Subject: Final Minutes, Quarterly Restoration Advisory Board (RAB) Meeting
Longhorn Army Ammunition Plant (LHAAP)
Location of Meeting: Conference Call
Date of Meeting: April 21, 2021, 6:00 PM Central Daylight Time (CDT)

Meeting Participants:

Army BRAC:	Rose M. Zeiler, Hank Procter
USACE:	Aaron Williams
USAEC:	Andrew Maly, Thomas Toudouze
Bhate:	Kim Nemmers
APTIM:	Bill Foss
HDR, Inc.	Philip Werner
TLI:	Kyra Donnell
USEPA Region 6:	Lauren Poulos and Kent Becher-USGS Liaison
TCEQ:	April Palmie
RAB:	Present: Deon Hall, Richard LeTourneau, John Fortune, and Sharon McAvoy Absent: Judy VanDeventer; Terry Britt; John Pollard, Jr.; Tom Walker; Charles Dixon; Donna Burney; and Nigel R. Shivers
Public:	USEPA Technical Advisory Group: George Rice (Caddo Lake Institute [CLI]) and Janetta Coatts

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 via electronic mail (e-mail) and regular postal mail for hard copies.

Welcome and Introduction

Ms. Rose Zeiler, the RAB Co-Chair, called the meeting to order. Ms. Zeiler welcomed and introduced Mr. Hank Procter, as Tom Lederle's replacement. Mr. Procter is a Program Manager with the BRAC Field Branch of the Office of the Deputy Chief of Staff, G-9. Mr. Procter explained that he has oversight of multiple installations across the country for BRAC, including two other Texas sites, Lone Star Army Ammunition Plant and Red River Army Depot, both north of LHAAP.

Ms. Zeiler said that the Army is always interested in new members for the RAB. She asked if anyone knew of people that were interested in joining the RAB. Ms. Zeiler said that the application is on the website. Mr. John Fortune said he spoke to someone that might be interested and that he would get the person an application.

Ms. Zeiler asked for any comments or additions to the RAB meeting minutes from the January 2021 conference call. Based on no additional input, Ms. Zeiler asked for a motion to approve. Mr. Fortune made a motion to approve. Mr. Deon Hall seconded the motion to approve the minutes. Ms. Zeiler stated that the minutes were approved. Ms. Zeiler asked for questions or items that RAB members may want to discuss for the next meeting, but no input was received.

RAB Meeting Format and Presentation

Ms. Zeiler explained that there are three contractors managing work at LHAAP. Those contractors are Bhate Environmental Associates, Inc. with APTIM; MMG-TLI Joint Venture (JV); and HDR, Inc.

Defense Environmental Restoration

Ms. Kim Nemmers discussed the documents currently in progress. Ms. Nemmers explained that remedies have been put in place for most of the sites included in the Bhate contract. Ms. Nemmers explained that following implementation of remedies, there is periodic monitoring of the remedy, which is called Remedial Action Operation or RA-O. She explained that following implementation, RA-O is completed more frequently (quarterly) and then the sampling frequency reduces over time to semi-annual and annual. Ms. Nemmers said that RA-O Reports are in progress for LHAAP-04, -12, -16, and -67. She said that the Quarterly Groundwater Treatment Plant (GWTP) Reports are in progress for the Fourth Quarter 2020 and First Quarter 2021.

Ms. Nemmers discussed field work completed since the RAB meeting in January 2021. Ms. Nemmers said that the field work since the last meeting was all groundwater sampling to evaluate performance of the remedies. Ms. Nemmers explained that the surface water samples from the bayous were collected in February 2021 and the data is presented in the handouts included with the RAB slides.

LHAAP-50

Mr. Bill Foss explained that the site is associated with an aboveground storage tank (AST) that received industrial wastewater from various sumps from 1955 to 1988. Treated wastewater was discharged to Goose Prairie Creek. The primary compounds of concern at LHAAP-50 are chlorinated solvents and perchlorate. Mr. Foss said that baseline sampling was completed in November 2019 and then the in-situ bioremediation (ISB) injections were completed in March 2020. Quarterly RA-O sampling has been completed in July 2020, October 2020, and January 2021. The latest quarterly RA-O sampling was completed the week of April 12, 2021 but is not presented as the data was not available.

Mr. Foss presented the original plume configuration and the monitoring wells within the plume. He then presented the injection points as part of the ISB remedial action. Mr. Foss pointed out the previously completed soil excavation area and that the groundwater flow is from left to right (Slide 11). Mr. Foss then discussed the trend charts of data that included two sampling events prior to the ISB injections and the available data following the injections. Mr. Foss pointed out that the site has seasonal fluctuations of the groundwater elevations. Mr. Foss explained that following the ISB injections the dissolved oxygen and oxidation reduction potential (ORP) have been decreasing, which is supportive of the ISB remedy performing as intended. He also explained that cis-1,2-dichloroethene (DCE) is a breakdown product of trichloroethene (TCE) so the observed increases of cis-1,2-DCE are indicative of the degradation of TCE. Overall, Mr. Foss said that the aquifer conditions are reducing and supportive of ISB.

Groundwater Treatment Plant

Ms. Nemmers presented the operation of the GWTP. She explained that the water the GWTP treats is from LHAAP-18/24. The extraction of groundwater from LHAAP-18/24 for treatment by the GWTP is an interim measure. Ms. Nemmers explained that groundwater from LHAAP-18/24 is removed via interceptor collection trenches (ICTs) and pumped to the GWTP via double-walled piping. Ms. Nemmers explained that maintenance of the pumps is an ongoing operation along with ensuring that there are no leaks in the piping. Ms. Zeiler pointed out that Harrison Bayou is to the north of LHAAP-18/24. Ms. Zeiler then explained that the lines shown on the figure are interceptor trenches. Ms. Nemmers then explained that the trenches are for collection of groundwater to prevent it from migrating, creating a barrier. Ms. Nemmers said that ensuring the pumps are operational is important to ensure that this capture is maintained though she pointed out that the amount of water extracted by the ICTs does vary. Mr. Fortune asked if this was the old burning ground, which Ms. Nemmers confirmed. Mr. Kent Becher pointed out that there are high density polyethylene (HDPE) liners along the northeast and southwest ICTs. Ms. Zeiler indicated that these liners within the trenches provides additional prevention for cutoff of the plume. Mr. Richard LeTourneau asked if there is testing done at different points along Goose Prairie Creek away from the confluence of the GWTP effluent discharge. Ms. Nemmers said she would explain following the discussion regarding the GWTP process.

Ms. Nemmers stated that all of the groundwater from LHAAP-18/24 goes into Tank 140, which is the equalization tank. She noted that the schematic indicates that water is from the burning ground and LHAAP-17. She explained that LHAAP-17 groundwater is not currently extracted, but is planned to as part of the work being completed by MMG-TLI Joint Venture (JV) later in the year. Ms. Nemmers explained that there are other tanks used for equalization throughout the treatment process because some treatment processes are faster than others. She explained that the first treatment process is for metals. Ms. Nemmers explained that metals are flocculated out. Currently metals levels are low enough that treatment is unnecessary but is completed anyhow. The metals treatment is not bypassed. She explained that magnesium hydroxide is added to increase the pH of the water to allow the metals to precipitate which is enhanced using the polymer. The clarifier is used to remove the metals sludge, followed by a sand filter to remove any remaining solids. She explained that the solids are put through a belt filter present to remove the water and allow the solids to be disposed at a landfill offsite. Ms. Nemmers explained that the water from the solids removal is then put back into Tank 140. She explained that the GWTP has a wall around it to contain any water within the GWTP including rainwater. All water within the containment is put into Tank 140 and run through the treatment system.

Ms. Nemmers explained that the water is then treated by the air stripper, which works by having the water enter from the top and air blowing in from the bottom. She explained that there are plastic balls in the unit that assist in the stripping of the volatile compounds. Ms. Nemmers said that the plastic balls do need to be cleaned from time to time to allow for improvement of contact by the water to the media. She explained that the water can then go through a granular activated carbon (GAC) vessel to polish the water. The water then goes into the fluidized bed reactor (FBR),

which is a system that uses microbes to treat perchlorate. Ms. Nemmers explained that the recent freeze event did affect the FBR microbes. She explained that the perchlorate is key to the microbial growth and that acetic acid is also provided to the system to support the microbes. Ms. Nemmers explained that there are jets within the reactor that fluidize the GAC to provide a way for the microbes to attach and grow. Ms. Nemmers said that the media capture tank has been replaced by a strainer to capture biomass that leaves the FBR, which is minimal when the FBR is operating optimally. Ms. Nemmers then pointed out the locations of the spigots for collecting influent and effluent for sampling, which is completed weekly, biweekly, and monthly depending on the sampling location and parameters analyzed. Ms. Nemmers explained that the analytical data is presented in the quarterly GWTP reports.

Ms. Nemmers explained that, when discharging to the INF pond, the water is treated by the ion exchange (IX) vessels. The IX vessels are in series to allow for determination if there is breakthrough potential from the first vessel. There is a sampling spigot between the two IX vessels that allows for that determination. Ms. Nemmers explained that the treated groundwater is discharged to one of three possible locations: 1) Harrison Bayou, 2) the INF Pond, or 3) for irrigation at LHAAP-18/24. Ms. Nemmers explained that the treated groundwater is typically discharged to the Harrison Bayou if there is flow in the Bayou. Ms. Nemmers said that there is testing of surface water from both Harrison Bayou and Goose Prairie Creek. Mr. Fortune asked if TK-650 is sampled on a time basis and not a volume basis. Ms. Nemmers concurred and then explained that the GWTP is not a continual operation but rather a batch operation. Mr. Fortune asked if the batches are generally the same size. Ms. Nemmers agreed that the batches are generally similar in volume. Mr. Foss stated that Harrison Bayou is also being sampled as part of the LHAAP-16 remedy implementation on a quarterly basis. Ms. Zeiler said that Mr. LeTourneau's previous question was whether there is sampling conducted downgradient and that the answer is yes.

Look Ahead

Ms. Nemmers then discussed the 3-month look ahead for LHAAP field work. Ms. Nemmers said that more monitoring of the remedies will be completed as well as quarterly sampling of the surface water.

Ms. Nemmers explained that the RA-O Reports previously discussed will reviewed by the Regulators. Ms. Nemmers explained that the First Quarter 2021 GWTP Report is being prepared. Ms. Nemmers also said that all of the reports discussed during the RAB meetings are posted onto the Administrative Record online.

Groundwater Treatment Plant

Ms. Nemmers explained the higher volumes shown on the graph (slide 18 and GWTP handout page 2) means that there is high flow in the Bayou and that the water being discharged is from both the GWTP and the INF Pond. Ms. Nemmers said that the GWTP will typically treat from 200,000 to 300,000 gallons of groundwater each month so when you see less water discharged than that on the graph, it means something happened at the GWTP that did not allow processing of the groundwater. Ms. Nemmers explained that the low discharge amount in March 2021 was

due to the freeze that occurred in Texas. Following the freezing conditions, the FBR readout indicated that the system was well outside of the normal operating conditions. She explained there is a data readout on the system that allows the GWTP operators to know if the FBR is within acceptable operational levels. Ms. Nemmers explained that the FBR took weeks for the microbes to recover.

Mr. Fortune asked what happens when there is not flow in the Harrison Bayou and the INF Pond is full. Ms. Nemmers explained that there is a protocol to discharge to LHAAP-18/24 for irrigation.

Surface Water Sampling

Ms. Nemmers said that the surface water sampling results from 2020 and 2021 are all near or at non-detect. She pointed to the handouts for a map showing where the surface water samples are collected.

LHAAP-17

Ms. Kyra Donnell from MMG-TLI JV presented on LHAAP-17. She explained that slide 21 showed the depths of the excavations at the time of the Record of Decision (ROD). Slide 22 shows the remaining removal actions that need to be completed. Ms. Donnell said that a work stoppage occurred on September 30, 2019, due to the presence of munitions hazards not previously known to be present. The discovery of those munitions prompted the need for an Explanation of Significant Difference (ESD). Ms. Donnell explained that an ESD is required if after the adoption of the ROD the remedial action differs significantly from the selected remedy with respect to performance, scope, or cost. She said that an ESD has been prepared and that the ESD has undergone Regulatory review. Comments from the Regulators are being addressed and submittal will occur in the next several days. The ESD includes the removal of munitions and explosives of concern (MEC) in soil that may act as a potential continuing source (contributing perchlorate contamination to soil and groundwater) and to add MEC Land Use Controls (LUCs). All other components of the selected remedy in the 2016 ROD remain unchanged. MEC-specific LUCs include:

- Prohibiting residential land use until it is demonstrated that munitions no longer present a threat to public/human safety.
- Prohibiting intrusive subsurface activities, including digging, until it is demonstrated that the MEC no longer present an explosive hazard. However, intrusive subsurface activities may occur provided that the U.S. Army and the U.S. Environmental Protection Agency (USEPA) approve such intrusive subsurface activities before they are commenced and provided that they are undertaken by qualified personnel who are trained in explosives safety measures.

Ms. Donnell explained that the remaining effort at LHAAP-17 to address the potential presence of munitions and to continue soils excavation in consideration of munitions is in the work planning stage. She said that the Memorandum of Record has been approved for the management of water within the excavations. A Work Plan for munitions investigation and removal, if present, is being prepared for Regulatory review. Ms. Donnell said that a separate

Remedial Design/Remedial Action Work Plan Addendum is also being prepared to addresses how the excavation of soils will continue in consideration of the munitions hazards that may still be present. The Addendum is currently under Army review.

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

Mr. Philip Werner said HDR, Inc., is working on LHAAP-18/24, -29, and -47. He said that slide 26 presents the documents that HDR, Inc., is currently working on. The Draft Pre-Design Investigation (PDI) Report for LHAAP-29 is due in June 2021. Concurrent with the report, the draft Remedial Design is being prepared. For LHAAP-47, the draft final Feasibility Study Addendum was submitted for review in March with the final planned for April 2021. The Draft Revised Proposed Plan was submitted to the Regulators on 20 April 2021. Mr. Werner said that the PDI field work at LHAAP-18/24 still needs to be completed and includes the well installation and sampling. He said that they are awaiting analytical data to select where the permanent monitoring wells will be located and if any additional data is needed. The PDI Report for LHAAP-18/24 will be submitted in October 2021 to the Regulators. A draft Remedial Design will also be completed at that time. Mr. Werner explained that LHAAP-18 is the former burning grounds, and that LHAAP-24 is the former unlined evaporation pond and wash out facility.

Mr. Werner presented a summary of the PDI at LHAAP-29, which include 49 direct push technology (DPT) borings advanced to 16 feet below ground surface (bgs) for the most part. A total of 196 soil samples were collected for explosives analysis. Eight trenches were excavated along the former wooden, trinitrotoluene (TNT) waste water line. Where available, liquid and sediment samples from inside the pipe were also collected for explosives analysis. Liquid and sediment was collected from four of the eight planned locations with only sediment samples collected from the other four locations.

Mr. Werner presented the sampling completed at LHAAP-29. Mr. George Rice asked what the photo on the right (within slide 28) was to which Mr. Werner said that it was the wooden pipeline. Mr. Rice asked if the rings were to hold the pipe together, which Mr. Werner concurred. Mr. Werner said that the pipe was deteriorated. Ms. Zeiler said that the pipeline was being evaluated as a potential source for explosives, which is why the inside of the pipeline is being evaluated. Mr. Fortune asked where the pipeline went. Ms. Zeiler said that the pipeline was taking the waste water over to Site 32 where the treatment was to the northeast. Mr. Werner said that sampling at LHAAP-29 was completed on 11 March 2021, and the data is coming in now. Mr. Fortune asked if the surveyors that have been at LHAAP are involved in this project. Mr. Werner said yes and that the surveyors are doing a complete topographic survey of LHAAP-29 down to 1-foot contour intervals and picking up site features.

Mr. Werner provided a summary of the Phase 1 PDI at LHAAP-18/24. All 25 DPT borings were advanced to 40 feet bgs with a few borings advanced deeper. At each of the DPT boring locations, groundwater samples were collected for volatile organic compounds (VOCs) and perchlorate analysis. A total of nine soil samples were collected from borings advanced outside the ICT boundary to the northeast boundary of the site and analyzed for VOCs and perchlorate. The Phase 1 PDI field work was completed on 27 March 2021. The data, once received, will be used

to determine the location for the permanent monitoring well locations and if additional data gaps are present.

Mr. Werner presented the Phase 2 field work at LHAAP-18/24 which will include installation of six shallow zone and one Wilcox formation monitoring wells. Four of the monitoring wells will be located outside of the northeastern ICT boundary. One shallow monitoring well will be located within the ISB zone grid centered on monitoring well (MW-23). One shallow monitoring well will be to the north of that within the grid centered on 18CPT03 and 19CPTMW03SW. The one Wilcox formation monitoring well will be northwest of well MW-14 and the ISB grids. Mr. Werner explained that the shallow aquifer extends to a depth of 45 feet bgs and then the Wilcox formation lies just below that shallow zone. The two units are separated by a mostly contiguous clay layer across the site. Mr. Werner said that the clay unit separating the shallow unit from the Wilcox sands in the northwestern portion of the site thins out. Discussing slides 34 and 35, Mr. Werner presented the layout of LHAAP-18/24 and where the DPT soil borings were located. He pointed out the green dot in the north where the deeper Wilcox monitoring well will be placed. Mr. Werner said that the borings from Phase I Field Work were completed by March 27, 2021, and that the data is coming in from the laboratory.

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 **Wednesday, July 21, 2021,** with the **meeting starting at 6:00 pm Central Daylight Time**. Ms. Zeiler stated that whether the meeting is in person or again by conference call will be evaluated in May. Mr. Fortune said that he would like to meet in person.

Ms. McAvoy made a motion to adjourn; Mr. LeTourneau seconded the motion.

Adjourn

The meeting adjourned at 7:18 pm CDT.

April 2021 Meeting Attachments and Handouts:

- Color copy of Bhate presentation slides
- GWTP – Processed Groundwater Volumes Handout
- Surface Water Sampling Handout

Longhorn Army Ammunition Plant Quarterly Restoration Advisory Board Meeting

April 21, 2021
6:00 PM CDT

APTIM

bhate

Restoration Advisory Board Meeting

Abbreviations and Acronyms

µg/L	Micrograms per liter
bgs	Below ground surface
DERP	Defense Environmental Restoration Program
DPT	Direct push technology
ESD	Explanation of Significant Difference
GPW	Goose Prairie Creek Water Sample
GWP-Ind	Industrial Groundwater Use Protection
GWTP	Groundwater Treatment Plant
HBW	Harrison Bayou Water Sample
ISB	In situ bioremediation
J	Estimated laboratory value
LHAAP	Longhorn Army Ammunition Plant
LUC	Land Use Control
MEC	Munitions and explosives of concern
MSC	Medium-Specific Concentration
PCL	Protective Concentration Level
RAB	Restoration Advisory Board
RA(O)	Remedial Action Operation
ROD	Record of Decision
TCE	Trichloroethylene
TNT	Trinitrotoluene
TRRP	Texas Risk Reduction Program
VOC	Volatile organic compound

Restoration Advisory Board Meeting

Agenda

06:00 Welcome and Introduction

06:05 Open Items {RMZ}
- Purpose of the Restoration Advisory Board (RAB) Meeting
- Ongoing Outreach/Website
- RAB Administrative Issues
  - Membership Update
  - Minutes (January 2021 RAB Meeting)

06:15 Defense Environmental Restoration Program (DERP) Update {Bhate}
- Documents and Field Work Completed since last RAB
  - Update on LHAAP-50 Remedial Progress
  - What the Groundwater Treatment Plant (GWTP) does
- Three Month Look ahead
- GWTP Update

06:45 Other DERP Updates
- LHAAP-17 Explanation of Significant Difference (ESD) and Status {MMG-TLI}
- LHAAP-18/24, -29, and -47 Status {HDR}

06:55 Next RAB Meeting Schedule and Closing Remarks {RMZ}

RAB Administrative Issues

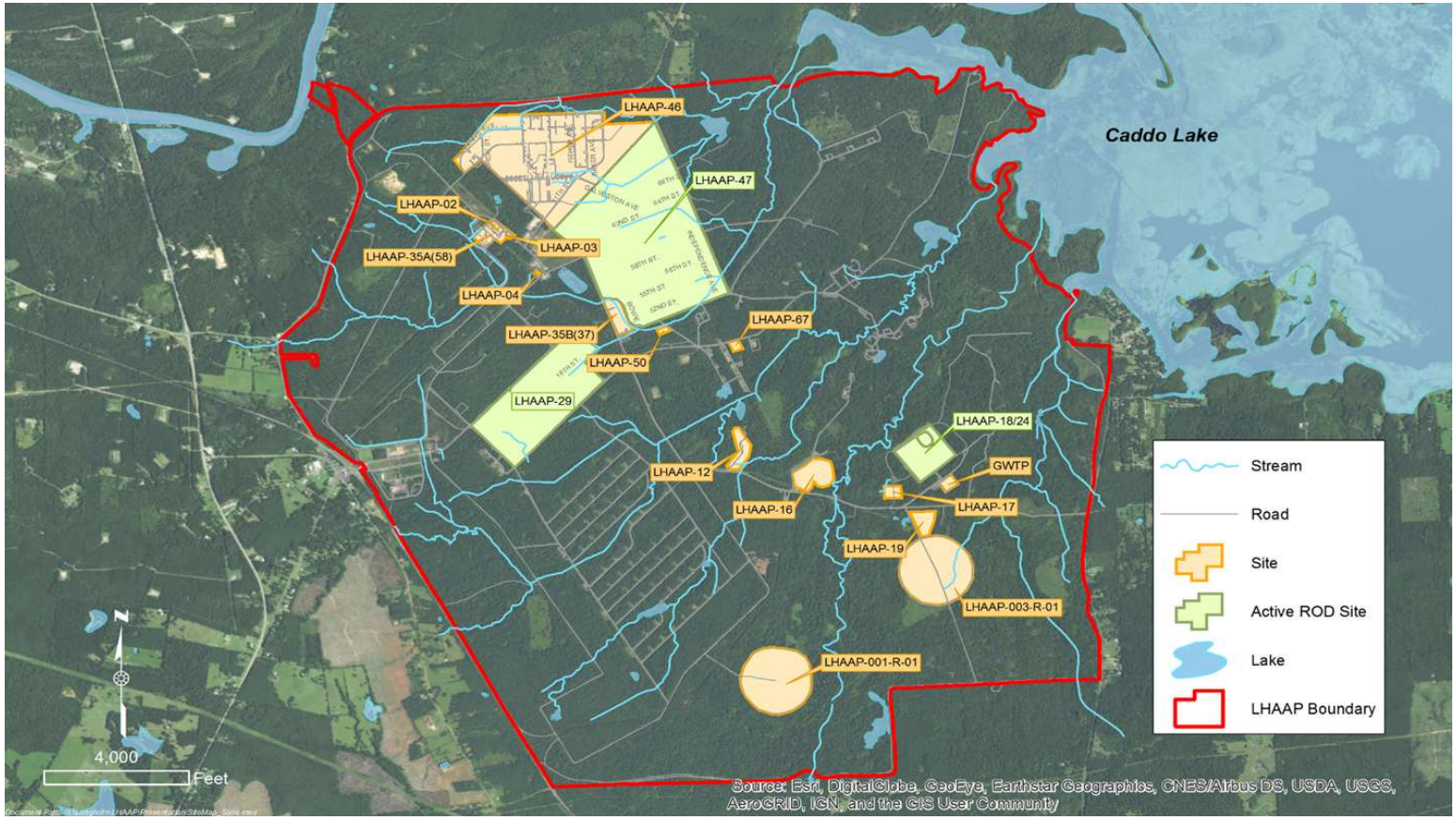
- Membership Update
  - Persons interested in being new members
- Minutes (January 2021 RAB Meeting)

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 the Longhorn Army Ammunition Plant (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.
- The 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
- There are three contractors working at LHAAP: Bhate/APTIM; MMG-TLI Joint Venture; and HDR, Inc. The work conducted by these contractors will be presented in the following slides in that order.

Restoration Advisory Board Meeting

Bhate/APTIM



Documents in Process

Site	Document
LHAAP-04	Annual Remedial Action Operation (RA[O]) Report
LHAAP-12	Annual RA(O) Report
LHAAP-16	Annual RA(O) Report
LHAAP-67	Annual RA(O) Report
GWTP	Quarterly Evaluation Report: Fourth Quarter (October – December 2020) Quarterly Evaluation Report: First Quarter (January – March 2021)

Restoration Advisory Board Meeting

Completed Field Work Since Last RAB Meeting

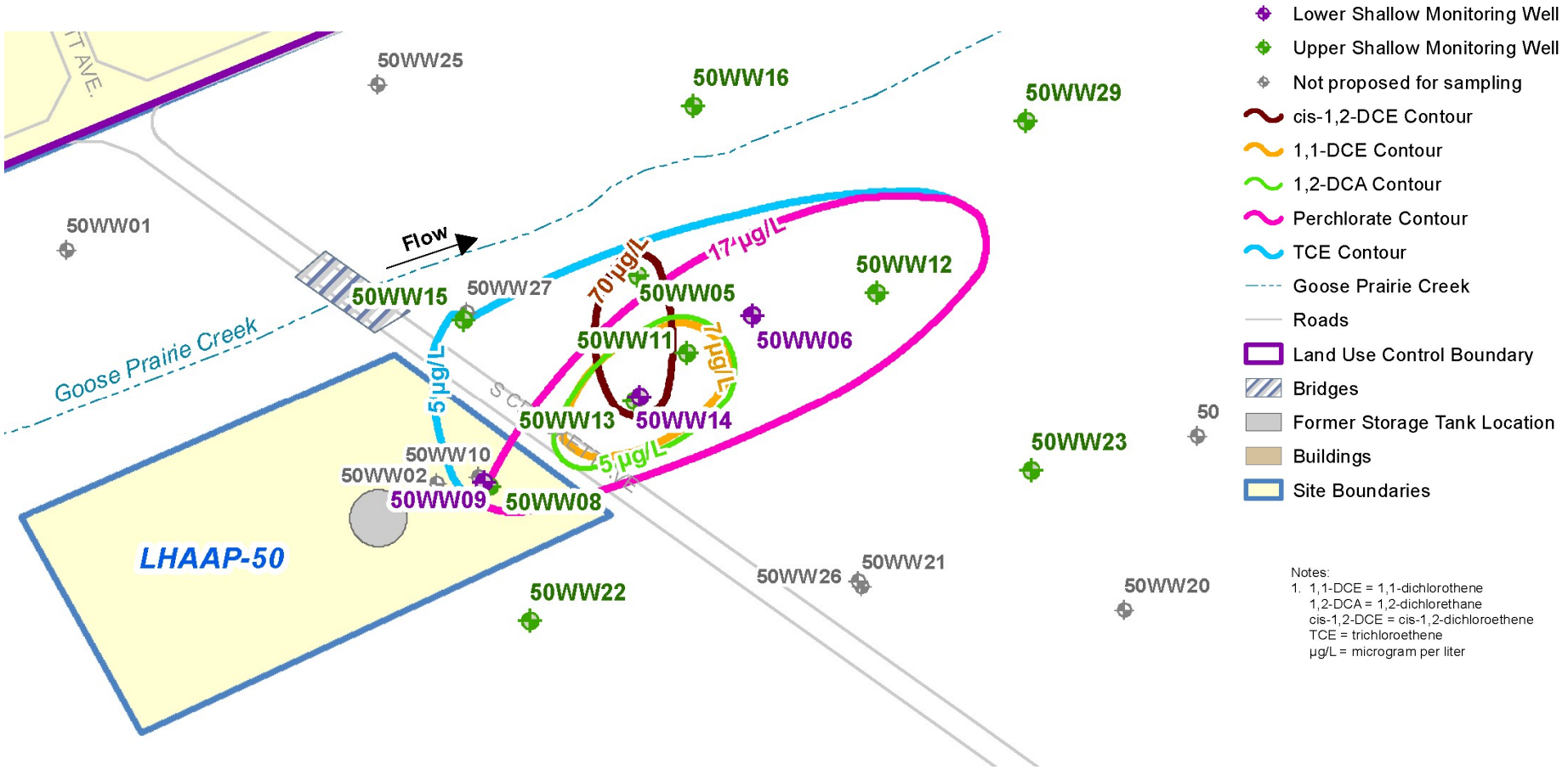
Site	Activity
LHAAP-04	Year 2 Quarter 1 Performance Sampling (March)
LHAAP-16	Year 1 Quarter 4 Performance Sampling (January-February)
LHAAP-46	Year 7 Annual Sampling (March)
LHAAP-50	Year 1 Quarter 3 Contingency Remedy Performance Sampling (January)
Multi-site	Well Plugging and Abandonment Waste Disposal
Surface Water	Surface Water Sampling (February)

LHAAP-50 Remedial Progress

- Site Background
  - LHAAP-50 had a 47,000-gallon aboveground storage tank receiving industrial wastewater from various production sumps throughout LHAAP between 1955 and 1988
  - After solids were filtered, the water was discharged to Goose Prairie Creek
  - Constituents of concern at LHAAP-50 were chlorinated solvents and perchlorate in groundwater and perchlorate in soil
- In-situ bioremediation remedy implemented in March 2020 after monitored natural attenuation found to be ineffective
- Baseline sampling performed in November 2019
- Quarterly sampling in July 2020, October 2020, and January 2021
- Next Quarterly Event (Year 1 Quarter 4) in April 2021

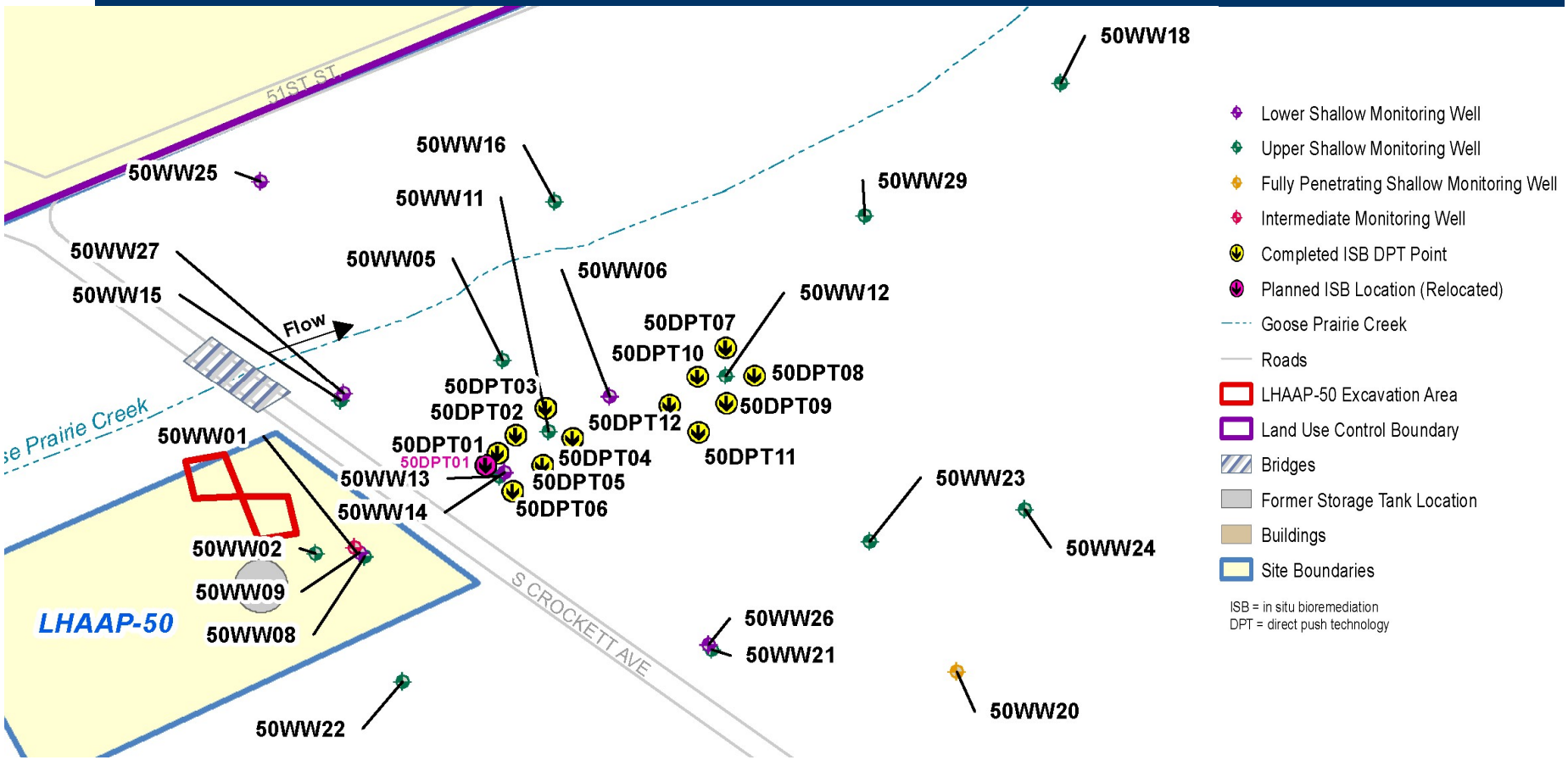
Restoration Advisory Board Meeting

LHAAP-50 Remedial Progress



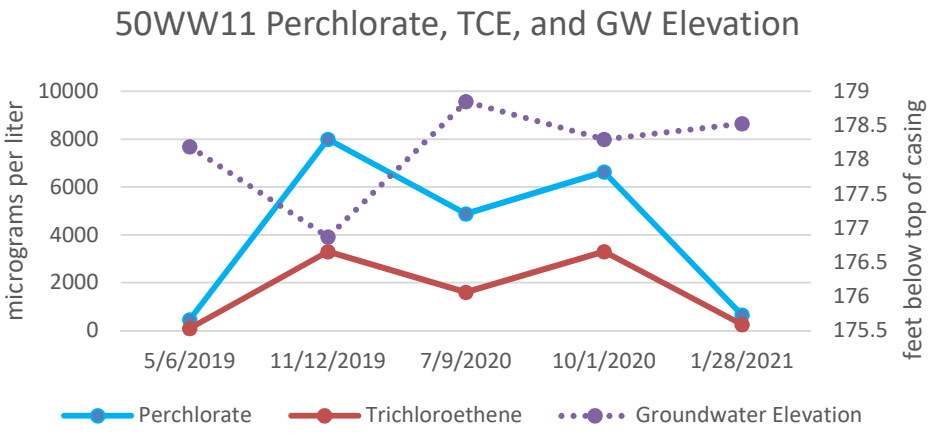
Restoration Advisory Board Meeting

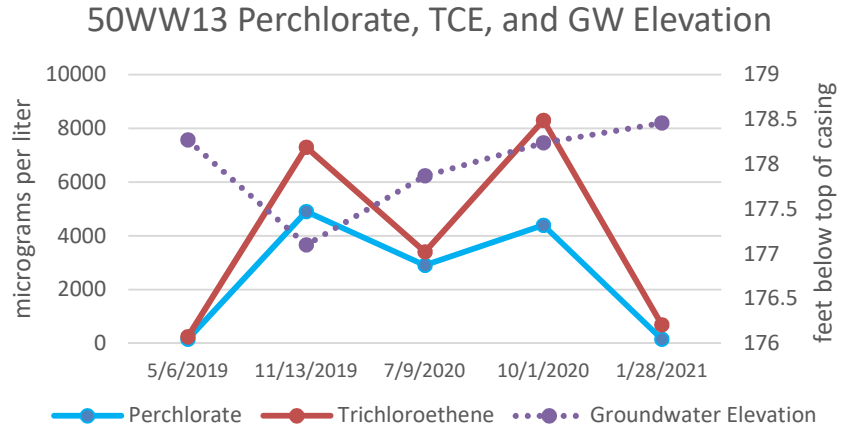
LHAAP-50 Remedial Progress

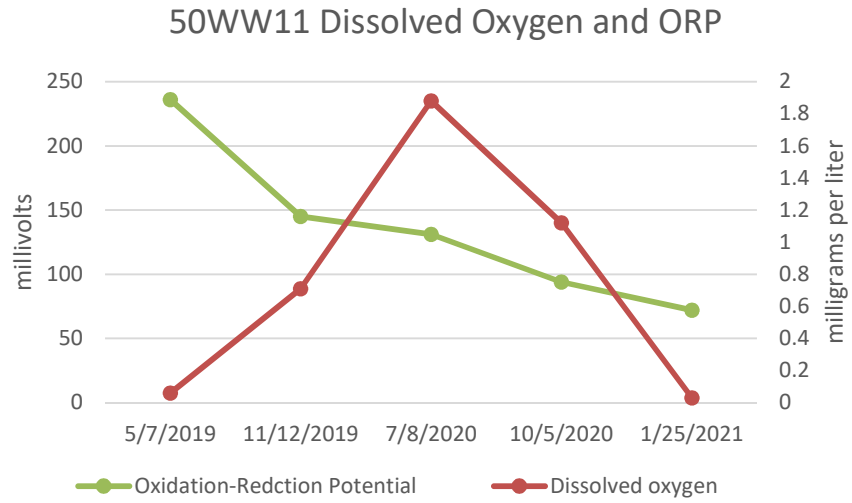


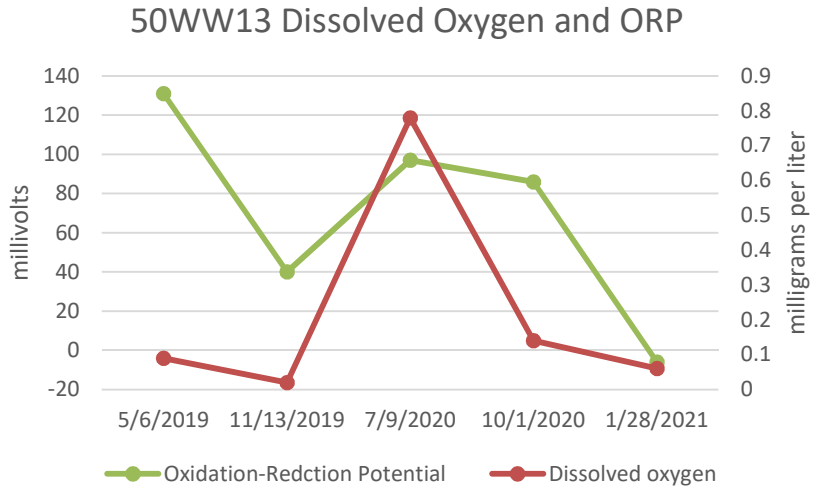
Restoration Advisory Board Meeting

LHAAP-50 Remedial Progress



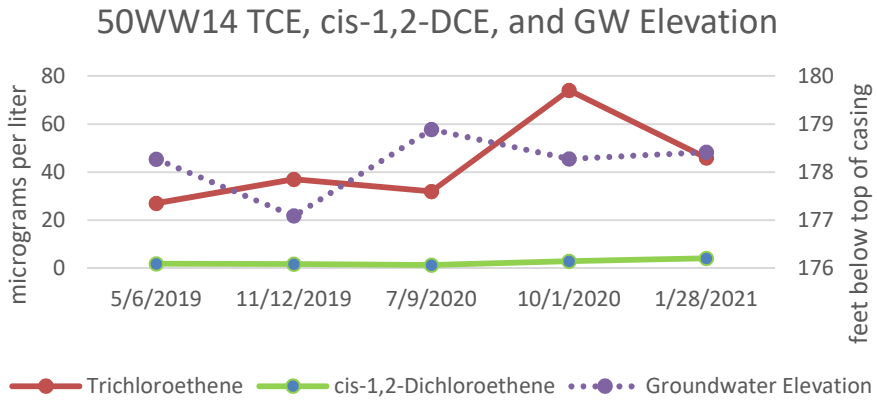


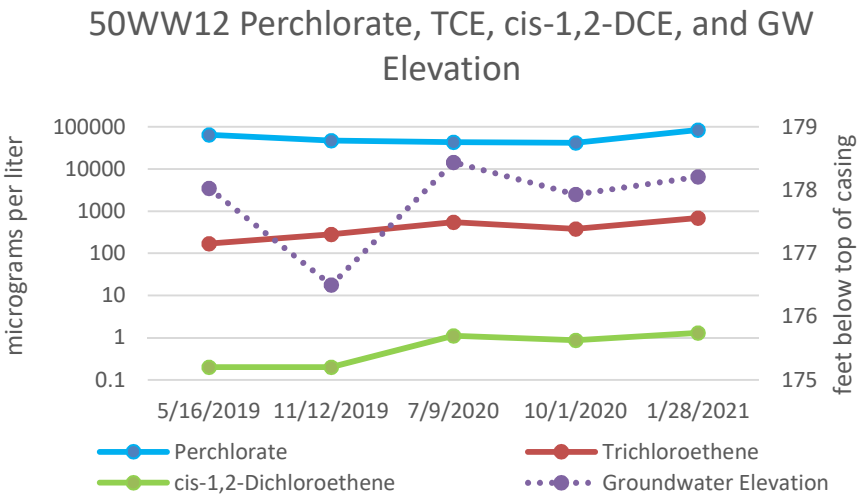


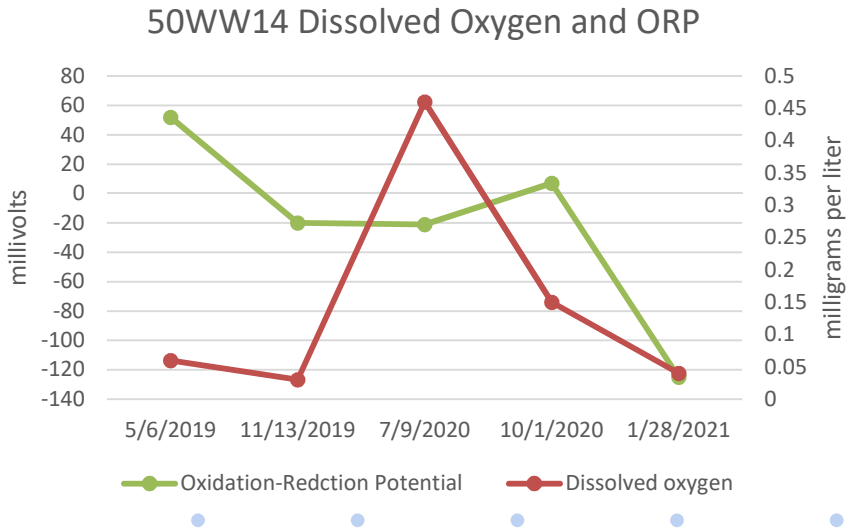


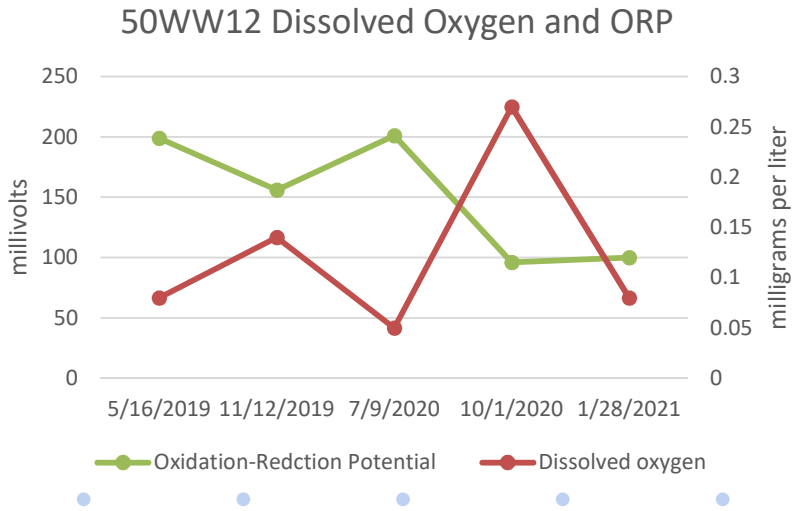
Restoration Advisory Board Meeting

LHAAP-50 Remedial Progress



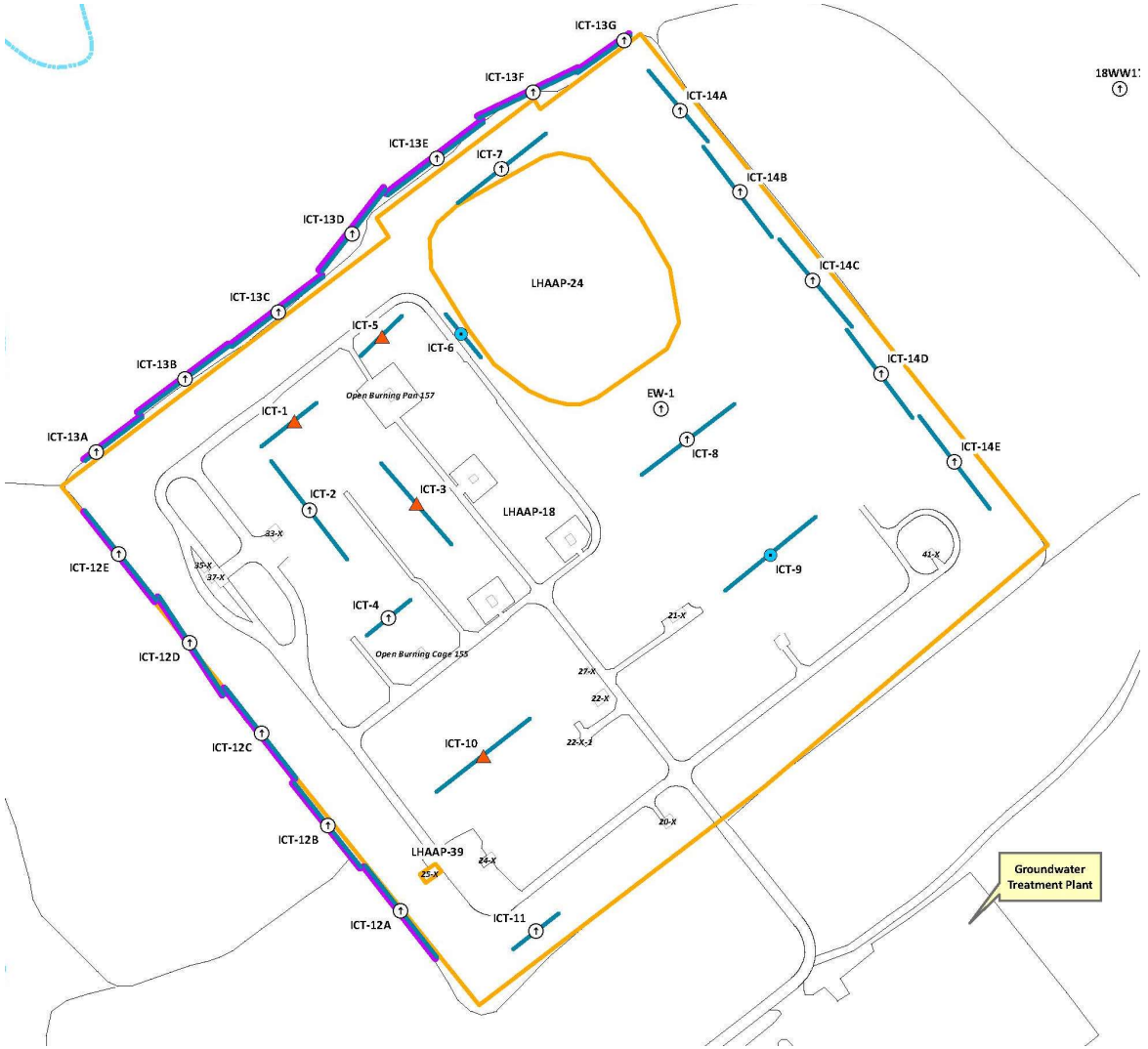






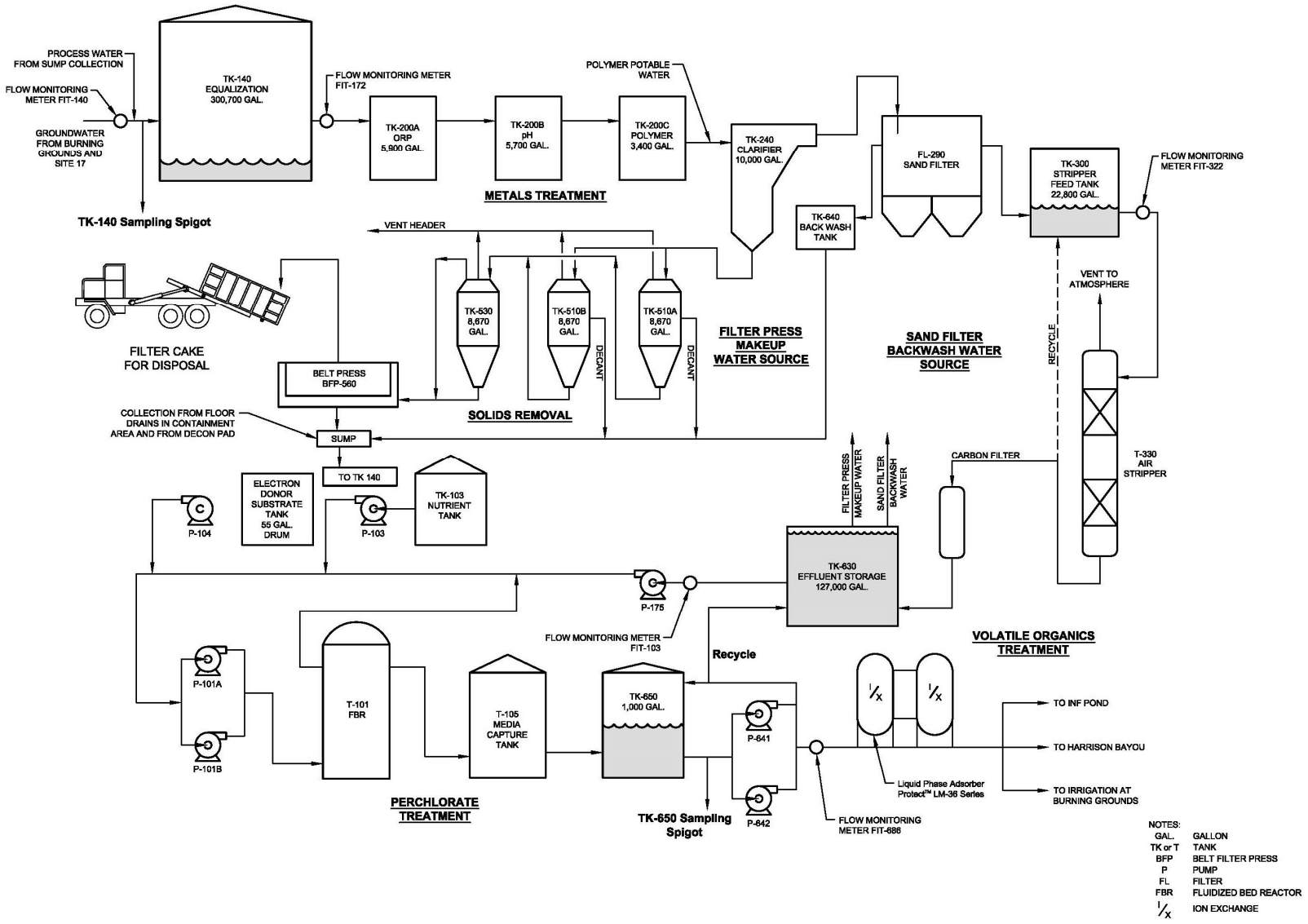
Restoration Advisory Board Meeting

LHAAP Extraction from LHAAP-18/24



Restoration Advisory Board Meeting

LHAAP Groundwater Treatment Plant



Restoration Advisory Board Meeting

3 Month Look Ahead - Field Work by Bhate Team

Site	Activity
LHAAP-04	Year 2 Quarter 2 Performance Monitoring (May 2021)
LHAAP-16	Year 2 Quarter 1 Remedy Performance Monitoring (April 2021)
LHAAP-37	Year 4 Semi-Annual RA(O) Sampling Event #2 (May 2021)
LHAAP-50	Year 1 Quarter 4 Contingency Remedy Performance Sampling (April 2021)
LHAAP-58	Semi-Annual Performance Monitoring (June 2021)
LHAAP-18/24	Semi-Annual RA(O) Sampling (June/July 2021)
Surface Water	2nd Quarter Sampling

Restoration Advisory Board Meeting

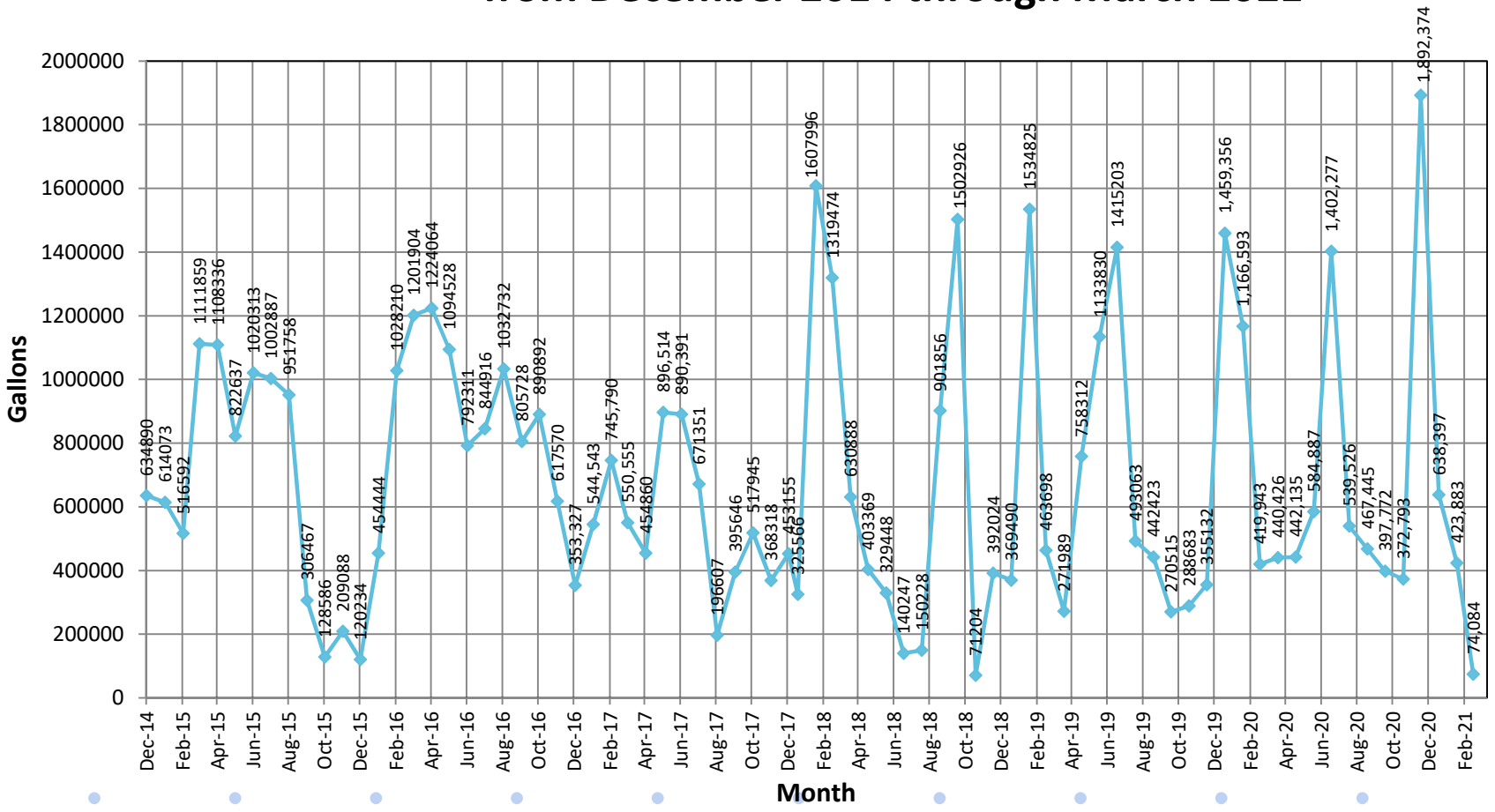
3 Month Look Ahead – Documents by Bhate Team

Site	Document
LHAAP-04	RA(O) Report to regulators
LHAAP-12	RA(O) Report to regulators
LHAAP-16	RA(O) Report to regulators
LHAAP-67	RA(O) Report to regulators
GWTP and LHAAP-18/24	Quarterly Evaluation Report: First Quarter (January to March 2021)

Restoration Advisory Board Meeting

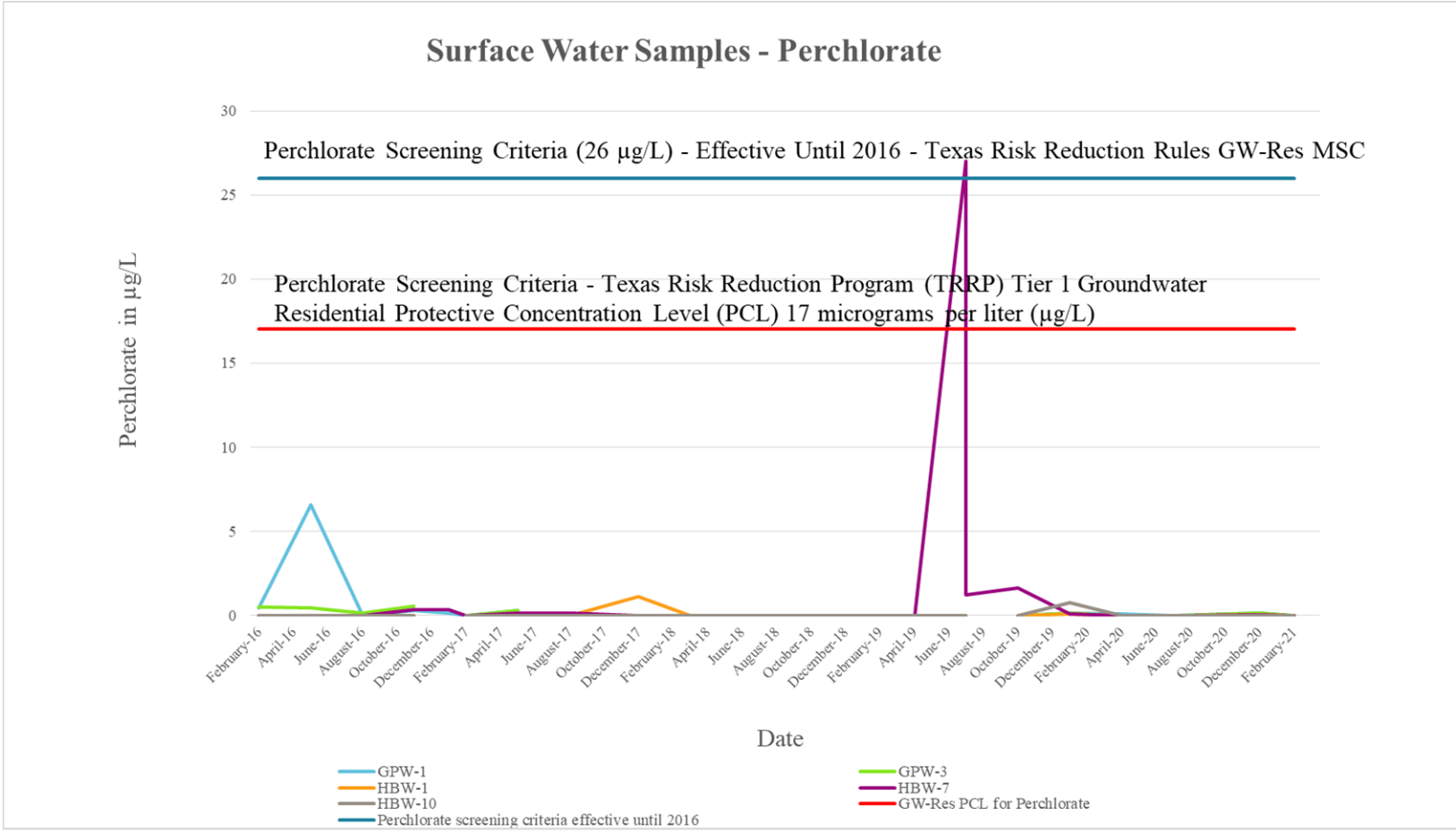
GWTP Update

Treated Groundwater Discharged Monthly from December 2014 through March 2021



Restoration Advisory Board Meeting

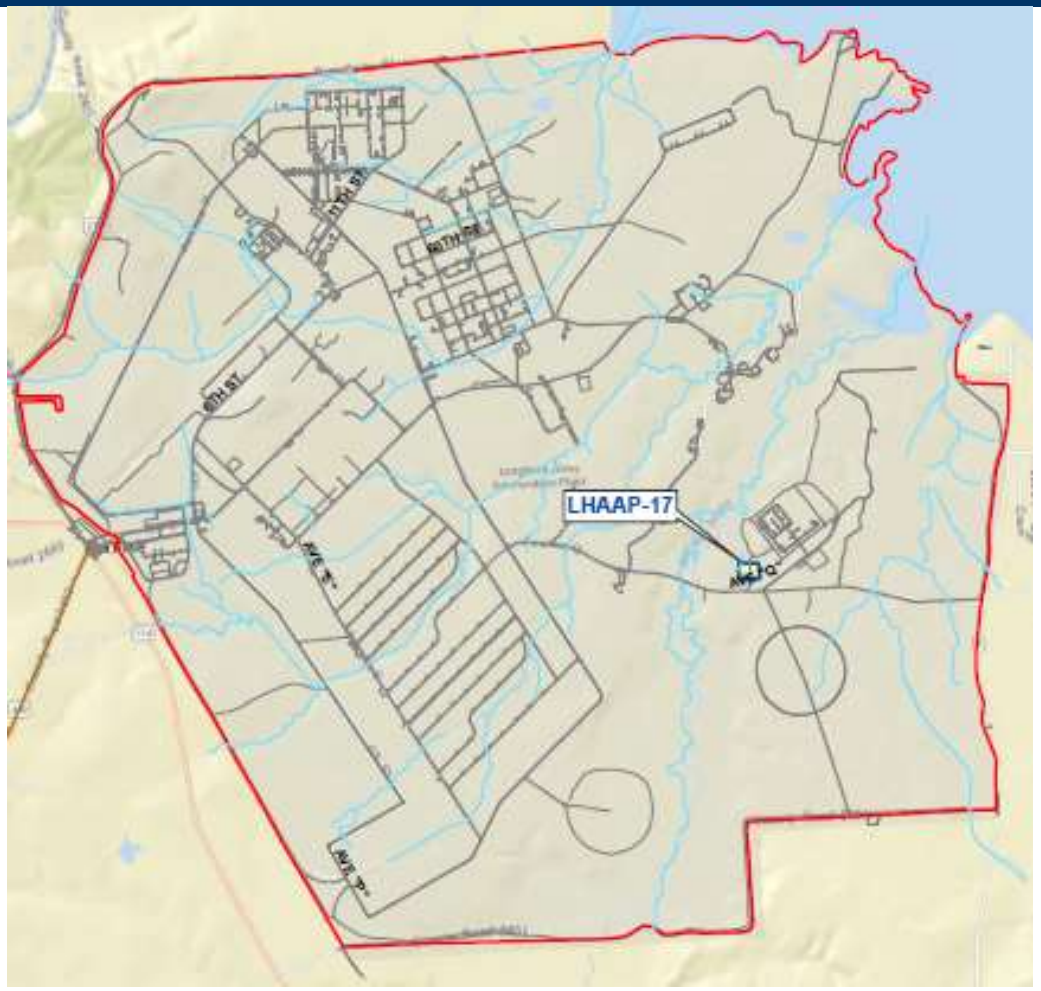
Surface Water Sample Results



Note: Surface water at HBW-7 had a detection of 27 µg/L from a sample collected on 11 July 2019. Surface water at HBW-7 was resampled 19 days later (30 July 2019) with a detection of 1.2 J µg/L.

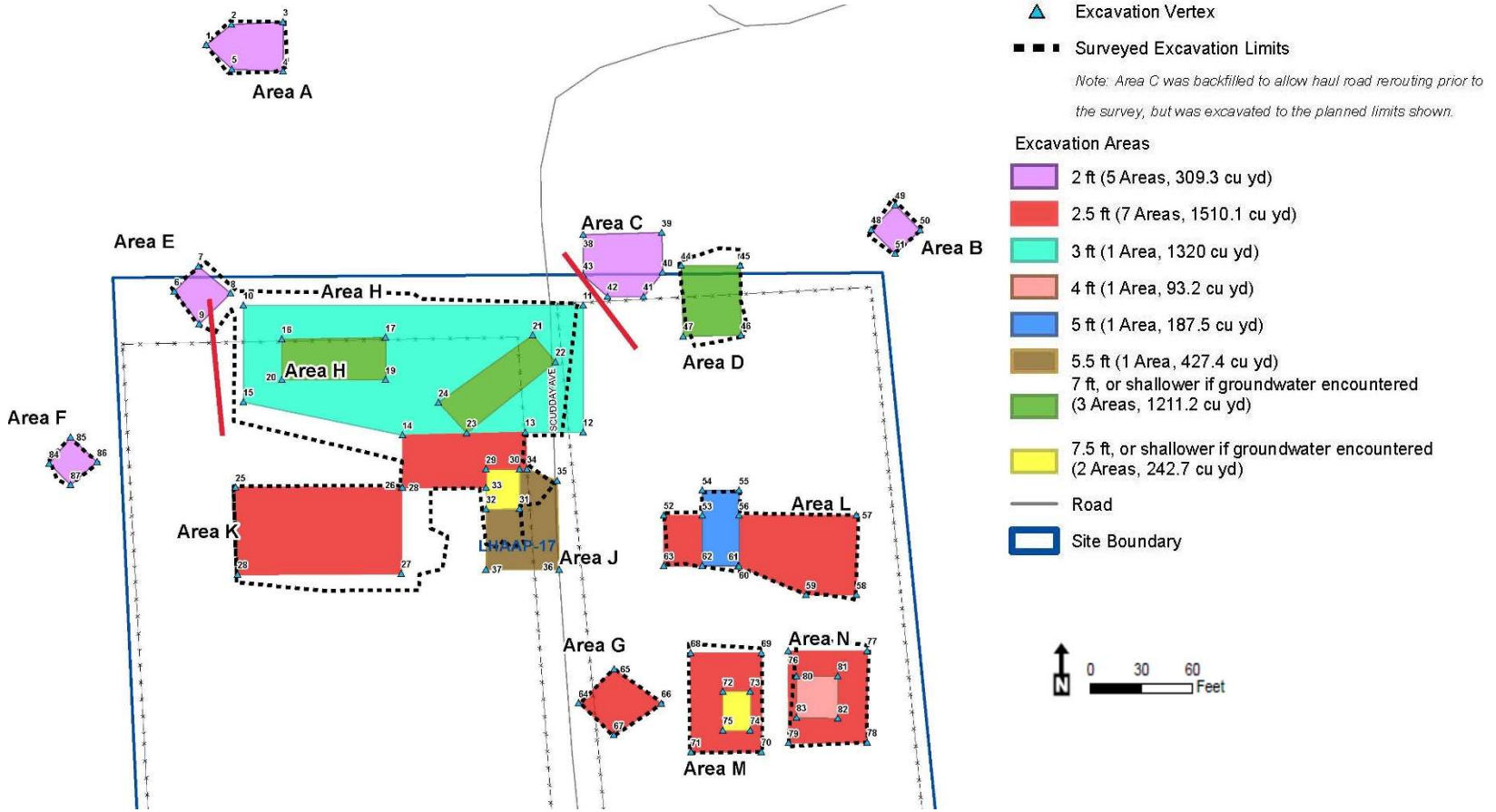
Restoration Advisory Board Meeting

MMG-TLI JV



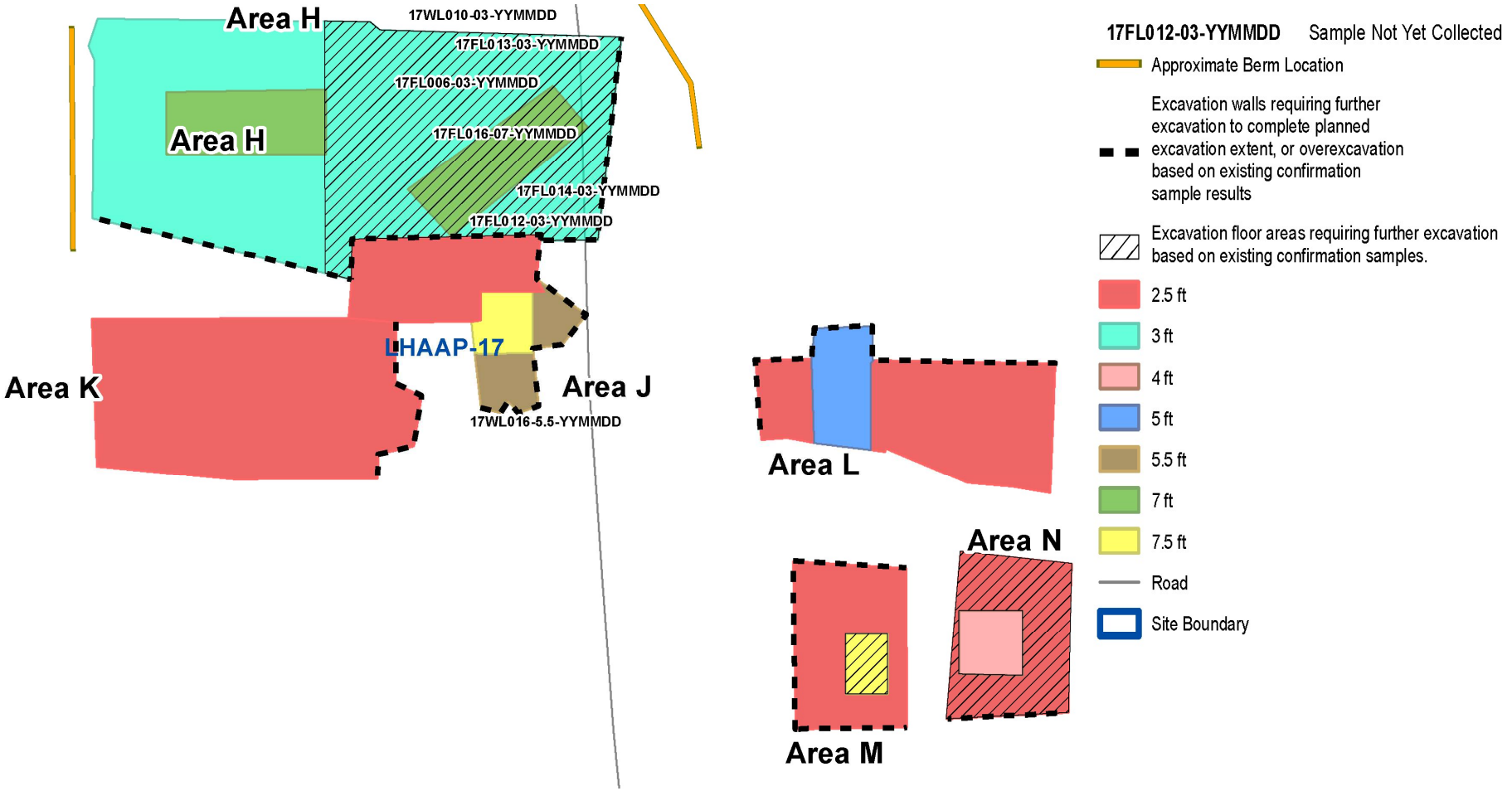
Restoration Advisory Board Meeting

LHAAP-17 Remedial Action-planned/completed to date



Restoration Advisory Board Meeting

LHAAP-17 Remedial Action-to be completed



Restoration Advisory Board Meeting

LHAAP-17 Remedial Action

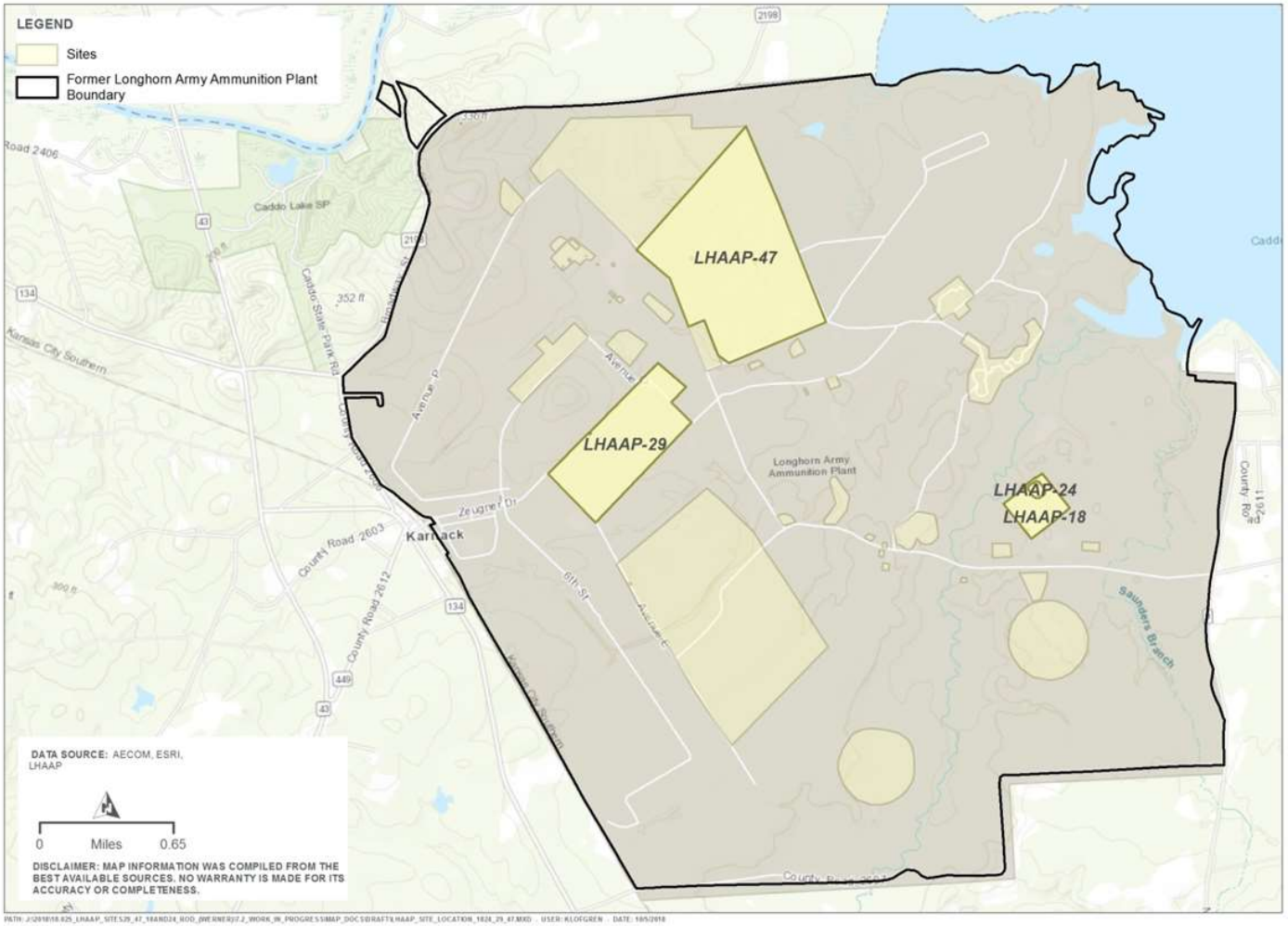
- A work stoppage occurred on September 30, 2019, due to the presence of munitions hazards not previously known to be present.
- An Explanation of Significant Difference (ESD) has been prepared and is currently under regulatory review to include the removal of munitions and explosives of concern (MEC) in soil that may act as a potential continuing source (contributing perchlorate contamination to soil and groundwater) and to add MEC Land Use Controls (LUCs). All other components of the selected remedy in the 2016 Record of Decision (ROD) remain unchanged. Addition of munitions-related LUCs include:
  - Prohibiting residential land use until it is demonstrated that munitions no longer present a threat to public/human safety.
  - Prohibiting intrusive subsurface activities, including digging, until it is demonstrated that the MEC no longer present an explosive hazard. However, intrusive subsurface activities may occur provided that the U.S. Army and the USEPA approve such intrusive subsurface activities before they are commenced and provided that they are undertaken by qualified personnel who are trained in explosives safety measures.

LHAAP-17 Remedial Action

- **Work plans/memoranda have been submitted for U.S. Army and regulatory review/acceptance:**
  - **Memorandum for Record: Draining of impounded water**
  - **Uniform Federal Policy-Quality Assurance Project Plan: Munitions Investigation and Removal**
  - **Remedial Design/Remedial Action Work Plan Addendum: Continued excavation of soils implementing explosives safety considerations including using remotely operated machinery and qualified Unexploded Ordnance Technicians to excavate and sift soils**

Restoration Advisory Board Meeting

HDR, Inc.



Restoration Advisory Board Meeting

LHAAP-18/24, -29, and -47 Document Status
3 Month Look Ahead - Documents by HDR Team

Site	Document
LHAAP-29	Draft Pre-Design Investigation Report, June 2021
LHAAP-47	Final Feasibility Study Addendum, April 2021
LHAAP-47	Draft Revised Proposed Plan, April 2021

Restoration Advisory Board Meeting

Future Field Work by HDR Team

Site	Activity
LHAAP-18/24	Pre-Design Investigation Field Work, Phase 2, Well Installation and Sampling, April - May 2021

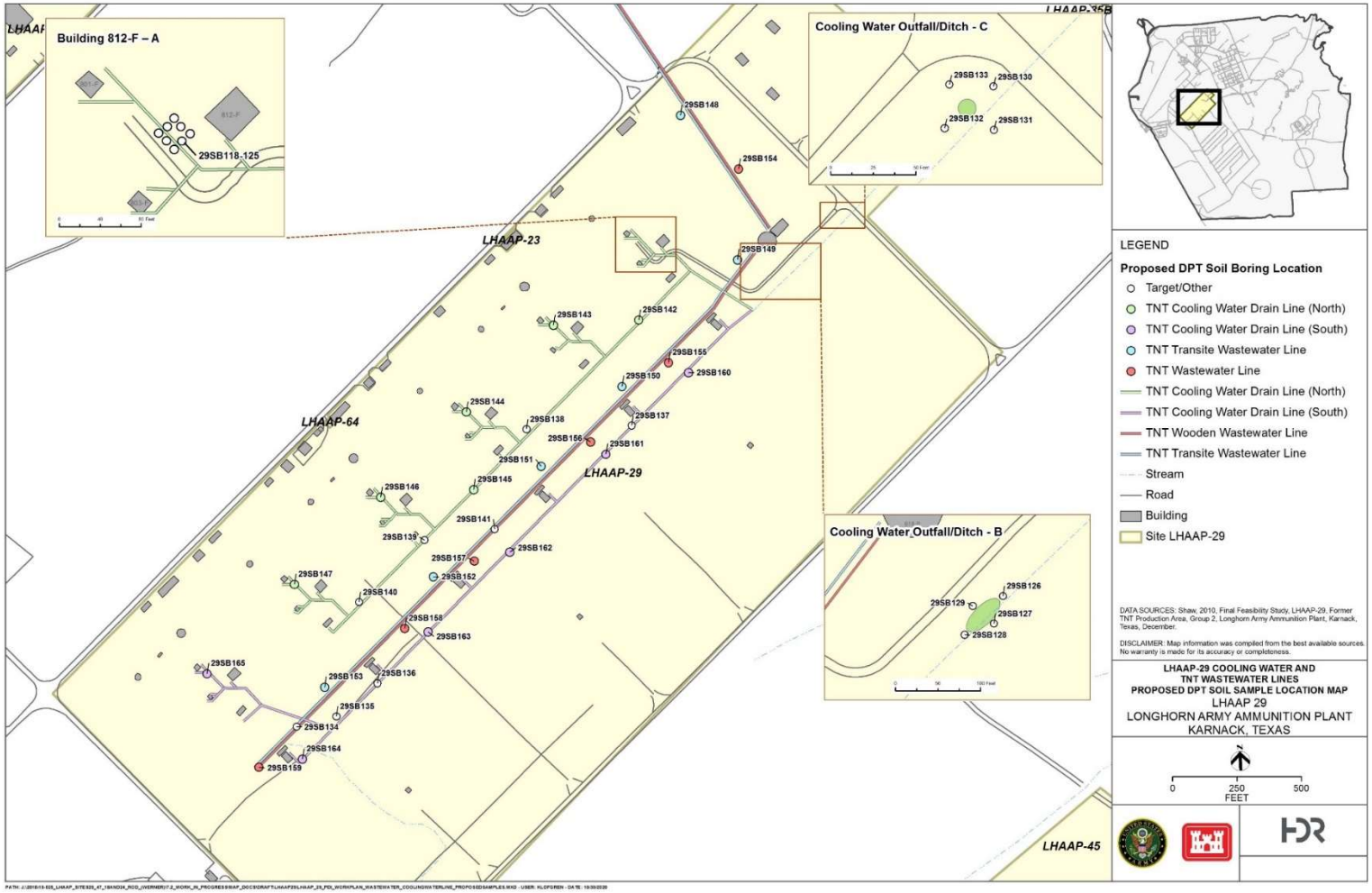
Restoration Advisory Board Meeting

Summary of LHAAP-29 Pre-Design Investigation Field Work

- 49 Direct Push Technology (DPT) soil borings advanced to depths not exceeding 16 feet below ground surface (bgs)
- 196 soil samples collected for explosives analyses (by Method SW8330A)
- Eight excavations completed along the former trinitrotoluene (TNT) Wooden Wastewater Line
- Liquid/sediment samples collected for explosives analyses (by Method SW8330A)

Restoration Advisory Board Meeting

Summary of LHAAP-29 Pre-Design Investigation Field Work Sample Locations



Restoration Advisory Board Meeting

Summary of LHAAP-18/24 Pre-Design Investigation Phase 1 Field Work

- 25 DPT soil borings advanced to depths not exceeding 40 feet bgs
- Nine soil samples collected for Volatile Organic Compound (VOC) and Perchlorate Analyses (by Methods SW8260 B & 6850, respectively)
- 25 Groundwater samples collected for VOC and Perchlorate Analyses (by Methods SW8260 B & 6850, respectively)
- Phase 1 Field Work Completed 27 March 2021

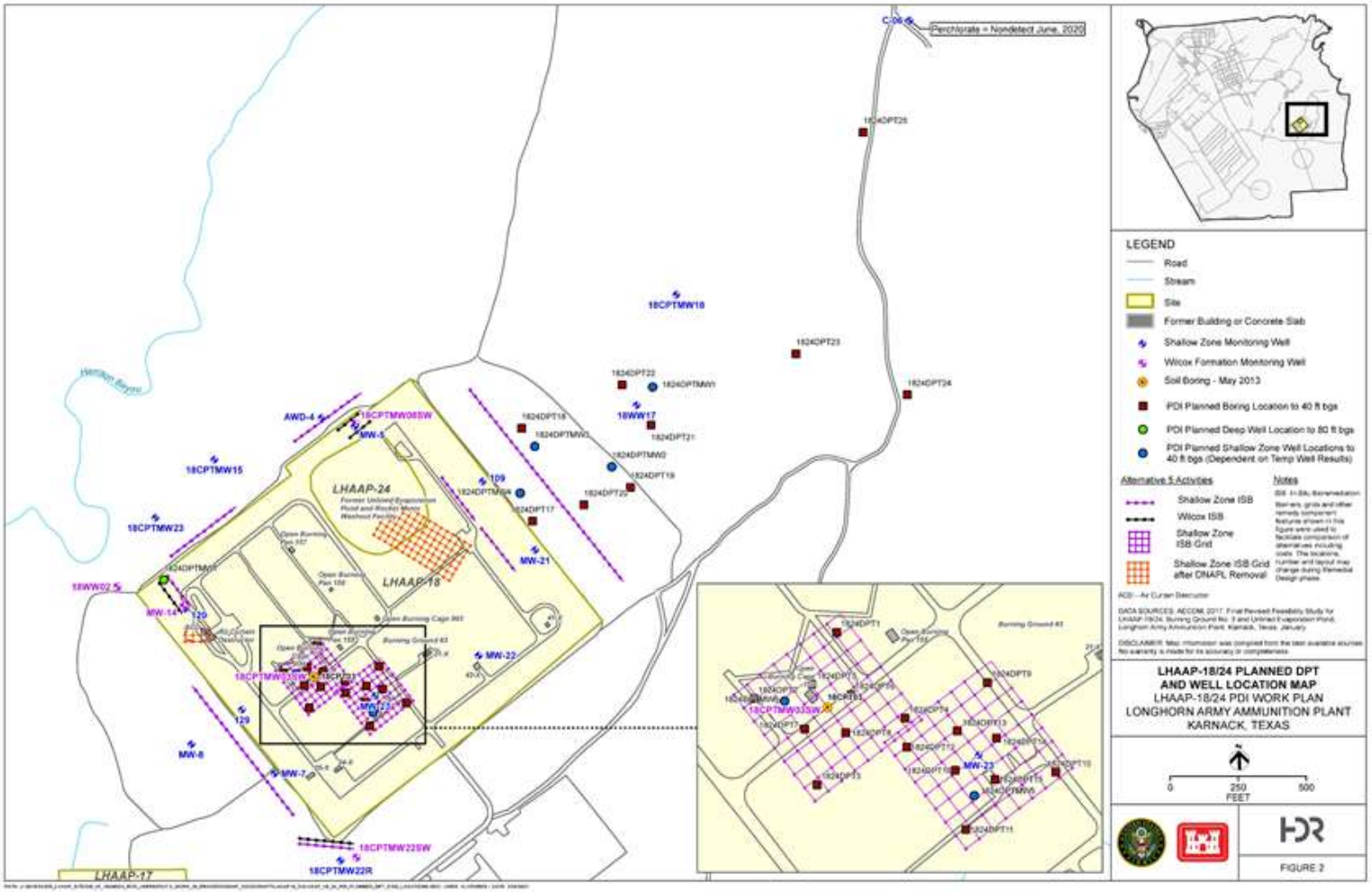
Restoration Advisory Board Meeting

LHAAP-18/24 Pre-Design Investigation Phase 2 Field Work

- Installation of six Shallow Zone and one Wilcox Formation wells
  - ✓ **Four outside the northeast interception-collection trench boundary**
  - ✓ **One at the in-situ bioremediation (ISB) shallow zone grid centered on Well MW-23**
  - ✓ **One at the ISB shallow zone grid centered on 18CPT03 and 18CPTMW03SW**
  - ✓ **One Wilcox Formation well northwest of well MW-14**

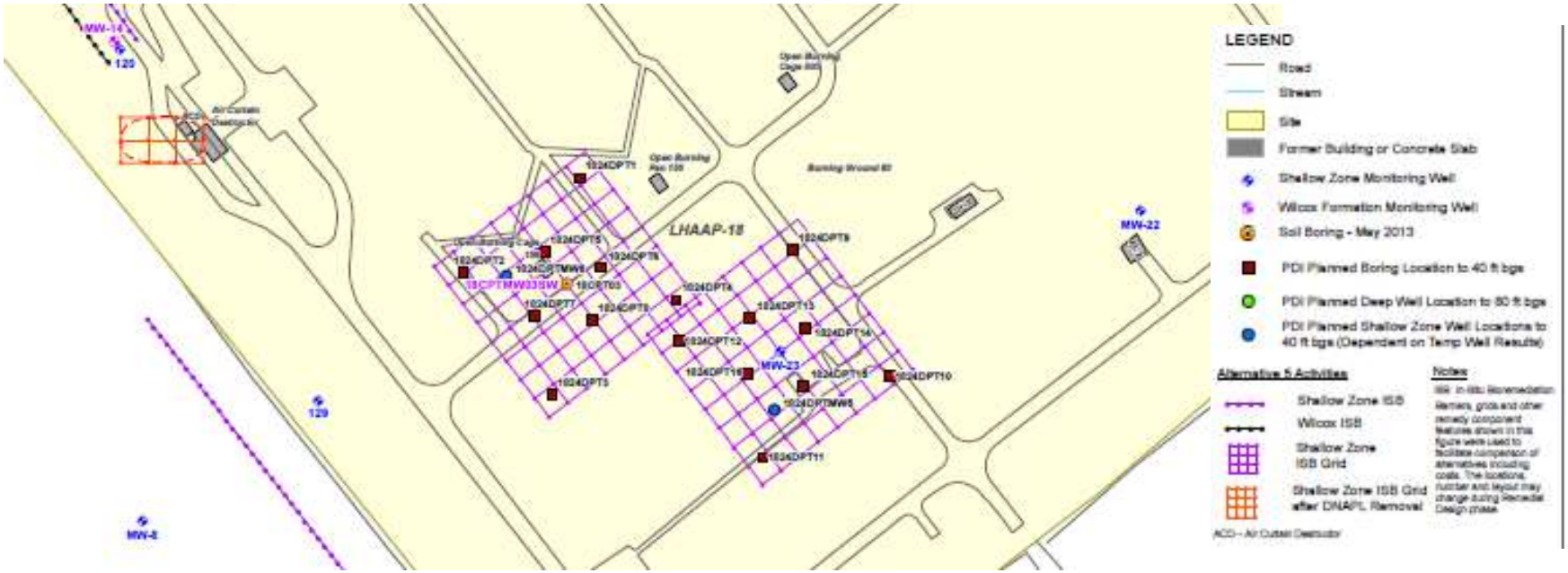
Restoration Advisory Board Meeting

LHAAP-18/24 Pre-Design Investigation Sample Locations



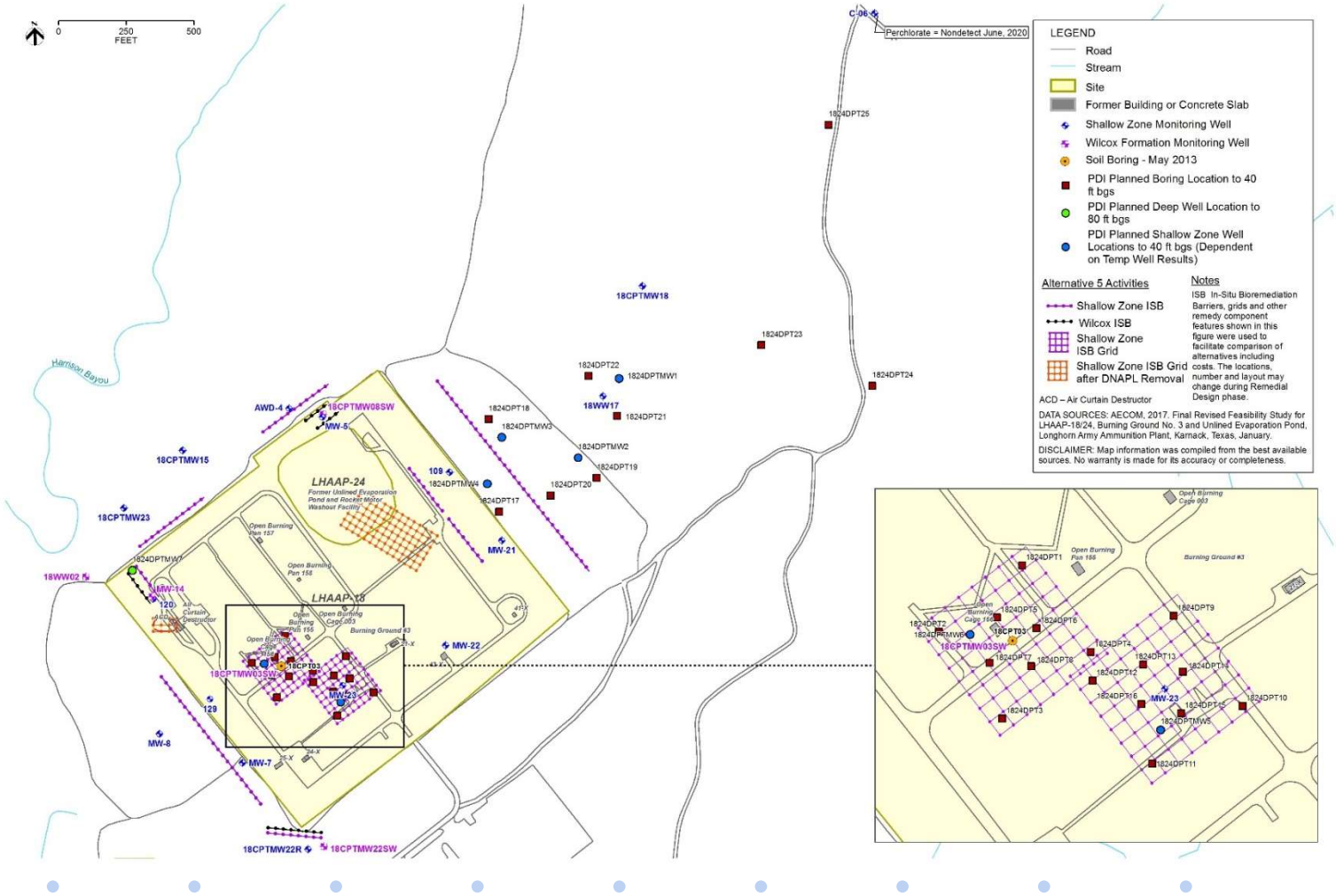
Restoration Advisory Board Meeting

LHAAP-18/24 Pre-Design Investigation Sample Locations



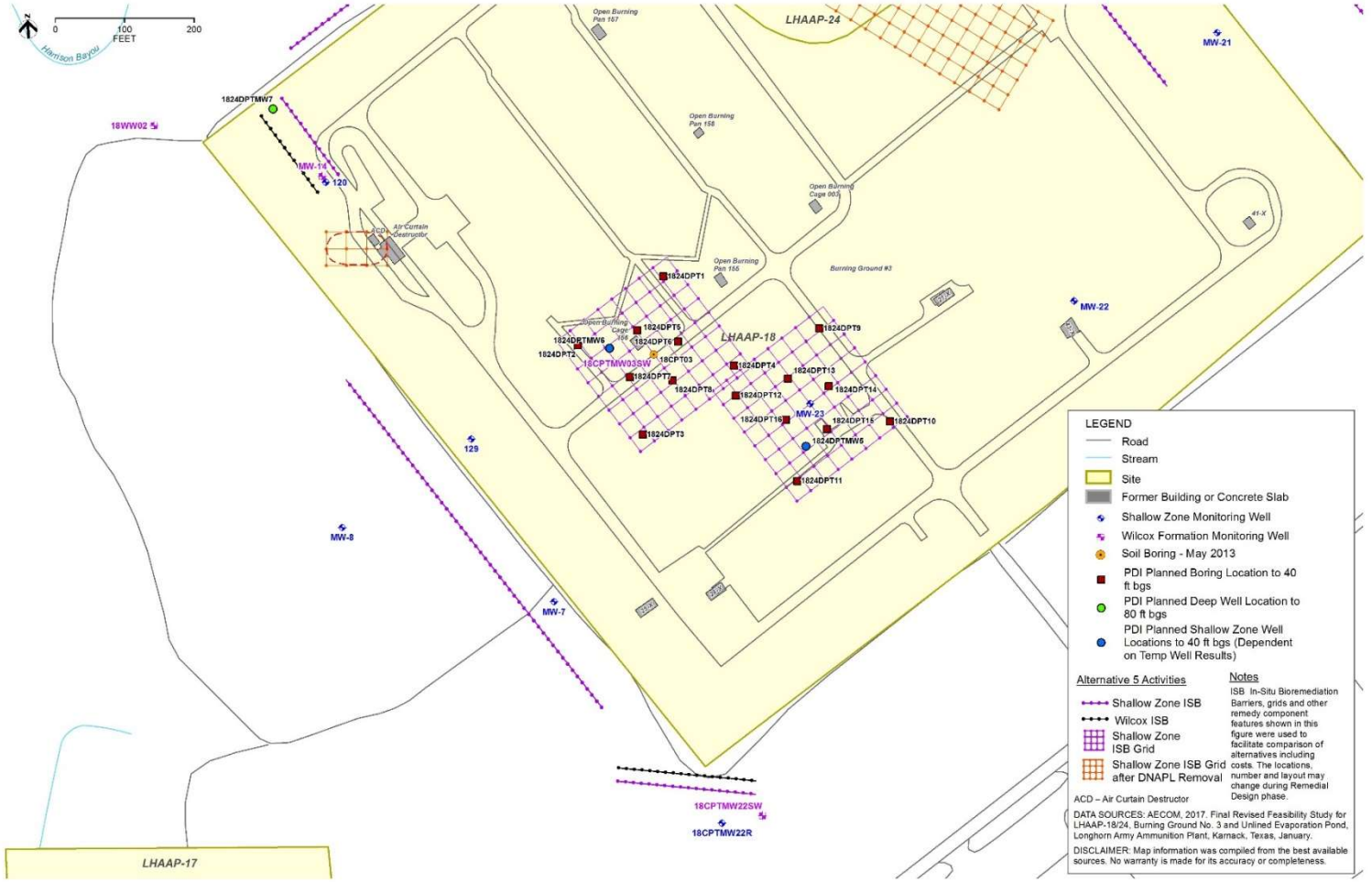
Restoration Advisory Board Meeting

LHAAP-18/24 Pre-Design Investigation Sample Locations



Restoration Advisory Board Meeting

LHAAP-18/24 Pre-Design Investigation Sample Locations



Next RAB Meeting Schedule & Closing Remarks

- Schedule July 2021 RAB Meeting
- Other Issues/Remarks
- Thank you for coming

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	3rd	4th	1st	2nd	3rd	4th	1st	2nd	3rd	4th	1st
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	<1.0 U	-	4	<4.0 U	<4.0 U	<4.0 U	-	2.65	<4.0 U	<4.0 U	<4.0 U
GPW-3	<1.0 U	<4.0 U	17	8	<4.0 U	<4.0 U	-	2.28	<4.0 U	<4.0 U	<4.0 U
HBW-1	-	<8.0 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	2nd	3rd	4th	1st	2nd	3rd	3rd	4th	2nd	3rd	4th
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	<0.2 U	<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	<0.2 U	<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	-	<0.2 U	<1.0 U	<1.0 U	<1.0 U	<1.0 U

Quarter	1st	2nd	3rd	4th	2nd	3rd	3rd	3rd	4th	1st	2nd
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	<0.5 U	<0.5 U	<0.22 U	16	<4 U	NS	<1.2 U	3.7	1.3 J	<0.6 U
GPW-3	21.9	9.42	1.1	<0.22 U	8.9	<4 U	NS	<0.6 U	2.8	1.8 J	<0.6 U
HBW-1	<0.5 U	<0.5 U	<0.5 U	<0.22 U	<0.55 U	<4 U	NS	<1.5 U	<0.275 U	1.5 U	<0.6 U
HBW-7	<0.5 U	<0.5 U	<0.5 U	<0.22 U	<0.55 U	<4 U	24	<1.2 U	<0.275 U	1.5 U	<0.6 U
HBW-10	<0.5 U	<0.5 U	<0.5 U	<0.22 U	<0.55 U	<4 U	NS	<1.5 U	<0.275 U	1.2 U	<0.6 U

Quarter	3rd	4th	1st	2nd	3rd	4th	1st	2nd	3rd	4th	1st
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	<0.1 U	8.7	Dry	Dry	1.76	0.163 J	Dry	NS	1.65	0.735
GPW-3	Dry	0.199 J	0.673	Dry	Dry	1.31	0.261	Dry	NS	1.74	0.754
HBW-1	Dry	<0.1 U	<0.2 U	Dry	Dry	<0.1 U	<0.1 U	Dry	NS	<0.2 U	<0.2 U
HBW-7	Dry	<0.1 U	<0.2 U	Dry	Dry	0.171 J	<0.1 U	Dry	NS	<0.2 U	<0.2 U
HBW-10	Dry	<0.1 U	<0.2 U	Dry	Dry	<0.1 U	<0.1 U	Dry	NS	<0.2 U	<0.2 U

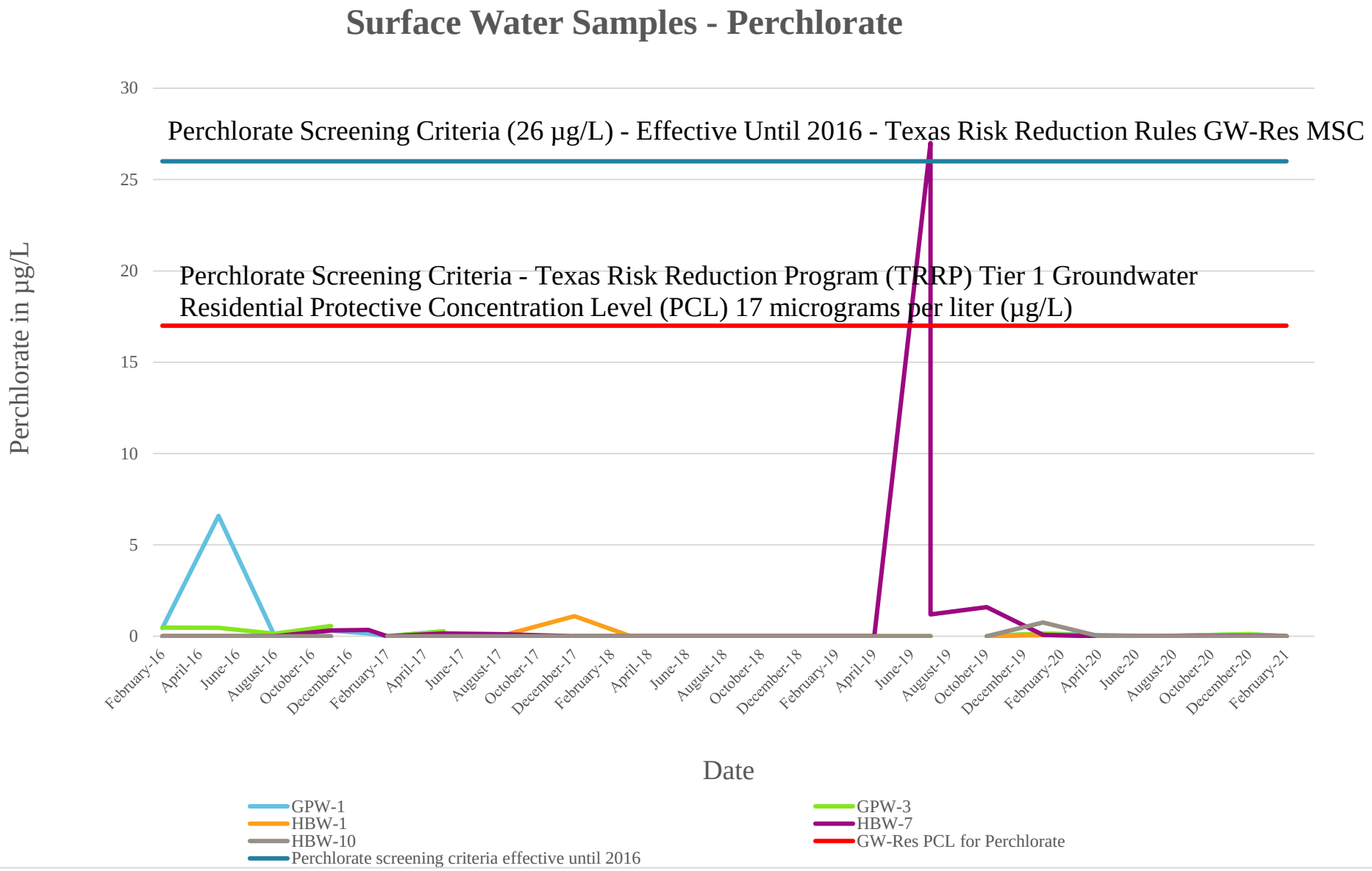
Quarter	2nd	3rd	4th	1st	2nd	3nd	4th	1st	2nd	3rd	4th
Creek Sample ID	**Jun 2013**	**Sept 2013**	**Dec 2013**	**Feb 2014**	**May 2014**	**Aug 2014**	**Nov 2014**	**Feb 2015**	**May 2015**	**Aug 2015**	**Nov 2015**
GPW-1	Dry	<0.2 U	Dry	0.766	Dry	Dry	0.244 J	0.311 J	0.156 J	Dry	0.142 J
GPW-3	Dry	<0.2 U	Dry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

Quarter	1st	2nd	3rd	4th	1st	2nd	3rd	4th	1st	2nd	3rd
Creek Sample ID	**Feb 2016**	**May 2016**	**Aug 2016**	**Nov 2016**	**Feb 2017**	**May 2017**	**Aug 2017**	**Dec 2017**	**Mar 2018**	**Jun 2018**	**Aug 2018**
GPW-1	0.447	6.59	<0.2 U	0.301 J	<1 U	0.263	Dry	<2.0 U	<2.0 U	Dry	<2.0 U
GPW-3	0.474	0.457	0.141	0.563	<1 U	0.274	Dry	<2.0 U	<2.0 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	<2.0 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	<2.0 U	<2.0 U	Dry	<2.0 U
HBW-10	<0.2 U	<0.2 U	<0.2 U	<0.2 U	<1 U	<0.2 U	0.111 J	<2.0 U	<2.0 U	Dry	<2.0 U

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

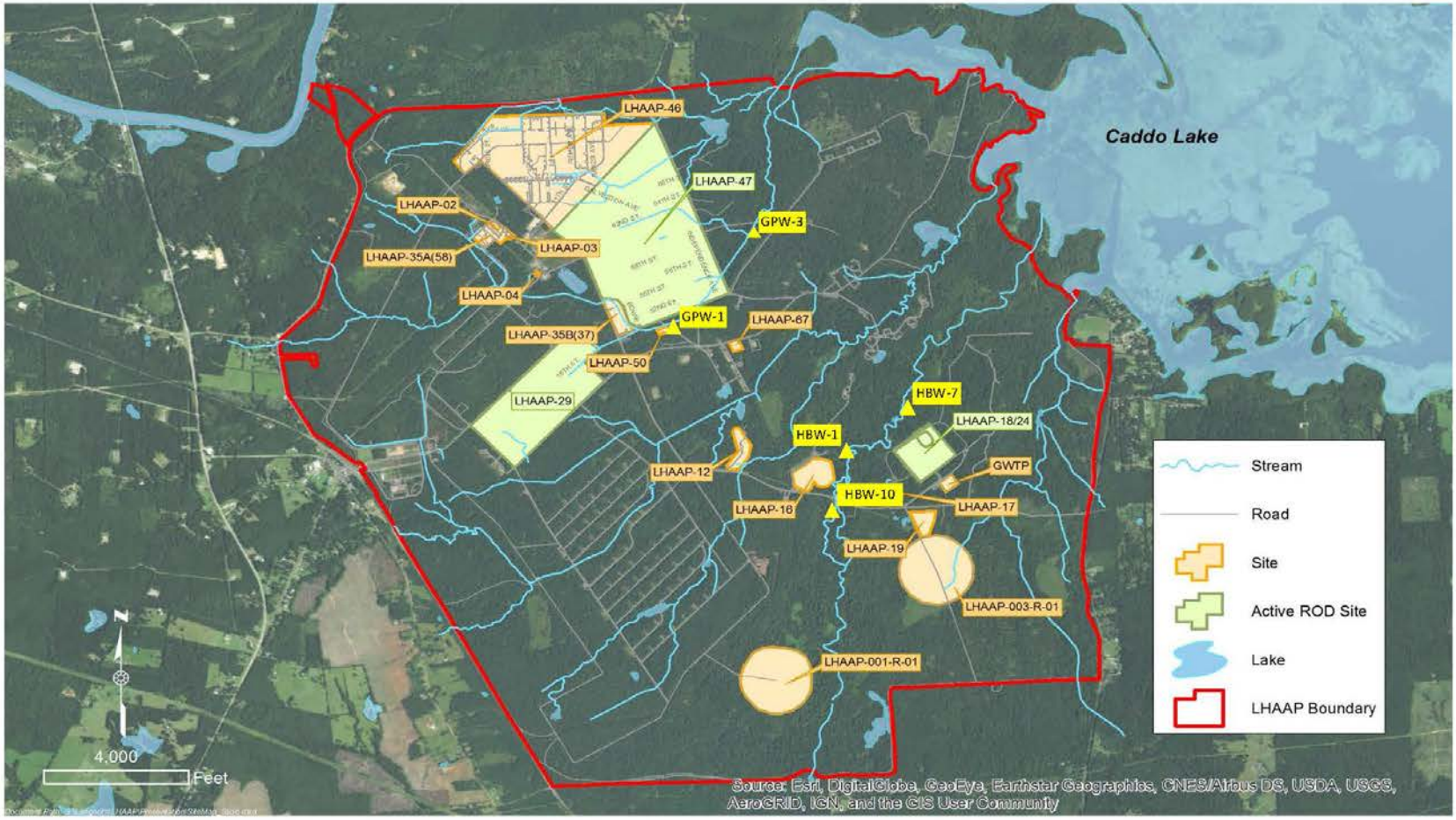
Quarter	4th	1st	2nd	3rd	4th	1st	2nd	3rd	4th	1st
Creek Sample ID	**Oct 2018**	**Jan 2019**	**Apr 2019**	**Jul 2019**	**Oct 2019**	**Jan 2020**	**Apr 2020**	**Jul 2020**	**Dec 2020**	**Feb 2021**
GPW-1	<2.0 U	<2.0 U	<2.0 U	<2.0 U	<2.0 U	0.163	0.0589 J	<0.05 U	0.110	<0.05 U
GPW-3	<2.0 U	<2.0 U	<2.0 U	<2.0 U	<2.0 U	0.156	0.0662 J	0.0326 J	0.108	<0.05 U
HBW-1	<2.0 U	<2.0 U	<2.0 U	<2.0 U	<2.0 U	0.0600 J	<0.05 U	<0.05 U	0.0374 J	<0.05 U
HBW-7	<2.0 U	<2.0 U	<2.0 U	27 (initial)/ 1.2 J (resample)	1.6 J	0.0761 J	<0.05 U	0.0318 J	0.0265 J	<0.05 U
HBW-10	<2.0 U	<2.0 U	<2.0 U	<2.0 U	<2.0 U	0.0782 J	<0.05 U	<0.05 U	<0.05 U	<0.05 U

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



Note: Surface water at HBW-7 had a detection of 27 µg/L from a sample collected on 11 July 2019. Surface water at HBW-7 was resampled 19 days later (30 July 2019) with a detection of 1.2 J µg/L.

Longhorn Army Ammuntion Plant Creek Sampling Locations



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

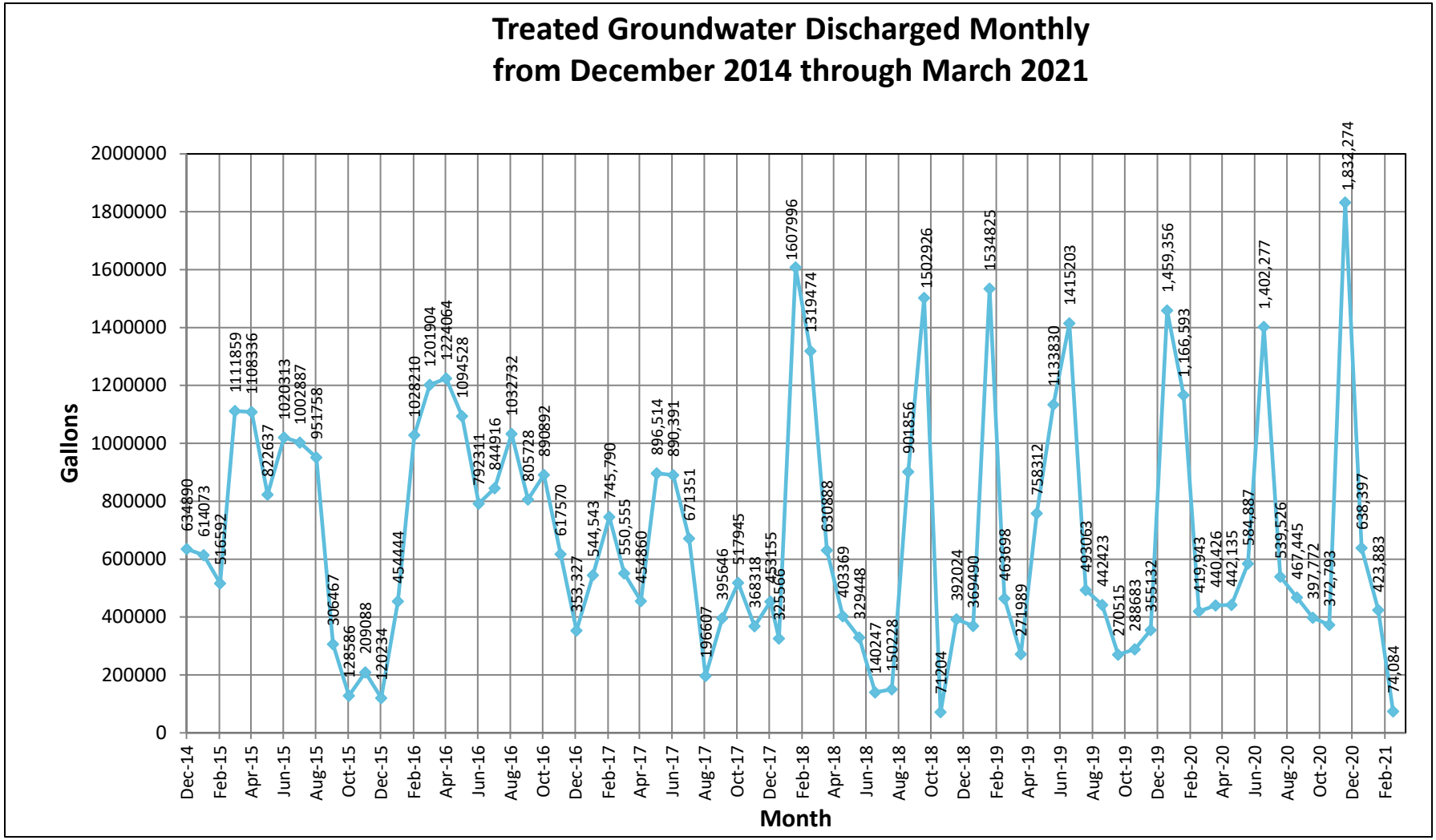
Oct-17	Nov-17	Dec-17	Jan-18	Feb-18	Mar-18	Apr-18	May-18	Jun-18	Jul - 18	Aug-18	Sep-18
517,945	368,318	453,155	325,566	1,607,996	1,319,474	630,888	403,369	329,448	140,247	150,228	901,856

Oct-18	Nov-18	Dec-18	Jan-19	Feb-19	Mar-19	Apr-19	May-19	Jun-19	Jul - 19	Aug-19	Sep-19
1,502,926	71,204	392,024	369,490	1,534,825	463,698	271,989	758,312	1,133,830	1,415,203	493,063	442,423

Oct-19	Nov-19	Dec-19	Jan-20	Feb-20	Mar-20	Apr-20	May-20	Jun-20	Jul-20	Aug-20	Sep-20
270,515	288,683	355,132	1,459,356	1,166,593	419,943	440,426	442,135	584,887	1,402,277	539,526	467,445

Oct-20	Nov-20	Dec-20	Jan-21	Feb-21	Mar-21						
397,772	372,793	1,832,274	638,397	423,883	74,084						

*Indicates Estimate


Treated Groundwater Discharged Monthly
from December 2014 through March 2021
Gallons
Month
2000000
1800000
1600000
1400000
1200000
1000000
800000
600000
400000
200000
0
Dec-14
Feb-15
Apr-15
Jun-15
Aug-15
Oct-15
Dec-15
Feb-16
Apr-16
Jun-16
Aug-16
Oct-16
Dec-16
Feb-17
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209088
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368318
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1319474
630888
403369
329448
140247
150228
901856
1502926
71204
392024
369490
1534825
463698
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758312
1133830
1415203
493063
442423
270515
288683
355132
1,459,356
1,166,593
419,943
440,426
442,135
584,887
1,402,277
539,526
467,445
397,772
372,793
1,832,274
638,397
423,883
74,084

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	0	0	534,155	0	0
Jun-17	958,404	0	294,550	490,574	0
Jul-17	0	0	528,538	0	0
Aug-17	0	0	195,197	0	0
Sep-17	651,434	0	309,980	651,434	0
Oct-17	0	0	517,945	0	0
Nov-17	0	0	368,318	0	0
Dec-17	560,350	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
Apr-19	271,989	0	0	0	0
May-19	758,312	0	0	253,817	0
Jun-19	1,133,830	0	0	847,918	0
Jul-19	1,415,203	0	0	903,001	0
Aug-19	374,629	0	118,434	0	0

Month	Total Combined to Harrison Bayou	LHAAP-18/24 Sprinklers	GWTP To INF Pond	INF Pond to Harrison Bayou	Contract Hauled Off-Site
Sep-19	0	0	442,423	0	0
Oct-19	0	0	270,515	0	0
Nov-19	115,503	0	173,180	0	0
Dec-19	318,248	0	36,884	0	0
Jan-20	1,459,396	0	0	1,115,183	0
Feb-20	1,166,593	0	0	741,954	0
Mar-20	419,943	0	0	0	0
Apr-20	440,426	0	0	0	0
May-20	442,135	0	0	0	0
June-20	584,887	0	0	0	0
July-20	1,402,277	0	0	984,393	0
Aug-20	216,197	0	323,359	0	0
Sep-20	0	0	467,445	0	0
Oct-20	0	0	397,772	0	0
Nov-20	0	0	372,793	0	0
Dec-20	1,832,274	0	60,199	1,571,432	0
Jan-21	638,397	0	0	383,318	0
Feb-21	423,883	0	0	259,875	0
Mar-21	74,084	0	0	74,084	0