J	11 J	7.2 J	5.9 J	2.8 J	0.15 J	0.090 U	0.060 U	12000 J	1000 J	140 J
Total pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	7.7 J	4.1 J	4.6 J	1.9 J	1.2 J	0.64 J	9.1 J	0.25 U	330 J	39 J	8.5 J
Total tetrachlorodibenzofuran (TCDF)	pg/g	4.7 J	200 J	160 J	140 J	64 J	7.2 J	2.0 J	0.89 J	220000 J	25000 J	3600 J
Total tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	5.3 J	45 J	37 J	29 J	15 J	2.1 J	7.4 J	0.60 J	56000 J	5800 J	780 J
TEQ												
Total WHO Dioxin TEQ(Human/Mammal)(ND=0)	pg/g	3.1 J	52 J	43 J	34 J	19 J	1.0 J	2.3 J	0.33 J	62000 J	6600 J	930 J
Total WHO Dioxin TEQ(Human/Mammal)(ND=0.5)	pg/g	3.1 J	52 J	43 J	34 J	19 J	2.0 J	2.3 J	0.40 J	62000 J	6600 J	930 J

Notes:
U - Not detected at the associated reporting limit
J - Estimated concentration
UJ - Not detected; associated reporting limit is estimated
J- - Estimated concentration, result may be biased low
J+ - Estimated concentration, result may be biased high
TEQ - Toxicity Equivalent Quotient
ft bgs - Feet below ground surface
pg/g - picogram per grams

Table 2-4

Supplemental Design Investigation Analytical Results - Northern Impoundment
Pre- Final 90% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Sample Location: Sample Identification: Sample Date: Sample Depth: Parameters	Units	SJSB090 11215702-080221-BN-SJSB090(6-8) 08/02/2021 (6-8) ft bgs	SJSB090 11215702-080221-BN-DUP-11 08/02/2021 (6-8) ft bgs Field Duplicate	SJSB090 11215702-080221-BN-SJSB090(8-10) 08/02/2021 (8-10) ft bgs	SJSB090 11215702-080221-BN-SJSB090 (8-10)-R 08/02/2021 (8-10) ft bgs Lab Duplicate	SJSB090 11215702-080221-BN-SJSB090(10-12) 08/02/2021 (10-12) ft bgs	SJSB090 11215702-080221-BN-SJSB090(12-14) 08/02/2021 (12-14) ft bgs	SJSB090 11215702-080221-BN-SJSB090(14-16) 08/02/2021 (14-16) ft bgs	SJSB090 11215702-080221-BN-SJSB090(16-18) 08/02/2021 (16-18) ft bgs	SJSB091 11215702-080321-BN-SJSB091(0-2) 08/03/2021 (0-2) ft bgs	SJSB091 11215702-080321-BN-SJSB091(2-4) 08/03/2021 (2-4) ft bgs	SJSB091 11215702-080321-BN-SJSB091(4-6) 08/03/2021 (4-6) ft bgs
Dioxins/Furans												
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	pg/g	0.67 U	0.67 U	3.3 U	5.0 J	0.67 U	1.8 U	0.67 U	0.88 U	3.3 U	0.67 U	0.67 U
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	pg/g	250	280	630	490	1400	890	780	780	4400	770	340
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	pg/g	0.22 U	0.057 U	7.8	12	0.23 J	1.9 J	0.45 J	0.12 U	0.50 J	0.21 J	0.21 J
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	11	12	28	28	59	36	31	31	130	32	10
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	pg/g	0.25 U	0.062 U	2.8 J	4.2 J	0.049 U	0.83 J	0.050 U	0.14 U	0.14 U	0.045 U	0.044 U
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.88 J	0.25 J	31	48	0.54 J	4.8 J	0.61 J	0.13 U	1.1 J	0.51 J	0.35 J
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.55 J	0.33 J	0.49 J	0.40 U	0.76 J	0.55 J	0.57 J	0.84 J	1.5 J	0.58 J	0.33 J
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.21 U	0.11 J	8.2	13	0.14 J	1.1 J	0.19 J	0.14 U	0.39 J	0.19 J	0.12 J
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.39 J	0.44 J	0.75 J	0.68 J	1.3 J	0.81 J	0.72 J	0.89 J	3.0 J	0.91 J	0.28 J
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	pg/g	0.14 U	0.11 J	0.66 J	0.89 J	0.14 J	0.17 J	0.10 J	0.10 J	0.19 J	0.080 J	0.080 J
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.27 U	0.75 J	1.5 J	1.3 J	3.2 J	1.8 J	1.8 J	2.8 J	5.6 J	2.1 J	0.57 J
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	0.71 J	0.19 J	29	42	0.51 J	0.86 J	0.28 J	0.17 U	1.1 J	0.56 J	0.31 J
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	0.38 U	0.089 U	1.7 J	2.8 J	0.31 J	0.22 J	0.075 U	0.23 U	0.26 U	0.31 J	0.11 J
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.15 U	0.048 U	1.0 J	1.5 J	0.033 U	0.092 J	0.027 U	0.096 U	0.076 U	0.040 J	0.065 J
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	0.27 U	0.16 J	15	21	0.19 J	0.39 J	0.18 J	0.17 U	0.50 J	0.23 J	0.23 J
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	pg/g	12	4.9	620 J	1200 J	7.5	16	7.4	2.9	31	11	14
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	4.5	1.9	190 J	420 J	2.5	5.5	2.3	0.87 J	8.6	4.2	3.2
Total heptachlorodibenzofuran (HpCDF)	pg/g	0.25 U	0.062 U	13 J	20 J	0.23 J	3.3 J	0.45 J	0.14 U	0.50 J	0.21 J	0.21 J
Total heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	36 J	47 J	73 J	71 J	190 J	110 J	120 J	120 J	300 J	83 J	38 J
Total hexachlorodibenzofuran (HxCDF)	pg/g	0.88 J	0.47 J	45 J	72 J	0.83 J	6.5 J	0.90 J	0.11 U	1.7 J	0.82 J	0.62 J
Total hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	7.1 J	13 J	16 J	16 J	48 J	26 J	28 J	35 J	51 J	21 J	11 J
Total pentachlorodibenzofuran (PeCDF)	pg/g	0.71 J	0.35 J	70 J	99 J	0.92 J	2.0 J	0.79 J	0.19 U	2.8 J	2.1 J	0.75 J
Total pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	0.38 U	1.3 J	3.7 J	4.7 J	7.3 J	4.1 J	3.0 J	4.3 J	5.0 J	4.5 J	1.9 J
Total tetrachlorodibenzofuran (TCDF)	pg/g	23 J	8.0 J	1100 J	2500 J	14 J	29 J	14 J	4.2 J	58 J	25 J	32 J
Total tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	4.5 J	2.8 J	210 J	470 J	8.6 J	8.9 J	5.5 J	4.5 J	12 J	9.5 J	5.4 J
TEQ												
Total WHO Dioxin TEQ(Human/Mammal)(ND=0)	pg/g	6.1 J	2.9 J	260 J	560 J	5.3 J	9.1 J	4.1 J	2.2 J	16 J	6.7 J	5.2 J
Total WHO Dioxin TEQ(Human/Mammal)(ND=0.5)	pg/g	6.4 J	2.9 J	260 J	560 J	5.3 J	9.1 J	4.1 J	2.3 J	16 J	6.7 J	5.2 J

Notes:
- U - Not detected at the associated reporting limit
- J - Estimated concentration
- UJ - Not detected; associated reporting limit is estimated
- J- - Estimated concentration, result may be biased low
- J+ - Estimated concentration, result may be biased high
- TEQ - Toxicity Equivalent Quotient
- ft bgs - Feet below ground surface
- pg/g - picogram per grams

Table 2-4

Supplemental Design Investigation Analytical Results - Northern Impoundment
Pre- Final 90% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Sample Location: Sample Identification: Sample Date: Sample Depth:	Units	SJSB091 11215702-080321-BN-SJSB091(6-8) 08/03/2021 (6-8) ft bgs	SJSB091 11215702-080321-BN-DUP-18 08/03/2021 (6-8) ft bgs	SJSB091 11215702-080321-BN-SJSB091(8-10) 08/03/2021 (8-10) ft bgs	SJSB091 11215702-080321-BN-SJSB091(10-12) 08/03/2021 (10-12) ft bgs	SJSB091 11215702-080321-BN-SJSB091(12-14) 08/03/2021 (12-14) ft bgs	SJSB091 11215702-080321-BN-SJSB091(14-16) 08/03/2021 (14-16) ft bgs	SJSB091 11215702-080321-BN-SJSB091(16-18) 08/03/2021 (16-18) ft bgs	SJSB092 11215702-072521-BN-SJSB092(0-2) 07/25/2021 (0-2) ft bgs	SJSB092 11215702-072521-BN-SJSB092(2-4) 07/25/2021 (2-4) ft bgs	SJSB092 11215702-072521-BN-SJSB092(4-6) 07/25/2021 (4-6) ft bgs	SJSB092 11215702-072521-BN-SJSB092(6-8) 07/25/2021 (6-8) ft bgs
Parameters			Field Duplicate									
Dioxins/Furans												
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	pg/g	0.67 U	0.67 U	0.67 U	0.67 U	0.67 U	0.67 U	0.67 U	450	250	1.6 U	0.075 U
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	pg/g	930	1700	1400	1500	1100	1200	1900	1800	1200	640	1100
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	pg/g	0.057 U	0.12 J	0.038 U	0.20 J	0.049 U	0.063 J	0.042 U	910	540	1.9 J	0.050 U
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	39	63	55	62	47	59	82	110	72 J	28	43
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	pg/g	0.065 U	0.062 U	0.043 U	0.068 U	0.055 U	0.046 U	0.046 U	330	170	1.0 J	0.048 U
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.096 J	0.15 J	0.076 J	0.071 U	0.048 U	0.048 U	0.040 U	3300	1800	11	0.036 U
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.66 J	0.77 J	0.71 J	1.0 J	0.75 J	0.81 J	0.84 J	1.9 U	1.1 U	0.15 U	0.31 U
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.068 J	0.047 U	0.033 U	0.071 U	0.050 U	0.049 U	0.039 U	880	500	2.8 J	0.039 U
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	1.1 J	1.4 J	1.3 J	1.7 J	1.3 J	1.5 J	2.2 J	9.4 J	7.0 J	0.16 U	0.35 U
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	pg/g	0.15 J	0.20 J	0.14 J	0.14 J	0.086 J	0.087 J	0.14 J	46 J	28 J	0.11 U	0.037 U
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	2.7 J	3.3 J	3.1 J	2.4 J	2.6 J	3.2 J	4.5 J	6.3 U	1.1 U	0.14 U	0.30 U
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	0.11 J	0.16 J	0.099 J	0.058 U	0.057 U	0.051 U	0.048 U	2200	1400 J	9.9	0.058 U
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	0.29 J	0.30 J	0.082 U	0.27 J	0.30 J	0.12 U	0.12 U	290	200	0.19 U	0.17 U
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.043 J	0.035 U	0.023 U	0.054 U	0.036 U	0.037 U	0.030 U	82 J	57 J	0.12 U	0.036 U
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	0.057 U	0.059 U	0.048 J	0.062 U	0.057 U	0.054 U	0.049 U	1500	1100	6.6 J	0.066 U
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	pg/g	3.1	1.3 U	1.4 U	0.91 U	1.3 U	0.93 U	0.51 U	210000	110000	340	7.4
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	0.72 J	0.56 J	0.50 J	0.51 J	0.74 J	0.53 J	0.39 J	21000 J	16000 J	93	3.1
Total heptachlorodibenzofuran (HpCDF)	pg/g	0.065 U	0.27 J	0.043 U	0.20 J	0.055 U	0.063 J	0.046 U	1500 J	820 J	3.6 J	0.083 U
Total heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	130 J	210 J	190 J	190 J	130 J	150 J	210 J	260 J	170 J	94 J	160 J
Total hexachlorodibenzofuran (HxCDF)	pg/g	0.35 J	0.34 J	0.24 J	0.14 J	0.086 J	0.087 J	0.14 J	4800 J	2700 J	14 J	0.077 U
Total hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	40 J	54 J	51 J	50 J	36 J	45 J	58 J	37 J	35 J	24 J	38 J
Total pentachlorodibenzofuran (PeCDF)	pg/g	0.11 J	0.16 J	0.15 J	0.089 J	0.080 J	0.063 J	0.049 U	5700 J	3800 J	24 J	0.066 U
Total pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	7.3 J	10 J	8.5 J	9.5 J	9.2 J	11 J	13 J	290 J	200 J	1.9 U	2.9 U
Total tetrachlorodibenzofuran (TCDF)	pg/g	4.3 J	2.5 J	2.6 J	1.6 J	2.9 J	1.9 J	1.3 J	160000 J	130000 J	670 J	13 J
Total tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	6.4 J	7.4 J	6.2 J	9.0 J	7.3 J	8.6 J	9.2 J	23000 J	17000 J	93 J	3.1 J
TEQ												
Total WHO Dioxin TEQ(Human/Mammal)(ND=0)	pg/g	2.5 J	2.6 J	2.0 J	2.4 J	2.3 J	2.0 J	2.6 J	43000 J	28000 J	130 J	4.6
Total WHO Dioxin TEQ(Human/Mammal)(ND=0.5)	pg/g	2.5 J	2.7 J	2.1 J	2.4 J	2.4 J	2.2 J	2.7 J	43000 J	28000 J	130 J	4.8

Notes:
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- J+ - Estimated concentration, result may be biased high
- TEQ - Toxicity Equivalent Quotient
- ft bgs - Feet below ground surface
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Supplemental Design Investigation Analytical Results - Northern Impoundment
Pre- Final 90% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Sample Location: Sample Identification: Sample Date: Sample Depth:	Units	SJSB092 11215702-072521-BN-SJSB092(8-10) 07/25/2021 (8-10) ft bgs	SJSB092 11215702-072521-BN-SJSB092(10-12) 07/25/2021 (10-12) ft bgs	SJSB092 11215702-072521-BN-SJSB092(12-14) 07/25/2021 (12-14) ft bgs	SJSB092 11215702-072521-BN-SJSB092(14-16) 07/25/2021 (14-16) ft bgs	SJSB092 11215702-072521-BN-SJSB092(16-18) 07/25/2021 (16-18) ft bgs	SJSB093 11215702-082421-BN-SJSB093(0-2) 08/24/2021 (0-2) ft bgs	SJSB093 11215702-082421-BN-SJSB093(2-4) 08/24/2021 (2-4) ft bgs	SJSB093 11215702-082421-BN-SJSB093(4-6) 08/24/2021 (4-6) ft bgs	SJSB093 11215702-082421-BN-SJSB093(6-8) 08/24/2021 (6-8) ft bgs	SJSB093 11215702-082421-BN-SJSB093(8-10) 08/24/2021 (8-10) ft bgs	SJSB093 11215702-082421-BN-SJSB093(10-12) 08/24/2021 (10-12) ft bgs
Parameters												
Dioxins/Furans												
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	pg/g	4.9 J	0.11 U	110	0.55 U	0.067 U	650 J	580 J	7.9 U	0.051 U	30 J	9.2 J
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	pg/g	870	1100	1300	340	450	920 J	680 J	460	420	810	480
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	pg/g	0.66 U	0.87 U	200	0.40 U	0.44 U	1500	1200	16 J	0.62 U	63 J	19 J
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	46	52	55	12	20	110 J	99 J	22 J	22 J	51 J	31 J
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	pg/g	0.66 J	0.046 U	69	0.20 U	0.047 U	520 J	350 J	5.7 J	0.36 U	22 J	8.7 J
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	1.4 J	2.0 J	660	0.78 J	0.66 J	3900	3000	53 J	0.53 U	180	86
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.20 U	0.16 U	0.86 U	0.35 U	0.33 U	1.2 U	0.29 U	2.1 U	0.22 U	0.056 U	1.3 U
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.47 J	0.51 J	180	0.29 J	0.029 U	1000	760	13 J	0.040 U	46 J	22 J
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.23 U	0.17 U	0.98 U	0.32 J	0.61 J	33 J	10 J	0.098 U	0.22 U	2.2 J	2.4 U
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	pg/g	0.053 U	0.38 U	11 J	0.18 U	0.41 U	5.7 U	2.4 U	4.6 U	0.75 U	0.20 U	0.23 U
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	2.7 J	2.6 J	0.85 U	0.77 J	1.6 J	13 J	11 J	2.5 J	0.22 U	2.1 J	2.3 U
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	1.9 J	1.4 J	550	0.54 J	0.063 U	2900	2500	43 J	0.084 U	140	91
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	0.20 U	0.22 U	82	0.24 J	0.11 U	390 J	430 J	6.0 J	0.19 U	20 J	13 J
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.055 U	0.084 U	22 J	0.12 J	0.028 U	190 J	160 J	4.0 U	0.035 U	8.0 J	5.6 J
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	0.92 J	0.97 J	420	0.42 J	0.065 U	2900	2400	40 J	0.30 U	120	82
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	pg/g	70	71	33000	27	20	120000 J	110000 J	1600	0.11 U	5000	4200
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	18	17 J	6800 J	7.2	4.5	27000	29000	450	0.17 U	1300	1000
Total heptachlorodibenzofuran (HpCDF)	pg/g	1.3 J	0.87 J	310 J	0.68 J	0.44 J	2300 J	1700 J	25 J	0.97 J	98 J	33 J
Total heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	150 J	150 J	150 J	38 J	64 J	240 J	180 J	67 J	87 J	140 J	91 J
Total hexachlorodibenzofuran (HxCDF)	pg/g	1.9 J	2.9 J	990 J	1.4 J	1.1 J	5600 J	4300 J	81 J	1.5 J	260 J	130 J
Total hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	42 J	39 J	26 J	8.6 J	16 J	120 J	86 J	19 J	31 J	36 J	38 J
Total pentachlorodibenzofuran (PeCDF)	pg/g	3.6 J	2.4 J	1500 J	1.3 J	0.24 U	8600 J	7300 J	120 J	0.84 J	400 J	270 J
Total pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	4.1 U	3.3 U	82 J	1.3 J	1.7 U	620 J	490 J	9.0 J	5.1 J	36 J	33 J
Total tetrachlorodibenzofuran (TCDF)	pg/g	130 J	150 J	50000 J	47 J	33 J	260000 J	240000 J	3700 J	1.7 J	11000 J	9500 J
Total tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	18 J	17 J	7400 J	8.3 J	4.5 J	30000 J	31000 J	500 J	1.3 J	1400 J	1100 J
TEQ												
Total WHO Dioxin TEQ(Human/Mammal)(ND=0)	pg/g	27 J	26 J	10000 J	11 J	7.1 J	41000 J	42000 J	640 J	0.35 J	1900 J	1500 J
Total WHO Dioxin TEQ(Human/Mammal)(ND=0.5)	pg/g	27 J	26 J	10000 J	11 J	7.2 J	41000 J	42000 J	640 J	0.68 J	1900 J	1500 J

Notes:
- U - Not detected at the associated reporting limit
- J - Estimated concentration
- UJ - Not detected; associated reporting limit is estimated
- J- - Estimated concentration, result may be biased low
- J+ - Estimated concentration, result may be biased high
- TEQ - Toxicity Equivalent Quotient
- ft bgs - Feet below ground surface
- pg/g - picogram per grams

Table 2-4

Supplemental Design Investigation Analytical Results - Northern Impoundment
Pre- Final 90% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Sample Location:	Units	SJSB093	SJSB093	SJSB093	SJSB094	SJSB094	SJSB094	SJSB094	SJSB094	SJSB094	SJSB094	SJSB094
Sample Identification:		11215702-082421-BN-SJSB093(12-14)	11215702-082421-BN-SJSB093(14-16)	11215702-082421-BN-SJSB093(16-18)	11215702-072621-BN-SJSB094(0-2)	11215702-072621-BN-SJSB094(2-4)	11215702-072621-BN-SJSB094(4-6)	11215702-072621-BN-SJSB094(6-8)	11215702-072621-BN-SJSB094 (6-8)-R	11215702-072621-BN-DUP-8	11215702-072621-BN-DUP-8-R	11215702-072621-BN-SJSB094(8-10)
Sample Date:		08/24/2021	08/24/2021	08/24/2021	07/26/2021	07/26/2021	07/26/2021	07/26/2021	07/26/2021	07/26/2021	07/26/2021	07/26/2021
Sample Depth:		(12-14) ft bgs	(14-16) ft bgs	(16-18) ft bgs	(0-2) ft bgs	(2-4) ft bgs	(4-6) ft bgs	(6-8) ft bgs	(6-8) ft bgs	(6-8) ft bgs	(6-8) ft bgs	(8-10) ft bgs
Parameters									Lab Duplicate	Field Duplicate	Lab Duplicate	
Dioxins/Furans												
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	pg/g	4.7 U	1.1 U	1.2 U	460 J	530	570	180 J	130	12 J	9.5 J	56 J
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	pg/g	340	170	220	720 J	750	1700	680 J	1200 J	1200	1100	620
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	pg/g	7.7 J	0.72 U	0.60 U	1100	1100	1300	290 J	300	19 J	21	110
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	19 J	12 J	13 J	68 J	70 J	140	42 J	61	48	42	32 J
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	pg/g	3.9 U	0.48 U	0.41 U	280	360	360	110	100	5.9 J	5.9 J	39
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	35 J	1.2 U	0.81 U	3200	3600	4400	1300 J	1100	62 J	61	430
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	1.1 U	1.2 U	0.70 U	3.6 J	0.97 U	1.5 UJ	1.2 U	3.5 U	1.0 J	0.65 U	0.45 U
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	8.8 J	0.50 U	0.78 U	740	960	1100	330 J	230	16 J	16	130
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.69 U	1.4 U	1.0 U	7.0 J	0.93 U	9.1 J	1.2 U	3.9 J	1.2 J	1.1 J	0.52 U
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	pg/g	1.2 U	0.55 U	0.87 U	42 J	57 J	45 J	16 J	16 J	0.99 J	1.1 J	5.5 J
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	1.2 U	1.6 U	1.5 U	5.6 J	0.88 U	7.0 J	1.1 U	4.1 U	2.7 J	2.5 J	0.45 U
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	30 J	1.5 U	1.4 U	2200	2700	2900	920 J	740	51 J	50	320
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	4.4 U	2.8 U	0.96 U	290	370	340	100 J	110	7.1	6.3 J	41
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	2.2 U	0.49 U	0.61 U	100	130	140	32 J	27 J	2.6 J	1.9 J	13 J
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	26 J	1.4 U	0.079 U	1600	2000	2000	700 J	700	47 J	36	240
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	pg/g	1100	45	10 J	110000 J	140000 J	130000 J	47000 J	45000 J	2300 J	2400 J	16000 J
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	300	10 J	2.4 J	24000 J	23000 J	26000 J	10000 J	12000 J	570 J	720 J	3700 J
Total heptachlorodibenzofuran (HpCDF)	pg/g	14 J	1.4 J	1.2 J	1500 J	1700 J	1900 J	480 J	470 J	30 J	31 J	180 J
Total heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	77 J	47 J	58 J	130 J	140 J	320 J	89 J	150 J	160 J	140 J	87 J
Total hexachlorodibenzofuran (HxCDF)	pg/g	52 J	2.7 J	3.1 J	4600 J	5400 J	6500 J	1900 J	1500 J	92 J	91 J	650 J
Total hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	36 J	27 J	28 J	48 J	17 J	37 J	9.9 J	43 J	42 J	37 J	16 J
Total pentachlorodibenzofuran (PeCDF)	pg/g	83 J	4.5 J	1.4 J	6200 J	7500 J	7800 J	2600 J	2300 J	150 J	140 J	860 J
Total pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	15 J	13 J	10 J	290 J	370 J	340 J	100 J	120 J	12 J	12 J	41 J
Total tetrachlorodibenzofuran (TCDF)	pg/g	2300 J	120 J	18 J	210000 J	210000 J	220000 J	87000 J	80000 J	4400 J	5000 J	26000 J
Total tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	340 J	16 J	7.8 J	26000 J	26000 J	28000 J	11000 J	14000 J	620 J	790 J	4100 J
TEQ												
Total WHO Dioxin TEQ(Human/Mammal)(ND=0)	pg/g	420 J	15 J	3.6 J	36000 J	39000 J	41000 J	15000 J	17000 J	830 J	990 J	5500 J
Total WHO Dioxin TEQ(Human/Mammal)(ND=0.5)	pg/g	430 J	17 J	4.4 J	36000 J	39000 J	41000 J	15000 J	17000 J	830 J	990 J	5500 J

Notes:
- U - Not detected at the associated reporting limit
- J - Estimated concentration
- UJ - Not detected; associated reporting limit is estimated
- J- - Estimated concentration, result may be biased low
- J+ - Estimated concentration, result may be biased high
- TEQ - Toxicity Equivalent Quotient
- ft bgs - Feet below ground surface
- pg/g - picogram per grams

Table 2-4

Supplemental Design Investigation Analytical Results - Northern Impoundment
Pre- Final 90% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Sample Location: Sample Identification: Sample Date: Sample Depth: Parameters	Units	SJSB094 11215702-072621-BN-SJSB094(10-12) 07/26/2021 (10-12) ft bgs	SJSB094 11215702-072621-BN-SJSB094(12-14) 07/26/2021 (12-14) ft bgs	SJSB094 11215702-072621-BN-SJSB094(14-16) 07/26/2021 (14-16) ft bgs	SJSB094 11215702-072621-BN-SJSB094(16-18) 07/26/2021 (16-18) ft bgs	SJSB095 11215702-072821-BN-SJSB095(0-2) 07/28/2021 (0-2) ft bgs	SJSB095 11215702-072821-BN-SJSB095(2-4) 07/28/2021 (2-4) ft bgs	SJSB095 11215702-072821-BN-SJSB095(4-6) 07/28/2021 (4-6) ft bgs	SJSB095 11215702-072821-BN-SJSB095(6-8) 07/28/2021 (6-8) ft bgs	SJSB095 11215702-072821-BN-DUP-10 07/28/2021 (6-8) ft bgs Field Duplicate	SJSB095 11215702-072821-BN-SJSB095(8-10) 07/28/2021 (8-10) ft bgs	SJSB095 11215702-072821-BN-SJSB095 (8-10)-R 07/28/2021 (8-10) ft bgs Lab Duplicate
Dioxins/Furans												
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	pg/g	0.17 U	0.15 U	0.11 U	0.11 U	340 J	18 J	0.17 U	0.12 U	0.61 J	25	13
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	pg/g	840	1400	1300	45	1400	1700	240	190	240	1300 J	550 J
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	pg/g	1.1 U	0.086 U	0.079 U	0.33 U	790	4.4 J	0.26 U	0.060 U	0.34 U	33	24
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	36	65	60	2.6 J	88 J	60	12	10 J	11	38 J	18 J
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	pg/g	0.091 U	0.080 U	0.077 U	0.058 U	250	2.0 J	0.068 U	0.057 U	0.054 U	10	6.5
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	2.7 J	0.047 U	0.046 U	0.029 U	2800	7.0	0.045 U	0.029 U	1.2 J	100	62
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.27 U	0.37 U	0.91 J	0.097 U	1.2 U	0.33 U	0.13 U	0.080 U	0.14 U	0.71 J	0.36 U
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.62 J	0.047 U	0.045 U	0.030 U	740	1.6 J	0.044 U	0.027 U	0.42 J	28	17
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.31 U	0.41 U	1.6 J	0.11 U	1.3 U	0.40 U	0.15 U	0.091 U	0.15 U	1.3 J	0.63 J
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	pg/g	0.12 U	0.047 U	0.046 U	0.029 U	40 J	0.36 U	0.045 U	0.026 U	0.040 U	1.3 J	0.98 J
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	2.4 J	4.8 J	4.4 J	0.096 U	4.8 J	0.33 U	0.74 J	0.50 J	1.0 J	1.7 J	0.99 J
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	1.7 J	0.066 U	0.063 U	0.047 U	2100	0.54 U	0.078 U	0.044 U	0.55 J	74	50
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	0.32 U	0.24 U	0.23 U	0.11 U	290	0.50 U	0.17 U	0.099 U	0.13 U	9.3	6.3
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.11 U	0.048 U	0.046 U	0.028 U	88 J	0.36 U	0.041 U	0.027 U	0.038 U	3.6 J	1.9 J
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	1.3 J	0.068 U	0.069 U	0.047 U	1700	0.57 U	0.085 U	0.051 U	0.48 J	55	37
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	pg/g	83	4.3 U	2.4 U	6.4 U	110000 J	140	11 U	5.5 UJ	27 J	3500 J	2400 J
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	22	0.13 U	1.3 J	1.4 J	23000 J	42	0.16 U	1.7 J	6.3 J	810 J	710 J
Total heptachlorodibenzofuran (HpCDF)	pg/g	1.1 J	0.086 U	0.23 U	0.33 J	1200 J	8.3 J	0.26 J	0.060 U	0.34 J	50 J	35 J
Total heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	130 J	190 J	190 J	8.1 J	200 J	150 J	45 J	38 J	44 J	100 J	58 J
Total hexachlorodibenzofuran (HxCDF)	pg/g	3.3 J	0.074 U	0.11 U	0.036 U	4100 J	8.6 J	0.078 U	0.036 U	1.6 J	160 J	92 J
Total hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	32 J	52 J	50 J	2.0 J	32 J	18 J	9.1 J	8.9 J	11 J	20 J	14 J
Total pentachlorodibenzofuran (PeCDF)	pg/g	4.0 J	0.068 U	0.069 U	0.14 U	6200 J	2.6 J	0.27 U	0.094 U	1.0 J	190 J	130 J
Total pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	5.2 J	8.8 J	8.4 J	0.26 U	290 J	1.3 U	1.2 U	0.48 U	0.90 J	10 J	7.9 J
Total tetrachlorodibenzofuran (TCDF)	pg/g	160 J	8.1 J	3.0 J	9.8 J	200000 J	240 J	19 J	8.9 J	49 J	6400 J	4900 J
Total tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	22 J	1.1 J	4.1 J	1.4 J	25000 J	42 J	0.45 U	1.7 J	6.3 J	880 J	780 J
TEQ												
Total WHO Dioxin TEQ(Human/Mammal)(ND=0)	pg/g	32 J	1.6 J	3.0 J	1.4 J	35000 J	58 J	0.27 J	1.9 J	9.6 J	1200 J	980 J
Total WHO Dioxin TEQ(Human/Mammal)(ND=0.5)	pg/g	32 J	2.0 J	3.2 J	1.9 J	35000 J	59 J	1.0 J	2.3 J	9.7 J	1200 J	980 J

Notes:
- U - Not detected at the associated reporting limit
- J - Estimated concentration
- UJ - Not detected; associated reporting limit is estimated
- J- - Estimated concentration, result may be biased low
- J+ - Estimated concentration, result may be biased high
- TEQ - Toxicity Equivalent Quotient
- ft bgs - Feet below ground surface
- pg/g - picogram per grams

Table 2-4

Supplemental Design Investigation Analytical Results - Northern Impoundment
Pre- Final 90% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Sample Location: Sample Identification: Sample Date: Sample Depth: Parameters	Units	SJSB095 11215702-072821-BN-SJSB095(10-12) 07/28/2021 (10-12) ft bgs	SJSB095 11215702-072821-BN-SJSB095 (10-12)-R 07/28/2021 (10-12) ft bgs Lab Duplicate	SJSB095 11215702-072821-BN-SJSB095(12-14) 07/28/2021 (12-14) ft bgs	SJSB095 11215702-072821-BN-SJSB095(14-16) 07/28/2021 (14-16) ft bgs	SJSB095 11215702-072821-BN-SJSB095 (14-16)-R 07/28/2021 (14-16) ft bgs Lab Duplicate	SJSB095 11215702-072821-BN-SJSB095(16-18) 07/28/2021 (16-18) ft bgs	SJSB096 11215702-072721-BN-SJSB096(0-2) 07/27/2021 (0-2) ft bgs	SJSB096 11215702-072721-BN-SJSB096(2-4) 07/27/2021 (2-4) ft bgs	SJSB096 11215702-072721-BN-SJSB096(4-6) 07/27/2021 (4-6) ft bgs	SJSB096 11215702-072721-BN-SJSB096(6-8) 07/27/2021 (6-8) ft bgs	SJSB096 11215702-072721-BN-DUP-9 07/27/2021 (6-8) ft bgs Field Duplicate
Dioxins/Furans												
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	pg/g	0.10 U	0.92 U	0.12 U	0.70 J	1.1 U	0.12 U	700	290	3.8 J	0.51 J	0.13 U
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	pg/g	200 J	500 J	130	170 J	400 J	260	1100	610	950	980	820
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	pg/g	0.62 U	0.52 U	0.29 U	0.66 U	1.6 U	0.28 U	1500	650	7.6	0.18 J	0.071 U
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	11	19	6.5	7.7	17	15	130	43 J	36	39	34
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	pg/g	0.35 J	0.26 U	0.043 U	0.28 J	0.51 U	0.061 U	450	200	2.6 J	0.041 U	0.072 U
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	3.8 J	0.69 J	0.032 U	2.1 J	4.0 J	0.019 U	4400	2000	25	0.74 J	0.29 J
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.097 U	0.34 U	0.057 U	0.33 J	0.39 U	0.28 U	5.9 J	2.1 J	0.26 U	0.59 J	0.23 U
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.91 J	0.30 J	0.032 U	0.64 J	1.3 J	0.018 U	1200	500	6.4 J	0.25 J	0.033 U
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.11 U	0.53 J	0.060 U	0.20 J	0.38 J	0.29 U	13	4.0 J	0.27 U	0.81 J	0.82 J
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	pg/g	0.17 J	0.15 U	0.030 U	0.17 J	0.15 U	0.018 U	89	23 J	0.26 U	0.12 J	0.034 U
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	1.1 J	1.5 J	0.054 U	0.78 J	1.4 J	0.26 U	10	2.6 J	2.1 J	2.9 J	0.23 U
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	2.9 J	0.58 J	0.071 U	2.7 J	3.2 J	0.052 U	3500	1300	18	0.86 J	0.042 U
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	0.14 U	0.22 J	0.10 U	0.43 J	0.47 J	0.15 U	550	130	2.6 J	0.29 J	0.15 U
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.14 J	0.089 J	0.029 U	0.13 J	0.16 J	0.017 U	150	47 J	0.73 J	0.043 J	0.032 U
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	2.1 J	0.41 J	0.078 U	2.7 J	2.2 J	0.056 U	3200	930	13	0.35 J	0.041 U
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	pg/g	150 J	27 J	17	170	150	3.6 U	250000 J	61000 J	910 J	8.8	8.6
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	40 J	7.0 J	4.1	35	38	0.13 U	60000 J	15000 J	210	2.4	2.5
Total heptachlorodibenzofuran (HpCDF)	pg/g	1.1 J	0.82 J	0.29 J	1.1 J	2.5 J	0.28 J	2200 J	980 J	12 J	0.18 J	0.072 U
Total heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	44 J	78 J	25 J	32 J	72 J	66 J	230 J	88 J	120 J	150 J	130 J
Total hexachlorodibenzofuran (HxCDF)	pg/g	5.0 J	1.2 J	0.075 U	3.3 J	5.6 J	0.052 U	6200 J	2900 J	32 J	1.3 J	0.29 J
Total hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	13 J	18 J	6.2 J	9.3 J	18 J	17 J	99 J	27 J	25 J	38 J	30 J
Total pentachlorodibenzofuran (PeCDF)	pg/g	7.0 J	1.2 J	0.078 U	7.6 J	8.3 J	0.056 U	9300 J	3400 J	48 J	1.9 J	0.057 U
Total pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	0.42 U	2.9 J	0.69 U	1.5 J	3.6 J	5.9 J	590 J	150 J	5.7 J	5.9 J	5.0 J
Total tetrachlorodibenzofuran (TCDF)	pg/g	300 J	48 J	25 J	300 J	280 J	6.1 J	390000 J	110000 J	1500 J	15 J	14 J
Total tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	40 J	9.3 J	4.1 J	40 J	43 J	1.2 J	70000 J	16000 J	230 J	7.9 J	4.1 J
TEQ												
Total WHO Dioxin TEQ(Human/Mammal)(ND=0)	pg/g	57 J	11 J	5.9	54 J	55 J	0.23	87000 J	22000 J	310 J	4.9 J	4.1 J
Total WHO Dioxin TEQ(Human/Mammal)(ND=0.5)	pg/g	57 J	11 J	6.0	54 J	55 J	0.60	87000 J	22000 J	310 J	4.9 J	4.2 J

Notes:
- U - Not detected at the associated reporting limit
- J - Estimated concentration
- UJ - Not detected; associated reporting limit is estimated
- J- - Estimated concentration, result may be biased low
- J+ - Estimated concentration, result may be biased high
- TEQ - Toxicity Equivalent Quotient
- ft bgs - Feet below ground surface
- pg/g - picogram per grams

Table 2-4

Supplemental Design Investigation Analytical Results - Northern Impoundment
Pre- Final 90% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Sample Location:	Units	SJSB096	SJSB096	SJSB096	SJSB096	SJSB096	SJSB096	SJSB096	SJSB097	SJSB097	SJSB097	SJSB097
Sample Identification:		11215702-072721-BN-SJSB096(8-10)	11215702-072721-BN-SJSB096 (8-10)-R	11215702-072721-BN-SJSB096(10-12)	11215702-072721-BN-SJSB096 (10-12)-R	11215702-072721-BN-SJSB096(12-14)	11215702-072721-BN-SJSB096(14-16)	11215702-072721-BN-SJSB096(16-18)	11215702-082221-BN-SJSB097(0-2)	11215702-082221-BN-SJSB097(2-4)	11215702-082221-BN-SJSB097(4-6)	11215702-082221-BN-SJSB097(6-8)
Sample Date:		07/27/2021	07/27/2021	07/27/2021	07/27/2021	07/27/2021	07/27/2021	07/27/2021	08/22/2021	08/22/2021	08/22/2021	08/22/2021
Sample Depth:		(8-10) ft bgs	(8-10) ft bgs	(10-12) ft bgs	(10-12) ft bgs	(12-14) ft bgs	(14-16) ft bgs	(16-18) ft bgs	(0-2) ft bgs	(2-4) ft bgs	(4-6) ft bgs	(6-8) ft bgs
Parameters			Lab Duplicate		Lab Duplicate							
Dioxins/Furans												
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	pg/g	37	63	0.74 J	0.66 U	0.095 U	0.74 J	0.60 J	58 J	0.71 U	0.76 U	0.98 U
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	pg/g	1000	610	1200	940	460	360	600	2500	350	430	320
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	pg/g	68 J	160 J	1.4 J	1.2 U	0.050 U	0.039 U	0.40 J	9.0 J	0.021 U	0.57 U	0.31 U
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	41	31	51	40	24	18	27	73 J	23 J	25 J	17 J
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	pg/g	22 J	60 J	0.39 J	0.45 U	0.048 U	0.036 U	0.059 U	0.84 U	0.025 U	0.039 U	0.27 U
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	200 J	630 J	4.9 J	3.7 J	0.038 U	0.024 U	0.91 J	2.3 U	0.024 U	0.42 U	0.31 U
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.79 J	1.1 U	0.49 J	0.68 U	0.19 U	0.29 J	0.29 U	1.7 U	0.52 U	0.59 U	0.48 U
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	51 J	140 J	1.2 J	1.1 J	0.038 U	0.025 U	0.036 U	1.0 U	0.24 U	0.44 U	0.23 U
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	1.3 J	1.8 J	1.3 J	1.1 J	0.21 U	0.54 J	0.33 U	2.0 J	0.048 U	0.093 U	1.0 J
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	pg/g	3.3 J	8.5	0.25 J	0.17 U	0.037 U	0.024 U	0.036 U	0.79 U	0.21 U	0.53 U	0.69 U
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	2.7 J	1.3 U	3.3 J	2.9 J	2.3 J	1.6 J	2.5 J	2.7 U	1.2 U	1.6 J	1.6 J
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	150 J	410 J	3.6 J	3.7 J	0.26 J	0.037 U	0.53 J	1.5 J	0.51 J	0.17 U	0.65 J
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	24 J	62 J	0.16 U	0.73 J	0.10 U	0.11 U	0.15 U	0.095 U	0.15 U	0.12 U	0.10 U
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	6.5 J	15	0.066 U	0.14 J	0.038 U	0.024 U	0.034 U	0.86 U	0.20 U	0.57 U	0.32 U
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	120 J	380 J	2.6 J	2.7 J	0.16 J	0.040 U	0.12 U	1.6 U	0.52 U	0.58 U	0.038 U
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	pg/g	8000 J	25000 J	190	230	11	3.9	32	26	0.067 U	3.8 J	2.3 J
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	1900 J	5700 J	45	58	3.3	0.95 J	8.7	0.062 U	0.54 J	1.1 U	0.95 U
Total heptachlorodibenzofuran (HpCDF)	pg/g	100 J	260 J	1.8 J	2.0 J	0.050 U	0.039 U	0.40 J	20 J	0.42 J	1.3 J	0.71 J
Total heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	140 J	95 J	160 J	140 J	100 J	71 J	130 J	230 J	94 J	110 J	66 J
Total hexachlorodibenzofuran (HxCDF)	pg/g	290 J	880 J	6.4 J	6.0 J	0.038 U	0.027 U	0.91 J	9.7 J	0.65 J	2.2 J	1.6 J
Total hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	36 J	32 J	41 J	42 J	28 J	24 J	42 J	47 J	28 J	31 J	22 J
Total pentachlorodibenzofuran (PeCDF)	pg/g	400 J	1200 J	8.5 J	9.8 J	0.43 J	0.040 U	0.53 J	9.1 J	1.5 J	1.1 J	1.3 J
Total pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	24 J	75 J	7.7 J	8.4 J	3.9 J	4.8 J	9.2 J	7.4 J	6.1 J	11 J	4.0 J
Total tetrachlorodibenzofuran (TCDF)	pg/g	14000 J	44000 J	360 J	440 J	17 J	5.6 J	60 J	52 J	0.94 J	4.3 J	2.9 J
Total tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	2100 J	6300 J	45 J	68 J	3.3 J	2.2 J	8.7 J	3.5 J	3.5 J	1.1 J	2.3 J
TEQ												
Total WHO Dioxin TEQ(Human/Mammal)(ND=0)	pg/g	2800 J	8500 J	67 J	84 J	5.1 J	1.9 J	13 J	4.4 J	0.89 J	0.92 J	0.78 J
Total WHO Dioxin TEQ(Human/Mammal)(ND=0.5)	pg/g	2800 J	8500 J	67 J	84 J	5.2 J	1.9 J	13 J	5.2 J	1.2 J	1.8 J	1.4 J

Notes:
U - Not detected at the associated reporting limit
J - Estimated concentration
UJ - Not detected; associated reporting limit is estimated
J- - Estimated concentration, result may be biased low
J+ - Estimated concentration, result may be biased high
TEQ - Toxicity Equivalent Quotient
ft bgs - Feet below ground surface
pg/g - picogram per grams

Table 2-4

Supplemental Design Investigation Analytical Results - Northern Impoundment
Pre- Final 90% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Sample Location: Sample Identification: Sample Date: Sample Depth: Parameters	Units	SJSB097 11215702-082221-BN-DUP-20 08/22/2021 (6-8) ft bgs Field Duplicate	SJSB097 11215702-082221-BN-SJSB097(8-10) 08/22/2021 (8-10) ft bgs	SJSB097 11215702-082221-BN-SJSB097(10-12) 08/22/2021 (10-12) ft bgs	SJSB097 11215702-082221-BN-SJSB097(12-14) 08/22/2021 (12-14) ft bgs	SJSB097 11215702-082221-BN-SJSB097(14-16) 08/22/2021 (14-16) ft bgs	SJSB098 11215702-082021-BN-SJSB098(0-2) 08/20/2021 (0-2) ft bgs	SJSB098 11215702-082021-BN-SJSB098(2-4) 08/20/2021 (2-4) ft bgs	SJSB098 11215702-082021-BN-SJSB098(4-6) 08/20/2021 (4-6) ft bgs	SJSB098 11215702-082021-BN-SJSB098(6-8) 08/20/2021 (6-8) ft bgs	SJSB098 11215702-082021-BN-SJSB098(8-10) 08/20/2021 (8-10) ft bgs	SJSB098 11215702-082021-BN-SJSB098(10-12) 08/20/2021 (10-12) ft bgs
Dioxins/Furans												
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	pg/g	1.3 J	1.0 U	0.089 U	0.089 U	0.089 U	39 J	73 J	120 J	57 J	130 J	82
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	pg/g	420	66 J	22	26	26	1800	1800	3000	1900	1700	1600
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	pg/g	1.5 J	0.62 U	0.082 U	0.064 U	0.064 U	8.3 J	31 J	38 J	13 J	250	150
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	24 J	3.6 U	1.1 J	1.6 J	1.7 J	58 J	71 J	120	77	95	71
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	pg/g	0.082 U	0.29 U	0.079 U	0.047 U	0.0030 U	1.3 U	9.9 J	12 J	3.0 J	80	48
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.86 U	0.69 U	0.064 U	0.067 U	0.063 U	8.5 J	120	130	24 J	790	450
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.17 U	0.76 U	0.055 J	0.10 J	0.069 J	0.76 U	1.6 J	0.18 U	2.2 U	2.0 U	0.94 J
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.84 U	0.92 U	0.056 U	0.050 U	0.047 U	2.3 J	29 J	31 J	6.5 J	200	110
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.18 U	0.74 J	0.098 U	0.16 J	0.12 U	2.5 J	6.3 J	3.7 J	2.7 J	7.8 J	4.0 J
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	pg/g	0.52 J	0.94 U	0.016 U	0.083 U	0.083 U	1.5 U	15 J	13 J	0.10 U	0.62 U	39
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.52 U	0.96 J	0.21 U	0.25 U	0.17 U	2.7 U	3.8 J	5.0 J	1.6 J	3.7 J	1.7 J
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	1.2 J	1.2 J	0.10 U	0.14 U	0.074 U	4.7 J	120	130	16 J	620	340
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	0.14 U	0.15 U	0.15 J	0.16 J	0.16 J	2.1 J	14 J	16 J	2.8 J	76	48
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.63 U	0.44 U	0.014 U	0.085 U	0.085 U	1.1 U	9.2 J	8.6 U	1.5 U	40 J	23
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	1.2 J	0.68 U	0.096 U	0.096 U	0.096 U	4.5 J	100	110	12 J	530	280
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	pg/g	1.4 J	9.3 J	1.2 J	1.1	0.11 U	180	5500	4500	360	21000	10000
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	0.095 U	2.1 U	0.44 J	1.0 J	0.050 J	47	1300	1300	110	7100 J	2700 J
Total heptachlorodibenzofuran (HpCDF)	pg/g	3.0 J	1.1 J	0.22 J	0.086 J	0.12 J	18 J	59 J	72 J	28 J	430 J	260 J
Total heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	93 J	11 J	3.9 J	6.5 J	5.4 J	190 J	240 J	370 J	77 J	230 J	190 J
Total hexachlorodibenzofuran (HxCDF)	pg/g	3.3 J	3.2 J	0.12 J	0.20 J	0.23 J	20 J	200 J	210 J	42 J	1100 J	690 J
Total hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	25 J	7.3 J	1.9 J	2.0 J	2.1 J	34 J	81 J	93 J	50 J	50 J	38 J
Total pentachlorodibenzofuran (PeCDF)	pg/g	2.8 J	3.0 J	0.24 J	0.23 J	0.36 J	19 J	350 J	370 J	50 J	1800 J	1200 J
Total pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	3.0 J	2.4 J	0.41 J	0.34 J	0.86 J	9.7 J	21 J	46 J	13 J	96 J	56 J
Total tetrachlorodibenzofuran (TCDF)	pg/g	2.4 J	14 J	1.8 J	8.0 J	0.11 J	360 J	10000 J	10000 J	480 J	46000 J	34000 J
Total tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	1.4 J	3.7 J	0.81 J	1.1 J	0.32 J	51 J	1400 J	1500 J	130 J	7900 J	7300 J
TEQ												
Total WHO Dioxin TEQ(Human/Mammal)(ND=0)	pg/g	0.97 J	1.2 J	0.73 J	1.3 J	0.24 J	71 J	1900 J	1800 J	160 J	9600 J	3900 J
Total WHO Dioxin TEQ(Human/Mammal)(ND=0.5)	pg/g	1.3 J	2.6 J	0.77 J	1.4 J	0.29 J	71 J	1900 J	1800 J	160 J	9600 J	3900 J

Notes:
- U - Not detected at the associated reporting limit
- J - Estimated concentration
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San Jacinto River Waste Pits Site
Harris County, Texas

Sample Location: Sample Identification: Sample Date: Sample Depth: Parameters	Units	SJSB098 11215702-082021-BN-SJSB098(12-14) 08/20/2021 (12-14) ft bgs	SJSB098 11215702-082021-BN-SJSB098(14-16) 08/20/2021 (14-16) ft bgs	SJSB098 11215702-082021-BN-SJSB098(16-18) 08/20/2021 (16-18) ft bgs	SJSB099 11215702-072421-SS-SJSB099(0-2) 07/24/2021 (0-2) ft bgs	SJSB099 11215702-072421-SS-SJSB099(2-4) 07/24/2021 (2-4) ft bgs	SJSB099 11215702-072421-SS-SJSB099(4-6) 07/24/2021 (4-6) ft bgs	SJSB099 11215702-072421-SS-SJSB099(6-8) 07/24/2021 (6-8) ft bgs	SJSB099 11215702-072421-SS-SJSB099(8-10) 07/24/2021 (8-10) ft bgs	SJSB099 11215702-072421-SS-SJSB099(10-12) 07/24/2021 (10-12) ft bgs	SJSB099 11215702-072421-SS-SJSB099 (10-12)-R 07/25/2021 (10-12) ft bgs Lab Duplicate	SJSB099 11215702-072421-SS-SJSB099(12-14) 07/24/2021 (12-14) ft bgs
Dioxins/Furans												
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	pg/g	9.8 J	0.39 U	0.22 U	1700	1300 J+	2.9 J	0.53 J	0.063 U	5.4 J	4.3 U	0.094 U
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	pg/g	610	610	19	11000	11000	160	110	120	440	360	220
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	pg/g	19	0.38 U	0.14 U	2800	2100	3.1 J	0.45 J	0.61 J	6.5 J	6.1 J	0.057 U
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	36	37	1.2 J	670	640	6.3	3.4 J	4.8 J	28	22	12
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	pg/g	6.5 J	0.20 U	0.057 U	790	620	1.0 J	0.055 U	0.20 J	2.5 J	2.5 J	0.055 U
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	61	1.3 J	0.051 U	6600	6000	11	1.2 J	1.6 J	21	22	0.021 U
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.83 J	0.60 J	0.044 U	6.3 J	8.2 J	0.30 J	0.32 J	0.058 U	0.52 J	0.73 U	0.31 J
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	15	0.43 J	0.064 U	1500	1700	2.9 J	0.31 J	0.43 J	5.8 J	4.9 J	0.022 U
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	1.3 J	1.1 J	0.088 U	49 J	41 J	0.41 J	0.069 U	0.068 U	1.1 J	0.91 J	0.51 J
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	pg/g	0.051 U	0.15 U	0.082 U	84 J	100 J	0.071 U	0.028 U	0.049 U	0.52 J	0.51 J	0.30 J
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	2.3 J	2.2 J	0.099 U	12 J	8.3 J	0.067 U	0.23 J	0.058 U	1.8 J	1.7 U	0.82 J
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	48	0.93 J	0.11 U	4000	4300	9.4	1.0 J	1.2 J	13	12	0.26 J
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	6.4 J	0.47 J	0.015 U	390	430	1.0 J	0.068 U	0.064 U	0.16 U	1.4 J	0.092 U
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	3.1 J	0.16 U	0.064 U	170	220	0.27 J	0.028 U	0.046 U	0.81 J	0.63 J	0.021 U
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	40	0.53 U	0.073 U	2500	2700	5.5 J	0.51 J	0.71 J	8.0	8.9	0.037 U
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	pg/g	1600	20	0.44 J	160000 J	120000 J	290	27	34	390	480	2.8 U
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	490	6.8	0.10 U	35000 J	40000 J	94	10	11	130	150	1.3 J
Total heptachlorodibenzofuran (HpCDF)	pg/g	31 J	0.93 J	0.29 J	4500 J	3600 J	5.4 J	0.74 J	1.0 J	11 J	11 J	0.057 U
Total heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	150 J	160 J	4.0 J	1500 J	1400 J	22 J	13 J	19 J	94 J	74 J	41 J
Total hexachlorodibenzofuran (HxCDF)	pg/g	87 J	2.2 J	0.31 J	9400 J	9100 J	16 J	1.5 J	2.0 J	32 J	31 J	0.30 J
Total hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	54 J	48 J	1.6 J	190 J	180 J	4.5 J	2.9 J	3.9 J	28 J	21 J	13 J
Total pentachlorodibenzofuran (PeCDF)	pg/g	130 J	2.5 J	0.40 J	10000 J	11000 J	23 J	2.0 J	2.3 J	34 J	34 J	0.26 J
Total pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	19 J	7.0 J	0.86 J	390 J	430 J	1.0 J	0.068 U	0.064 U	0.16 U	4.8 J	0.86 J
Total tetrachlorodibenzofuran (TCDF)	pg/g	3300 J	52 J	0.99 J	250000 J	280000 J	590 J	59 J	70 J	830 J	870 J	4.8 J
Total tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	540 J	14 J	0.20 J	38000 J	43000 J	100 J	10 J	11 J	140 J	170 J	1.3 J
TEQ												
Total WHO Dioxin TEQ(Human/Mammal)(ND=0)	pg/g	680 J	10 J	0.062 J	53000 J	54000 J	130 J	13 J	15 J	180 J	210 J	1.7 J
Total WHO Dioxin TEQ(Human/Mammal)(ND=0.5)	pg/g	680 J	11 J	0.16 J	53000 J	54000 J	130 J	13 J	15 J	180 J	210 J	1.9 J

Notes:
- U - Not detected at the associated reporting limit
- J - Estimated concentration
- UJ - Not detected; associated reporting limit is estimated
- J- - Estimated concentration, result may be biased low
- J+ - Estimated concentration, result may be biased high
- TEQ - Toxicity Equivalent Quotient
- ft bgs - Feet below ground surface
- pg/g - picogram per grams

Table 2-4

Supplemental Design Investigation Analytical Results - Northern Impoundment
Pre- Final 90% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Sample Location: Sample Identification: Sample Date: Sample Depth: Parameters	Units	SJSB099 11215702-072421-SS-SJSB099(14-16) 07/24/2021 (14-16) ft bgs	SJSB099 11215702-072421-SS-SJSB099(16-18) 07/24/2021 (16-18) ft bgs	SJSB099 11215702-072421-DUP-6 07/24/2021 (16-18) ft bgs Field Duplicate	SJSB100 11215702-082321-BN-SJSB100(0-2) 08/23/2021 (0-2) ft bgs	SJSB100 11215702-082321-BN-SJSB100(2-4) 08/23/2021 (2-4) ft bgs	SJSB100 11215702-082321-BN-SJSB100(4-6) 08/23/2021 (4-6) ft bgs	SJSB100 11215702-082321-BN-SJSB100(6-8) 08/23/2021 (6-8) ft bgs	SJSB100 11215702-082321-BN-SJSB100(8-10) 08/23/2021 (8-10) ft bgs	SJSB100 11215702-082321-BN-SJSB100(10-12) 08/23/2021 (10-12) ft bgs	SJSB100 11215702-082321-BN-SJSB100(12-14) 08/23/2021 (12-14) ft bgs	SJSB100 11215702-082321-BN-SJSB100(14-16) 08/23/2021 (14-16) ft bgs
Dioxins/Furans												
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	pg/g	1.0 J	0.59 J	1.1 J	170 J	2.9 J	4.2 U	0.82 U	2.2 U	0.16 U	0.092 U	0.16 U
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	pg/g	350	280	360	4600	380	220	340	200	52	15	49
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	pg/g	0.90 J	0.50 J	0.90 J	23 J	0.83 J	1.3 U	1.6 U	0.61 U	0.22 U	0.14 U	0.24 U
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	17	13	17	170	18 J	15 J	25 J	8.8 J	2.8 J	1.1 J	2.9 J
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	pg/g	0.24 J	0.15 J	0.058 U	5.1 J	0.50 J	0.63 U	0.036 U	0.61 U	0.12 U	0.052 U	0.073 U
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	2.5 J	0.76 J	1.4 J	15 J	0.82 J	1.7 U	1.7 U	1.4 U	0.26 U	0.14 U	0.29 U
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.11 U	0.14 U	0.48 J	5.0 J	0.67 J	0.84 U	0.051 U	0.48 U	0.28 J	0.18 J	0.14 J
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.55 J	0.30 J	0.54 J	7.9 J	0.63 J	0.41 U	1.3 U	0.48 U	0.28 J	0.22 U	0.17 U
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.12 U	0.15 U	0.50 J	6.3 J	0.69 J	1.2 J	1.3 J	0.76 J	0.23 J	0.17 J	0.18 J
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	pg/g	0.050 U	0.032 U	0.045 U	5.0 J	0.44 J	1.2 U	0.055 U	0.43 U	0.13 U	0.11 U	0.098 U
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	1.3 J	0.72 J	1.3 J	8.6 J	1.3 J	2.2 J	0.052 U	1.3 J	0.43 J	0.21 U	0.21 U
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	1.8 J	0.47 J	1.1 J	12 J	1.2 J	1.5 J	0.082 U	0.15 U	0.31 U	0.22 U	0.28 U
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	0.11 U	0.089 U	0.11 U	5.7 J	0.64 J	1.3 J	0.13 U	1.2 J	0.32 J	0.29 J	0.23 J
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.050 U	0.035 U	0.044 U	4.4 J	0.13 J	0.45 U	0.65 U	0.64 U	0.14 U	0.18 U	0.085 U
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	1.2 J	0.36 J	0.67 J	10 J	1.1 J	1.2 U	0.066 U	0.90 U	0.26 U	0.25 U	0.012 U
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	pg/g	55	14	27	230	7.3 J	15	0.076 U	3.4 J	0.33 U	0.28 U	0.54 U
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	19	5.0	10	66	1.2 J	5.4 J	0.10 U	0.14 U	0.0048 U	0.13 J	0.13 J
Total heptachlorodibenzofuran (HpCDF)	pg/g	1.1 J	0.65 J	1.3 J	52 J	2.1 J	3.1 J	1.6 J	1.6 J	0.46 J	0.23 J	0.48 J
Total heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	64 J	55 J	66 J	530 J	63 J	54 J	95 J	32 J	8.0 J	3.3 J	9.3 J
Total hexachlorodibenzofuran (HxCDF)	pg/g	3.1 J	1.1 J	1.9 J	50 J	2.3 J	5.1 J	4.3 J	3.1 J	0.80 J	0.70 J	0.91 J
Total hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	18 J	16 J	21 J	120 J	18 J	22 J	28 J	11 J	3.3 J	1.7 J	2.1 J
Total pentachlorodibenzofuran (PeCDF)	pg/g	4.1 J	0.84 J	1.7 J	38 J	4.2 J	5.2 J	2.9 J	4.9 J	0.58 J	0.55 J	0.73 J
Total pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	1.4 J	1.5 J	1.5 J	15 J	2.7 J	3.3 J	6.2 J	1.2 J	1.1 J	0.68 J	0.36 J
Total tetrachlorodibenzofuran (TCDF)	pg/g	100 J	23 J	48 J	420 J	9.6 J	24 J	2.8 J	6.2 J	0.33 J	0.28 J	1.8 J
Total tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	19 J	5.0 J	10 J	78 J	3.7 J	9.5 J	1.5 J	0.85 J	0.66 J	0.30 J	0.36 J
TEQ												
Total WHO Dioxin TEQ(Human/Mammal)(ND=0)	pg/g	26 J	6.9 J	14 J	110 J	3.7 J	8.8 J	0.48 J	1.9 J	0.49 J	0.47 J	0.44 J
Total WHO Dioxin TEQ(Human/Mammal)(ND=0.5)	pg/g	26 J	7.0 J	14 J	110 J	3.7 J	9.2 J	0.81 J	2.3 J	0.58 J	0.57 J	0.51 J

Notes:
- U - Not detected at the associated reporting limit
- J - Estimated concentration
- UJ - Not detected; associated reporting limit is estimated
- J- - Estimated concentration, result may be biased low
- J+ - Estimated concentration, result may be biased high
- TEQ - Toxicity Equivalent Quotient
- ft bgs - Feet below ground surface
- pg/g - picogram per grams

Table 2-4

Supplemental Design Investigation Analytical Results - Northern Impoundment
Pre- Final 90% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Sample Location: Sample Identification: Sample Date: Sample Depth: Parameters	Units	SJSB101 11215702-072521-SS-SJSB101(0-2) 07/25/2021 (0-2) ft bgs	SJSB101-Waste 11215702-072521-SS-SJSB101(0-2)-WC 07/25/21 (0-2) ft bgs	SJSB101 11215702-072521-SS-SJSB101(2-4) 07/25/2021 (2-4) ft bgs	SJSB101-Waste 11215702-072521-SS-SJSB101(2-4)-WC 07/25/21 (2-4) ft bgs	SJSB101 11215702-072521-SS-SJSB101(4-6) 07/25/2021 (4-6) ft bgs	SJSB101 11215702-072521-SS-SJSB101(6-8) 07/25/2021 (6-8) ft bgs	SJSB101 11215702-072521-SS-SJSB101(8-10) 07/25/2021 (8-10) ft bgs	SJSB101 11215702-072521-SS-SJSB101(10-12) 07/25/2021 (10-12) ft bgs	SJSB101 11215702-072521-SS-SJSB101 (10-12)-R 07/25/2021 (10-12) ft bgs Lab Duplicate	SJSB101 11215702-072521-SS-SJSB101(12-14) 07/25/2021 (12-14) ft bgs	SJSB101 11215702-072521-SS-SJSB101(14-16) 07/25/2021 (14-16) ft bgs
Dioxins/Furans												
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	pg/g	1700	1400	1400	1200	640	0.61 J	0.095 U	5.0 J	3.5 U	1.7 J	0.66 J
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	pg/g	10000	10000	9700	5800	4500	110	88	170	150	180	95
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	pg/g	3100	2500	2300	2800	1100	0.72 J	0.20 J	7.5	6.6	0.94 J	0.24 J
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	540	670	610	470	280	3.9 J	3.2 J	7.0	7.1	11	5.1 J
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	pg/g	1000	890	700	860	370	0.26 J	0.034 U	2.5 J	4.2 J	0.060 U	0.044 U
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	10000	8500	7300	10000	3400	2.3 J	0.56 J	26	36	0.72 J	0.029 U
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	6.1 J	4.5 J	7.5 J	7.1 J	2.4 J	0.24 J	0.20 J	0.073 U	0.33 U	0.13 U	0.085 U
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	2800	2200	1800	2600	1000	0.57 J	0.14 J	6.7	7.6	0.038 U	0.030 U
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	36 J	40 J	44 J	30 J	18 J	0.19 J	0.23 J	0.076 U	0.23 J	0.14 U	0.095 U
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	pg/g	180	120	110 J	140 J	65 J	0.36 U	0.025 U	0.74 U	0.69 J	0.28 U	0.25 U
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	18 J	16 J	11 J	15 J	6.9 J	0.26 J	0.059 U	0.37 J	0.45 U	1.1 J	0.083 U
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	7000	5500	4700	5500	2200	1.7 J	0.31 J	18	11	0.045 U	0.035 U
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	400 J	370	380	280	160	0.079 U	0.080 U	1.6 J	0.77 J	0.11 U	0.083 U
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	340	250	220	260	120	0.046 U	0.028 U	0.52 J	0.76 J	0.035 U	0.029 U
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	3400	2900	2700	2400	1300	0.83 J	0.051 U	11	6.0	0.045 U	0.038 U
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	pg/g	160000 J	140000 J	150000 J	100000 J	62000 J	42	6.9	540 J	290 J	1.1 J	0.71 J
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	44000 J	35000 J	42000 J	34000 J	18000 J	13	1.8	170 J	92 J	0.11 U	0.077 U
Total heptachlorodibenzofuran (HpCDF)	pg/g	4900 J	4300 J	3800 J	4300 J	1900 J	1.3 J	0.20 J	13 J	14 J	0.94 J	0.24 J
Total heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	1100 J	1400 J	1300 J	970 J	590 J	12 J	13 J	20 J	19 J	35 J	18 J
Total hexachlorodibenzofuran (HxCDF)	pg/g	15000 J	13000 J	11000 J	15000 J	5200 J	3.2 J	0.70 J	39 J	51 J	1.0 J	0.25 J
Total hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	190 J	190 J	190 J	150 J	82 J	3.2 J	3.1 J	5.5 J	7.2 J	12 J	5.5 J
Total pentachlorodibenzofuran (PeCDF)	pg/g	16000 J	14000 J	12000 J	12000 J	5300 J	3.7 J	0.31 J	40 J	27 J	0.17 U	0.038 U
Total pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	400 J	370 J	380 J	280 J	160 J	0.079 U	0.080 U	1.6 J	2.4 J	1.2 J	0.083 U
Total tetrachlorodibenzofuran (TCDF)	pg/g	260000 J	230000 J	250000 J	170000 J	100000 J	72 J	9.6 J	1100 J	530 J	1.6 J	0.71 J
Total tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	48000 J	38000 J	46000 J	37000 J	19000 J	13 J	1.8 J	190 J	100 J	1.0 J	0.15 U
TEQ												
Total WHO Dioxin TEQ(Human/Mammal)(ND=0)	pg/g	63000 J	52000 J	59000 J	47000 J	25000 J	18 J	2.7 J	230 J	130 J	0.47 J	0.15 J
Total WHO Dioxin TEQ(Human/Mammal)(ND=0.5)	pg/g	63000 J	52000 J	59000 J	47000 J	25000 J	18 J	2.7 J	230 J	130 J	0.62 J	0.27 J

Notes:
- U - Not detected at the associated reporting limit
- J - Estimated concentration
- UJ - Not detected; associated reporting limit is estimated
- J- - Estimated concentration, result may be biased low
- J+ - Estimated concentration, result may be biased high
- TEQ - Toxicity Equivalent Quotient
- ft bgs - Feet below ground surface
- pg/g - picogram per grams

Table 2-4

Supplemental Design Investigation Analytical Results - Northern Impoundment
Pre- Final 90% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Sample Location:	Units	SJSB101	SJSB101	SJSB102	SJSB102	SJSB102	SJSB102	SJSB102	SJSB102	SJSB102	SJSB102	SJSB102
Sample Identification:		11215702-072521-SS-SJSB101(16-18)	11215702-072521-SS-SJSB101(18-20)	11215702-081921-BN-SJSB102(0-2)	11215702-081921-BN-SJSB102(2-4)	11215702-081921-BN-SJSB102(4-6)	11215702-081921-BN-SJSB102(6-8)	11215702-081921-BN-SJSB102(8-10)	11215702-081921-BN-SJSB102(10-12)	11215702-081921-BN-SJSB102(12-14)	11215702-081921-BN-SJSB102 (12-14)-R	11215702-081921-BN-SJSB102(14-16)
Sample Date:		07/25/2021	07/25/2021	08/19/2021	08/19/2021	08/19/2021	08/19/2021	08/19/2021	08/19/2021	08/19/2021	08/19/2021	08/19/2021
Sample Depth:		(16-18) ft bgs	(18-20) ft bgs	(0-2) ft bgs	(2-4) ft bgs	(4-6) ft bgs	(6-8) ft bgs	(8-10) ft bgs	(10-12) ft bgs	(12-14) ft bgs	(12-14) ft bgs	(14-16) ft bgs
Parameters											Lab Duplicate	
Dioxins/Furans												
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	pg/g	19	0.38 U	150 J	12 U	13 J	1.4 U	1.1 U	0.26 U	1.9 J	2.7 J	0.0043 U
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	pg/g	180	150	2900	160	710	580	590	890	590	620	800
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	pg/g	1.2 J	0.15 U	120 J	3.0 U	12 J	0.63 U	0.34 U	0.13 U	1.0 J	5.9 J	0.11 U
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	9.3	7.3	180 J	14 J	34 J	49 J	27 J	39	25	28	35
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	pg/g	0.088 U	0.074 U	15 J	1.1 U	3.9 J	0.044 U	0.22 U	0.0079 U	0.34 J	2.9 J	0.0058 U
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	1.3 J	0.38 J	120 J	1.1 U	28 J	3.1 U	2.0 U	0.24 U	3.3 J	45 J	0.093 U
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.097 U	0.26 J	7.0 J	0.099 U	1.4 U	0.90 U	0.091 U	0.58 J	0.43 J	0.37 U	0.44 J
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.052 U	0.18 U	37 J	0.23 U	8.1 J	0.87 U	0.041 U	0.21 U	0.88 J	10	0.0039 U
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.11 U	0.21 U	13 J	1.3 U	2.8 J	0.14 U	0.63 J	1.2 J	0.63 J	0.65 J	0.94 J
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	pg/g	0.29 U	0.092 U	1.0 U	1.2 U	0.13 U	0.31 U	0.35 U	0.0084 U	0.0093 U	5.6 J	0.15 U
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.096 U	0.34 J	11 J	1.1 U	1.4 J	3.7 J	1.9 J	1.2 J	1.1 J	1.5 J	1.4 J
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	1.0 J	0.33 J	98 J	1.6 U	23 J	1.5 J	3.4 J	0.35 U	2.9 J	28 J	0.20 U
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	0.16 U	0.19 U	20 J	1.0 U	3.8 J	1.4 J	0.31 U	0.50 J	0.43 J	0.39 J	0.15 J
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.049 U	0.074 U	13 J	0.80 U	2.2 U	0.038 U	0.037 U	0.22 U	0.24 U	2.5 J	0.0037 U
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	0.077 U	0.25 U	95 J	1.2 U	23 J	1.8 U	1.9 U	0.0070 U	2.3 J	9.5	0.096 U
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	pg/g	24	6.6	3900	17	960	54	41	3.1	87	55	3.5
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	8.5	2.1	960	3.0 J	230	16	0.16 U	0.71 J	23	14	0.014 U
Total heptachlorodibenzofuran (HpCDF)	pg/g	3.0 J	0.38 J	220 J	10 J	20 J	0.63 J	0.56 J	0.20 J	1.9 J	11 J	0.18 J
Total heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	34 J	29 J	450 J	25 J	91 J	100 J	82 J	120 J	84 J	86 J	110 J
Total hexachlorodibenzofuran (HxCDF)	pg/g	1.6 J	0.74 J	250 J	5.0 J	41 J	4.6 J	2.4 J	0.67 J	5.0 J	68 J	0.25 J
Total hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	9.6 J	13 J	120 J	7.6 J	33 J	22 J	31 J	43 J	26 J	23 J	33 J
Total pentachlorodibenzofuran (PeCDF)	pg/g	1.0 J	19 J	380 J	4.5 J	66 J	3.9 J	5.8 J	0.72 J	7.8 J	53 J	0.47 J
Total pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	0.16 U	4.2 J	30 J	2.1 J	11 J	4.7 J	4.0 J	8.3 J	5.1 J	3.7 J	6.9 J
Total tetrachlorodibenzofuran (TCDF)	pg/g	42 J	13 J	8900 J	20 J	2400 J	110 J	57 J	4.6 J	190 J	120 J	9.8 J
Total tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	8.5 J	4.9 J	1100 J	3.8 J	270 J	17 J	0.16 U	6.9 J	27 J	18 J	4.1 J
TEQ												
Total WHO Dioxin TEQ(Human/Mammal)(ND=0)	pg/g	11 J	3.0 J	1400 J	4.9 J	340 J	24 J	4.9 J	2.5 J	34 J	31 J	1.4 J
Total WHO Dioxin TEQ(Human/Mammal)(ND=0.5)	pg/g	11 J	3.2 J	1400 J	5.9 J	340 J	24 J	5.6 J	2.5 J	34 J	31 J	1.4 J

Notes:
- U - Not detected at the associated reporting limit
- J - Estimated concentration
- UJ - Not detected; associated reporting limit is estimated
- J- - Estimated concentration, result may be biased low
- J+ - Estimated concentration, result may be biased high
- TEQ - Toxicity Equivalent Quotient
- ft bgs - Feet below ground surface
- pg/g - picogram per grams

Table 2-4

Supplemental Design Investigation Analytical Results - Northern Impoundment
Pre- Final 90% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Sample Location: / Sample Identification: / Sample Date: / Sample Depth: / Parameters	Units	SJSB102 11215702-081921-BN-SJSB102(16-18) 08/19/2021 (16-18) ft bgs	SJSB102 11215702-081921-BN-SJSB102 (16-18)-R 08/19/2021 (16-18) ft bgs Lab Duplicate	SJSB102 11215702-081921-BN-SJSB102(18-20) 08/19/2021 (18-20) ft bgs	SJSB102 11215702-081921-BN-SJSB102(20-22) 08/19/2021 (20-22) ft bgs	SJSB102 11215702-081921-BN-SJSB102(22-24) 08/19/2021 (22-24) ft bgs	SJSB103 11215702-082121-BN-SJSB103(0-2) 08/21/2021 (0-2) ft bgs	SJSB103 11215702-082121-BN-SJSB103(2-4) 08/21/2021 (2-4) ft bgs	SJSB103 11215702-082121-BN-SJSB103(4-6) 08/21/2021 (4-6) ft bgs	SJSB103 11215702-082121-BN-SJSB103(6-8) 08/21/2021 (6-8) ft bgs	SJSB103 11215702-082121-BN-SJSB103(8-10) 08/21/2021 (8-10) ft bgs	SJSB103 11215702-082121-BN-SJSB103(10-12) 08/21/2021 (10-12) ft bgs
Dioxins/Furans												
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	pg/g	7.6 U	8.5 J	2.0 U	1.4 U	0.69 U	1.6 U	0.10 U	2.5 U	1.4 U	0.76 U	0.089 U
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	pg/g	900	760	810	790	730	35 U	35 U	220	14 J	8.4 U	28
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	pg/g	3.5 U	3.7 J	1.4 U	0.51 U	0.93 U	0.67 U	1.3 U	1.1 U	0.88 U	0.55 U	0.064 U
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	40 J	38 J	52 J	40 J	40 J	2.6 U	0.14 U	11 J	2.1 U	1.9 U	1.0 J
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	pg/g	1.7 U	0.70 U	1.3 U	0.57 U	0.69 U	0.057 U	0.39 U	0.60 U	0.62 U	0.53 U	0.047 U
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	10 J	5.6 J	2.9 U	1.2 U	0.87 U	0.29 U	0.81 U	1.7 U	1.3 U	1.3 U	0.063 U
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	1.1 U	0.64 U	2.6 U	3.3 U	1.5 U	0.062 U	0.46 U	0.40 U	0.82 U	1.0 U	0.043 J
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	3.0 U	2.4 J	1.4 U	0.68 U	0.48 U	0.38 U	0.83 U	0.91 U	1.5 U	1.2 U	0.051 U
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	1.7 U	0.76 U	4.1 U	3.9 U	2.7 U	0.27 U	0.14 U	1.0 J	0.62 J	1.4 J	0.055 U
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	pg/g	1.6 U	0.22 U	2.6 U	1.2 U	0.57 U	0.47 U	0.13 U	0.62 U	0.72 U	1.3 U	0.083 U
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	2.6 J	1.2 J	5.1 U	2.7 U	3.2 U	0.55 U	0.14 U	1.0 J	0.86 J	1.7 J	0.12 U
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	7.9 J	4.5 J	1.6 U	1.9 U	1.4 U	0.36 J	0.18 U	1.2 J	2.8 J	2.6 J	0.074 U
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	2.3 U	0.15 U	4.1 U	3.6 U	3.9 U	1.4 J	1.0 U	0.46 J	2.0 J	1.8 J	0.043 J
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.91 U	0.13 U	1.5 U	0.64 U	0.59 U	0.48 U	0.41 U	0.39 U	0.88 U	0.85 U	0.085 U
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	7.7 J	3.4 J	3.2 U	1.3 U	0.48 U	0.11 U	0.53 U	1.3 U	2.1 U	1.6 U	0.096 U
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	pg/g	290 J	140 J	16	1.4 U	0.50 U	5.6 J	2.1 J	13	7.4 J	5.2 J	0.96 J
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	72 J	38 J	6.0 U	0.98 U	1.7 U	0.12 U	0.34 U	11	2.4 U	1.2 U	0.29 J
Total heptachlorodibenzofuran (HpCDF)	pg/g	7.7 J	5.6 J	2.6 J	1.1 J	1.6 J	1.6 J	2.7 J	2.3 J	2.1 J	1.4 J	0.12 J
Total heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	120 J	120 J	130 J	95 J	100 J	5.5 J	4.3 J	42 J	4.3 J	4.0 J	4.0 J
Total hexachlorodibenzofuran (HxCDF)	pg/g	19 J	10 J	8.8 J	4.0 J	2.8 J	3.7 J	2.7 J	4.1 J	4.6 J	4.8 J	0.21 J
Total hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	33 J	27 J	55 J	40 J	40 J	1.9 J	1.3 J	12 J	3.4 J	5.8 J	1.7 J
Total pentachlorodibenzofuran (PeCDF)	pg/g	26 J	13 J	6.5 J	7.8 J	4.5 J	4.0 J	6.0 J	2.8 J	5.5 J	5.0 J	0.26 J
Total pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	9.6 J	4.1 J	15 J	10 J	15 J	1.4 J	4.1 J	5.5 J	3.4 J	3.9 J	0.61 J
Total tetrachlorodibenzofuran (TCDF)	pg/g	600 J	270 J	28 J	2.6 J	1.7 J	11 J	5.3 J	64 J	8.7 J	6.8 J	2.7 J
Total tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	84 J	48 J	7.6 J	6.2 J	4.1 J	0.12 U	0.34 U	11 J	2.4 J	1.2 J	0.56 J
TEQ												
Total WHO Dioxin TEQ(Human/Mammal)(ND=0)	pg/g	110 J	55 J	2.4 J	0.64 J	0.62 J	1.0 J	0.21 J	13 J	3.0 J	2.7 J	0.45 J
Total WHO Dioxin TEQ(Human/Mammal)(ND=0.5)	pg/g	110 J	55 J	8.9 J	3.9 J	4.0 J	2.2 J	1.1 J	14 J	4.8 J	3.9 J	0.49 J

Notes:

U - Not detected at the associated reporting limit
J - Estimated concentration
UJ - Not detected; associated reporting limit is estimated
J- - Estimated concentration, result may be biased low
J+ - Estimated concentration, result may be biased high
TEQ - Toxicity Equivalent Quotient
ft bgs - Feet below ground surface
pg/g - picogram per grams

Table 2-4

Supplemental Design Investigation Analytical Results - Northern Impoundment
Pre- Final 90% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Sample Location: Sample Identification: Sample Date: Sample Depth:	Units	SJSB103 11215702-082121-BN-SJSB103(12-14) 08/21/2021 (12-14) ft bgs	SJSB104 11215702-072421-BN-SJSB104(0-2) 07/24/2021 (0-2) ft bgs	SJSB104 11215702-072421-BN-SJSB104(2-4) 07/24/2021 (2-4) ft bgs	SJSB104 11215702-072421-BN-SJSB104(4-6) 07/24/2021 (4-6) ft bgs	SJSB104 11215702-072421-BN-SJSB104(6-8) 07/24/2021 (6-8) ft bgs	SJSB104 11215702-072421-BN-SJSB104(8-10) 07/24/2021 (8-10) ft bgs	SJSB104 11215702-072421-BN-SJSB104(10-12) 07/24/2021 (10-12) ft bgs	SJSB104 11215702-072421-BN-SJSB104(12-14) 07/24/2021 (12-14) ft bgs	SJSB104 11215702-072421-BN-SJSB104(14-16) 07/24/2021 (14-16) ft bgs	SJSB104 11215702-072421-BN-SJSB104(16-18) 07/24/2021 (16-18) ft bgs	SJSB105 11215702-072321-BN-SJSB105(0-2) 07/23/2021 (0-2) ft bgs
Parameters												
Dioxins/Furans												
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	pg/g	0.099 U	1.5 U	0.25 U	0.54 U	0.86 U	1.7 U	0.075 U	1.7 U	0.042 U	0.092 U	470
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	pg/g	49	1300	1100	710	1300	770	1400	430	80	130	3200
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	pg/g	0.064 U	0.48 U	0.14 U	0.33 U	0.14 U	0.59 U	0.043 U	0.021 U	0.030 U	0.038 U	800
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	3.0 J	41	46	29	48	32	56	17	2.4 J	3.6 J	180
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	pg/g	0.047 U	0.10 J	0.028 U	0.089 J	0.040 U	0.068 J	0.041 U	0.021 U	0.029 U	0.036 U	240
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.063 U	0.90 J	0.12 J	0.76 J	0.10 J	0.33 J	0.049 U	0.024 U	0.019 U	0.042 U	2500
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.13 J	0.56 U	0.66 U	0.45 U	0.58 U	0.59 U	0.33 U	0.11 U	0.060 U	0.058 U	3.0 J
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.041 U	0.30 J	0.080 J	0.25 J	0.049 J	0.087 J	0.051 U	0.026 U	0.021 U	0.046 U	710
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.21 J	0.84 J	0.87 J	0.66 J	0.81 J	0.73 J	0.37 U	0.12 U	0.076 U	0.065 U	11
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	pg/g	0.083 U	0.22 U	0.35 U	0.27 U	0.29 U	0.28 U	0.36 U	0.026 U	0.27 U	0.35 U	40
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.24 U	1.7 J	2.4 J	1.4 J	2.2 J	2.1 J	3.6 J	0.11 U	0.062 U	0.056 U	6.7 J
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	0.088 U	0.91 J	0.30 J	0.75 J	0.26 J	0.24 J	0.074 U	0.046 U	0.046 U	0.056 U	2000
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	0.25 J	0.31 J	0.23 J	0.22 J	0.20 J	0.21 J	0.21 U	0.082 U	0.068 U	0.083 U	240
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.085 U	0.047 J	0.032 J	0.055 J	0.017 U	0.019 U	0.049 U	0.025 U	0.020 U	0.045 U	80
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	0.096 U	0.54 J	0.12 J	0.43 J	0.095 J	0.034 U	0.074 U	0.049 U	0.046 U	0.055 U	1400
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	pg/g	0.28 U	38	3.2	24	2.6	1.2 J	2.2	1.3	0.91 J	0.063 U	83000 J
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	0.075 J	9.9	1.0 J	7.0	0.91 J	0.38 J	0.11 U	0.051 U	0.081 U	0.071 U	27000 J
Total heptachlorodibenzofuran (HpCDF)	pg/g	0.11 J	0.78 J	0.11 J	0.57 J	0.12 J	0.77 J	0.13 U	0.20 U	0.030 U	0.038 U	1200 J
Total heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	8.5 J	140 J	160 J	110 J	160 J	100 J	160 J	46 J	8.5 J	12 J	420 J
Total hexachlorodibenzofuran (HxCDF)	pg/g	0.28 J	1.5 J	0.59 J	1.3 J	0.44 J	0.78 J	0.36 J	0.051 U	0.27 J	0.35 J	3700 J
Total hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	2.7 J	28 J	43 J	26 J	40 J	30 J	47 J	8.7 J	3.2 J	1.1 J	110 J
Total pentachlorodibenzofuran (PeCDF)	pg/g	0.36 J	2.1 J	0.54 J	1.7 J	0.47 J	0.36 J	0.11 U	0.13 U	0.083 U	0.056 U	5400 J
Total pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	0.39 J	5.2 J	9.8 J	5.4 J	8.0 J	6.9 J	4.5 U	1.1 U	0.92 U	0.35 U	260 J
Total tetrachlorodibenzofuran (TCDF)	pg/g	0.43 J	68 J	5.9 J	43 J	5.1 J	2.6 J	2.4 J	1.7 J	0.91 J	0.18 U	160000 J
Total tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	0.39 J	14 J	7.2 J	10 J	5.5 J	5.1 J	1.3 U	0.60 U	2.1 J	0.22 U	30000 J
TEQ												
Total WHO Dioxin TEQ(Human/Mammal)(ND=0)	pg/g	0.40 J	15 J	2.7 J	11 J	2.6 J	1.6 J	1.7 J	0.43	0.14 J	0.075 J	36000 J
Total WHO Dioxin TEQ(Human/Mammal)(ND=0.5)	pg/g	0.46 J	15 J	2.8 J	11 J	2.6 J	1.7 J	1.8 J	0.53	0.25 J	0.20 J	36000 J

Notes:
U - Not detected at the associated reporting limit
J - Estimated concentration
UJ - Not detected; associated reporting limit is estimated
J- - Estimated concentration, result may be biased low
J+ - Estimated concentration, result may be biased high
TEQ - Toxicity Equivalent Quotient
ft bgs - Feet below ground surface
pg/g - picogram per grams

Table 2-4

Supplemental Design Investigation Analytical Results - Northern Impoundment
Pre- Final 90% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Sample Location: Sample Identification: Sample Date: Sample Depth: Parameters	Units	SJSB105 11215702-072321-BN-SJSB105(2-4) 07/23/2021 (2-4) ft bgs	SJSB105 11215702-072321-BN-SJSB105(4-6) 07/23/2021 (4-6) ft bgs	SJSB105 11215702-072321-BN-SJSB105(6-8) 07/23/2021 (6-8) ft bgs	SJSB105 11215702-072321-BN-SJSB105(8-10) 07/23/2021 (8-10) ft bgs	SJSB105 11215702-072321-BN-SJSB105(10-12) 07/23/2021 (10-12) ft bgs	SJSB105 11215702-072321-BN-SJSB105(12-14) 07/23/2021 (12-14) ft bgs	SJSB105 11215702-072321-BN-SJSB105 (12-14)-R 07/23/2021 (12-14) ft bgs Lab Duplicate	SJSB105 11215702-072321-BN-SJSB105(14-16) 07/23/2021 (14-16) ft bgs	SJSB105 11215702-072321-BN-SJSB105 (14-16)-R 07/23/2021 (14-16) ft bgs Lab Duplicate	SJSB105 11215702-072321-BN-SJSB105(16-18) 07/23/2021 (16-18) ft bgs	SJSB106 11215702-080821-BN-SJSB106(0-2) 08/08/2021 (0-2) ft bgs
Dioxins/Furans												
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	pg/g	480	3.9 J	0.47 U	0.49 U	0.39 U	4.3 J	13 J	2.9 J	0.87 U	0.32 U	31
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	pg/g	1600	1500	1800	1600	1100	1600	1300	1400	1600	1400	4400
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	pg/g	1200	5.0 J	0.52 U	0.15 U	0.32 U	7.0 J	25 J	1.3 J	1.1 U	0.20 U	4.7 U
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	110	49	68	64	37	64	49	57	70	57	130
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	pg/g	440	1.6 J	0.18 U	0.080 U	0.062 U	2.1 J	9.0	0.68 U	0.41 U	0.049 U	0.78 J
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	4200	17	1.8 J	0.55 J	1.0 J	24 J	98 J	3.3 J	3.6 J	0.38 J	2.2 J
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	3.4 J	0.54 U	0.50 U	0.92 U	0.63 U	0.58 U	0.77 U	0.62 U	1.1 U	0.76 U	2.5 J
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	1100	5.2 J	0.53 J	0.22 U	0.29 J	6.8 J	22	1.0 J	0.96 J	0.14 U	1.1 J
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	8.4 J	0.90 J	1.9 J	1.4 J	0.89 J	1.2 J	1.4 J	1.2 J	1.8 J	1.3 J	3.0 J
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	pg/g	54 J	0.38 U	0.053 U	0.046 U	0.040 U	0.41 U	1.4 J	0.21 U	0.22 U	0.11 U	0.18 U
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	5.1 J	2.1 J	3.2 J	3.1 J	1.8 J	2.8 J	2.0 J	2.6 J	3.1 J	3.6 J	6.4 J
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	2600	12	1.2 J	0.44 J	0.86 J	18 J	68 J	2.9 J	2.6 J	0.39 J	2.0 J
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	300	1.9 J	0.15 U	0.16 U	0.27 J	2.6 J	7.9	0.59 J	0.71 J	0.32 J	0.58 U
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	110	0.53 J	0.051 U	0.044 U	0.039 U	0.79 J	2.8 J	0.12 J	0.16 U	0.029 U	0.18 U
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	1900	9.2	1.0 J	0.39 J	0.54 J	13 J	58 J	2.1 J	2.3 J	0.18 J	1.1 J
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	pg/g	130000 J	610 J	71	33	39	900 J	3700 J	160	150	14	71 J
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	33000 J	170	20	8.1	11	250 J	970 J	41	41	4.3	27 J
Total heptachlorodibenzofuran (HpCDF)	pg/g	1900 J	8.0 J	0.70 J	0.15 J	0.32 J	11 J	42 J	2.2 J	1.9 J	0.20 J	8.9 J
Total heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	230 J	170 J	190 J	200 J	110 J	200 J	150 J	180 J	210 J	200 J	310 J
Total hexachlorodibenzofuran (HxCDF)	pg/g	6000 J	24 J	2.3 J	0.78 J	1.3 J	36 J	140 J	5.3 J	5.6 J	0.62 J	6.6 J
Total hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	59 J	33 J	40 J	51 J	26 J	45 J	39 J	42 J	54 J	51 J	65 J
Total pentachlorodibenzofuran (PeCDF)	pg/g	6800 J	34 J	3.4 J	0.83 J	1.7 J	48 J	200 J	7.9 J	8.0 J	0.72 J	6.1 J
Total pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	320 J	7.7 J	8.3 J	13 J	6.0 J	12 J	14 J	8.6 J	11 J	11 J	0.58 U
Total tetrachlorodibenzofuran (TCDF)	pg/g	210000 J	1100 J	120 J	57 J	70 J	1600 J	6300 J	290 J	280 J	27 J	110 J
Total tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	37000 J	190 J	26 J	16 J	18 J	270 J	1100 J	50 J	51 J	11 J	27 J
TEQ												
Total WHO Dioxin TEQ(Human/Mammal)(ND=0)	pg/g	48000 J	240 J	29 J	13 J	17 J	350 J	1400 J	60 J	60 J	7.6 J	39 J
Total WHO Dioxin TEQ(Human/Mammal)(ND=0.5)	pg/g	48000 J	240 J	29 J	13 J	17 J	350 J	1400 J	60 J	60 J	7.7 J	39 J

Notes:
- U - Not detected at the associated reporting limit
- J - Estimated concentration
- UJ - Not detected; associated reporting limit is estimated
- J- - Estimated concentration, result may be biased low
- J+ - Estimated concentration, result may be biased high
- TEQ - Toxicity Equivalent Quotient
- ft bgs - Feet below ground surface
- pg/g - picogram per grams

Table 2-4

Supplemental Design Investigation Analytical Results - Northern Impoundment
Pre- Final 90% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Sample Location: Sample Identification: Sample Date: Sample Depth: Parameters	Units	SJSB106 11215702-080821-BN-SJSB106 (0-2)-R 08/08/2021 (0-2) ft bgs Lab Duplicate	SJSB106 11215702-080821-BN-SJSB106(2-4) 08/08/2021 (2-4) ft bgs	SJSB106 11215702-080821-BN-SJSB106(4-6) 08/08/2021 (4-6) ft bgs	SJSB106 11215702-080821-BN-SJSB106(6-8) 08/08/2021 (6-8) ft bgs	SJSB106 11215702-080821-BN-DUP-15 08/08/2021 (6-8) ft bgs Field Duplicate	SJSB106 11215702-080821-BN-SJSB106(8-10) 08/08/2021 (8-10) ft bgs	SJSB106 11215702-080821-BN-SJSB106(10-12) 08/08/2021 (10-12) ft bgs	SJSB106 11215702-080821-BN-SJSB106(12-14) 08/08/2021 (12-14) ft bgs	SJSB106 11215702-080821-BN-SJSB106(14-16) 08/08/2021 (14-16) ft bgs	SJSB106 11215702-080821-BN-SJSB106(16-18) 08/08/2021 (16-18) ft bgs
Dioxins/Furans											
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	pg/g	5.6 U	0.69 J	3.1 J	0.65 J	0.078 U	0.65 J	0.77 J	0.61 J	0.80 J	0.80 J
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	pg/g	3600	950 J	2700	1400	810	1000	1900	1300	990	1100
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	pg/g	1.2 U	0.39 U	1.0 U	0.37 U	0.084 U	0.47 U	0.45 U	0.37 U	0.51 U	0.37 U
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	100	36	73	58	35	47	85	61	46	53
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	pg/g	0.093 U	0.12 U	0.26 J	0.076 U	0.076 U	0.092 U	0.13 U	0.097 U	0.11 U	0.095 U
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.67 U	0.42 J	0.92 J	0.037 U	0.030 U	0.065 U	0.046 U	0.058 U	0.078 U	0.057 U
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	1.5 U	0.79 J	0.77 J	0.94 J	0.25 U	0.68 J	0.75 J	1.0 J	0.38 U	0.87 J
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.27 U	0.069 U	0.46 J	0.037 U	0.029 U	0.063 U	0.047 U	0.054 U	0.078 U	0.057 U
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	1.8 J	1.0 J	1.5 J	1.3 J	0.27 U	1.4 J	2.1 J	1.9 J	0.44 U	1.4 J
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	pg/g	0.12 U	0.27 J	0.21 J	0.036 U	0.024 U	0.056 U	0.044 U	0.055 U	0.071 U	0.15 J
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	3.6 J	2.7 J	3.1 J	3.3 J	2.8 J	3.3 J	5.2 J	3.8 J	3.9 J	3.8 J
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	0.50 J	0.69 J	0.13 U	0.072 U	0.053 U	0.37 J	0.076 U	0.076 U	0.10 U	0.093 U
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	0.39 J	0.29 U	0.32 U	0.25 U	0.23 U	0.38 U	0.35 U	0.30 U	0.24 U	0.28 U
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.15 U	0.18 J	0.073 U	0.037 U	0.026 U	0.058 U	0.045 U	0.054 U	0.076 U	0.053 U
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	0.41 J	0.17 U	0.13 U	0.075 U	0.062 U	0.080 U	0.076 U	0.078 U	0.11 U	0.11 U
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	pg/g	22 J	4.5	17	2.7	0.79 U	3.5	0.77 U	0.99 U	2.3 U	3.2
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	6.6 J	1.8	5.3	0.90 J	0.098 U	1.5 J	0.19 U	0.69 J	0.18 U	1.4 J
Total heptachlorodibenzofuran (HpCDF)	pg/g	2.0 J	0.39 J	1.3 J	0.57 J	0.084 U	0.47 J	0.45 J	0.27 J	0.51 J	0.28 J
Total heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	240 J	100 J	190 J	190 J	110 J	130 J	240 J	180 J	140 J	160 J
Total hexachlorodibenzofuran (HxCDF)	pg/g	2.0 J	0.87 J	1.6 J	0.037 U	0.030 U	0.065 U	0.047 U	0.058 U	0.14 U	0.15 J
Total hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	42 J	24 J	35 J	55 J	38 J	38 J	64 J	54 J	43 J	48 J
Total pentachlorodibenzofuran (PeCDF)	pg/g	2.7 J	3.8 J	0.51 U	0.075 U	0.062 U	0.75 J	0.076 U	0.078 U	0.11 U	0.14 U
Total pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	8.0 J	0.29 U	0.32 U	0.25 U	0.23 U	0.38 U	0.35 U	0.30 U	0.24 U	0.28 U
Total tetrachlorodibenzofuran (TCDF)	pg/g	39 J	6.4 J	27 J	2.4 J	0.79 J	5.7 J	0.77 J	0.99 J	1.6 J	2.8 J
Total tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	12 J	4.6 J	5.3 J	5.6 J	2.4 J	4.4 J	1.8 J	4.9 J	2.3 J	1.4 J
TEQ											
Total WHO Dioxin TEQ(Human/Mammal)(ND=0)	pg/g	12 J	3.4 J	9.2 J	2.7 J	0.87 J	3.2 J	2.2 J	2.4 J	1.2 J	3.2 J
Total WHO Dioxin TEQ(Human/Mammal)(ND=0.5)	pg/g	12 J	3.6 J	9.4 J	2.9 J	1.1 J	3.4 J	2.6 J	2.6 J	1.6 J	3.4 J

Notes:
- U - Not detected at the associated reporting limit
- J - Estimated concentration
- UJ - Not detected; associated reporting limit is estimated
- J- - Estimated concentration, result may be biased low
- J+ - Estimated concentration, result may be biased high
- TEQ - Toxicity Equivalent Quotient
- ft bgs - Feet below ground surface
- pg/g - picogram per grams

Table 2-5

Supplemental Design Investigation Waste Characterization Results
Pre-Final 90% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Sample Location: Sample Identification: Sample Date: Sample Depth: Sample Type:	Units	SJSB101-Waste 11215702-072521-SS-SJSB101(0-2)-WC 07/25/21 (0-2) ft bgs	SJSB101-Waste 11215702-072521-SS-SJSB101(2-4)-WC 07/25/21 (2-4) ft bgs	SJSB102-Waste 11215702-081921-BN-SJSB102(8-10)-WC 08/19/21 (8-10) ft bgs	SJSB102-Waste 11215702-081921-BN-SJSB102(10-12)-WC 08/19/21 (10-12) ft bgs	SJSB083-Waste 11215702-072221-BN-SJSB083(8-10)-WC 07/22/21 (8-10) ft bgs	SJSB083-Waste 11215702-072221-BN-SJSB083(10-12)-WC 07/22/21 (10-12) ft bgs
TCLP Herbicides							
2,4,5-TP (Silvex)	mg/L	0.0064 U	0.0064 U	0.0064 U	0.0064 U	0.0064 U	0.0064 U
2,4-Dichlorophenoxyacetic acid (2,4-D)	mg/L	0.020 U	0.020 U	0.020 U	0.020 U	0.020 U	0.020 U
TCLP Metals							
Arsenic	mg/L	0.041 U	0.041 U	0.041 U	0.041 U	0.041 U	0.041 U
Barium	mg/L	1.4 J	0.98 J	0.22 J	0.28 J	0.86 J	0.39 J
Cadmium	mg/L	0.0028 U	0.0028 U	0.0028 U	0.0028 U	0.0028 U	0.0028 U
Chromium	mg/L	0.019 U	0.019 U	0.019 U	0.019 U	0.019 U	0.019 U
Lead	mg/L	0.033 J	0.029 U	0.029 U	0.029 U	0.029 U	0.029 U
Mercury	mg/L	0.00013 U	0.00016 J	0.00013 U	0.00013 U	0.00013 U	0.00013 U
Selenium	mg/L	0.036 U	0.036 U	0.036 U	0.036 U	0.50 U	0.036 U
Silver	mg/L	0.0085 U	0.0085 U	0.0085 U	0.0085 U	0.0085 U	0.0085 U
Polychlorinated Biphenyls							
Aroclor-1016 (PCB-1016)	ug/kg	13 U	10 U	7.2 U	8.5 U	11 U	8.0 U
Aroclor-1221 (PCB-1221)	ug/kg	14 U	11 U	7.9 U	9.2 U	12 U	8.7 U
Aroclor-1232 (PCB-1232)	ug/kg	9.5 U	7.7 U	5.4 U	6.4 U	8.2 U	6.0 U
Aroclor-1242 (PCB-1242)	ug/kg	5.7 U	4.6 U	3.3 U	3.8 U	4.9 U	3.6 U
Aroclor-1248 (PCB-1248)	ug/kg	9.3 U	7.6 U	5.3 U	6.3 U	8.1 U	5.9 U
Aroclor-1254 (PCB-1254)	ug/kg	12 U	9.5 U	6.7 U	7.8 U	10 U	7.4 U
Aroclor-1260 (PCB-1260)	ug/kg	1500	1900	6.3 U	7.4 U	670	7.0 U
TCLP Pesticides							
Chlordane, technical	mg/L	0.0029 U	0.0029 U	0.0029 U	0.0029 U	0.0029 U	0.0029 U
Endrin	mg/L	0.000091 U	0.000091 U	0.000091 U	0.000091 U	0.000091 U	0.000091 U
gamma-BHC (lindane)	mg/L	0.00012 U	0.00012 U	0.00012 U	0.00012 U	0.00012 U	0.00012 U
Heptachlor	mg/L	0.00018 U	0.00018 U	0.00018 U	0.00018 U	0.00018 U	0.00018 U
Heptachlor epoxide	mg/L	0.00014 U	0.00014 U	0.00014 U	0.00014 U	0.00014 U	0.00014 U
Methoxychlor	mg/L	0.00031 U	0.00031 U	0.00031 U	0.00031 U	0.00031 U	0.00031 U
Toxaphene	mg/L	0.020 U	0.020 U	0.020 U	0.020 U	0.020 U	0.020 U
TCLP Semi-Volatile Organic Compounds (SVOCs)							
1,4-Dichlorobenzene	mg/L	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U
2,4,5-Trichlorophenol	mg/L	0.0079 U	0.0079 U	0.0079 U	0.0079 U	0.0079 U	0.0079 U
2,4,6-Trichlorophenol	mg/L	0.0095 U	0.0095 U	0.0095 U	0.0095 U	0.0095 U	0.0095 U
2,4-Dinitrotoluene	mg/L	0.0079 U	0.0079 U	0.0079 U	0.0079 U	0.0079 U	0.0079 U
2-Methylphenol	mg/L	0.0040 U	0.0040 U	0.0040 U	0.0040 U	0.0040 U	0.0040 U
3&4-Methylphenol	mg/L	0.0079 U	0.0079 U	0.0079 U	0.0079 U	0.0079 U	0.0079 U
Hexachlorobenzene	mg/L	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U
Hexachlorobutadiene	mg/L	0.0084 U	0.0084 U	0.0084 U	0.0084 U	0.0084 U	0.0084 U
Hexachloroethane	mg/L	0.0040 U	0.0040 U	0.0040 U	0.0040 U	0.0040 U	0.0040 U
Methylphenol (cresol)	mg/L	0.012 U	0.012 U	0.012 U	0.012 U	0.012 U	0.012 U
Nitrobenzene	mg/L	0.012 U	0.012 U	0.012 U	0.012 U	0.012 U	0.012 U
Pentachlorophenol	mg/L	0.0075 U	0.0075 U	0.0075 U	0.0075 U	0.0075 U	0.0075 U
Pyridine	mg/L	0.0082 U	0.0082 U	0.0082 U	0.0082 U	0.0082 U	0.0082 U
TCLP Volatile Organic Compounds (VOCs)							
1,1-Dichloroethene	mg/L	0.057 U	0.057 U	0.11 U	0.11 U	0.057 U	0.057 U
1,2-Dichloroethane	mg/L	0.029 U	0.029 U	0.058 U	0.058 U	0.029 U	0.029 U
1,4-Dichlorobenzene	mg/L	0.020 U	0.020 U	0.041 U	0.041 U	0.020 U	0.020 U
2-Butanone (Methyl ethyl ketone) (MEK)	mg/L	0.058 U	0.058 U	0.12 U	0.12 U	0.058 U	0.058 U
Benzene	mg/L	0.039 U	0.039 U	0.079 U	0.079 U	0.039 U	0.039 U
Carbon tetrachloride	mg/L	0.066 U	0.066 U	0.13 U	0.13 U	0.066 U	0.066 U
Chlorobenzene	mg/L	0.032 U	0.032 U	0.063 U	0.063 U	0.032 U	0.032 U
Chloroform (Trichloromethane)	mg/L	0.042 U	0.042 U	0.085 U	0.085 U	0.042 U	0.042 U
Tetrachloroethene	mg/L	0.040 U	0.040 U	0.080 U	0.080 U	0.040 U	0.040 U
Trichloroethene	mg/L	0.030 U	0.030 U	0.060 U	0.060 U	0.030 U	0.030 U
Vinyl chloride	mg/L	0.073 U	0.073 U	0.15 U	0.15 U	0.073 U	0.073 U
General Chemistry							
Cyanide (total)	mg/kg	0.51 U	0.50 U	0.29 U	0.36 U	0.48 U	0.37 U
Free liquid	none	0.10 CNF	0.10 CNF	0.10 CNF	0.10 CNF	0.10 CNF	0.10 CFL
Ignitability	Deg F	140	140	140	140	140	140
pH, lab	s.u.	9.5 J-	8.0 J-	8.8 J-	8.4 J-	8.6 J-	8.9 J-
Reactive cyanide	mg/kg	0.011 U	0.011 U	0.012 U	0.011 U	0.011 U	0.012 U
Reactive sulfide	mg/kg	1.2 U	1.2 U	1.3 U	1.2 U	1.2 U	25
Sulfide	mg/kg	15 U	17 U	8.2 U	9.1 U	13 U	11 U

Notes:
U - Not detected at the associated reporting limit
J - Estimated concentration
J- - Estimated concentration, result may be biased low
CNL - Contains Free Liquid
CNF - Contains No Free Liquid
TCLP - Toxicity Characteristic Leaching Procedure
mg/L - milligrams per liter
ug/kg - micrograms per kilogram
ft bgs - feet below ground surface
mg/kg - micrograms per kilogram
s.u. - standard units

Table 2-6

RI, PDI-1, PDI-2, and SDI Dioxins and Furans Results Summary - Northern Impoundment
Pre- Final 90% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

ELEVATION	SJGB010	SJGB011	SJGB012	SJGB013	SJGB014	SJGB015	SJGB016	SJGB017	SJSB028	DUP (28 8-10)	SJSB029	SJSB030	SJSB031	DUP (31 0-2)	SJSB032	DUP (32 4-6)	SJSB033	SJSB034	SJSB035	DUP (35 12-14)	SJSB036	SJSB037	SJSB038
																		5.12 J	1.32 J				
+5													2.46 J	1.72 J									
+5 / +4									59.2 J			5.54 J						1.17 J	0.585 J				
+4 / +3													0.77 J				95.6 J						
+3 / +2									2.4 J		14.9 J	1.9 J						3.04 J	0.995				
+2 / +1													0.666 J		3,410 J		1,050						
+1 / 0	4,720 J	12,700 J	4,050 J						35.9 J		2.95 J	0.735 J						0.988 J	0.896 J				
0																					50,500 J		
0 / -1													0.719 J		7,660 J		7,120 J						
-1 / -2	26,900 J	22,200 J	25,100 J		31,600 J			1.95 J	12.3 J		2.12 J	2.81 J						0.98 J	0.64 J				
-2 / -3							3,520 J						0.726 J		3,170 J	1,740 J	5,740 J					40,400	
-3 / -4	6,350 J	9,430 J	24,400 J		210 J			1.46 J	7.13 J	21.2 J	1.48 J	0.44 J						0.812 J	0.801 J		276 J		
-4 / -5							75.3 J						0.97 J		6.19 J		1,700					0.873 J	
-5 / -6	194 J	14,800 J	17,700 J		531 J	1.22 J		0.909 J	3.35 J		1.35 J	0.82 J						0.592 J	1.26 J	0.471 J			
-6 / -7							0.464 J						0.333 J		85.8 J		157 J						
-7																					519 J		
-7 / -8		8,710 J			213 J	0.640 J		0.853 J	2.59 J		2.45 J	0.453 J						1.5 J	0.962 J				
-8																					19 J	618 J	
-8 / -9				5,100 J			2.33 J						0.653 J		26.5 J		24 J						
-9																					189 J	2.59 J	96,700
-9 / -10		3.37 J			18.6 J	1.48 J		0.177 J	2.39 J		1.36 J	0.592						0.897 J	0.516 J				
-10																						11.5 J	364 J
-10 / -11				1,740 J			6.15 J						0.362 J		15.9 J		17.6 J						
-11																							152 J
-11 / -12					1.29 J	1.51 J			1.19 J		0.769 J	0.982 J											
-12																							4.71 J
-12 / -13				338 J											2.13 J		12.5 J						
-13 / -14						0.850 J					9.13 J												
-14 / -15				104 J											12.7 J								
-16 / -17				25.2 J																			

Note:
J - Estimated concentration

Table 2-6

RI, PDI-1, PDI-2, and SDI Dioxins and Furans Results Summary - Northern Impoundment
Pre- Final 90% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

ELEVATION	SJSB045	DUP (45 2-4)	DUP (45 6-8)	SJSB045-C1	SJSB046	DUP (46 12-14)	SJSB046-C1	DUP (46-C1 16-18)	SJSB047	SJSB047-C1	SJSB048	SJSB048-C1	SJSB049	SJSB050	DUP (50 2-4)	SJSB050-C1	DUP (50-C1 16-18)	SJSB051	DUP (51 16-18)	SJSB052	DUP (52 16-18)	SJSB052-C1	SJSB053
+5																							
+4																							
+3																							
+2																							
+1																							
0																							
-1				286 J																			
-2	10.3 J				636 J		1,550 J		1.19 J		1.7 J							3.02 J				9.22 J	
-3				190 J										7.41 J									
-4	3.42 J	5.26 J			2,660 J		3,350 J		1.35 J	7,470 J	1.02 J	623 J						4.98 J				1.2 J	
-5				286 J									23,600 J	3.05 J	3.13 J					2.07 J			
-6	5.58 J				8,610 J		2,820 J		1.53 J	6,310 J	1.72 J	55.1 J				2.27 J		2.48 J				0.493 J	
-7				46.8 J									6,640 J	1.33 J						1.94 J			
-8	2.16 J		4.88 J		28,500 J		11,700 J		2.73 J	139 J	2.46 J	592 J				1.97 J		2.64 J				1.47 J	
-9				54.6 J									2,350 J	1.48 J						1.99 J			1.79 J
-10	3.25 J				6,930 J		14,900 J		2.03 J	29.4 J	2.52 J	4.95 J				2.22 J		3.03 J				2.32 J	
-11				50.4 J									110 J	3.38 J						1.99 J			0.917 J
-12	0.717 J				111 J		55.1 J		1.41 J	769 J	1.77 J	323 J				3.1 J		1.71 J				1.39 J	
-13				3.79 J									251 J	2.71 J						2.01 J			1.44 J
-14	1.52 J				3,420 J	3,370 J	2,230 J		1.69 J	685 J	2.03 J	6.35 J				1.31 J		2.91 J				1.71 J	
-15				22.4 J									112 J	1.81 J						2.8 J			1.44 J
-16	2.36 J				1,710 J		205 J		1.98 J	821 J	1.66 J	147 J				1.54 J		2.35 J				1.79 J	
-17				5.81 J									117 J	1.77 J						2.24 J			1.28 J
-18	4.96 J				3,400 J		5,690 J	3,980 J	1.67 J	327 J	2.56 J	143 J				3.38 J		2.48 J	1.7 J			2.08 J	
-19													28.1 J	0.351 J						0.694 J			1.79 J
-20					4.82 J					7.35 J		219 J				2.88 J							
-21													5.87 J							12.1 J	10.1 J		0.22 J
-22												11.8 J				1.33 J	0.473 J						
-23																							3.33 J
-24												1.07 J											
-25																							0.35 J
-26																							
-27																							
-28																							
-29																							
-30																							
-31																							
-32																							
-33																							
-34																							
-35																							

Note:
J - Estimated concentration

Table 2-6

RI, PDI-1, PDI-2, and SDI Dioxins and Furans Results Summary - Northern Impoundment
Pre- Final 90% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

ELEVATION	SJSB053-C1	SJSB054	SJSB055	SJSB055-C1	SJSB056	SJSB056-C1	DUP (56-C1 14-16)	SJSB057	SJSB058	SJSB070	SJSB071	SJSB072	SJSB072-R	SJSB073	SJSB074	DUP-5 (74 2-4)	SJSB075	SJSB076	SJSB076-R	SJSB077	DUP-3 (77 6-8)	SJSB077-R
+5																						
+4															7,800 J							
+3																	NA	3,000 J				
+2												NA		9.6 J	70,000 J	59,000 J				NA		
+1									12 J								NA	49,000 J				
0											34,700 J	NA		31,000 J	30,000 J					NA		
-1									36,100 J	43,900 J							55,000 J	63,000 J				
-2											45,900 J	NA		26,000 J	87 J					NA		
-3									48,400 J	68,600 J							NA	210 J				
-4			1.36 J			0.792 J					26.8 J	NA		68,000 J	5.1 J					63,000 J	61,000 J	
-5									324 J	45,600 J							NA	11 J				
-6			1.07 J			1.14 J					2.24 J	12 J		83,000 J	3.1 J					77,000 J		
-7	0.806 J	16,600 J							1,160 J	24,300 J							270 J	150 J	110 J			
-8			0.814 J			0.26 J					1.03 J	340 J		41 J	0.37 J					50 J		150 J
-9	0.855 J	1,550 J		34.3 J					376 J	16,700 J							0.88 J	21 J				
-10			1.28 J			0.597 J					1.48 J	1.3 J		5.2 J	2.6 J					24 J		23 J
-11	1.34 J	6.43 J		31.1 J					9,890 J	1,000 J							1.8 J	5.2 J				
-12			2.53 J		3.35 J	1.4 J					0.523 J	1.7 J		15 J	0.84 J					350 J		330 J
-13	1.4 J	5.94 J		1.34 J					136 J	609 J							6.7 J	3.7 J				
-14			0.89 J		1.65 J	1.33 J					44.6 J	34 J		5.6 J						0.21 J		
-15	0.936 J	17.6 J		0.697 J					788 J	6.9 J												
-16			1.09 J		0.803 J	0.596 J					45.4 J	0.52 J										
-17	1.76 J	5.28 J		1.07 J					0.524 J	4.69 J												
-18			1.42 J		0.782 J	0.593 J	0.624 J	24,200 J				74 J	120 J									
-19	1.15 J	369 J		1.16 J																		
-20			0.92 J		3.76 J	0.962 J		37,600 J				0.81 J										
-21	2.2 J	32.7 J		0.671 J																		
-22					0.928 J			3,540 J														
-23		6.52 J		1.12 J																		
-24					2.91 J			372 J														
-25				5.49 J																		
-26					4.44 J			7.6 J														
-27																						
-28					0.457 J			2.93 J														
-29																						
-30								15.9 J														
-31																						
-32								1.59 J														
-33																						
-34								1.5 J														
-35																						

Note:
J - Estimated concentration

Table 2-6

RI, PDI-1, PDI-2, and SDI Dioxins and Furans Results Summary - Northern Impoundment
Pre- Final 90% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

ELEVATION	SJSB078	DUP-2 (78 14-16)	SJSB078-R	SJSB079	DUP-7 (79 8-10)	SJSB080	DUP-4 (80 16-18)	SJSB081	DUP-13 (81 6-8)	SJSB081-R	SJSB082	DUP-16 (82 6-8)	SJSB082-R	SJSB083	SJSB083 WC	SJSB084	SJSB085	SJSB085-R	SJSB086	DUP-12 (86 6-8)	SJSB087	DUP-17 (87 6-8)	SJSB087-R
+5																							
+4																							
+3																							
+2	33,000 J			32,000 J		23,000 J																	
+1																							
0	47,000 J			52,000 J		14,000 J																	
-1											15,000 J												
-2	86,000 J			28,000 J		9,200 J		2,300 J						46,000 J					5.0 J				
-3											670 J					12,000 J					4,600 J		
-4	32 J		140 J	50,000 J		3,200 J		47,000 J						2,200 J					2.3 J				
-5											2,000 J					3,200 J	42,000 J				25,000 J		
-6	64 J		100 J	45,000 J	50,000 J	1,500 J		47,000 J						9.8 J					1.3 J				
-7											7.7 J	5.4 J				45 J	720 J				2,300 J		
-8	91 J		110 J	190 J		12 J		5.3 J	2.1 J					14 J					1.2 J	1.1 J			
-9											120 J		42 J			23 J	27 J				10 J	2.4 J	
-10	16 J			3.1 J		1.5 J		19,000 J		11,000 J				15,000 J	4,400 J				2.2 J				
-11											4.1 J					6.1 J	44 J	7.4 J			570 J		
-12	7.3 J	12 J		16 J		0.44 J		280 J		200 J				200 J	47 J				2.3 J				
-13											1.1 J					7.8 J	25 J				3.5 J		
-14	120 J		140 J	0.64 J		13 J	3.0 J	2.8 J						24 J					3.2 J				
-15											3.7 J					6.1 J	4.3 J				110 J		110 J
-16	2.7 J							1.7 J						9.0 J					2.9 J				
-17											0.99 J					3.7 J	7.0 J				570 J		1,500 J
-18	260 J		200 J					0.87 J						0.72 J					1.6 J				
-19																3.9 J	11 J				3.0 J		
-20	0.42 J													4.8 J									
-21																	7.8 J						
-22																							
-23																							
-24																							
-25																							
-26																							
-27																							
-28																							
-29																							
-30																							
-31																							
-32																							
-33																							
-34																							
-35																							

Note:
J - Estimated concentration

Table 2-6

RI, PDI-1, PDI-2, and SDI Dioxins and Furans Results Summary - Northern Impoundment
Pre- Final 90% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

ELEVATION	SJSB088	DUP-14 (88 6-8)	SJSB088-R	SJSB089	SJSB089-R	DUP-19 (89 6-8)	SJSB089 (DUP-19)-R	SJSB090	DUP-11 (90 6-8)	SJSB090-R	SJSB091	DUP-18 (91 6-8)	SJSB092	SJSB093	SJSB094	SJSB094-R	DUP-8 (94 6-8)	SJSB094 (DUP-8)-R	SJSB095	DUP-10 (95 6-8)	SJSB095-R	SJSB096	DUP-9 (96 6-8)	SJSB096-R
+5																								
+4																								
+3																								
+2																								
+1																								
0																								
-1								62,000 J						41,000 J										
-2	39,000 J			820 J															35,000 J					
-3								6,600 J			16 J			42,000 J										
-4	43,000 J			53 J									43,000 J		36,000 J				59 J					
-5								930 J			6.7 J			640 J										
-6	50,000 J			18 J									28,000 J		39,000 J				1.0 J			87,000 J		
-7								6.4 J	2.9 J		5.2 J			0.68 J										
-8	54,000 J	63,000 J	71,000 J	2.5 J		3.5 J	3.1 J						130 J		41,000 J				2.3 J	9.7 J		22,000 J		
-9								260 J		560 J	2.5 J	2.7 J		1,900 J										
-10	51,000 J			52 J	43 J								4.8		15,000 J	17,000 J	830 J	990 J	1,200 J		980 J	310 J		
-11								5.3 J			2.1 J			1,500 J										
-12	5.3 J			34 J	19 J								27 J		5,500 J				57 J		11 J	4.9 J	4.2 J	
-13								9.1 J			2.4 J			430 J										
-14	0.68 J			2.0 J									26 J		32 J				6.0			2,800 J		8,500 J
-15								4.1 J			2.4 J			17 J										
-16	1.3 J			2.3 J									10,000 J		2.0 J				54 J		55 J	67 J		84 J
-17								2.3 J			2.2 J			4.4 J										
-18	520 J		1,800 J	0.40 J									11 J		3.2 J				0.60			5.2 J		
-19											2.7 J													
-20	2.5 J												7.2 J		1.9 J							1.9 J		
-21																								
-22	2.2 J																					13 J		
-23																								
-24	1.1 J																							
-25																								
-26																								
-27																								
-28																								
-29																								
-30																								
-31																								
-32																								
-33																								
-34																								
-35																								

Note:
J - Estimated concentration

Table 2-6

RI, PDI-1, PDI-2, and SDI Dioxins and Furans Results Summary - Northern Impoundment
Pre- Final 90% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

ELEVATION	SJSB097	DUP-20 (97 6-8)	SJSB098	SJSB099	DUP-6 (99 16-18)	SJSB099-R	SJSB100	SJSB101	SJSB101 WC	SJSB101-R	SJSB102	SJSB102-R	SJSB103	SJSB104	SJSB105	SJSB105-R	SJSB0106	DUP-15 (106 6-8)	SJSB106-R
+5																			
+4																			
+3																			
+2																			
+1																			
0				53,000 J				63,000 J	52,000 J										
-1																			
-2				54,000 J				59,000 J	47,000 J		1,400 J								
-3																	39 J		12 J
-4				130 J				25,000 J			5.9 J				36,000 J				
-5														15 J			3.6 J		
-6				13 J				18 J			340 J				48,000 J				
-7														2.8 J			9.4 J		
-8				15 J				2.7 J			24 J				240 J				
-9														11 J			2.9 J	1.1 J	
-10				180 J		210 J		230 J		130 J	5.6 J				29 J				
-11														2.6 J			3.4 J		
-12				1.9 J				0.62 J			2.5 J				13 J				
-13							110 J							1.7 J			2.6 J		
-14			71 J	26 J				0.27 J			34 J	31 J			17 J				
-15	5.2 J						3.7 J						2.2 J	1.8 J			2.6 J		
-16			1,900 J	7.0 J	14 J			11 J			1.4 J				350 J	1,400 J			
-17	1.2 J						9.2 J						1.1 J	0.53			1.6 J		
-18			1,800 J					3.2 J			110 J	55 J			60 J	60 J			
-19	1.8 J						0.81 J						14 J	0.25 J			3.4 J		
-20			160 J								8.9 J				7.7 J				
-21	1.4 J	1.3 J					2.3 J						4.8 J	0.20 J					
-22			9,600 J								3.9 J								
-23	2.6 J						0.58 J						3.9 J						
-24			3,900 J								4.0 J								
-25	0.77 J						0.57 J						0.49 J						
-26			680 J																
-27	1.4 J						0.51 J						0.46 J						
-28			11 J																
-29	0.29 J																		
-30			0.16 J																
-31																			
-32																			
-33																			
-34																			
-35																			

Note:
J - Estimated concentration

Table 3-1

2019 Treatability Waste Material Characterization Results - Northern Impoundment
Pre-Final 90% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Area: Sample Location: Sample Identification: Sample Date: Report Sample Delivery Group (SDG):	Units	Initial Sample - Southwest Initial 11187072-NORTH-IMPCT-INITIALS 10/15/2019 180-97287-1, 180-97287-2	Composite Sample 2 - Northwest Area 2 11187072-N.TREATMENT AREA #2 12/18/2019 180-100205-1	Composite Sample 3 - Northeast Area 3 11187072-N.TREATMENT AREA #3 12/18/2019 180-100205-1	Composite Sample 4 - Southeast Area 4 11187072-N.TREATMENT AREA #4 12/18/2019 180-100205-1
General Chemistry					
Cyanide (total)	mg/kg	0.43 U	0.37 U	0.40 U	0.40 U
Free liquid	none	U	U	U	U
Ignitability	Deg F	> 140	> 140	> 140	> 140
Percent solids	%	--	71.4	67.4	66.7
pH, lab	s.u.	7.9 J	8.5 J	8.7 J	7.9 J
Sulfide	mg/kg	76 J	72	59	24 J
TCLP-Dioxins/Furans					
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	pg/L	7.6 U	95 J	19 U	16 U
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	pg/L	34 U	77 J	11 U	9.9 U
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	pg/L	5.3 U	9.0 U	8.5 U	8.3 U
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	pg/L	3.4 U	23 J	7.5 U	5.9 U
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	pg/L	6.2 U	31 J	12 U	11 U
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	pg/L	2.9 U	15 U	12 U	10 U
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/L	4.5 U	20 J	8.7 U	6.9 U
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/L	3.1 U	13 U	11 U	11 U
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/L	4.7 U	7.9 U	9.2 U	7.5 U
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	pg/L	2.2 U	15 J	7.3 U	7.1 U
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/L	4.3 U	6.7 U	7.9 U	6.3 U
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	pg/L	4.6 U	10 U	8.4 U	8.3 U
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	pg/L	8.4 U	19 U	20 U	16 U
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/L	2.5 U	9.2 U	7.5 U	6.8 U
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	pg/L	4.6 U	11 U	9.2 U	9.4 U
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	pg/L	2.8 U	11 J	6.5 U	6.6 U
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	pg/L	3.4 U	12 U	12 U	12 U
Total heptachlorodibenzofuran (HpCDF)	pg/L	6.2 U	31 J	12 U	11 U
Total heptachlorodibenzo-p-dioxin (HpCDD)	pg/L	10 U	23 J	7.5 U	5.9 U
Total hexachlorodibenzofuran (HxCDF)	pg/L	3.1 U	15 J	12 U	11 U
Total hexachlorodibenzo-p-dioxin (HxCDD)	pg/L	4.7 U	20 J	9.2 U	7.5 U
Total pentachlorodibenzofuran (PeCDF)	pg/L	4.6 U	11 U	9.2 U	9.4 U
Total pentachlorodibenzo-p-dioxin (PeCDD)	pg/L	8.4 U	19 U	20 U	16 U
Total tetrachlorodibenzofuran (TCDF)	pg/L	2.8 U	11 J	6.5 U	6.6 U
Total tetrachlorodibenzo-p-dioxin (TCDD)	pg/L	4.4 J	12 U	12 U	12 U
TCLP-Glycol					
2-Ethoxyethanol	mg/L	2.5 U	2.5 U	2.5 U	2.5 U
Ethylene glycol	mg/L	1.9 U	1.9 U	1.9 U	1.9 U
Ethylene glycol monomethyl ether (2-methyoxyethanol)	mg/L	2.4 U	2.4 U	2.4 U	2.4 U
TCLP-Herbicides					
2,4,5-TP (Silvex)	mg/L	0.0030 U	0.0030 U	0.0030 U	0.0030 U
2,4-Dichlorophenoxyacetic acid (2,4-D)	mg/L	0.020 U	0.020 U	0.020 U	0.020 U
Dinoseb	mg/L	0.038 U	0.038 U	0.038 U	0.038 U
TCLP-Metals					
Arsenic	mg/L	0.041 U	0.041 U	0.041 U	0.041 U
Barium	mg/L	1.1 J	0.53 J	0.44 J	0.48 J
Cadmium	mg/L	0.0028 U	0.0028 U	0.0028 U	0.0028 U
Chromium	mg/L	0.0078 U	0.0078 U	0.011 J	0.0078 U
Lead	mg/L	0.029 U	0.029 U	0.029 U	0.029 U
Mercury	mg/L	0.00010 U	0.00010 U	0.00010 U	0.00010 U
Selenium	mg/L	0.036 U	0.036 U	0.036 U	0.036 U
Silver	mg/L	0.0085 U	0.0085 U	0.0085 U	0.0085 U

Table 3-1

2019 Treatability Waste Material Characterization Results - Northern Impoundment
Pre-Final 90% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Area: Sample Location: Sample Identification: Sample Date: Report Sample Delivery Group (SDG):	Units	Initial Sample - Southwest Initial 11187072-NORTH-IMPCT-INITIALS 10/15/2019 180-97287-1, 180-97287-2	Composite Sample 2 - Northwest Area 2 11187072-N.TREATMENT AREA #2 12/18/2019 180-100205-1	Composite Sample 3 - Northeast Area 3 11187072-N.TREATMENT AREA #3 12/18/2019 180-100205-1	Composite Sample 4 - Southeast Area 4 11187072-N.TREATMENT AREA #4 12/18/2019 180-100205-1
Misc					
Methomyl	ug/L	0.12 U	0.13 U	0.12 U	0.13 U
TCLP-PCBs					
Aroclor-1016 (PCB-1016)	mg/L	0.00018 U	0.00019 U	0.00019 U	0.00019 U
Aroclor-1221 (PCB-1221)	mg/L	0.00022 U	0.00022 U	0.00023 U	0.00023 U
Aroclor-1232 (PCB-1232)	mg/L	0.00020 U	0.00020 U	0.00021 U	0.00021 U
Aroclor-1242 (PCB-1242)	mg/L	0.00035 U	0.00036 U	0.00036 U	0.00036 U
Aroclor-1248 (PCB-1248)	mg/L	0.00012 U	0.00012 U	0.00012 U	0.00012 U
Aroclor-1254 (PCB-1254)	mg/L	0.00037 U	0.00037 U	0.00038 U	0.00038 U
Aroclor-1260 (PCB-1260)	mg/L	0.00015 U	0.00015 U	0.00016 U	0.00016 U
TCLP-Pesticides					
4,4'-DDD	mg/L	0.00021 U	0.00021 U	0.00021 U	0.00021 U
4,4'-DDE	mg/L	0.00012 U	0.00012 U	0.00012 U	0.00012 U
4,4'-DDT	mg/L	0.00012 U	0.00012 U	0.00012 U	0.00012 U
alpha-Chlordane	mg/L	--	0.00015 U	0.00015 U	0.00015 U
Chlordane	mg/L	0.0029 U	0.0029 U	0.0029 U	0.0029 U
Dieldrin	mg/L	0.00011 U	0.00011 U	0.00011 U	0.00011 U
Endosulfan I	mg/L	0.00027 U	0.00027 U	0.00027 U	0.00027 U
Endosulfan II	mg/L	0.00013 U	0.00013 U	0.00013 U	0.00013 U
Endosulfan sulfate	mg/L	0.00026 U	0.00026 U	0.00026 U	0.00026 U
Endrin	mg/L	0.000091 U	0.000091 U	0.000091 U	0.000091 U
gamma-BHC (lindane)	mg/L	0.00012 U	0.00012 U	0.00012 U	0.00012 U
gamma-Chlordane	mg/L	--	0.00016 U	0.00016 U	0.00016 U
Heptachlor	mg/L	0.00018 U	0.00018 U	0.00018 U	0.00018 U
Heptachlor epoxide	mg/L	0.00014 U	0.00014 U	0.00014 U	0.00014 U
Methoxychlor	mg/L	0.00031 U	0.00031 U	0.00031 U	0.00031 U
Mirex	mg/L	0.000084 U	0.000084 U	0.000084 U	0.000084 U
Toxaphene	mg/L	0.020 U	0.020 U	0.020 U	0.020 U
TCLP-Semi-Volatile Organic Compounds (SVOCs)					
1,4-Dichlorobenzene	mg/L	0.0045 U	0.0045 U	0.0045 U	0.0045 U
2,4,5-Trichlorophenol	mg/L	0.0079 U	0.0079 U	0.0079 U	0.0079 U
2,4,6-Trichlorophenol	mg/L	0.0095 U	0.0095 U	0.0095 U	0.0095 U
2,4-Dinitrotoluene	mg/L	0.0079 U	0.0079 U	0.0079 U	0.0079 U
2-Methylphenol	mg/L	0.0040 U	0.0040 U	0.0040 U	0.0040 U
3&4-Methylphenol	mg/L	0.0079 U	0.0079 U	0.0079 U	0.0079 U
Hexachlorobenzene	mg/L	0.0055 U	0.0055 U	0.0055 U	0.0055 U
Hexachlorobutadiene	mg/L	0.0084 U	0.0084 U	0.0084 U	0.0084 U
Hexachloroethane	mg/L	0.0040 U	0.0040 U	0.0040 U	0.0040 U
Nitrobenzene	mg/L	0.012 U	0.012 U	0.012 U	0.012 U
Pentachlorophenol	mg/L	0.0075 U	0.0075 U	0.0075 U	0.0075 U
Pyridine	mg/L	0.0082 U	0.0082 U	0.0082 U	0.0082 U

Table 3-1

2019 Treatability Waste Material Characterization Results - Northern Impoundment
Pre-Final 90% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Area: Sample Location: Sample Identification: Sample Date: Report Sample Delivery Group (SDG):	Units	Initial Sample - Southwest Initial 11187072-NORTH-IMPCT-INITIALS 10/15/2019 180-97287-1, 180-97287-2	Composite Sample 2 - Northwest Area 2 11187072-N.TREATMENT AREA #2 12/18/2019 180-100205-1	Composite Sample 3 - Northeast Area 3 11187072-N.TREATMENT AREA #3 12/18/2019 180-100205-1	Composite Sample 4 - Southeast Area 4 11187072-N.TREATMENT AREA #4 12/18/2019 180-100205-1
TCLP-Volatile Organic Compounds (VOCs)					
1,1,1,2-Tetrachloroethane	mg/L	0.16 U	0.16 U	0.16 U	0.16 U
1,1,1-Trichloroethane	mg/L	0.10 U	0.10 U	0.10 U	0.10 U
1,1,2,2-Tetrachloroethane	mg/L	0.12 U	0.12 U	0.12 U	0.12 U
1,1,2-Trichloroethane	mg/L	0.096 U	0.096 U	0.096 U	0.096 U
1,1-Dichloroethene	mg/L	0.11 U	0.11 U	0.11 U	0.11 U
1,2,3-Trichloropropane	mg/L	0.11 U	0.11 U	0.11 U	0.11 U
1,2-Dibromoethane (Ethylene dibromide)	mg/L	0.11 U	0.11 U	0.11 U	0.11 U
1,2-Dichloroethane	mg/L	0.058 U	0.058 U	0.058 U	0.058 U
1,3-Dichloropropene	mg/L	0.13 U	0.13 U	0.13 U	0.13 U
1,4-Dichlorobenzene	mg/L	0.041 U	0.041 U	0.041 U	0.041 U
2-Butanone (Methyl ethyl ketone) (MEK)	mg/L	0.12 U	0.12 U	0.12 U	0.12 U
4-Methyl-2-pentanone (Methyl isobutyl ketone) (MIBK)	mg/L	0.074 U	0.074 U	0.074 U	0.074 U
Acetone	mg/L	0.13 U	0.13 U	0.13 U	0.13 U
Acetonitrile	mg/L	2.0 U	2.0 U	2.0 U	2.0 U
Acrylonitrile	mg/L	1.3 U	1.3 U	1.3 U	1.3 U
Benzene	mg/L	0.079 U	0.079 U	0.079 U	0.079 U
Bromodichloromethane	mg/L	0.094 U	0.094 U	0.094 U	0.094 U
Bromoform	mg/L	0.10 U	0.10 U	0.10 U	0.10 U
Bromomethane (Methyl bromide)	mg/L	0.18 U	0.18 U	0.18 U	0.18 U
Carbon disulfide	mg/L	0.12 U	0.12 U	0.12 U	0.12 U
Carbon tetrachloride	mg/L	0.13 U	0.13 U	0.13 U	0.13 U
Chlorobenzene	mg/L	0.063 U	0.063 U	0.063 U	0.063 U
Chloroform (Trichloromethane)	mg/L	0.085 U	0.085 U	0.085 U	0.085 U
Dichlorodifluoromethane (CFC-12)	mg/L	0.12 U	0.12 U	0.12 U	0.12 U
Ethylbenzene	mg/L	0.086 U	0.086 U	0.086 U	0.086 U
Hexachlorobutadiene	mg/L	0.073 U	0.073 U	0.073 U	0.073 U
Isobutanol (isobutyl alcohol)	mg/L	3.6 U	3.6 U	3.6 U	3.6 U
Methyl acrylonitrile	mg/L	1.6 U	1.6 U	1.6 U	1.6 U
Methylene chloride	mg/L	0.15 U	0.15 U	0.15 U	0.15 U
Styrene	mg/L	0.053 U	0.053 U	0.053 U	0.053 U
Tetrachloroethene	mg/L	0.080 U	0.080 U	0.080 U	0.080 U
Toluene	mg/L	0.067 U	0.067 U	0.067 U	0.067 U
trans-1,3-Dichloropropene	mg/L	0.069 U	0.069 U	0.069 U	0.069 U
Trichloroethene	mg/L	0.060 U	0.060 U	0.060 U	0.060 U
Trichlorofluoromethane (CFC-11)	mg/L	0.058 U	0.058 U	0.058 U	0.058 U
Vinyl chloride	mg/L	0.15 U	0.15 U	0.15 U	0.15 U
Xylenes (total)	mg/L	0.17 U	0.17 U	0.17 U	0.17 U

Notes:
TCLP - Toxicity Characteristic Leaching Procedure
mg/L - milligrams per Liter
ug/L - microgram per Liter
mg/kg - milligram per kilogram
Deg F - Degrees in Fahrenheit
s.u. - standard unit
U - Not detected at the associated reporting limit.
J - Estimated concentration.
-- Data not available

Table 3-2

2019 Pilot Test Effluent Characterization Results - Northern Impoundment
Pre-Final 90% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Area:	Units	Estimated Discharge Criteria [1,2]	Non-homogenized Contact Water	Excavation Seepage Water	Homogenized Contact Water - from tank feeding clarifier	Homogenized Contact Water - from tank feeding clarifier/filter	Equalized Contact Water - from tank feeding clarifier/filter	Clarified Effluent - from mix tank	Filter Effluent - from mix tank	Clarifier Underflow - composite	Settled Sludge - from bottom of cone bottom tank
Sample Location:			Contact-Initial	EXC-1	INF3	INF4	INF4	CEFF	FEFF	CUI	SS
Sample Identification:			11187072-CONTACT-INITIAL	11187072-091319-LL-EXC-1	INF 3	INF 4	DUP	1. CEFF, CEFF-Filtered	FEFF 1, FEFF-Filtered	CUI	SS
Sample Date:			9/24/2019	9/13/2019	10/25/2019	10/25/2019	10/25/2019	10/25/2019 , 11/5/2019	10/26/2019, 11/5/2019	10/26/2019	10/26/2019
Sample Type:							Duplicate				
Report Sample Delivery Group (SDG):			180-96144-1	600-191956-1, 600-191956-2	600-194690-1	600-194690-1	600-194690-1	600-194690-1, 320-56102-1	600-194690-1, 320-56102-1	600-194690-1	600-194690-1
Dioxins/Furans											
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	pg/L	100	130	5.8 U	590	370 J-	--	6.4 U	5.5 U	--	--
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	pg/L	100	3300	90 J	15000 J+	8800 J	--	44 U	44 U	--	--
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	pg/L	50	160	6.9 U	880 J-	600 J-	--	2.9 U	1.9 U	--	--
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	pg/L	50	150	4.1 U	840	540 J-	--	4.9 J	6.7 J	--	--
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	pg/L	50	58	1.8 U	320	240 J-	--	1.4 U	1.3 U	--	--
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	pg/L	50	410	19 J	3100	2500 J-	--	3.9 J	1.6 J	--	--
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/L	50	2.8 U	0.82 U	11 U	4.9 U	--	2.6 U	0.83 U	--	--
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/L	50	110	5.6 J	790	650 J-	--	1.7 J	0.77 U	--	--
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/L	50	4.1 U	0.83 U	30 J	20 J-	--	1.6 J	0.79 U	--	--
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	pg/L	50	4.2 U	0.68 U	53	40 J-	--	2.0 U	0.52 U	--	--
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/L	50	1.8 U	0.74 U	18 J-	8.5 J-	--	1.4 U	0.73 U	--	--
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	pg/L	50	200	11 J	2100	1900	--	2.5 J	1.5 J	--	--
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	pg/L	50	18 U	1.1 U	160	130	--	0.94 U	0.99 U	--	--
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/L	50	12 U	0.73 U	93	73 J-	--	1.2 U	0.52 U	--	--
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	pg/L	50	110	6.2 J	1200	1100	--	0.65 U	0.63 U	--	--
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	pg/L	10	3900	220	50000	46000	--	37	7.1 J	--	--
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	pg/L	10	1500	61	18000	15000	--	13	3.2 J	--	--
Total heptachlorodibenzofuran (HpCDF)	pg/L	NL	280 J	11 J	1600 J	1100 J	--	4.3 J	1.9 J	--	--
Total heptachlorodibenzo-p-dioxin (HpCDD)	pg/L	NL	370 J	10 J	2000 J	1300 J	--	8.2 J	13 J	--	--
Total hexachlorodibenzofuran (HxCDF)	pg/L	NL	620 J	25 J	4600 J	3800 J	--	8.8 J	1.6 J	--	--
Total hexachlorodibenzo-p-dioxin (HxCDD)	pg/L	NL	35 J	0.83 U	260 J	180 J	--	5.6 J	0.83 U	--	--
Total pentachlorodibenzofuran (PeCDF)	pg/L	NL	490 J	26 J	5000 J	4600 J	--	2.5 J	1.5 J	--	--
Total pentachlorodibenzo-p-dioxin (PeCDD)	pg/L	NL	20 J	1.1 U	190 J	160 J	--	0.94 U	0.99 U	--	--
Total tetrachlorodibenzofuran (TCDF)	pg/L	NL	8100 J	390 J	100000 J	100000 J	--	68 J	11 J	--	--
Total tetrachlorodibenzo-p-dioxin (TCDD)	pg/L	NL	1600 J	66 J	20000 J	16000 J	--	13 J	3.2 J	--	--
Dioxins/Furans (dissolved)											
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF) (dissolved)	pg/L	100	--	2.1 U	170	11 U	--	13 J	22 J	--	--
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD) (dissolved)	pg/L	100	--	17 UJ	5400 J+	280 J+	--	21 U	29 U	--	--
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF) (dissolved)	pg/L	50	--	3.6 J	240	12 J	--	2.5 J	6.0 J	--	--
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD) (dissolved)	pg/L	50	--	1.1 U	250	27 J	--	2.4 J	6.4 J	--	--
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF) (dissolved)	pg/L	50	--	2.8 J	88	4.9 U	--	1.1 U	4.9 J	--	--
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF) (dissolved)	pg/L	50	--	7.6 J	750	31 J	--	0.91 U	3.1 J	--	--
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD) (dissolved)	pg/L	50	--	1.2 U	4.6 U	3.1 U	--	2.9 J	4.9 J	--	--
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF) (dissolved)	pg/L	50	--	2.7 J	190	9.8 J	--	0.89 U	3.5 J	--	--
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD) (dissolved)	pg/L	50	--	1.2 U	6.7 J	2.1 J	--	1.1 U	4.4 J	--	--
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF) (dissolved)	pg/L	50	--	2.0 U	14 J	4.8 U	--	1.9 J	3.8 J	--	--
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD) (dissolved)	pg/L	50	--	1.1 U	5.7 J	1.7 U	--	0.97 U	4.8 J	--	--
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF) (dissolved)	pg/L	50	--	3.4 U	450	20 J	--	1.2 U	3.2 J	--	--
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD) (dissolved)	pg/L	50	--	1.6 U	40 J	3.0 J	--	3.1 J	4.6 J	--	--
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF) (dissolved)	pg/L	50	--	0.71 U	23 J	2.8 U	--	1.5 J	3.0 J	--	--
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF) (dissolved)	pg/L	50	--	1.7 U	250	11 J	--	1.2 U	1.3 U	--	--
2,3,7,8-Tetrachlorodibenzofuran (TCDF) (dissolved)	pg/L	10	--	21	11000	540 J	--	2.7 J	1.1 U	--	--
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD) (dissolved)	pg/L	10	--	7.1 J	3800	150 J	--	1.1 U	1.6 U	--	--
Total heptachlorodibenzofuran (HpCDF) (dissolved)	pg/L	NL	--	6.4 J	430 J	20 J	--	2.5 J	11 J	--	--
Total heptachlorodibenzo-p-dioxin (HpCDD) (dissolved)	pg/L	NL	--	1.1 U	630 J	51 J	--	2.4 J	6.4 J	--	--
Total hexachlorodibenzofuran (HxCDF) (dissolved)	pg/L	NL	--	12 J	1100 J	48 J	--	3.4 J	13 J	--	--
Total hexachlorodibenzo-p-dioxin (HxCDD) (dissolved)	pg/L	NL	--	1.2 U	74 J	6.9 J	--	2.9 J	14 J	--	--
Total pentachlorodibenzofuran (PeCDF) (dissolved)	pg/L	NL	--	3.4 J	1100 J	44 J	--	1.3 U	3.2 J	--	--
Total pentachlorodibenzo-p-dioxin (PeCDD) (dissolved)	pg/L	NL	--	1.6 U	51 J	3.0 J	--	4.4 J	4.6 J	--	--
Total tetrachlorodibenzofuran (TCDF) (dissolved)	pg/L	NL	--	39 J	21000 J	920 J	--	2.7 J	1.1 U	--	--
Total tetrachlorodibenzo-p-dioxin (TCDD) (dissolved)	pg/L	NL	--	7.1 J	4000 J	170 J	--	1.1 U	1.6 U	--	--
Herbicides											
2,4,5-TP (Silvex)	ug/L	NL	0.29 U	0.020 U	--	--	--	--	--	--	--
2,4-Dichlorophenoxyacetic acid (2,4-D)	ug/L	NL	1.9 U	0.040 U	--	--	--	--	--	--	--
Metals											
Aluminum	mg/L	NL	0.048 U	--	--	--	--	--	--	--	--
Antimony	mg/L	25.623	0.0098 U	0.0039 U	0.0039 U	0.0039 U	--	0.0039 U	0.0039 U	--	--
Arsenic	mg/L	0.164	0.012 U	0.089	0.026	0.023	--	0.0029 U	0.0029 U	--	--
Barium	mg/L	N/A	0.17	2.1	1.1	0.96	--	0.29	0.28	--	--
Beryllium	mg/L	NL	0.00037 J	0.00042 U	0.0074	0.0062	--	0.00042 U	0.00042 U	--	--
Boron	mg/L	NL	--	1.1	0.26	0.25	--	0.21	0.20	--	--
Cadmium	mg/L	0.0439	0.00050 U	0.00080 J	0.0028 J	0.0025 J	--	0.00040 J	0.00028 U	--	--
Calcium	mg/L	NL	35	250	130	120	--	55	53	--	--
Chromium	mg/L	0.389	0.0012 U	0.0017 J	0.12	0.11	--	0.0016 U	0.0016 U	--	--
Cobalt	mg/L	NL	0.0030 U	0.0066 J	0.051	0.043	--	0.00040 J	0.00031 U	--	--
Copper	mg/L	0.0167	0.011 U	0.0081 U	0.11	0.093	--	0.0081 U	0.0081 U	--	--
Iron	mg/L	NL	0.022 J	13	110	88	--	0.29 J	0.13 J	--	--
Lead	mg/L	0.107	0.0025 U	0.0022 U	0.12	0.098	--	0.0022 U	0.0022 U	--	--
Magnesium	mg/L	NL	22	250	58	54	--	33	31	--	--
Manganese	mg/L	NL	0.14	2.7	1.1	1.0	--	0.088	0.029	--	--
Mercury	mg/L	0.000598	0.00010 U	--	--	--	--	--	--	--	--
Mercury	ng/L	598	--	--	28 J	--	6.3 J	18 J	2.5 J	--	--
Mercury	ug/L	0.598	--	0.10 U	--	--	--	--	--	--	--
Molybdenum	mg/L	NL	0.0079 J	0.0068 J	0.0084 J	0.0090 J	--	0.010	0.010	--	--
Nickel	mg/L	0.103	0.0024 U	0.0036 J	0.095	0.081	--	0.0021 J	0.0020 J	--	--
Phosphorus	mg/L	NL	0.050 U	--	--	--	--	--	--	--	--
Potassium	mg/L	NL	12	27	25	23	--	12	12	--	--
Selenium	mg/L	0.619	0.013 U	0.0029 U	0.0029 U	0.0029 U	--	0.0029 U	0.0029 U	--	--
Silver	mg/L	0.00493	0.00084 U	0.0013 U	0.0013 U	0.0013 U	--	0.0013 U	0.0013 U	--	--
Sodium	mg/L	NL	250	2400	340	350	--	350	360	--	--
Strontium	mg/L	NL	0.31	2.5	0.84	0.79	--	0.48	0.46	--	--
Thallium	mg/L	0.5	0.0090 U	--	0.0042 U	0.0042 U	--	0.0042 U	0.026 U	--	--
Thallium	ug/L	500	--	0.14 U	--	--	--	--	--	--	--
Tin	mg/L	NL	--	0.00059 U	0.0048 J	0.0057 J	--	0.00059 U	0.00059 U	--	--
Titanium	mg/L	NL	--	0.0077 J	0.23	0.22	--	0.0011 J	0.00070 J	--	--
Vanadium	mg/L	NL	0.0019 U	0.00047 U	0.20	0.17	--	0.0036 J	0.0028 J	--	--
Zinc	mg/L	0.165	0.011 U	0.031	0.40	0.36	--	0.045	0.036	--	--

Table 3-2

2019 Pilot Test Effluent Characterization Results - Northern Impoundment
Pre-Final 90% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Area:	Units	Estimated Discharge Criteria [1,2]	Non-homogenized Contact Water	Excavation Seepage Water	Homogenized Contact Water - from tank feeding clarifier	Homogenized Contact Water - from tank feeding clarifier/filter	Equalized Contact Water - from tank feeding clarifier/filter	Clarified Effluent - from mix tank	Filter Effluent - from mix tank	Clarifier Underflow - composite	Settled Sludge - from bottom of cone bottom tank
Sample Location:			Contact-Initial	EXC-1	INF3	INF4	INF4	CEFF	FEFF	CUI	SS
Sample Identification:			11187072-CONTACT-INITIAL	11187072-091319-LL-EXC-1	INF 3	INF 4	DUP	1. CEFF, CEFF-Filtered	FEFF 1, FEFF-Filtered	CUI	SS
Sample Date:			9/24/2019	9/13/2019	10/25/2019	10/25/2019	10/25/2019	10/25/2019 , 11/5/2019	10/26/2019, 11/5/2019	10/26/2019	10/26/2019
Sample Type:							Duplicate				
Report Sample Delivery Group (SDG):			180-96144-1	600-191956-1, 600-191956-2	600-194690-1	600-194690-1	600-194690-1	600-194690-1, 320-56102-1	600-194690-1, 320-56102-1	600-194690-1	600-194690-1
Metals (dissolved)											
Aluminum (dissolved)	mg/L	NL	0.048 U	--	--	--	--	0.048 U	0.048 U	--	--
Antimony (dissolved)	mg/L	25.623	0.0098 U	0.0039 U	0.0039 U	0.0039 U	--	0.0098 U	0.0098 U	--	--
Arsenic (dissolved)	mg/L	0.164	0.012 U	0.037	0.014	0.0041 J	--	0.012 U	0.012 U	--	--
Barium (dissolved)	mg/L	N/A	0.18	1.9	0.55	0.30	--	0.30	0.32	--	--
Beryllium (dissolved)	mg/L	NL	0.00030 U	0.00042 U	0.0026 J	0.00042 U	--	0.00030 U	0.00030 U	--	--
Boron (dissolved)	mg/L	NL	--	1.1	0.22	0.20	--	--	--	--	--
Cadmium (dissolved)	mg/L	0.0439	0.00050 U	0.00080 J	0.0013 J	0.00040 J	--	0.00050 U	0.00050 U	--	--
Calcium (dissolved)	mg/L	NL	37	240	67	55	--	59	57	--	--
Chromium (dissolved)	mg/L	0.389	0.0012 U	0.0016 U	0.048	0.0039 J	--	0.0012 U	0.0012 U	--	--
Cobalt (dissolved)	mg/L	NL	0.0030 U	0.0064 J	0.017	0.0012 J	--	0.0030 U	0.0030 U	--	--
Copper (dissolved)	mg/L	0.0167	0.014	0.0081 U	0.036	0.0081 U	--	0.0072 J	0.0053 J	--	--
Iron (dissolved)	mg/L	NL	0.020 U	0.12 J	40	2.9	--	0.056 J	0.020 U	--	--
Lead (dissolved)	mg/L	0.107	0.0025 U	0.0022 U	0.037	0.0022 U	--	0.0025 U	0.0025 U	--	--
Magnesium (dissolved)	mg/L	NL	22	250	42	32	--	32	31	--	--
Manganese (dissolved)	mg/L	NL	0.15	2.6	0.34	0.035	--	0.064	0.028	--	--
Mercury (dissolved)	mg/L	0.000598	0.00037	--	--	--	--	--	--	--	--
Mercury (dissolved)	ng/L	598	--	--	--	22 J	--	1.7	1.7	--	--
Mercury (dissolved)	ug/L	0.598	--	0.10 U	--	--	--	--	--	--	--
Molybdenum (dissolved)	mg/L	NL	0.0076 J	0.011	0.0084 J	0.010	--	0.010 J	0.0096 J	--	--
Nickel (dissolved)	mg/L	0.103	0.0024 U	0.0050 J	0.033	0.0030 J	--	0.0024 U	0.0024 U	--	--
Phosphorus (dissolved)	mg/L	NL	0.066 J	--	--	--	--	0.050 U	0.050 U	--	--
Potassium (dissolved)	mg/L	NL	11	27	17	13	--	14	13	--	--
Selenium (dissolved)	mg/L	0.619	0.013 U	0.0029 U	0.0029 U	0.0029 U	--	0.013 U	0.013 U	--	--
Silver (dissolved)	mg/L	0.00493	0.00084 U	0.0013 U	0.0013 U	0.0013 U	--	0.00084 U	0.00084 U	--	--
Sodium (dissolved)	mg/L	NL	260	2400	340	350	--	330	330	--	--
Strontium (dissolved)	mg/L	NL	0.32	2.4	0.57	0.47	--	0.51	0.49	--	--
Thallium (dissolved)	mg/L	0.5	0.0090 U	--	0.0042 U	0.0042 U	--	0.0090 U	0.0090 U	--	--
Thallium (dissolved)	ug/L	500	--	0.14 J	--	--	--	--	--	--	--
Tin (dissolved)	mg/L	NL	--	0.0014 J	0.0012 J	0.00059 U	--	--	--	--	--
Titanium (dissolved)	mg/L	NL	--	0.0022 J	0.17	0.025	--	--	--	--	--
Vanadium (dissolved)	mg/L	NL	0.0019 U	0.00047 U	0.086	0.012	--	0.0038 J	0.0035 J	--	--
Zinc (dissolved)	mg/L	0.165	0.013 U	0.015 U	0.15	0.026 J	--	0.012	0.014	--	--
General Chemistry											
Alkalinity (as CaCO3 pH=4.5)	mg/L	NL	210	--	--	--	--	--	--	--	--
Alkalinity, bicarbonate	mg/L	NL	210	1000	190 J	170 J	--	160 J	140	--	--
Alkalinity, carbonate	mg/L	NL	5.0 U	20 U	20 UJ	20 UJ	--	20 UJ	20 U	--	--
Alkalinity, total (as CaCO3)	mg/L	NL	--	1000	190 J	170 J	--	160 J	140	--	--
Ammonia-N	mg/L	NL	2.7	7.1	0.073 J	0.23	--	0.067 U	0.067 U	--	--
Biochemical oxygen demand (BOD)	mg/L	NL	6.0 U	10 U	--	--	--	--	--	--	--
Bromide	mg/L	NL	1.5	9.9	0.12 J	0.15 J	--	0.20 J	0.30 J	--	--
Chemical oxygen demand (COD)	mg/L	NL	92	82	170	310	--	27	16	--	--
Chloride	mg/L	NL	400	4200	540	500	--	480	820	--	--
Cyanide (total)	mg/kg	NL	--	--	--	--	--	--	--	--	--
Cyanide (total)	ug/L	NL	--	3.1 U	--	--	--	--	--	--	--
Ferrous iron	mg/L	NL	--	0.016 UJ	--	--	--	--	--	--	--
Fluoride	mg/L	NL	--	--	1.2 U	0.26 J	--	0.34	0.060 UJ	--	--
Free liquid	none	NL	--	--	--	--	--	--	--	--	--
Hydrogen sulfide	mg/L	NL	--	0.048 U	--	--	--	--	--	--	--
Ignitability	Deg F	NL	--	--	--	--	--	--	--	--	--
Nitrate (as N)	mg/L	NL	--	0.025 U	R	R	--	R	R	--	--
Nitrite (as N)	mg/L	NL	--	0.030 U	R	R	--	R	R	--	--
Oil and grease (n-Hexane Extractable Material [HEM]), total	mg/L	NL	--	--	2.0 J	2.1 J	1.8 J	--	--	--	--
Oil and grease (Silica Gel Treated n-Hexane Extractable Material [SGT HEM]), non-polar material	mg/L	NL	--	--	1.0 U	1.0 U	1.0 U	--	--	--	--
Percent solids	%	NL	--	--	--	--	--	--	--	--	--
pH, lab	s.u.	NL	7.8 J	6.9 J	8.2 J	7.9 J	8.9 J	7.7 J	7.8 J	--	--
Phosphorus	mg/L	NL	--	0.031 J	1.1	0.25	--	0.066	0.095	--	--
Phosphorus, total (as PO4)	mg/L	NL	--	0.095 J	3.3	0.77	--	0.20	0.29	--	--
Sulfate	mg/L	NL	8.7	6.5	37	36	--	1.9 U	62	--	--
Sulfide	mg/kg	NL	--	--	--	--	--	--	--	--	--
Sulfide	mg/L	NL	--	0.045 U	0.57	0.061	0.19	0.0090 U	0.0090 U	--	--
TOC average duplicates	mg/L	NL	4.5	--	--	--	--	--	--	--	--
Total dissolved solids (TDS)	mg/L	NL	910	8800	980	1100	--	1300	1300	--	--
Total organic carbon (TOC)	mg/L	NL	--	24	17 J	9.2 J	--	5.0 J	4.3 J	--	--
Total suspended solids (TSS)	mg/L	NL	3400	240	3500	4600	--	11	2.2	16000	110000
PCBs											
Aroclor-1016 (PCB-1016)	ug/L	NL	0.18 U	0.56 U	--	--	--	--	--	--	--
Aroclor-1221 (PCB-1221)	ug/L	NL	0.22 U	0.46 U	--	--	--	--	--	--	--
Aroclor-1232 (PCB-1232)	ug/L	NL	0.20 U	0.13 U	--	--	--	--	--	--	--
Aroclor-1242 (PCB-1242)	ug/L	NL	0.34 U	0.17 U	--	--	--	--	--	--	--
Aroclor-1248 (PCB-1248)	ug/L	NL	0.11 U	0.21 U	--	--	--	--	--	--	--
Aroclor-1254 (PCB-1254)	ug/L	NL	0.36 U	0.15 U	--	--	--	--	--	--	--
Aroclor-1260 (PCB-1260)	ug/L	NL	0.15 U	0.35 U	--	--	--	--	--	--	--
PCBs (dissolved)											
Aroclor-1016 (PCB-1016) (dissolved)	ug/L	NL	--	0.64 U	--	--	--	--	--	--	--
Aroclor-1221 (PCB-1221) (dissolved)	ug/L	NL	--	0.52 U	--	--	--	--	--	--	--
Aroclor-1232 (PCB-1232) (dissolved)	ug/L	NL	--	0.14 U	--	--	--	--	--	--	--
Aroclor-1242 (PCB-1242) (dissolved)	ug/L	NL	--	0.19 U	--	--	--	--	--	--	--
Aroclor-1248 (PCB-1248) (dissolved)	ug/L	NL	--	0.24 U	--	--	--	--	--	--	--
Aroclor-1254 (PCB-1254) (dissolved)	ug/L	NL	--	0.17 U	--	--	--	--	--	--	--
Aroclor-1260 (PCB-1260) (dissolved)	ug/L	NL	--	0.40 U	--	--	--	--	--	--	--

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2019 Pilot Test Effluent Characterization Results - Northern Impoundment
Pre-Final 90% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Area:	Units	Estimated Discharge Criteria [1,2]	Non-homogenized Contact Water	Excavation Seepage Water	Homogenized Contact Water - from tank feeding clarifier	Homogenized Contact Water - from tank feeding clarifier/filter	Equalized Contact Water - from tank feeding clarifier/filter	Clarified Effluent - from mix tank	Filter Effluent - from mix tank	Clarifier Underflow - composite	Settled Sludge - from bottom of cone bottom tank
Sample Location:			Contact-Initial	EXC-1	INF3	INF4	INF4	CEFF	FEFF	CUI	SS
Sample Identification:			11187072-CONTACT-INITIAL	11187072-091319-LL-EXC-1	INF 3	INF 4	DUP	1. CEFF, CEFF-Filtered	FEFF 1, FEFF-Filtered	CUI	SS
Sample Date:			9/24/2019	9/13/2019	10/25/2019	10/25/2019	10/25/2019	10/25/2019 , 11/5/2019	10/26/2019, 11/5/2019	10/26/2019	10/26/2019
Sample Type:							Duplicate				
Report Sample Delivery Group (SDG):			180-96144-1	600-191956-1, 600-191956-2	600-194690-1	600-194690-1	600-194690-1	600-194690-1, 320-56102-1	600-194690-1, 320-56102-1	600-194690-1	600-194690-1
Pesticides											
alpha-Chlordane	ug/L	NL	--	0.10 U	--	--	--	--	--	--	--
Chlordane	ug/L	NL	0.27 U	0.13 U	--	--	--	--	--	--	--
Endrin	ug/L	NL	0.0086 U	0.015 U	--	--	--	--	--	--	--
gamma-BHC (lindane)	ug/L	NL	0.011 U	0.013 U	--	--	--	--	--	--	--
gamma-Chlordane	ug/L	NL	--	0.015 U	--	--	--	--	--	--	--
Heptachlor	ug/L	NL	0.017 U	0.013 U	--	--	--	--	--	--	--
Heptachlor epoxide	ug/L	NL	0.013 U	0.015 U	--	--	--	--	--	--	--
Hexachlorobenzene	ug/L	NL	0.016 U	--	--	--	--	--	--	--	--
Methoxychlor	ug/L	NL	0.029 U	0.019 U	--	--	--	--	--	--	--
Toxaphene	ug/L	NL	1.9 U	5.1 U	--	--	--	--	--	--	--
Semi-Volatile Organic Compounds (SVOCs)											
2,2'-Oxybis(1-chloropropane) (bis(2-Chloroisopropyl) ether)	ug/L	NL	0.56 U	--	--	--	--	--	--	--	--
2,4,5-Trichlorophenol	ug/L	NL	0.59 U	4.4 U	--	--	--	--	--	--	--
2,4,6-Trichlorophenol	ug/L	NL	0.65 UJ	3.5 U	--	--	--	--	--	--	--
2,4-Dichlorophenol	ug/L	NL	0.49 UJ	--	--	--	--	--	--	--	--
2,4-Dimethylphenol	ug/L	NL	0.39 UJ	--	--	--	--	--	--	--	--
2,4-Dinitrophenol	ug/L	NL	15 U	--	--	--	--	--	--	--	--
2,4-Dinitrotoluene	ug/L	NL	0.49 U	2.2 U	--	--	--	--	--	--	--
2,6-Dinitrotoluene	ug/L	NL	0.58 U	2.9 U	--	--	--	--	--	--	--
2-Chloronaphthalene	ug/L	NL	0.57 UJ	--	--	--	--	--	--	--	--
2-Chlorophenol	ug/L	NL	0.62 UJ	--	--	--	--	--	--	--	--
2-Methylnaphthalene	ug/L	NL	0.60 UJ	--	--	--	--	--	--	--	--
2-Methylphenol	ug/L	NL	2.9 UJ	1.5 U	--	--	--	--	--	--	--
2-Nitroaniline	ug/L	NL	5.3 U	--	--	--	--	--	--	--	--
2-Nitrophenol	ug/L	NL	0.59 U	--	--	--	--	--	--	--	--
3&4-Methylphenol	ug/L	NL	3.6 UJ	1.4 U	--	--	--	--	--	--	--
3,3'-Dichlorobenzidine	ug/L	NL	5.6 U	--	--	--	--	--	--	--	--
3-Nitroaniline	ug/L	NL	0.64 U	--	--	--	--	--	--	--	--
4,6-Dinitro-2-methylphenol	ug/L	NL	14 U	--	--	--	--	--	--	--	--
4-Bromophenyl phenyl ether	ug/L	NL	0.61 U	--	--	--	--	--	--	--	--
4-Chloro-3-methylphenol	ug/L	NL	0.59 U	--	--	--	--	--	--	--	--
4-Chloroaniline	ug/L	NL	0.42 UJ	--	--	--	--	--	--	--	--
4-Chlorophenyl phenyl ether	ug/L	NL	0.59 UJ	--	--	--	--	--	--	--	--
4-Nitroaniline	ug/L	NL	0.56 U	--	--	--	--	--	--	--	--
4-Nitrophenol	ug/L	NL	1.4 U	--	--	--	--	--	--	--	--
Acenaphthene	ug/L	NL	0.63 UJ	--	--	--	--	--	--	--	--
Acenaphthylene	ug/L	NL	0.63 UJ	--	--	--	--	--	--	--	--
Acetophenone	ug/L	NL	0.60 U	--	--	--	--	--	--	--	--
Anthracene	ug/L	NL	0.47 U	--	--	--	--	--	--	--	--
Atrazine	ug/L	NL	6.1 U	--	--	--	--	--	--	--	--
Benzaldehyde	ug/L	NL	1.1 U	--	--	--	--	--	--	--	--
Benzo(a)anthracene	ug/L	NL	0.72 U	--	--	--	--	--	--	--	--
Benzo(a)pyrene	ug/L	NL	0.51 U	--	--	--	--	--	--	--	--
Benzo(b)fluoranthene	ug/L	NL	0.93 U	--	--	--	--	--	--	--	--
Benzo(g,h,i)perylene	ug/L	NL	0.66 UJ	--	--	--	--	--	--	--	--
Benzo(k)fluoranthene	ug/L	NL	0.85 U	--	--	--	--	--	--	--	--
Biphenyl (1,1-Biphenyl)	ug/L	NL	0.57 UJ	--	--	--	--	--	--	--	--
bis(2-Chloroethoxy)methane	ug/L	NL	0.64 UJ	--	--	--	--	--	--	--	--
bis(2-Chloroethyl)ether	ug/L	NL	0.38 UJ	--	--	--	--	--	--	--	--
bis(2-Ethylhexyl)phthalate (DEHP)	ug/L	NL	60 U	--	--	--	--	--	--	--	--
Butyl benzylphthalate (BBP)	ug/L	NL	4.4 U	--	--	--	--	--	--	--	--
Caprolactam	ug/L	NL	4.5 U	--	--	--	--	--	--	--	--
Carbazole	ug/L	NL	0.49 U	--	--	--	--	--	--	--	--
Chrysene	ug/L	NL	0.78 U	--	--	--	--	--	--	--	--
Dibenz(a,h)anthracene	ug/L	NL	0.69 U	--	--	--	--	--	--	--	--
Dibenzofuran	ug/L	NL	0.70 UJ	--	--	--	--	--	--	--	--
Diethyl phthalate	ug/L	NL	5.5 U	--	--	--	--	--	--	--	--
Dimethyl phthalate	ug/L	NL	0.54 U	--	--	--	--	--	--	--	--
Di-n-butylphthalate (DBP)	ug/L	NL	7.1 U	--	--	--	--	--	--	--	--
Di-n-octyl phthalate (DnOP)	ug/L	NL	6.6 U	--	--	--	--	--	--	--	--
Fluoranthene	ug/L	NL	0.58 U	--	--	--	--	--	--	--	--
Fluorene	ug/L	NL	0.66 UJ	--	--	--	--	--	--	--	--
Hexachlorobenzene	ug/L	NL	0.54 U	3.4 U	--	--	--	--	--	--	--
Hexachlorobutadiene	ug/L	NL	0.66 UJ	2.7 U	--	--	--	--	--	--	--
Hexachlorocyclopentadiene	ug/L	NL	R	--	--	--	--	--	--	--	--
Hexachloroethane	ug/L	NL	0.60 UJ	3.4 U	--	--	--	--	--	--	--
Indeno(1,2,3-cd)pyrene	ug/L	NL	0.82 U	--	--	--	--	--	--	--	--
Isophorone	ug/L	NL	0.52 U	--	--	--	--	--	--	--	--
Naphthalene	ug/L	NL	0.57 UJ	--	--	--	--	--	--	--	--
Nitrobenzene	ug/L	NL	4.8 U	2.7 U	--	--	--	--	--	--	--
N-Nitrosodi-n-propylamine	ug/L	NL	0.68 U	--	--	--	--	--	--	--	--
N-Nitrosodiphenylamine	ug/L	NL	1.1 U	--	--	--	--	--	--	--	--
Pentachlorophenol	ug/L	NL	8.1 U	3.3 U	--	--	--	--	--	--	--
Phenanthrene	ug/L	NL	0.53 U	--	--	--	--	--	--	--	--
Phenol	ug/L	NL	4.7 UJ	--	--	--	--	--	--	--	--
Pyrene	ug/L	NL	0.52 U	--	--	--	--	--	--	--	--
Pyridine	ug/L	NL	5.2 UJ	2.3 U	--	--	--	--	--	--	--

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Sample Location:			Contact-Initial	EXC-1	INF3	INF4	INF4	CEFF	FEFF	CUI	SS
Sample Identification:			11187072-CONTACT-INITIAL	11187072-091319-LL-EXC-1	INF 3	INF 4	DUP	1. CEFF, CEFF-Filtered	FEFF 1, FEFF-Filtered	CUI	SS
Sample Date:			9/24/2019	9/13/2019	10/25/2019	10/25/2019	10/25/2019	10/25/2019 , 11/5/2019	10/26/2019, 11/5/2019	10/26/2019	10/26/2019
Sample Type:							Duplicate				
Report Sample Delivery Group (SDG):			180-96144-1	600-191956-1, 600-191956-2	600-194690-1	600-194690-1	600-194690-1	600-194690-1, 320-56102-1	600-194690-1, 320-56102-1	600-194690-1	600-194690-1
Volatile Organic Compounds (VOCs)											
1,1,1-Trichloroethane	ug/L	NL	2.5 U	--	--	--	--	--	--	--	--
1,1,2-Trichloroethane	ug/L	NL	2.4 U	--	--	--	--	--	--	--	--
1,1-Dichloroethane	ug/L	NL	1.8 U	--	--	--	--	--	--	--	--
1,1-Dichloroethene	ug/L	NL	2.9 U	0.76 U	--	--	--	--	--	--	--
1,2,4-Trichlorobenzene	ug/L	NL	3.7 U	--	--	--	--	--	--	--	--
1,2-Dichlorobenzene	ug/L	NL	2.0 U	--	--	--	--	--	--	--	--
1,2-Dichloroethane	ug/L	NL	1.5 U	1.0 U	--	--	--	--	--	--	--
1,2-Dichloropropane	ug/L	NL	2.5 U	--	--	--	--	--	--	--	--
1,3-Dichlorobenzene	ug/L	NL	1.6 U	--	--	--	--	--	--	--	--
1,4-Dichlorobenzene	ug/L	NL	1.0 U	0.91 U	--	--	--	--	--	--	--
2-Butanone (Methyl ethyl ketone) (MEK)	ug/L	NL	2.9 U	1.6 U	--	--	--	--	--	--	--
Benzene	ug/L	NL	2.0 U	0.56 U	--	--	--	--	--	--	--
Bromodichloromethane	ug/L	NL	2.4 U	--	--	--	--	--	--	--	--
Bromoform	ug/L	NL	2.6 U	--	--	--	--	--	--	--	--
Carbon disulfide	ug/L	NL	--	1.7 U	--	--	--	--	--	--	--
Carbon tetrachloride	ug/L	NL	3.3 U	0.92 U	--	--	--	--	--	--	--
Chlorobenzene	ug/L	NL	1.6 U	0.82 U	--	--	--	--	--	--	--
Chloroethane	ug/L	NL	2.6 U	--	--	--	--	--	--	--	--
Chloroform (Trichloromethane)	ug/L	NL	2.1 U	0.82 U	--	--	--	--	--	--	--
cis-1,2-Dichloroethene	ug/L	NL	1.6 U	--	--	--	--	--	--	--	--
cis-1,3-Dichloropropene	ug/L	NL	1.6 U	--	--	--	--	--	--	--	--
Ethylbenzene	ug/L	NL	2.2 U	--	--	--	--	--	--	--	--
Hexachlorobutadiene	ug/L	NL	--	1.2 U	--	--	--	--	--	--	--
m&p-Xylenes	ug/L	NL	1.9 U	1.3 U	--	--	--	--	--	--	--
o-Xylene	ug/L	NL	2.4 U	0.93 U	--	--	--	--	--	--	--
Tetrachloroethene	ug/L	NL	2.0 U	1.2 U	--	--	--	--	--	--	--
Toluene	ug/L	NL	1.7 U	--	--	--	--	--	--	--	--
trans-1,2-Dichloroethene	ug/L	NL	2.5 U	--	--	--	--	--	--	--	--
trans-1,3-Dichloropropene	ug/L	NL	1.7 U	--	--	--	--	--	--	--	--
Trichloroethene	ug/L	NL	1.5 U	1.6 U	--	--	--	--	--	--	--
Vinyl chloride	ug/L	NL	3.7 U	0.85 U	--	--	--	--	--	--	--
Xylenes (total)	ug/L	NL	4.3 U	2.0 U	--	--	--	--	--	--	--

Notes:

[1] Per an EPA email dated February 18, 2020, compliance with the Texas Surface Water Quality Standards will be determined using the minimum level from the EPA approved method (1613B), cited in 40 CFR Part 136, in sampling of dioxin concentrations for surface water discharges during the site remedial action.

[2] Estimated discharge criteria were calculated for all parameters except dioxins and furans utilizing the TCEQ model, TEXTOX MENU # 5 for bays or wide tidal rivers.

TCLP - Toxicity Characteristic Leaching Procedure
EPA - US Environmental Protection Agency
CFR - Code of Federal Regulations
TCEQ - Texas Commission on Environmental Quality
BHC - benzene hexachloride
PCB - polychlorinated biphenyl
mg/L - milligrams per Liter
ug/L - microgram per Liter
mg/kg - milligram per kilogram
pg/L - picograms per Liter

Deg F - Degrees in Fahrenheit
s.u. - standard unit
J - Estimated concentration.
J- - Estimated concentration, result may be biased high.
U - Not detected at the associated reporting limit.
Dup - indicates the result from a duplicate sample
UJ - Not detected; associated reporting limit is estimated.
NL - No limit
-- Data not available

Table 3-3

2019 Bench-Scale Contact Water Filtration Results - Northern Impoundment
Pre-Final 90% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Area:	Units	Non-homogenized contact water - effluent from 100 µm filter	Non-homogenized contact water - effluent from 10 µm filter	Non-homogenized contact water - effluent from 1 µm filter	Non-homogenized contact water - effluent from 0.45 µm filter	Non-homogenized contact water - effluent from 0.1 µm filter
Sample Location:		Filter Test	Filter Test	Filter Test	Filter Test	Filter Test
Sample Identification:		11187072-Filter Test-1	11187072-Filter Test-3	11187072-Filter Test-4	11187072-Filter Test-5	11187072-Filter Test-6
Sample Date:		9/30/2019	9/30/2019	9/30/2019	9/30/2019	9/30/2019
Report Sample Delivery Group (SDG):		320-54852-1	320-54852-1	320-54852-1	320-54852-1	320-54852-1
Filter Size:		100 µm	10 µm	1 µm	0.45 µm	0.1 µm
Solids Collected on Filter						
	mg/L	9.53	4099	342	3.27	0.05
Dioxins/Furans						
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	pg/L	61 J	24 U	0.90 U	1.9 U	1.8 U
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	pg/L	1900	850	12 U	4.0 U	4.6 U
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	pg/L	84	30 J	0.75 U	1.1 U	1.2 U
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	pg/L	75	30 J	1.7 U	0.53 U	1.4 U
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	pg/L	28 J	11 J	0.87 U	0.47 U	0.47 U
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	pg/L	210	74	1.1 U	0.60 U	1.2 U
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/L	2.7 U	1.7 U	2.0 U	1.9 U	1.9 U
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/L	53	20 J	0.44 U	1.2 U	0.86 U
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/L	2.7 U	0.84 U	0.45 U	0.62 U	1.3 U
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	pg/L	4.5 U	2.1 U	0.67 U	0.75 U	1.1 U
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/L	2.3 U	0.60 U	0.71 U	0.57 U	1.5 U
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	pg/L	100	39 J	0.53 U	0.60 U	0.64 U
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	pg/L	9.4 J	4.2 J	0.92 U	1.0 U	1.2 U
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/L	7.0 J	2.8 U	0.36 U	0.94 U	0.47 U
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	pg/L	59	22 J	0.56 U	0.57 U	0.66 U
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	pg/L	2500	820	8.7 J	1.6 J	0.93 J
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	pg/L	800	270	3.6 J	0.76 U	0.65 U
Total heptachlorodibenzofuran (HpCDF)	pg/L	140 J	52 J	1.6 J	1.1 J	1.2 J
Total heptachlorodibenzo-p-dioxin (HpCDD)	pg/L	190 J	78 J	3.9 J	0.53 U	2.3 J
Total hexachlorodibenzofuran (HxCDF)	pg/L	310 J	110 J	1.8 J	2.9 J	3.2 J
Total hexachlorodibenzo-p-dioxin (HxCDD)	pg/L	27 J	7.5 J	2.7 J	2.5 J	4.6 J
Total pentachlorodibenzofuran (PeCDF)	pg/L	250 J	91 J	0.56 U	0.69 U	0.66 U
Total pentachlorodibenzo-p-dioxin (PeCDD)	pg/L	9.4 J	4.2 J	0.92 U	1.0 U	1.2 U
Total tetrachlorodibenzofuran (TCDF)	pg/L	4200 J	1400 J	13 J	1.6 J	0.93 J
Total tetrachlorodibenzo-p-dioxin (TCDD)	pg/L	860 J	290 J	5.0 J	0.76 U	0.65 U

Notes:
- mg/L - milligrams per Liter
- pg/L - picograms per Liter
- µm - micron
- U - Not detected at the associated reporting limit.
- J - Estimated concentration.

Table 3-4

2019 Focused Filtration Testing Results - Northern Impoundment
Pre-Final 90% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Area:	Units	Pilot Test Filter Effluent - effluent from 1 um filter	Pilot Test Filter Effluent - effluent from 0.45 um filter	Pilot Test Filter Effluent - effluent from 0.1 um filter	Pilot Test Filter Effluent - effluent from 0.050 um filter	Pilot Test Filter Effluent - effluent from 0.025 um filter
Sample Location:		FEFF	FEFF	FEFF	FEFF	FEFF
Sample Identification:		11187072-FEFF-1um	11187072-FEFF-0.45um	11187072-FEFF-0.1um	11187072-FEFF-0.050um	11187072-FEFF-0.025um
Sample Date:		1/9/2020	1/9/2020	1/9/2020	1/13/2020	1/13/2020
Report Sample Delivery Group (SDG):		320-57624-1	320-57624-1	320-57624-1	320-57717-1	320-57717-1
Filter Size:		1 um	0.45 um	0.1um	0.05 um	0.025 um
Dioxins/Furans						
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	pg/L	1.5 J	1.0 J	2.1 J	1.3 J	0.93 U
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	pg/L	9.3 U	3.6 U	14 U	3.7 U	14 U
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	pg/L	0.51 U	0.52 U	0.95 U	0.67 U	0.84 U
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	pg/L	1.1 U	0.722 U	1.7 U	0.73 J	1.3 J
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	pg/L	0.29 U	0.20 U	0.27 U	0.80 U	0.96 U
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	pg/L	0.40 U	0.41 U	0.50 U	0.65 U	0.72 U
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/L	1.8 U	1.6 U	1.8 U	1.6 J	1.8 J
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/L	0.41 U	0.42 U	0.50 U	0.63 U	0.71 U
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/L	0.30 U	0.30 U	0.33 U	0.66 J	0.85 J
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	pg/L	0.29 U	0.30 U	0.50 J	0.96 U	0.68 U
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/L	0.26 U	0.50 J	0.29 U	0.44 U	0.52 U
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	pg/L	0.25 U	0.33 U	0.32 U	0.59 U	0.78 U
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	pg/L	0.40 U	0.40 U	0.35 U	1.1 U	1.2 U
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/L	0.30 U	0.31 U	0.34 U	0.41 U	0.48 U
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	pg/L	0.26 U	0.33 U	0.35 U	0.62 U	0.80 U
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	pg/L	0.22 U	0.21 U	0.24 U	0.34 U	0.41 U
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	pg/L	0.40 U	0.41 U	0.48 U	0.62 U	0.70 U
Total heptachlorodibenzofuran (HpCDF)	pg/L	0.51 J	0.52 J	0.95 J	0.80 U	0.96 U
Total heptachlorodibenzo-p-dioxin (HpCDD)	pg/L	2.5 J	0.72 J	3.2 J	1.8 J	2.9 J
Total hexachlorodibenzofuran (HxCDF)	pg/L	0.41 U	0.42 U	0.50 J	0.96 J	0.68 J
Total hexachlorodibenzo-p-dioxin (HxCDD)	pg/L	1.8 J	2.1 J	1.8 J	5.6 J	2.6 J
Total pentachlorodibenzofuran (PeCDF)	pg/L	0.30 U	0.33 U	0.43 U	0.62 U	0.80 U
Total pentachlorodibenzo-p-dioxin (PeCDD)	pg/L	0.40 U	0.40 U	0.35 U	1.1 U	1.2 U
Total tetrachlorodibenzofuran (TCDF)	pg/L	0.22 U	0.21 U	0.24 U	0.34 U	0.41 U
Total tetrachlorodibenzo-p-dioxin (TCDD)	pg/L	0.40 U	0.41 U	0.48 U	1.0 J	0.90 J

Notes:
pg/L - picograms per Liter
µm - micron
U - Not detected at the associated reporting limit.
J - Estimated concentration.

Table 3-5

2019 Armored Cap Test Results - Northern Impoundment
Pre-Final 90% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Area:	Units	Elutriate From Armored Cap Material	Elutriate From Armored Cap Material	Elutriate From Armored Cap Material
Sample Location:		Berm	Eastern	Western
Sample Identification:		11187072-Berm-GW	11187072-Eastern-GW	11187072-Western-GW
Sample Date:		1/29/2020	1/29/2020	1/29/2020
Report Sample Delivery Group (SDG):		320-58170-1	320-58170-1	320-58170-1
Dioxins/Furans				
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	pg/L	21 U	14 U	13.8 U
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	pg/L	83 U	94 U	51 U
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	pg/L	7.54 U	7.54 U	7.54 U
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	pg/L	9.52 U	9.52 U	9.52 U
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	pg/L	5.85 U	5.85 U	0.71 U
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	pg/L	5.92 U	5.92 U	0.79 U
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/L	7.72 U	7.72 U	7.72 U
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/L	6.14 U	0.81 U	0.70 U
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/L	0.48 U	0.52 U	0.48 U
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	pg/L	6.25 U	6.25 U	0.53 U
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/L	6.10 U	6.10 U	6.10 U
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	pg/L	0.46 U	0.48 U	0.42 U
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	pg/L	6.12 U	6.12 U	0.47 U
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/L	5.39 U	0.55 U	0.49 U
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	pg/L	0.51 U	0.55 U	0.46 U
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	pg/L	0.28 U	0.36 U	0.35 U
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	pg/L	0.60 U	0.44 U	3.4 J
Total heptachlorodibenzofuran (HpCDF)	pg/L	13 J	8.9 J	3.2 J
Total heptachlorodibenzo-p-dioxin (HpCDD)	pg/L	15 J	16 J	8.3 J
Total hexachlorodibenzofuran (HxCDF)	pg/L	6.8 J	3.9 J	0.79 U
Total hexachlorodibenzo-p-dioxin (HxCDD)	pg/L	5.0 J	3.4 J	4.1 J
Total pentachlorodibenzofuran (PeCDF)	pg/L	0.51 U	0.55 U	0.46 U
Total pentachlorodibenzo-p-dioxin (PeCDD)	pg/L	1.1 J	0.62 J	0.47 U
Total tetrachlorodibenzofuran (TCDF)	pg/L	0.28 U	0.36 U	0.35 U
Total tetrachlorodibenzo-p-dioxin (TCDD)	pg/L	0.60 U	0.44 U	3.4 J

Table 3-5

2019 Armored Cap Test Results - Northern Impoundment
Pre-Final 90% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Area:		Solids Washed From Armored Cap Material	Solids Washed From Armored Cap Material	Solids Washed From Armored Cap Material
Sample Location:	Units	Berm	Eastern	Western
Sample Identification:		11187072-Berm-Solids	11187072-Eastern-Solids	11187072-Western-Solids
Sample Date:		1/29/2020	1/29/2020	1/29/2020
Report Sample Delivery Group (SDG):		320-58170-1	320-58170-1	320-58170-1
Dioxins/Furans				
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	pg/g	5.0 J	4.0 J	12 J
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	pg/g	320	280	540
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	pg/g	1.9 J	0.75 U	3.2 J
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	0.61 U	12	26
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	pg/g	0.30 U	0.24 U	0.29 U
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.27 U	0.18 J	0.21 U
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.48 U	0.46 U	0.69 U
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.23 U	0.14 U	0.17 U
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.86 J	0.38 J	0.67 J
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	pg/g	0.18 U	0.24 J	0.11 U
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.62 J	0.48 J	0.68 J
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	0.12 U	0.12 J	0.13 U
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	0.15 U	0.18 U	0.17 U
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.16 U	0.095 U	0.12 U
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	0.13 U	0.12 U	0.17 U
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	pg/g	0.73 J	2.2	2.5
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	0.56 J	0.98 J	1.0 J
Total heptachlorodibenzofuran (HpCDF)	pg/g	3.8 J	2.0 J	9.6 J
Total heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	20 J	33 J	62 J
Total hexachlorodibenzofuran (HxCDF)	pg/g	0.69 J	1.2 J	1.9 J
Total hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	5.0 J	4.9 J	7.9 J
Total pentachlorodibenzofuran (PeCDF)	pg/g	0.69 J	0.12 J	1.4 J
Total pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	0.15 U	0.18 U	0.20 J
Total tetrachlorodibenzofuran (TCDF)	pg/g	0.73 J	3.6 J	5.0 J
Total tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	0.56 J	0.98 J	1.0 J
Total WHO Dioxin TEQ(Human/Mammal)(ND=0)	pg/g	0.898	1.54	1.84
Total WHO Dioxin TEQ(Human/Mammal)(ND=0.5)	pg/g	1.06	1.68	2.02
Percent solids	%	99.6	99.6	99.7

Table 3-5

2019 Armored Cap Test Results - Northern Impoundment
Pre-Final 90% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Area:		Crushed Rock Armored Cap Material	Crushed Rock Armored Cap Material	Crushed Rock Armored Cap Material
Sample Location:	Units	Berm	Eastern	Western
Sample Identification:		11187072-Berm-Rock	11187072-Eastern Rock	11187072-Western-Rock
Sample Date:		2/11/2020	2/11/2020	2/11/2020
Report Sample Delivery Group (SDG):		320-58545-1	320-58545-1	320-58545-1
Dioxins/Furans				
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	pg/g	0.57 U	0.58 U	3.4 U
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	pg/g	9.6 J	61	160
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	pg/g	0.229 U	0.27 U	1.2 J
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	0.59 J	4.4 J	12
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	pg/g	0.18 J	0.027 U	0.14 J
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.085 U	0.098 U	0.13 U
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.24 U	0.27 U	0.30 U
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.076 U	0.090 U	0.11 U
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.046 U	0.26 U	0.33 U
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	pg/g	0.27 U	0.18 U	0.20 U
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.042 U	0.13 J	0.26 J
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	0.17 J	0.16 J	0.13 J
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	0.093 J	0.11 J	0.058 U
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.084 J	0.059 U	0.068 U
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	0.050 U	0.060 U	0.057 U
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	pg/g	0.11 J	0.15 J	0.18 J
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	0.059 U	0.14 J	0.15 J
Total heptachlorodibenzofuran (HpCDF)	pg/g	0.46 J	0.38 J	3.7 J
Total heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	1.3 J	12 J	26 J
Total hexachlorodibenzofuran (HxCDF)	pg/g	0.35 J	0.18 J	0.98 J
Total hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.24 J	1.1 J	2.1 J
Total pentachlorodibenzofuran (PeCDF)	pg/g	0.17 J	0.16 J	0.13 J
Total pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	0.093 J	0.11 J	0.24 J
Total tetrachlorodibenzofuran (TCDF)	pg/g	0.23 J	0.15 J	0.18 J
Total tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	0.059 U	0.14 J	0.15 J
Total WHO Dioxin TEQ(Human/Mammal)(ND=0)	pg/g	0.128	0.345	0.379
Total WHO Dioxin TEQ(Human/Mammal)(ND=0.5)	pg/g	0.204	0.404	0.474
Percent solids	%	99.7	94.4	94.2

Notes:
pg/L - picograms per Liter
U - Not detected at the associated reporting limit.
J - Estimated concentration.
TEQ - toxic equivalency
WHO - World Health Organization

Table 3-6

Analytical Results from 2020 Field Filtration Testing
Pre-Final 90% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Parameter	Units	Influent - Sand-Filtered and Clarified Contact Water	1 µm Filtrate	0.5 µm Filtrate
TSS	mg/L	11	3.8	2.0 U
Total TCDD	pg/L	6.5 J	3.6 J	3.8 J
Total TCDF	pg/L	20 J	5.6 J	0.96 J
2,3,7,8-TCDD	pg/L	1.9 J	0.72 U	0.56 U
2,3,7,8-TCDF	pg/L	12	3.4 J	0.96 J

Notes:
- mg/L - milligram per liter
- pg/L - picogram per liter
- µm - micrometer
- TSS = total suspended solids
- Total TCDD = Total tetrachlorinated dibenzo-p-dioxin
- Total TCDF = Total tetrachlorodibenzofuran
- 2,3,7,8-TCDD = 2,3,7,8 tetrachlorinated dibenzo-p-dioxin
- 2,3,7,8-TCDF = 2,3,7,8 tetrachlorodibenzofuran
- J - Estimated concentration
- U - Not detected at the associated reporting limit

Table 3-7

Results from Filtrate Generated from Particle Size Analysis - Approach B Filtration Testing
Pre-Final 90% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Filter Size (µm)	With Chemical Addition						Without Chemical Addition					
	Solids on Filter (mg/L)	Solids Retained (%)	Total TCDD (pg/L)	Total TCDF (pg/L)	2,3,7,8-TCDD (pg/L)	2,3,7,8-TCDF (pg/L)	Solids on Filter (mg/L)	Solids Retained (%)	Total TCDD (pg/L)	Total TCDF (pg/L)	2,3,7,8-TCDD (pg/L)	2,3,7,8-TCDF (pg/L)
100	29.2	0.26	13,000 J	68,000 J	12,000	35,000	18	0.45	3,000 J	16,000 J	2,700	9,500
41	2,226	19.54	8,600 J	41,000 J	8,000	23,000	136.6	3.42	28,000 J	13,000 J	26,000	80,000
10	8,756	76.86	42 J	160 J	37	97	3,577	89.49	59 J	260 J	52	140
1	325.6	2.86	17 J	59 J	12	34	228.5	5.72	120 J	600 J	110	350
0.45	33.2	0.29	11 J	29 J	6.1 J	19	22.6	0.57	4.5 J	21 J	4.5 J	11
0.1	22.4	0.20	13 J	49 J	11	31	14.4	0.36	15 J	81 J	15	48

Notes:
mg/L - milligram per liter
pg/L - picogram per liter
µm - micrometer
Total TCDD = Total tetrachlorinated dibenzo-p-dioxin
Total TCDF = Total tetrachlorodibenzofuran
2,3,7,8-TCDD = 2,3,7,8 tetrachlorinated dibenzo-p-dioxin
2,3,7,8-TCDF = 2,3,7,8 tetrachlorodibenzofuran
J - Estimated concentration

Table 3-8

Constituent Concentrations throughout Treatment Process - Additional WTS Treatability Testing
Pre-Final 90% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Parameter	Units	Supernatant after Initial Setting	Supernatant after Chemical Addition and Settling	Chemical Addition Supernatant - 5-µm Filtrate	Chemical Addition Supernatant - 1-µm Filtrate
Total TCDD	pg/L	650 J	19 J	1.1 U	0.96 U
Total TCDF	pg/L	2,900 J	99 J	2.5 J	2.4 J
2,3,7,8-TCDD	pg/L	600	19	1.1 U	0.96 U
2,3,7,8-TCDF	pg/L	1,600	56	2.5 U	2.4 J
TSS	mg/L	1,050	5	2	2

Notes:
mg/L - milligram per liter
pg/L - picogram per liter
µm - micrometer
WTS - Water Treatment System
Total TCDD = Total tetrachlorinated dibenzo-p-dioxin
Total TCDF = Total tetrachlorodibenzofuran
2,3,7,8-TCDD = 2,3,7,8 tetrachlorinated dibenzo-p-dioxin
2,3,7,8-TCDF = 2,3,7,8 tetrachlorodibenzofuran
J - Estimated concentration
U - Not detected at the associated reporting limit

Table 4-1

Applicable or Relevant and Appropriate Requirements (ARAR)
Pre-Final 90% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Item No.	Media/Topic	Status, Regulations, Standards, or Requirements	Citations or References	Description	Comment
1.	Surface Water	Clean Water Act (CWA): Sections 303 and 304: Federal Water Quality Criteria.	33 U.S.C. §§1313 and 1314 (304(a))	Under §303 (33 U.S.C. §1313), individual states have established water quality standards to protect existing and attainable uses. CWA §301(b)(1)(C) requires that pollutants contained in direct discharges be controlled beyond BCT/BAT equivalents. Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) §121(d)(2)(B)(i) establishes conditions under which water quality criteria, which were developed by USEPA as guidance for states to establish location-specific water quality standards, are to be considered relevant and appropriate. Two kinds of water quality criteria have been developed under CWA §304 (33 U.S.C. §1314): one for protection of human health, and another for protection of aquatic life. These requirements include establishment of total maximum daily loads (TMDL).	A TMDL for dissolved nickel in the Houston Ship Channel System has been adopted and an implementation plan approved. Discharge criteria for the Northern Impoundment, including nickel, was determined by establishing Water Quality-Based Effluent Limitations (WQBELs) using TexTox Menus model provided by TCEQ; therefore, the use of the same model used to develop the TMDL ensures that the cumulative effects will not cause an exceedance of the water quality criteria for nickel. Per the 2020 Texas Integrated Report – Texas 303(d) list, San Jacinto River Segment 1005 is classified as impaired body of water for dioxin and polychlorinated biphenyls (PCBs) in edible tissues as category 5; therefore, it is suitable for development of a TMDL. A TMDL for dioxin and PCBs in edible tissues Segment 1005 has not been developed yet. The Texas Surface Water Quality Standard (TSWQS) for dioxins is applicable for surface water discharge from the Northern Impoundment, in accordance with the EPA's February 18, 2020, e-mail (included in Appendix D of this Northern Impoundment 90% RD Package), which stated: *EPA has determined that compliance with the TSWQS ARAR will be attained as follows:* *- The state surface water quality standard for Dioxins/Furans is 7.97 x 10-8 μg/L [0.0797 pg/L] (as TCDD equivalents);* *- Compliance with the TSWQS will be determined by using minimum level of the EPA approved method (1613B), cited in 40 CFR Part 136 (GUIDELINES ESTABLISHING TEST PROCEDURES FOR THE ANALYSIS OF POLLUTANTS), in sampling of surface water discharges during the Site remedial action.* *- If an effluent sample analyzed for dioxin is below the minimum level using the EPA approved method, the sample result would be identified as non-detect and the discharge would be determined to be in compliance with the ARAR.* *This approach is consistent with the state's guidance and other permits issued by TCEQ. EPA's determination is contingent on the water treatment facility using a 1 micron final filtration step in the water treatment process.*
2.	Surface Water	Clean Water Act (CWA): Criteria and standards for imposing technology -based treatment requirements under §402.	33 U.S.C. §1342; 40 CFR Part 125 Subpart A	Both on-site and off-site discharges from CERCLA Sites to surface waters are required to meet the substantive CWA (National Pollutant Discharge Elimination System) NPDES requirements.	On-site discharges to surface water must comply with the substantive technical requirements of the CWA but do not require a permit. Off-site discharges to a Publicly Owned Treatment Work (POTW) would be regulated under the conditions of a NPDES permit for the POTW. Water that is generated during removal activities in the Northern Impoundment will be treated and discharged to the San Jacinto River (Segment 1005). The discharge location(s) have yet to be determined but will be in close proximity to the Northern Impoundment, so only the substantive requirements of an NPDES permit, but not an NPDES permit, will be required. Water quality-based effluent limitations using TexTox menu # 5 for bay or wide tidal river were calculated and considered for the water treatment design. Development of the treatment system discharge limits are discussed further below.

Table 4-1

Applicable or Relevant and Appropriate Requirements (ARAR)
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Harris County, Texas

Item No.	Media/Topic	Status, Regulations, Standards, or Requirements	Citations or References	Description	Comment
3.	Surface Water	Clean Water Act (CWA): Section 307(b): Pretreatment standards.	33 U.S.C. §1317(b)	CERCLA §121(e) states that no Federal, state, or local permit for direct discharges is required for the portion of any removal or remedial action conducted entirely on-site (the aerial extent of contamination and all suitable areas in close proximity to the contamination necessary for implementation of the response action) (USEPA, 1988).	If off-site discharges from a CERCLA response activity were to enter receiving waters directly or indirectly, through treatment at a POTW, the POTW must comply with applicable Federal, State, and Local substantive requirements and formal administrative permitting requirements. Per the RD as described in this Northern Impoundment 90% RD Package, contact water generated during excavation activities will not be discharged to a POTW; therefore this regulation does not apply.
4.	Surface Water	Clean Water Act (CWA).	Section 401: Water Quality Certification 33 U.S.C. §1341 30 TAC Chapter 279	Requires activities that involve a discharge into navigable waters of the U.S. to obtain certification from state or regional regulatory agencies that the proposed discharge will comply with CWA Sections 301, 302, 303, 306, and 307.	Water Quality Certification is a requirement of projects that involve discharge of dredge/fill or would impact waters of the U.S. or wetland. The cofferdam barrier wall to be installed at the Northern Impoundment is considered "fill material"; therefore, Section 401 would apply to the project. The project will comply with substantive requirements of Section 401.
5.	Surface Water	Clean Water Act (CWA).	CWA Section 404 and 404(b)(1): Dredge and Fill 33 U.S.C. §1344 (b)(1); 33 CFR 320 and 330; 40 CFR 230	Discharges of dredged and fill material into waters of the U.S. must comply with the CWA §404 (33 U.S.C. 1344) guidelines and demonstrate the public interest is served.	The San Jacinto River is a water of the U.S. These requirements are applicable to dredging, in-water disposal, capping, construction of berms or levees, stream channelization, excavation and/or dewatering within the river. Therefore, they would apply to the work in the Northern Impoundment. Under the 404(b)(1) guidelines, efforts should be made to avoid, minimize, and mitigate adverse effects on the waters of the U.S. and, where possible, select a practicable (engineering feasible) alternative with the least adverse effects. A permit for the on-site work will not be required; however, the substantive technical requirements of Section 404 will apply in the development, evaluation, and implementation of the remedial action to minimize adverse impacts to waters of the U.S. AA "Waters and Wetlands Delineation Report" will be included in a submittal to the USACE following submittal of the Northern Impoundment 90% RD.
6.	Surface Water	Storm Water Discharge from Construction Activities.	40 CFR 450 30 TAC Chapter 205	Requires new construction project that will disturb 5 or more acres to request coverage under a Texas Commission on Environmental Quality (TCEQ) construction general permit (TX15000) and develop a storm water pollution prevention plan (SWPPP) to control discharges of storm water associated with construction activities in accordance with the NPDES program.	A permit is not required, however, the work must comply with the substantive technical requirements of these regulations. A SWPPP will be developed and implemented using best management practices to minimize erosion and entrainment of sediments in stormwater runoff.
7.	Surface Water	Texas Surface Water Quality Standards.	30 TAC §307.4-7, 10	These state regulations provide general narrative criteria, anti-degradation policy, numerical criteria for pollutants, numerical and narrative criteria for water-quality related uses (e.g., human use), and site-specific criteria for San Jacinto River basin.	The TSWQS for dioxins is applicable for surface water discharge from the Northern Impoundment, in accordance with EPA's February 18, 2020, e-mail quoted in Item No. 1, and included in Appendix D of this Northern Impoundment 90% RD Package.
8.	Surface Water	Texas Water Quality: Pollutant Discharge Elimination System (TPDES).	30 TAC §279.10	These state regulations require storm water discharge permits for either industrial discharge or construction-related discharge. The State of Texas was authorized by USEPA to administer the NPDES program in Texas on September 14, 1998.	No permit is required for on-site activities. A SWPPP will be developed and implemented using best management practices to minimize soil erosion and entrainment of sediments in stormwater runoff.

Table 4-1

Applicable or Relevant and Appropriate Requirements (ARAR)
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Item No.	Media/Topic	Status, Regulations, Standards, or Requirements	Citations or References	Description	Comment
9.	Surface Water	Texas Water Quality: Water Quality Certification.	30 TAC §279.10	These state regulations establish procedures and criteria for applying for, processing, and reviewing state certifications under CWA, §401. It is the purpose of this chapter, consistent with the Texas Water Code and the federal CWA, to maintain the chemical, physical, and biological integrity of the state's waters.	Water Quality Certification is a requirement for projects that involve discharge of dredge fill or would impact waters of the U.S. or wetlands. The cofferdam barrier wall that will be installed at the Northern Impoundment, as described in this 90% Northern Impoundment RD Package, is considered "fill material"; therefore, Section 401 would apply to the project. The BMP installation and removal activities will comply with substantive requirements of Section 401.
10.	Surface Water	Water Use.	TWC Sections 11.121 and 11.138; 30 TAC §297.11	Impoundment, diversion and storage, taking or use of state water with certain exemptions as provided in state law require obtaining a water rights permit. These exemptions are not applicable to the Northern Impoundment. These state regulations establish procedures for applying for, and obtaining the temporary diversion of surplus state water under a temporary water rights permit.	A temporary use permit is a requirement for projects that involve the use of state water and/or divert water for up to three years. Projects that would use more than 10 acre-feet of water and/or exceed one year term are subject to public notice and hearing. Hydrodynamic modeling was performed at the request of the Harris County Flood Control District (HCFCD) to evaluate the effect the cofferdam barrier wall planned for the Northern Impoundment may have on the water levels of the surrounding floodplain. Results of the evaluation suggest that the effect of the structure on the floodplain would be negligible under 2-year, 10-year, and 100-year flood event scenarios. This evaluation was summarized in a letter submitted to the HCFCD on March 30, 2022. A revised version of the letter was submitted on May 6, 2022, which addressed comments from the HCFCD that were received on April 8, 2022. The revised letter is included in Appendix D of this Northern Impoundment 90% RD package. At the request of the Texas Department of Transportation (TxDOT) the Respondents also evaluated the potential effect the cofferdam barrier would have on the river velocity and shear stress. The results of this evaluation were submitted to TxDOT on April 11, 2022. This submittal is also included in Appendix D.
11.	Waste	Resource Conservation And Recovery Act (RCRA): Hazardous Waste Management.	42 U.S.C. §§6921 et seq.; 40 CFR Parts 260 - 268	RCRA Subtitle C and its implementing regulations contain the federal requirements for the management of hazardous wastes.	This requirement would apply to certain activities if the waste materials or affected soils contain RCRA listed hazardous waste or exhibit a hazardous waste characteristic. Waste management in the Northern Impoundment would be required to comply with these regulations. Based on the results of the pre-design investigations (PDI-1, PDI-2) and supplemental design investigation (SDI), the Northern Impoundment waste materials sampled to date are not listed hazardous waste, do not contain listed hazardous waste above RCRA-thresholds, and are not classified as characteristic hazardous waste. The evaluation and designation of the material as non-hazardous was summarized in a letter to the EPA dated October 20, 2020. The EPA provided a response letter dated November 19, 2020, supporting the waste classification. These letters are included in Appendix D of this Northern Impoundment 90% RD Package. The results of the SDI confirmed the waste classification, as described in Section 3.3 of the main text of the Northern Impoundment 90% RD Package.
12.	Waste	Toxic Substances Control Act (TSCA).	15 USC §2601, et. seq.; 40 CFR 761.61 (c)	40 CFR 761.61 provides TSCA clean-up and disposal options for PCB remediation waste, which includes PCB-contaminated soil, sediment, sewage or industrial sludge, and building material. 761.61(c) is the risk-based option for PCB remediation waste.	Total PCB concentrations in the Northern Impoundment are below the regulatory threshold of 50 mg/kg, calculated as specified in 40 CFR 761 that could require management of any waste materials as a TSCA waste.
13.	Waste	RCRA: General Requirements for Solid Waste Management.	42 U.S.C. §§6941, et seq.; 40 CFR 258)	Requirements for construction for municipal solid waste landfills that receive RCRA Subtitle D wastes, including industrial solid waste. Requirements for run-on/run-off control systems, groundwater monitoring systems, surface water requirements, etc.	The Northern Impoundment remedial activities will not involve the construction of a municipal landfill; therefore, this regulation does not apply.

Table 4-1

Applicable or Relevant and Appropriate Requirements (ARAR)
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Item No.	Media/Topic	Status, Regulations, Standards, or Requirements	Citations or References	Description	Comment
14.	Waste	30 Texas Administrative Code (TAC) Part 1: Industrial Solid Waste and Municipal Hazardous Waste General Terms	30 TAC §§335.1 - 335.15	Substantive requirements for the transportation of industrial solid and hazardous wastes; requirements for the location, design, construction, operation, and closure of solid waste management facilities.	This regulation contains guidelines to promote the proper collection, handling, storage, processing, and disposal of industrial solid waste or municipal hazardous waste in a manner consistent with the purposes of Texas Health and Safety Code, Chapter 361. These regulations also define the classification of the Industrial Solid Waste from the Northern Impoundment. They are applicable and will be followed for waste materials from the Northern Impoundment that are transported to off-site landfills.
15.	Waste	30 TAC Part 1: Industrial Solid Waste and Municipal Hazardous Waste: Notification.	30 TAC Chapter 335 Subchapter P	Requires placement of warning signs in contaminated and hazardous areas if a determination is made by the executive director of the Texas Water Commission a potential hazard to public health and safety exists which will be eliminated or reduced by placing a warning sign on the contaminated property.	It is not expected that warning signs will be necessary based on this regulation. The Northern Impoundment will be protected with appropriate signage and other site controls as defined in the Health and Safety Plan. Any issues with respect to maintenance of current signage required pursuant to the Operations and Maintenance (O&M) Plan for the Time Critical Removal Action (TCRA) are expected to be addressed through modifications to the O&M Plan.
16.	Waste	30 TAC Part 1: Industrial Solid Waste and Municipal Hazardous Waste: Generators.	30 TAC Chapter 335, Subchapter C	Standards for hazardous waste generators either disposing of waste on-site or shipping off-site with the exception of conditionally exempt small quantity generators. The definition of hazardous involves state and federal standards.	Waste management with respect to RA activities associated with the Northern Impoundment would be required to comply with these regulations. Based on the results of the PDIs and SDI for the RD, the Northern Impoundment waste materials sampled to date are not listed hazardous waste, do not contain listed hazardous waste above RCRA -thresholds, and are not classified as characteristic hazardous waste. The evaluation and designation of the material as non-hazardous was summarized in a letter to the EPA dated October 20, 2020. The EPA provided a response letter dated November 19, 2020, supporting the waste classification. These letters are included in Appendix D of the Northern Impoundment 90% RD Package. The results of the SDI confirmed the waste classification, as described in Section 3.3 of the main text of the Northern Impoundment 90% RD Package.
17.	Waste	Hazardous Materials Transportation Act	49 U.S.C. §§1801, et seq.; 49 CFR Subchapter C	Establishes standards for packaging, documenting, and transporting hazardous materials.	These requirements would apply to all hazardous material transported to and from work sites for the Northern Impoundment RA. Based on the results of the PDIs and the SDI, it is not expected that the waste materials excavated from beneath the Northern Impoundment and transported off-site will be classified as hazardous material so these requirements would not apply.
18.	Air	Clean Air Act (CAA).	42 U.S.C. §§7401, et seq.	Authorization of potential emissions of dust, volatile organic compounds (VOCs), and/or hazardous air pollutants (HAP) resulting from the excavation, solidification and stabilization of the soil in the Northern Impoundment.	Any air discharges are required to be in compliance with the substantive technical requirements of the CAA and the work will be required to comply with any applicable TCEQ requirements regarding such emissions.
19.	Air	Texas Air Quality Rules.	30 TAC Chapter 116	Authorization of potential emissions of dust, VOCs, and/or HAP resulting from the excavation, solidification and stabilization of the soil in the Northern Impoundment.	TCEQ is the designated authority to issue air permits in Texas, so discharges must comply with the substantive technical requirements of this regulation. Emissions generated from equipment used to extract, handle, process, condition, reclaim or destroy contaminants for the purpose of remediation are covered by a TCEQ's permit by rule (PBR) as long as emissions are limited to 5 ton per year or 1 pound per hour for the site activities (30 TAC 106.533). Prior to commencing construction, emission calculations would be performed with respect to compliance with the PBR.
20.	Dredging/Floodplain	Rivers And Harbors Act of 1899: Obstruction of navigable waters (generally wharves, piers, etc.); excavation and fill.	33 U.S.C. §401	Controls the alteration of navigable waters (i.e., waters subject to ebb and flow of the tide shoreward to the mean high water mark). Activities controlled include construction of structures such as piers, berms, and installation of pilings as well as excavation and fill. Section 10 may be applicable for any action that may obstruct or alter a navigable waterway. No permit is required for on-site activities. However, substantive requirements might limit in-water construction activities.	The cofferdam barrier wall to be installed at the Northern Impoundment is considered "fill material"; therefore, Section 10 of the Rivers and Harbors Act of 1899 would apply to the BMP installation and removal activities and the work will be performed in a manner that complies with substantive requirements of Section 10.

Table 4-1

Applicable or Relevant and Appropriate Requirements (ARAR)
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Item No.	Media/Topic	Status, Regulations, Standards, or Requirements	Citations or References	Description	Comment
21.	Dredging/Floodplain	Coastal Zone Management Act.	16 USC §§1451, et seq.; 15 CFR 930	Federal activities must be consistent with, to the maximum extent practicable, state coastal zone management programs. Federal agencies must supply the state with a consistency determination.	The San Jacinto River lies within the Coastal Zone Boundary (GLO TCMP). During the Remedial Investigation/Feasibility Study (RI/FS), an evaluation was made as to whether remedial alternatives may affect (adversely or not) the coastal zone and provides a technical basis for the lead agency (EPA) to determine whether the activity will be consistent with the state's TCMP. These requirements have been incorporated into the design as applicable.
22.	Dredging/Floodplain	FEMA (Federal Emergency Management Agency), Department of Homeland Security (Operating Regulations).	42 U.S.C. 4001, et seq.; 44 CFR Chapter 1	Prohibits alterations to river or floodplains that may increase potential for flooding.	The FEMA flood insurance rate map ID 48201C074M, effective on 1/6/2017, indicates that the Northern Impoundment is located within a designated coastal zone (Zone VE), which is within the Riverine Floodway. As stated in Item No. 10 above, hydrodynamic modeling was conducted as part of the RD to determine if the cofferdam structure, as described in the Northern Impoundment 90% RD Package, would have any adverse effect on the floodplain. The results of that evaluation suggest that the impacts would be negligible.
23.	Dredging/Floodplain	National Flood Insurance Program (NFIP) Regulations.	42 U.S.C. Subchapter III, §§4101, et seq.	Provides federal flood insurance to local authorities and requires that the local authorities not allow fill in the river that would cause an increase in water levels associated with floods.	As stated in Item No. 10 above, hydrodynamic modeling was conducted to determine if the cofferdam structure would have any adverse effect on the floodplain. The results of that evaluation suggest that the impacts would be negligible.
24.	Dredging/Floodplain	Floodplain Management and Wetlands Protection.	Executive Orders (EO) 11988 and 11990	Requires federal agencies to conduct their activities to avoid, if possible, adverse impacts associated with the destruction or modification of wetlands and occupation or modification of floodplains. Executive Orders 11988 and 11990 require federal projects to avoid adverse effects and minimize potential harm to wetlands and within flood plains. The EO 11990 requires federal agencies to avoid to the extent possible the long and short-term adverse impacts associated with the destruction or modification of wetlands and to avoid direct or indirect support of new construction in wetlands wherever there is a practicable alternative.	The Northern Impoundment is within a floodplain and the temporary structure (cofferdam barrier wall) will be constructed in the river. As stated in Item No. 10 above, hydrodynamic modeling was conducted to determine if the cofferdam structure would have any adverse effect on the floodplain. The results of that evaluation suggest that the impacts would be negligible. The Respondents will be preparing and submitting to the USACE a “Waters and Wetlands Delineation Report” to address requirements under EO 11990.
25.	Dredging/Floodplain	Texas Coastal Coordination Council Policies for Development in Critical Areas.	31 TAC §501.23	Dredging in critical areas is prohibited if activities have adverse effects or degradation on shellfish and/or jeopardize the continued existence of endangered species or results in an adverse effect on a coastal natural resource area (CNRA) 5; prohibits the location of facilities in coastal natural resource areas unless adverse effects are prevented and/or no practicable alternative. Specifies compensatory mitigation.	Any removal (excavation) activities will occur within the cofferdam wall and footprint of the Northern Impoundment and do not currently involve dredging, and therefore will not impact critical areas. An updated Threatened and Endangered (T&E) Species Habitat Suitability Evaluation will be included in a submittal to the USACE following submittal of the Northern Impoundment 90% RD.
26.	Dredging/Floodplain	Texas Coastal Management Plan (TCMP) Consistency.	31 TAC, §506.12	Specifies federal actions within the TCMP boundary that may adversely affect CNRAs, specifically, selection of remedial actions.	The San Jacinto River lies within the Coastal Zone Boundary (GLO TCMP). During the RI/FS, an evaluation was made as to whether remedial alternatives may affect (adversely or not) the coastal zone and provides a technical basis for the lead agency (EPA) to determine whether the activity will be consistent with the state's TCMP. These requirements will be incorporated into the design as applicable.
27.	Dredging/Floodplain	Texas State Code - obstructions to navigation.	Natural Resources Code §51.302 Prohibition and Penalty	Prohibits construction or maintenance of any structure or facility on land owned by the state without an easement, lease, permit, or other instrument from the state.	Because this is a CERCLA action, a formal instrument should not be required; however, the work will be coordinated with the State.

Table 4-1

Applicable or Relevant and Appropriate Requirements (ARAR)
Pre-Final 90% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Item No.	Media/Topic	Status, Regulations, Standards, or Requirements	Citations or References	Description	Comment
28.	Dredging/Floodplain	Floodplain Management of Harris County, Texas.	Texas Code Section 240.901 and TTC Sections 251.001-251.059 and Sections 254.001-254.019	Establishes construction requirements along the segment of the San Jacinto River at or near the Northern Impoundment.	The FEMA flood insurance rate map ID 48201C074M, effective on January 6, 2017, indicates that the Northern Impoundment is located within a designated coastal zone (Zone VE), which is within the Riverine Floodway. Much of the surrounding property that may be used for offices, laydown and staging areas are above an elevation with a 1 percent annual exceedance probability (AEP) for flooding Zone AE. Design of any temporary structure, including gas or liquid storage tanks, will comply with Harris County Texas floodplain management requirements. Additionally, at the request of HCFCD, as stated in Item No. 10 above, hydrodynamic modeling was conducted as part of the RD to determine if the cofferdam structure would have any adverse effect on the floodplain. The results of that evaluation suggest that the impacts would be negligible.
29.	Wildlife Protection	Endangered Species Act.	16 U.S.C. §§ 1531, et seq.	Federal agencies must ensure that actions they authorize, fund, or carry out are not likely to adversely modify or destroy critical habitat of endangered or threatened species. Actions authorized, funded, or carried out by federal agencies may not jeopardize the continued existence of endangered or threatened species as well as adversely modify or destroy their critical habitats.	During the RI/FS in 2010, a desktop review of photographs and U.S. Fish and Wildlife Service (USFWS) and National Marine Fisheries Service (NMFS) species and habitat maps was performed. Another evaluation was performed in 2021. Both evaluations concluded that there are no federally listed T&E or critical habitats present on the Northern Impoundment or in areas in the vicinity of the Northern Impoundment. An updated evaluation will be included in a submittal to the USACE following submittal of the Northern Impoundment 90% RD.
30.	Wildlife Protection	Fish and Wildlife Coordination Act.	16 U.S.C. §§661, et seq., 16 U.S.C. §742a, 16 U.S.C. § 2901	Requires adequate provision for protection of fish and wildlife resources. This title has been expanded to include requests for consultation with USFWS for water resources development projects (Mueller, 1980). Any modifications to rivers and channels require consultation with the USFWS, Department of Interior, and state wildlife resources agency. Project-related losses (including discharge of pollutants to water bodies) may require mitigation or compensation.	Depending on the site conditions after final restoration of the Northern Impoundment after remedial activities are completed, consultation with the USFWS, Department of Interior, and state wildlife resources agency may be required to address adequate protection of fish and wildlife resources.
31.	Wildlife Protection	Bald and Golden Eagle Protection Act.	16 U.S.C. §668a-d	Makes it unlawful to take, import, export, possess, buy, sell, purchase, or barter any bald or golden eagle, nest, or egg. "Take" is defined as pursuing, hunting, shooting, poisoning, wounding, killing, capturing, trapping and collecting, molesting, or disturbing.	No readily available information suggests bald or golden eagles frequent the Northern Impoundment; however, if bald or golden eagles are identified prior to or during construction, activities will be designed to conserve the species and their habitat.
32.	Wildlife Protection	Migratory Bird Treaty Act.	16 U.S.C. §§703-712; 50 CFR §10.12	Makes it unlawful to take, import, export, possess, buy, sell, purchase, or barter any migratory bird. "Take" is defined as pursuing, hunting, shooting, poisoning, wounding, killing, capturing, and trapping and collecting.	The Northern Impoundment remedy will be carried out in a manner to avoid adversely affecting migratory bird species, including individual birds or their nests.

Table 4-1

Applicable or Relevant and Appropriate Requirements (ARAR)
Pre-Final 90% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Item No.	Media/Topic	Status, Regulations, Standards, or Requirements	Citations or References	Description	Comment
33.	Wildlife Protection	State of Texas Threatened and Endangered (T&E) Species Regulations.	31 TAC 65.171 - 65.176	No person may take, possess, propagate, transport, export, sell or offer for sale, or ship any species of fish or wildlife listed as threatened or endangered.	During the RI/FS in 2010, a desktop review of photographs and USFWS and NMFS species and habitat maps was performed. Another evaluation was performed in 2021. Both evaluations concluded that there are no federally listed T&E or critical habitats present on the Northern Impoundment or in areas in the vicinity of the Northern Impoundment. An updated T&E Habitat Suitability Evaluation will be included in a submittal to the USACE following submittal of the Northern Impoundment 90% RD.
34.	Historic Preservation	National Historic Preservation Act.	16 U.S.C. §§ 470, et seq.; 36 CFR 800	Section 106 of this statute requires federal agencies to consider effects of their undertakings on historic properties. Historic properties may include any district, Site, building, structure, or object included in or eligible for the National Register of Historic Places (NRHP), including artifacts, records, and material remains related to such a property.	According to the San Jacinto River Waste Pits RI/FS cultural resources assessment, no NRHP-eligible properties are documented in the area of concern. This was further confirmed by a cultural resources assessment completed in December 2021. This assessment will be included in a submittal to the USACE following submittal of the 90% RD. This requirement is therefore not applicable.
35.	Historic Preservation	Natural Resources Code, Antiquities Code of Texas.	Texas Parks and Wildlife Commission Regulations 191.092-171	Requires that the Texas Historical Commission staff review any action that has the potential to disturb historic and archeological Sites on public land. Actions that need review include any construction program that takes place on land owned or controlled by a state agency or a state political subdivision, such as a city or a county. Without local control, this requirement does not apply.	According to the San Jacinto River Waste Pits RI/FS cultural resources assessment, no NRHP-eligible properties are documented in the area of concern. This was further confirmed by a cultural resources assessment completed in December 2021. This assessment will be included in a submittal to the USACE following submittal of the Northern Impoundment 90% RD. This requirement is therefore not applicable.
36.	Historic Preservation	Practice and Procedure, Administrative Code of Texas.	13 TAC Part 2, Chapter 26	Regulations implementing the Antiquities Code of Texas. Describes criteria for evaluating archaeological Sites and permit requirements for archaeological excavation.	This requirement is only applicable if an archaeological site is found; based on evaluations during the RI/FS, it is unlikely that archaeological resources would be found on the Northern Impoundment. This was further confirmed by a cultural resources assessment completed in December 2021. This requirement is therefore not expected to be applicable.
37.	Noise	Noise Control Act.	42 U.S.C. §§4901, et seq.; 40 CFR Subchapter G §201, et seq.	Noise Control Act remains in effect but unfunded.	Noise is regulated at the state level.
38.	Noise	Noise Regulations.	Texas Penal Code Chapter 42, Section 42.01	The Texas Penal Code regulates any noise that exceeds 85 decibels after the noise is identified as a public nuisance.	A noise is presumed to be unreasonable if the noise exceeds a decibel level of 85 at the point of potential human exposure after the person making the noise receives notice from a magistrate or peace officer that the noise is a public nuisance. Activities associated with the Northern Impoundment RA, as described in the Northern Impoundment 90% RD Package, are not likely to exceed the 85-decibel level beyond the immediate work area. The activities are not anticipated to constitute a public nuisance due to the isolation of the work, its location adjacent to a freeway with high volumes of traffic during normal working hours, and the industrial nature of activities on the Northern Impoundment. As indicated in the Site-Wide Monitoring Plan (Appendix J), noise impacts from pile driving will be assessed and monitored by the remedial contractor at the start of work.

Area-Based Average Concentration (Excluding the Northwest Corner)	23.31

Table 5-1

Area-Based Average Concentration Calculations
Pre-Final 90% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Starting Elevation (Mud-line)	1.29	0.62	-0.15	-0.80	1.43	-1.17	-0.61	-8.04	-13.36	-14.36	-18.39	-15.36	-15.64	-12.40	-4.29	-2.07	-9.54	-4.90	-6.55	-1.22	-7.40	-9.70	-7.40	-4.22	-2.20	-5.70	-2.70	-4.93
Assigned Polygon Area (Acres)	0.32	0.09	Paired with SJSB071[2]	0.21	0.18											0.16	0.13	0.07	0.14	0.21	0.06	0.01	0.07	0.13	0.18	0.07	Outside Excavation Area	0.29
Post-Excavation Surface Concentration	41.0	0.524	0.62		2.59											57.0	34.3	1.36	84.0	18.60	0.855	1.79	32.7	32.0	1.79	2.07	3.02	11.0
	SJSB073	SJSB058	SJSB101	SJSB071	SJSB037	SJSB070	SJSB099	SJGB013	SJSB100	SJSB098	SJSB057	SJSB103	SJSB097	SJSB056	SJSB056-C1	SJSB095	SJSB055-C1	SJSB055	SJSB096	SJGB014	SJSB053-C1	SJSB053	SJSB054	SJSB094	SJSB052-C1	SJSB052	SJSB051	SJSB092
ELEVATION (feet NAVD88)																												
+5																												
+4																												
+3																												
+2																												
+1	9.6	12			NA																							
0	9.6	12	63000		NA																							
-1	31000	36100	63000	34700	NA	43900	53000													31625								
-2	31000	36100	59000	34700	NA	43900	53000									35000				31625					9.22			
-3	26000	48400	59000	45900	40400	68600	54000									35000				210.4					9.22		3.02	
-4	26000	48400	25000	45900	40400	68600	54000								0.79	59				210.4				36000	1.2		3.02	
-5	68000	324	25000	26.8	0.87	45600	130								0.79	59		1.36		531.3				36000	1.2		4.98	43000
-6	68000	324	18	26.8	0.87	45600	130								1.14	1.0		1.36		531.3				39000	0.49	2.07	4.98	43000
-7	83000	1160	18	2.24		24300	13								1.14	1.0		1.07	87000	213.3	0.806		16600	39000	0.49	2.07	2.48	28000
-8	83000	1160	2.7	2.24		24300	13	5095.5							0.26	9.7		1.07	87000	213.3	0.806		16600	41000	1.47	1.94	2.48	28000
-9	41.0	376	2.7	1.03	618	16700	15	5095.5							0.26	9.7		0.81	22000	18.6	0.855		1550	41000	1.47	1.94	2.64	130
-10	41.0	376	230	1.03	2.59	16700	15	1743.2							0.60	1200	34.3	0.81	22000	18.6	0.855	1.79	1550	17000	2.32	1.99	2.64	130
-11	5.2	9890	230	1.48	11.5	1000	210	1743.2							0.60	1200	34.3	1.28	310	1.29	1.34	1.79	6.43	17000	2.32	1.99	3.03	4.8
-12	5.2	9890	0.62	1.48		1000	210	337.5						3.35	1.4	57	31.1	1.28	310	1.29	1.34	0.92	6.43	5500	1.39	1.99	3.03	4.8
-13	15	136	0.62	0.52		609	1.9	337.5	110					3.35	1.4	57	31.1	2.53	4.9		1.4	0.92	5.94	5500	1.39	1.99	1.71	27
-14	15	136	0.27	0.52		609	1.9	104.4	110	71				1.65	1.33	6.0	1.34	2.53	4.9		1.4	1.44	5.94	32	1.71	2.01	1.71	27
-15	5.6	788	0.27	44.6		6.9	26	104.4	3.7	71		2.2		1.65	1.33	6.0	1.34	0.89	8500		0.94	1.44	17.6	32	1.71	2.01	2.91	26
-16	5.6	788	11	44.6		6.9	26	25.2	3.7	1900		2.2	5.2	0.80	0.60	55	0.70	0.89	8500		0.94	1.44	17.6	2.0	1.79	2.8	2.91	26
-17		0.52	11	45.4		4.69	14	25.2	9.2	1900		1.1	5.2	0.80	0.60	55	0.70	1.09	84.0		1.76	1.44	5.28	2.0	1.79	2.8	2.35	10000
-18		0.52	3.2	45.4		4.69	14		9.2	1800	24200	1.1	1.2	0.78	0.62	0.60	1.07	1.09	84.0		1.76	1.28	5.28	3.2	2.08	2.24	2.35	10000
-19			3.2						0.81	1800	24200	14	1.2	0.78	0.62	0.60	1.07	1.42	5.2		1.15	1.28	369	3.2	2.08	2.24	2.48	11
-20									0.81	160	37600	14	1.8	3.76	0.96		1.16	1.42	5.2		1.15	1.79	369	1.9		0.69	2.48	11
-21									2.3	160	37600	4.8	1.8	3.76	0.96		1.16	0.92	1.9		2.2	1.79	32.7	1.9		0.69		7.2
-22									2.3	9600	3540	4.8	1.4	0.93			0.67	0.92	1.9		2.2	0.22	32.7			12.1		7.2
-23									0.58	9600	3540	3.9	1.4	0.93			0.67		13			0.22	6.52			12.1		
-24									0.58	3900	372	3.9	2.6	2.91			1.12		13			0.34	6.52					
-25									0.57	3900	372	0.49	2.6	2.91			1.12					0.34						
-26									0.57	680	7.6	0.49	0.77	4.44			5.49					0.35						
-27									0.51	680	7.6	0.46	0.77	4.44			5.49					0.35						
-28									0.51	11	2.93	0.46	1.4	0.46														
-29										11	2.93		1.4	0.46														
-30										0.16	15.9		0.29															
-31										0.16	15.9		0.29															
-32											1.59																	
-33											1.59																	
-34											1.5																	
-35											1.5																	
Calculated Excavation Elevation	-8.71	-17.38	-12.15	-12.80	-9.57											-12.07	-9.54	-4.90	-16.55	-9.22	-9.97	-9.70	-21.40	-14.22	-16.33	-5.70	-2.70	-18.93
Calculated Excavation Depth	10	18	12	12	11											10	0	0	10	8	3	0	14	10	14	0	0	14
Hydraulic Heave Elevation	-18.91	-20.90	-20.81	-20.73	-20.57	-20.69	-20.76	-16.29	-14.20	-14.52	-14.34	-13.33	-13.62	-14.00	-32.31	-31.69	-33.78	-13.58	-32.94	-25.98	-24.14	-24.78	-24.14	-23.25	-22.69	-22.39	-22.53	-23.45
Hydraulic Heave Depth	20.20	21.52	20.66	19.93	22.00	19.52	20.15	8.25	0.84	0.16	-4.05	-2.03	-2.02	1.60	28.02	29.62	24.24	8.68	26.39	24.76	16.74	15.08	16.74	19.03	20.49	16.69	19.83	18.52
						NW Corner	NW Corner	NW Corner	NW Corner	NW Corner	NW Corner	NW Corner	NW Corner	NW Corner	NW Corner													
(Area x Concentration)	12.96	0.05	0.13		0.46											8.88	4.60	0.09	11.55	3.92	0.05	0.01	2.43	4.31	0.33	0.14		3.18

Area-Based Average Concentration (Excluding the Northwest Corner)	23.31

Table 5-1

Area-Based Average Concentration Calculations
Pre-Final 90% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

	SJSB093	SJSB038	SJGB016	SJSB104	SJSB088[1]	SJSB090	SJGB015	SJSB050-C1	SJSB033	SJGB012	SJSB072[1]
Starting Elevation (Mud-line)	-1.53	-1.98	-2.07	-5.49	-2.12	-1.50	-5.94	-6.30	3.12	0.43	1.42
Assigned Polygon Area (Acres)	0.25	Paired with SJSB093[2]	paired with SJSB038[2]	0.04	0.26	0.19	Paired with SJSB050-C1[2]	0.13	0.23	Paired with SJSB072[2]	0.25
Post-Excavation Surface Concentration	17.0			15.0	5.30	5.30	2.27		157.0	1.30	
ELEVATION (feet NAVD88)											
+5											
+4											
+3									95.6		
+2									95.6		
+1									1050		NA
0									1050	4050.5	NA
-1									7120	4050.5	NA
-2	41000	NA	3517.8		39000	62000			7120	25065.3	NA
-3	41000	NA	3517.8		39000	62000			5740	25065.3	NA
-4	42000	NA	75.3		43000	6600			5740	24424.6	NA
-5	42000	NA	75.3	15	43000	6600			1700	24424.6	NA
-6	640	NA	0.46	15	50000	930	1.22	2.27	1700	17740	NA
-7	640	NA	0.46	2.8	50000	930	1.22	2.27	157	17740	12
-8	0.68	NA	2.33	2.8	71000	6.4	0.64	1.97	157		12
-9	0.68	NA	2.33	11	71000	6.4	0.64	1.97	24		340
-10	1900	96700	6.15	11	51000	260	1.48	2.22	24		340
-11	1900	364	6.15	2.6	51000	260	1.48	2.22	17.6		1.3
-12	1500	152		2.6	5.3	5.3	1.51	3.1	17.6		1.3
-13	1500	4.71		1.7	5.3	5.3	1.51	3.1	12.5		1.7
-14	430			1.7	0.68	9.1	0.85	1.31	12.5		1.7
-15	430			1.8	0.68	9.1	0.85	1.31			34
-16	17			1.8	1.3	4.1		1.54			34
-17	17			0.53	1.3	4.1		1.54			0.52
-18	4.4			0.53	1800	2.3		3.38			0.52
-19	4.4			0.25	1800	2.3		3.38			120
-20				0.25	2.5			2.88			120
-21				0.20	2.5			2.88			0.81
-22				0.20	2.2			1.33			0.81
-23					2.2			1.33			
-24					1.1						
-25					1.1						
-26											
-27											
-28											
-29											
-30											
-31											
-32											
-33											
-34											
-35											
Calculated Excavation Elevation	-15.53	-14.67	-13.91	-5.49	-12.12	-11.50	-6.30		-6.88	-11.57	-10.58
Calculated Excavation Depth	14	13	12	0	10	10	0		10	12	12
Hydraulic Heave Elevation	-18.58	-18.70	-18.70	-23.55	-18.51	-18.97	-23.00	-23.45	-20.43	-19.11	-18.93
Hydraulic Heave Depth	17.05	16.72	16.63	18.06	16.39	17.47	17.00	17.15	23.55	19.54	20.35
(Area x Concentration)	4.30			0.59	1.38	1.03	0.29		35.62	0.00	

	SJSB074	SJSB076	SJSB075	SJSB036	SJGB011	SJSB032	SJSB077	SJGB010	SJSB078[1]	SJSB080	SJSB079	SJSB081	SJSB082	SJSB046-C1
Starting Elevation (Mud-line)	3.34	2.26	2.28	2.25	0.41	1.71	1.42	0.88	1.82	1.77	1.05	-2.26	-1.75	-2.39
Assigned Polygon Area (Acres)	0.29	0.15	Paired with SJSB036[2]	0.17	0.15	0.22	0.29	Paired with SJSB077[2]	0.17	0.26	0.30	0.26	0.23	0.15
Post-Excavation Surface Concentration	87.0	11.0	0.88		3.37	6.19	0.21		16.0	12.0	3.10	2.80	7.70	4.80
ELEVATION (feet NAVD88)														
+5														
+4														
+3	7800													
+2	7800	3000	NA	NA		3410			33000	23000				
+1	70000	3000	NA	NA		3410	NA	4723.8	33000	23000	32000			
0	70000	49000	NA	NA	12724.8	7660	NA	4723.8	47000	14000	32000			
-1	30000	49000	NA	50500	12724.8	7660	NA	30873.4	47000	14000	52000			
-2	30000	63000	55000	NA	22222.8	3170	NA	30873.4	86000	9200	52000	2300	15000	1550
-3	87	63000	55000	NA	22222.8	3170	NA	6354	86000	9200	28000	2300	15000	1550
-4	87	210	NA	276	9427.6	6.19	NA	6354	140	3200	28000	47000	670	3350
-5	5.1	210	NA	276	9427.6	6.19	63000	194	140	3200	50000	47000	670	3350
-6	5.1	11	NA	NA	14768.5	85.8	63000	194	100	1500	50000	47000	2000	2820
-7	3.1	11	NA	NA	14768.5	85.8	77000		100	1500	50000	47000	2000	2820
-8	3.1	150	270	519	8707.4	26.5	77000		110	12	50000	5.3	7.7	11700
-9	0.37	150	270	19	8707.4	26.5	150		110	12	190	5.3	7.7	11700
-10	0.37	21	0.88	189	3.37	15.9	150		16	1.5	190	19000	120	14900
-11	2.6	21	0.88		3.37	15.9	24		16	1.5	3.1	19000	120	14900
-12	2.6	5.2	1.8			2.13	24		12	0.44	3.1	280	4.1	55.1
-13	0.84	5.2	1.8			2.13	350		12	0.44	16	280	4.1	55.1
-14	0.84	3.7	6.7			12.7	350		140	13	16	2.8	1.1	2230
-15		3.7	6.7			12.7	0.21		140	13	0.64	2.8	1.1	2230
-16							0.21		2.7		0.64	1.7	3.7	205
-17									2.7			1.7	3.7	205
-18									260			0.87	0.99	5690
-19									260			0.87	0.99	5690
-20									0.42					
-21									0.42					
-22														
-23														
-24														
-25														
-26														
-27														
-28														
-29														
-30														
-31														
-32														
-33														
-34														
-35														
Calculated Excavation Elevation	-2.66	-5.74	-10.72	-10.75	-9.59	-4.29	-14.58		-10.18	-8.23	-10.95	-14.26	-7.75	-20.39
Calculated Excavation Depth	6	8	13	13	10	6	16		12	10	12	12	6	18
Hydraulic Heave Elevation	-20.66	-19.03	-20.53	-21.38	-19.11	-20.64	-20.43	-20.62	-20.48	-22.77	-22.68	-22.29	-22.35	-22.43
Hydraulic Heave Depth	24.00	21.29	22.81	23.63	19.52	22.35	21.85	21.50	22.30	24.54	23.73	20.03	20.60	20.04
(Area x Concentration)	24.94	1.61	0.15		0.50	1.36	0.06	2.74		3.09	0.94	0.73	1.78	

Area-Based Average Concentration (Excluding the Northwest Corner)	23.31

Table 5-1

Area-Based Average Concentration Calculations
Pre-Final 90% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Starting Elevation (Mud-line)	-2.93	-2.05	4.48	-2.10	-1.30	-2.00	-3.86	-3.01	-1.85	-2.72	-4.00	-2.10	-5.67	-2.40	-4.00	-5.10	-2.88	-3.40	-4.36	-3.10	-3.58	2.68	4.33	5.12	6.99	6.64
Assigned Polygon Area (Acres)	Paired with SJSB046-C1[2]	0.10	0.16	0.10	0.13	0.11	0.17	0.24	0.20	0.19	0.16	0.11	0.16	0.06	0.13	0.12	0.22	0.06	0.18	0.24	0.12	0.16	0.34	0.16	0.34	0.38
Post-Excavation Surface Concentration		24.0	3.4	10.3	46.8	4.82	45.0	3.0	0.177	1.20	327	1.35	27.0	1.70	6.35	112	53.0	7.41	60.0	2.60	2.40	2.45	0.453	0.653	0.897	0.516
	SJSB083	SJSB102	SJSB028	SJSB045	SJSB045-C1	SJSB046	SJSB084	SJSB087	SJGB017	SJSB086	SJSB047-C1[1]	SJSB047	SJSB085	SJSB048	SJSB048-C1	SJSB049	SJSB089	SJSB050	SJSB105	SJSB106	SJSB091	SJSB029	SJSB030	SJSB031	SJSB034	SJSB035
ELEVATION (feet NAVD88)																										
+5																								2.46	1.17	0.59
+4			59.2																				5.54	2.46	1.17	0.59
+3			59.2																			14.90	5.54	0.77	3.04	1.00
+2			2.4																			14.9	1.9	0.77	3.04	1.00
+1			2.4																			2.95	1.9	0.67	0.99	0.90
0			35.9																			2.95	0.74	0.67	0.99	0.90
-1			35.9		**286**																	2.12	0.74	0.72	0.98	0.64
-2		**1400**	12.3	10.3	**286**	**636**			1.95			1.19		1.7								2.12	2.81	0.72	0.98	0.64
-3	**46000**	**1400**	12.3	10.3	**190**	**636**		**4600**	1.95	5.0		1.19		1.7			**820**	7.41		**39**		1.48	2.81	0.73	0.81	0.80
-4	**46000**	5.9	21.2	5.26	**190**	**2660**	**12000**	**4600**	1.46	5.0	**7470**	1.35		1.02	**623**		**820**	7.41	**36000**	**39**	16	1.48	0.44	0.73	0.81	0.80
-5	**2200**	5.9	21.2	5.26	**286**	**2660**	**12000**	**25000**	1.46	2.3	**7470**	1.35		1.02	**623**	**23600**	**53**	3.13	**36000**	3.6	16	1.35	0.44	0.97	0.59	1.26
-6	**2200**	**340**	3.35	5.58	**286**	**8610**	**3200**	**25000**	0.91	2.3	**6310**	1.53	**42000**	1.72	**55.1**	**23600**	**53**	3.13	**48000**	3.6	6.7	1.35	0.82	0.97	0.59	1.26
-7	9.8	**340**	3.35	5.58	**46.8**	**8610**	**3200**	**2300**	0.91	1.3	**6310**	1.53	**42000**	1.72	**55.1**	**6640**	18	1.33	**48000**	9.4	6.7	2.45	0.82	0.33	1.5	0.96
-8	9.8	24	2.59	4.88	**46.8**	**28500**	**45**	**2300**	0.85	1.3	**139**	2.73	**720**	2.46	**592**	**6640**	18	1.33	**240**	9.4	5.2	2.45	0.45	0.33	1.5	0.96
-9	14	24	2.59	4.88	**54.6**	**28500**	**45**	10	0.85	1.2	**139**	2.73	**720**	2.46	**592**	**2350**	3.5	1.48	**240**	2.9	5.2	1.36	0.45	0.65	0.90	0.52
-10	14	5.6	2.39	3.25	**54.6**	**6930**	23	10	0.18	1.2	29.4	2.03	27	2.52	4.95	**2350**	3.5	1.48	29	2.9	2.7	1.36	0.59	0.65	0.90	0.52
-11	**15000**	5.6	2.39	3.25	**50.4**	**6930**	23	**570**	0.18	2.2	29.4	2.03	27	2.52	4.95	**110**	**52**	3.38	29	3.4	2.7	0.77	0.59	0.36		
-12	**15000**	2.5	1.19	0.72	**50.4**	**111**	6.1	**570**		2.2	**769**	1.41	**44**	1.77	**323**	**110**	**52**	3.38	13	3.4	2.1	0.77	0.98	0.36		
-13	**200**	2.5	1.19	0.72	3.79	**111**	6.1	3.5		2.3	**769**	1.41	**44**	1.77	**323**	**251**	**34**	2.71	13	2.6	2.1	9.13	0.98			
-14	**200**	**34**		1.52	3.79	**3420**	7.8	3.5		2.3	**685**	1.69	25	2.03	6.35	**251**	**34**	2.71	17	2.6	2.4	9.13				
-15	24	**34**		1.52	22.4	**3420**	7.8	**110**		3.2	**685**	1.69	25	2.03	6.35	**112**	2.00	1.81	17	2.6	2.4					
-16	24	1.4		2.36	22.4	**1710**	6.1	**110**		3.2	**821**	1.98	4.3	1.66	**147**	**112**	2.00	1.81	**1400**	2.6	2.4					
-17	9.0	1.4		2.36	5.81	**1710**	6.1	**1500**		2.9	**821**	1.98	4.3	1.66	**147**	**117**	2.30	1.77	**1400**	1.6	2.4					
-18	9.0	**110**		4.96	5.81	**3400**	3.7	**1500**		2.9	**327**	1.67	7.0	2.56	**143**	**117**	2.30	1.77	**60**	1.6	2.2					
-19	0.72	**110**		4.96		**3400**	3.7	3.0		1.6	**327**	1.67	7.0	2.56	**143**	28.1	0.40	0.351	**60**	3.4	2.2					
-20	0.72	8.9				4.82	3.9	3.0		1.6	7.35		11		**219**	28.1	0.40	0.351	7.7	3.4	2.7					
-21	4.8	8.9				4.82	3.9				7.35		11		**219**	5.87			7.7		2.7					
-22	4.8	3.9											7.8		11.8	5.87										
-23		3.9											7.8		11.8											
-24		4.0													1.07											
-25		4.0													1.07											
-26																										
-27																										
-28																										
-29																										
-30																										
-31																										
-32																										
-33																										
-34																										
-35																										
Calculated Excavation Elevation	-20.93	-8.05	-7.30	-2.10	-7.30	-20.00	-7.86	-19.01	-11.21	-9.16	-18.00	-4.29	-9.67	-2.40	-14.00	-15.10	-4.88	-3.40	-18.36	-13.74	-16.51	-8.02	-8.26	-8.88	-9.27	-11.65
Calculated Excavation Depth	18	6	12	0	6	18	4	16	9	6	14	2	4	0	10	10	2	0	14	11	13	11	13	14	16	18
Hydraulic Heave Elevation	-22.58	-22.34	-21.48	-22.35	-22.13	-22.32	-22.50	-22.20	-21.90	-22.52	-19.29	-19.59	-25.27	-25.02	-25.17	-25.04	-19.35	-23.35	-25.12	-25.21	-21.42	-21.03	-22.27	-22.07	-18.51	-18.51
Hydraulic Heave Depth	19.65	20.29	25.96	20.25	20.83	20.32	18.64	19.19	20.05	19.80	15.29	17.49	19.60	22.62	21.17	19.94	16.47	19.95	20.76	22.11	17.84	23.71	26.60	27.19	25.50	25.15
(Area x Concentration)	0.00	2.35	0.53	1.04	5.99	0.53	7.61	0.73	0.04	0.22	50.92	0.15	4.37	0.10	0.81	13.50	11.90	0.45	10.57	0.63	0.28	0.39	0.15	0.11	0.31	0.20

Area-Based Average
23.31

Notes:

1) Bold font indicates dioxins results >30 ng/kg TEQ.
2) Yellow shading indicates material >30 ng/kg TEQ being removed.
3) Green shading indicates material <30 ng/kg TEQ being removed.
4) Red line indicates the elevation in each boring at which there is risk of hydraulic heave (Factor of Safety <1.25).
5) Green line indicates the target excavation elevation for each boring.
6) Grey shading indicates soil borings in the northwest corner that are excluded from the calculations shown herein.
7) The excavation elevations were calculated such that the resulting post-excavation surface average concentration is <30 ng/kg TEQ. These concentrations will be verified through confirmation sampling. The target elevations were determined utilizing three guiding principles: 1) No material removed below the elevation at risk of hydraulic heave; 2) Remove all material above 300 ng/kg (representative of the principle threat waste [PTW] concentration identified in the ROD); and 3) The resulting area-weighted average will be <30 ng/kg TEQ. Target excavation elevations were adjusted to account for the grading between surrounding boring locations.

[1] Excavation to the deepest elevation of dioxins concentrations >30 ng/kg TEQ would be at risk of hydraulic heave (or within a foot).

[2] The data from collocated borings was consolidated, taking the higher of the two values into consideration.

Table 5-2

Rationale for Excavation Elevations
Pre-Final 90% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Soil Boring Location	Excavation Elevation Rationale
SJGB010	Excavation elevation based upon removal of all material above 30 ng/kg TEQ
SJGB011	
SJGB012	
SJGB014	
SJGB015	
SJGB016	
SJGB017	
SJSB028	
SJSB029	
SJSB030	
SJSB031	
SJSB034	
SJSB035	
SJSB036	
SJSB037	
SJSB038	
SJSB045	
SJSB046	
SJSB046-C1	
SJSB047	
SJSB048	
SJSB050	
SJSB050-C1	
SJSB051	
SJSB052	
SJSB052-C1	
SJSB053	
SJSB053-C1	
SJSB055	
SJSB058	
SJSB075	
SJSB077	
SJSB079	
SJSB080	
SJSB081	
SJSB083	
SJSB086	
SJSB087	
SJSB090	
SJSB091	
SJSB092	
SJSB093	
SJSB101	
SJSB104	
SJSB106	

Table 5-2

Rationale for Excavation Elevations
Pre-Final 90% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Soil Boring Location	Excavation Elevation Rationale
SJSB047-C1	Further excavation would put the area at risk of Hydraulic Heave
SJSB072	
SJSB078*	
4	
SJSB032	Excavation elevation based upon removal of all material > 300 ng/kg TEQ; resulting area-weighted average <30 ng/kg (23.31 ng/kg)
SJSB033	
SJSB045-C1	
SJSB048-C1	
SJSB049	
SJSB054	
SJSB055-C1	
SJSB071	
SJSB073	
SJSB074	
SJSB076	
SJSB082	
SJSB084	
SJSB085	
SJSB089	
SJSB094	
SJSB095	
SJSB096	
SJSB102	
SJSB105	
SJGB013	Northwest Corner (excluded from dataset)
SJSB056	
SJSB056-C1	
SJSB057	
SJSB070	
SJSB097	
SJSB098	
SJSB099	
SJSB100	
SJSB103	

Notes:
1) Target excavation elevations identified in Table 5-1 will be verified using post-excavation confirmation sampling.
* All material >300 ng/kg also removed at these borings.

Table 5-3

Water Treatment Basis of Sizing
Pre-Final 90% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Equipment/Process Description	Sizing/Selection Criteria Assumptions	Design Value	Notes
Remediation Cell Dewatering Pump	Dewater BMP area after largest expected rain event within 4 days *after* rain event stops.	Dewatering flowrate of up to 1000 gpm.	Dewatering times for rainfall events as follows (from start of rainfall): 24-Hour Rainfall (in) Dewatering Time (days) 3 1.1 4 1.5 5 3.3 6 4.6
Influent Tanks	Working volume to hold 3.4-inch, 24-hour rain event in BMP area, containment area, truck wash, excavated materials storage, and dewatering area.	1.72 million-gallons (~860,000 gallons working volume/tank).	Lake Tank B-24 portable storage tank was used for design. Assumes 8 inches of freeboard and minimum water level of 24 inches to keep liner in place.
Containment Area Sump Pump(s)	Contractor shall select pump to dewater Containment Area after a rain event to allow work to resume. Preliminary flowrate provided on project drawings.	TBD by contractor. Preliminary flowrate provided on project drawings.	Largest 24-hour rain event for the construction period (November to April) for the years 1930-2019 was ~6.2."
WTS Dewatering Sump	Contractor shall select pump to ensure the contact water draining from the Dewatering Boxes and any rain water is delivered to the Influent Tank without backing up in the sump. Preliminary flowrate provided on project drawings.	TBD by contractor. Preliminary flowrate provided on project drawings.	
Treatment Feed Pump	300 gpm base treatment flow.	300 gpm to accommodate return streams.	Pump will operate on VFD to adjust treatment rate, as required. Pump will shutdown on high level in Inclined Plate Clarifier.
Rapid Mix Tank	Minimum retention time: 7 minutes.	Minimum working volume of 2,100 gallon capacity.	Provide mixing at high enough velocity to fully mix coagulant, organosulfides, acid and/or caustic, and polymer. Overflow of tank shall be set above the operating level of the Inclined Plate Clarifier to allow for gravity flow.
Flocculation Tank	Minimum retention time: 7 minutes.	Minimum working volume of 2,100 gallon capacity.	Tank will include baffles to prevent vertexing. Tank will be mixed by top entry mixer(s) with paddle-type blades to prevent shearing solids. Mixer shall be variable speed. Overflow of tank shall be set above the operating level of the Inclined Plate Clarifier to allow for gravity flow.
Inclined Plate Clarifier	Maximum Hydraulic Loading rate: 0.25 gpm/ft2.	3,200 ft^2 of inclined plate separation area.	Clarifier shall include integral sludge hopper to allow for sludge withdrawal. Overflow shall be set above the operating level of the Filter Feed Tank to allow for gravity flow.
Filter Feed Tank	Nominal retention time: 20 minutes.	Minimum working volume of 6,000 gallon capacity.	Overflow of tank shall be set above the operating level of the Inclined Plate Clarifier.
Filter Feed Pump	300 gpm base treatment flow.	Up to 400 gpm.	Pump will operate on VFD and controlled by level in Filter Feed Tank.
Multimedia Filters	5-15 gpm/ft2 Hydraulic Loading.	Minimum of 60 ft^2 of active media filter area.	Minimum of three vessels, forward-feed automated backwash.
10-um Bag Filtration System (2 in parallel)	10 micron with 95% minimum removal efficiency.	25 gpm/cartridge elements with total system capacity of 400 gpm.	Rosedale Filter Cartridge Model PL-POMF-R1-10-P2.
1-um Bag Filtration System (2 in parallel)	1 micron with 95% minimum removal efficiency.	25 gpm/cartridge elements with total system capacity of 400 gpm.	Rosedale Filter Cartridge Model PL-POMF-R1-1-P2.
Granular Activated Carbon	10 minute Empty Bed Contact Time (min) per stage. 5 gpm/ft2 Hydraulic Loading.	400 ft^3 Bed Volume; 60 ft^2 of active bed area.	GAC vessels will be configured in a lead-lag configuration providing a total contact time up to 20 minutes (total).
Sludge Wasting/Recycle Pump	75 gpm (~25% of Influent Feed Pump).	50 gpm to 150 gpm.	Sludge Wasting/Recycle pump will be positive displacement pump (e.g., air diaphragm). Flowrate will depend on solids accumulation rate and will be adjusted during start-up and operations.
Sludge Dewater Boxes	Allow for dewatering of sludge from Inclined Plate Clarifier. Filter fabric over a false bottom to trap solids and allow contact water to drain into sump.	25-CY filter box.	25-CY Filter Boxes are available.
Coagulant Feed Pumps	Flow paced at dosage of 50 ppm coagulant solution - treatability study used 100 ppm.	Up to 2 GPH.	Chemical metering pumps. (e.g., diaphragm, peristaltic).
Organosulfide Feed Pumps (if needed)	Flow paced at dose of 50 ppm organosulfide solution.	Up to 2 GPH.	Chemical metering pumps. (e.g., diaphragm, peristaltic).
Acid/Caustic Feed Pumps (if needed)	Flow paced based on measured pH of contact water in Rapid Mixing Tank.	Up to 2 GPH.	Chemical metering pumps. (e.g., diaphragm, peristaltic).
Polymer Feed Pumps	Flow paced at dose of 25 ppm (neat polymer).	Up to 15 GPH (dilute polymer solution).	Chemical metering pumps. (e.g., diaphragm, peristaltic), polymer activation/aging equipment will be provided, as needed.

Notes:
The 90% process flow diagram (drawing P-01) and piping and instrumentation diagrams (drawings P-02 through P-05) illustrate the major water treatment system equipment and components.
gpm - Gallons per minute
VFD - Variable frequency drive
ft^2 - Square feet
ft^3 - Cubic feet
ppm - Parts per million
GPH - Gallons per hour
CY - Cubic yard

Table 6-1

Sand Separation Area Analytical Results - Northern Impoundment
Pre-Final 90% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Area Sample Location: Sample Identification: Sample Date: Sample Depth:	Units	Sand Separation Area SJSSA01 11187072-120719-SS-SJSSA01 (0-1) 12/7/2019 (0-1) ft bgs	Sand Separation Area SJSSA01 11187072-120719-SS-SJSSA01 (0-2.5 CM) 12/7/2019 (0-2.5) cm	Sand Separation Area SJSSA01 11187072-120719-SS-SJSSA01 (1-2) 12/7/2019 (1-2) ft bgs	Sand Separation Area SJSSA01 11187072-120719-SS-SJSSA01 (2-4) 12/7/2019 (2-4) ft bgs	Sand Separation Area SJSSA01 11187072-120719-SS-SJSSA01 (4-6) 12/7/2019 (4-6) ft bgs	Sand Separation Area SJSSA01 11187072-120719-SS-SJSSA01 (7.5-10 CM) 12/7/2019 (7.5-10) cm	Sand Separation Area SJSSA01 11187072-120719-SS-SJSSA01 (15-17.5 CM) 12/7/2019 (15-17.5) cm
Dioxins/Furans								
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	pg/g	48	--	23	4.5 U	35	--	--
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	pg/g	2400	--	1100	330	1100	--	--
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	pg/g	6.6 J	--	2.5 J	0.86 J	3.9 J	--	--
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	62	--	41	16	45	--	--
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	pg/g	1.0 J	--	0.19 U	0.14 U	0.65 J	--	--
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	1.8 J	--	0.79 J	0.25 J	1.7 J	--	--
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	1.0 J	--	0.65 J	0.54 J	0.81 J	--	--
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.91 J	--	0.39 J	0.096 U	0.74 J	--	--
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	1.5 J	--	0.96 U	0.62 U	1.3 J	--	--
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	pg/g	0.15 U	--	0.41 J	0.20 J	0.12 U	--	--
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	3.2 J	--	2.4 J	1.5 J	2.5 J	--	--
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	1.1 J	--	0.74 J	0.44 J	1.2 J	--	--
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	0.48 J	--	0.32 U	0.29 U	0.29 U	--	--
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.55 J	--	0.20 J	0.095 U	0.14 U	--	--
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	0.75 J	--	0.14 U	0.12 U	0.17 U	--	--
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	pg/g	27	--	21	15	38	--	--
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	8.6	--	7.0	3.4	12	--	--
Total heptachlorodibenzofuran (HpCDF)	pg/g	17 J	--	7.4 J	2.7 J	11 J	--	--
Total heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	210 J	--	170 J	63 J	160 J	--	--
Total hexachlorodibenzofuran (HxCDF)	pg/g	7.4 J	--	3.5 J	0.45 J	5.5 J	--	--
Total hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	49 J	--	41 J	27 J	46 J	--	--
Total pentachlorodibenzofuran (PeCDF)	pg/g	4.0 J	--	1.5 J	0.44 J	3.3 J	--	--
Total pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	9.6 J	--	5.3 J	6.6 J	10 J	--	--
Total tetrachlorodibenzofuran (TCDF)	pg/g	38 J	--	31 J	15 J	53 J	--	--
Total tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	14 J	--	11 J	11 J	17 J	--	--
Total WHO Dioxin TEQ(Human/Mammal)(ND=0)	pg/g	14.4	--	10.4	5.43	17.4	--	--
Total WHO Dioxin TEQ(Human/Mammal)(ND=0.5)	pg/g	14.4	--	10.6	5.63	17.6	--	--
Radiochemistry								
Cesium-137	pCi/g	--	0.1323 U+/-0.08434	--	--	--	0.1896 U+/-0.1132	0.1845 U+/-0.09896
Lead-210	pCi/g	--	0.713 +/-0.0564	--	--	--	0.694 +/-0.0588	0.5 +/-0.0513
General Chemistry								
Percent solids	%	45.2	--	57.4	53.6	57.2	--	--

Notes:
pg/g - picogram per gram
pCi/g - picocuries per gram
DUP - indicates the result from a duplicate sample
U - Not detected at the associated reporting limit.
J - Estimated concentration.
-- - Not analyzed

Table 6-1

Sand Separation Area Analytical Results - Northern Impoundment
Pre-Final 90% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Area Sample Location: Sample Identification: Sample Date: Sample Depth:	Units	Sand Separation Area SJSSA01 11187072-120719-SS-SJSSA01 (22.5-25 CM) 12/7/2019 (22.5-25) cm	Sand Separation Area SJSSA01 11187072-120719-SS-SJSSA01 (30-32.5 CM) 12/7/2019 (30-32.5) cm	Sand Separation Area SJSSA01 11187072-120719-SS-SJSSA01 (37.5-40 CM) 12/7/2019 (37.5-40) cm	Sand Separation Area SJSSA01 11187072-120719-SS-SJSSA01 (45-47.5 CM) 12/7/2019 (45-47.5) cm	Sand Separation Area SJSSA01 11187072-120719-SS-SJSSA01 (52.5-55 CM) 12/7/2019 (52.5-55) cm	Sand Separation Area SJSSA01 11187072-120719-SS-SJSSA01 (60-62.5 CM) 12/7/2019 (60-62.5) cm	Sand Separation Area SJSSA01 11187072-120719-SS-SJSSA01 (70-72.5 CM) 12/7/2019 (70-72.5) cm
Dioxins/Furans								
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	pg/g	--	--	--	--	--	--	--
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	pg/g	--	--	--	--	--	--	--
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	pg/g	--	--	--	--	--	--	--
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	--	--	--	--	--	--	--
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	pg/g	--	--	--	--	--	--	--
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	--	--	--	--	--	--	--
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	--	--	--	--	--	--	--
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	--	--	--	--	--	--	--
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	--	--	--	--	--	--	--
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	pg/g	--	--	--	--	--	--	--
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	--	--	--	--	--	--	--
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	--	--	--	--	--	--	--
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	--	--	--	--	--	--	--
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	--	--	--	--	--	--	--
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	--	--	--	--	--	--	--
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	pg/g	--	--	--	--	--	--	--
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	--	--	--	--	--	--	--
Total heptachlorodibenzofuran (HpCDF)	pg/g	--	--	--	--	--	--	--
Total heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	--	--	--	--	--	--	--
Total hexachlorodibenzofuran (HxCDF)	pg/g	--	--	--	--	--	--	--
Total hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	--	--	--	--	--	--	--
Total pentachlorodibenzofuran (PeCDF)	pg/g	--	--	--	--	--	--	--
Total pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	--	--	--	--	--	--	--
Total tetrachlorodibenzofuran (TCDF)	pg/g	--	--	--	--	--	--	--
Total tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	--	--	--	--	--	--	--
Total WHO Dioxin TEQ(Human/Mammal)(ND=0)	pg/g	--	--	--	--	--	--	--
Total WHO Dioxin TEQ(Human/Mammal)(ND=0.5)	pg/g	--	--	--	--	--	--	--
Radiochemistry								
Cesium-137	pCi/g	0.1497 U+/-0.08256	0.1376 U+/-0.08681	0.1214 U+/-0.07948	0.09617 U+/-0.07003	0.09826 U+/-0.06292	0.1139 U+/-0.07255	0.1443 U+/-0.07964
Lead-210	pCi/g	0.635 +/-0.0545	0.682 +/-0.0577	0.513 +/-0.059	0.538 +/-0.0583	0.599 +/-0.0532	0.465 +/-0.0503	0.456 +/-0.0478
General Chemistry								
Percent solids	%	--	--	--	--	--	--	--

Notes:
pg/g - picogram per gram
pCi/g - picocuries per gram
DUP - indicates the result from a duplicate sample
U - Not detected at the associated reporting limit.
J - Estimated concentration.
-- - Not analyzed

Table 6-1

Sand Separation Area Analytical Results - Northern Impoundment
Pre-Final 90% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Area		Sand Separation Area	Sand Separation Area	Sand Separation Area	Sand Separation Area	Sand Separation Area	Sand Separation Area	Sand Separation Area	Sand Separation Area
Sample Location:		SJSSA01	SJSSA02	SJSSA02	SJSSA02	SJSSA02	SJSSA02	SJSSA02	SJSSA02
Sample Identification:	Units	11187072-120719-SS-SJSSA01 (80-82.5 CM)	11187072-120719-SS-SJSSA02 (0-2.5 CM)	11187072-120719-SS-SJSSA02(0-1)	11187072-120719-SS-SJSSA02(1-2)	11187072-120719-SS-SJSSA02(2-4)	11187072-120719-SS-SJSSA02(4-6)	11187072-120719-SS-SJSSA02 (7.5-10 CM)	11187072-120719-SS-SJSSA02 (15-17.5 CM)
Sample Date:		12/7/2019	12/7/2019	12/7/2019	12/7/2019	12/7/2019	12/7/2019	12/7/2019	12/7/2019
Sample Depth:		(80-82.5) cm	(0-2.5) cm	(0-1) ft bgs	(1-2) ft bgs	(2-4) ft bgs	(4-6) ft bgs	(7.5-10) cm	(15-17.5) cm
Dioxins/Furans									
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	pg/g	--	--	3.8 U	4.3 U	25	5.3 U	--	--
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	pg/g	--	--	400	510	1000	450	--	--
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	pg/g	--	--	0.67 U	2.6 J	4.2 J	0.90 U	--	--
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	--	--	14 J	21	44	22	--	--
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	pg/g	--	--	0.083 U	0.52 U	0.77 U	0.062 U	--	--
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	--	--	0.094 U	1.1 J	2.3 J	0.42 J	--	--
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	--	--	0.14 U	0.33 J	0.39 J	0.39 J	--	--
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	--	--	0.092 U	0.35 J	0.73 J	0.23 J	--	--
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	--	--	0.32 J	0.42 J	1.1 J	0.54 J	--	--
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	pg/g	--	--	0.13 U	0.12 U	0.20 U	0.11 U	--	--
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	--	--	0.80 J	1.4 J	2.3 J	1.0 J	--	--
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	--	--	0.095 U	0.063 U	1.3 J	0.10 U	--	--
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	--	--	0.062 U	0.17 J	0.42 J	0.080 U	--	--
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	--	--	0.097 U	0.084 U	0.25 J	0.081 U	--	--
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	--	--	0.092 U	0.061 U	1.2 J	0.26 J	--	--
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	pg/g	--	--	3.6 J	3.2	18	2.0	--	--
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	--	--	1.1 J	1.1 J	6.8	0.62 J	--	--
Total heptachlorodibenzofuran (HpCDF)	pg/g	--	--	1.5 J	4.8 J	11 J	2.3 J	--	--
Total heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	--	--	48 J	77 J	150 J	70 J	--	--
Total hexachlorodibenzofuran (HxCDF)	pg/g	--	--	0.85 J	3.1 J	8.7 J	2.2 J	--	--
Total hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	--	--	18 J	34 J	51 J	26 J	--	--
Total pentachlorodibenzofuran (PeCDF)	pg/g	--	--	0.095 U	1.1 J	6.1 J	0.88 J	--	--
Total pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	--	--	4.3 J	8.8 J	11 J	4.6 J	--	--
Total tetrachlorodibenzofuran (TCDF)	pg/g	--	--	7.7 J	6.8 J	49 J	5.0 J	--	--
Total tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	--	--	7.0 J	11 J	20 J	5.2 J	--	--
Total WHO Dioxin TEQ(Human/Mammal)(ND=0)	pg/g	--	--	1.83	2.34	10.9	1.51	--	--
Total WHO Dioxin TEQ(Human/Mammal)(ND=0.5)	pg/g	--	--	1.91	2.36	10.9	1.57	--	--
Radiochemistry									
Cesium-137	pCi/g	0.1333 U+/-0.08375	0.1145 U+/-0.07314	--	--	--	--	0.114 U+/-0.06986	0.08665 U+/-0.05227
Lead-210	pCi/g	0.399 U+/-0.0504	0.657 +/-0.0547	--	--	--	--	0.552 +/-0.0573	0.346 +/-0.0448
General Chemistry									
Percent solids	%	--	--	71.2	75.2	76.0	79.7	--	--

Notes:
- pg/g - picogram per gram
- pCi/g - picocuries per gram
- DUP - indicates the result from a duplicate sample
- U - Not detected at the associated reporting limit.
- J - Estimated concentration.
- -- - Not analyzed

Table 6-1

Sand Separation Area Analytical Results - Northern Impoundment
Pre-Final 90% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Area Sample Location: Sample Identification: Sample Date: Sample Depth:	Units	Sand Separation Area SJSSA02 11187072-120719-SS-SJSSA02 (22.5-25 CM) 12/7/2019 (22.5-25) cm	Sand Separation Area SJSSA02 11187072-120719-SS-SJSSA02 (30-32.5 CM) 12/7/2019 (30-32.5) cm	Sand Separation Area SJSSA02 11187072-120719-SS-SJSSA02 (37.5-40 CM) 12/7/2019 (37.5-40) cm	Sand Separation Area SJSSA02 11187072-120719-SS-SJSSA02 (45-47.5 CM) 12/7/2019 (45-47.5) cm	Sand Separation Area SJSSA02 11187072-120719-SS-SJSSA02 (52.5-55 CM) 12/7/2019 (52.5-55) cm	Sand Separation Area SJSSA02 11187072-120719-SS-SJSSA02 (60-62.5 CM) 12/7/2019 (60-62.5) cm	Sand Separation Area SJSSA02 11187072-120719-SS-SJSSA02 (70-72.5 CM) 12/7/2019 (70-72.5) cm
Dioxins/Furans								
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	pg/g	--	--	--	--	--	--	--
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	pg/g	--	--	--	--	--	--	--
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	pg/g	--	--	--	--	--	--	--
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	--	--	--	--	--	--	--
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	pg/g	--	--	--	--	--	--	--
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	--	--	--	--	--	--	--
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	--	--	--	--	--	--	--
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	--	--	--	--	--	--	--
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	--	--	--	--	--	--	--
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	pg/g	--	--	--	--	--	--	--
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	--	--	--	--	--	--	--
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	--	--	--	--	--	--	--
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	--	--	--	--	--	--	--
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	--	--	--	--	--	--	--
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	--	--	--	--	--	--	--
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	pg/g	--	--	--	--	--	--	--
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	--	--	--	--	--	--	--
Total heptachlorodibenzofuran (HpCDF)	pg/g	--	--	--	--	--	--	--
Total heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	--	--	--	--	--	--	--
Total hexachlorodibenzofuran (HxCDF)	pg/g	--	--	--	--	--	--	--
Total hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	--	--	--	--	--	--	--
Total pentachlorodibenzofuran (PeCDF)	pg/g	--	--	--	--	--	--	--
Total pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	--	--	--	--	--	--	--
Total tetrachlorodibenzofuran (TCDF)	pg/g	--	--	--	--	--	--	--
Total tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	--	--	--	--	--	--	--
Total WHO Dioxin TEQ(Human/Mammal)(ND=0)	pg/g	--	--	--	--	--	--	--
Total WHO Dioxin TEQ(Human/Mammal)(ND=0.5)	pg/g	--	--	--	--	--	--	--
Radiochemistry								
Cesium-137	pCi/g	0.04357 U+/-0.02621	0.03245 U+/-0.02093	0.08767 U+/-0.0544	0.06205 U+/-0.04939	0.07463 U+/-0.046	0.0845 U+/-0.0547	0.06443 U+/-0.03829
Lead-210	pCi/g	0.28 +/-0.0495	0.226 +/-0.0474	0.245 +/-0.0566	0.342 +/-0.0461	0.326 +/-0.0472	0.331 +/-0.0483	0.38 +/-0.0497
General Chemistry								
Percent solids	%	--	--	--	--	--	--	--

Notes:
pg/g - picogram per gram
pCi/g - picocuries per gram
DUP - indicates the result from a duplicate sample
U - Not detected at the associated reporting limit.
J - Estimated concentration.
-- - Not analyzed

Table 6-1

Sand Separation Area Analytical Results - Northern Impoundment
Pre-Final 90% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Area Sample Location: Sample Identification: Sample Date: Sample Depth:	Units	Sand Separation Area SJSSA02 11187072-120719-SS-SJSSA02 (80-82.5 CM) 12/7/2019 (80-82.5) cm	Sand Separation Area SJSSA03 11187072-120619-SS-SJSSA03 (0-2.5 CM) 12/6/2019 (0-2.5) cm	Sand Separation Area SJSSA03 11187072-120619-SS-SJSSA03(0-1) 12/6/2019 (0-1) ft bgs	Sand Separation Area SJSSA03 11187072-120619-SS-SJSSA03(1-2) 12/6/2019 (1-2) ft bgs	Sand Separation Area SJSSA03 11187072-120619-SS-SJSSA03(2-4) 12/6/2019 (2-4) ft bgs	Sand Separation Area SJSSA03 11187072-120619-SS-SJSSA03(4-6) 12/6/2019 (4-6) ft bgs	Sand Separation Area SJSSA03 11187072-120619-SS-SJSSA03 (7.5-10 CM) 12/6/2019 (7.5-10) cm	Sand Separation Area SJSSA03 11187072-120619-SS-SJSSA03 (15-17.5 CM) 12/6/2019 (15-17.5) cm
Dioxins/Furans									
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	pg/g	--	--	10 U	5.5 U	1.6 U	120	--	--
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	pg/g	--	--	980	810	700	2300	--	--
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	pg/g	--	--	2.2 J	1.1 U	0.42 U	11	--	--
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	--	--	41	34	30	90	--	--
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	pg/g	--	--	0.35 U	0.23 U	0.082 U	1.5 J	--	--
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	--	--	4.1 J	0.66 J	0.084 U	2.6 J	--	--
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	--	--	0.56 J	0.48 J	0.40 J	0.95 J	--	--
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	--	--	1.2 J	0.095 U	0.081 U	1.5 J	--	--
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	--	--	0.79 J	0.87 J	0.56 J	2.7 J	--	--
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	pg/g	--	--	0.096 U	0.14 U	0.11 U	0.21 U	--	--
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	--	--	2.7 J	2.3 J	2.2 J	3.9 J	--	--
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	--	--	4.6 J	0.32 J	0.091 U	1.1 J	--	--
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	--	--	0.40 J	0.32 J	0.20 J	0.62 J	--	--
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	--	--	0.37 J	0.10 U	0.090 U	0.34 J	--	--
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	--	--	4.9 J	0.26 J	0.083 U	0.89 J	--	--
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	pg/g	--	--	34	12	0.92 J	24	--	--
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	--	--	8.4	3.8	0.20 J	8.5	--	--
Total heptachlorodibenzofuran (HpCDF)	pg/g	--	--	5.0 J	2.8 J	0.98 J	27 J	--	--
Total heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	--	--	160 J	130 J	110 J	270 J	--	--
Total hexachlorodibenzofuran (HxCDF)	pg/g	--	--	8.8 J	2.3 J	0.52 J	24 J	--	--
Total hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	--	--	53 J	53 J	32 J	61 J	--	--
Total pentachlorodibenzofuran (PeCDF)	pg/g	--	--	19 J	2.1 J	0.78 J	16 J	--	--
Total pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	--	--	12 J	11 J	6.1 J	9.3 J	--	--
Total tetrachlorodibenzofuran (TCDF)	pg/g	--	--	82 J	28 J	2.8 J	58 J	--	--
Total tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	--	--	20 J	17 J	4.9 J	15 J	--	--
Total WHO Dioxin TEQ(Human/Mammal)(ND=0)	pg/g	--	--	15.5	6.42	1.32	14.8	--	--
Total WHO Dioxin TEQ(Human/Mammal)(ND=0.5)	pg/g	--	--	15.5	6.45	1.35	14.8	--	--
Radiochemistry									
Cesium-137	pCi/g	0.03835 U+/-0.02381	0.09548 U+/-0.05456	--	--	--	--	0.1187 U+/-0.07539	0.09875 U+/-0.06434
Lead-210	pCi/g	0.266 +/-0.0437	0.487 +/-0.0502	--	--	--	--	0.516 +/-0.0512	0.278 +/-0.0511
General Chemistry									
Percent solids	%	--	--	62.3	71.8	76.6	67.8	--	--

Notes:
pg/g - picogram per gram
pCi/g - picocuries per gram
DUP - indicates the result from a duplicate sample
U - Not detected at the associated reporting limit.
J - Estimated concentration.
-- - Not analyzed

Table 6-1

Sand Separation Area Analytical Results - Northern Impoundment
Pre-Final 90% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Area Sample Location: Sample Identification: Sample Date: Sample Depth:	Units	Sand Separation Area SJSSA03 11187072-120619-SS-SJSSA03 (22.5-25 CM) 12/6/2019 (22.5-25) cm	Sand Separation Area SJSSA03 11187072-120619-SS-SJSSA03 (30-32.5 CM) 12/6/2019 (30-32.5) cm	Sand Separation Area SJSSA03 11187072-120619-SS-SJSSA03 (37.5-40 CM) 12/6/2019 (37.5-40) cm	Sand Separation Area SJSSA03 11187072-120619-SS-SJSSA03 (45-47.5 CM) 12/6/2019 (45-47.5) cm	Sand Separation Area SJSSA03 11187072-120619-SS-SJSSA03 (52.5-55 CM) 12/6/2019 (52.5-55) cm	Sand Separation Area SJSSA03 11187072-120619-SS-SJSSA03 (60-62.5 CM) 12/6/2019 (60-62.5) cm	Sand Separation Area SJSSA03 11187072-120619-SS-SJSSA03 (70-72.5 CM) 12/6/2019 (70-72.5) cm
Dioxins/Furans								
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	pg/g	--	--	--	--	--	--	--
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	pg/g	--	--	--	--	--	--	--
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	pg/g	--	--	--	--	--	--	--
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	--	--	--	--	--	--	--
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	pg/g	--	--	--	--	--	--	--
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	--	--	--	--	--	--	--
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	--	--	--	--	--	--	--
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	--	--	--	--	--	--	--
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	--	--	--	--	--	--	--
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	pg/g	--	--	--	--	--	--	--
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	--	--	--	--	--	--	--
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	--	--	--	--	--	--	--
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	--	--	--	--	--	--	--
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	--	--	--	--	--	--	--
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	--	--	--	--	--	--	--
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	pg/g	--	--	--	--	--	--	--
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	--	--	--	--	--	--	--
Total heptachlorodibenzofuran (HpCDF)	pg/g	--	--	--	--	--	--	--
Total heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	--	--	--	--	--	--	--
Total hexachlorodibenzofuran (HxCDF)	pg/g	--	--	--	--	--	--	--
Total hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	--	--	--	--	--	--	--
Total pentachlorodibenzofuran (PeCDF)	pg/g	--	--	--	--	--	--	--
Total pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	--	--	--	--	--	--	--
Total tetrachlorodibenzofuran (TCDF)	pg/g	--	--	--	--	--	--	--
Total tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	--	--	--	--	--	--	--
Total WHO Dioxin TEQ(Human/Mammal)(ND=0)	pg/g	--	--	--	--	--	--	--
Total WHO Dioxin TEQ(Human/Mammal)(ND=0.5)	pg/g	--	--	--	--	--	--	--
Radiochemistry								
Cesium-137	pCi/g	0.07308 U+/-0.04441	0.06646 U+/-0.043	0.08151 U+/-0.04759	0.0821 U+/-0.05179	0.094 U+/-0.05404	0.06385 U+/-0.0392	0.05209 U+/-0.0324
Lead-210	pCi/g	0.302 +/-0.0498	0.447 +/-0.0471	0.261 +/-0.0447	0.452 +/-0.0469	0.286 +/-0.0498	0.0695 U+/-0.0435	0.402 +/-0.0489
General Chemistry								
Percent solids	%	--	--	--	--	--	--	--

Notes:
- pg/g - picogram per gram
- pCi/g - picocuries per gram
- DUP - indicates the result from a duplicate sample
- U - Not detected at the associated reporting limit.
- J - Estimated concentration.
- -- - Not analyzed

Table 6-1

Sand Separation Area Analytical Results - Northern Impoundment
Pre-Final 90% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Area Sample Location: Sample Identification: Sample Date: Sample Depth:	Units	Sand Separation Area SJSSA03 11187072-120619-SS-SJSSA03 (80-82.5 CM) 12/6/2019 (80-82.5) cm	Sand Separation Area SJSSA04 11187072-120919-BN-SJSSA04 (0-2.5 CM) 12/9/2019 (0-2.5) cm	Sand Separation Area SJSSA04 11187072-120919-BN-SJSSA04(0-1) 12/9/2019 (0-1) ft bgs	Sand Separation Area SJSSA04 11187072-120919-BN-SJSSA04(1-2) 12/9/2019 (1-2) ft bgs	Sand Separation Area SJSSA04 11187072-120919-BN-SJSSA04(2-4) 12/9/2019 (2-4) ft bgs	Sand Separation Area SJSSA04 11187072-120919-BN-SJSSA04(4-6) 12/9/2019 (4-6) ft bgs	Sand Separation Area SJSSA04 11187072-120919-BN-SJSSA04 (7.5-10 CM) 12/9/2019 (7.5-10) cm	Sand Separation Area SJSSA04 11187072-120919-BN-SJSSA04 (15-17.5 CM) 12/9/2019 (15-17.5) cm
Dioxins/Furans									
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	pg/g	--	--	12 U	35 U	9.2 U	190	--	--
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	pg/g	--	--	720	2100	750	4700	--	--
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	pg/g	--	--	1.7 U	4.2 J	1.0 U	20	--	--
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	--	--	31	57	31	180	--	--
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	pg/g	--	--	0.32 U	0.56 U	0.36 U	2.2 U	--	--
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	--	--	1.2 J	1.8 J	0.78 J	5.6 J	--	--
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	--	--	0.63 J	0.98 J	0.63 J	1.9 J	--	--
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	--	--	0.41 J	1.2 J	0.33 J	2.6 J	--	--
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	--	--	0.88 J	1.5 J	0.99 J	4.4 J	--	--
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	pg/g	--	--	0.61 J	0.31 U	0.16 U	0.39 J	--	--
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	--	--	2.4 J	2.3 J	2.5 J	5.7 J	--	--
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	--	--	1.1 J	1.6 J	0.70 J	3.9 J	--	--
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	--	--	0.40 U	0.71 U	0.40 U	0.88 J	--	--
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	--	--	0.16 U	0.31 U	0.16 U	0.92 J	--	--
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	--	--	0.77 J	1.0 J	0.60 J	2.1 J	--	--
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	pg/g	--	--	43	50	29	110	--	--
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	--	--	11	13	7.7	31	--	--
Total heptachlorodibenzofuran (HpCDF)	pg/g	--	--	4.9 J	12 J	2.5 J	65 J	--	--
Total heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	--	--	130 J	220 J	120 J	610 J	--	--
Total hexachlorodibenzofuran (HxCDF)	pg/g	--	--	4.1 J	6.4 J	1.1 J	29 J	--	--
Total hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	--	--	41 J	40 J	39 J	96 J	--	--
Total pentachlorodibenzofuran (PeCDF)	pg/g	--	--	2.7 J	5.4 J	2.1 J	16 J	--	--
Total pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	--	--	8.9 J	5.3 J	7.7 J	13 J	--	--
Total tetrachlorodibenzofuran (TCDF)	pg/g	--	--	72 J	89 J	52 J	180 J	--	--
Total tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	--	--	21 J	19 J	16 J	39 J	--	--
Total WHO Dioxin TEQ(Human/Mammal)(ND=0)	pg/g	--	--	16.7	20.4	11.9	49.2	--	--
Total WHO Dioxin TEQ(Human/Mammal)(ND=0.5)	pg/g	--	--	16.9	20.8	12.1	49.3	--	--
Radiochemistry									
Cesium-137	pCi/g	0.06432 U+/-0.04086	0.1421 U+/-0.08159	--	--	--	--	0.0665 U+/-0.03796	0.04764 U+/-0.02799
Lead-210	pCi/g	0.476 +/-0.055	1.11 +/-0.0613	--	--	--	--	1 +/-0.0639	0.93 +/-0.0592
General Chemistry									
Percent solids	%	--	--	41.6	50.8	46.1	42.6	--	--

Notes:
- pg/g - picogram per gram
- pCi/g - picocuries per gram
- DUP - indicates the result from a duplicate sample
- U - Not detected at the associated reporting limit.
- J - Estimated concentration.
- -- - Not analyzed

Table 6-1

Sand Separation Area Analytical Results - Northern Impoundment
Pre-Final 90% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Area		Sand Separation Area	Sand Separation Area	Sand Separation Area	Sand Separation Area	Sand Separation Area	Sand Separation Area	Sand Separation Area
Sample Location:		SJSSA04	SJSSA04	SJSSA04	SJSSA04	SJSSA04	SJSSA04	SJSSA04
Sample Identification:	Units	11187072-120919-BN-SJSSA04 (22.5-25 CM)	11187072-120919-BN-SJSSA04 (30-32.5 CM)	11187072-120919-BN-SJSSA04 (37.5-40 CM)	11187072-120919-BN-SJSSA04 (45-47.5 CM)	11187072-120919-BN-SJSSA04 (52.5-55 CM)	11187072-120919-BN-SJSSA04 (60-62.5 CM)	11187072-120919-BN-SJSSA04 (70-72.5 CM)
Sample Date:		12/9/2019	12/9/2019	12/9/2019	12/9/2019	12/9/2019	12/9/2019	12/9/2019
Sample Depth:		(22.5-25) cm	(30-32.5) cm	(37.5-40) cm	(45-47.5) cm	(52.5-55) cm	(60-62.5) cm	(70-72.5) cm
Dioxins/Furans								
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	pg/g	--	--	--	--	--	--	--
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	pg/g	--	--	--	--	--	--	--
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	pg/g	--	--	--	--	--	--	--
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	--	--	--	--	--	--	--
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	pg/g	--	--	--	--	--	--	--
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	--	--	--	--	--	--	--
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	--	--	--	--	--	--	--
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	--	--	--	--	--	--	--
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	--	--	--	--	--	--	--
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	pg/g	--	--	--	--	--	--	--
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	--	--	--	--	--	--	--
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	--	--	--	--	--	--	--
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	--	--	--	--	--	--	--
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	--	--	--	--	--	--	--
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	--	--	--	--	--	--	--
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	pg/g	--	--	--	--	--	--	--
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	--	--	--	--	--	--	--
Total heptachlorodibenzofuran (HpCDF)	pg/g	--	--	--	--	--	--	--
Total heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	--	--	--	--	--	--	--
Total hexachlorodibenzofuran (HxCDF)	pg/g	--	--	--	--	--	--	--
Total hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	--	--	--	--	--	--	--
Total pentachlorodibenzofuran (PeCDF)	pg/g	--	--	--	--	--	--	--
Total pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	--	--	--	--	--	--	--
Total tetrachlorodibenzofuran (TCDF)	pg/g	--	--	--	--	--	--	--
Total tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	--	--	--	--	--	--	--
Total WHO Dioxin TEQ(Human/Mammal)(ND=0)	pg/g	--	--	--	--	--	--	--
Total WHO Dioxin TEQ(Human/Mammal)(ND=0.5)	pg/g	--	--	--	--	--	--	--
Radiochemistry								
Cesium-137	pCi/g	0.1216 U+/-0.0706	0.1144 U+/-0.0658	0.09033 U+/-0.06255	0.128 U+/-0.07696	0.1268 U+/-0.07849	0.1293 U+/-0.07496	0.1496 U+/-0.08865
Lead-210	pCi/g	0.889 +/-0.0681	1.05 +/-0.0586	0.638 +/-0.0505	0.607 +/-0.0531	0.832 +/-0.0595	0.881 +/-0.0591	0.84 +/-0.052
General Chemistry								
Percent solids	%	--	--	--	--	--	--	--

Notes:
pg/g - picogram per gram
pCi/g - picocuries per gram
DUP - indicates the result from a duplicate sample
U - Not detected at the associated reporting limit.
J - Estimated concentration.
-- - Not analyzed

Table 6-1

Sand Separation Area Analytical Results - Northern Impoundment
Pre-Final 90% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Area Sample Location: Sample Identification: Sample Date: Sample Depth:	Units	Sand Separation Area SJSSA04 11187072-120919-BN-SJSSA04 (80-82.5 CM) 12/9/2019 (80-82.5) cm	Sand Separation Area SJSSA05 11187072-120819-BN-SJSSA05 (0-1) 12/8/2019 (0-1) ft bgs	Sand Separation Area SJSSA05 11187072-120819-BN-SJSSA05 (0-2.5 CM) 12/8/2019 (0-2.5) cm	Sand Separation Area SJSSA05 11187072-120819-BN-SJSSA05 (1-2) 12/8/2019 (1-2) ft bgs	Sand Separation Area SJSSA05 11187072-120819-BN-SJSSA05 (2-4) 12/8/2019 (2-4) ft bgs	Sand Separation Area SJSSA05 11187072-120819-BN-DUP2 12/8/2019 (4-6) ft bgs	Sand Separation Area SJSSA05 11187072-120819-BN-SJSSA05 (4-6) 12/8/2019 (4-6) ft bgs	Sand Separation Area SJSSA05 11187072-120819-BN-SJSSA05 (7.5-10 CM) 12/8/2019 (7.5-10) cm
Dioxins/Furans									
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	pg/g	--	10 J	--	3.4 U	4.3 U	4.4 U	2.4 U	--
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	pg/g	--	550	--	190	140	380	160	--
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	pg/g	--	1.5 J	--	0.49 J	0.63 J	0.77 J	0.43 J	--
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	--	18	--	8.0	7.2	15	6.6 J	--
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	pg/g	--	0.27 J	--	0.23 J	0.39 J	0.066 U	0.071 U	--
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	--	2.1 J	--	0.26 J	0.21 J	0.28 J	0.13 U	--
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	--	0.37 J	--	0.36 J	0.31 J	0.45 J	0.29 J	--
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	--	0.49 J	--	0.090 U	0.12 U	0.12 U	0.14 U	--
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	--	0.56 U	--	0.29 U	0.41 U	0.38 U	0.31 U	--
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	pg/g	--	0.10 U	--	0.31 J	0.20 J	0.17 J	0.18 J	--
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	--	1.4 J	--	0.71 J	0.76 J	1.1 J	0.54 J	--
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	--	1.8 J	--	0.33 J	0.24 J	0.38 J	0.27 J	--
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	--	0.18 U	--	0.15 U	0.13 U	0.16 U	0.20 U	--
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	--	0.11 U	--	0.071 U	0.094 U	0.088 U	0.11 U	--
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	--	1.0 J	--	0.094 U	0.10 U	0.086 U	0.13 U	--
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	pg/g	--	78	--	6.0	2.9 J	9.9 J	4.5	--
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	--	18	--	1.5	0.76 J	2.7	1.3 J	--
Total heptachlorodibenzofuran (HpCDF)	pg/g	--	3.7 J	--	1.4 J	1.9 J	1.8 J	1.0 J	--
Total heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	--	70 J	--	29 J	25 J	65 J	24 J	--
Total hexachlorodibenzofuran (HxCDF)	pg/g	--	3.5 J	--	0.57 J	0.41 J	0.45 J	0.18 J	--
Total hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	--	20 J	--	11 J	12 J	28 J	10 J	--
Total pentachlorodibenzofuran (PeCDF)	pg/g	--	4.5 J	--	0.33 J	0.24 J	0.85 J	0.27 J	--
Total pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	--	3.3 J	--	2.4 J	3.3 J	7.6 J	3.0 J	--
Total tetrachlorodibenzofuran (TCDF)	pg/g	--	130 J	--	9.1 J	4.1 J	16 J	6.4 J	--
Total tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	--	22 J	--	4.0 J	4.1 J	14 J	4.5 J	--
Total WHO Dioxin TEQ(Human/Mammal)(ND=0)	pg/g	--	27.0	--	2.42	1.33	4.17	1.98	--
Total WHO Dioxin TEQ(Human/Mammal)(ND=0.5)	pg/g	--	27.1	--	2.53	1.44	4.30	2.13	--
Radiochemistry									
Cesium-137	pCi/g	0.1537 U+/-0.08935	--	0.1064 U+/-0.06604	--	--	--	--	0.1099 U+/-0.06103
Lead-210	pCi/g	0.749 +/-0.055	--	0.212 +/-0.052	--	--	--	--	0.259 +/-0.0486
General Chemistry									
Percent solids	%	--	64.1	--	71.3	75.8	76.5	68.5	--

Notes:
pg/g - picogram per gram
pCi/g - picocuries per gram
DUP - indicates the result from a duplicate sample
U - Not detected at the associated reporting limit.
J - Estimated concentration.
-- - Not analyzed

Table 6-1

Sand Separation Area Analytical Results - Northern Impoundment
Pre-Final 90% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Area Sample Location: Sample Identification: Sample Date: Sample Depth:	Units	Sand Separation Area SJSSA05 11187072-120819-BN-SJSSA05 (15-17.5 CM) 12/8/2019 (15-17.5) cm	Sand Separation Area SJSSA05 11187072-120819-BN-SJSSA05 (22.5-25 CM) 12/8/2019 (22.5-25) cm	Sand Separation Area SJSSA05 11187072-120819-BN-SJSSA05 (30-32.5 CM) 12/8/2019 (30-32.5) cm	Sand Separation Area SJSSA05 11187072-120819-BN-SJSSA05 (37.5-40 CM) 12/8/2019 (37.5-40) cm	Sand Separation Area SJSSA05 11187072-120819-BN-SJSSA05 (45-47.5 CM) 12/8/2019 (45-47.5) cm	Sand Separation Area SJSSA05 11187072-120819-BN-SJSSA05 (52.5-55 CM) 12/8/2019 (52.5-55) cm	Sand Separation Area SJSSA05 11187072-120819-BN-SJSSA05 (60-62.5 CM) 12/8/2019 (60-62.5) cm
Dioxins/Furans								
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	pg/g	--	--	--	--	--	--	--
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	pg/g	--	--	--	--	--	--	--
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	pg/g	--	--	--	--	--	--	--
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	--	--	--	--	--	--	--
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	pg/g	--	--	--	--	--	--	--
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	--	--	--	--	--	--	--
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	--	--	--	--	--	--	--
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	--	--	--	--	--	--	--
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	--	--	--	--	--	--	--
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	pg/g	--	--	--	--	--	--	--
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	--	--	--	--	--	--	--
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	--	--	--	--	--	--	--
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	--	--	--	--	--	--	--
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	--	--	--	--	--	--	--
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	--	--	--	--	--	--	--
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	pg/g	--	--	--	--	--	--	--
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	--	--	--	--	--	--	--
Total heptachlorodibenzofuran (HpCDF)	pg/g	--	--	--	--	--	--	--
Total heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	--	--	--	--	--	--	--
Total hexachlorodibenzofuran (HxCDF)	pg/g	--	--	--	--	--	--	--
Total hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	--	--	--	--	--	--	--
Total pentachlorodibenzofuran (PeCDF)	pg/g	--	--	--	--	--	--	--
Total pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	--	--	--	--	--	--	--
Total tetrachlorodibenzofuran (TCDF)	pg/g	--	--	--	--	--	--	--
Total tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	--	--	--	--	--	--	--
Total WHO Dioxin TEQ(Human/Mammal)(ND=0)	pg/g	--	--	--	--	--	--	--
Total WHO Dioxin TEQ(Human/Mammal)(ND=0.5)	pg/g	--	--	--	--	--	--	--
Radiochemistry								
Cesium-137	pCi/g	0.1084 U+/-0.06582	0.07979 U+/-0.04556	0.09782 U+/-0.05617	0.07139 U+/-0.05011	0.06645 U+/-0.04037	0.09536 U+/-0.05946	0.08828 U+/-0.04935
Lead-210	pCi/g	0.35 +/-0.0423	0.119 +/-0.0422	0.181 +/-0.079	0.073 +/-0.0455	0.0704 U+/-0.0418	0.317 +/-0.0542	0.352 +/-0.0526
General Chemistry								
Percent solids	%	--	--	--	--	--	--	--

Notes:
pg/g - picogram per gram
pCi/g - picocuries per gram
DUP - indicates the result from a duplicate sample
U - Not detected at the associated reporting limit.
J - Estimated concentration.
-- - Not analyzed

Table 6-1

Sand Separation Area Analytical Results - Northern Impoundment
Pre-Final 90% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Area Sample Location: Sample Identification: Sample Date: Sample Depth:	Units	Sand Separation Area SJSSA05 11187072-120819-BN-DUP1 12/8/2019 (60-62.5) cm	Sand Separation Area SJSSA05 11187072-120819-BN-SJSSA05 (70-72.5 CM) 12/8/2019 (70-72.5) cm	Sand Separation Area SJSSA05 11187072-120819-BN-SJSSA05 (80-82.5 CM) 12/8/2019 (80-82.5) cm	Sand Separation Area SJSSA06 11187072-120619-SS-SJSSA06 (0-2.5 CM) 12/6/2019 (0-2.5) cm	Sand Separation Area SJSSA06 11187072-120619-SS-SJSSA06(0-1) 12/6/2019 (0-1) ft bgs	Sand Separation Area SJSSA06 11187072-120619-SS-SJSSA06(1-2) 12/6/2019 (1-2) ft bgs	Sand Separation Area SJSSA06 11187072-120619-SS-DUP1 12/6/2019 (1-2) ft bgs	Sand Separation Area SJSSA06 11187072-120619-SS-SJSSA06(2-4) 12/6/2019 (2-4) ft bgs	Sand Separation Area SJSSA06 11187072-120619-SS-SJSSA06(4-6) 12/6/2019 (4-6) ft bgs
Dioxins/Furans										
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	pg/g	--	--	--	--	10 J	4.8 U	9.0 U	3.4 U	46 U
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	pg/g	--	--	--	--	380	210	230	200	1300 J
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	pg/g	--	--	--	--	3.1 J	2.7 J	19 J	2.8 J	100 J
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	--	--	--	--	16	9.9	12	9.3	75 J
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	pg/g	--	--	--	--	0.79 U	1.0 U	9.3	0.93 U	41 J
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	--	--	--	--	9.6	9.2 J	120 J	9.7	420 J
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	--	--	--	--	0.20 J	0.20 J	0.71 J	0.16 J	0.65 U
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	--	--	--	--	2.3 J	2.4 J	31 J	2.3 J	110 J
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	--	--	--	--	0.45 J	0.24 J	0.91 J	0.42 J	0.64 U
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	pg/g	--	--	--	--	0.24 J	0.17 J	2.8 J	0.15 J	7.3 J
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	--	--	--	--	0.87 J	0.72 J	1.2 J	0.58 J	4.0 J
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	--	--	--	--	6.6	6.2 J	160 J	6.2	250 J
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	--	--	--	--	0.69 J	0.70 J	7.7 J	0.68 J	25 J
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	--	--	--	--	0.35 J	0.32 J	9.5	0.37 J	11 J
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	--	--	--	--	4.7 J	5.1 J	190 J	5.4 J	170 J
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	pg/g	--	--	--	--	270	300 J	1900 J	290	3900
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	--	--	--	--	74	83 J	360 J	82	2800
Total heptachlorodibenzofuran (HpCDF)	pg/g	--	--	--	--	6.1 J	5.3 J	34 J	4.3 J	180 J
Total heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	--	--	--	--	55 J	38 J	42 J	35 J	250 J
Total hexachlorodibenzofuran (HxCDF)	pg/g	--	--	--	--	16 J	15 J	190 J	15 J	630 J
Total hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	--	--	--	--	14 J	11 J	18 J	11 J	62 J
Total pentachlorodibenzofuran (PeCDF)	pg/g	--	--	--	--	19 J	20 J	530 J	20 J	700 J
Total pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	--	--	--	--	2.7 J	2.2 J	11 J	2.2 J	28 J
Total tetrachlorodibenzofuran (TCDF)	pg/g	--	--	--	--	600 J	650 J	4500 J	640 J	17000 J
Total tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	--	--	--	--	84 J	94 J	420 J	94 J	3100 J
Total WHO Dioxin TEQ(Human/Mammal)(ND=0)	pg/g	--	--	--	--	105	117	637	115	3330
Total WHO Dioxin TEQ(Human/Mammal)(ND=0.5)	pg/g	--	--	--	--	105	117	637	115	3330
Radiochemistry										
Cesium-137	pCi/g	0.1223 U+/-0.06922	0.1146 U+/-0.06916	0.06587 U+/-0.04211	0.06482 U+/-0.03688	--	--	--	--	--
Lead-210	pCi/g	0.333 +/-0.0544	0.442 +/-0.0572	0.365 +/-0.0568	0.221 +/-0.057	--	--	--	--	--
General Chemistry										
Percent solids	%	--	--	--	--	83.6	89.6	55.0	82.5	60.9

Notes:
pg/g - picogram per gram
pCi/g - picocuries per gram
DUP - indicates the result from a duplicate sample
U - Not detected at the associated reporting limit.
J - Estimated concentration.
-- - Not analyzed

Table 6-1

Sand Separation Area Analytical Results - Northern Impoundment
Pre-Final 90% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Area Sample Location: Sample Identification: Sample Date: Sample Depth:	Units	Sand Separation Area SJSSA06 11187072-120619-SS-SJSSA06 (7.5-10 CM) 12/6/2019 (7.5-10) cm	Sand Separation Area SJSSA06 11187072-120619-SS-SJSSA06 (15-17.5 CM) 12/6/2019 (15-17.5) cm	Sand Separation Area SJSSA06 11187072-120619-SS-SJSSA06 (22.5-25 CM) 12/6/2019 (22.5-25) cm	Sand Separation Area SJSSA06 11187072-120619-SS-SJSSA06 (30-32.5 CM) 12/6/2019 (30-32.5) cm	Sand Separation Area SJSSA06 11187072-120619-SS-SJSSA06 (37.5-40 CM) 12/6/2019 (37.5-40) cm	Sand Separation Area SJSSA06 11187072-120619-SS-SJSSA06 (45-47.5 CM) 12/6/2019 (45-47.5) cm	Sand Separation Area SJSSA06 11187072-120619-SS-SJSSA06 (52.5-55 CM) 12/6/2019 (52.5-55) cm
Dioxins/Furans								
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	pg/g	--	--	--	--	--	--	--
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	pg/g	--	--	--	--	--	--	--
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	pg/g	--	--	--	--	--	--	--
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	--	--	--	--	--	--	--
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	pg/g	--	--	--	--	--	--	--
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	--	--	--	--	--	--	--
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	--	--	--	--	--	--	--
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	--	--	--	--	--	--	--
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	--	--	--	--	--	--	--
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	pg/g	--	--	--	--	--	--	--
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	--	--	--	--	--	--	--
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	--	--	--	--	--	--	--
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	--	--	--	--	--	--	--
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	--	--	--	--	--	--	--
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	--	--	--	--	--	--	--
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	pg/g	--	--	--	--	--	--	--
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	--	--	--	--	--	--	--
Total heptachlorodibenzofuran (HpCDF)	pg/g	--	--	--	--	--	--	--
Total heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	--	--	--	--	--	--	--
Total hexachlorodibenzofuran (HxCDF)	pg/g	--	--	--	--	--	--	--
Total hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	--	--	--	--	--	--	--
Total pentachlorodibenzofuran (PeCDF)	pg/g	--	--	--	--	--	--	--
Total pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	--	--	--	--	--	--	--
Total tetrachlorodibenzofuran (TCDF)	pg/g	--	--	--	--	--	--	--
Total tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	--	--	--	--	--	--	--
Total WHO Dioxin TEQ(Human/Mammal)(ND=0)	pg/g	--	--	--	--	--	--	--
Total WHO Dioxin TEQ(Human/Mammal)(ND=0.5)	pg/g	--	--	--	--	--	--	--
Radiochemistry								
Cesium-137	pCi/g	0.05367 U+/-0.03063	0.03911 U+/-0.02794	0.06255 U+/-0.03486	0.1076 U+/-0.06432	0.0544 U+/-0.0336	0.07865 U+/-0.04602	0.0497 U+/-0.03368
Lead-210	pCi/g	0.161 +/-0.0493	0.0939 +/-0.0491	0.215 +/-0.0476	0.113 +/-0.0522	0.0852 +/-0.0513	0.166 +/-0.0478	0.0697 U+/-0.0434
General Chemistry								
Percent solids	%	--	--	--	--	--	--	--

Notes:
pg/g - picogram per gram
pCi/g - picocuries per gram
DUP - indicates the result from a duplicate sample
U - Not detected at the associated reporting limit.
J - Estimated concentration.
-- - Not analyzed

Table 6-1

Sand Separation Area Analytical Results - Northern Impoundment
Pre-Final 90% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Area Sample Location: Sample Identification: Sample Date: Sample Depth:	Units	Sand Separation Area SJSSA06 11187072-120619-SS-SJSSA06 (60-62.5 CM) 12/6/2019 (60-62.5) cm	Sand Separation Area SJSSA06 11187072-120619-SS-SJSSA06 (70-72.5 CM) 12/6/2019 (70-72.5) cm	Sand Separation Area SJSSA06 11187072-120619-SS-SJSSA06 (80-82.5 CM) 12/6/2019 (80-82.5) cm	Sand Separation Area SJSSA07 11187072-120919-BN-SJSSA07 (0-2.5 CM) 12/9/2019 (0-2.5) cm	Sand Separation Area SJSSA07 11187072-120919-BN-SJSSA07(0-1) 12/9/2019 (0-1) ft bgs	Sand Separation Area SJSSA07 11187072-120919-BN-SJSSA07(1-2) 12/9/2019 (1-2) ft bgs	Sand Separation Area SJSSA07 11187072-120919-BN-SJSSA07(2-4) 12/9/2019 (2-4) ft bgs	Sand Separation Area SJSSA07 11187072-120919-BN-SJSSA07(4-6) 12/9/2019 (4-6) ft bgs
Dioxins/Furans									
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	pg/g	--	--	--	--	44	5.4 U	0.17 U	27 U
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	pg/g	--	--	--	--	2400	430	36	890
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	pg/g	--	--	--	--	4.8 J	0.64 U	0.15 U	0.52 U
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	--	--	--	--	61	16	1.4 U	39
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	pg/g	--	--	--	--	1.3 U	0.21 U	0.17 U	0.70 U
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	--	--	--	--	1.3 J	0.12 U	0.092 U	0.33 U
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	--	--	--	--	1.1 J	0.40 J	0.19 J	0.51 U
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	--	--	--	--	1.1 J	0.15 J	0.088 U	0.31 U
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	--	--	--	--	1.9 J	0.59 J	0.11 U	0.54 U
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	pg/g	--	--	--	--	0.78 J	0.097 U	0.071 U	0.26 U
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	--	--	--	--	2.7 J	1.3 J	0.096 U	2.6 J
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	--	--	--	--	1.1 J	0.16 U	0.11 U	0.39 U
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	--	--	--	--	0.51 U	0.28 U	0.15 U	0.66 U
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	--	--	--	--	0.60 J	0.093 U	0.070 U	0.24 U
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	--	--	--	--	0.74 J	0.16 U	0.12 U	0.41 U
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	pg/g	--	--	--	--	28	2.7	0.073 U	0.25 U
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	--	--	--	--	8.6	1.1 J	0.10 U	0.34 U
Total heptachlorodibenzofuran (HpCDF)	pg/g	--	--	--	--	15 J	1.5 J	0.17 U	5.6 J
Total heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	--	--	--	--	220 J	75 J	5.7 J	130 J
Total hexachlorodibenzofuran (HxCDF)	pg/g	--	--	--	--	8.8 J	0.15 J	0.092 U	0.33 U
Total hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	--	--	--	--	38 J	20 J	1.9 J	28 J
Total pentachlorodibenzofuran (PeCDF)	pg/g	--	--	--	--	4.8 J	0.17 U	0.12 U	0.43 U
Total pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	--	--	--	--	3.7 J	4.2 J	0.28 J	5.4 J
Total tetrachlorodibenzofuran (TCDF)	pg/g	--	--	--	--	47 J	3.1 J	0.073 U	0.25 U
Total tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	--	--	--	--	11 J	3.8 J	0.40 J	0.57 J
Total WHO Dioxin TEQ(Human/Mammal)(ND=0)	pg/g	--	--	--	--	14.0	1.90	0.030	0.917
Total WHO Dioxin TEQ(Human/Mammal)(ND=0.5)	pg/g	--	--	--	--	14.3	2.09	0.213	1.62
Radiochemistry									
Cesium-137	pCi/g	0.03504 U+/-0.02395	0.05251 U+/-0.03429	0.04477 U+/-0.02713	0.112 U+/-0.06301	--	--	--	--
Lead-210	pCi/g	0.113 +/-0.0485	0.188 +/-0.054	0.0941 +/-0.0531	0.905 +/-0.062	--	--	--	--
General Chemistry									
Percent solids	%	--	--	--	--	43.4	64.4	81.7	56.0

Notes:
- pg/g - picogram per gram
- pCi/g - picocuries per gram
- DUP - indicates the result from a duplicate sample
- U - Not detected at the associated reporting limit.
- J - Estimated concentration.
- -- - Not analyzed

Table 6-1

Sand Separation Area Analytical Results - Northern Impoundment
Pre-Final 90% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Area	Units	Sand Separation Area	Sand Separation Area	Sand Separation Area	Sand Separation Area	Sand Separation Area	Sand Separation Area	Sand Separation Area
Sample Location:		SJSSA07	SJSSA07	SJSSA07	SJSSA07	SJSSA07	SJSSA07	SJSSA07
Sample Identification:		11187072-120919-BN-SJSSA07 (7.5-10 CM)	11187072-120919-BN-SJSSA07 (15-17.5 CM)	11187072-120919-BN-SJSSA07 (22.5-25 CM)	11187072-120919-BN-SJSSA07 (30-32.5 CM)	11187072-120919-BN-SJSSA07 (37.5-40 CM)	11187072-120919-BN-SJSSA07 (45-47.5 CM)	11187072-120919-BN-SJSSA07 (52.5-55 CM)
Sample Date:		12/9/2019	12/9/2019	12/9/2019	12/9/2019	12/9/2019	12/9/2019	12/9/2019
Sample Depth:		(7.5-10) cm	(15-17.5) cm	(22.5-25) cm	(30-32.5) cm	(37.5-40) cm	(45-47.5) cm	(52.5-55) cm
Dioxins/Furans								
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	pg/g	--	--	--	--	--	--	--
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	pg/g	--	--	--	--	--	--	--
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	pg/g	--	--	--	--	--	--	--
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	--	--	--	--	--	--	--
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	pg/g	--	--	--	--	--	--	--
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	--	--	--	--	--	--	--
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	--	--	--	--	--	--	--
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	--	--	--	--	--	--	--
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	--	--	--	--	--	--	--
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	pg/g	--	--	--	--	--	--	--
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	--	--	--	--	--	--	--
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	--	--	--	--	--	--	--
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	--	--	--	--	--	--	--
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	--	--	--	--	--	--	--
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	--	--	--	--	--	--	--
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	pg/g	--	--	--	--	--	--	--
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	--	--	--	--	--	--	--
Total heptachlorodibenzofuran (HpCDF)	pg/g	--	--	--	--	--	--	--
Total heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	--	--	--	--	--	--	--
Total hexachlorodibenzofuran (HxCDF)	pg/g	--	--	--	--	--	--	--
Total hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	--	--	--	--	--	--	--
Total pentachlorodibenzofuran (PeCDF)	pg/g	--	--	--	--	--	--	--
Total pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	--	--	--	--	--	--	--
Total tetrachlorodibenzofuran (TCDF)	pg/g	--	--	--	--	--	--	--
Total tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	--	--	--	--	--	--	--
Total WHO Dioxin TEQ(Human/Mammal)(ND=0)	pg/g	--	--	--	--	--	--	--
Total WHO Dioxin TEQ(Human/Mammal)(ND=0.5)	pg/g	--	--	--	--	--	--	--
Radiochemistry								
Cesium-137	pCi/g	0.05777 U+/-0.03325	0.1033 U+/-0.0658	0.0679 U+/-0.03908	0.1 U+/-0.05852	0.06529 U+/-0.04338	0.0502 U+/-0.03476	0.07514 U+/-0.04497
Lead-210	pCi/g	0.853 +/-0.0707	0.912 +/-0.0704	1.05 +/-0.0803	0.655 +/-0.0602	0.156 +/-0.0533	0.0682 U+/-0.0423	0.0808 U+/-0.0502
General Chemistry								
Percent solids	%	--	--	--	--	--	--	--

Notes:
- pg/g - picogram per gram
- pCi/g - picocuries per gram
- DUP - indicates the result from a duplicate sample
- U - Not detected at the associated reporting limit.
- J - Estimated concentration.
- -- - Not analyzed

Table 6-1

Sand Separation Area Analytical Results - Northern Impoundment
Pre-Final 90% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Area:	Units	Sand Separation Area	Sand Separation Area	Sand Separation Area	Sand Separation Area	Sand Separation Area	Sand Separation Area	Sand Separation Area	Sand Separation Area
Sample Location:		SJSSA07	SJSSA07	SJSSA07	SJSSA08	SJSSA08	SJSSA08	SJSSA08	SJSSA08
Sample Identification:		11187072-120919-BN-SJSSA07 (60-62.5 CM)	11187072-120919-BN-SJSSA07 (70-72.5 CM)	11187072-120919-BN-SJSSA07 (80-82.5 CM)	11187072-120419-SS-SJSSA08 (0-2.5 CM)	11187072-120419-SS-SJSSA08(0-1)	11187072-120419-SS-SJSSA08(1-2)	11187072-120419-SS-SJSSA08(2-4)	11187072-120419-SS-SJSSA08(4-6)
Sample Date:		12/9/2019	12/9/2019	12/9/2019	12/4/2019	12/4/2019	12/4/2019	12/4/2019	12/4/2019
Sample Depth:		(60-62.5) cm	(70-72.5) cm	(80-82.5) cm	(0-2.5) cm	(0-1) ft bgs	(1-2) ft bgs	(2-4) ft bgs	(4-6) ft bgs
Dioxins/Furans									
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	pg/g	--	--	--	--	20	53	93	8.6 U
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	pg/g	--	--	--	--	930	2600	3600	830
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	pg/g	--	--	--	--	3.1 J	6.6 J	13	2.3 J
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	--	--	--	--	28	73	110	35
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	pg/g	--	--	--	--	0.53 U	1.0 U	2.2 J	0.41 U
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	--	--	--	--	0.84 J	2.5 J	10	4.0 J
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	--	--	--	--	0.31 J	0.98 J	1.4 J	0.35 J
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	--	--	--	--	0.37 J	1.1 J	3.2 J	0.99 J
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	--	--	--	--	0.57 J	1.7 J	2.6 J	0.90 J
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	pg/g	--	--	--	--	0.16 U	0.16 U	0.34 J	0.21 U
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	--	--	--	--	1.3 J	3.0 J	4.8 J	2.3 J
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	--	--	--	--	0.49 J	1.2 J	6.9 J	2.7 J
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	--	--	--	--	0.20 J	0.49 J	1.5 J	0.52 J
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	--	--	--	--	0.12 U	0.25 J	0.59 J	0.16 U
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	--	--	--	--	0.29 J	0.86 J	5.2 J	2.6 J
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	pg/g	--	--	--	--	11	32	260	120
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	--	--	--	--	4.1	10	75	35
Total heptachlorodibenzofuran (HpCDF)	pg/g	--	--	--	--	7.1 J	16 J	29 J	4.6 J
Total heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	--	--	--	--	89 J	240 J	370 J	130 J
Total hexachlorodibenzofuran (HxCDF)	pg/g	--	--	--	--	4.4 J	12 J	29 J	6.5 J
Total hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	--	--	--	--	18 J	50 J	80 J	40 J
Total pentachlorodibenzofuran (PeCDF)	pg/g	--	--	--	--	3.6 J	7.3 J	27 J	8.7 J
Total pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	--	--	--	--	2.4 J	6.4 J	11 J	8.2 J
Total tetrachlorodibenzofuran (TCDF)	pg/g	--	--	--	--	26 J	68 J	540 J	260 J
Total tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	--	--	--	--	6.4 J	17 J	92 J	47 J
Total WHO Dioxin TEQ(Human/Mammal)(ND=0)	pg/g	--	--	--	--	6.44	16.5	109	49.9
Total WHO Dioxin TEQ(Human/Mammal)(ND=0.5)	pg/g	--	--	--	--	6.45	16.5	109	49.9
Radiochemistry									
Cesium-137	pCi/g	0.09191 U+/-0.05208	0.08917 U+/-0.05545	0.08095 U+/-0.04787	0.07898 U+/-0.0474	--	--	--	--
Lead-210	pCi/g	0.0815 +/-0.0467	0.0969 U+/-0.0587	0.198 +/-0.0468	0.076 U+/-0.0475	--	--	--	--
General Chemistry									
Percent solids	%	--	--	--	--	76.3	67.5	57.7	70.1

Notes:
- pg/g - picogram per gram
- pCi/g - picocuries per gram
- DUP - indicates the result from a duplicate sample
- U - Not detected at the associated reporting limit.
- J - Estimated concentration.
- -- - Not analyzed

Table 6-1

Sand Separation Area Analytical Results - Northern Impoundment
Pre-Final 90% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Area Sample Location: Sample Identification: Sample Date: Sample Depth:	Units	Sand Separation Area SJSSA08 11187072-120419-SS-SJSSA08 (7.5-10 CM) 12/4/2019 (7.5-10) cm	Sand Separation Area SJSSA08 11187072-120419-SS-SJSSA08 (15-17.5 CM) 12/4/2019 (15-17.5) cm	Sand Separation Area SJSSA08 11187072-120419-SS-SJSSA08 (22.5-25 CM) 12/4/2019 (22.5-25) cm	Sand Separation Area SJSSA08 11187072-120419-SS-SJSSA08 (30-32.5 CM) 12/4/2019 (30-32.5) cm	Sand Separation Area SJSSA08 11187072-120419-SS-SJSSA08 (37.5-40 CM) 12/4/2019 (37.5-40) cm	Sand Separation Area SJSSA08 11187072-120419-SS-SJSSA08 (45-47.5 CM) 12/4/2019 (45-47.5) cm	Sand Separation Area SJSSA08 11187072-120419-SS-SJSSA08 (52.5-55 CM) 12/4/2019 (52.5-55) cm
Dioxins/Furans								
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	pg/g	--	--	--	--	--	--	--
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	pg/g	--	--	--	--	--	--	--
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	pg/g	--	--	--	--	--	--	--
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	--	--	--	--	--	--	--
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	pg/g	--	--	--	--	--	--	--
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	--	--	--	--	--	--	--
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	--	--	--	--	--	--	--
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	--	--	--	--	--	--	--
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	--	--	--	--	--	--	--
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	pg/g	--	--	--	--	--	--	--
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	--	--	--	--	--	--	--
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	--	--	--	--	--	--	--
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	--	--	--	--	--	--	--
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	--	--	--	--	--	--	--
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	--	--	--	--	--	--	--
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	pg/g	--	--	--	--	--	--	--
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	--	--	--	--	--	--	--
Total heptachlorodibenzofuran (HpCDF)	pg/g	--	--	--	--	--	--	--
Total heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	--	--	--	--	--	--	--
Total hexachlorodibenzofuran (HxCDF)	pg/g	--	--	--	--	--	--	--
Total hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	--	--	--	--	--	--	--
Total pentachlorodibenzofuran (PeCDF)	pg/g	--	--	--	--	--	--	--
Total pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	--	--	--	--	--	--	--
Total tetrachlorodibenzofuran (TCDF)	pg/g	--	--	--	--	--	--	--
Total tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	--	--	--	--	--	--	--
Total WHO Dioxin TEQ(Human/Mammal)(ND=0)	pg/g	--	--	--	--	--	--	--
Total WHO Dioxin TEQ(Human/Mammal)(ND=0.5)	pg/g	--	--	--	--	--	--	--
Radiochemistry								
Cesium-137	pCi/g	0.0429 U+/-0.02742	0.06693 U+/-0.04252	0.09049 U+/-0.04816	0.04994 U+/-0.02875	0.1452 U+/-0.07804	0.1771 U+/-0.1092	0.1565 U+/-0.08324
Lead-210	pCi/g	0.0758 U+/-0.045	0.0683 U+/-0.0422	0.083 U+/-0.0493	0.0681 U+/-0.0405	0.611 +/-0.0567	0.833 +/-0.0641	0.54 +/-0.0671
General Chemistry								
Percent solids	%	--	--	--	--	--	--	--

Notes:
- pg/g - picogram per gram
- pCi/g - picocuries per gram
- DUP - indicates the result from a duplicate sample
- U - Not detected at the associated reporting limit.
- J - Estimated concentration.
- -- - Not analyzed

Table 6-1

Sand Separation Area Analytical Results - Northern Impoundment
Pre-Final 90% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Area: Sample Location: Sample Identification: Sample Date: Sample Depth:	Units	Sand Separation Area SJSSA08 11187072-120419-SS-SJSSA08 (60-62.5 CM) 12/4/2019 (60-62.5) cm	Sand Separation Area SJSSA08 11187072-120419-SS-SJSSA08 (70-72.5 CM) 12/4/2019 (70-72.5) cm	Sand Separation Area SJSSA08 11187072-120419-SS-SJSSA08 (80-82.5 CM) 12/4/2019 (80-82.5) cm	Sand Separation Area SJSSA09 11187072-120819-BN-SJSSA09 (0-1) 12/8/2019 (0-1) ft bgs	Sand Separation Area SJSSA09 11187072-120819-BN-SJSSA09 (0-2.5 CM) 12/8/2019 (0-2.5) cm	Sand Separation Area SJSSA09 11187072-120819-BN-SJSSA09 (1-2) 12/8/2019 (1-2) ft bgs	Sand Separation Area SJSSA09 11187072-120819-BN-SJSSA09 (2-4) 12/8/2019 (2-4) ft bgs	Sand Separation Area SJSSA09 11187072-120819-BN-SJSSA09 (4-6) 12/8/2019 (4-6) ft bgs
Dioxins/Furans									
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	pg/g	--	--	--	4.4 U	--	3.6 U	4.1 U	7.3 U
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	pg/g	--	--	--	300	--	180	180	130
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	pg/g	--	--	--	0.83 J	--	1.2 J	1.1 J	1.1 J
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	--	--	--	7.4	--	6.2 J	6.1 J	5.5 J
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	pg/g	--	--	--	0.087 U	--	0.35 J	0.56 J	0.32 J
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	--	--	--	0.33 J	--	0.78 J	3.3 J	0.64 J
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	--	--	--	0.087 U	--	0.096 U	0.24 J	0.27 J
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	--	--	--	0.073 U	--	0.32 J	0.82 J	0.28 J
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	--	--	--	0.31 U	--	0.50 U	0.21 U	0.19 U
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	pg/g	--	--	--	0.13 J	--	0.28 J	0.46 J	0.23 J
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	--	--	--	0.34 J	--	0.58 J	0.44 J	0.36 J
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	--	--	--	0.35 J	--	0.64 J	1.2 J	0.40 J
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	--	--	--	0.14 U	--	0.15 U	0.18 U	0.12 U
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	--	--	--	0.070 U	--	0.073 U	0.10 U	0.094 U
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	--	--	--	0.092 U	--	0.079 U	0.61 J	0.092 U
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	pg/g	--	--	--	13	--	20	44	14
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	--	--	--	3.0	--	4.4	9.7	3.0
Total heptachlorodibenzofuran (HpCDF)	pg/g	--	--	--	2.3 J	--	4.0 J	2.5 J	3.0 J
Total heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	--	--	--	27 J	--	18 J	22 J	16 J
Total hexachlorodibenzofuran (HxCDF)	pg/g	--	--	--	0.83 J	--	3.3 J	4.6 J	1.2 J
Total hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	--	--	--	3.3 J	--	4.3 J	5.0 J	3.3 J
Total pentachlorodibenzofuran (PeCDF)	pg/g	--	--	--	0.76 J	--	0.74 J	2.7 J	0.40 J
Total pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	--	--	--	0.14 U	--	0.15 U	0.18 U	0.14 J
Total tetrachlorodibenzofuran (TCDF)	pg/g	--	--	--	19 J	--	29 J	68 J	20 J
Total tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	--	--	--	3.0 J	--	4.4 J	11 J	3.3 J
Total WHO Dioxin TEQ(Human/Mammal)(ND=0)	pg/g	--	--	--	4.56	--	6.75	15.0	4.70
Total WHO Dioxin TEQ(Human/Mammal)(ND=0.5)	pg/g	--	--	--	4.67	--	6.87	15.1	4.79
Radiochemistry									
Cesium-137	pCi/g	0.1584 U+/-0.0959	0.1831 U+/-0.09753	0.183 U+/-0.1084	--	0.08415 U+/-0.05819	--	--	--
Lead-210	pCi/g	0.294 U+/-0.0491	0.596 +/-0.0531	0.524 +/-0.0536	--	0.095 +/-0.0428	--	--	--
General Chemistry									
Percent solids	%	--	--	--	71.0	--	75.2	78.4	75.4

Notes:
pg/g - picogram per gram
pCi/g - picocuries per gram
DUP - indicates the result from a duplicate sample
U - Not detected at the associated reporting limit.
J - Estimated concentration.
-- - Not analyzed

Table 6-1

Sand Separation Area Analytical Results - Northern Impoundment
Pre-Final 90% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Area Sample Location: Sample Identification: Sample Date: Sample Depth:	Units	Sand Separation Area SJSSA09 11187072-120819-BN-SJSSA09 (7.5-10 CM) 12/8/2019 (7.5-10) cm	Sand Separation Area SJSSA09 11187072-120819-BN-SJSSA09 (15-17.5 CM) 12/8/2019 (15-17.5) cm	Sand Separation Area SJSSA09 11187072-120819-BN-SJSSA09 (22.5-25 CM) 12/8/2019 (22.5-25) cm	Sand Separation Area SJSSA09 11187072-120819-BN-SJSSA09 (30-32.5 CM) 12/8/2019 (30-32.5) cm	Sand Separation Area SJSSA09 11187072-120819-BN-SJSSA09 (37.5-40 CM) 12/8/2019 (37.5-40) cm	Sand Separation Area SJSSA09 11187072-120819-BN-SJSSA09 (45-47.5 CM) 12/8/2019 (45-47.5) cm	Sand Separation Area SJSSA09 11187072-120819-BN-SJSSA09 (52.5-55 CM) 12/8/2019 (52.5-55) cm
Dioxins/Furans								
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	pg/g	--	--	--	--	--	--	--
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	pg/g	--	--	--	--	--	--	--
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	pg/g	--	--	--	--	--	--	--
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	--	--	--	--	--	--	--
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	pg/g	--	--	--	--	--	--	--
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	--	--	--	--	--	--	--
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	--	--	--	--	--	--	--
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	--	--	--	--	--	--	--
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	--	--	--	--	--	--	--
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	pg/g	--	--	--	--	--	--	--
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	--	--	--	--	--	--	--
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	--	--	--	--	--	--	--
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	--	--	--	--	--	--	--
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	--	--	--	--	--	--	--
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	--	--	--	--	--	--	--
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	pg/g	--	--	--	--	--	--	--
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	--	--	--	--	--	--	--
Total heptachlorodibenzofuran (HpCDF)	pg/g	--	--	--	--	--	--	--
Total heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	--	--	--	--	--	--	--
Total hexachlorodibenzofuran (HxCDF)	pg/g	--	--	--	--	--	--	--
Total hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	--	--	--	--	--	--	--
Total pentachlorodibenzofuran (PeCDF)	pg/g	--	--	--	--	--	--	--
Total pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	--	--	--	--	--	--	--
Total tetrachlorodibenzofuran (TCDF)	pg/g	--	--	--	--	--	--	--
Total tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	--	--	--	--	--	--	--
Total WHO Dioxin TEQ(Human/Mammal)(ND=0)	pg/g	--	--	--	--	--	--	--
Total WHO Dioxin TEQ(Human/Mammal)(ND=0.5)	pg/g	--	--	--	--	--	--	--
Radiochemistry								
Cesium-137	pCi/g	0.09609 U+/-0.05366	0.08249 U+/-0.05073	0.1153 U+/-0.06196	0.09361 U+/-0.0574	0.0758 U+/-0.04698	0.06056 U+/-0.03959	0.08343 U+/-0.05239
Lead-210	pCi/g	0.0718 U+/-0.0451	0.0967 +/-0.0467	0.0732 U+/-0.0459	0.0755 +/-0.0432	0.0714 U+/-0.0446	0.12 +/-0.0473	0.08 U+/-0.0481
General Chemistry								
Percent solids	%	--	--	--	--	--	--	--

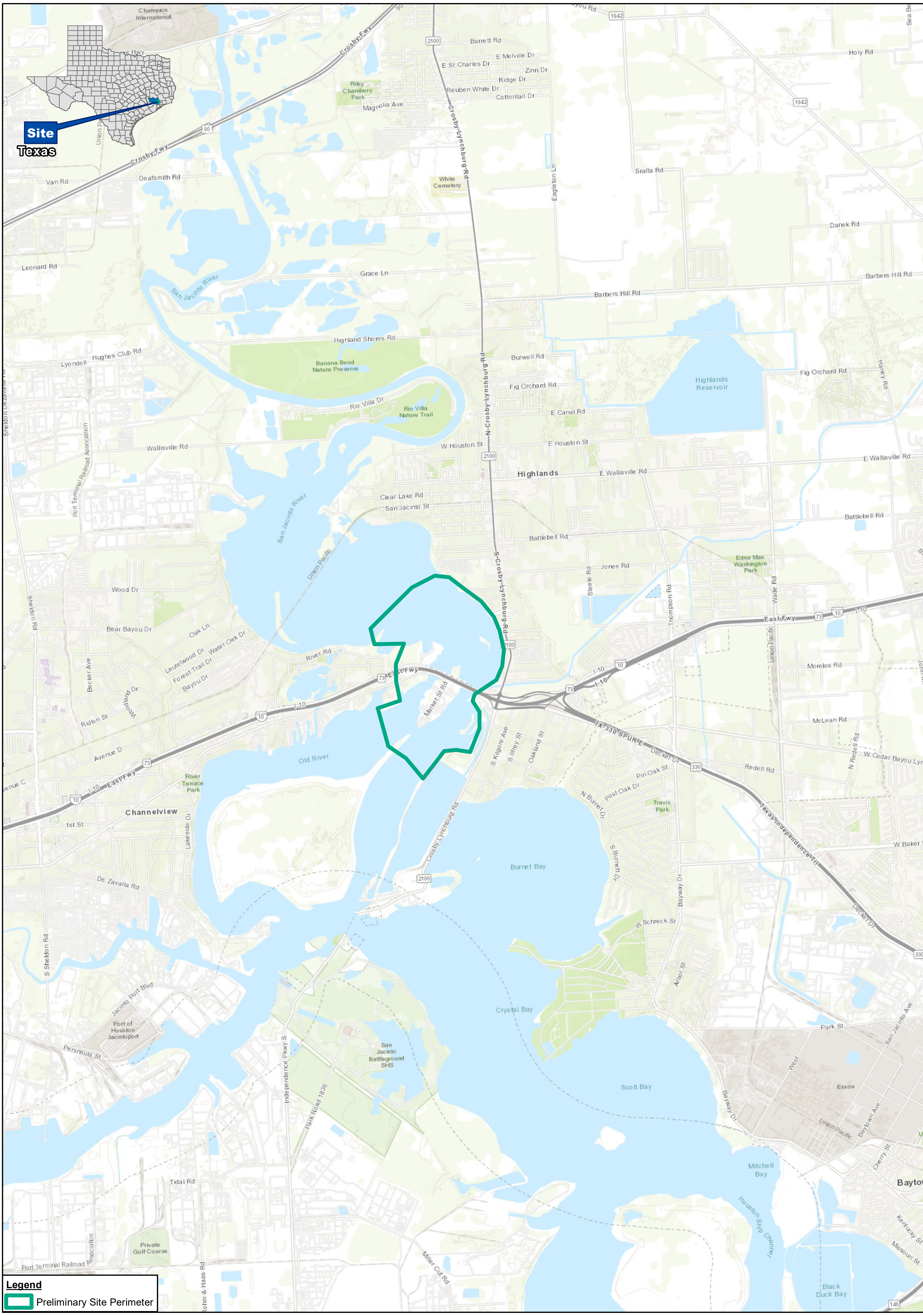
Notes:
pg/g - picogram per gram
pCi/g - picocuries per gram
DUP - indicates the result from a duplicate sample
U - Not detected at the associated reporting limit.
J - Estimated concentration.
-- - Not analyzed

Table 6-1

Sand Separation Area Analytical Results - Northern Impoundment
Pre-Final 90% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Area / Sample Location: / Sample Identification: / Sample Date: / Sample Depth:	Units	Sand Separation Area SJSSA09 11187072-120819-BN-SJSSA09 (60-62.5 CM) 12/8/2019 (60-62.5) cm	Sand Separation Area SJSSA09 11187072-120819-BN-SJSSA09 (70-72.5 CM) 12/8/2019 (70-72.5) cm	Sand Separation Area SJSSA09 11187072-120819-BN-SJSSA09 (80-82.5 CM) 12/8/2019 (80-82.5) cm
Dioxins/Furans				
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	pg/g	--	--	--
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	pg/g	--	--	--
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	pg/g	--	--	--
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	--	--	--
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	pg/g	--	--	--
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	--	--	--
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	--	--	--
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	--	--	--
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	--	--	--
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	pg/g	--	--	--
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	--	--	--
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	--	--	--
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	--	--	--
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	--	--	--
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	--	--	--
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	pg/g	--	--	--
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	--	--	--
Total heptachlorodibenzofuran (HpCDF)	pg/g	--	--	--
Total heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	--	--	--
Total hexachlorodibenzofuran (HxCDF)	pg/g	--	--	--
Total hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	--	--	--
Total pentachlorodibenzofuran (PeCDF)	pg/g	--	--	--
Total pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	--	--	--
Total tetrachlorodibenzofuran (TCDF)	pg/g	--	--	--
Total tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	--	--	--
Total WHO Dioxin TEQ(Human/Mammal)(ND=0)	pg/g	--	--	--
Total WHO Dioxin TEQ(Human/Mammal)(ND=0.5)	pg/g	--	--	--
Radiochemistry				
Cesium-137	pCi/g	0.09455 U+/-0.06032	0.1217 U+/-0.06699	0.05701 U+/-0.03507
Lead-210	pCi/g	0.0744 U+/-0.0461	0.0816 +/-0.0451	0.105 +/-0.0417
General Chemistry				
Percent solids	%	--	--	--

Notes:
pg/g - picogram per gram
pCi/g - picocuries per gram
DUP - indicates the result from a duplicate sample
U - Not detected at the associated reporting limit.
J - Estimated concentration.
-- - Not analyzed



Paper Size ANSI B

0 160 320 480 640

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Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: NAD 1983 StatePlane Texas South Central FIPS 4204 Feet

GHD

SAN JACINTO RIVER WASTE PITS SITE
HARRIS COUNTY, TEXAS

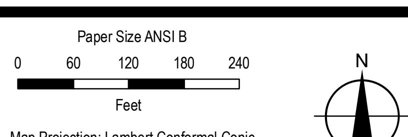
VICINITY MAP

Project No. **11215702**
Revision No. **-**
Date **May 11, 2022**

FIGURE 1-1

Q:\GIS\PROJECTS\11215000s\11215702\RPT006\11215702_202205_RPT006_GIS001-1.mxd

Data source: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community.



Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: NAD 1983 StatePlane Texas South Central FIPS 4204 Feet

SAN JACINTO RIVER WASTE PITS SITE
HARRIS COUNTY, TEXAS

NORTHERN IMPOUNDMENT AND SAND SEPARATION AREA

Project No. 11215702
Revision No. -
Date May 11, 2022

FIGURE 1-2

Q:\GIS\PROJECTS\11215000s\11215702\RPT006\11215702_202205_RPT006_GIS001-2.mxd

Data source: Google Earth Imagery

Paper Size ANSI B

0 40 80 120 160

Feet

N

Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: NAD 1983 StatePlane Texas South Central FIPS 4204 Feet

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SAN JACINTO RIVER WASTE PITS SITE
HARRIS COUNTY, TEXAS

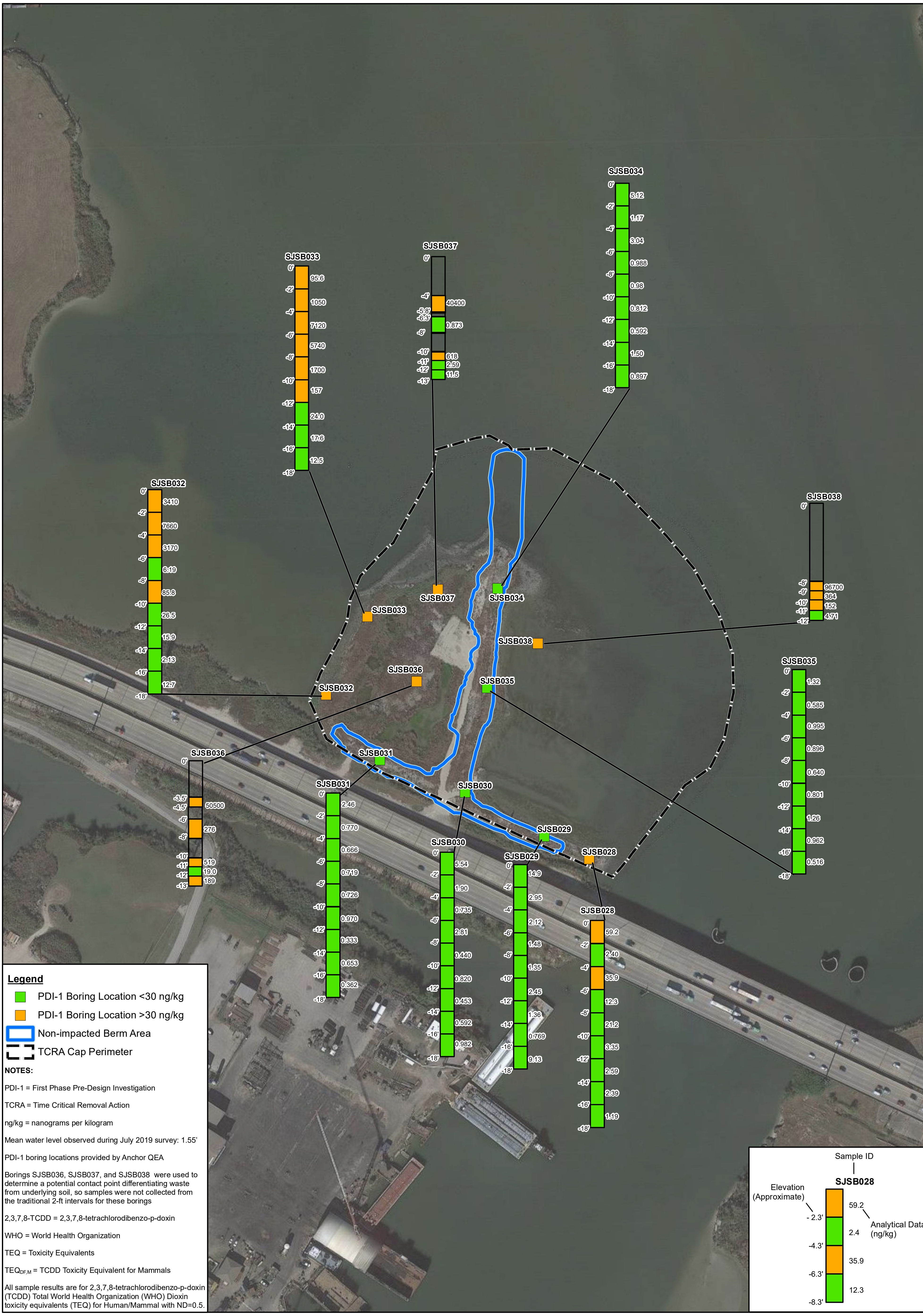
FIRST PHASE PRE-DESIGN INVESTIGATION BORING LOCATIONS

Project No. 11215702
Revision No. -
Date May 11, 2022

FIGURE 2-1

Q:\GIS\PROJECTS\11215000s\11215702\RPT006\11215702_202205_RPT006_GIS002-1.mxd

Data source: Google Earth Imagery



Paper Size ANSI B

0 60 120 180 240

Feet

Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: NAD 1983 StatePlane Texas South Central FIPS 4204 Feet

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SAN JACINTO RIVER WASTE PITS SITE
HARRIS COUNTY, TEXAS

FIRST PHASE PRE-DESIGN INVESTIGATION RESULTS

Project No. 11215702
Revision No. -
Date Jun 27, 2022

FIGURE 2-2

Q:\GIS\PROJECTS\11215000s\11215702\RPT006\11215702_202205_RPT006_GIS002-2.mxd

Data source: Google Earth Imagery

Paper Size ANSI B

0 40 80 120 160

Feet

Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: NAD 1983 StatePlane Texas South Central FIPS 4204 Feet

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SAN JACINTO RIVER WASTE PITS SITE
HARRIS COUNTY, TEXAS

SECOND PHASE PRE-DESIGN
INVESTIGATION BORING LOCATIONS

Project No. 11215702
Revision No. -
Date Jun 10, 2022

FIGURE 2-3

Q:\GIS\PROJECTS\11215000s\11215702\RPT006\11215702_202205_RPT006_GIS002-3.mxd

Data source: Google Earth Imagery

Paper Size ANSI B
0 60 120 180 240
Feet

Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: NAD 1983 StatePlane Texas South Central FIPS 4204 Feet

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SAN JACINTO RIVER WASTE PITS SITE
HARRIS COUNTY, TEXAS

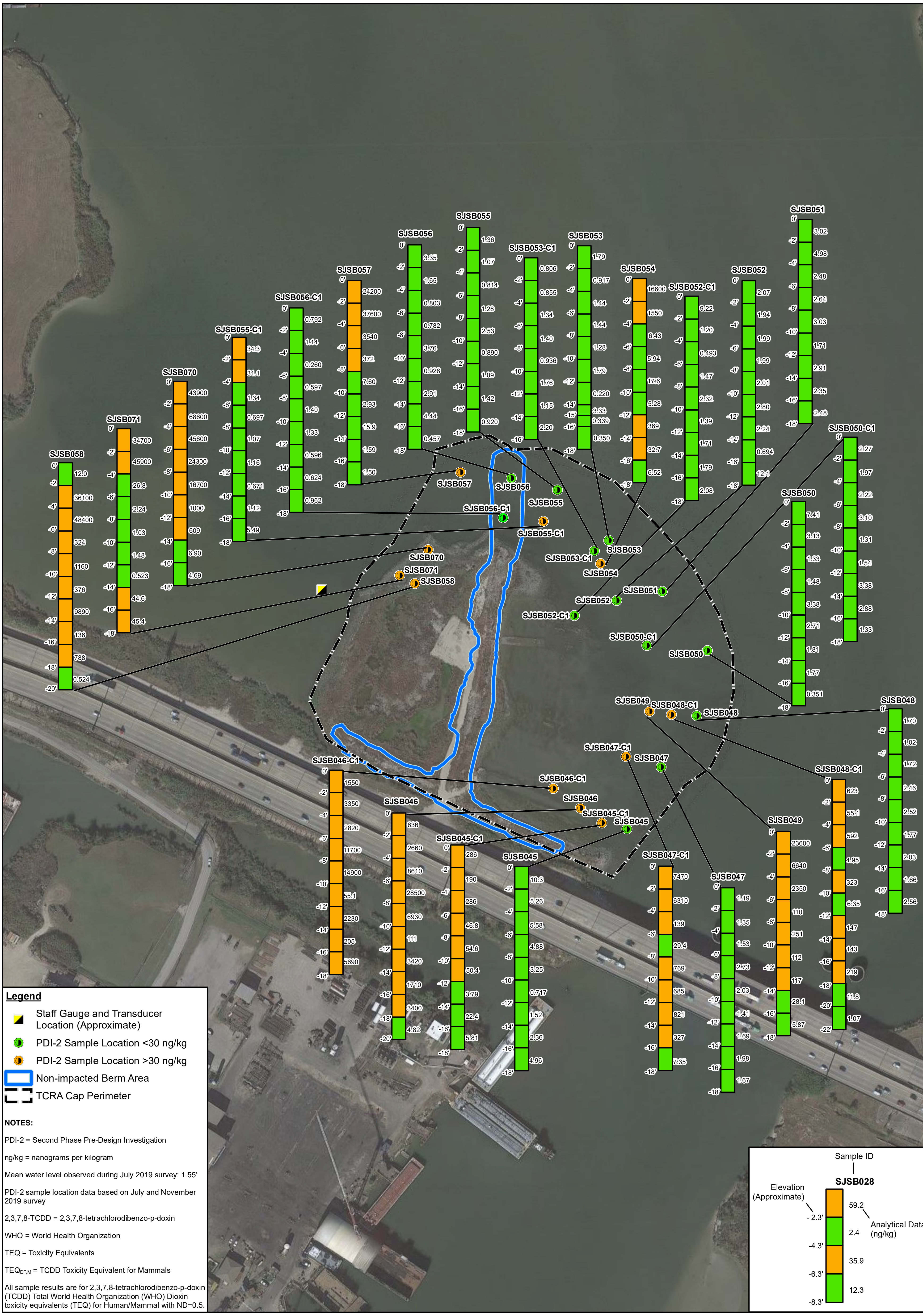
SAND SEPARATION AREA
SAMPLE LOCATIONS

Project No. 11215702
Revision No. -
Date May 11, 2022

FIGURE 2-4

Q:\GIS\PROJECTS\11215000s\11215702\RPT006\11215702_202205_RPT006_GIS002-4.mxd

Data source: Google Earth Imagery



Paper Size ANSI B

0 60 120 180 240 Feet

Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: NAD 1983 StatePlane Texas South Central FIPS 4204 Feet

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SAN JACINTO RIVER WASTE PITS SITE
HARRIS COUNTY, TEXAS

SECOND PHASE PRE-DESIGN INVESTIGATION RESULTS

Project No. 11215702
Revision No. -
Date Jun 27, 2022

FIGURE 2-5

Q:\GIS\PROJECTS\11215000s\11215702\RPT006\11215702_202205_RPT006_GIS002-5.mxd

Data source: Google Earth Imagery

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SAN JACINTO RIVER WASTE PITS SITE
HARRIS COUNTY, TEXAS

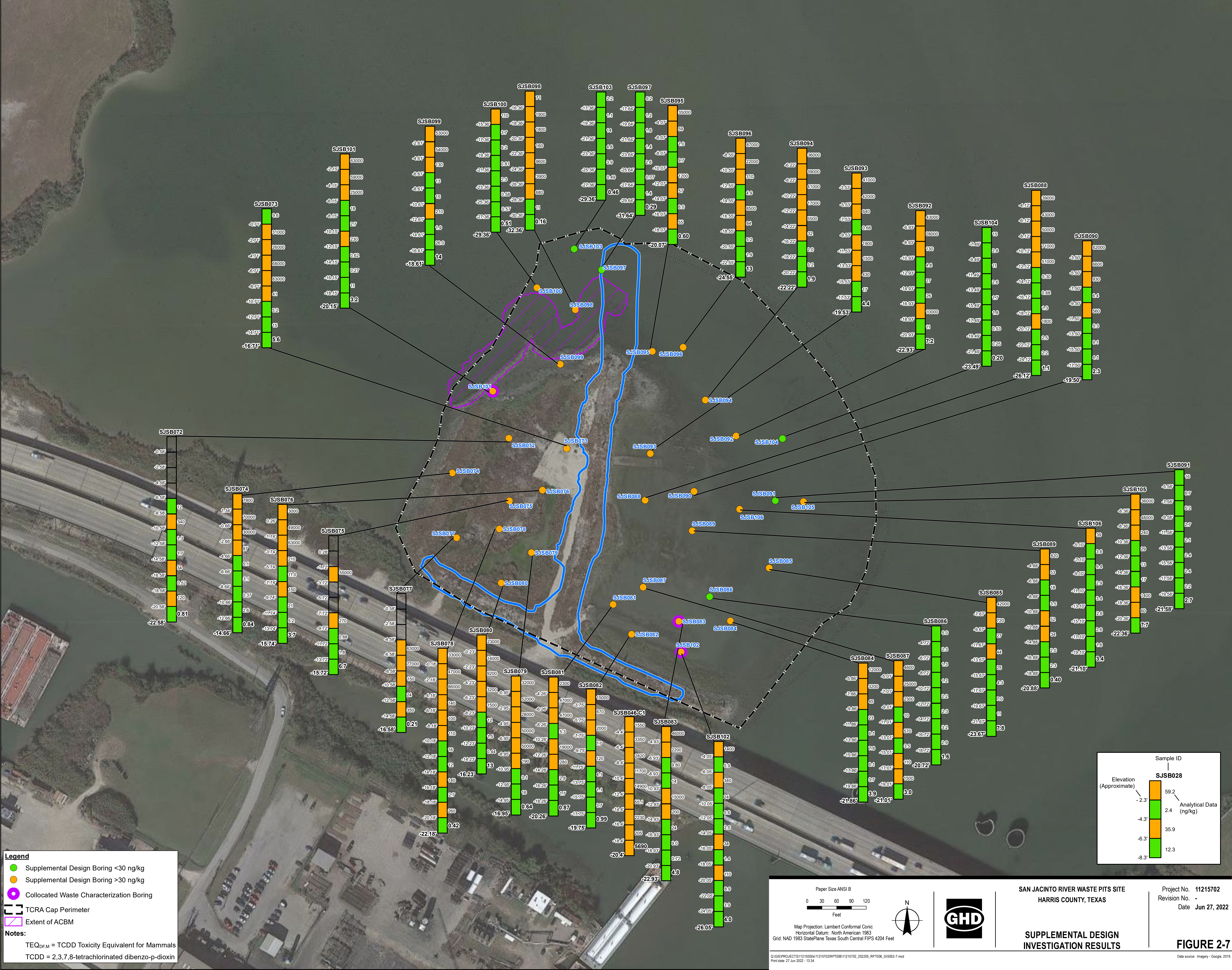
SUPPLEMENTAL DESIGN INVESTIGATION BORING LOCATIONS

Project No. 11215702
Revision No. -
Date May 11, 2022

FIGURE 2-6

Q:\GIS\PROJECTS\11215000s\11215702\RPT006\11215702_202205_RPT006_GIS002-6.mxd
Print date: 11 May 2022 - 12:18

Data source: Imagery - Google, 2019.



Legend
Supplemental Design Boring <30 ng/kg
Supplemental Design Boring >30 ng/kg
Collocated Waste Characterization Boring
TCRA Cap Perimeter
Extent of ACBM
Notes:
TEQ$_{DF,M}$ = TCDD Toxicity Equivalent for Mammals
TCDD = 2,3,7,8-tetrachlorinated dibenzo-p-dioxin
Sample ID
SJSB028
Elevation (Approximate)
Analytical Data (ng/kg)
Paper Size ANSI B
0 30 60 90 120
Feet
Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: NAD 1983 StatePlane Texas South Central FIPS 4204 Feet
N
GHD
SAN JACINTO RIVER WASTE PITS SITE
HARRIS COUNTY, TEXAS
Project No. 11215702
Revision No. -
Date Jun 27, 2022
SUPPLEMENTAL DESIGN INVESTIGATION RESULTS
FIGURE 2-7
Data source: Imagery - Google, 2019.

Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: NAD 1983 StatePlane Texas South Central FIPS 4204 Feet

SAN JACINTO RIVER WASTE PITS SITE
HARRIS COUNTY, TEXAS

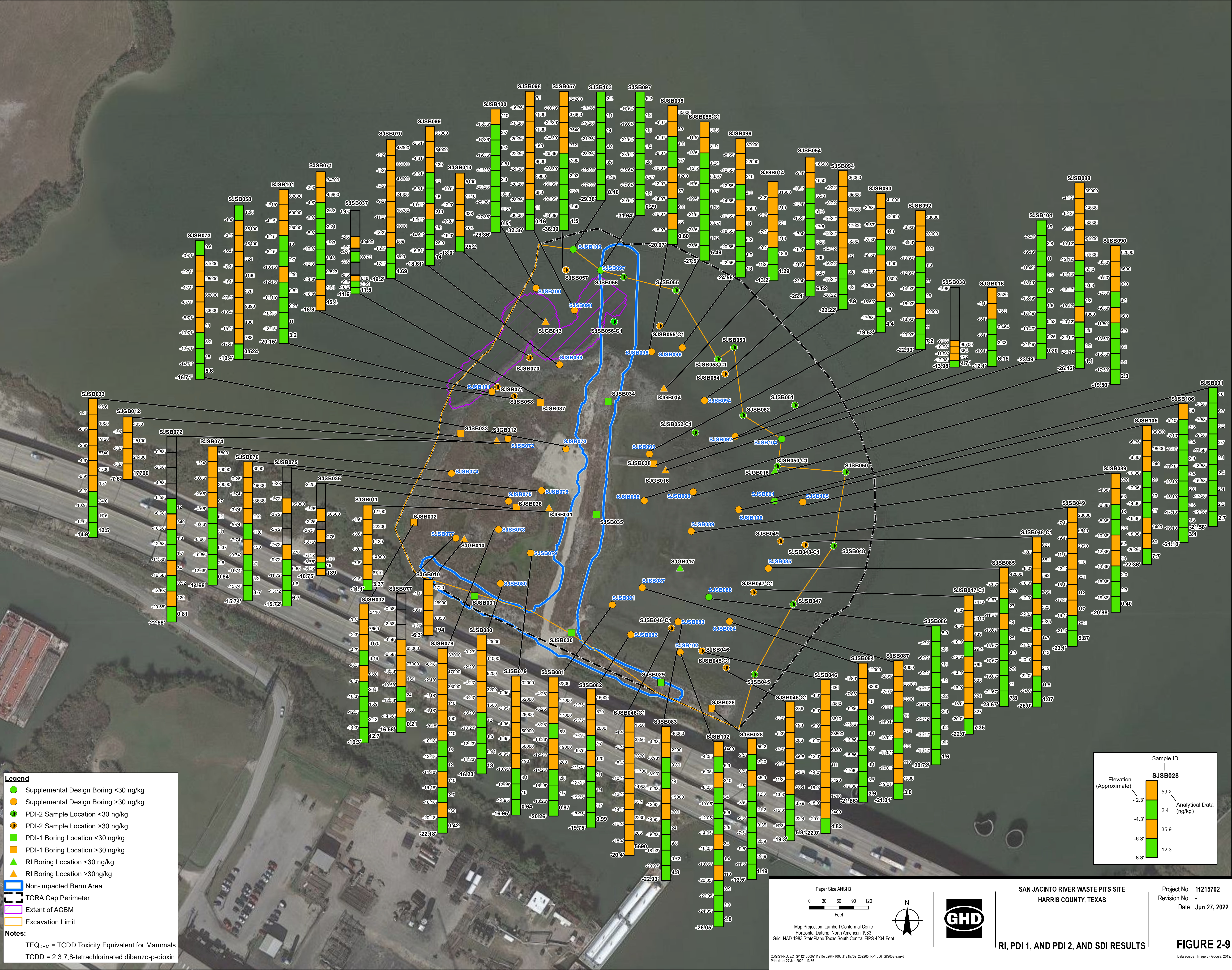
VELOCITY MONITORS AND AMBIENT TURBIDITY MEASUREMENT LOCATIONS

Project No. 11215702
Revision No. -
Date May 11, 2022

FIGURE 2-8

Q:\GIS\PROJECTS\11215000s\11215702\RPT006\11215702_202205_RPT006_GIS002-8.mxd
Print date: 11 May 2022 - 12:29

Data source: Imagery - Google, 2019.



Legend
Supplemental Design Boring <30 ng/kg
Supplemental Design Boring >30 ng/kg
PDI-2 Sample Location <30 ng/kg
PDI-2 Sample Location >30 ng/kg
PDI-1 Boring Location <30 ng/kg
PDI-1 Boring Location >30 ng/kg
RI Boring Location <30 ng/kg
RI Boring Location >30ng/kg
Non-impacted Berm Area
TCRA Cap Perimeter
Extent of ACBM
Excavation Limit
Notes:
$TEQ_{DF,M}$ = TCDD Toxicity Equivalent for Mammals
TCDD = 2,3,7,8-tetrachlorinated dibenzo-p-dioxin
Sample ID
SJSB028
Elevation (Approximate)
Analytical Data (ng/kg)
Paper Size ANSI B
0 30 60 90 120
Feet
Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: NAD 1983 StatePlane Texas South Central FIPS 4204 Feet
N
GHD
SAN JACINTO RIVER WASTE PITS SITE
HARRIS COUNTY, TEXAS
Project No. 11215702
Revision No. -
Date Jun 27, 2022
RI, PDI 1, AND PDI 2, AND SDI RESULTS
FIGURE 2-9
Data source: Imagery - Google, 2019.

Paper Size ANSI B

0 40 80 120 160

Feet

Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: NAD 1983 StatePlane Texas South Central FIPS 4204 Feet

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SAN JACINTO RIVER WASTE PITS SITE
HARRIS COUNTY, TEXAS

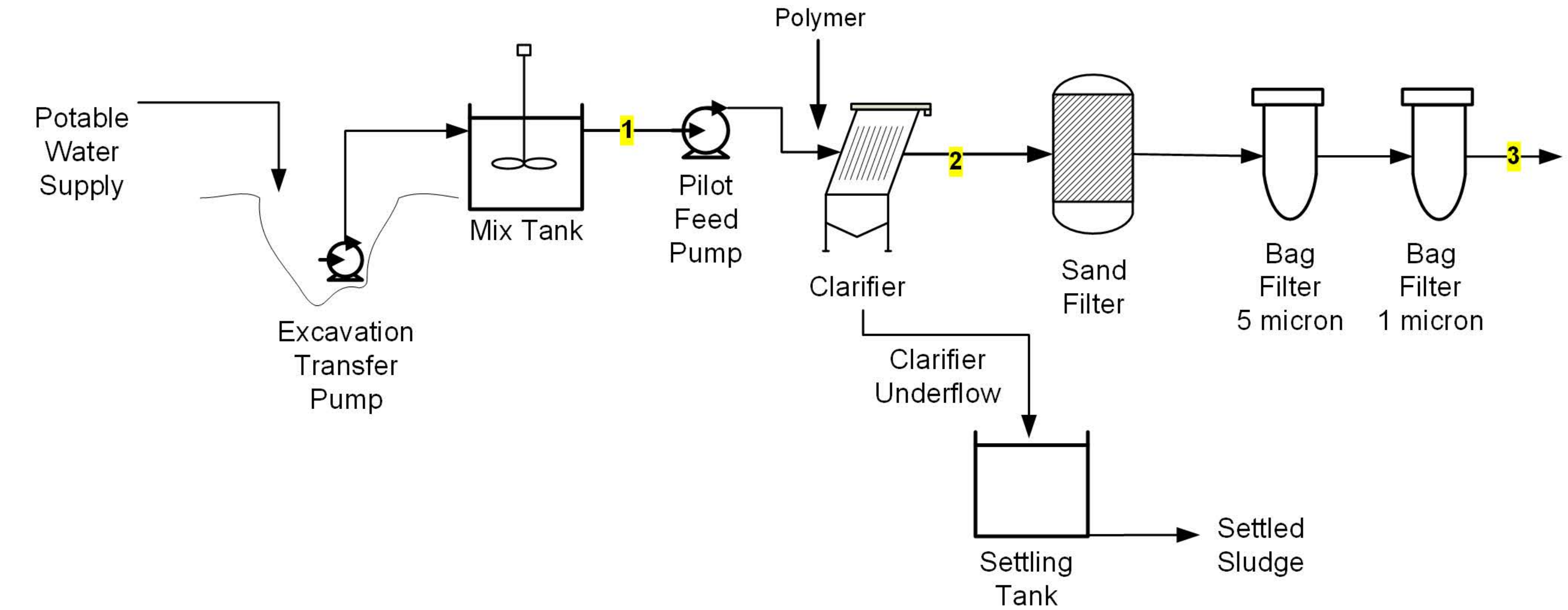
2019 TREATABILITY WASTE MATERIAL SAMPLE LOCATIONS

Project No. **11215702**
Revision No. **-**
Date **May 11, 2022**

FIGURE 3-1

Q:\GIS\PROJECTS\11215000s\11215702\RPT006\11215702_202205_RPT006_GIS003-1.mxd

Data source: Google Earth Imagery



Parameter		Sample Point 1: Contact Water (average)[2]	Sample Point 2: Clarifier Effluent[2]	Sample Point 3: Filter Effluent[2]
2,3,7,8 TCDD[1]	pg/L	16,500	13	<10
Copper	mg/L	0.10	0.0081 U	0.0081 U
Lead	mg/L	0.11	0.0022 U	0.0022 U
Zinc	mg/L	0.38	0.045	0.036
TSS	mg/L	4,050	11	2

Notes:
pg/L = picogram per liter
mg/L = milligram per liter
2,3,7,8 TCDD =Tetrachlorodibenzodioxin
TSS = total suspended solids
U = not detected at the associated reporting limit

1) The Minimum Level (ML) of EPA approved method 1613B is 10 pg/L.
2) Full analytical data set included in Table 3-2. Lab reports included in Appendix D.

Paper Size ANSI B

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SAN JACINTO RIVER WASTE PITS SITE
HARRIS COUNTY, TEXAS

2019 PILOT TEST
PROCESS FLOW DIAGRAM

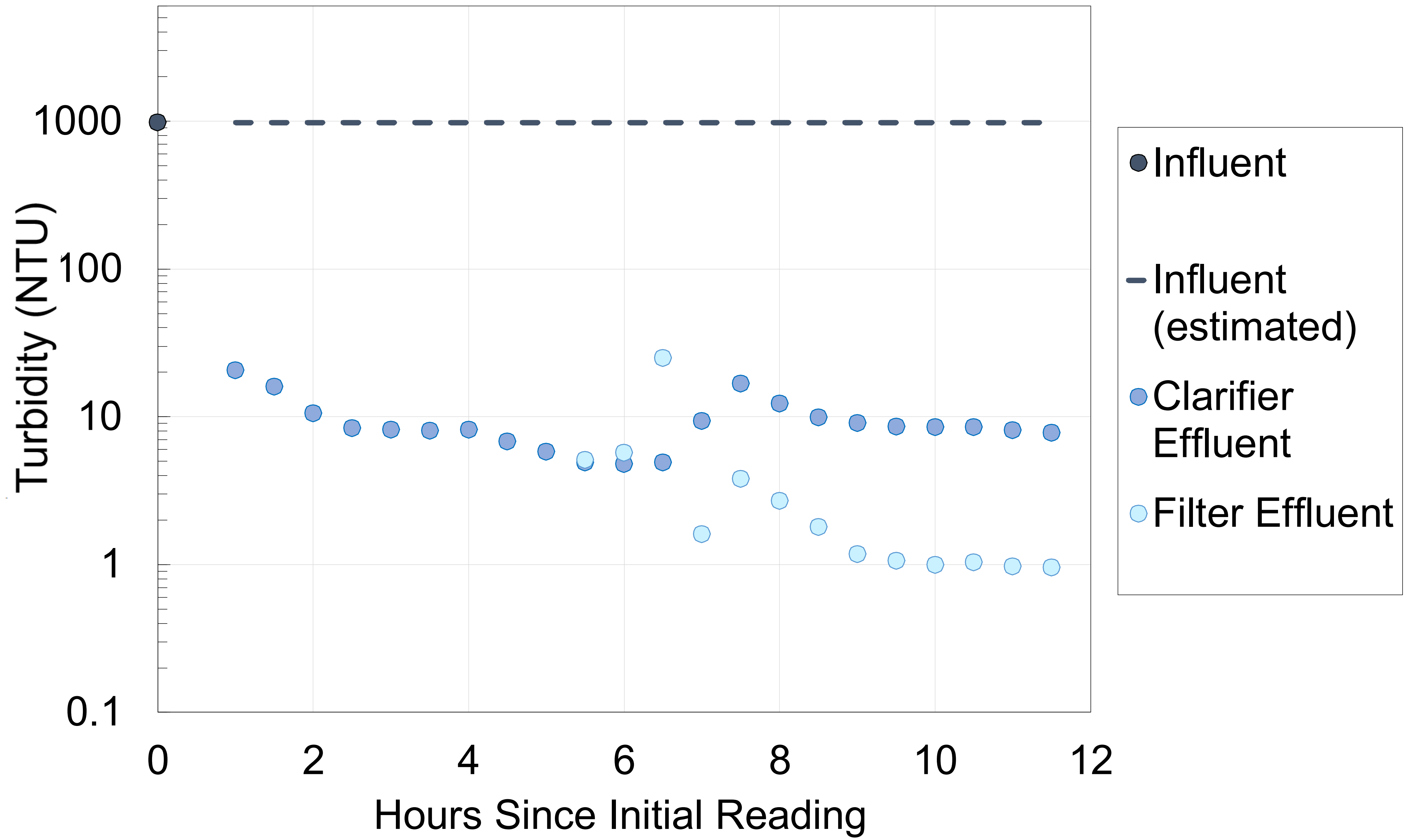
Project No. 11215702
Revision No. -
Date May 6, 2022

FIGURE 3-2

Q:\GIS\PROJECTS\11215000s\11215702\RPT006\11215702_202205_RPT006_GIS003-2.mxd

Notes:
NTU = Nephelometric Turbidity Unit

Turbidity was measured during the on-site water treatment pilot test. Real-time turbidity readings were taken for the influent, the post-clarification effluent, and the post-filtration effluent.



Paper Size ANSI B

SAN JACINTO RIVER WASTE PITS SITE
HARRIS COUNTY, TEXAS

2019 PILOT TEST
EFFLUENT TURBIDITY

Project No. 11215702
Revision No. -
Date May 6, 2022

FIGURE 3-3

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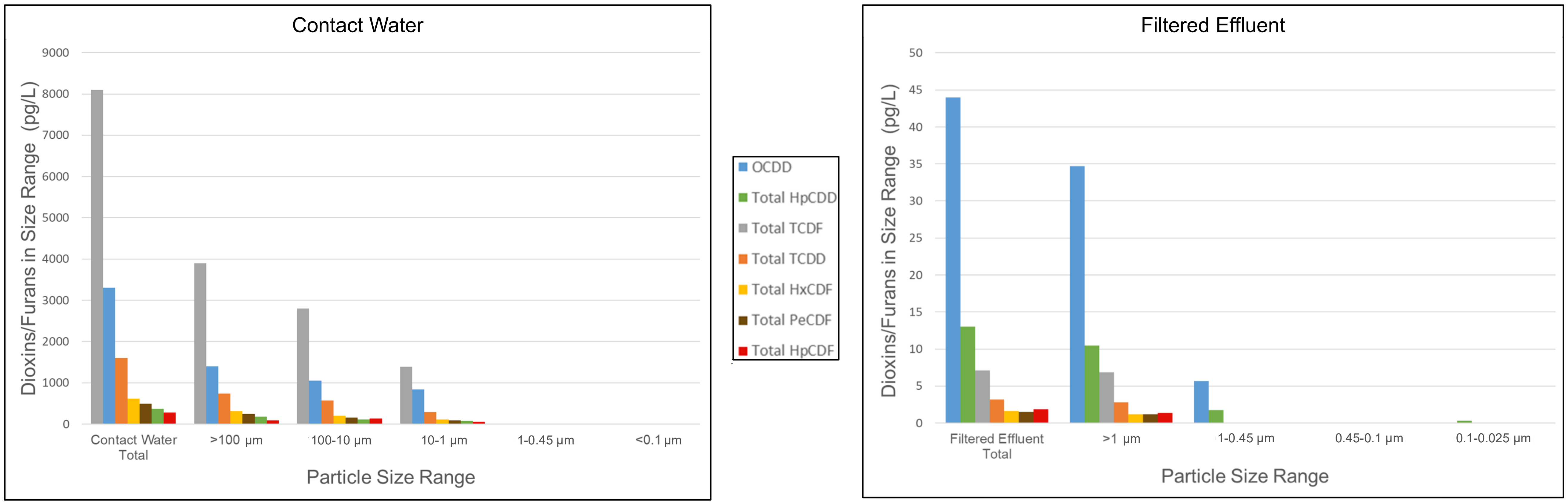
Notes:
pg/L = picogram per liter
µm = micron
TCDF =Tetrachlorodibenzofuran
OCDD = Octachlorodibenzodioxin
TCDD = Tetrachlorodibenzodioxin
HxCDF = Hexachlorodibenzofuran
PeCDF = Pentachlorodibenzofuran
HpCDD = Heptachlorodibenzodioxin
HpCDF = Heptachlorodibenzofuran

The graph on the left shows dioxin/furan results after the raw contact water was filtered through 100 µm, 10 µm, 1 µm, 0.45 µm, and 0.1 µm filters.

The graph on the right shows dioxin/furan results after the clarified and filtered effluent from the on-site pilot test was then filtered through 1 µm, 0.45 µm, 0.1 µm, 0.05 µm, and 0.025 µm filters.



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SAN JACINTO RIVER WASTE PITS SITE
HARRIS COUNTY, TEXAS

Project No. 11215702
Revision No. -
Date May 6, 2022

2019 FILTRATION TESTING RESULTS

FIGURE 3-4

Q:\GIS\PROJECTS\11215000s\11215702\RPT006\11215702_202205_RPT006_GIS003-4.mxd

Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: NAD 1983 StatePlane Texas South Central FIPS 4204 Feet

GHD

SAN JACINTO RIVER WASTE PITS SITE
HARRIS COUNTY, TEXAS

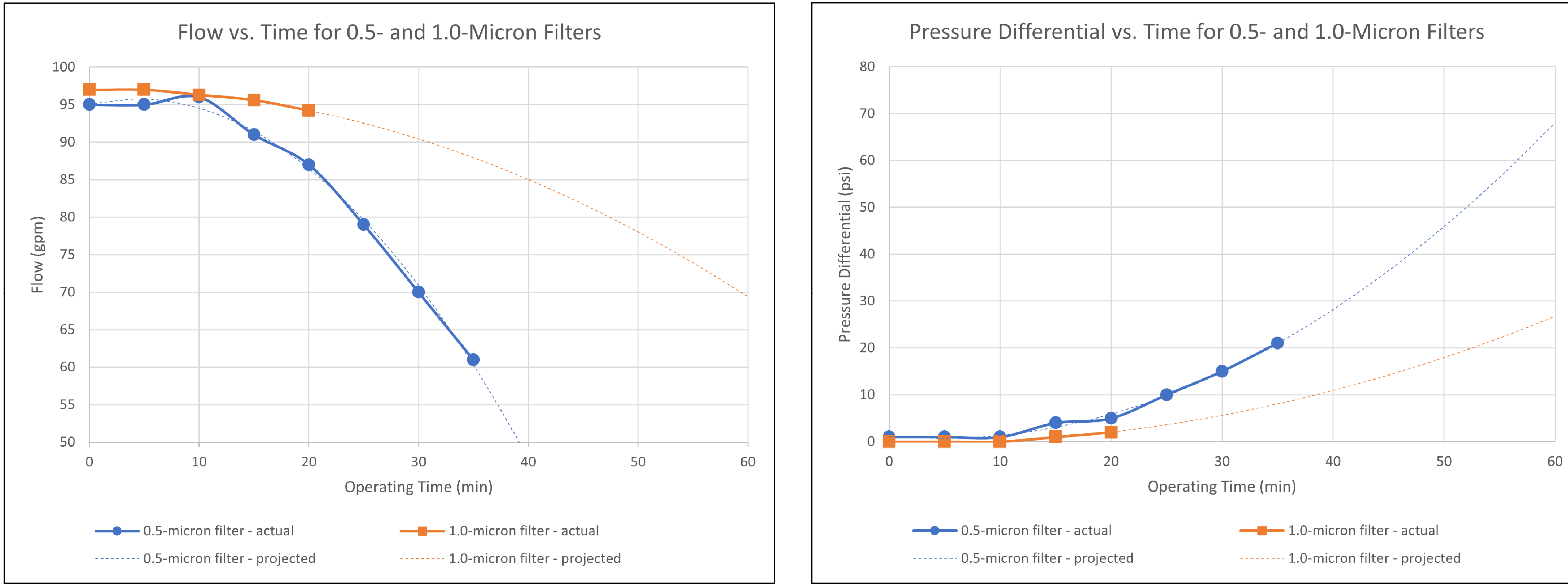
2019 ARMORED CAP MATERIAL SAMPLE LOCATIONS

Project No. **11215702**
Revision No. **-**
Date **May 11, 2022**

FIGURE 3-5

Q:\GIS\PROJECTS\11215000s\11215702\RPT006\11215702_202205_RPT006_GIS003-5.mxd

Data source: Google Earth Imagery



Notes:
- gpm = gallons per minute
- min = minutes
- psi = pounds per square inch

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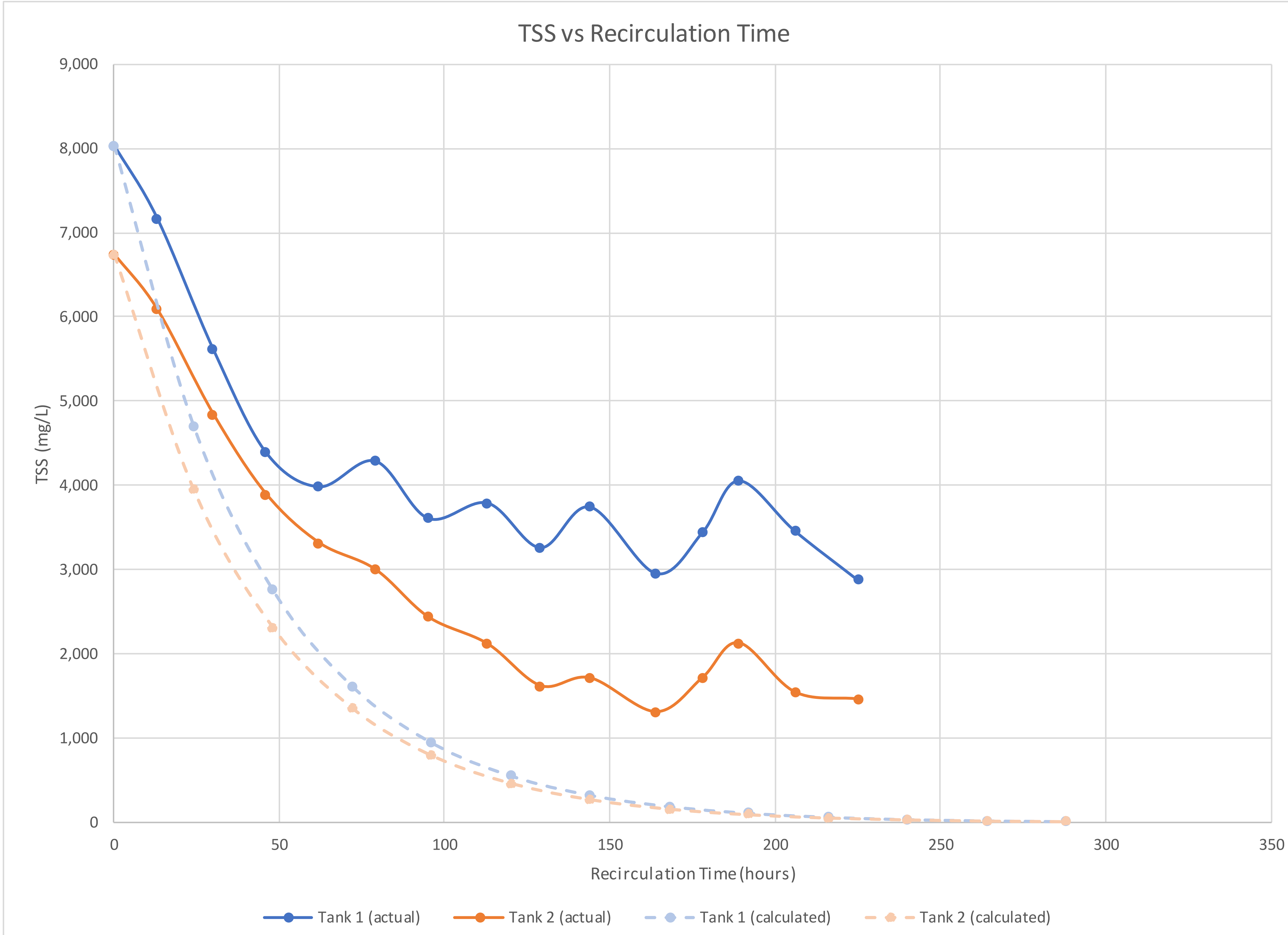
SAN JACINTO RIVER WASTE PITS SITE
HARRIS COUNTY, TEXAS

FLOW AND DIFFERENTIAL PRESSURE OVER TIME - FIELD FILTRATION TESTING

Project No. **11215702**
Revision No. **-**
Date **May 19, 2022**

FIGURE 3-6

Q:\GIS\PROJECTS\11215000s\11215702\RPT006\11215702_202205_RPT006_GIS003-6.mxd



Notes:

- TSS = total suspended solids
- mg/L = milligrams per liter
- This graph shows the TSS values after recirculation. Expected TSS values for filtrate from Tank 1 and Tank 2 were calculated based on particle size distributions prior to recirculation versus filter pore sizes used during recirculation.

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SAN JACINTO RIVER WASTE PITS SITE
HARRIS COUNTY, TEXAS

ACTUAL VERSUS EXPECTED (CALCULATED) TSS VALUES - APPROACH B FILTRATION TESTING

Project No. 11215702
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Date May 19, 2022

FIGURE 3-7

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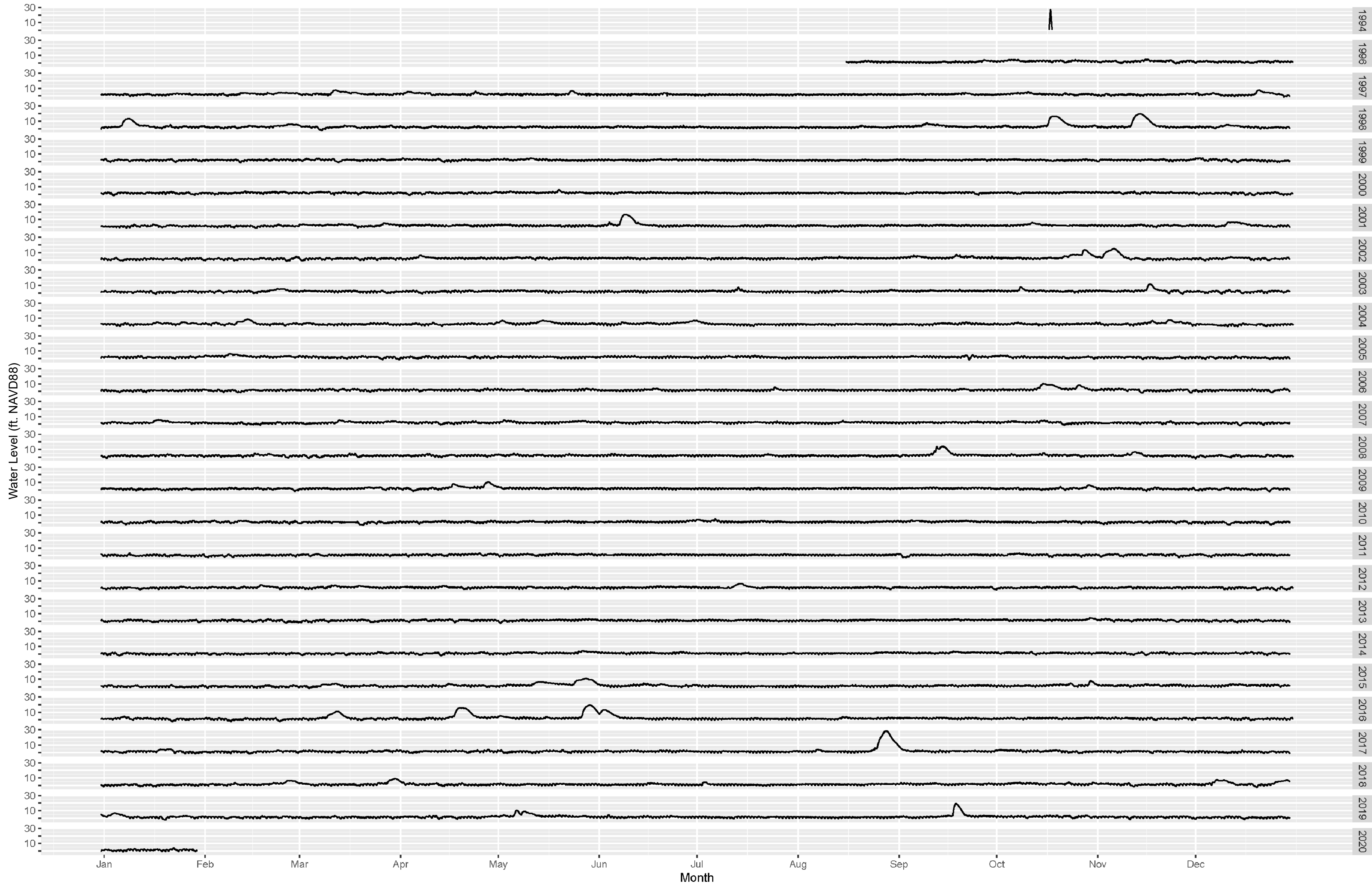

Legend

Water Surface Elevation (Feet NAVD88)

Notes:
San Jacinto River water surface elevations measured at the Sheldon Gage (USGS #08072050)

NAVD88 = North American Vertical Datum of 1988

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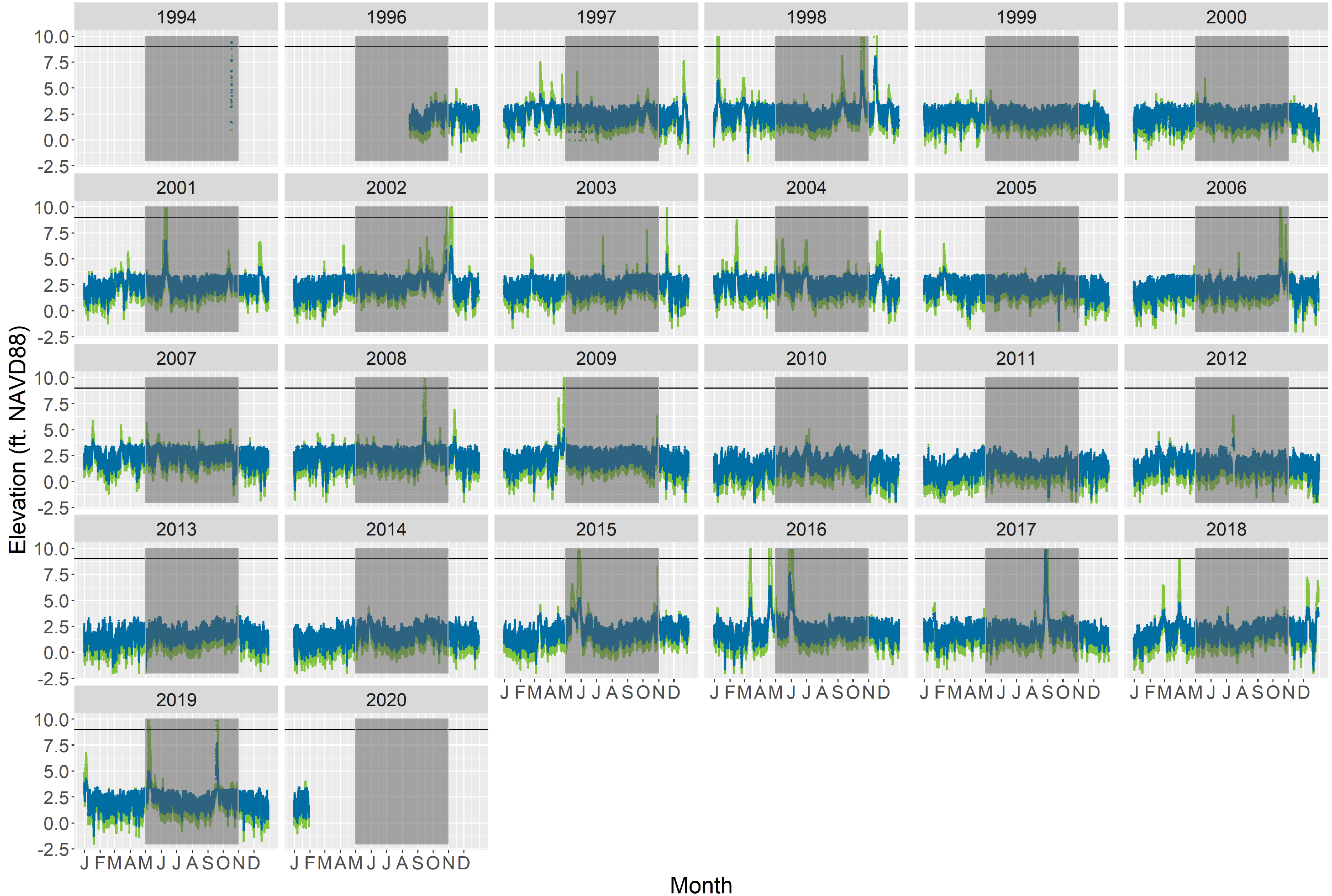
SAN JACINTO RIVER WASTE PITS SITE
HARRIS COUNTY, TEXAS

HISTORICAL RIVER ELEVATIONS - SHELDON GAGE

Project No. 11215702
Revision No. -
Date May 6, 2022

FIGURE 5-1

Q:\GIS\PROJECTS\11215000s\11215702\RPT006\11215702_202205_RPT006_GIS005-1.mxd



Legend

- Top of BMP
- Northern Impoundment Water Surface (Hindcasted)
- Sheldon Gage Water Surface (Measured)
- Non-Excavation Season (November through April)

Notes:
San Jacinto River water surface elevations measured at the Sheldon Gage (USGS #08072050)

NAVD88 = North American Vertical Datum of 1988

San Jacinto River water surface data at the Northern Impoundment based upon data obtained from a transducer installed in the river on the west side of the Northern Impoundment in July, 2019

BMP = Best Management Practice (ie: cofferdam or sheetpile wall)"

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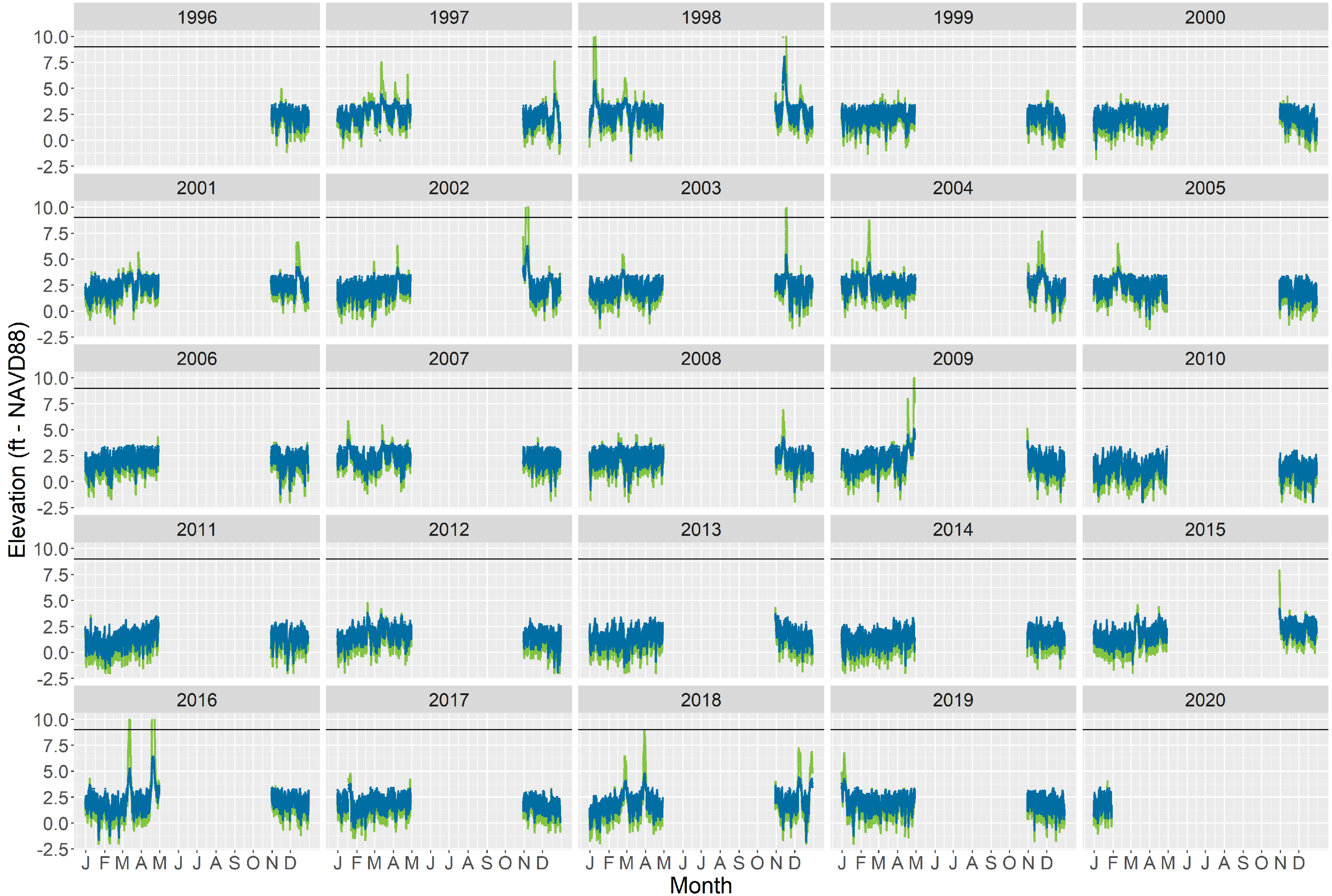
SAN JACINTO RIVER WASTE PITS SITE
HARRIS COUNTY, TEXAS

HINDCASTED WATER SURFACE ELEVATIONS - YEAR ROUND

Project No. 11215702
Revision No. -
Date May 6, 2022

FIGURE 5-2

Q:\GIS\PROJECTS\11215000s\11215702\RPT006\11215702_202205_RPT006_GIS005-2.mxd



Legend

- Top of BMP
- Northern Impoundment Water Surface (Hindcasted)
- Sheldon Gage Water Surface (Measured)

Notes:
San Jacinto River water surface elevations measured at the Sheldon Gage (USGS #08072050)

NAVD88 = North American Vertical Datum of 1988

San Jacinto River water surface data at the Northern Impoundment based upon data obtained from a transducer installed in the river on the west side of the Northern Impoundment in July, 2019

BMP = Best Management Practice (ie: cofferdam or sheetpile wall)"

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SAN JACINTO RIVER WASTE PITS SITE
HARRIS COUNTY, TEXAS

HINDCASTED WATER SURFACE ELEVATIONS - NOVEMBER TO APRIL

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Date May 6, 2022

FIGURE 5-3

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