Subject: Final Minutes, Quarterly Restoration Advisory Board (RAB) Meeting
Longhorn Army Ammunition Plant (LHAAP)
Location of Meeting: Caddo Lake State Park, Recreation Hall, Karnak, Texas
Date of Meeting: July 21, 2021, 5:00 PM Central Daylight Time (CDT)

Meeting Participants:

Army BRAC:	Rose M. Zeiler, Hank Procter
USACE:	Aaron Williams, Chelsea Montoya
USAEC:	Andrew Maly, Thomas Toudouze, Ana C. Nieves, Laura Zographos, and Lena Sierocinski
Bhate:	Kim Nemmers, Zach Beck
APTIM:	Bill Foss
HDR, Inc.	Philip Werner, Joy Rogalla
TLI:	Kyra Donnell, Brian Gentry
USGS Liaison:	Kent Becher and Christopher Braun
USEPA Region 6:	Lauren Poulos and Brian Follin (Phone Call-In)
TCEQ:	April Palmie (Phone Call-In)
USFWS:	Paul Bruckwicki
RAB:	Present: Deon Hall, Donna Burney, John Fortune, Sharon McAvoy, Charles Dixon, and Judy VanDeventer Absent: Terry Britt; John Pollard, Jr.; Tom Walker; Richard LeTourneau; and Nigel R. Shivers
Public:	USEPA Technical Advisory Group: George Rice (Caddo Lake Institute [CLI]) and Laura-Ashleigh Overdyke (CLI)

A color copy of the slide presentation and handouts (see list at end of meeting minutes) were provided for meeting attendees.

Welcome and Introduction

Ms. Judy VanDeventer, the RAB Co-Chair, called the meeting to order with a second from Ms. Sharon McAvoy. Ms. Rose Zeiler welcomed and introduced Mr. Hank Procter as Mr. Tom Lederle's replacement. Mr. Procter is a Program Manager and the Base Realignment and Closure (BRAC) Field Branch Chief under the Environmental Division of the Installation Services Division, 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 announced that she would be retiring from the Army position effective August 7, 2021. Shortly after, Ms. Zeiler will return as a part time contractor and will continue her current LHAAP role. Ms. Zeiler stated that her e-mail and cell phone number will eventually change but her address will remain the same.

Ms. Lauren Poulos, the United States Environmental Protection Agency (USEPA) Remedial Project Manager (RPM) who took over in December 2020, introduced her replacement, Mr. Brian Follin.

Mr. Andrew Maly, the United States Army Environmental Command (USAEC), acting Environmental Restoration Manger (ERM) introduced Ms. Ana Nieves. Mr. Maly who has been covering this position, has placed Ms. Nieves as the ERM for LHAAP moving forward. Mr. Aaron Williams, the United States Army Corps of Engineers (USACE) Technical Manager, introduced Ms. Chelsea Montoya as the new USACE-Tulsa District Project Manager (PM), replacing Mr. Richard Smith. Mr. Kent Becher, the United States Geological Survey (USGS) liaison, announced his retirement which will go into effect August 28, 2021, and introduced Mr. Christopher Braun. Mr. Braun will be taking over for Mr. Becher with his retirement. Ms. Kim Nemmers introduced Mr. Zach Beck as an Assistant PM for Bhate Environmental Associates, Inc. (Bhate). Mr. Beck has been with Bhate for 14 years and has been involved with the LHAAP project behind the scenes.

Minutes (April 2021 RAB Meeting)

Ms. Zeiler asked for any comments or additions to the RAB meeting minutes from the April 2021 conference call. Based on no additional input, Ms. Zeiler asked for a motion to approve. Ms. VanDeventer made a motion to approve. Mr. John Fortune seconded the motion to approve the minutes. Ms. Zeiler stated that the minutes were approved.

Membership Update

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. No one spoke up to mention any other people who may be interested.

Ms. Zeiler explained that the Army wants the public to be informed of the LHAAP activities and site status. She encouraged everyone to attend the RAB meetings and/or become a member of the RAB. Ms. Zeiler mentioned the Longhorn environmental website at www.longhornaap.com. The website is regularly updated to indicate upcoming field events at each site such as groundwater sampling, well installations, soil sampling, and remediation activities.

Ms. Zeiler explained that there are three contractors managing work at LHAAP. Those contractors are Bhate with APTIM; MMG-TLI Joint Venture (JV); and HDR, Inc. Ms. Zeiler introduced Ms. Kyra Donnell and Mr. Brian Gentry with TLI, which is part of the MMG-TLI JV. Ms. Donnell is the TLI Project Manager and Mr. Gentry is the TLI Munitions Response Operations Manager overseeing the field work. Mr. Gentry discussed his previous involvement at other LHAAP munitions response sites in 2008.

Ms. Nemmers discussed the active sites at LHAAP managed by Bhate/APTIM, HDR, Inc., and MMG-TLI JV. Ms. Nemmers presented the LHAAP site map (page 8 of the slide presentation) which shows the locations of each site within LHAAP.

Documents in Progress

Ms. 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, -16, -46, -50, -58, and -67. Evaluations of analytical data collected in June 2021 are ongoing for LHAAP-16 and-50. Ms. Nemmers said that the Quarterly Groundwater Treatment Plant (GWTP) Report is in progress for the 2nd Quarter 2021 (April – June 2021).

Completed Field Work Since Last RAB Meeting

Ms. Nemmers discussed field work completed since the RAB meeting in April 2021, including the Year 2 Quarter 2 (May 2021) Performance Sampling at LHAAP-04; the Year 2 Quarter 1 (April 2021) Performance Sampling at LHAAP-16; the Year 4 Semi-Annual Sampling Event 2 (May 2021) at LHAAP-37; the Year 1 Quarter 4 Performance Sampling (April 2021) at LHAAP-50; the Year 7 Semi-Annual Sampling Event 2 (June 2021) at LHAAP-58; and the surface water sampling completed in April 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 Harrison Bayou and Goose Prairie Creek were collected in April 2021 and the data is presented in the handouts included with the RAB slides.

Three Month Look Ahead – Documents by Bhate/APTIM Team

Ms. Nemmers presented the 3 month look ahead for upcoming documents to be prepared by the Bhate/APTIM team. The list of documents included the RA-O Reports for LHAAP-16, -37, -46, -50, -58, and -67 and the LHAAP-18/24 and GWTP Quarterly Evaluation Report 2nd Quarter (April – June 2021).

Three Month Look Ahead – Field Work by Bhate/APTIM Team

Ms. Nemmers presented the 3 month look ahead for upcoming field work to be performed including the Year 2 Quarter 3 (August 2021) Performance Sampling at LHAAP-04; the Year 2 Quarter 2 (July 2021) Performance Sampling at LHAAP-16; the Year 2 Quarter 3 (October 2021) Performance Sampling at LHAAP-16; the Year 2 Quarter 1 Performance Sampling (July 2021) at LHAAP-50; the Year 2 Quarter 2 Performance Sampling (October 2021) at LHAAP-50; and the 3rd Quarter surface water sampling (August 2021).

GWTP Update

Ms. Nemmers presented an update on the operation of the GWTP including monthly treated groundwater discharged to the Harrison Bayou. She explained that the groundwater treated by the GWTP 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 generally the GWTP treats between 200,000 and 400,000 gallons of water each month. Ms. Nemmers explained that the volume of water treated is dependent upon the amount of precipitation the area received. When discharge amounts are over 1 million gallons in a month, this volume of water discharged means that there is enough surface water flow in Harrison Bayou to discharge from a holding pond, used

for treated groundwater when there is not sufficient flow for discharge in the bayou. The surface water sample results continue to be either non-detect or very low levels; the handout provides the actual data. Ms. Laura-Ashleigh Overdyke asked Ms. Nemmers to confirm that the handout is where the actual data is. Ms. Nemmers concurred.

HDR: LHAAP-18/24, -29, and -47 Document Status

Mr. Phillip Werner introduced the sites HDR, Inc. are working on and gave an update on document status, including the LHAAP-18/24 Draft Pre-Design Investigation (PDI) Report due in October 2021 and the LHAAP-18/24 Draft Remedial Design due in February 2022. Mr. Werner noted that the LHAAP-29 Draft Pre-Design Investigation Report has been pushed back to June 2022, and subsequently the LHAAP-29 Draft Remedial Design has been pushed back to September 2022. Mr. Werner stated that the LHAAP-47 Final Revised Proposed Plan was finished in June 2021 and the LHAAP-47 Draft Record of Decision (ROD) is due in September 2021. Ms. Zeiler asked if anyone on the RAB or in the public had seen the notice about the LHAAP-47 Final Revised Proposed Plan in the Marshall News Messenger or in the Shreveport Times. No one mentioned having seen the notice in either newspaper. Mr. Werner mentioned that the comment period is from July 7 to August 6, 2021, and the document is at the library and on the LHAAP website.

LHAAP-18/24 Pre-Design Investigation

Mr. Werner introduced the LHAAP-18/24 PDI which was completed in two separate phases. Phase I of the LHAAP-18/24 PDI was performed in March 2021, on the area outside the interceptor trench (ICT) northeast boundary. Mr. Werner presented the preliminary findings of the Phase I groundwater sampling. Mr. Werner noted that perchlorate was detected in eight of nine temporary monitoring wells located outside of the northeast ICT boundary at concentrations above the Texas Risk Reduction Program (TRRP) Tier 1 Protective Concentration Limit or PCL. In addition, three of the eight perchlorate detections exceeded 20,000 micrograms per liter (µg/L). The volatile organic compound (VOC), cis-1,2-dichloroethene (DCE), was also detected in one of the nine temporary monitoring wells, along with trichloroethene (TCE) which was detected in five of the nine temporary monitoring wells at concentrations that exceeded their respective maximum contaminant levels (MCLs).

Mr. Werner presented the preliminary findings of the Phase I soil sampling. Perchlorate was detected in eight direct push technology (DPT) borings, and exceeded the Texas Commission on Environmental Quality (TCEQ) soil medium-specific concentration (MSC) for industrial use based on groundwater protection. Mr. Werner also explained that TCE was detection in three DPT boring soil samples in Phase I, including one sample at a concentration that exceeds the MSC.

Ms. VanDeventer stated that the information presented so far for LHAAP-18/24 doesn't sound good. Ms. Zeiler added a little background information to explain why this investigation was performed. Ms. Zeiler noted that additional characterization was needed for LHAAP-18/24 ahead of the final remedial design. The Army team and the regulators had made a recommendation to collect additional data, based on previously collected data prior to the LHAAP-18/24 ROD. The

team had identified two areas that required additional information including this area outside of the ICT boundary. Ms. Zeiler explained that the PDI has been successful in gathering further information on the source, extent of contamination and the magnitude of contamination. Ms. Nemmers asked Ms. VanDeventer if this answered her question. Ms. VanDeventer answered that yes it had. Mr. Werner referenced the figures, which visually depict the area investigated outside the ICT boundary.

Mr. Werner next discussed the PDI field work in the shallow zone in-situ bioremediation (ISB) grids, which was also completed in March 2021. Mr. Werner presented the preliminary findings for the Phase I ISB groundwater samples. Perchlorate was detected in all wells sampled including 16 temporary wells that exceeded the TRRP PCL. Of those 16 temporary wells, 15 perchlorate sample concentrations also exceeded 20,000 µg/L. The VOCs benzene, cis-1,2-DCE, tetrachloroethene (PCE), TCE, and vinyl chloride (VC) concentrations also exceeded USEPA MCLs at multiple temporary well locations.

Mr. Werner discussed the LHAAP-18/24 Phase 2 PDI field work, which began on June 7, 2021, and was completed on June 30, 2021. The LHAAP-18/24 PDI Phase 2 field work consisted of the installation of 11 temporary wells to 40 feet below ground surface (bgs) at the shallow zone ISB grids and the installation of one permanent monitoring well in the shallow zone ISB grid area. A groundwater sample was collected at each well for VOC analysis via USEPA method 8260B and perchlorate analysis via USEPA method 6850. Mr. Werner noted that all the perchlorate samples were collected using a 0.2 micron filter. The permanent well was surveyed by a professional Texas licensed surveyor. Mr. Werner expected the sampled results from the Phase 2 groundwater sampling to be available by the end of July, possibly next week.

Mr. Werner presented the Phase 2 PDI field work completed outside the ICT northeast boundary. Mr. Werner discussed the activities completed in June 2021 which included the installation of eight temporary wells between 30 and 45 feet bgs. Two temporary wells were installed at 45 feet bgs at previous temporary well locations to look at vertical distribution of contaminants. Mr. Werner explained that these wells were co-located and were installed approximately 6 feet apart from each other. Soil samples were collected from the borehole of each temporary well for VOC and perchlorate analysis. Mr. Werner explained that the soil samples were collected at the bottom of the boring at the sand/clay interface. Groundwater samples were also collected from each well for VOC and perchlorate analysis. Mr. Werner expected the soil and groundwater results to be available by the end of July 2021.

LHAAP-29 Pre-Design Investigation

Mr. Werner presented a brief site history of the LHAAP-29 site. The plant operated from 1942 through 1945, when four million pounds of flake trinitrotoluene (TNT) were produced. The production facility was mothballed until 1959 when the bulk of the infrastructure was removed. Currently nothing remains at the site but a few concrete pads, and the site is heavily vegetated. Mr. Werner presented a summary of the LHAAP-29 Phase 1 PDI field work completed in March 2021. Mr. Werner said that 49 DPT soil borings were advanced to depths not exceeding 16 feet bgs. Mr. Werner explained the DPT soil sampling process was a hollow rod with an acetate liner

advanced in 4 foot sections. Four samples per location were collected for a total of 196 soil samples which were analyzed for explosives via USEPA method 8330A. Mr. Werner then described two different types of underground wastewater pipelines that were formerly used at the LHAAP-29 facility. One of the pipes was constructed of wood and the second was constructed of transite or a concrete like material. Eight excavations were completed along the former TNT wooden wastewater line. Mr. Werner explained that if there was sludge or liquid present in the wastewater line, then a sample was collected of that substance. However, if no sludge or sediment was present then a sample of the wood was collected. The samples were analyzed for explosives via USEPA method 8330A. Mr. Werner explained that due to the hummocky nature of the site, the depth to the wastewater lines varied from approximately 4 feet bgs to 10 feet bgs.

Mr. Werner presented a summary of the LHAAP-29 Phase 1 PDI results. Several explosives were detected across the site exceeding the MSC in soil samples. Mr. Werner stated that because of these results, additional PDI field work is now being planned. Mr. Werner explained that the soil sampling locations were selected based on likely leak points along both of the wastewater lines. Mr. Werner explained that some of the soil results were inconclusive due to the laboratory detection limits being higher than the soil screening levels. As a result, a subset of the soil samples were sent to a third party laboratory with the capability of running the soil samples via a different analytical method (8321A) that could achieve a detection limit below the soil screening levels. Mr. Werner explained the subset of soil samples sent to the third party laboratory included samples that had analytical results that were non-detect and that had high concentrations and low concentrations detected. Mr. Werner stated that this data has just been reported by the laboratory and is undergoing validation.

Mr. Werner asked if anyone had questions regarding the LHAAP-29 Phase 1 PDI field work. Although there were no questions, Ms. Zeiler added that this data collected at LHAAP-29 will help with how much soil will need to be excavated from the site.

LHAAP-17 Remedial Action

Ms. Donnell presented a brief site history of LHAAP-17. Ms. Donnell stated that the Final ROD is in place, and that the remedy chosen consisted of excavation of impacted soil and extraction and treatment of impacted groundwater. Ms. Donnell presented the remedial action to be completed at the LHAAP-17 site. Soil excavations to remove perchlorate contaminated soil were started in 2019 at 13 areas. However, a work stoppage occurred on September 30, 2019, due to the presence of unexpected and undocumented munitions hazards. Of the initial 13 areas to be excavated, five areas need additional excavations due to the work stoppage. Ms. Donnell stated that work will recommence once planning documents are approved. Ms. Donnell outlined the major work elements to be completed next at LHAAP-17. Due to the wet nature of the site, water has collected in the open excavations that were not completed in 2019, therefore, the impounded water will be drained. Ms. Donnell stated that some water sampling had been done to support the removal process and all of the water was found to be essentially clean with the exception of Area H. Area H had water with perchlorate just above the action level. However, once the sediment settled out of the water, the perchlorate levels were below the action level.

Therefore, with the exception of Area H, the water impounded in the excavations will be pumped from each excavation and drained to an open area north of the site. The approved process includes draining to an area north of site if the water is 'clean', and collecting the water from Area H in a frac tank to allow for settling of solids so that a representative water sample can be collected and achieve acceptable levels. Mr. Charles Dixon asked about this noting that perchlorate is soluble. Ms. Nemmers stated that perchlorate is an ionic compound, much like salt. Mr. Dixon then asked about the cost/quality of the groundwater samples. Ms. Nemmers and Mr. Bill Foss explained that when you collect a perchlorate water sample that is turbid the solids will settle out. If you collect a sample that is turbid, the analytical result is not accurate and is high because the perchlorate adheres to the particulates. Ms. Overdyke then asked, when discharge occurs what happens to the stuff that settles (sediment) at the bottom. Ms. Nemmers explained the process with a frac tank and that the sludge that settles out of the water will be hauled off-site for proper disposal. Mr. George Rice asked for clarification with the sampling of turbid water versus clear water. Ms. Nemmers stated that the decanted or filtered water isn't clean and the perchlorate didn't go away, but that it's low enough to not exceed the action level. She also clarified that the initial detection was just slightly above the action level, which is why this process works. Mr. Becher, with the USGS, further explained the perchlorate analytical method and the reasoning for using a 0.2 micron filter. The 0.2 micron filter helps remove the microbes so that you can get a representative sample for perchlorate. He clarified that the reduction in the perchlorate was likely due to some microbial degradation during the decanting process.

Ms. Donnell presented the next actions after the impounded water is removed which includes erosion and surface water controls, placement of a remotely operated Screening/Sifting Plant, and establishment of exclusion zones or explosive safety arcs. MMG-TLI JV plans to clear the soil surface in all accessible areas of any potential munitions and any metal debris that may interfere with geophysical mapping. Then MMG-TLI JV will complete digital geophysical mapping using manned portable equipment to identify subsurface anomalies that may represent munitions or targets of interest (TOIs). They will identify a dig list for TOIs to be removed and identified by Explosive Ordinance Disposal (EOD) technicians. The TOIs will be disposed by detonation on-site as necessary. Ms. Donnell clarified that they could potentially find non-munitions debris, munitions debris that has no explosive hazard at all, and or munitions debris that still has an explosive hazard. Ms. Donnell stated that all munitions related debris will be inspected to verify no explosive hazard remains and document as safe. This is termed 'Material Documented as Safe (MDAS).' The MDAS will be temporarily stored for later off-site disposal by a qualified vendor, who will provide a certificate of destruction. Ms. Donnell then turned the discussion over to Mr. Gentry.

Mr. Gentry stated that previously the public may have heard the detonations completed at LHAAP-17 by the Army EOD which was via open air detonation. However, MMG-TLI JV plans to make the smallest impact possible and will employ contained detonations. The contained detonations will be performed by digging a 4-foot pit and burying the debris with an appropriate amount of explosive material. Mr. Gentry stated that all non-munitions related debris will be temporarily stored for off-site disposal. The soil that was stockpiled on-site from the open

excavations will be moved using remotely operated, robotic earth moving equipment to the remotely operated sifting plant. Mr. Gentry explained that this operation will segregate soils from debris. Then the areas beneath the soil stockpiles will then be cleared using geophysical equipment.

Mr. Gentry explained that once the surface is cleared and the TOIs removed, the excavations can be completed per the Remedial Design/Remedial Action Work Plan via robotic earth moving machinery. The screened contaminated soil will be staged for off-site disposal. The segregated debris will be moved by robotic equipment to a Material Potentially Presenting an Explosive Hazard (MPPEH) processing area, where the debris will be segregated into munitions and explosives of concern (MEC), MDAS, and other debris. The accumulated MEC will be disposed of by on-site consolidated shot. Mr. Gentry explained that the site does not have high explosives but rather low explosives such as an illuminator. Once the MEC is detonated, soil sampling will be completed within the excavations to verify remediation goals are met. During operations all excavated areas will be backfilled as soon as possible upon 'clean' extents.

Ms. Nemmers described the installation of the groundwater extraction system to reduce perchlorate to levels that can allow TCE and perchlorate to naturally attenuate. Extracted groundwater will be pumped to the GWTP for treatment. Ms. Nemmers stated that fortunately site LHAAP-16 is currently connected to the GWTP, but is no longer used. The piping from LHAAP-16 runs adjacent to site LHAAP-17; therefore, the plan is to plumb the LHAAP-17 system into that piping. To close the LHAAP-17 discussion, Ms. Donnell presented a few pictures of the LHAAP-17 site, including the type of equipment used for the screening/sifting plant. Ms. Overdyke said that the photos were helpful.

Mr. Procter stated that if there are any concerns with the remedial action at LHAAP-17, please know that MMG-TLI JV has extensive experience working with MEC and has a good plan for the site work. Mr. Procter reiterated that the Army encourages questions. Ms. Zeiler asked a final time if there were any additional questions. None were asked.

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, October 20, 2021**. The location will be determined

Ms. VanDeventer made a motion to adjourn; Ms. McAvoy seconded the motion.

Adjourn

The meeting adjourned at 6:08 pm CDT.

July 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

July 21, 2021
5:00 PM CDT

APTIM

bhate

Restoration Advisory Board Meeting

Abbreviations and Acronyms

µg/L	Micrograms per liter
bgs	Below ground surface
DCE	Dichloroethene
DERP	Defense Environmental Restoration Program
DNT	Dinitrotoluene
DPT	Direct push technology
ft	feet
GPW	Goose Prairie Creek Water Sample
GWP-Ind	Industrial Groundwater Use Protection
GWTP	Groundwater Treatment Plant
HBW	Harrison Bayou Water Sample
ICT	Interceptor collection trench
ISB	In-situ bioremediation
J	Estimated laboratory value
LHAAP	Longhorn Army Ammunition Plant

MCL	Maximum Contaminant Levels
MDAS	Material Documented As Safe
MEC	Munitions and explosives of concern
MPPEH	Material Potentially Presenting an Explosive Hazard
MSC	Medium-Specific Concentration
PCE	Tetrachloroethene
PCL	Protective Concentration Level
RAB	Restoration Advisory Board
RA(O)	Remedial Action Operation
TCE	Trichloroethene
TCEQ	Texas Commission on Environmental Quality
TNT	Trinitrotoluene
TOI	Targets of interest
TRRP	Texas Risk Reduction Program
VC	Vinyl chloride
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 (April 2021 RAB Meeting)

06:15 Defense Environmental Restoration Program (DERP) Update {Bhate}
- Documents and Field Work Completed since last RAB
- Three Month Look Ahead
- Groundwater Treatment Plant (GWTP) Update

06:30 Other DERP Updates
- LHAAP-18/24, -29, and -47 Status {HDR}
- LHAAP-17 Status {MMG-TLI}

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

Introductions

Hank Procter
Program Analyst/Manager
Office of the Deputy Chief of Staff, G-9
BRAC Branch, IS Environmental Division

Brian Follin
Remedial Project Manager
U.S. Environmental Protections Agency
Region 6

Ana C. Nieves
Environmental Restoration Manager
Army Environmental Command

Chelsea Montoya
Project Manager
U. S. Army Corps of Engineers,
Tulsa District

Christopher L. Braun
U. S. Geological Survey

Zack Beck
Assistant Project Manager
Bhate

RAB Administrative Issues

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

The Army Wants You to be Informed

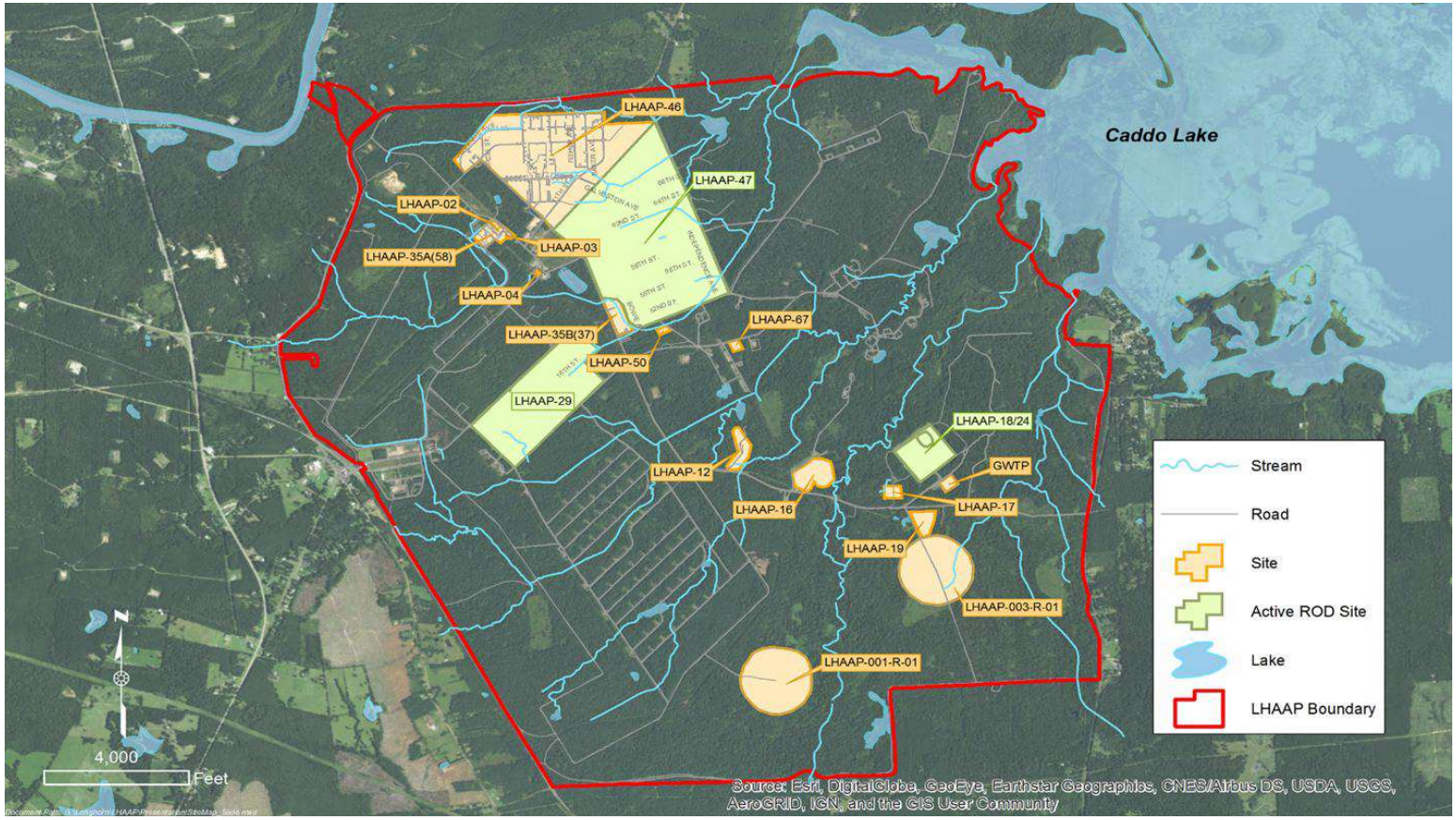
- The Army is committed to protecting human health and the environment; key to that commitment is engaging the community and increasing public participation in environmental restoration at the Longhorn Army Ammunition Plant (LHAAP)
- You are encouraged to:
  - Attend RAB Meetings and/or become a member 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; HDR, Inc. and MMG-TLI Joint Venture. The work conducted by these contractors will be presented in the following slides in that order.

LHAAP Environmental Contractors

- Bhate/Aptim: LHAAP-02, -03, 04, -12, -16, -17, -37, -46, -50, -58, -67, -001-R-01, -001-R-03, and -18/24 (interim remedy)
- HDR: LHAAP-18/24, -29, and -47
- MMG/TLI: LHAAP-17

Restoration Advisory Board Meeting

Bhate/APTIM



Documents in Process

Site	Document
LHAAP-04	Draft Final Annual Remedial Action Operation (RA[O]) Report to Regulators
LHAAP-16	Annual RA(O) Report – in progress
LHAAP-46	Annual RA(O) Report – in progress
LHAAP-50	Annual RA(O) Report – in progress
LHAAP-58	Annual RA(O) Report – in progress
LHAAP-67	Draft Annual RA(O) Report to Regulators; responding to comments
GWTP	Quarterly Evaluation Report: Second Quarter (April – June 2021) – in progress

Restoration Advisory Board Meeting

Completed Field Work Since Last RAB Meeting

Site	Activity
LHAAP-04	Year 2 Quarter 2 Performance Sampling (May)
LHAAP-16	Year 2 Quarter 1 Performance Sampling (April)
LHAAP-37	Year 4 Semi-annual Event 2 Sampling (May)
LHAAP-50	Year 1 Quarter 4 Performance Sampling (April)
LHAAP-58	Year 7 Semi-Annual Event 2 Groundwater Sampling
LHAAP-18/24	Semi-annual Groundwater Sampling
Surface Water	Surface Water Sampling (April)

Restoration Advisory Board Meeting

3 Month Look Ahead – Documents by Bhate Team

Site	Document
LHAAP-16	Draft RA(O) Report to regulators
LHAAP-37	Draft RA(O) Report to regulators
LHAAP-46	Draft RA(O) Report to regulators
LHAAP-50	Draft RA(O) Report to regulators
LHAAP-58	Draft Year 7 RA(O) Report to regulators
LHAAP-67	Draft Final RA(O) Report to Regulators
GWTP and LHAAP-18/24	Quarterly Evaluation Report Second Quarter (April – June 2021)

Restoration Advisory Board Meeting

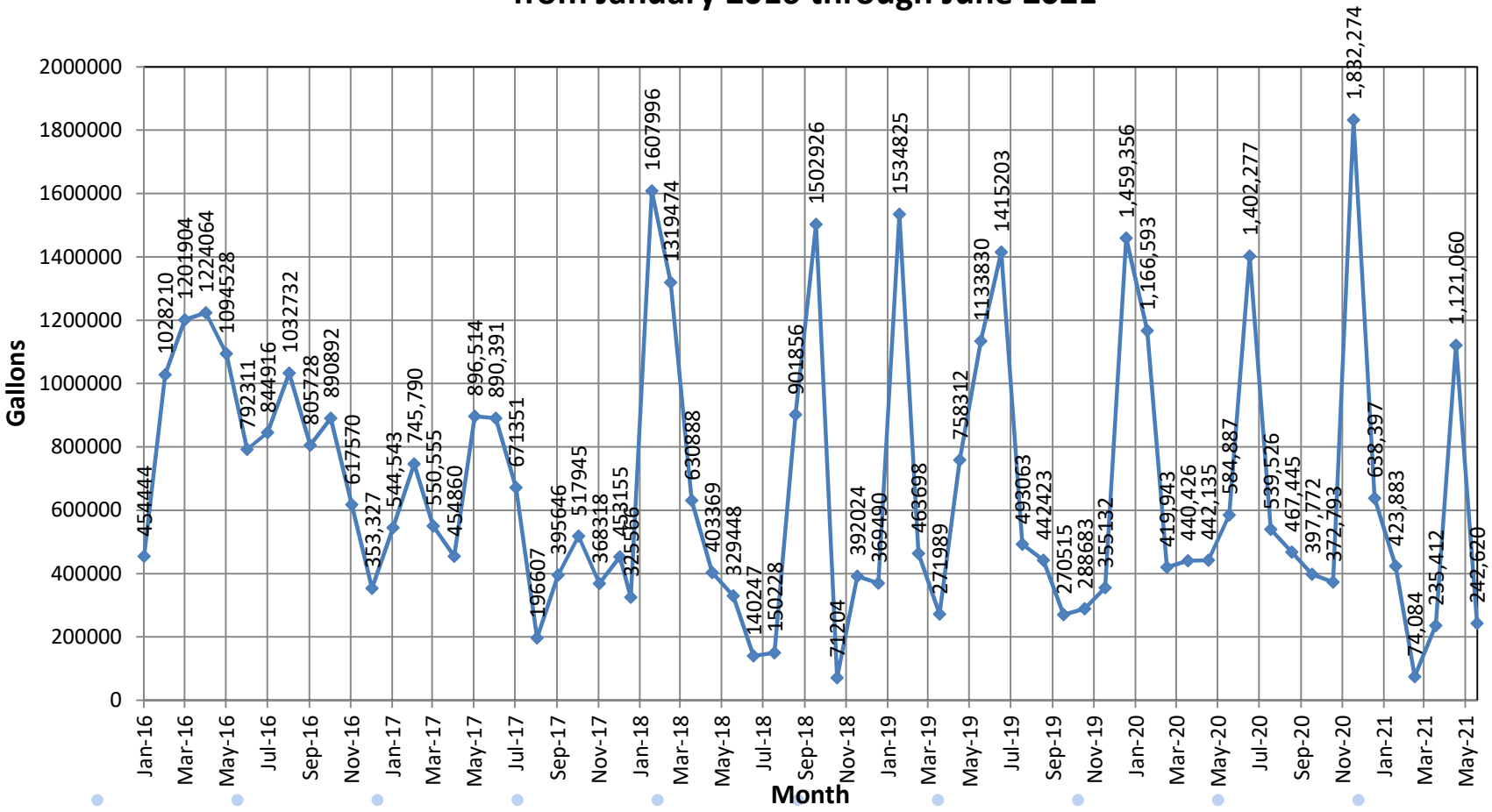
3 Month Look Ahead - Field Work by Bhate Team

Site	Activity
LHAAP-04	Year 2 Quarter 3 Performance Monitoring (August)
LHAAP-16	Year 2 Quarter 2 Performance Monitoring (July)
LHAAP-16	Year 2 Quarter 3 Performance Monitoring (October)
LHAAP-50	Year 2 Quarter 1 Performance Sampling (July)
LHAAP-50	Year 2 Quarter 2 Performance Sampling (October)
Surface Water	3rd Quarter Sampling

Restoration Advisory Board Meeting

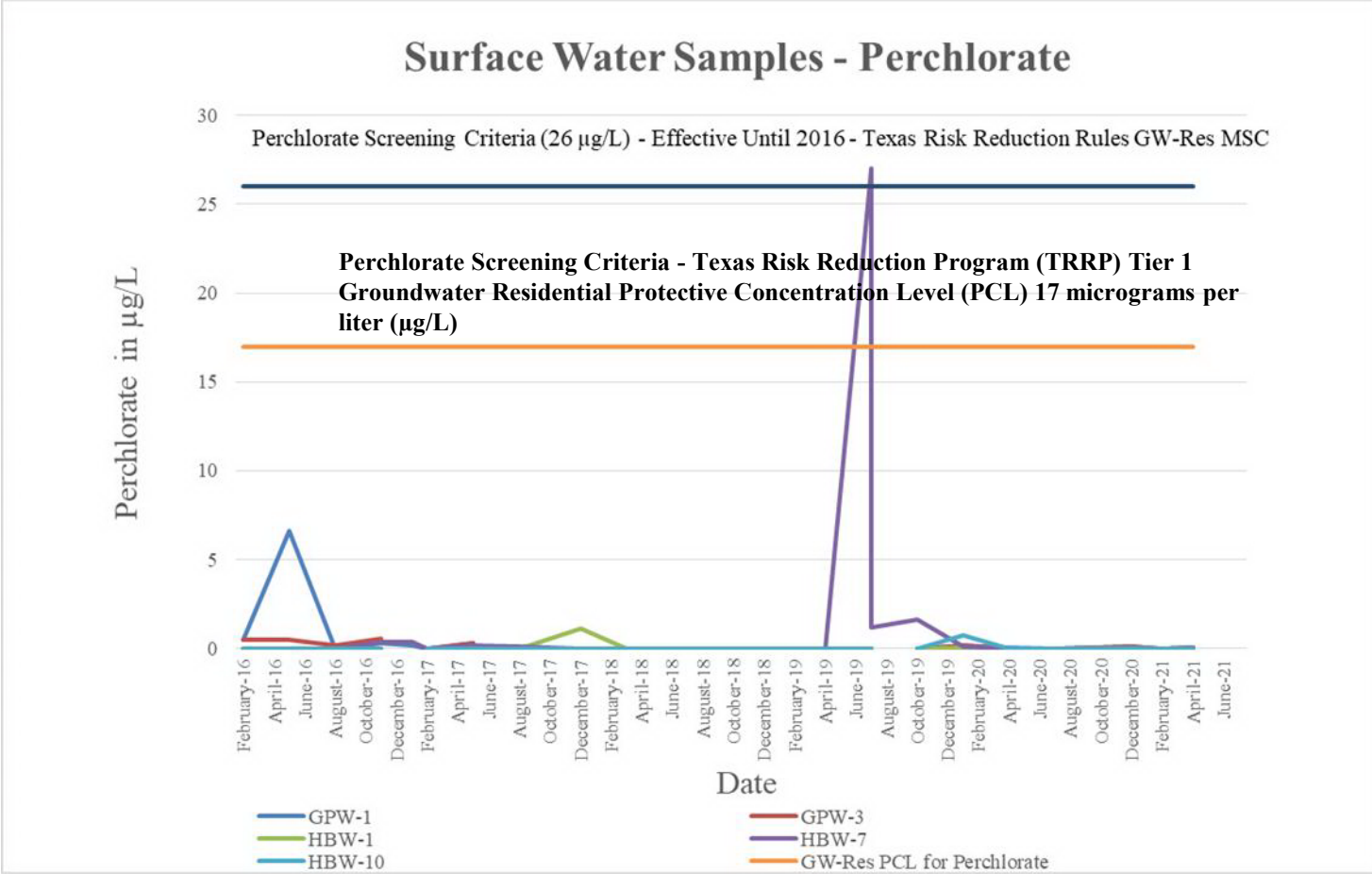
GWTP Update

Treated Groundwater Discharged Monthly from January 2016 through June 2021



Restoration Advisory Board Meeting

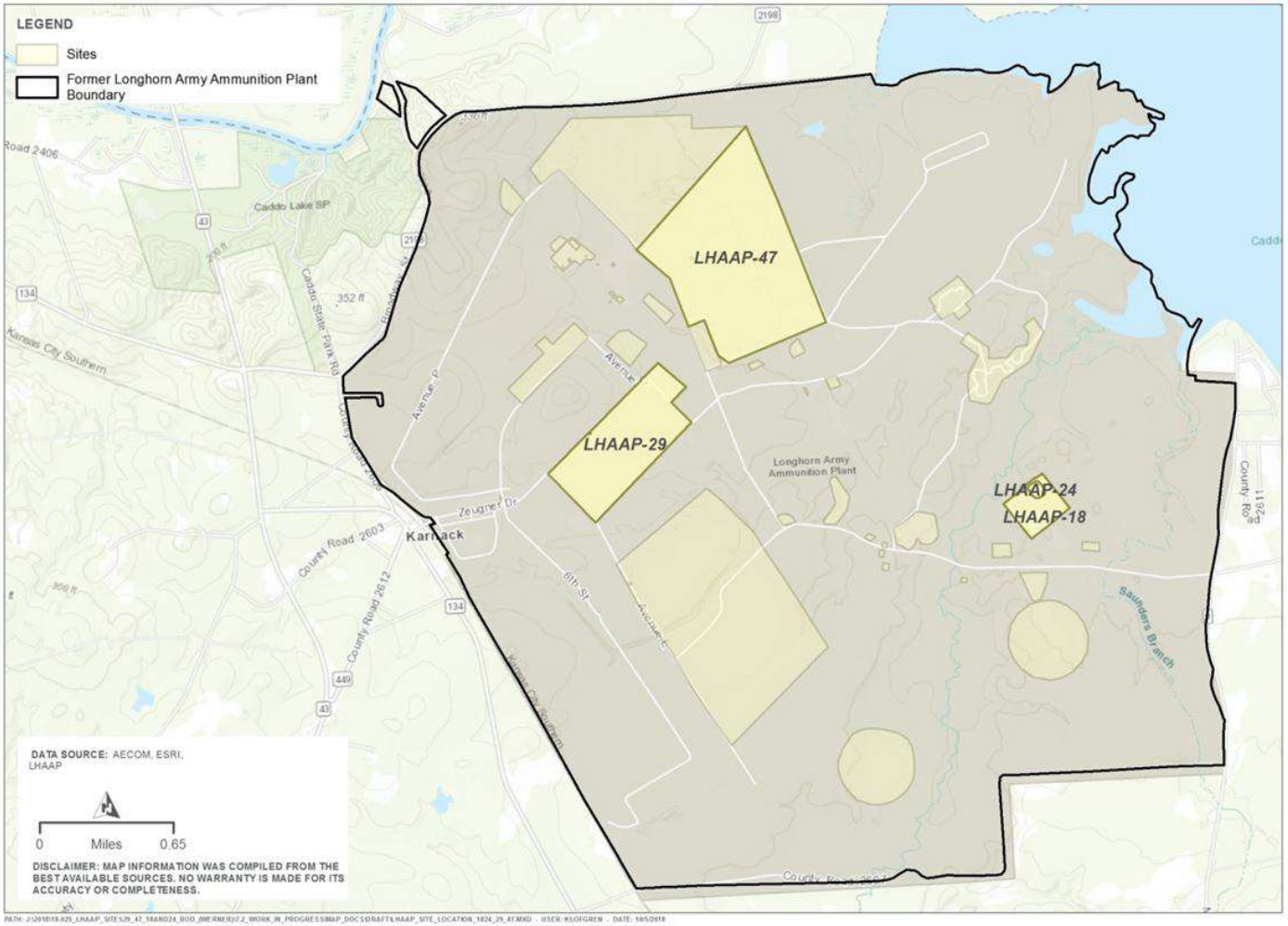
Surface Water Sample Results



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

HDR



Restoration Advisory Board Meeting

LHAAP-18/24, -29 and -47 Document Status Documents by HDR Team

Site	Document
LHAAP-18/24	Draft Pre-Design Investigation Report, October 2021
LHAAP-18/24	Draft Remedial Design, February 2022
LHAAP-29	Draft Pre-Design Investigation Report, June 2022
LHAAP-29	Draft Remedial Design, September 2022
LHAAP-47	Final Revised Proposed Plan, June 2021
LHAAP-47	Draft Record of Decision LHAAP-47, September 2021

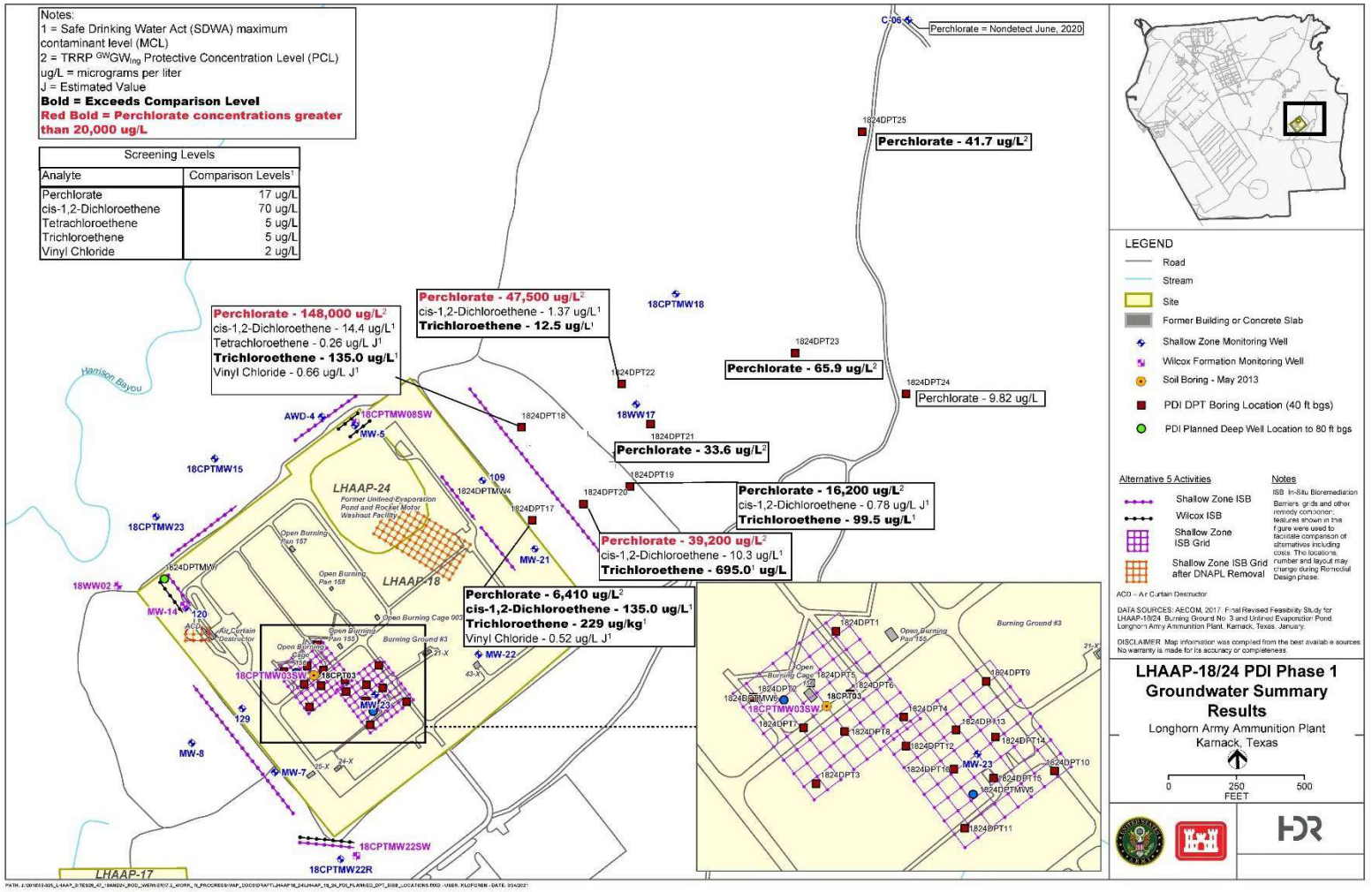
Restoration Advisory Board Meeting

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

Site	Activity
LHAAP-18/24	**Pre-Design Investigation Field Work Outside the Interceptor Trench (ICT) Northeast Boundary, March 2021** **Preliminary Findings - Groundwater** ✓ Perchlorate was detected in 8 of 9 temp wells located outside the Northeast ICT Boundary at concentrations that exceeded the Texas Risk Reduction Program (TRRP) Tier 1 Protective Concentration Level (PCL) for residential groundwater use ($^{GW}GW_{Ing}$). ✓ Three perchlorate detections exceeded 20,000 micrograms per liter (µg/L). ✓ The VOCs cis-1,2-Dichloroethene (DCE) (1 out of 9 temp wells) and Trichloroethene (TCE) (5 out of 9 temp wells) were detected at concentrations that exceeded the Maximum Contaminant Levels (MCLs). **Preliminary Findings - Soil** ✓ Perchlorate was detected in 8 direst push technology (DPT) boring soil samples collected outside the Northeast ICT Boundary; 2 at concentrations that exceeded the Texas Commission on Environmental Quality (TCEQ) soil medium-specific concentration (MSC) for industrial use based on groundwater protection (GWP-Ind). ✓ TCE was detected in 3 DPT boring soil samples collected outside the Northeast ICT Boundary; 1 at a concentration that exceeded the MSC GWP-Ind.

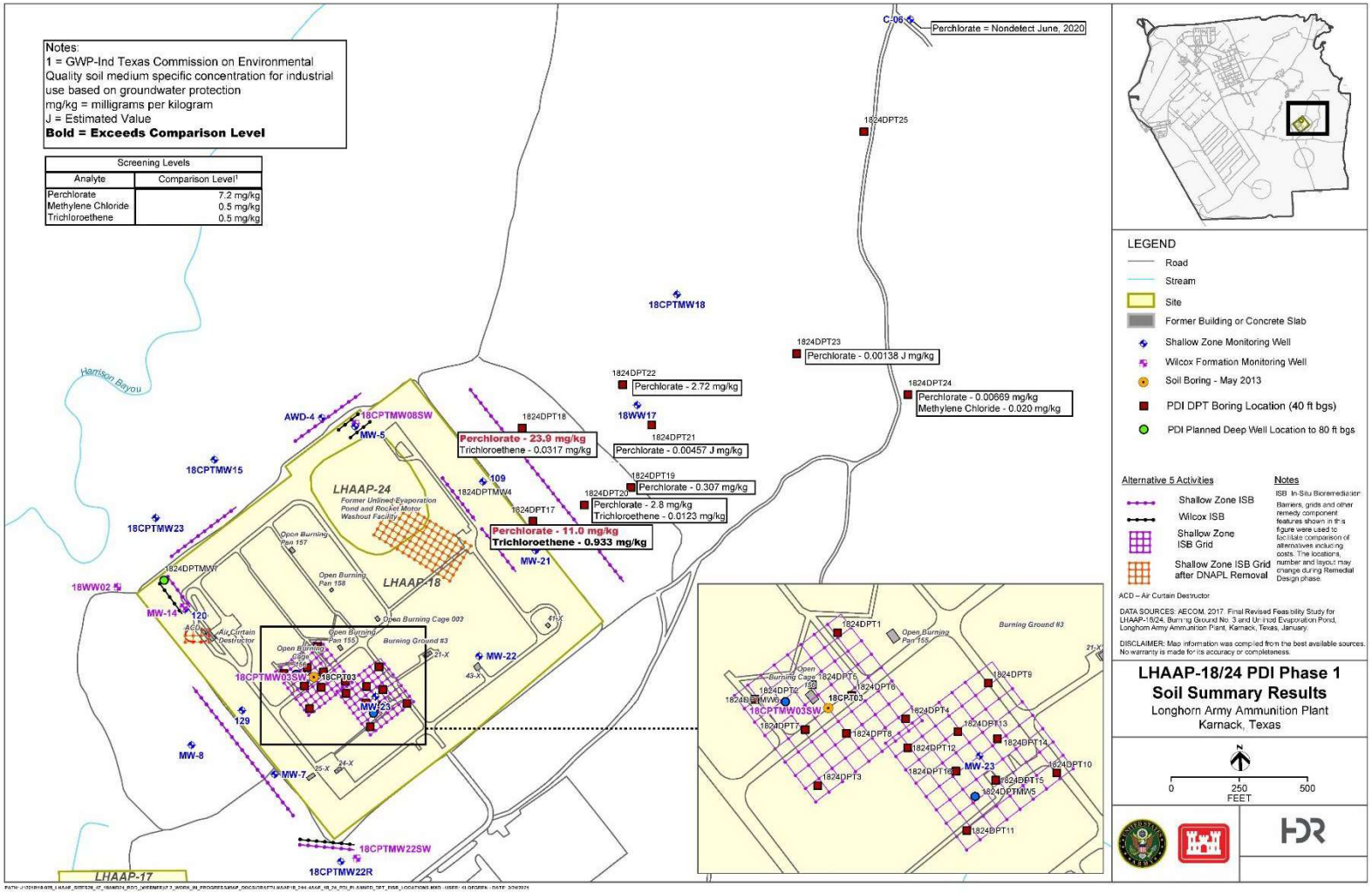
Restoration Advisory Board Meeting

Summary of LHAAP-18/24 Phase 1 Pre-Design Investigative Field Work – Outside the Northeast ICT Boundary



Restoration Advisory Board Meeting

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

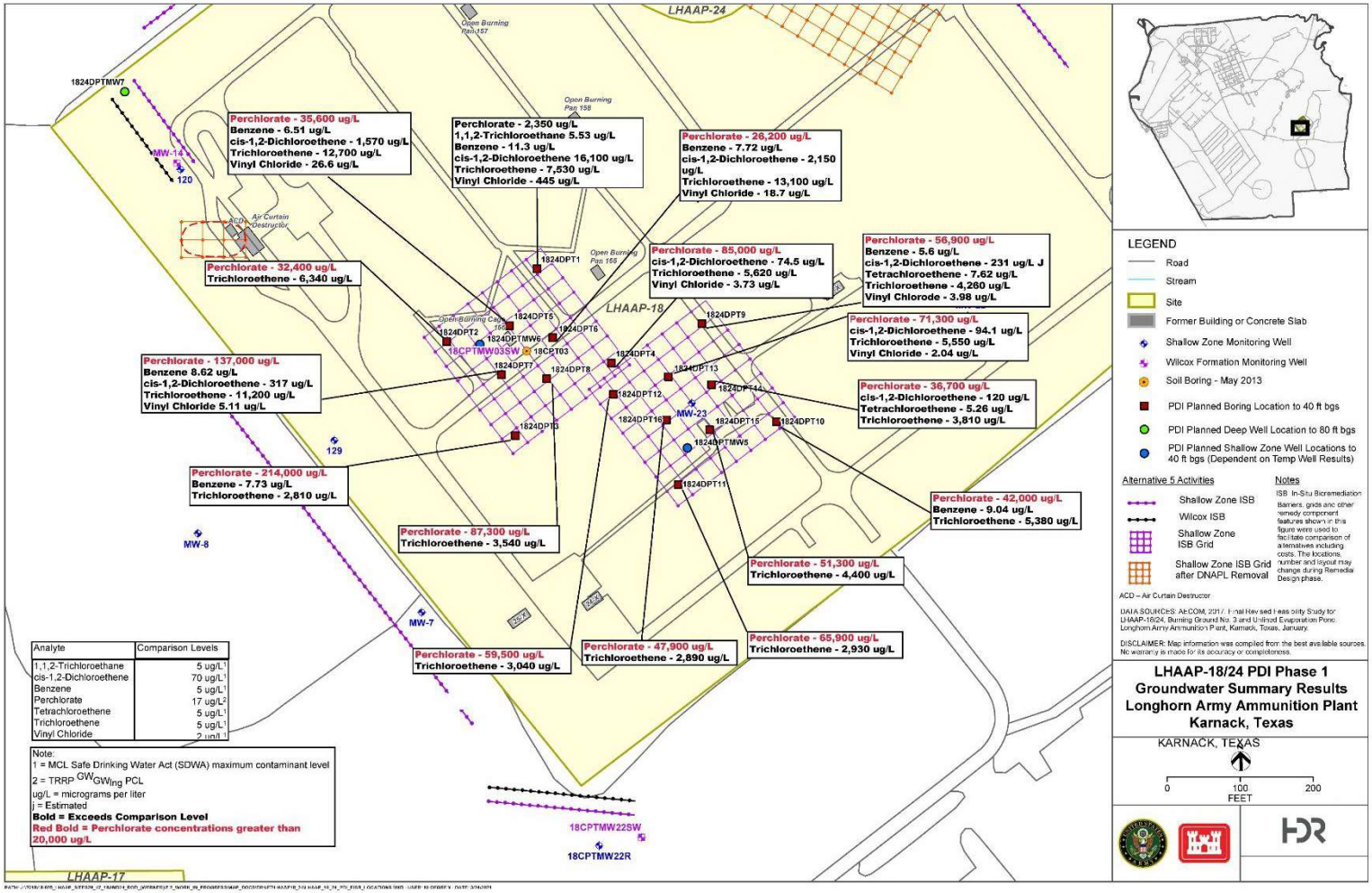


Summary of LHAAP-18/24 Phase 1 Pre-Design Investigative Field Work

Site	Activity
LHAAP-18/24	Pre-Design Investigation Field Work Shallow Zone in-situ bioremediation (ISB) Grids, March 2021 Preliminary Findings - Groundwater ✓ Perchlorate was detected in 16 temp wells located at concentrations that exceeded the TRRP PCL for $^{GW}GW_{Ing}$. ✓ Fifteen sample concentrations exceeded 20,000 µg/L. ✓ Benzene, cis-1,2-DCE, Tetrachloroethene (PCE), TCE, Vinyl Chloride (VC) concentrations exceeded MCLs at multiple temp wells.

Restoration Advisory Board Meeting

Summary of LHAAP-18/24 Phase 1 Pre-Design Investigative Field Work - Shallow Zone ISB Grids



LHAAP-18/24 Pre-Design Investigative Field Work, Phase 2, Completed by HDR

Site	Activity
LHAAP-18/24	Pre-Design Investigation Field Work Phase 2, June 2021 1) Shallow Zone ISB Grids ✓ Installation of 11 temporary wells to 40 feet (ft) below ground surface (bgs) at the Shallow Zone ISB Grids ✓ Collection of 1 groundwater sample for VOCs (SW8260B) and perchlorate (SW6850) analyses. Perchlorate samples were field filtered using a 0.2 micron filter. ✓ Installation of 1 permanent well to 40 ft bgs at the Shallow Zone ISB Grids. ✓ Collection of 1 groundwater sample for VOCs (SW8260B) and perchlorate (SW6850) analyses. ✓ Perchlorate sample was field filtered using a 0.2 micron filter. ✓ Permanent well surveyed by Texas licensed Surveyor.

LHAAP-18/24 Pre-Design Investigative Field Work, Phase 2, Completed by HDR

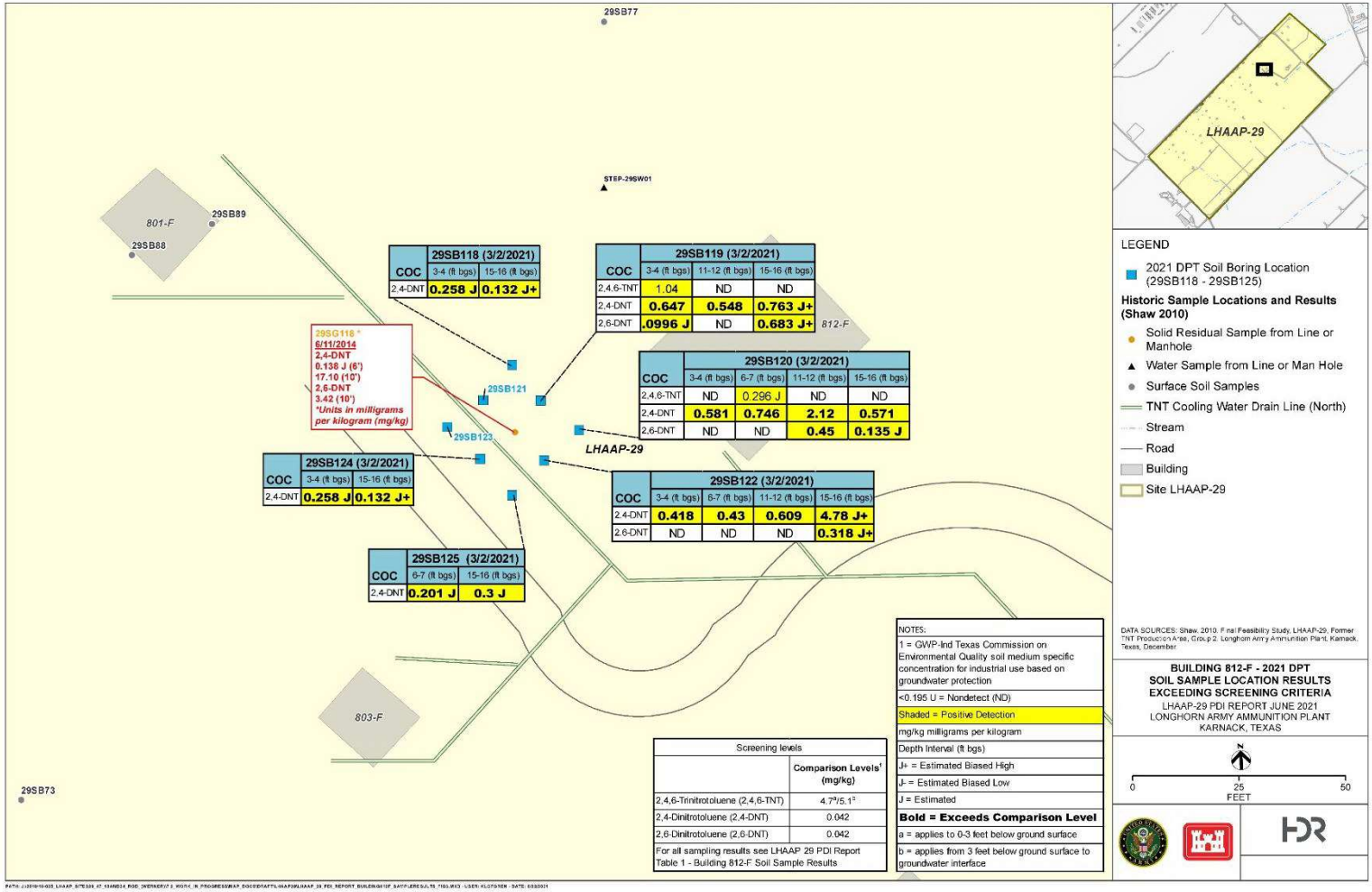
Site	Activity
LHAAP-18/24	Pre-Design Investigation Field Work Phase 2, June 2021 1) Outside the ICT Northeast Boundary ✓ Installation of 8 temporary wells between 30 and 45 ft bgs outside the northeast boundary. ✓ Two temporary wells installed to 45 ft bgs at previous temporary wells 1824DPT25 and 1824DPT24. ✓ Two DPT boring locations installed paired temporary wells (DPTs 1824DPT27/1824DPT27A and 1824DPT2/1824DPT29A). ✓ First temporary well installed to 30 ft bgs, second temporary well to 40 ft bgs. ✓ Two temporary wells installed to ft bgs. ✓ Collection of 1 soil sample from each DPT boring for VOCs (SW8260B) and perchlorate (SW6850) analyses. Soil samples collected at the bottom of the boring at the sand/clay interface. ✓ Collection of 1 groundwater sample for VOCs (SW8260B) and perchlorate (SW6850) analyses. ✓ Perchlorate sample was field filtered using a 0.2 micron filter.

Summary of LHAAP-29 Phase 1 Pre-Design Investigation Field Work

Site	Location
LHAAP-29	Pre-Design Investigation Field Work Phase 1, March 2021 Preliminary Findings ✓ Building 812-F GWP-Ind Exceedances in DPT Soil Boring Locations: • 2,4-Dinitrotoluene (2,4-DNT) was detected at concentrations exceeding the GWP-Ind MSC at six DPT soil boring locations from depths 3 ft bgs to 16 ft bgs. • 2,6-DNT was detected at concentrations exceeding the GWP-Ind MSC at four DPT soil boring locations from depths ranging from 3 ft bgs to 16 ft bgs.

Restoration Advisory Board Meeting

Summary of LHAAP-29 Phase 1 Pre-Design Investigation Field Work

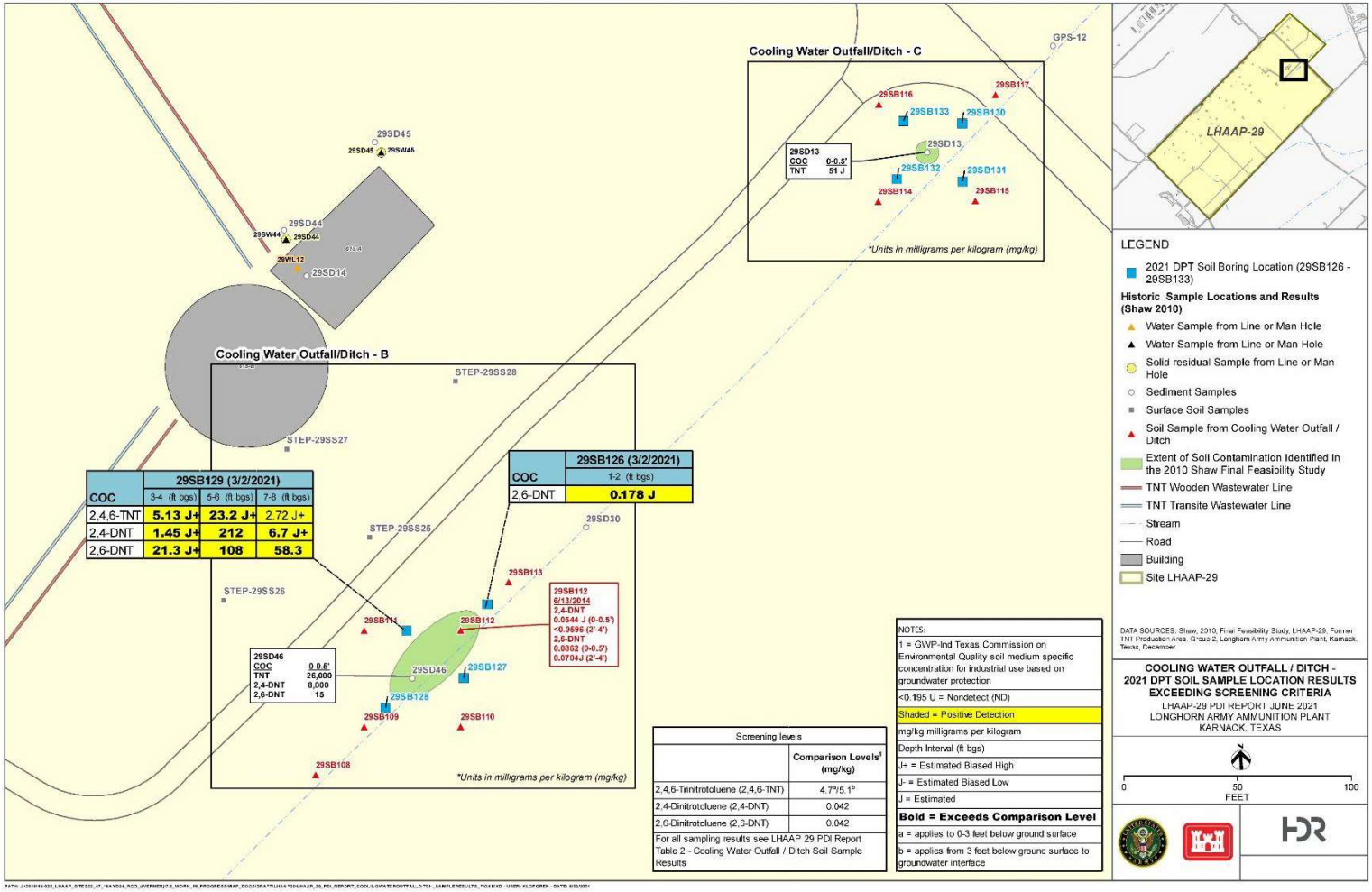


Summary of LHAAP-29 Phase 1 Pre-Design Investigation Field Work

Site	Location
LHAAP-29	Pre-Design Investigation Field Work Phase 1, March 2021 Preliminary Findings ✓ Cooling Water Outfall / Ditch GWP-Ind Exceedances in DPT Soil Boring Locations: • 2,4-DNT was detected at concentrations exceeding the GWP-Ind MSC at one DPT soil boring location from depths 3 ft bgs to 8 ft bgs. • 2,6-Dinitrotoluene (2,6-DNT) was detected at concentrations exceeding the GWP-Ind MSC at two DPT soil boring locations from depths ranging from 1 ft bgs to 8 ft bgs. • 2,4,6-Trinitrotoluene (2,4,6-TNT) was detected at one DPT soil boring location at concentrations exceeding the GWP-Ind MSC at depths of 3 ft bgs and 6 ft bgs.

Restoration Advisory Board Meeting

Summary of LHAAP-29 Phase 1 Pre-Design Investigation Field Work



COC	29SB129 (3/2/2021) 3-4 (ft bgs)	5-6 (ft bgs)	7-8 (ft bgs)
2,4,6-TNT	**5.13 J+**	**23.2 J+**	2.72 J+
2,4-DNT	**1.45 J+**	**212**	**6.7 J+**
2,6-DNT	**21.3 J+**	**108**	**58.3**

COC	29SB126 (3/2/2021) 1-2 (ft bgs)
2,6-DNT	**0.178 J**

Screening levels	Comparison Levels[1] (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	4.7[a]/5.1[b]
2,4-Dinitrotoluene (2,4-DNT)	0.042
2,6-Dinitrotoluene (2,6-DNT)	0.042
For all sampling results see LHAAP 29 PDI Report Table 2 - Cooling Water Outfall / Ditch Soil Sample Results	

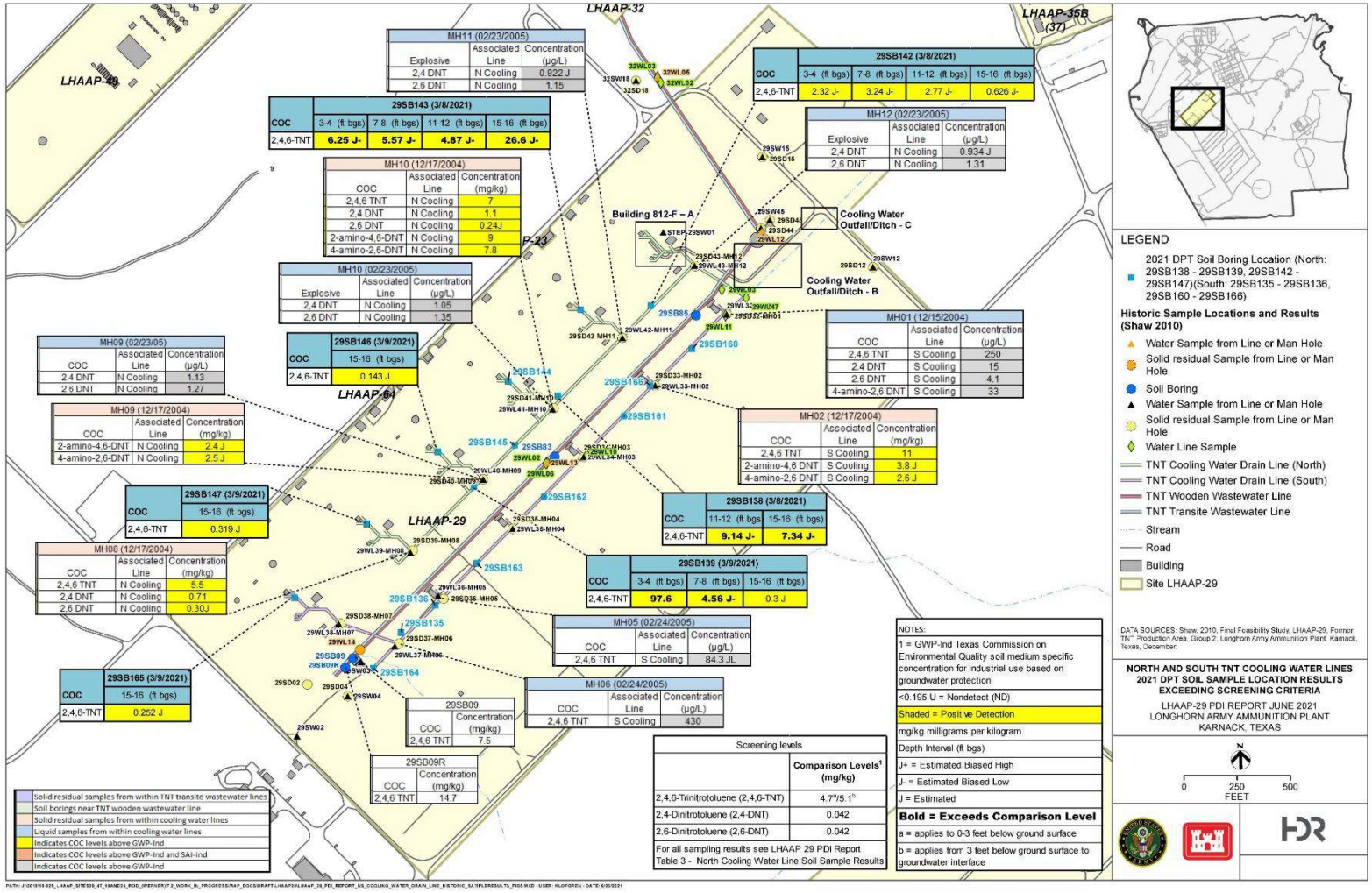
NOTES:
1 = GWP-Ind Texas Commission on Environmental Quality soil medium specific concentration for industrial use based on groundwater protection
<0.195 U = Nondetect (ND)
Shaded = Positive Detection
mg/kg milligrams per kilogram
Depth Interval (ft bgs)
J+ = Estimated Biased High
J- = Estimated Biased Low
J = Estimated
Bold = Exceeds Comparison Level
a = applies to 0-3 feet below ground surface
b = applies from 3 feet below ground surface to groundwater interface

Summary of LHAAP-29 Phase 1 Pre-Design Investigation Field Work

Site	Location
LHAAP-29	Pre-Design Investigation Field Work Phase 1, March 2021 Preliminary Findings ✓ North and South Cooling Water Lines GWP-Ind Exceedances in DPT Soil Boring Locations: • 2,4,6-TNT was detected at 3 DPT soil borings at concentrations exceeding the GWP-Ind MSC at depths between 3 ft bgs and 16 ft bgs

Restoration Advisory Board Meeting

Summary of LHAAP-29 Phase 1 Pre-Design Investigation Field Work

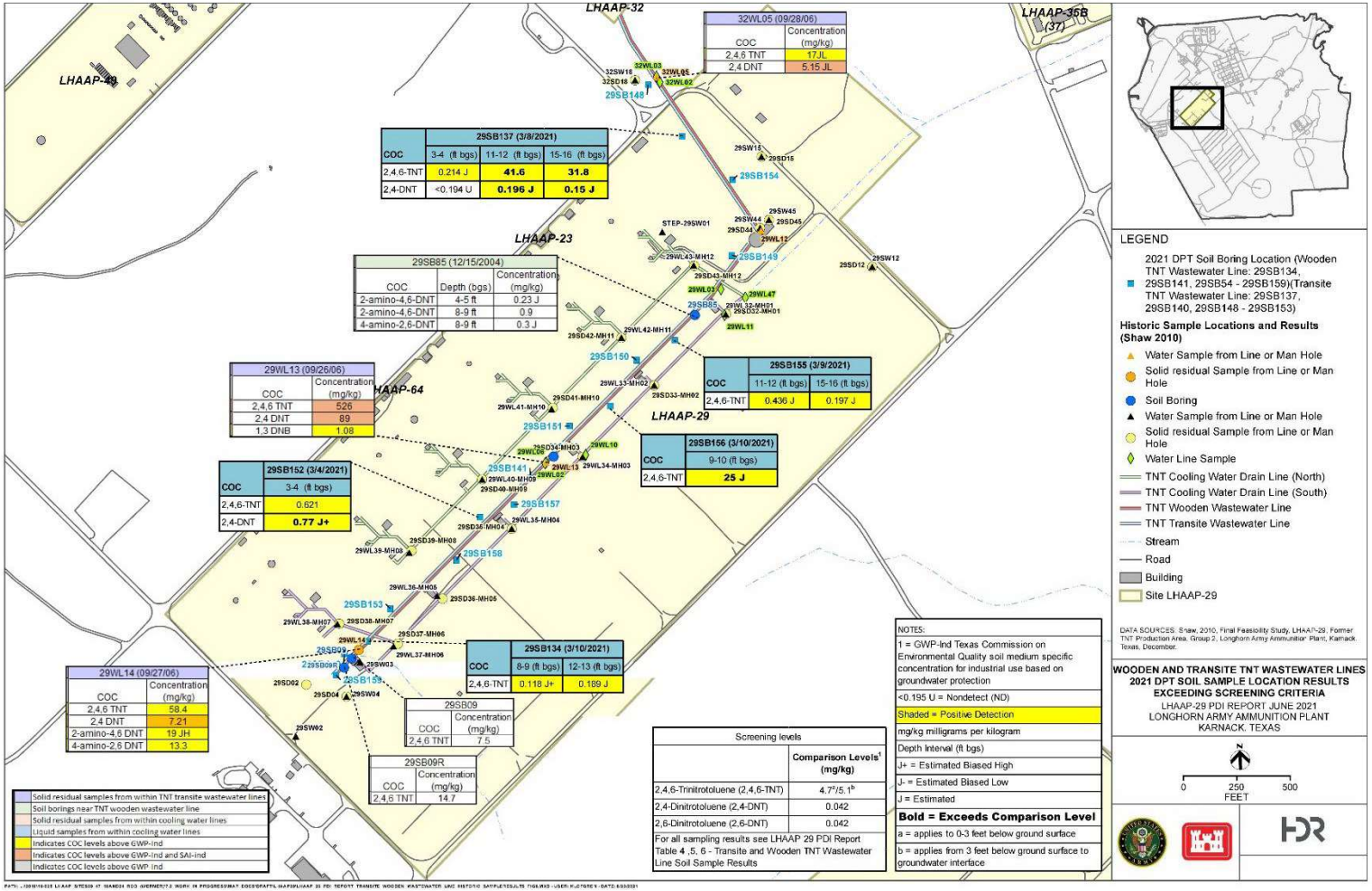


Summary of LHAAP-29 Phase 1 Pre-Design Investigation Field Work

Site	Location
LHAAP-29	Pre-Design Investigation Field Work Phase 1, March 2021 Preliminary Findings ✓ Transite and Wooden TNT Wastewater Lines GWP-Ind Exceedances in DPT Soil Boring Locations: • 2,4-DNT was detected at concentrations exceeding the GWP-Ind MSC at two DPT soil boring locations from depths 3 ft bgs to 16 ft bgs. • 2,4,6-TNT was detected at concentrations exceeding the GWP-Ind MSC at one DPT soil boring location from depths 11 ft bgs to 16 ft bgs.

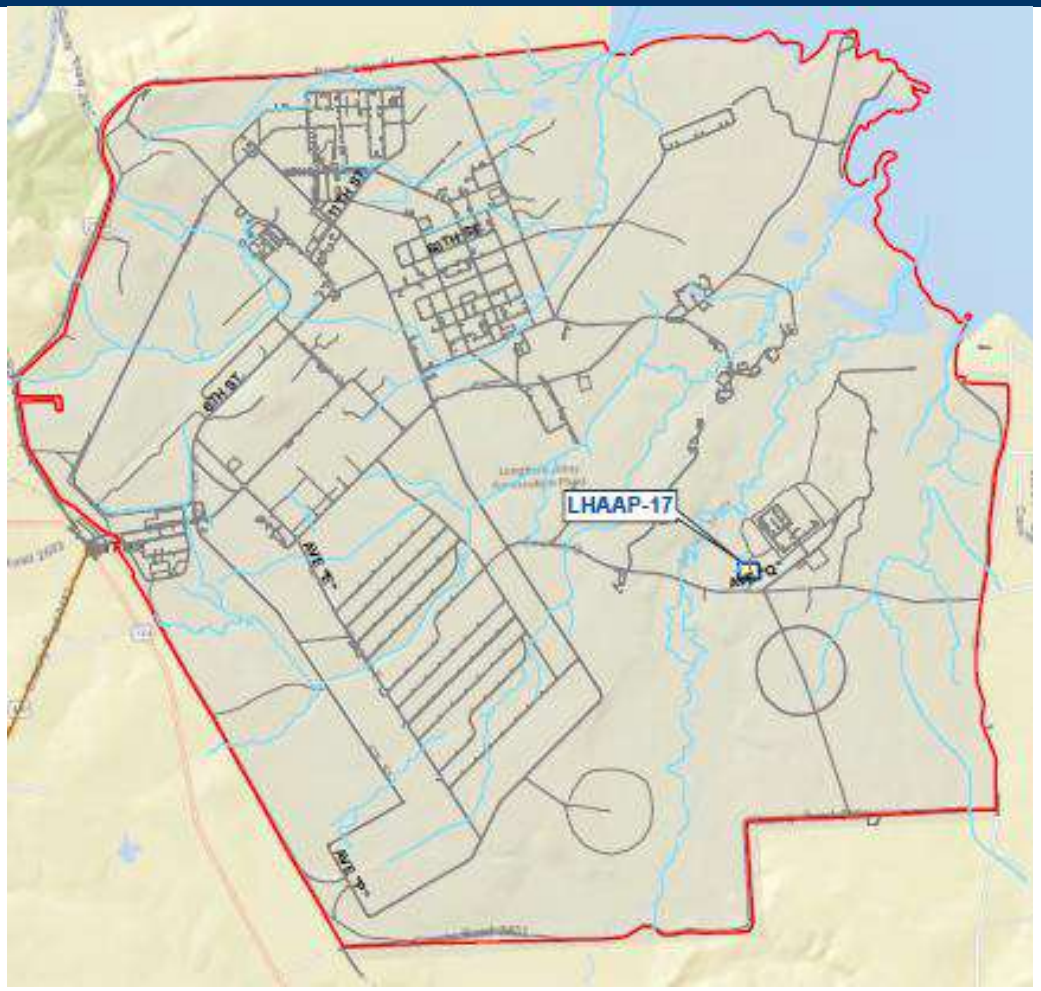
Restoration Advisory Board Meeting

Summary of LHAAP-29 Phase 1 Pre-Design Investigation Field Work



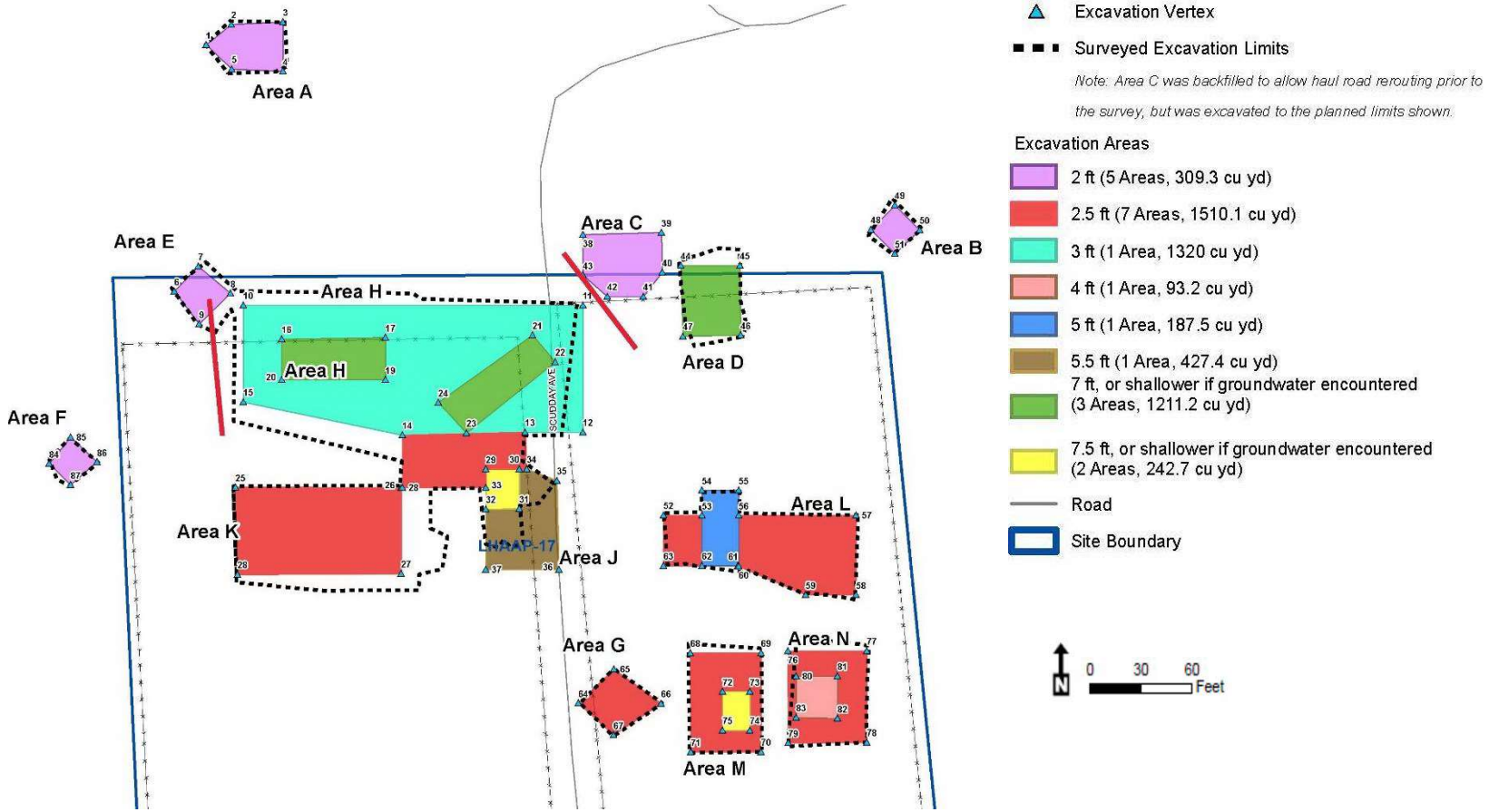
Restoration Advisory Board Meeting

MMG-TLI JV



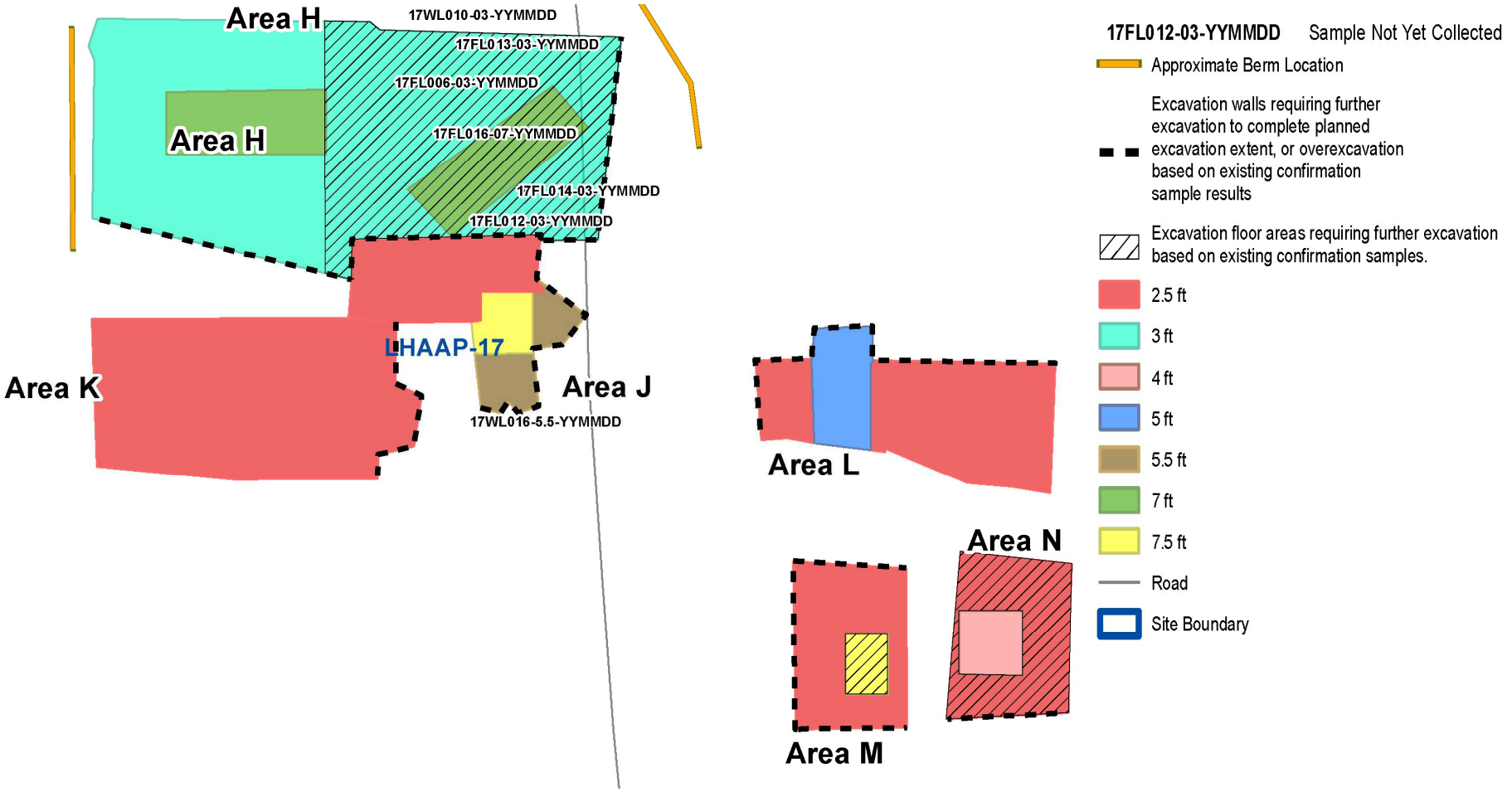
Restoration Advisory Board Meeting

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 unexpected and undocumented munitions hazards.
- Work will recommence once planning documents are approved. Major work elements are as follows:
  - Drain any remaining impounded water and verify/place erosion and surface water controls (e.g., berms/sediment fencing)
    - The approved process includes draining to an area north of the site (if "clean") or collecting first in a tank for settling (to allow perchlorate in solids to settle out and water to achieve acceptable levels).
    - Treatment trailer will be mobilized if acceptable levels cannot be achieved by settling
  - Complete site set-up, including placement of a Remotely Operated Screening/Sifting Plant
  - Establish Exclusion Zones (i.e., explosives safety arcs) as needed (using barricades)

LHAAP-17 Remedial Action

- **Major work elements -continued:**
  - Clear the soil surface in all accessible areas of any potential munitions and any metal or debris that may interfere with digital geophysical mapping of the subsurface
  - Complete digital geophysical mapping to identify subsurface anomalies that may represent munitions (i.e., Targets of Interest or TOI)
  - Dig/remove all identified subsurface TOI
  - Disposal by detonation on-site as necessary
    - Public will be notified of potential detonations in print media

Restoration Advisory Board Meeting

LHAAP-17 Remedial Action

- **Major work elements -continued:**
  - Inspect all munitions-related debris to verify no explosive hazard remains and document as safe (termed Material Documented As Safe [MDAS]) and temporarily store for later disposal off-site by a qualified vendor who will provide a certificate of destruction
  - Temporarily store all non-munitions related debris for off-site disposal
  - Move soil in existing soils stockpiles using robotic earth moving machinery to the remotely operated Screening/Sifting Plant and completed screening/sifting of these soils. This operation will segregate soils from debris.
  - "Clear" areas beneath the now removed stockpiles using geophysical equipment to detect and then remove subsurface anomalies indicative of munitions and explosives of concern (MEC)
  - Complete the excavation of soils per the Remedial Design/Remedial Action Work Plan while employing robotic earth moving machinery followed by screening/sifting and segregation of soil from debris
  - Stage screened/sifted soil on-site in a "cleared" area for off-site disposal
  - Move debris using robotic equipment to a "Material Potentially Presenting an Explosive Hazard (MPPEH)" Processing Area where debris will be segregated into:
    - MEC
    - MDAS
    - Other Debris
  - Manage MEC, MDAS, and non-munitions related debris as previously described
  - Dispose of accumulated MEC by on-site consolidated shot

Restoration Advisory Board Meeting

LHAAP-17 Remedial Action

- **Major work elements continued:**
  - Complete sampling at locations where MEC is recovered and where it is detonated
  - Complete sampling within excavations as needed to verify remediation goals are achieved
  - Refill all excavated areas as soon as possible upon approval of “clean”
  - Complete site restoration throughout the field work
  - Install groundwater extraction system to reduce perchlorate to levels that can naturally attenuate
    - Extracted groundwater will be pumped to the GWTP for treatment

Restoration Advisory Board Meeting

LHAAP-17 Site Layout

Restoration Advisory Board Meeting

LHAAP-17 Impounded Water in Open Excavations

Restoration Advisory Board Meeting

LHAAP-17 Screening/Sifting Plan

Next RAB Meeting Schedule & Closing Remarks

- Schedule October 2021 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

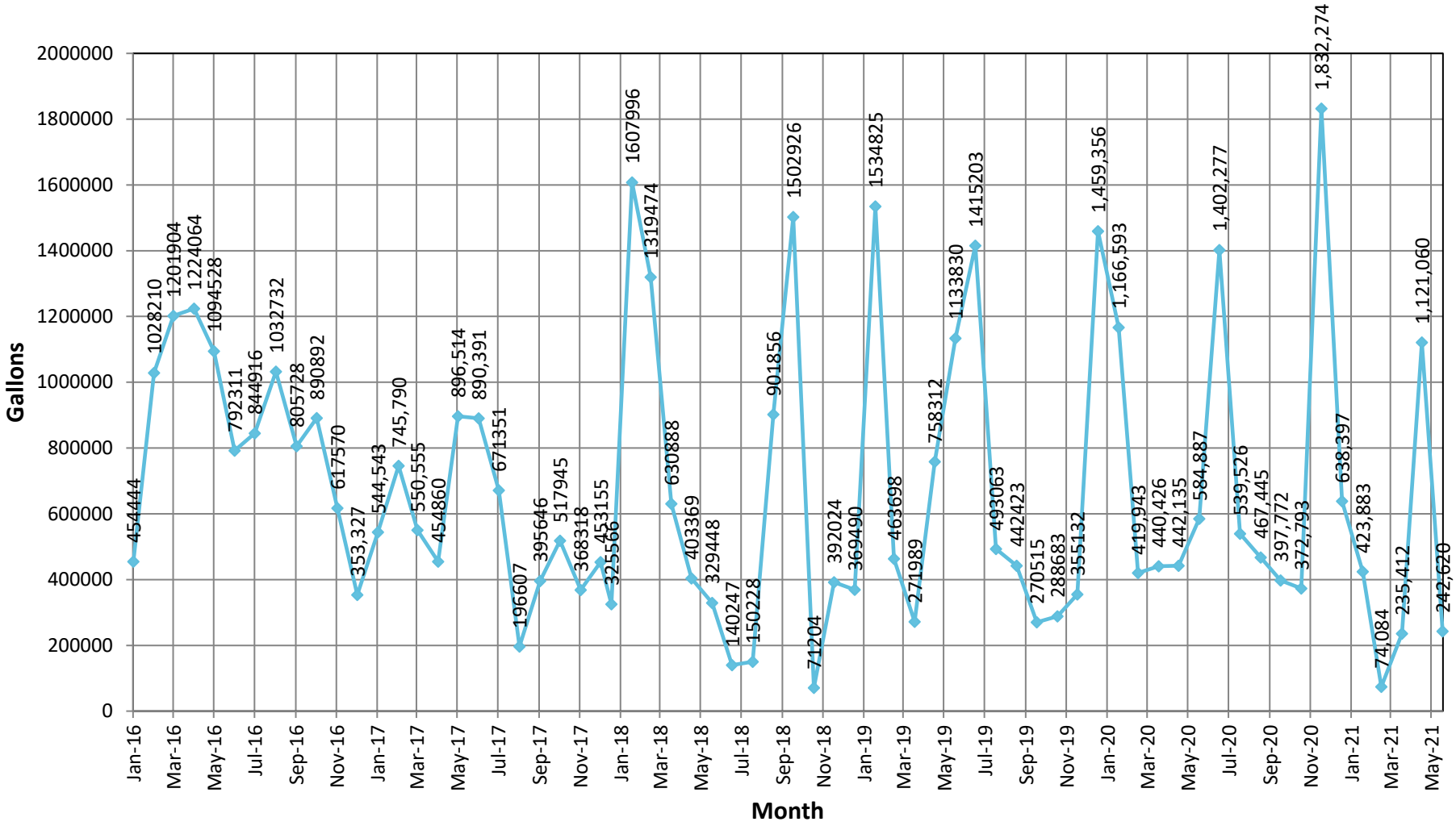
Oct-17	Nov-17	Dec-17	Jan-18	Feb-18	Mar-18	Apr-18	May-18	Jun-18	Jul - 18	Aug-18	Sep-18
517,945	368,318	453,155	325,566	1,607,996	1,319,474	630,888	403,369	329,448	140,247	150,228	901,856

Oct-18	Nov-18	Dec-18	Jan-19	Feb-19	Mar-19	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	Apr-21	May-21	Jun-21			
397,772	372,793	1,832,274	638,397	423,883	74,084	235,412	1,121,060	242,620			

*Indicates Estimate


Treated Groundwater Discharged Monthly
from December 2014 through June 2021
Gallons
Month
2000000
1800000
1600000
1400000
1200000
1000000
800000
600000
400000
200000
0
Jan-16
Mar-16
May-16
Jul-16
Sep-16
Nov-16
Jan-17
Mar-17
May-17
Jul-17
Sep-17
Nov-17
Jan-18
Mar-18
May-18
Jul-18
Sep-18
Nov-18
Jan-19
Mar-19
May-19
Jul-19
Sep-19
Nov-19
Jan-20
Mar-20
May-20
Jul-20
Sep-20
Nov-20
Jan-21
Mar-21
May-21
454444
1028210
1201904
1224064
1094528
792311
844916
1032732
805728
890892
617570
353,327
544,543
745,790
550,555
454860
896,514
890,391
671351
196607
395646
517945
368318
453155
325566
1607996
1319474
630888
403369
329448
140247
150228
901856
1502926
71204
392024
369490
1534825
463698
271989
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
235,412
1,121,060
242,620

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
Apr-21	235,412	0	0	0	0
May-21	1,121,060	0	0	900,000	0
Jun-21	242,620	0	0	0	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	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

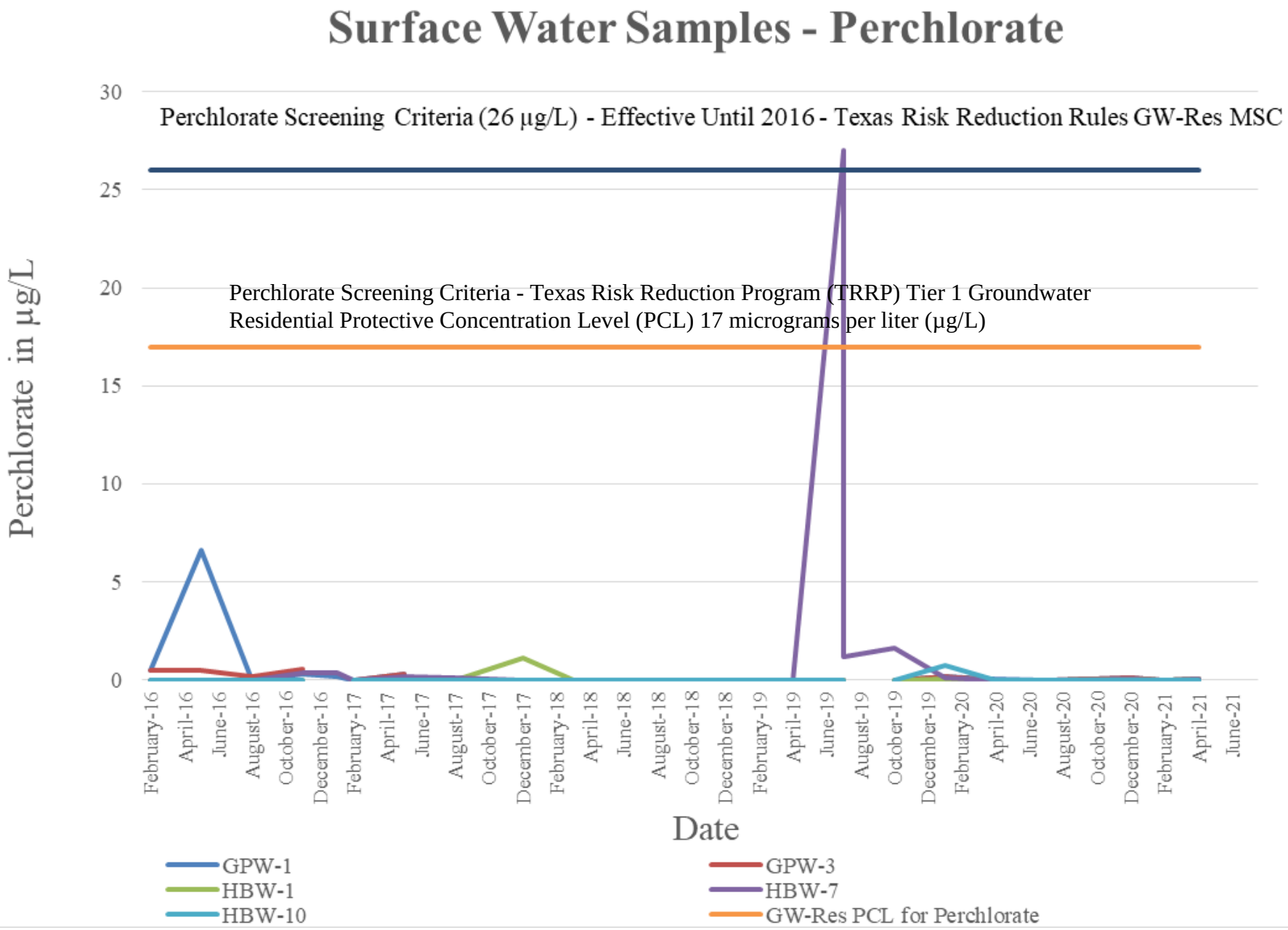
Quarter	2nd	3rd	4th	1st	2nd	3nd	4th	1st	2nd	3rd	4th
Creek Sample ID	**Jun 2013**	**Sept 2013**	**Dec 2013**	**Feb 2014**	**May 2014**	**Aug 2014**	**Nov 2014**	**Feb 2015**	**May 2015**	**Aug 2015**	**Nov 2015**
GPW-1	Dry	<0.2 U	Dry	0.766	Dry	Dry	0.244 J	0.311 J	0.156 J	Dry	0.142 J
GPW-3	Dry	<0.2 U	Dry	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	2nd
Creek Sample ID	**Oct 2018**	**Jan 2019**	**Apr 2019**	**Jul 2019**	**Oct 2019**	**Jan 2020**	**Apr 2020**	**Jul 2020**	**Dec 2020**	**Feb 2021**	**Apr 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	0.0268 J
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	0.0321 J
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	0.0410 J
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	0.0373 J
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	<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