



**Subject: Final Minutes, Quarterly Restoration Advisory Board (RAB) Meeting
Longhorn Army Ammunition Plant (LHAAP)**

Location of Meeting: Karnack Community Center, Karnack, Texas

Date of Meeting: April 25, 2019, 5:00-5:40 PM Central Daylight Time (CDT)

Meeting Participants:

Army BRAC: Rose M. Zeiler
USACE: Aaron Williams and John Doran
USAEC: Andrew Maly
USGS: Kent Becher
Bhate: Kim Nemmers
APTIM: William (Bill) Foss
USEPA Region 6: Rich Mayer, Dorelle Harrison, and Janetta Coats
TCEQ: April Palmie
USFWS: Eric Duerkop
RAB: Present: Judy VanDeventer, Paul Fortune, Carol Fortune, Charles Dixon,
and Richard LeTourneau
Absent: Terry Britt; John Pollard, Jr.; Tom Walker; and Nigel R. Shivers
Public: Laura-Ashley Overdyke (Executive Director of the Caddo Lake Institute
[CLI]), George Rice (CLI), John Fortune (New RAB Member), Sharron
McAvoy (New RAB Member), Deon Hall (New RAB Member) Brad Eskue,
Robert Speight, and James Saunders

An agenda for the RAB meeting, a color copy of the Bhate Environmental Associates, Inc. (Bhate) slide presentation, and handouts (see list at end of meeting minutes) were provided for meeting attendees.

Welcome and Introduction

Mr. Paul Fortune, RAB Installation Co-Chair, called the RAB meeting to order at 5:05 pm CDT. Mr. Fortune welcomed everyone and asked if there was anyone present that had not attended before. Mr. Aaron Williams stated that Mr. John Doran was new to the RAB Meeting. Mr. Doran stated that he was with the United States Army Corps of Engineers (USACE) and was assisting Mr. Williams on the project and had been with the USACE for about 6 months.

Ms. Rose M. Zeiler welcomed everyone and explained the purpose of the RAB meeting. Ms. Zeiler explained that the meeting is held every 3 months and then presented the mission for the RAB. Ms. Zeiler stated that it is important for everyone to ask questions or provide comments and that you can just raise your hand or speak up when you need to.

Administrative

Ms. Zeiler stated that there are three RAB applicants, who were John Fortune, Sharron McAvoy, and Deon Hall. Ms. Zeiler stated that ballots should have been handed out to RAB members. Ms. Zeiler emphasized how great it was that there were three applicants. Ms. Zeiler then explained that the charter calls for a vote and requires a 2/3 majority for approval. Two of the three



applicants were present and were asked to stand up. Mr. Hall was not present. Mr. John Fortune was one of the interested RAB members and explained that he had grown up in Karnack, worked at the Army Ammunition Plant for Thiokol and had recently moved back and wanted to participate. Ms. Sharron McAvoy stated her interest in environmental protection and that she was a member of the Sierra Club. Ms. Zeiler asked for the votes to be handed to her during the meeting. **Note:** votes were tallied by Mr. Paul Fortune and Ms. Zeiler at the end of the RAB Meeting, when it was announced that each of the three applicants were approved as new RAB members.

Open Items

Ms. Zeiler noted that the RAB Meeting minutes had been sent out in November 2018. Ms. VanDeventer made a motion to accept the October 2018 RAB Meeting minutes. Mr. Fortune seconded the motion. (**Note:** no meeting was held in January 2019 due to the partial Government shutdown).

Ms. Zeiler then reminded everyone of the ongoing outreach with the website address listed in the slide packet. Ms. Zeiler stated that the meeting minutes, ongoing activities, and information by site are on the website as well as the administrative record.

Defense Environmental Restoration

Ms. Kim Nemmers reminded everyone that copies of the slides were available and that Bhate's role was to manage most of the sites as a contractor with the exception of LHAAP-29, LHAAP-18/24, and LHAAP-47. Ms. Nemmers then pointed out the slide with the acronyms and reviewed the agenda for the meeting. Ms. Nemmers then stated that three sites will be discussed by Mr. Bill Foss.

LHAAP-03

Mr. Foss provided an update on LHAAP-03, which was discussed about a year ago. Mr. Foss stated that LHAAP-03 is a very small site that was a former waste collection pad outside of the paint shop building. Site soils are contaminated with lead and arsenic. The Record of Decision (ROD) selected a remedy of excavation. Mr. Foss explained that additional soil samples were collected in November 2018 to both narrow down what area needed to be excavated and to determine if lateral or vertical delineation could be achieved to eliminate some of the confirmation sampling following excavation. Mr. Foss stated that a Remedial Design (RD)/ Remedial Action Work Plan (RAWP) was prepared using the older data and the data collected in November 2018. The RD/RAWP is currently in Army review. Mr. Foss stated that the plan is to excavate in late summer/early fall 2019. Mr. Foss explained that the map shows the area of excavation but noted that the scale makes it look like a large area. Mr. Foss also pointed out that much of the excavation is only down to 2 to 3 feet below ground surface (bgs). Mr. Foss explained that the yellow dots were the November 2018 samples.

LHAAP-04

Mr. Foss stated that LHAAP-04 is the location of a former pilot Wastewater Treatment Plant. In 1997, the structures were demolished. Then soil excavation was completed in 2009 for mercury and perchlorate contamination. The ROD selected a remedy for perchlorate treatment. Mr. Foss



explained that the first thing completed under Bhate's contract was to install monitoring wells and collect samples. The results indicated that the plume appeared to have shifted. So, the Army provided a scope of work to complete additional sampling. Mr. Foss explained that the plume used to be centered around monitoring well 04WW04. However, 04WW05 had perchlorate detections that increased. So, this indicated that the plume may have shifted to the west. The yellow circles are the additional data collected via direct push technology to evaluate the lithology and grab a groundwater sample. Then three new wells were installed based upon the data (04WW09, 04WW10, and 04WW11). The center of the mass of the plume did shift and this information was used to develop the RD. Mr. Foss explained that the RD will use in-situ bioremediation (ISB) which uses bacteria to degrade the contaminants. Mr. Foss explained that 25 direct push points will be advanced to allow for a little over 1,400 gallons of injectate (emulsified vegetable oil [EVO], nutrients, and water) to be added. Monitoring will be completed to evaluate the injections and RD. Land use controls (LUCs) will also be monitored which basically does not allow for groundwater use except for the environmental groundwater sampling. LUCs also restrict land use to prevent residential use. Mr. Foss then showed the location of the injection points and pointed out that the target area is where the contamination is 5 times the cleanup level (hot spot) and then there are a few locations to the south and west based upon the known plume migration. Mr. Foss stated that the RD was approved so the plan is to do the work in June or July 2019. Mr. Richard LeTourneau asked about backfilling. Mr. Foss stated that the site will be backfilled with soil that is either certified clean or sampled for offsite laboratory analysis to verify that the soil does not contain any contaminants above cleanup levels. Ms. Zeiler stated that this site had a substantial excavation previously.

LHAAP-17

Mr. Foss explained that LHAAP-17 was a former burning ground and flashing ground near the groundwater treatment plant (GWTP) and site LHAAP-18/24. The site was used for burning of TNT and flashing of powder. The waste was removed in the 1980s but contamination remains. Mr. Foss explained that the contaminants are mostly explosives, perchlorate, and solvents. The ROD that was signed in 2016 included groundwater extraction for the large perchlorate plume that has concentrations that are restrictive to natural attenuation. Mr. Foss explained that soil excavation of the explosives contaminated area will also be completed. Monitoring will be completed to evaluate the remedy, and LUCs will remain. Ms. Zeiler stated that there is a contingent remedy. Mr. Foss stated that the contingent remedy will apply if the reduction of perchlorate has not occurred in 18 months and includes another active remediation ahead of monitored natural attenuation.

Mr. Foss stated that previously the presentations at the RAB included a briefing on the pre-design investigation that included an aquifer pumping test and soil and groundwater sampling. The pumping test provided the basis for the type of system to install. The soil sampling provided the extent of soil requiring excavation. Based upon that information, the RD includes approximately 5,300 cubic yards of soil that is mostly 2 to 3 feet bgs. The excavation depth will be controlled by groundwater depth because soil excavation will not extend into the groundwater, which is expected to be at 7 feet bgs. Groundwater extraction will include up to three wells and will run for 18 months. The extracted groundwater will be piped to the GWTP. The contingent remedy



will be used if the perchlorate remains above 20,000 parts per million (ppm) following the extraction for 18 months. Mr. Foss explained that monitoring of the remedy will be completed and that LUCs will be in place. Mr. Foss stated that the LUCs prohibit groundwater use and limit site usage due to the perchlorate.

Mr. Foss explained the slide with the soil excavations. Mr. Foss stated that the areas furthest out from the site boundary were being excavated due to ecological concerns. The other deeper areas are due to explosives such as TNT. Mr. Foss then pointed out the deeper areas that were determined based upon the historic data as well as the newer data collected. Mr. Foss then showed the potential wells that will be used for groundwater extraction. Mr. Foss stated that wells 17WW02 and 17WW06 will be used for extraction. Groundwater results from 17WWW01 will determine if that well is brought online for extraction also. Mr. Foss explained the purple line is the current perchlorate plume.

Overview of Sites

Ms. Zeiler explained that several remedies are being implemented this summer. Mr. Foss stated that the areas need to dry-up following all the rain this winter/spring. Ms. Zeiler stated that the website would have a schedule of the work.

Ms. Nemmers explained that field work is completed, and then a report is prepared with that information. Also, remedial action operation (RA-O) sampling is completed semi-annually at a minimum. Ms. Nemmers explained that RA-O sampling is primarily sampling of monitoring wells to evaluate the remedy once it is in place. Ms. Nemmers stated that the ion exchange vessels at the GWTP were replaced and that the ion exchange is used to ensure that there is no perchlorate in the GWTP effluent.

Ms. Nemmers stated that the ongoing documents include the RD/RAWP for LHAAP-03 that Mr. Foss discussed. Ms. Nemmers stated that even though quite a bit of sampling has occurred, the list of documents for the sites are minimal because the reports are not written until additional sampling events are completed.

For the 3 month look ahead, Ms. Nemmers presented the four sites planned for field work (LHAAP-03, LHAAP-04, LHAAP-16, and LHAAP-17) in July or August and explained soil excavation will be conducted at two of the sites (LHAAP-03 and LHAAP-17). Ms. Nemmers explained that the schedule will be dependent upon the weather and that work will be moved up if possible.

Groundwater Treatment Plant

Ms. Nemmers stated that there were handouts with the information on the slides for the GWTP as well as handouts for the RDs of LHAAP-04 and LHAAP-17. Ms. Nemmers stated that the chart had a couple of dips since that last RAB meeting, which is due to power issues to the GWTP. Currently, the GWTP is on a generator. Ms. Judy VanDeventer asked if the site used Southwestern Electric Power Company (SWEPCO) to which Ms. Nemmers stated that the GWTP does use SWEPCO. Ms. VanDeventer pointed out that there has been power loss more frequently as of late from SWEPCO. Ms. Nemmers stated that the site has not been affected recently because it is pulling its power from the generator. Ms. Nemmers then pointed out that you will



see a big jump in water processed the next month following power outage because the GWTP operators are working to fix pumps and motors while the GWTP is not operating.

Surface Water Sampling

Ms. Nemmers presented the five locations sampled for surface water and stated that results are usually non-detect and well below the action level.

LHAAP-18/24, LHAAP-29 and LHAAP-47

Mr. Williams explained that a separate contractor, HDR, is responsible for developing the Proposed Plan (PP) for the preferred remedy followed by the ROD for LHAAP-18/24, LHAAP-29, and LHAAP-47. For LHAAP-18/24, the PP was finalized in February and the public meeting is after the RAB meeting. Mr. Williams encouraged everyone to stay stating that LHAAP-18/24 is considered to be the most contaminated site at Longhorn. Mr. Williams stated that the comment period goes through May 2, 2019. Mr. Williams stated that the expectation is to have the ROD drafted by September 2019. Ms. Zeiler then stated that no comments had been received yet.

Mr. Williams explained that the LHAAP-29 PP was finalized and the public meeting was held in December 2018. The ROD has been submitted to the regulators for review.

Mr. Williams stated that the LHAAP-47 Post-Screening Investigation data had been shared at the last RAB meeting in October 2018. Mr. Williams explained that many of the shallow wells are now dry and thus the plume has shrunk. In the intermediate wells, there are somewhat higher hits but overall the remedy remains the same. Therefore, Mr. Williams stated that the remedy remains the same and so a revision to the Draft Final ROD is being prepared for submittal to the regulators in August 2019.

Mr. Williams stated that in addition to the PP that is online you can also review the Final Revised Feasibility Study (FS) that details all of the remedial alternatives evaluated for LHAAP-18/24. The FS is in the administrative record.

Mr. Williams stated that some surface water sampling needed to be completed for LHAAP-47, which was completed in March 2019. The results are either non-detect or below the cleanup levels.

Next RAB Meeting Schedule and Closing Remarks

Ms. Zeiler then discussed the next meeting with the RAB members. It was decided that the next RAB Meeting will be held on **July 25, 2019**, with the **meeting starting at 6:00 pm CDT** at the Karnack Community Center.

Adjourn

Ms. VanDeventer made the motion to adjourn, and Mr. Paul Fortune seconded the motion. The meeting adjourned at 5:41 pm CDT.



April 2019 Meeting Attachments and Handouts:

- Meeting Agenda
- Color Copy of Bhate Presentation Slides
- Groundwater Treatment Plant (GWTP) – Processed Groundwater Volumes Handout
- Surface Water Sampling Handout
- Remedial Design Handout for LHAAP-17 and LHAAP-04



LONGHORN ARMY AMMUNITION PLANT
RESTORATION ADVISORY BOARD

Karnack, Texas
(479) 635-0110

AGENDA

DATE: Thursday, April 25, 2019
TIME: 5:00 – 6:00 PM
PLACE: Karnack Community Center, Karnack, Texas

05:00 Welcome and Introduction

05:05 Open Items {RMZ}

- Purpose of the RAB Meeting
- RAB Administrative Issues
 - o RAB Applicants
 - o Minutes (October 2018 RAB Meeting)
- Ongoing Outreach/Website

05:15 Defense Environmental Restoration Program (DERP) Update {Bhate}

- LHAAP-03 Field Work Status Update
- LHAAP-04 Field Work Status Update
- Documents and Field Work Completed since last RAB
- Three Month Lookahead
- Groundwater Treatment Plant (GWTP) Update

05:45 Other Defense Environmental Restoration Program (DERP) Update {RMZ}

- LHAAP-18/24 Proposed Plan
- LHAAP-29 Record of Decision and Responsiveness Summary
- LHAAP-47 Pre-Screening Investigation (PSI) Update
- Five Year Review Update

05:55 Next RAB Meeting Schedule and Closing Remarks {RMZ}

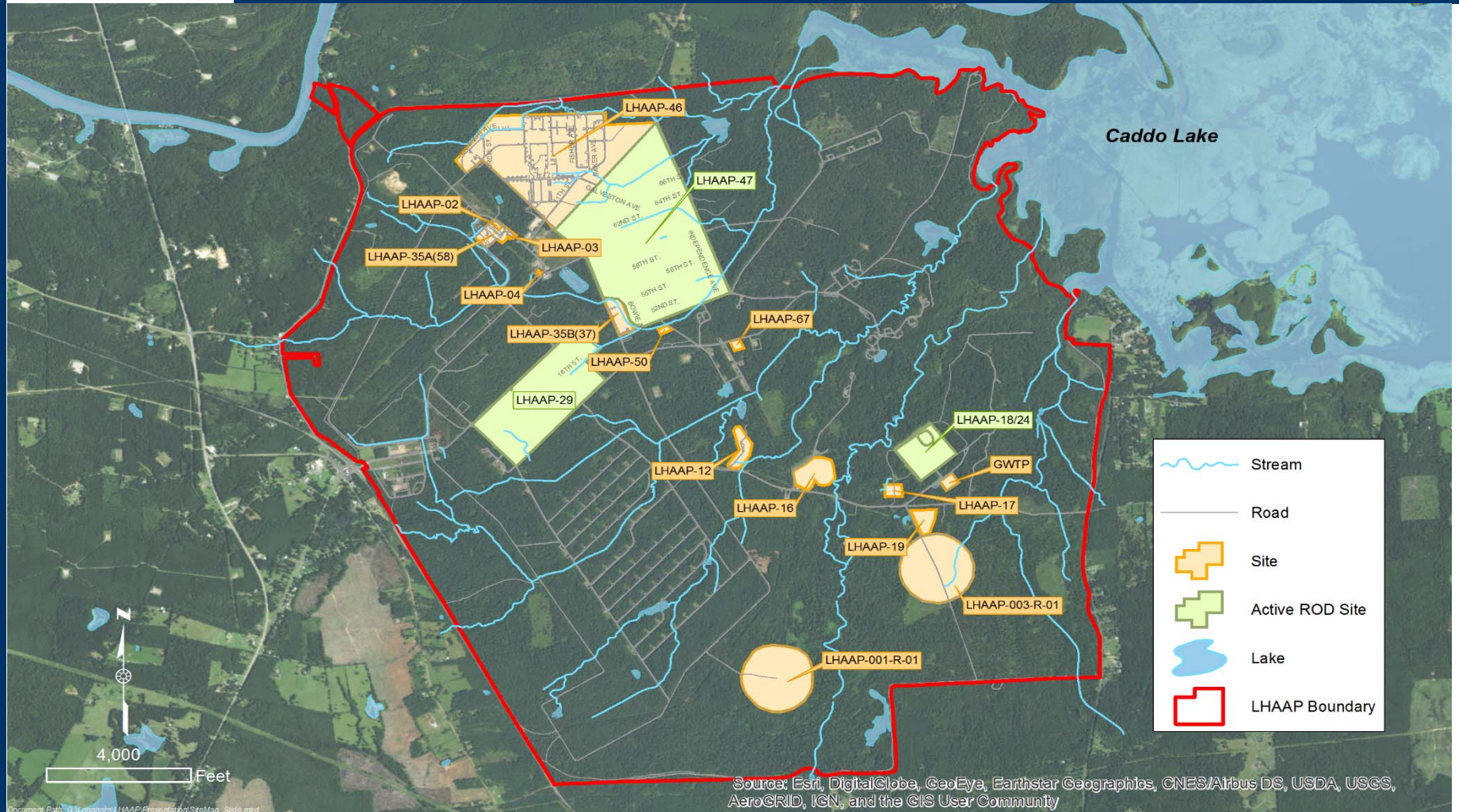
Longhorn Army Ammunition Plant Quarterly Restoration Advisory Board Meeting

Karnack Community Center
April 25, 2019
5:00 PM CDT



Restoration Advisory Board Meeting

Site Map



Restoration Advisory Board Meeting

Abbreviations and Acronyms

µg/L	Micrograms per liter
DERP	Defense Environmental Restoration Program
ECP	Environmental Condition of Property
EISB	Enhanced In-situ Bioremediation
FBR	Fluidized Bed Reactor
ft bgs	Feet below ground surface
GWTP	Groundwater Treatment Plant
ISB	In-Situ Bioremediation
LHAAP	Longhorn Army Ammunition Plant
LUC	Land Use Control
MNA	Monitored natural attenuation

PCL	Protective Concentration Level
PDI	Pre-Design Investigation
PSI	Pre-Screening Investigation
RAB	Restoration Advisory Board
RA(O)	Remedial Action Operation
RAWP	Remedial Action Work Plan
RD	Remedial Design
ROD	Record of Decision
TCEQ	Texas Commission on Environmental Quality
TRRP	Texas Risk Reduction Program
USEPA	U.S. Environmental Protection Agency
VOCs	Volatile organic compounds

Restoration Advisory Board Meeting

Agenda

- 05:00** Welcome and Introduction
- 05:05** Open Items {RMZ}
- Purpose of the Restoration Advisory Board (RAB) Meeting
 - RAB Administrative Issues
 - RAB Applicants
 - Minutes (October 2018 RAB Meeting)
 - Ongoing Outreach/Website
- 05:15** Defense Environmental Restoration Program (DERP) Update {Bhate}
- LHAAP-03 Field Work Status Update
 - LHAAP-04 Field Work Status Update
 - LHAAP-17 Remedial Design Update
 - Documents and Field Work Completed Since Last RAB
 - Three Month Look Ahead
 - Groundwater Treatment Plant (GWTP) Update
- 05:45** Other DERP Update {AW}
- LHAAP-18/24 Proposed Plan
 - LHAAP-29 Record of Decision (ROD) and Responsiveness Summary
 - LHAAP-47 Pre-Screening Investigation (PSI) Update
 - Five Year Review Update
- 05:55** Next RAB Meeting Schedule and Closing Remarks {RMZ}

Restoration Advisory Board Meeting

Purpose of the RAB Meeting

- Held every 3 months
- The mission of the Longhorn Army Ammunition Plant (LHAAP) RAB is to promote community awareness and obtain constructive community review and comments on environmental restoration activities at the former LHAAP

Restoration Advisory Board Meeting

The Army Wants You to be Informed

- **The Army is committed to protecting human health and the environment; key to that commitment is engaging the community and increasing public participation in environmental restoration at LHAAP**
- **You are encouraged to:**
 - **Attend RAB Meetings and/or become a member of the RAB**
 - **Visit the Longhorn environmental website at www.longhornaap.com**
 - **Website is regularly updated to indicate the upcoming field events at each site including groundwater sampling, monitoring well installations, soil sampling, or remediation activities**
 - **Make suggestions for improving communication – the Army welcomes and appreciates community feedback**

Restoration Advisory Board Meeting

RAB Administrative Issues

- RAB Membership
- Discussion of October 2018 RAB Meeting minutes/motion to accept



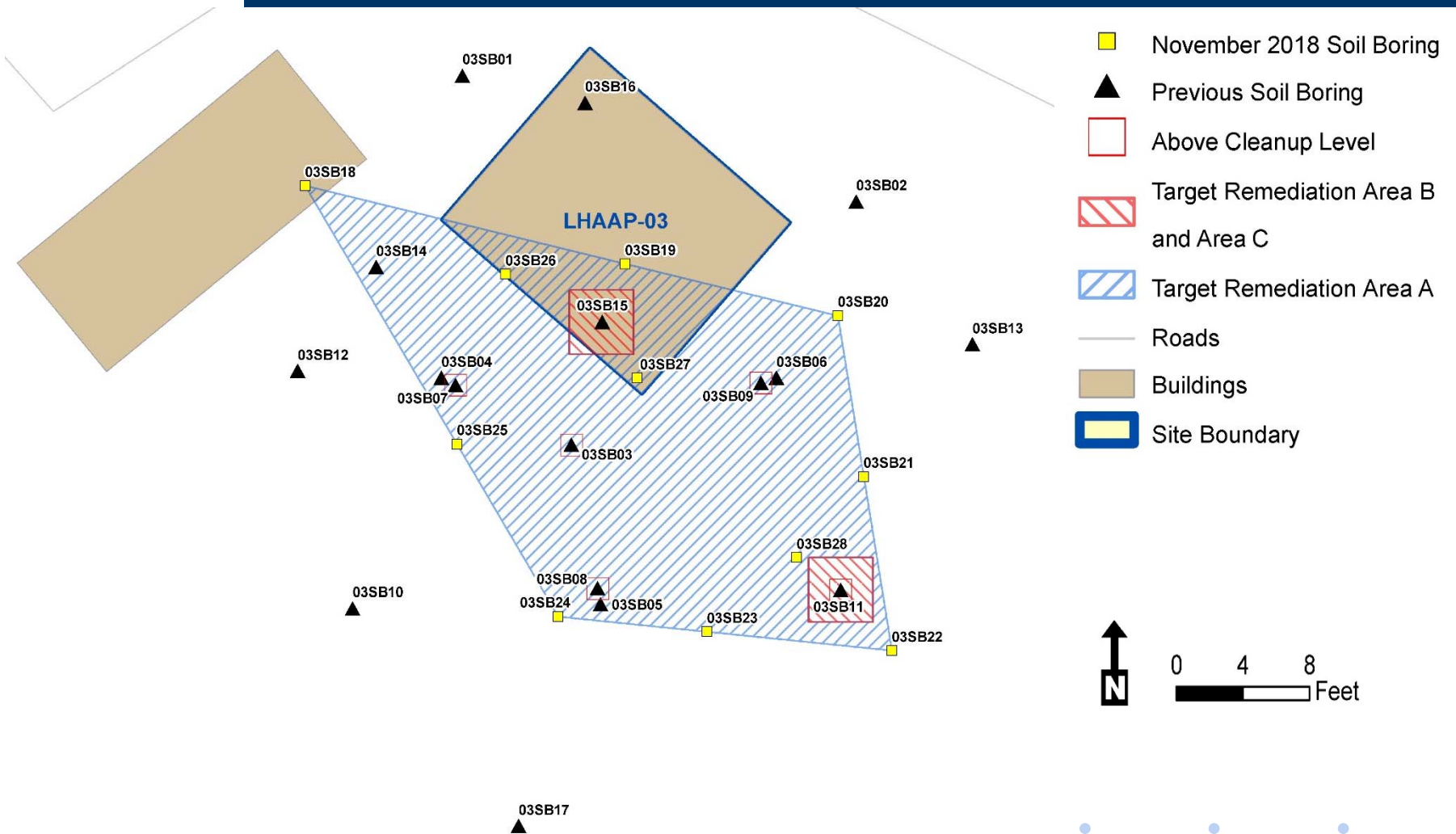
Restoration Advisory Board Meeting

LHAAP-03 Pre-Excavation Soil Sampling

- **Site Background**
 - LHAAP-03 is the site of a former Waste Collection Pad for the Building 722-P Paint Shop
 - Building 722-P and the surrounding structures have been demolished
 - Soil is contaminated with arsenic and lead at concentrations that could be a risk to groundwater and the ROD selected excavation and offsite disposal as the remedy
 - Groundwater is being addressed as part of site LHAAP-35A(58)
- **Recent Activities**
 - Pre-excavation soil samples were collected in late November 2018 from locations surrounding the excavation area defined in the ROD
 - Samples were used to better define the area where excavation is required
 - Soil sample data will be included in the Remedial Design (RD) and Remedial Action Work Plan (RAWP)
 - RD/RAWP is currently in preparation for submittal to the U.S. Environmental Protection Agency (USEPA) and Texas Commission on Environmental Quality (TCEQ)

Restoration Advisory Board Meeting

LHAAP-03 Pre-Excavation Soil Sampling



Restoration Advisory Board Meeting

LHAAP-04 Remedial Design

- **Site Background**
 - LHAAP-04 is the site of the former Pilot Wastewater Treatment Plant, located near the former Fire Station
 - Demolition of the structures and disposal of associated wastes was conducted in 1997
 - Soil contaminated with mercury and perchlorate was excavated in 2009
 - The ROD published in October 2016 selected In-Situ Bioremediation (ISB), Long-Term Monitoring, and Land Use Controls (LUCs) as the remedy for groundwater
- **Recent Activities**
 - Groundwater sampling in January 2018 revealed that the groundwater plume may have migrated since the previous sampling in 2010-2011
 - Additional direct-push groundwater sampling was performed in November-December 2019 and additional monitoring wells were installed in January 2019
 - January 2019 sampling of the new and existing wells confirmed that the plume had migrated slightly to the southwest, but is still adequately delineated

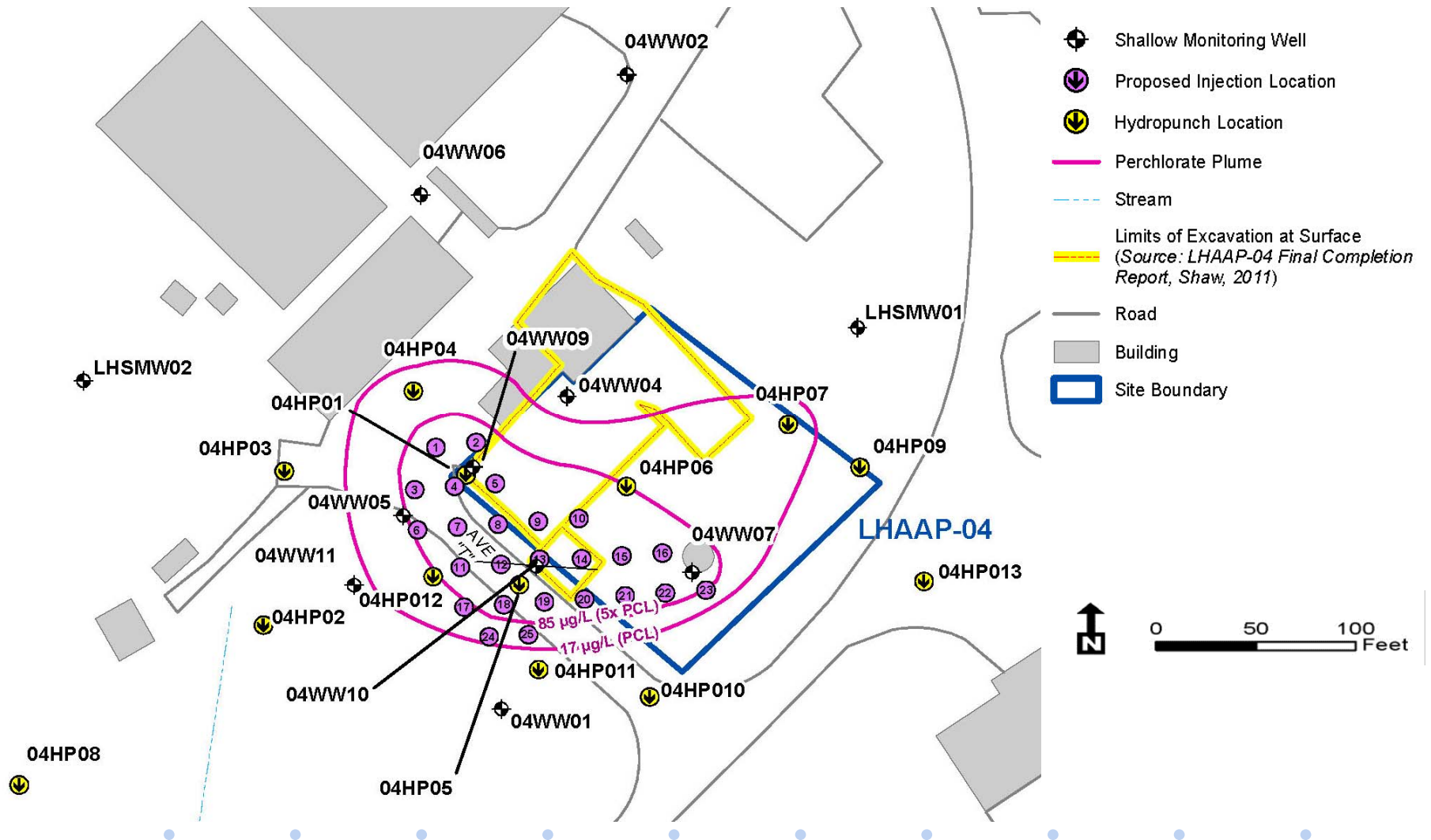
Restoration Advisory Board Meeting

LHAAP-04 Remedial Design

- **Remedial Design**
 - ISB will be implemented for the hot-spot defined as 5 times the Texas Risk Reduction Program (TRRP) Protective Concentration Level (PCL) for Residential Groundwater (17 micrograms per liter [$\mu\text{g}/\text{L}$])
 - 25 direct push injection locations will be used to inject emulsified vegetable oil (EVO)
 - Each location will receive approximately 15 gallons of EVO, 6 gallons of nutrients, and 1,463 gallons of water to treat a radius of approximately 10 feet around the location
 - Injection grid is spaced approximately 20-25 feet apart and shifted slightly to the south and west to account for future migration of the plume
- **Long-Term Monitoring and LUCs**
 - Baseline sampling of all site wells prior to injections, quarterly sampling for the first 2 years, semi-annual sampling for years 3 through 5, and annual sampling thereafter
 - LUCs include prohibition on use of groundwater (except for environmental monitoring), restriction to non-residential land use, and maintenance of remediation and monitoring systems
 - LUCs will remain in place until the concentration of perchlorate allows for unrestricted use and unlimited exposure

Restoration Advisory Board Meeting

LHAAP-04 Injection Plan



Restoration Advisory Board Meeting

LHAAP-17 Remedial Design

- **Site Background**
 - LHAAP-17 is the site of the former Burning Ground No. 2/Flashing Ground used from 1959 to 1980 for burning of bulk TNT, photo flash powder, and reject material from Universal Match Corporation
 - Waste material was reportedly removed from the burning trenches in 1984
 - Contaminants include explosives and metals in soil, and perchlorate and chlorinated solvents in groundwater
 - The ROD published in August 2016 selected Groundwater Extraction, Monitored Natural Attenuation (MNA), Soil Excavation, Long-Term Monitoring, and LUCs as the remedy
- **Recent Activities**
 - Pre-Design Investigation (PDI) (aquifer pumping test and soil and groundwater sampling) conducted in January 2018
 - Groundwater sampling to assess current plume conditions
 - Soil sampling refined the extent of the soil contamination requiring excavation
 - Aquifer pumping test provided design basis for the groundwater extraction system design

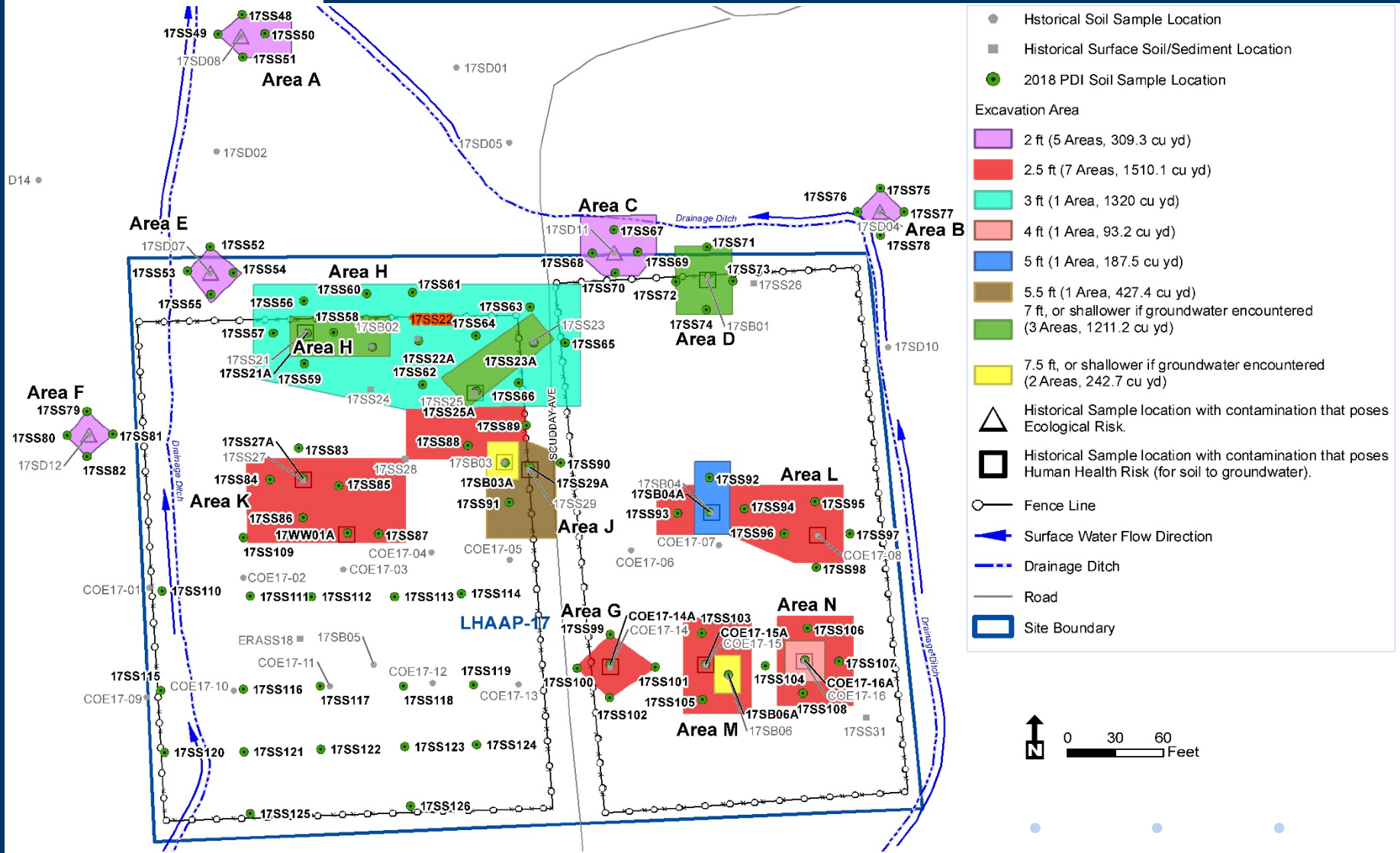
Restoration Advisory Board Meeting

LHAAP-17 Remedial Design

- **Remedial Design**
 - Approximately 5,300 in-place cubic yards of soil will be excavated based on the previous soil sampling data and transported to an offsite licensed disposal facility
 - Excavation will be backfilled with clean soil once sampling confirms contaminated soil has been removed
 - Groundwater extraction will be conducted for 18 months in up to three wells to reduce perchlorate concentrations to less than 20,000 $\mu\text{g/L}$
 - MNA will be the remedy for chlorinated solvents and perchlorate in groundwater unless perchlorate remains above 20,000 $\mu\text{g/L}$
- **Long-Term Monitoring and LUCs**
 - Extraction: Baseline sampling prior to extraction, monthly sampling for first 6 months of extraction, quarterly sampling for last 12 months of extraction
 - MNA: quarterly sampling for the first 2 years, semi-annual sampling for years 3 through 5, and annual sampling thereafter
 - LUCs include prohibiting use of groundwater (except for environmental monitoring), restricting land use to non-residential, and maintaining remediation/monitoring systems
 - LUCs will remain in place until the concentration of perchlorate allows for unrestricted use and unlimited exposure

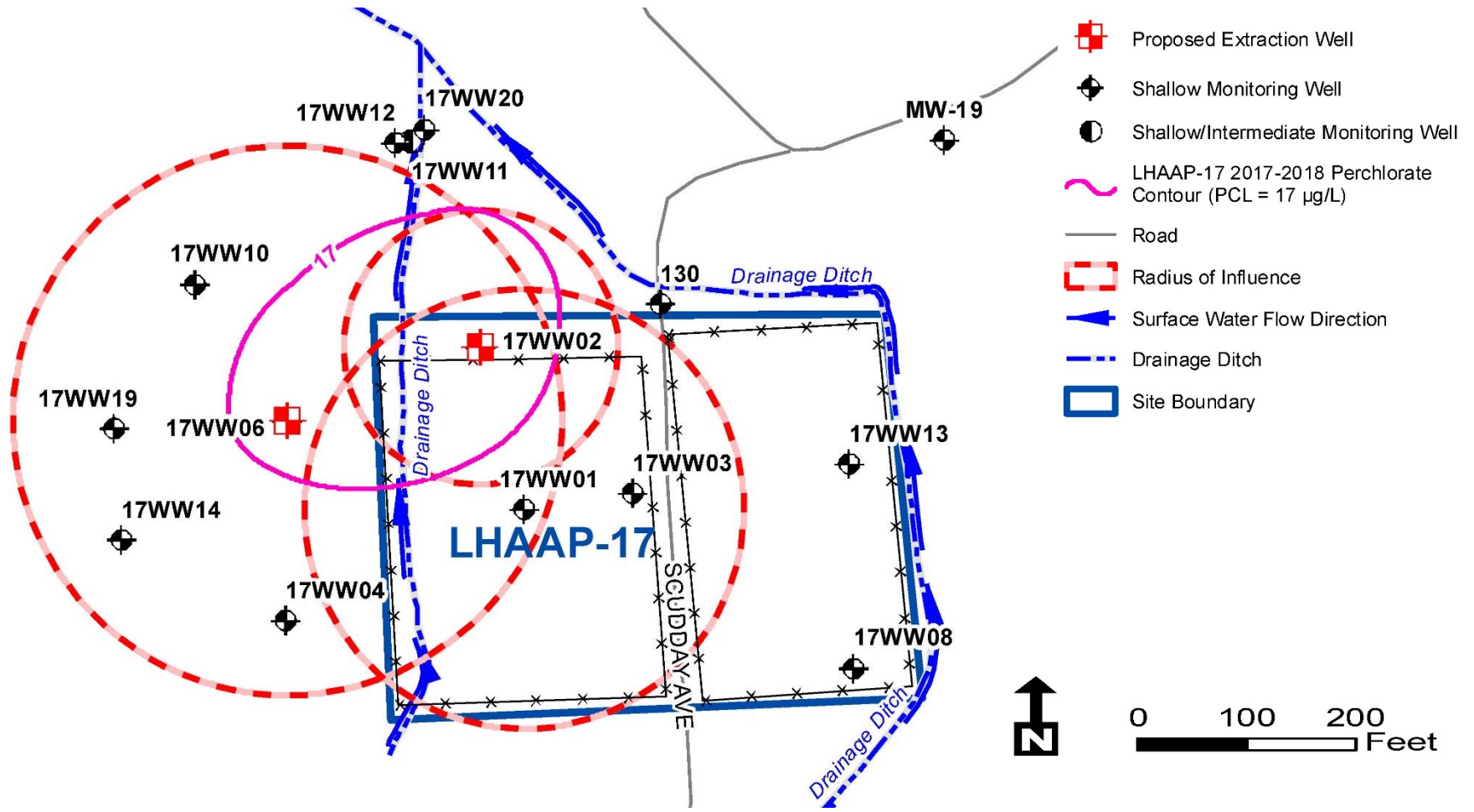
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LHAAP-17 Soil Excavation Areas



Restoration Advisory Board Meeting

LHAAP-17 Groundwater Extraction



Restoration Advisory Board Meeting

Completed Field Work Since Last RAB Meeting

Site	Activity
LHAAP-03	Supplemental Soil Sampling – November 2018
LHAAP-04	Supplemental Groundwater Sampling – November 2018 to January 2019
LHAAP-12	Remedial Action Operation (RA(O)) Sampling – December 2018
LHAAP-16	Annual Compliance Sampling – February 2019
LHAAP-37	RA(O) Sampling – November 2018, February 2019
LHAAP-46	RA(O) Sampling – February 2019
LHAAP-50	RA(O) Sampling – November 2018
LHAAP-58	RA(O) Sampling –December 2018, March 2019
LHAAP-67	RA(O) Sampling – October/November 2018
LHAAP-001-R	Groundwater Sampling – November 2018
LHAAP-001-R and LHAAP-003-R	Annual LUC Report-Year 1
GWTP	Replaced and disposed of ion exchange vessels (used to polish groundwater for perchlorate)
LHAAP-18/24	RA(O) Sampling – December 2018

Restoration Advisory Board Meeting

Documents in Process

Site	Document
LHAAP-03	Remedial Design and Remedial Action Work Plan
LHAAP-12	Annual RA(O) Report
GWTP	Quarterly Evaluation 4 th Quarter (October - December 2018) Quarterly Evaluation 1 st Quarter (January – March 2019)

Restoration Advisory Board Meeting

3 Month Look Ahead - Field Work

Site	Activity
LHAAP-03	Complete soil excavation
LHAAP-04	Complete ISB injections
LHAAP-16	Complete well installations and ISB injections
LHAAP-17	Complete soil excavation and extraction system installation
LHAAP-37	RA(O) Sampling – May 2019
LHAAP-50	RA(O) Sampling – May 2019
LHAAP-58	RA(O) Sampling – June 2019
LHAAP-67	RA(O) Sampling – May 2019
LHAAP-18/24	RA(O) Sampling – June 2019

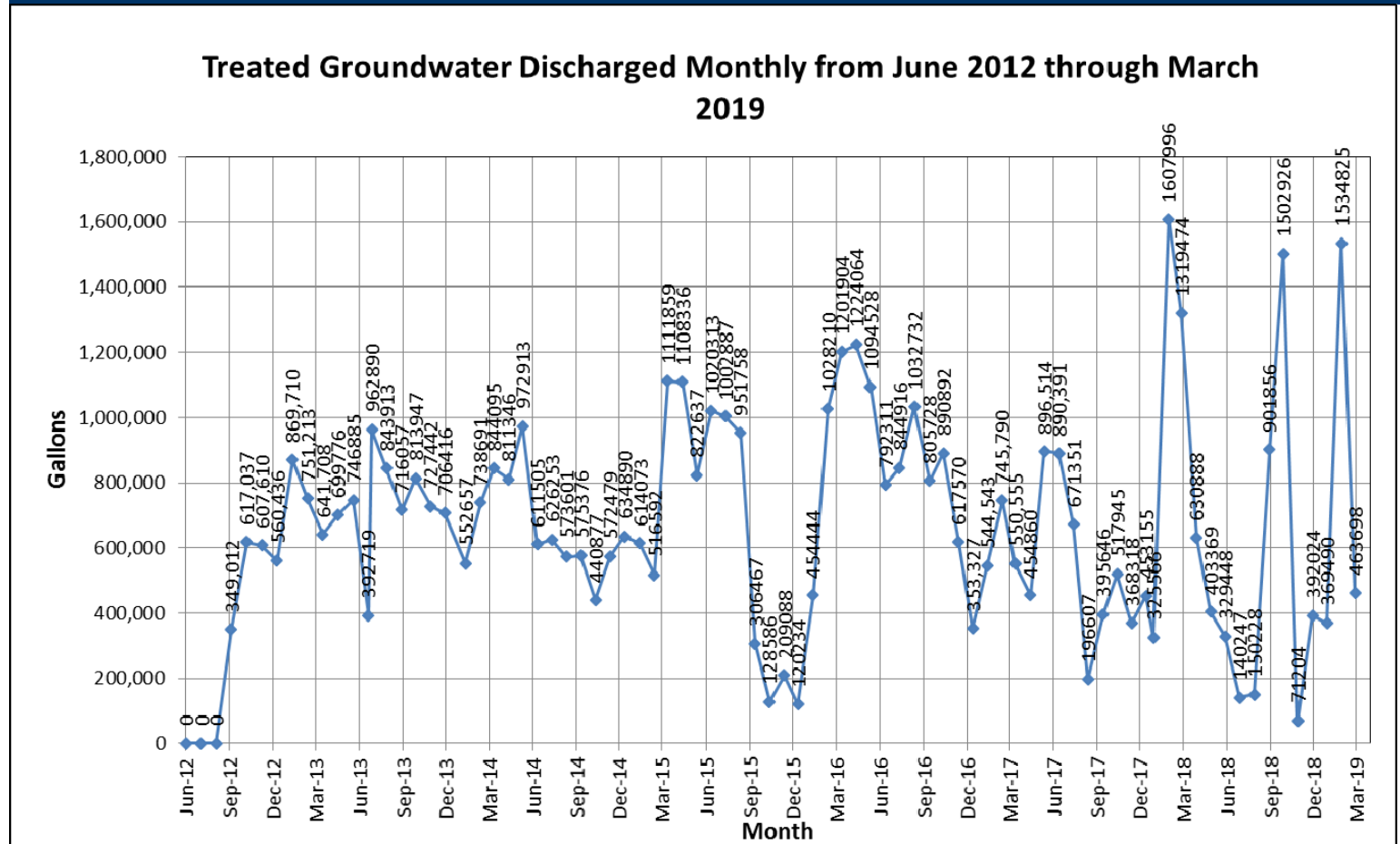
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3 Month Look Ahead - Documents

Site	Document
LHAAP-03	Remedial Design and Remedial Action Work Plan
LHAAP-12	2018 RA(O) Report
GWTP, LHAAP-16, and LHAAP-18/24	Quarterly Evaluation Report: Fourth Quarter (October – December) 2018 Quarterly Evaluation Report: First Quarter (January – March 2019)

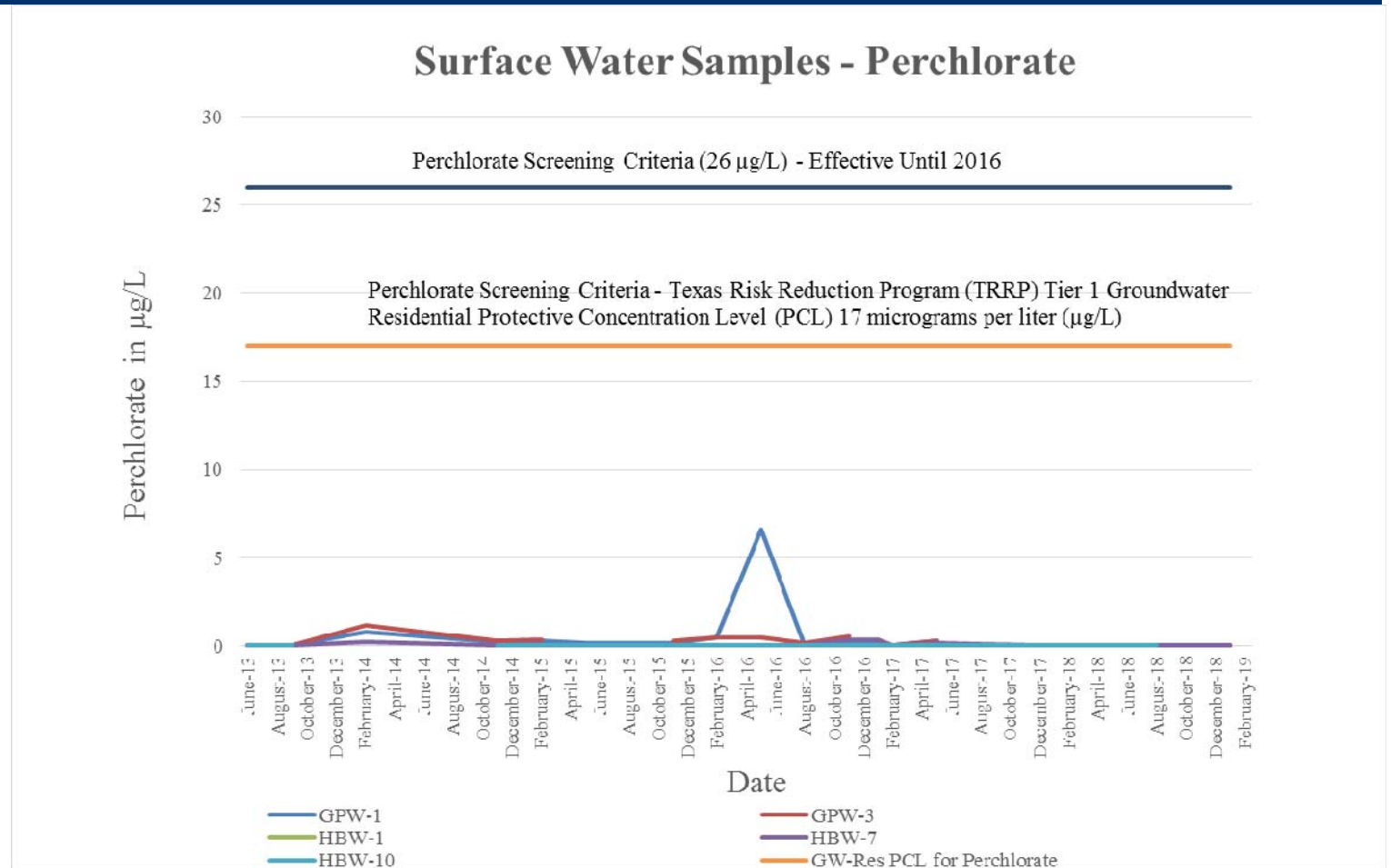
Restoration Advisory Board Meeting

GWTP Update



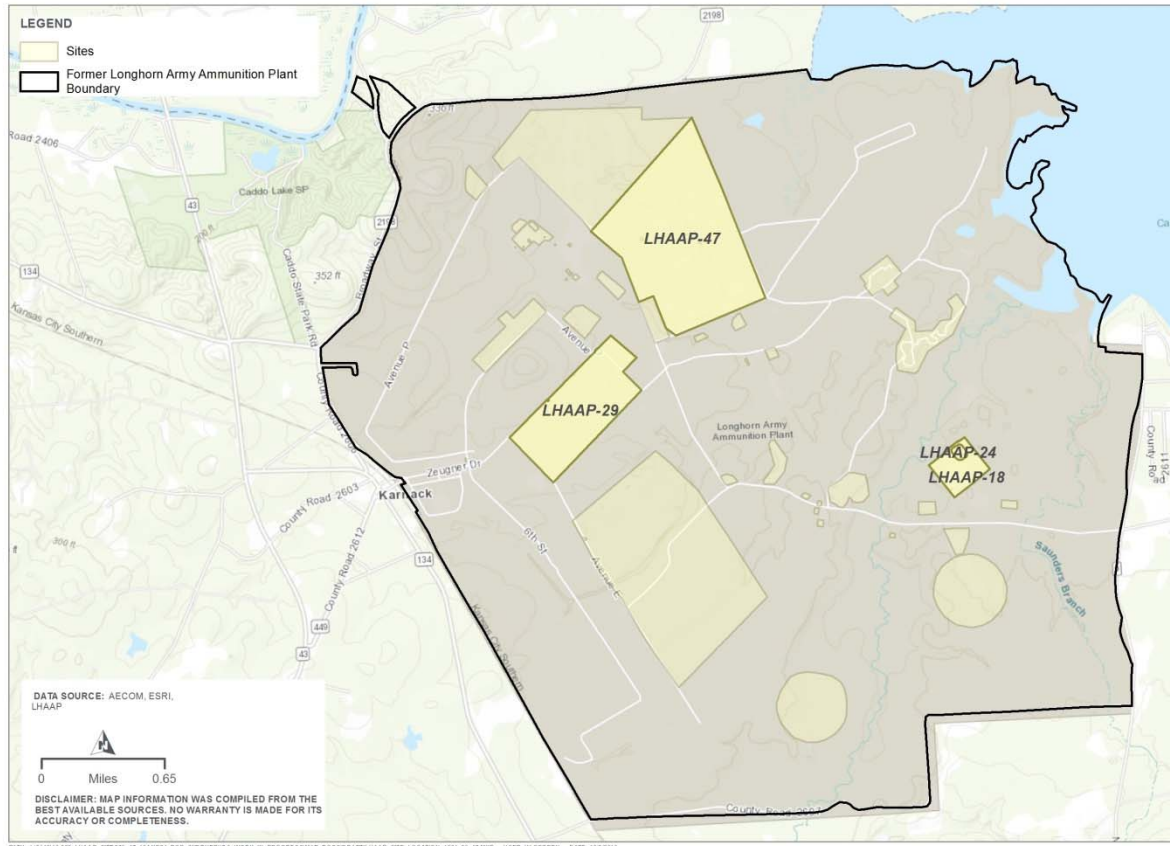
Restoration Advisory Board Meeting

Surface Water Sample Results



Restoration Advisory Board Meeting

LHAAP-18/24, 29, 47 Status Update



Restoration Advisory Board Meeting

LHAAP-18/24, 29 & 47 Document Status

- **LHAAP-18/24**
 - Proposed Plan finalized February 2019
 - Public meeting April 25, 2019, 6:00pm – 7:30pm
 - Public comment period April 2 to May 2, 2019
 - Draft Record of Decision submittal planned for September 2019
- **LHAAP-29**
 - Proposed Plan finalized November 2018 and public meeting was held December 6, 2018.
 - Draft Record of Decision submittal planned for May 2019
- **LHAAP-47**
 - Post Screening Investigation Report finalized April 2019
 - Revised Draft Final Record of Decision submittal planned for August 2019



Restoration Advisory Board Meeting

Feasibility Study for LHAAP-18/24

- LHAAP-18/24
 - Final Revised Feasibility Study located in the Administrative Record, Volume 1, 2017, Bate Stamp 00692951 - 00731961

Administrative Record located on the Longhorn environmental website at www.longhornaap.com

Restoration Advisory Board Meeting

LHAAP-47 Field Work Update

- **Work Completed**
 - Collected 4 surface water samples March 2019



Restoration Advisory Board Meeting

Next RAB Meeting Schedule & Closing Remarks

- Schedule July 2019 RAB Meeting
- Other Issues/Remarks
- Thank you for coming

Groundwater Treatment Plant - Processed Groundwater Volumes

The amount of groundwater treated is determined by measuring the number of gallons of processed water discharged.

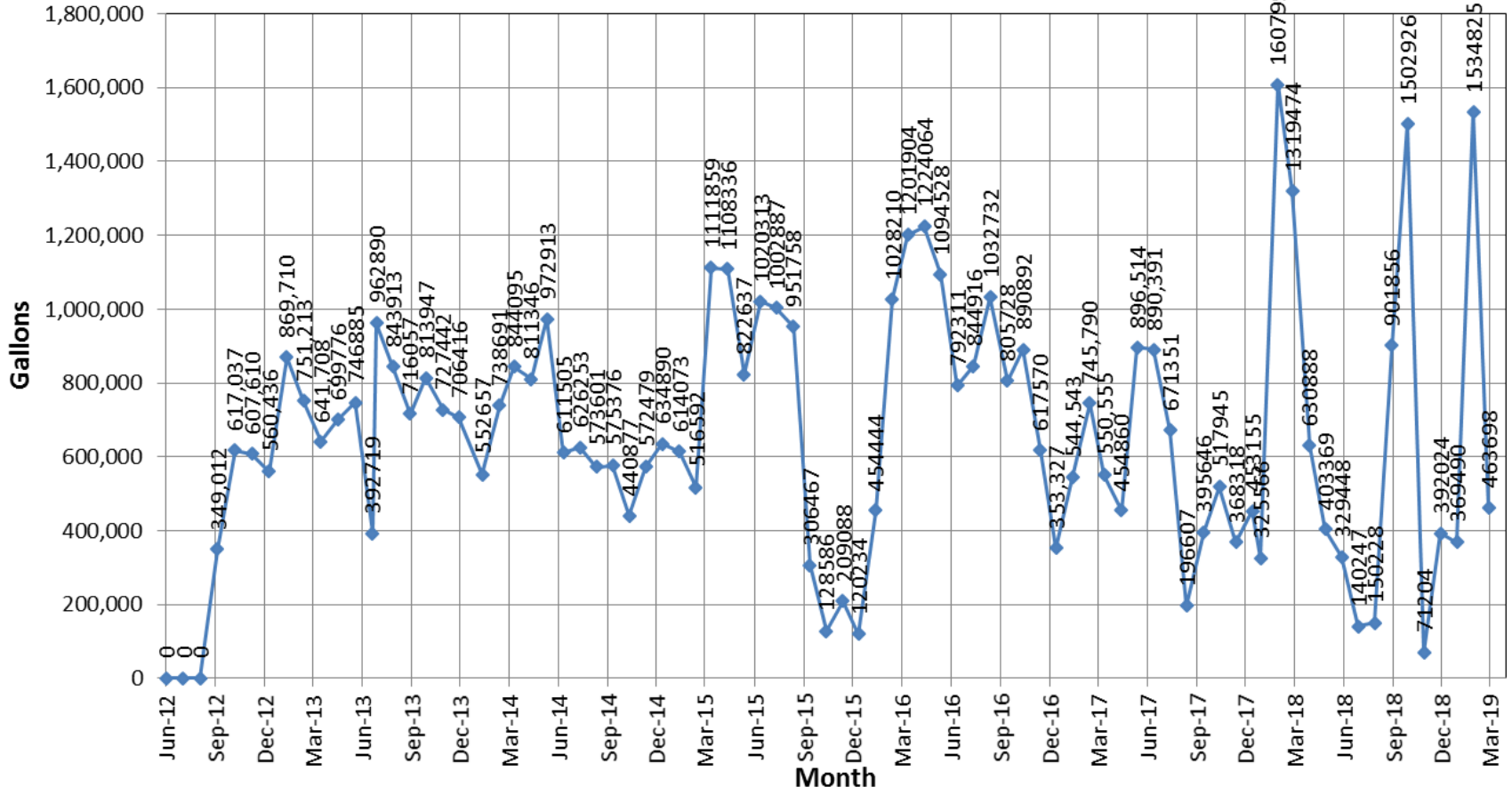
Processed Water Discharged Data

(in gallons)

Oct-07	Nov-07	Dec-07	Jan-08	Feb-08	Mar-08	Apr-08	May-08	Jun-08	Jul-08	Aug-08	Sep-08
1,041,491	848,356	804,822	792,148	665,883	818,872	791,306	568,812	776,904	748,377	690,052	617,199
Oct-08	Nov-08	Dec-08	Jan-09	Feb-09	Mar-09	Apr-09	May-09	Jun-09	Jul-09	Aug-09	Sep-09
655,059	619,274	726,118	552,299	598,144	433,800	488,807	526,958	387,644	0	414,853	735,716
Oct-09	Nov-09	Dec-09	Jan-10	Feb-10	Mar-10	Apr-10	May-10	Jun-10	Jul-10	Aug-10	Sep-10
808,322	636,306	727,492	391,898	695,343	802,656	894,731	962,121	1,257,977	1,314,924	1,041,495	1,136,547
Oct-10	Nov-10	Dec-10	Jan-11	Feb-11	Mar-11	Apr-11	May-11	Jun-11	Jul-11	Aug-11	Sep-11
956,567	705,805	849,712	811,679	668,281	1,090,348	817,325	900,338	916,552	784,369	652,524	733,456
Oct-11	Nov-11	Dec-11	Jan-12	Feb-12	Mar-12	Apr-12	May-12	Jun-12	Jul-12	Aug-12	Sep-12
748,102	658,250	684,903	865,453	725,000*	730,000*	980,000*	630,000*	0	0	0	349,012
Oct-12	Nov-12	Dec-12	Jan-13	Feb-13	Mar-13	Apr-13	May-13	Jun-13	Jul-13	Aug-13	Sep-13
617,037	607,610	560,436	869,710	751,213	641,708	699,776	746,885	392,719	962,890	843,913	716,057
Oct-13	Nov-13	Dec-13	Jan-14	Feb-14	Mar-14	Apr-14	May-14	Jun-14	Jul-14	Aug-14	Sep-14
813,974	727,442	706,416	552,657	738,691	844,095	811,346	972,913	611,505	626,253	573,601	575,376
Oct-14	Nov-14	Dec-14	Jan-15	Feb-15	Mar-15	Apr-15	May-15	Jun-15	Jul-15	Aug-15	Sep-15
440,877	572,479	634,890	614,073	516,592	1,111,859	1,108,336	822,637	1,020,313	1,002,887	951,758	306,467
Oct-15	Nov-15	Dec-15	Jan-16	Feb-16	Mar-16	Apr-16	May-16	Jun-16	Jul-16	Aug-16	Sep-16
128,586	209,088	120,234	454,444	1,028,210	1,201,904	1,224,064	1,094,528	792,311	844,916	1,032,732	805,728
Oct-16	Nov-16	Dec-16	Jan-17	Feb-17	Mar-17	Apr-17	May-17	Jun-17	Jul-17	Aug-17	Sep-17
890,892	617,570	353,327	544,543	745,790	550,555	454,860	896,514	890,391	528,538	195,198	961,324
Oct-17	Nov-17	Dec-17	Jan-18	Feb-18	Mar-18	Apr-18	May-18	Jun-18	Jul - 18	Aug-18	Sep-18
517,945	368,318	453,155	325,566	1,607,996	1,319,474	630,888	403,369	329,448	140,247	150,228	901,856
Oct-18	Nov-18	Dec-18	Jan-19	Feb-19	Mar-19						
1,502,926	71,204	392,024	369,490	1,534,825	463,698						

*Indicates Estimate

Treated Groundwater Discharged Monthly from June 2012 through March 2019



Water Discharge Location and Volume (Gallons)

Month	Total Combined to Harrison Bayou	LHAAP-18/24 Sprinklers	GWTP To INF Pond	INF Pond to Harrison Bayou	Contract Hauled Off-Site
Dec-16	0	236,688	0	0	0
Jan-17	0	0	0	0	0
Feb-17	0	0	0	0	14,355
Mar-17	127,242	0	0	0	14,400
Apr-17	113,038	0	236,821	0	0
May-17	205,665	0	534,155	0	0
Jun-17	467,830	0	294,550	490,574	0
Jul-17	0	0	528,538	0	0
Aug-17	0	0	195,197	0	0
Sep-17	0	0	309,980	651,434	0
Oct-17	0	0	517,945	0	0
Nov-17	0	0	368,318	0	0
Dec-17	0	0	453,155	560,350	0
Jan-18	325,566	0	253,177	325,566	0
Feb-18	1,607,996	0	62,017	1,430,634	0
Mar-18	1,319,474	0	0	870,816	0
Apr-18	630,888	0	0	630,888	0
May-18	403,369	0	0	403,369	0
Jun-18	193,669	0	135,779	0	0
Jul -18	0	0	140,247	0	0
Aug -18	49,409	0	100,819	0	0
Sep-18	585,397	0	316,459	524,484	0
Oct-18	1,409,106	0	93,820	1,016,285	0
Nov-18	71,204	0	0	0	0
Dec-18	392,024	0	0	0	0
Jan-19	369,490	0	0	369,490	0
Feb-19	1,534,825	0	0	1,326,485	0
Mar-19	463,698	0	0	83,250	0

Harrison Bayou and Goose Prairie Creek – Perchlorate Data

Surface water samples are collected quarterly from each location in Harrison Bayou and Goose Prairie Creek, unless the sampling location is dry.

Surface Water Sample Data (in micrograms per liter)

Quarter	3 rd	4 th	1 st	2 nd	3 rd	4 th	1 st	2 nd	3 rd	4 th	1 st
Creek Sample ID	Jul 1999	Sep 1999	Feb 2000	Apr 2000	Aug 2000	Dec 2000	Feb 2001	Apr 2001	July 2001	Oct 2001	Jan 2002
GPW-1	<1.0U	-	4	<4.0 U	<4.0 U	<4.0 U	-	2.65	<4.0 U	<4.0 U	<4.0 U
GPW-3	<1.0U	<4.0 U	17	8	<4.0 U	<4.0 U	-	2.28	<4.0 U	<4.0 U	<4.0 U
HBW-1	-	<80.0 U	310	23	-	-	<4.0 U	-	<4.0 U	<4.0 U	<4.0 U
HBW-7	-	<8.0 U	370	110	-	-	<4.0 U	-	<4.0 U	<4.0 U	<4.0 U
HBW-10	-	<8.0 U	905	650	<4.0 U	-	<4.0 U	-	<4.0 U	-	-

Quarter	2 nd	3 rd	4 th	1 st	2 nd	3 rd	3 rd	4 th	2 nd	3 rd	4 th
Creek Sample ID	June 2002	Sept 2002	Dec 2002	Feb 2003	June 2003	Aug 2003	July 2004	Dec 2006	May 2007	Aug 2007	Dec 2007
GPW-1	<4.0 U	<4.0 U	18.3	18.6	59.9	-	2.25	-	<1.0 U	<1.0 U	10.7
GPW-3	<4.0 U	<4.0 U	5.49	12.6	14.7	-	2.2	-	<1.0 U	<1.0 U	7.48
HBW-1	<4.0 U	<4.0 U	<4.0 U	-	<4.0 U	99.3	<0.2U	<1.0 U	<1.0 U	122	<1.0 U
HBW-7	<4.0 U	<4.0 U	<4.0 U	-	<4.0 U	<4.0 U	<0.2U	<1.0 U	<1.0 U	1.02	<1.0 U
HBW-10	<4.0 U	<4.0 U	<4.0 U	-	<4.0 U	-	<0.2U	<1.0 U	<1.0 U	<1.0 U	<1.0 U

Quarter	1 st	2 nd	3 rd	4 th	2 nd	3 rd	3 rd	3 rd	4 th	1 st	2 nd
Creek Sample ID	Mar 2008	Jun 2008	Sep 2008	Dec 2008	May 2009	Jul 2009	Aug 2009	Sep 2009	Dec 2009	Mar 2010	Jun 2010
GPW-1	27	<0.5U	<0.5U	<0.22U	16	<4U	NS	<1.2U	3.7	1.3J	<0.6U
GPW-3	21.9	9.42	1.1	<0.22U	8.9	<4U	NS	<0.6U	2.8	1.8J	<0.6U
HBW-1	<0.5U	<0.5U	<0.5U	<0.22U	<0.55U	<4U	NS	<1.5U	<0.275U	1.5U	<0.6U
HBW-7	<0.5U	<0.5U	<0.5U	<0.22U	<0.55U	<4U	24	<1.2U	<0.275U	1.5U	<0.6U
HBW-10	<0.5U	<0.5U	<0.5U	<0.22U	<0.55U	<4U	NS	<1.5U	<0.275U	1.2U	<0.6U

Quarter	3 rd	4 th	1 st	2 nd	3 rd	4 th	1 st	2 nd	3 rd	4 th	1 st
Creek Sample ID	Sep 2010	Dec 2010	Mar 2011	Jun 2011	Sep 2011	Dec 2011	Mar 2012	Jun 2012	Not Applicable	Jan & Feb 2013	Mar 2013
GPW-1	dry	<0.1U	8.7	dry	dry	1.76	0.163J	dry	NS	1.65	0.735
GPW-3	dry	0.199J	0.673	dry	dry	1.31	0.261	dry	NS	1.74	0.754
HBW-1	dry	<0.1U	<0.2U	dry	dry	<0.1U	0.1U	dry	NS	<0.2U	<0.2U
HBW-7	dry	<0.1U	<0.2U	dry	dry	0.171J	0.1U	dry	NS	<0.2U	<0.2U
HBW-10	dry	<0.1U	<0.2U	dry	dry	<0.1U	0.1U	dry	NS	<0.2U	<0.2U

Quarter	2 nd	3 rd	4 th	1 st	2 nd	3 rd	4 th	1 st	2 nd	3 rd	4 th
Creek Sample ID	Jun 2013	Sept 2013	Dec 2013	Feb 2014	May 2014	Aug 2014	Nov 2014	Feb 2015	May 2015	Aug 2015	Nov 2015
GPW-1	dry	<0.2 U	dry	0.766	dry	dry	0.244 J	0.311 J	0.156J	dry	0.142 J
GPW-3	dry	<0.2 U	dry	1.15	dry	dry	0.276 J	0.344 J	dry	dry	0.311 J
HBW-1	<0.2U	<0.2 U	dry	<0.2 U	dry	dry	<0.2 U	<0.2 U	dry	dry	<0.2 U
HBW-7	<0.2U	<0.2 U	dry	0.201 J	dry	dry	<0.2 U	0.124 J	dry	dry	<0.2 U
HBW-10	<0.2U	<0.2 U	dry	<0.2 U	dry	dry	<0.2 U	<0.2 U	dry	dry	<0.2 U

Quarter	1 st	2 nd	3 rd	4 th	1 st	2 nd	3 rd	4 th	1 st	2 nd	3 rd
Creek Sample ID	Feb 2016	May 2016	Aug 2016	Nov 2016	Feb 2017	May 2017	Aug 2017	Dec 2017	Mar 2018	June 2018	August 2018
GPW-1	0.447	6.59	<0.2 U	0.301 J	<1 U	0.263	dry	<4.0 U	<4.0 U	dry	<2.0 U
GPW-3	0.474	0.457	0.141	0.563	<1 U	0.274	dry	<4.0 U	<4.0 U	dry	<2.0 U
HBW-1	<0.2 U	<0.2 U	<0.2 U	<0.2 U	<1 U	<0.2 U	<0.2 U	1.1 J	<4.0 U	dry	<2.0 U
HBW-7	<0.2 U	<0.2 U	<0.2 U	0.318 J	<1 U	0.155	<0.2 U	<4.0 U	<4.0 U	dry	<2.0 U
HBW-10	<0.2 U	<0.2 U	<0.2 U	<0.2 U	<1 U	<0.2 U	0.111J	<4.0 U	<4.0 U	dry	<2.0 U

NS – not sampled U – non-detect J – Estimated Dry – no surface water

Quarter	4th	1st
Creek Sample ID	Oct 2018	Jan 2019
GPW-1	<2.0 U	<2.0 U
GPW-3	<2.0 U	<2.0 U
HBW-1	<2.0 U	<2.0 U
HBW-7	<2.0 U	<2.0 U
HBW-10	<2.0 U	<2.0 U

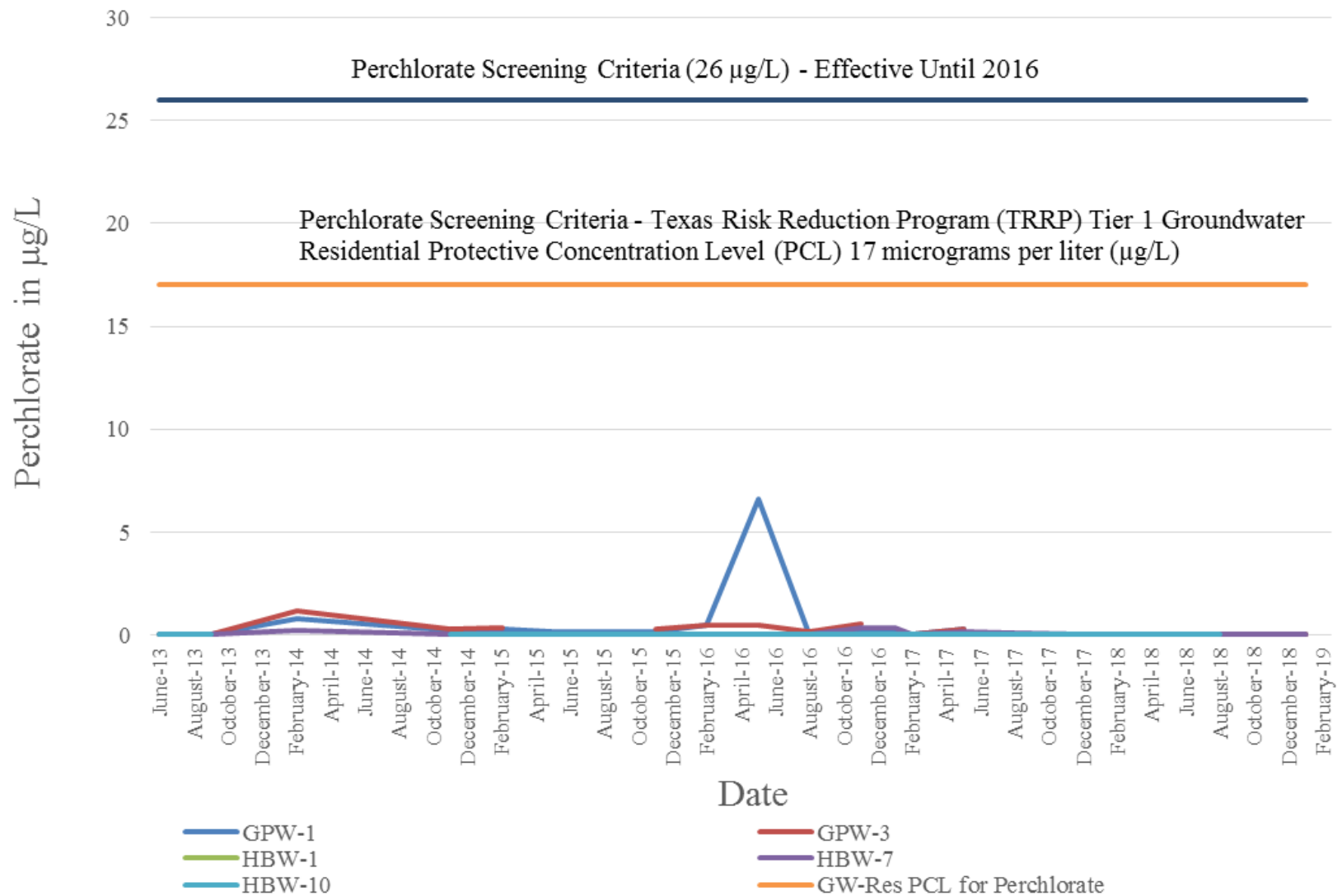
NS – not sampled

U – non-detect

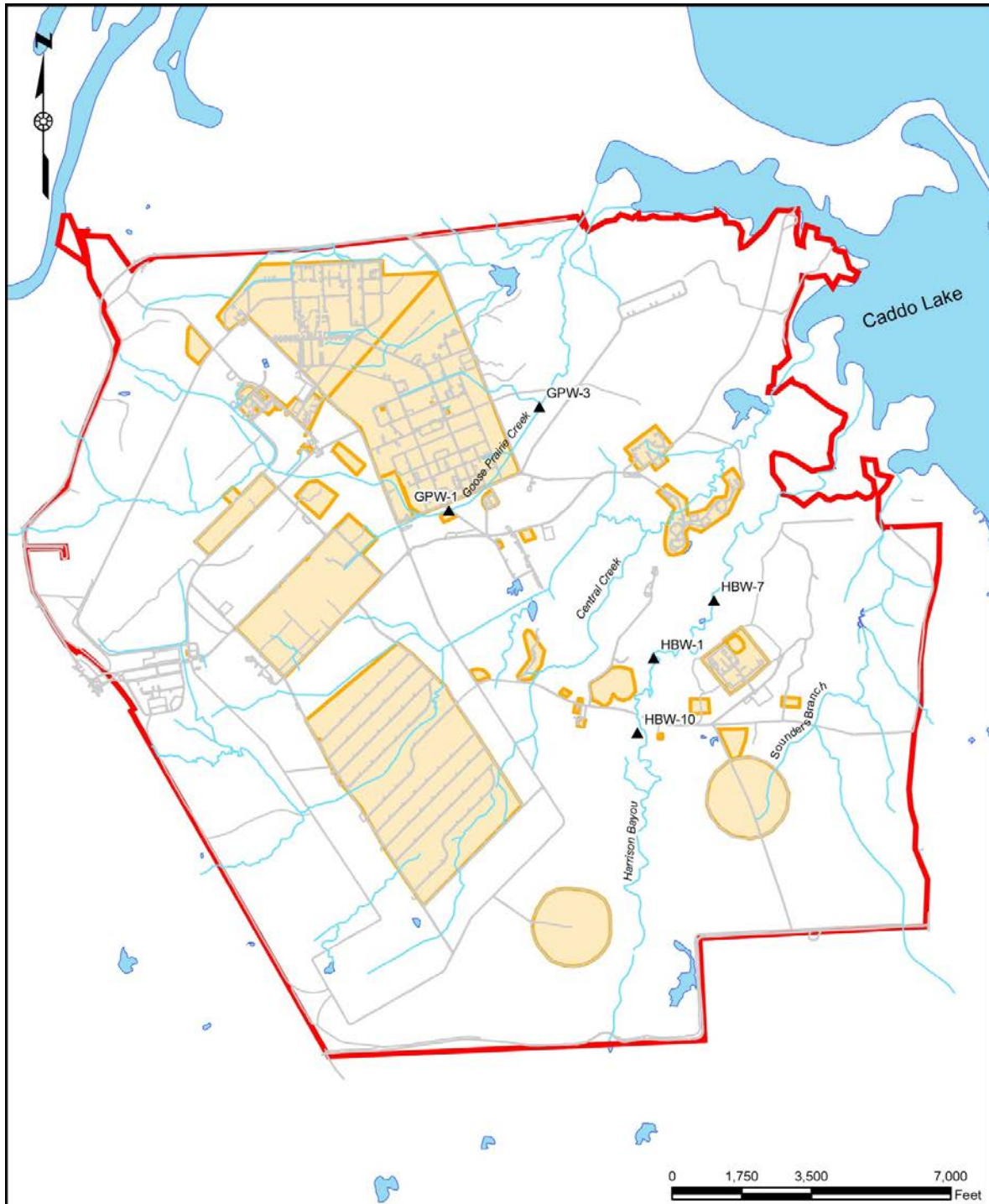
J – Estimated

Dry – no surface water

Surface Water Samples - Perchlorate



Longhorn Army Ammunition Plant Creek Sampling Locations



Legend <ul style="list-style-type: none">▲ Surface Water Sampling Location— Stream— Road■ Site■ Lake	U.S. ARMY CORPS OF ENGINEERS TULSA DISTRICT TULSA, OKLAHOMA
SURFACE WATER SAMPLING LOCATION LONGHORN ARMY AMMUNITION PLANT KARNACK, TEXAS	