Subject: Final Minutes, Quarterly Restoration Advisory Board (RAB) Meeting
Longhorn Army Ammunition Plant (LHAAP)
Location of Meeting: Karnack Community Center, Karnack, Texas
Date of Meeting: October 18, 2018, 6:00-7:15 PM Central Daylight Time (CDT)

Meeting Participants:

Army BRAC:	Rose M. Zeiler
USACE:	Aaron Williams
USAEC:	Nicholas Smith
USGS:	Kent Betcher
Bhate:	Kim Nemmers
APTIM:	William (Bill) Foss
USEPA Region 6:	Rich Mayer
TCEQ:	April Palmie
RAB:	Present: Judy VanDeventer, Tom Walker, Nigel R. Shivers, and Richard Le Tourneau Absent: Paul Fortune; Carol Fortune; Charles Dixon; Terry Britt; and John Pollard, Jr.
Public:	Laura-Ashley Overdyke (Executive Director of the Caddo Lake Institute)

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

Welcome and Introduction

Ms. Rose Zeiler, RAB Installation Co-Chair, called the RAB meeting to order at 6:05 pm CDT. Ms. Judy VanDeventer noted that Mr. Terry Britt was in Canada. Ms. Zeiler noted that Paul and Carol Fortune had notified her that they would not be able to attend the meeting.

Ms. Zeiler pointed out the three sites not included in the Bhate contract, which are LHAAP-18/24, LHAAP-29, and LHAAP-47. Ms. Zeiler noted that these sites are in a different color on the LHAAP map.

Ms. Zeiler noted that no new persons were present but asked for suggestions to get more RAB members. Mr. Nigel Shivers stated that it is difficult to get more volunteers. Ms. Laura-Ashley Overdyke suggested having an information table at the next community event and offered to man the table. Ms. Zeiler stated that the Army would send information to support that if the date for the next event could be provided. Ms. Overdyke stated that she would want an application for the RAB membership and some information about how to get involved in the RAB. Mr. Bill Foss stated that the master naturalists get credit for volunteering and suggested reaching out to the local chapter.

Open Items

Ms. Zeiler noted that the RAB Meeting minutes had been sent out in August 2018. Ms. VanDeventer made a motion to approve the July 2018 RAB Meeting minutes. Mr. Tom Walker seconded the motion.

Defense Environmental Restoration

Overview of Waste Management

Ms. Zeiler explained that the first presentation on waste management at LHAAP was developed in response to interest expressed during the previous RAB meeting. Ms. Kim Nemmers stated that the slides are meant to help with the discussion and hopefully more clearly present how waste is managed at LHAAP. Ms. Nemmers explained that the waste typically generated at LHAAP is investigation derived waste, which is typically the soil generated from cuttings from borings or from installation of wells. Ms. Nemmers stated that groundwater extracted from monitoring activities is the second main waste generated at LHAAP. Ms. Nemmers also stated that other waste generated from LHAAP includes excavated soils and a dried cake from the metals precipitation system at the Groundwater Treatment Plant (GWTP). Mr. Walker asked if the naturally occurring metals are considered during waste management. Ms. Nemmers confirmed that metals are analyzed for in the filter cake and that the Interim Record of Decision (IROD) for LHAAP-18/24 requires treatment for metals even though the current levels of metals in groundwater at the site is consistent with background concentrations. Ms. Zeiler stated that soils are not always analyzed for nutrient metals because these metals are not used in hazardous waste determination. Mr. Rich Mayer stated that the concern is for metals that are hazardous.

Ms. Nemmers then explained the terms often used in waste management. Ms. Nemmers stated that a disposal facility means a permitted facility or part of a permitted facility where waste will be placed based upon the facility's permit. Ms. Nemmers stated that a manifest is the document used to take waste from cradle to grave because it is signed by the generator, signed by the transporter, and signed by the disposal facility and then copies are provided to each of these participants. If the waste is non-hazardous, then another document like a bill of lading can be used instead. However, Ms. Nemmers noted that the non-hazardous waste process provides the same documentation with the only exception being that a copy of the bill of lading or manifest doesn't need to be sent to the U.S. Environmental Protection Agency (USEPA). Ms. Zeiler clarified that Ms. Nemmers was discussing waste that goes offsite only. Ms. Nemmers explained that the generator for LHAAP is the Army. Ms. Nemmers stated that most of the waste generated is special waste, which means that the waste requires special handling, but is not considered hazardous.

Ms. Nemmers explained what a solid waste was and that nothing can be considered special waste or hazardous waste until it is determined to be a solid waste. Ms. Nemmers stated that the reason for that is some material can be reused or recycled in place of being a waste. Ms.

Nemmers stated that the USEPA defines solid waste as a garbage, refuse, sludge, or other discarded material. Hazardous waste breaks down per the Federal regulations as either listed waste, meaning we know the process that generated the waste; or characteristic waste, which is most typical for environmental waste. Ms. Nemmers explained that the waste gets tested and is classified as characteristically hazardous waste if the waste has a high flash point or is reactive, toxic, or ignitable. Ms. Nemmers explained that environmental waste is most often hazardous based upon toxicity of the soils. Mr. Mayer asked if hazardous waste was generated at LHAAP. Ms. Zeiler explained that the drying bed sludge was considered hazardous due to the process generating the metals but then the mixture rule was applied to allow for the waste stream to be non-hazardous, special waste.

Ms. Nemmers explained that toxicity is most often the reason for environmental waste to be considered hazardous waste because it is based upon a specific compound, such as lead, exceeding an established criteria. Ms. Nemmers explained the process for determining if a waste is hazardous using the flow chart in the slides and how there are several ways of excluding a waste from being classified as hazardous. Ms. Zeiler clarified that even though a waste may not be considered hazardous based upon being a listed hazardous waste, the waste could be classified as hazardous due to high lead or TCE. Ms. Nemmers explained that the waste is tested by an offsite laboratory to determine if the waste is hazardous. Ms. Nemmers clarified that the waste can be classified by generator knowledge but that is often a very specific situation whereby the source of the waste is known though testing is usually completed regardless.

The documentation is provided by the Contractor (Bhate) for Army review and/or sent to the disposal facility to prepare a waste profile. Then the Army will sign the waste profile documenting that the information about the waste is correct. Mr. Mayer asked if the receiving facility will test the waste. Ms. Nemmers stated that the receiving facility typically pushes the testing back onto the contractor based upon so many yards or tons of material received. Ms. Zeiler explained that annual recertification of waste is also required. Mr. Foss stated that typically a sample is required every 1,000 yards or a similar volume, but that sampling at the landfill is usually focused on free liquids present in the waste in case the facility needs to solidify the waste.

Ms. Nemmers then discussed the slide showing the USEPA waste classifications and the Texas Commission on Environmental Quality (TCEQ) waste classifications. Ms. Nemmers stated that the waste is non-hazardous when it is considered Class 1, 2, or 3 under the TCEQ regulations. Ms. April Palmie explained that non-hazardous waste still has contamination present but at a much lower concentration than hazardous waste. Ms. Palmie stated that the waste is industrial waste and must be disposed of based upon the Class that the waste falls under. Mr. Walker asked if the “F” listing is based upon flammability. Ms. Zeiler stated that the drying bed filter cake waste used to be classified as “F” listed based on its source prior to use of the mixture

rule. Mr. Mayer stated that "F" does not necessarily mean flammability. Mr. Walker stated that he wondered if the letter code matched up with the characteristic to the right of the code on the slide. Ms. Palmie clarified that there was no relationship in that way but that the wastes that are listed have similarities. Ms. Nemmers stated that each listed waste is a very specific industry process that generated the waste.

Ms. Nemmers explained that waste generated during investigation of a site is typically placed into a drum that is then labeled "Pending Analysis" to know what the drum contains but that the waste is not classified. Ms. Nemmers explained that if the waste was determined to be hazardous then a date would be placed on the waste because Federal regulations require you to dispose of the waste within a certain period of time. Ms. Nemmers explained that waste water is either treated by the GWTP or transported and disposed offsite. Ms. Nemmers stated that drilling waste is tested and then either spread on the ground where it was generated or disposed offsite depending on the results of the analysis. Ms. Nemmers stated that excavated soil is sent off typically as Class 2 or Class 3 non-hazardous waste. Ms. Zeiler stated that perchlorate waste is classified as hazardous waste based on the ignitability characteristic and is not listed waste. Mr. Mayer stated that this classification rarely occurs to which Ms. Zeiler concurred. Mr. Shivers asked if the timeframe discussed was 90 days. Ms. Zeiler stated that the time is 90 days. Mr. Shivers asked where the waste is stored. Ms. Zeiler stated that waste is typically stored in a closed drum with a label on it. Ms. Nemmers stated that LHAAP does not produce very much hazardous waste and is considered a Conditionally Exempt Small Quantity Generator, otherwise additional requirements might apply to LHAAP.

LHAAP-03

Mr. Foss provided an update on LHAAP-03, which was discussed more completely at the previous RAB Meeting. Mr. Foss stated that LHAAP-03 is a very small soils site contaminated with lead and arsenic. The Record of Decision (ROD) was finalized, and the public notice was published a few days ago. Mr. Foss explained that the technical memorandum for soil sampling was issued and reviewed by the regulators. Those comments are being addressed. Mr. Foss explained that the hope was to move forward with the soil sampling within the next month or two. The soil data will then be used to prepare the remedial design. Mr. Foss explained the purpose of the sampling, which is to confirm the size of the excavation presented in the ROD.

LHAAP-16

Mr. Foss explained that bioremediation is planned for LHAAP-16, but first a series of wells need to be installed for both monitoring of the groundwater plume and injections for the bioremediation. Mr. Foss pointed out on the map where the low-lying area is at the site, which has made well installation difficult due to the recent rain events. Mr. Foss explained that the handout of slides presents what was hoped to be completed by now, but the presentation correctly lists the wells installed to date. Mr. Foss said that 17 wells were installed in April 2018 but the remainder were not installed due to the site being so wet. Mr. Foss stated that the

team remobilized in October 2018, but 5.5-inches of rain fell over the weekend prior to the mobilization. Mr. Foss stated that four wells were installed leaving six wells to be installed. Mr. Foss stated that the baseline sampling of the wells installed has been completed. Mr. Foss stated that once the other wells are installed, those wells will be sampled as part of the baseline sampling event also. Mr. Shivers asked what was being injected. Mr. Foss stated that vegetable oil and sodium lactate will be injected to allow for microbial growth. Ms. Zeiler stated that the lines shown are lines of injections. Mr. Foss clarified that some wells will be used for injections and others will be used to circulate the injectate. Mr. Shivers asked where the bugs are incubated. Mr. Foss explained that some of the bug are naturally occurring, but the bacteria is also used to inoculate. Ms. Zeiler explained that the aquifer is first treated to prepare the groundwater for the bacteria and then the bacteria are added to the aquifer. Mr. Foss explained that the bacteria needs a low dissolved oxygen level, which is tested prior to inoculating. Mr. Foss presented a photo of the track-rig being used at Site 16. Mr. Shivers asked the depth of the wells. Mr. Foss stated that the depth is 20 to 35 feet deep with one monitoring well about 50 to 55 feet deep. Ms. Zeiler stated that the work is being coordinated with Fish and Wildlife.

LHAAP-58

Ms. Nemmers provided an update on LHAAP-58, which has an eastern and western lobe. The eastern lobe had the remedy implemented several years ago, and the remedy is being monitored. Ms. Nemmers stated that the western plume received injections in March and April 2018. Ms. Nemmers explained that the focus is on the groundwater as the soil does not pose a threat to human health. The ROD for LHAAP-58 stated that natural attenuation would be implemented for the western lobe of the plume, which was evaluated for a couple of years. The evaluation determined that natural attenuation was not successfully remediating the plume and that active treatment was necessary to help reduce the plume. Ms. Nemmers explained that microbial analysis prior to the injections indicated that the bacteria necessary was naturally occurring. Ms. Nemmers presented the remedial action completed in March/April 2018 including the additional two monitoring wells installed. Ms. Nemmers explained that one of the monitoring wells installed was used to define the extent of the plume, which it did based upon laboratory analysis. Ms. Nemmers then presented the plume shapes prior to and following the 2018 groundwater treatment. Ms. Nemmers noted that bioremediation is still being observed within the eastern plume after 5 years, which is a good surprise. Ms. Nemmers also pointed out the significant decrease in the western lobe of the plume within a short period of time. Ms. Nemmers stated that the groundwater would continue to be monitored.

Overview of Sites

Ms. Nemmers explained that the work continues at LHAAP-16 as presented by Mr. Foss but the soil samples were able to be collected from LHAAP-17 in August 2017 to prepare the remedial design. Remedial action operations (RA-O) sampling continues for many sites. Ms. Nemmers

explained that some sites are sampled every 6 months and other sites are sampled every 3 months. Ms. Nemmers stated that the sites will have a lot of RA-O sampling as remedies are put in place or were in place and continue to be evaluated.

Ms. Nemmers explained the repairs to the fluidized bed reactor (FBR) at the GWTP, which treats the perchlorate. Ms. Nemmers stated that the nozzles and laterals were replaced. These parts are used to fluidize the granular activated carbon. The FBR was repaired in July 2018, and Ms. Nemmers stated that big improvements have been observed following the repairs.

Ms. Nemmers stated that surface water samples have been collected for both the third and fourth quarters due to the rainfall observed.

Ms. Nemmers stated that with sampling comes reporting of the data so many RA-O Reports are in process. Ms. Nemmers stated that technical memorandums are being prepared based upon data collected or planned to be collected. Ms. Nemmers stated that the Land Use Controls (LUCs) for the munitions response sites were the primary update for the LUC Management Plan Update. Ms. Nemmers stated that the remedial design for LHAAP-17 was in process.

Ms. Nemmers stated the goal going forward is to get the wells installed and the injections completed at LHAAP-16. Ms. Nemmers said the look ahead included a lot of groundwater sampling for performance remedy evaluations. Ms. Nemmers explained that the reports in the 3 month lookahead appears similar to the current documents because of the time to complete those documents.

Groundwater Treatment Plant

Ms. Nemmers explained the dip in the extraction and treatment in July and August 2018 was due primarily to the repairs to the FBR coupled with lower precipitation during that time. Ms. Nemmers also stated that the pumps for the extraction wells require maintenance which was behind due to the FBR repairs. However, Ms. Nemmers pointed out that the treatment system jumped back up with increased treatment volumes in September 2018.

Surface Water Sampling

Ms. Nemmers explained the surface water sampled from August 2018 was non-detect for perchlorate.

LHAAP-18/24 and LHAAP-29

Mr. Aaron Williams explained that a separate contractor, HDR, is responsible for developing the final remedy for LHAAP-18/24, LHAAP-29, and LHAAP-47. Mr. Williams explained that the Sites 29 and 18/24 are in the Proposed Plan (PP) stage and that LHAAP-47 already has a PP. For LHAAP-18/24, Mr. Williams explained that the PP is ahead of schedule and the public meeting for the PP will be in conjunction with the next RAB in January 2019. For Site 29, the PP is draft final and will have the public meeting in November or early December 2018.

Mr. Williams stated that Site 18/24 is a 34.5-acre area that was used for the treatment, storage, and disposal of solid and liquid explosive, pyrotechnic, and solvent waste by open burning/open detonation, incineration, and evaporation. Mr. Williams explained that interceptor collection trenches (ICTs) operate along with the GWTP as the interim remedy to control the plume until the permanent remedy is put into place. Mr. Williams stated that the sampling at Site 18/24 identified dense non-aqueous phase liquid (DNAPL) and dissolution of that DNAPL is considered a continuing source. Mr. Williams explained that there are two groundwater zones with one being the shallow zone and the other is the Wilcox Formation. Ms. Zeiler stated that contamination is present in both the shallow zone and the Wilcox Formation. Ms. VanDeventer asked if the Wilcox Formation had contamination. Ms. Zeiler confirmed that both zones do have contamination. Mr. Shivers asked if this is a problem. Ms. Zeiler stated that the problem is more that it moved. Ms. Zeiler explained that the layering of the soils makes it difficult to understand why and how the contamination moved. Mr. Mayer stated that LHAAP-18/24 is the worst site at LHAAP. Ms. Palmie stated that the burning ground was located in an area distant from the rest of the plant. Ms. Nemmers pointed out that this is the reason for the GWTP and interim remedy so this contamination is not a surprise. Ms. Zeiler explained that the selected remedy presented in the PP was a collaborative effort with regulators to aggressively treat the most contaminated areas at LHAAP-18/24 and identify areas where additional information will be collected to support the remedial design.

Mr. Williams summarized that volatile organic compounds (VOCs), perchlorate, and metals are present in both the shallow and Wilcox zones. Mr. Williams indicated that the draft PP will be submitted to the Regulators in October 2018. A total of six remedies were evaluated which are more fully detailed in the Feasibility Study (FS). The selected remedy is Alternative 5 which includes enhanced groundwater extraction and treatment, LUCs, enhanced in-situ bioremediation inside and outside the containment area in the shallow and Wilcox Formation, unsaturated soil excavation and off-site disposal, and thermal DNAPL removal. Mr. Williams then presented an overview of the other remedies considered which all included containment of the plume. Mr. Williams explained that the difference in Alternative 4 for LHAAP-18/24 was that surfactant was evaluated in place of thermal removal for the DNAPL. For Alternative 6, Zero-Valent Iron was considered in place of thermal DNAPL removal. Mr. Williams then explained that Alternative 5 was selected based upon best value considering cost and time for remedy implementation. Mr. Williams then showed a slide that visually depicts the implementation of Alternative 5 as presented in the FS that shows gridding for in-situ bioremediation and the areas of thermal treatment. Ms. Zeiler added that this depiction is just conceptual and that some changes from the FS are already planned based upon discussion with the regulators and costing.

Mr. Williams then presented the trinitrotoluene (TNT) production area, LHAAP-29, which produced 400 millions pounds of TNT between 1942 and 1945. Mr. Williams stated that the site was used for “soak-out” or solvent bath for rocket motors, which is the primary source for

the out-of-specification methylene chloride (MC) present in the intermediate aquifer. Mr. Williams stated that the MC in the intermediate aquifer is the primary area that requires treatment at the site. In addition, Mr. Williams explained the contaminants of concern (COCs) in soil are explosives and perchlorate and in shallow groundwater are VOCs, explosives, perchlorate, and metals. Mr. Williams explained that metals and other VOCs are also COCs in the intermediate aquifer. The transite TNT waste water line and vitrified clay cooling water lines have COCs that are explosives. Mr. Williams stated that all remedies evaluated for Site 29 included flushing and capping of those lines. Ms. Overdyke asked if testing beyond the shallow groundwater zone had been completed, to which Mr. Williams said "yes." Mr. Williams stated that the PP was sent to the Regulators on the day of the October 2018 RAB Meeting and that once the PP is finalized it will be distributed for Public Comment and review.

Mr. Williams presented the preferred remedy consisting of excavation and off-site disposal and LUCs for soil; flush and plug lines; in-situ thermal desorption (ISTD) using either electrical resistance heating (ERH) or thermal conduction heating (TCH); monitored natural attenuation (MNA) and LUCs for intermediate zone groundwater; and MNA and LUCs for shallow zone groundwater. Mr. Williams then presented the other remedies considered including excavation and off-site disposal and LUCs, flushing and plugging of lines, in situ chemical oxidation (ISCO) of the intermediate zone for the MC, MNA and LUCs for the intermediate zone groundwater, and MNA and LUCs for the shallow groundwater that makes up Alternative 2. Alternative 3 is similar but considered groundwater extraction for the intermediate zone as opposed to ISCO. Mr. Williams explained that the MC was detected in the millions of milligrams per liter. Ms. Palmie pointed out the area is isolated and in a very small footprint.

Mr. Williams explained that if anyone wants more details there are documents in the Administrative Record with the information. For LHAAP-18/24, there is a Final Revised FS and for LHAAP-29 there is a Final FS and a Draft Final FS Addendum. Mr. Williams stated that the MC concentration and information is contained in the Draft Final FS Addendum for LHAAP-29. Ms. Zeiler state that ISCO was first selected in the Final FS for LHAAP-29 but that has been revised due to the cost associated with follow-on ISCO treatments that would be needed.

LHAAP-47

Mr. Williams then presented LHAAP-47, which already has a PP and is ready for the ROD. However, due to the time since the PP, additional investigation was completed to confirm previous data and re-evaluate monitoring wells that had been dry. Mr. Williams said that a post-screening investigation (PSI) is being completed. Mr. Williams stated that the direct push technology (DPT) results were presented during the previous RAB Meeting. Since then, additional wells were installed and a total of 25 wells were sampled in July 2018. Mr. Williams explained that results from the July 2018 groundwater sampling are presented during this October 2018 RAB Meeting. An additional 11 wells were sampled in September 2018 and those results will be presented at the next RAB Meeting. All of the wells are installed and sampled so

the next step is preparing the PSI Report. Mr. Williams also stated that surface water samples will be collected in the winter. Ms. Zeiler stated that a draft ROD had been prepared, but then the dispute resolution occurred and time passed. So, the Army made the decision to re-evaluate the site due to the amount of time that has passed to ensure that everything gets addressed. Ms. Zeiler confirmed with Mr. Williams that there were not any big surprises. Ms. Zeiler stated than many of the shallow wells remain dry which is believed to be because the process related activities are no longer generating water and that it was a perched system. Ms. Zeiler stated that there are nine new monitoring wells and a lot of DPT points were advanced. Mr. Williams stated that DPT results presented at the last RAB Meeting showed non-detect but a source area was known to be present. So, a new shallow well was installed to ensure that the area was not larger than envisioned. The new monitoring well to the west had 120,000 micrograms per liter (µg/L) of trichloroethylene (TCE), which was a little bit of a surprise because the previous detection had been 25,000 µg/L of TCE. Mr. Williams also pointed out the area to the east where additional investigation was completed and did not result in any changes to the plan for the remedy. Mr. Williams explained that since TCE was detected in the eastern part of the site for the intermediate groundwater zone, new intermediate monitoring wells were installed which were sampled in September 2018. Mr. Williams stated the data from these new monitoring wells will be presented at the next RAB Meeting and will determine if there is a need to re-design the remedy for LHAAP-47. Ms. Zeiler explained that the ROD would not need to be revised because the remedy itself will remain in-situ bioremediation. Ms. Overdyke asked if the plume is further east than known. Mr. Williams confirmed the statement.

Other RAB Items Discussed

Ms. Zeiler discussed the Five-Year Review (FYR). Ms. VanDeventer stated that she and Paul (Fortune) had responded to the FYR interview form. Ms. Zeiler stated that the FYR is in Army and AEC review currently and will then be sent as draft to the Regulators in December 2018. Ms. Zeiler also asked for any topics of interest that could be presented at the next RAB Meetings.

Ms. Zeiler named the four parcels (Signal Test, Pistol Range, South Test/South Bomb and the Demolition Debris Landfill Areas) that are included in Environmental Condition of Property (ECP) VII document that is used for Fed-to-Fed transfers. The sites are on the schedule to be transferred to the U.S. Fish and Wildlife Service (USFWS) for incorporation into the refuge. Ms. Zeiler stated that the ECP has been through Army and legal review and is with USFWS and the regulators currently. Once the ECP is final, then the letter of offer is sent from the Army to the USFWS and that letter includes the Environmental Protection Provisions (EPPs) within the ECP as well as a land use survey and other information. The USEPA Reviews the ECP because of the LUCs as a requirement of the RODs. Ms. Zeiler stated that USFWS is also working on transfer of some water rights also that will result in a total of 85% transfer of water rights.

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 **January 17, 2019,** with the **meeting starting at 5:00 pm CST** at the Karnack Community Center. The **PP meeting for LHAAP-18/24 is planned for 6:00 pm to 7:30 pm CST** on the same night following the January 2019 RAB Meeting. Ms. Zeiler explained that there will be a court reporter for the PP portion of the meeting. For LHAAP-29, the PP Meeting was selected as December 6 or November 29, 2018 (which is the 5th Thursday), at 6 pm to 7:30 pm CST.

Adjourn

Mr. Richard LeTourneau motioned to adjourn. Ms. VanDeventer seconded the motion. The Meeting adjourned at 7:21 pm CDT.

October 2018 Meeting Attachments and Handouts:

- Meeting Agenda
- Color Copy of Bhate Presentation Slides
- Groundwater Treatment Plant (GWTP) – Processed Groundwater Volumes Handout
- Surface Water Sampling Handout

LONGHORN ARMY AMMUNITION PLANT
RESTORATION ADVISORY BOARD
Karnack, Texas
(479) 635-0110

AGENDA

DATE:	Thursday, July 19, 2018
TIME:	6:00 – 7:00 PM
PLACE:	Karnack Community Center, Karnack, Texas

06:00 **Welcome and Introduction**

06:05 **Open Items {RMZ}**
- Purpose of the RAB Meeting
- RAB Administrative Issues
- Minutes (April 2018 RAB Meeting)
- Ongoing Outreach/Website

06:15 **Defense Environmental Restoration Program (DERP) Update {Bhate}**
- LHAAP Geology and Hydrology Discussion
- LHAAP-03 ROD and LHAAP-35A(58) ESD Status Update
- Documents and Field Work Completed in 2nd Quarter 2018
- Three Month Lookahead
- Groundwater Treatment Plant (GWTP) Update

06:45 **Other Defense Environmental Restoration Program (DERP) Update {RMZ}**

06:50 **Next RAB Meeting Schedule and Closing Remarks {RMZ}**

Longhorn Army Ammunition Plant Quarterly Restoration Advisory Board Meeting

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

APTIM

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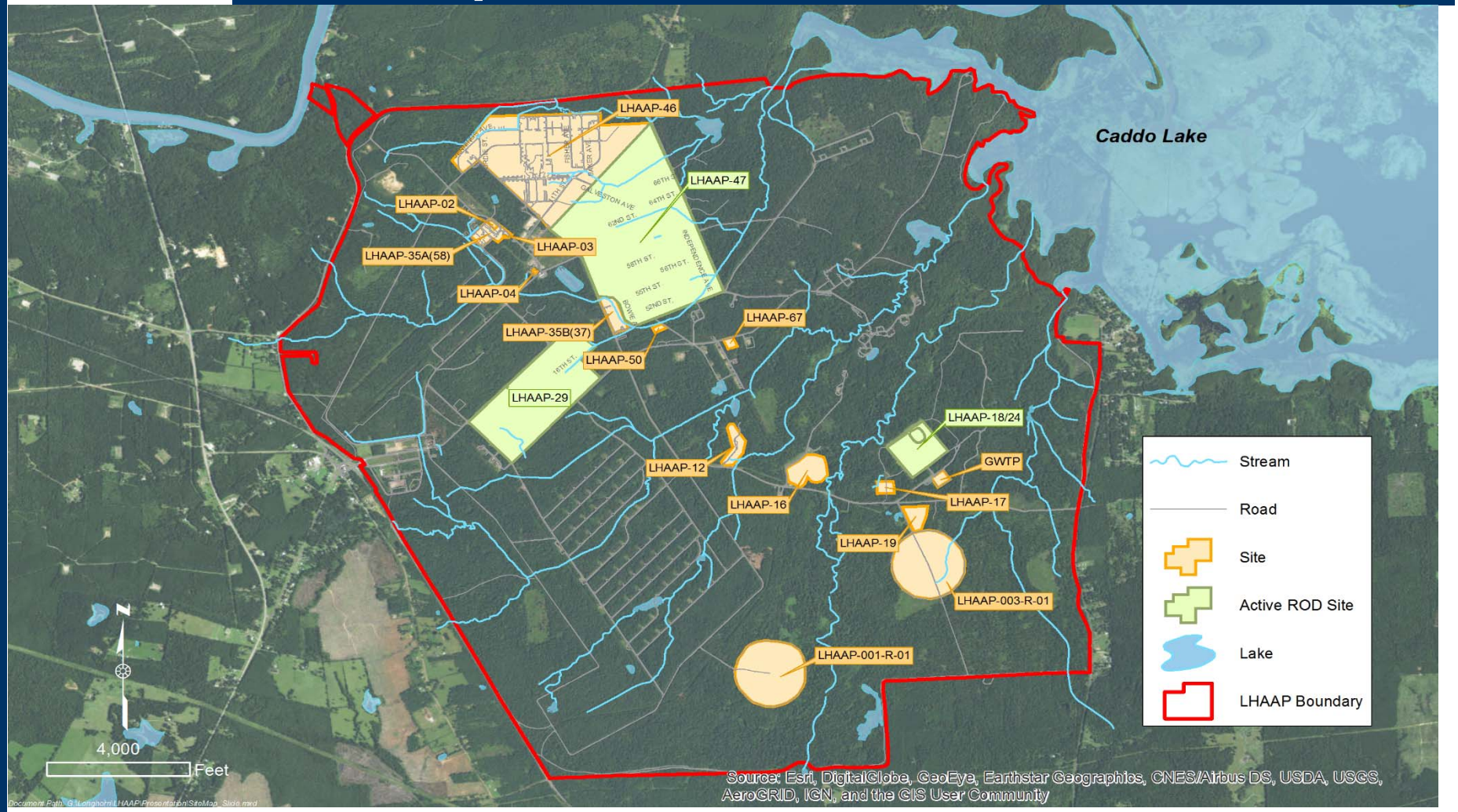
Restoration Advisory Board Meeting

Site Map



Abbreviations and Acronyms

µg/L	Micrograms per liter
DERP	Defense Environmental Restoration Program
ECP	Environmental Condition of Property
EISB	Enhanced In-situ Bioremediation
FBR	Fluidized Bed Reactor
ft bgs	Feet below ground surface
GWTP	Groundwater Treatment Plant
ISB	In-Situ Bioremediation
LHAAP	Longhorn Army Ammunition Plant
LUC	Land Use Control
MNA	Monitored natural attenuation
PCL	Protective Concentration Level
PDI	Pre-Design Investigation
PSI	Pre-Screening Investigation
RAB	Restoration Advisory Board
RA(O)	Remedial Action Operation
RAWP	Remedial Action Work Plan
RD	Remedial Design
ROD	Record of Decision
TCEQ	Texas Commission on Environmental Quality
TRRP	Texas Risk Reduction Program
USEPA	U.S. Environmental Protection Agency
VOCs	Volatile organic compounds

Restoration Advisory Board Meeting

Agenda

05:00 Welcome and Introduction

05:05 Open Items {RMZ}

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

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

- LHAAP-03 Field Work Status Update
- LHAAP-04 Field Work Status Update
- LHAAP-17 Remedial Design Update
- Documents and Field Work Completed Since Last RAB
- Three Month Look Ahead
- Groundwater Treatment Plant (GWTP) Update

05:45 Other DERP Update {AW}

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

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

Purpose of the RAB Meeting

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

The Army Wants You to be Informed

- The Army is committed to protecting human health and the environment; key to that commitment is engaging the community and increasing public participation in environmental restoration at LHAAP

- You are encouraged to:
  - Attend RAB Meetings and/or become a member of the RAB
  - Visit the Longhorn environmental website at www.longhornaap.com
    - Website is regularly updated to indicate the upcoming field events at each site including groundwater sampling, monitoring well installations, soil sampling, or remediation activities
  - Make suggestions for improving communication – the Army welcomes and appreciates community feedback

RAB Administrative Issues

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

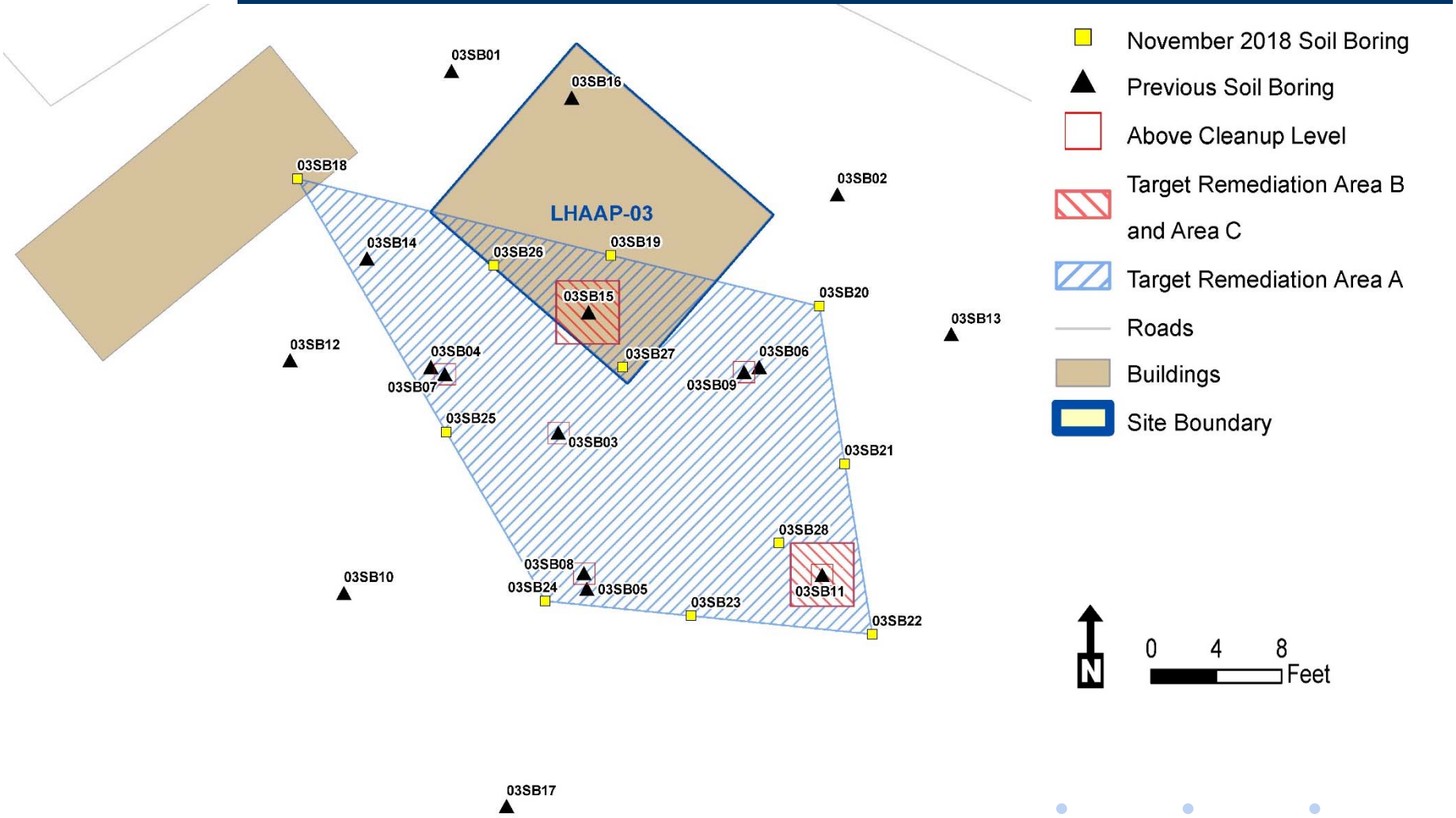
Restoration Advisory Board Meeting

LHAAP-03 Pre-Excavation Soil Sampling

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

Restoration Advisory Board Meeting

LHAAP-03 Pre-Excavation Soil Sampling



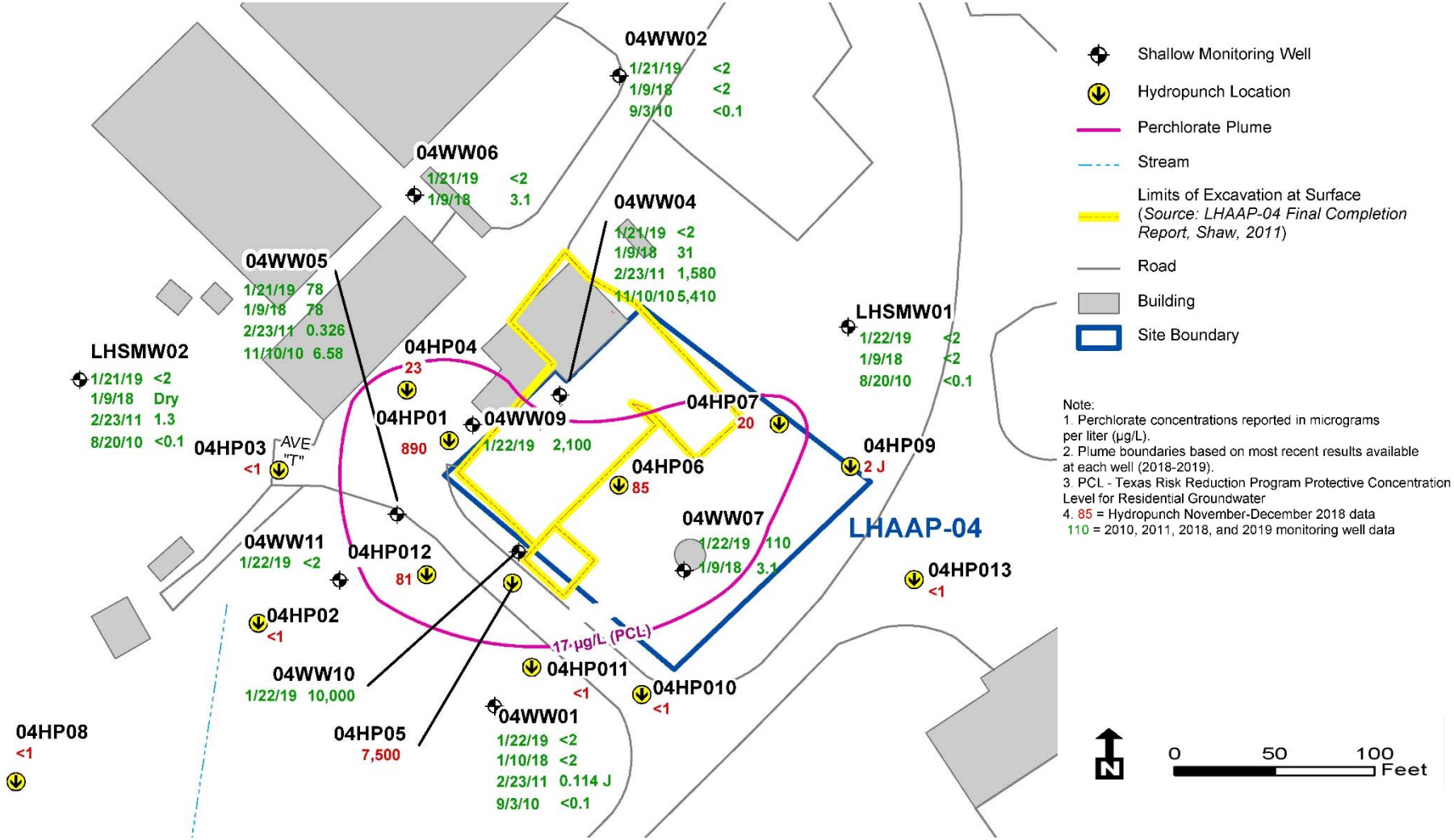
Restoration Advisory Board Meeting

LHAAP-04 Remedial Design

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

Restoration Advisory Board Meeting

LHAAP-04 2010-2019 Perchlorate Data



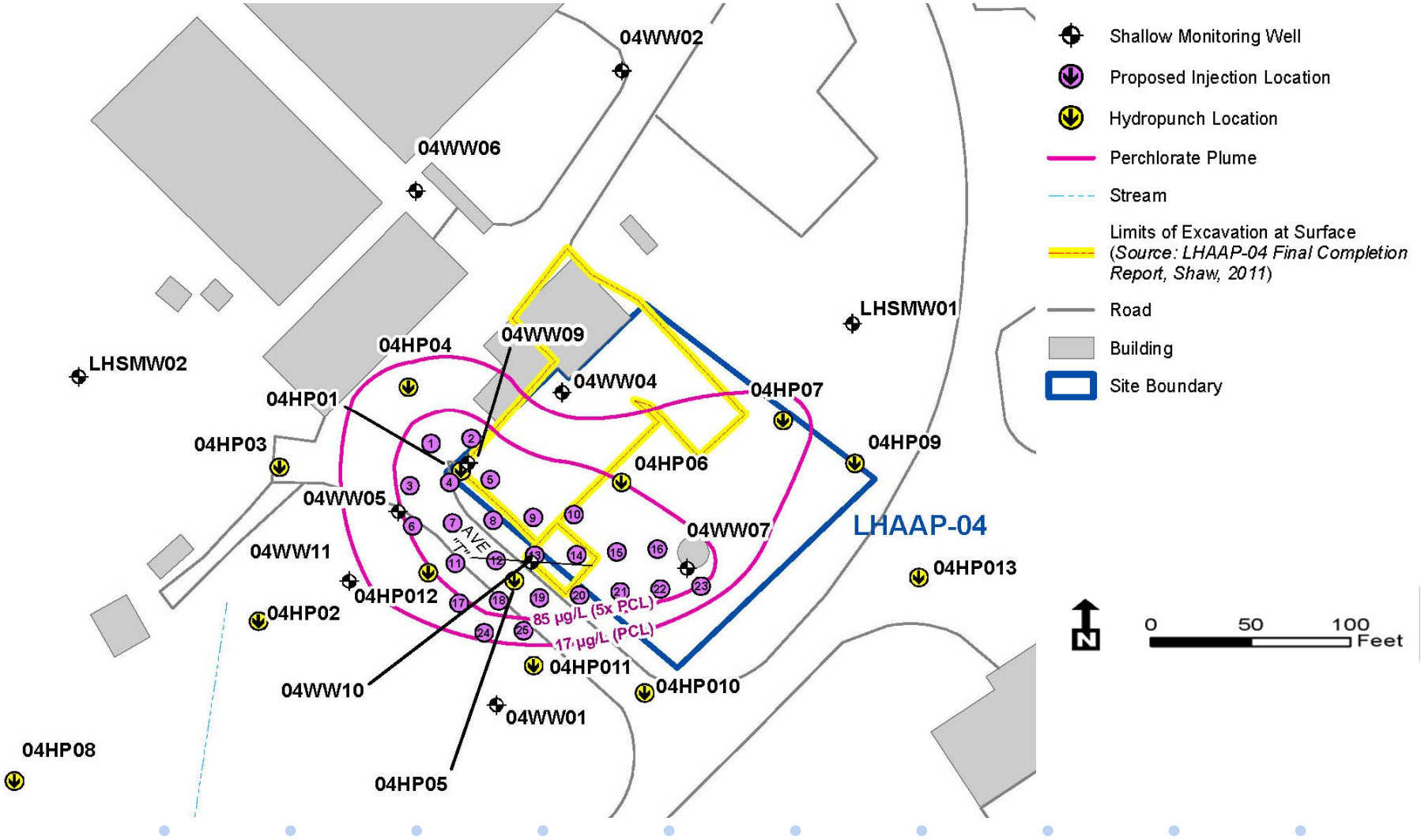
Restoration Advisory Board Meeting

LHAAP-04 Remedial Design

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

Restoration Advisory Board Meeting

LHAAP-04 Injection Plan



Restoration Advisory Board Meeting

LHAAP-17 Remedial Design

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

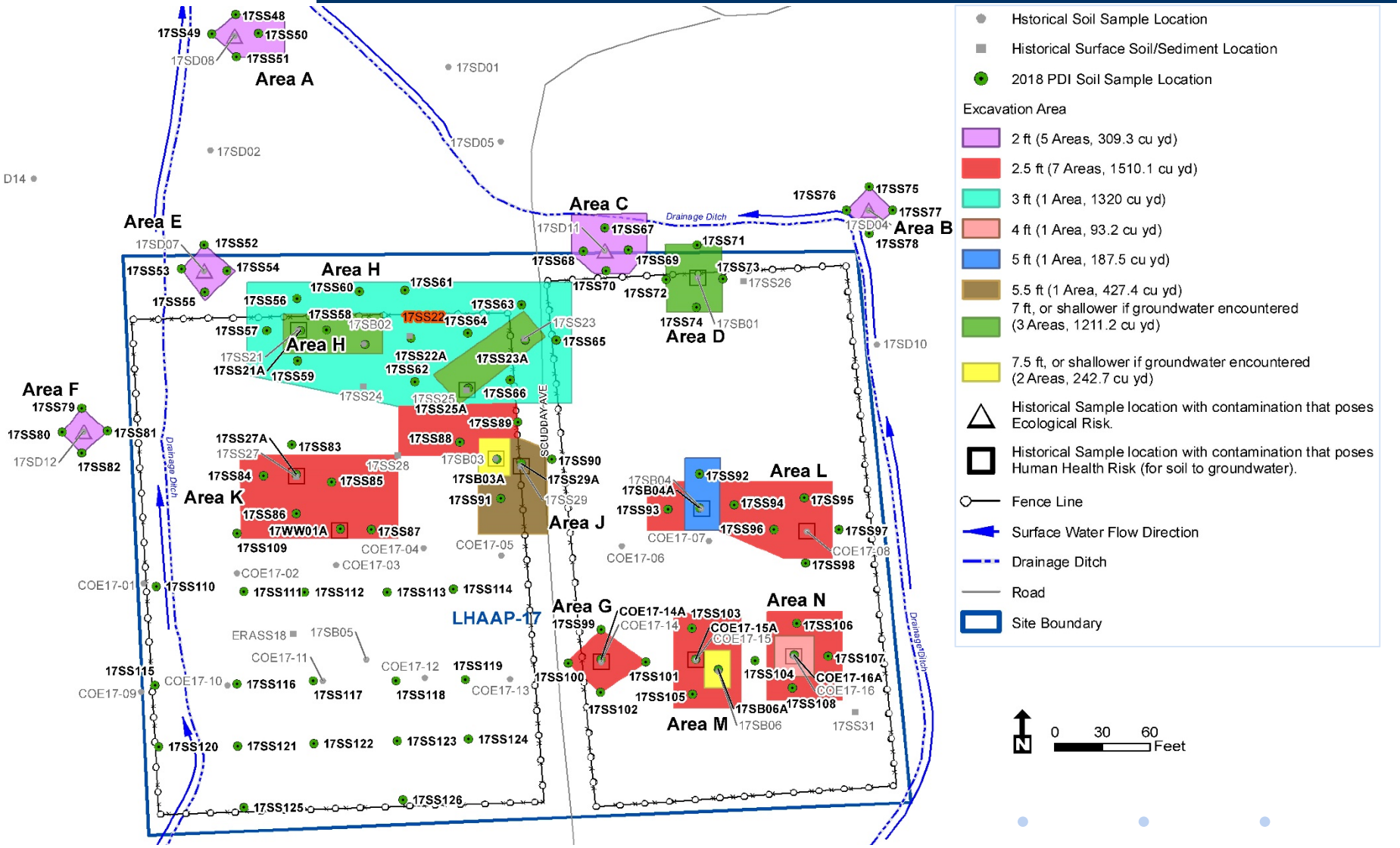
Restoration Advisory Board Meeting

LHAAP-17 Remedial Design

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

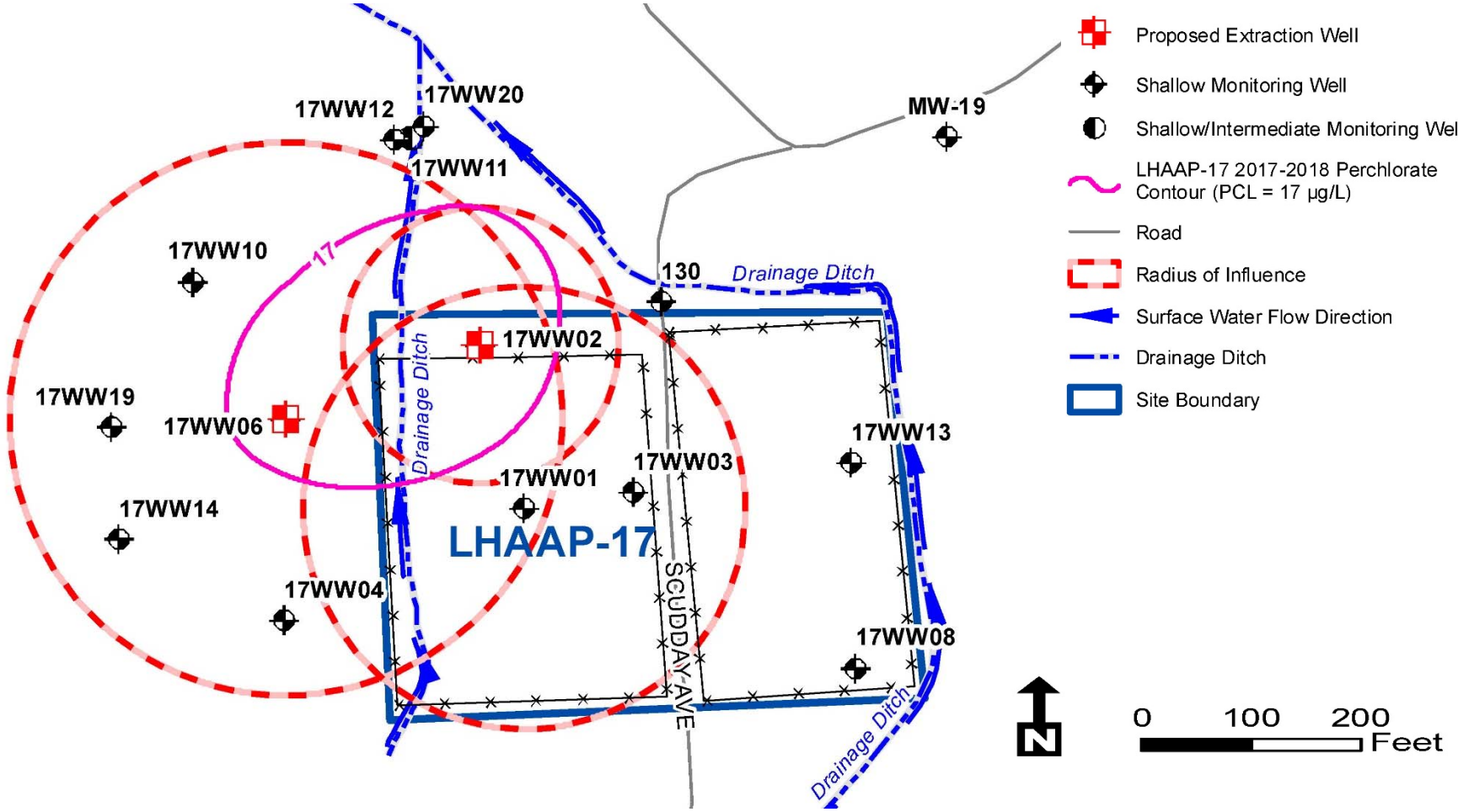
Restoration Advisory Board Meeting

LHAAP-17 Soil Excavation Areas



Restoration Advisory Board Meeting

LHAAP-17 Groundwater Extraction



Restoration Advisory Board Meeting

Completed Field Work Since Last RAB Meeting

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

Restoration Advisory Board Meeting

Documents in Process

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

Restoration Advisory Board Meeting

3 Month Look Ahead - Field Work

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

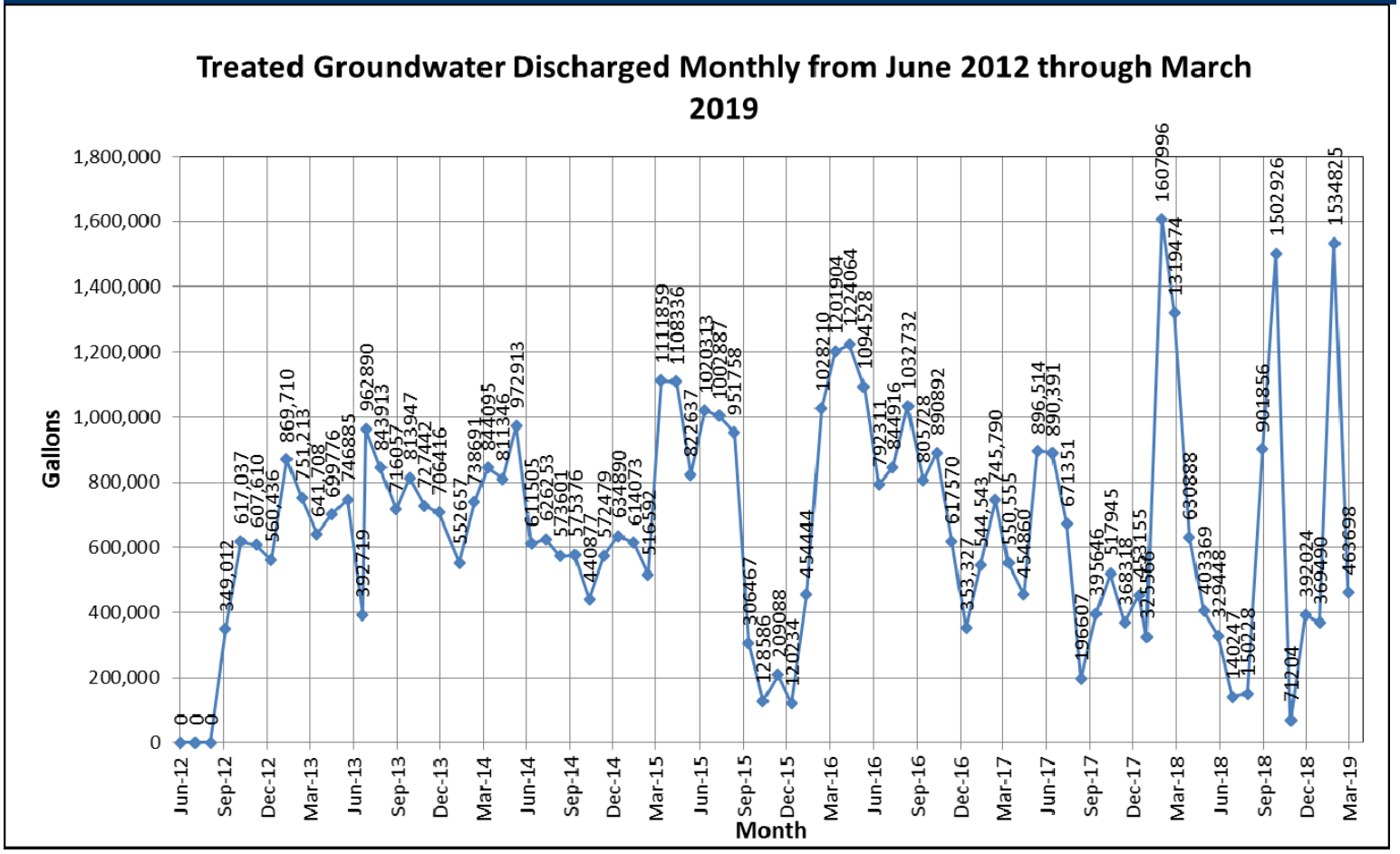
Restoration Advisory Board Meeting

3 Month Look Ahead - Documents

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

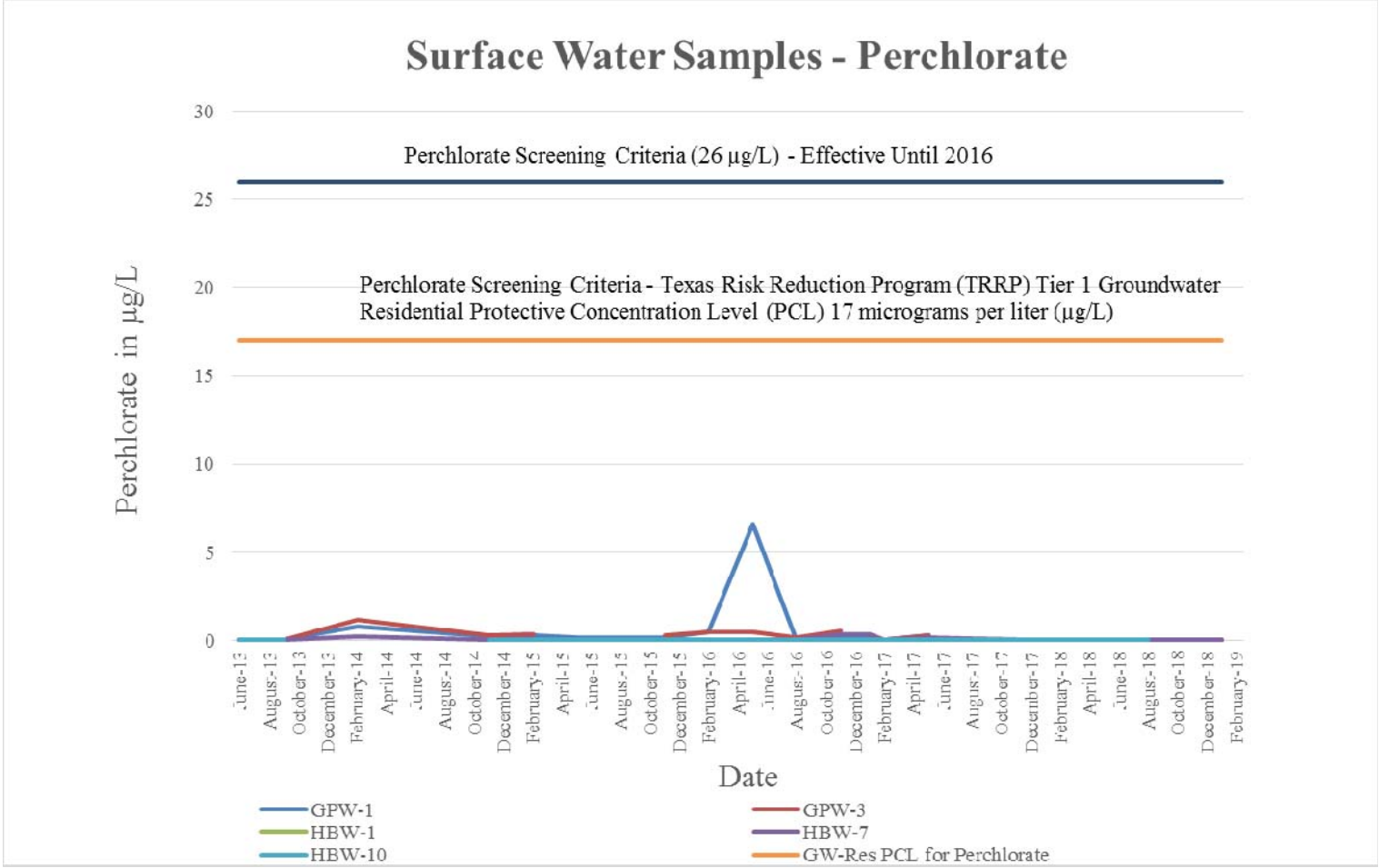
Restoration Advisory Board Meeting

GWTP Update



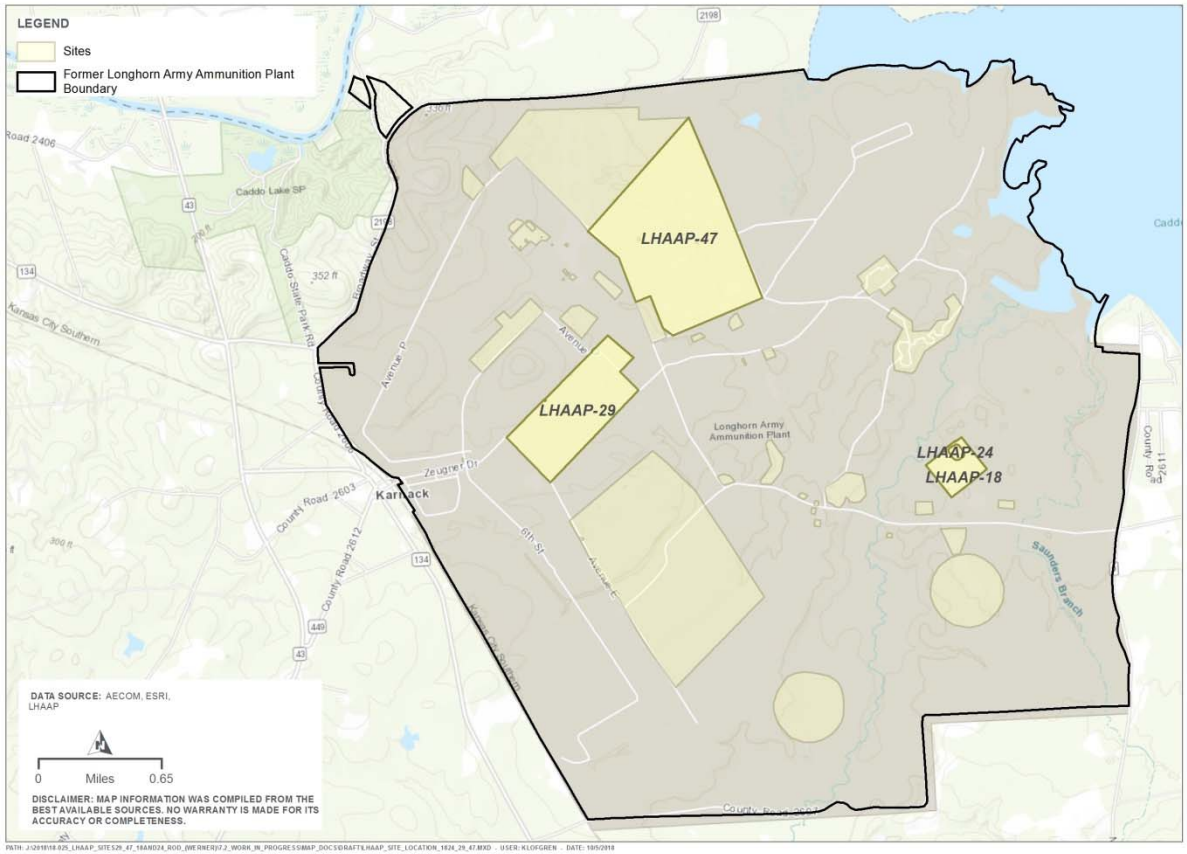
Restoration Advisory Board Meeting

Surface Water Sample Results



Restoration Advisory Board Meeting

LHAAP-18/24, 29, 47 Status Update



Restoration Advisory Board Meeting

LHAAP-18/24, 29 & 47 Document Status

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

Restoration Advisory Board Meeting

Feasibility Study for LHAAP-18/24

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

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

Restoration Advisory Board Meeting

LHAAP-47 Field Work Update

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

Next RAB Meeting Schedule & Closing Remarks

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

Groundwater Treatment Plant - Processed Groundwater Volumes

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

Processed Water Discharged Data

(in gallons)

Oct-07	Nov-07	Dec-07	Jan-08	Feb-08	Mar-08	Apr-08	May-08	Jun-08	Jul-08	Aug-08	Sep-08
1,041,491	848,356	804,822	792,148	665,883	818,872	791,306	568,812	776,904	748,377	690,052	617,199

Oct-08	Nov-08	Dec-08	Jan-09	Feb-09	Mar-09	Apr-09	May-09	Jun-09	Jul-09	Aug-09	Sep-09
655,059	619,274	726,118	552,299	598,144	433,800	488,807	526,958	387,644	0	414,853	735,716

Oct-09	Nov-09	Dec-09	Jan-10	Feb-10	Mar-10	Apr-10	May-10	Jun-10	Jul-10	Aug-10	Sep-10
808,322	636,306	727,492	391,898	695,343	802,656	894,731	962,121	1,257,977	1,314,924	1,041,495	1,136,547

Oct-10	Nov-10	Dec-10	Jan-11	Feb-11	Mar-11	Apr-11	May-11	Jun-11	Jul-11	Aug-11	Sep-11
956,567	705,805	849,712	811,679	668,281	1,090,348	817,325	900,338	916,552	784,369	652,524	733,456

Oct-11	Nov-11	Dec-11	Jan-12	Feb-12	Mar-12	Apr-12	May-12	Jun-12	Jul-12	Aug-12	Sep-12
748,102	658,250	684,903	865,453	725,000*	730,000*	980,000*	630,000*	0	0	0	349,012

Oct-12	Nov-12	Dec-12	Jan-13	Feb-13	Mar-13	Apr-13	May-13	Jun-13	Jul-13	Aug-13	Sep-13
617,037	607,610	560,436	869,710	751,213	641,708	699,776	746,885	392,719	962,890	843,913	716,057

Oct-13	Nov-13	Dec-13	Jan-14	Feb-14	Mar-14	Apr-14	May-14	Jun-14	Jul-14	Aug-14	Sep-14
813,974	727,442	706,416	552,657	738,691	844,095	811,346	972,913	611,505	626,253	573,601	575,376

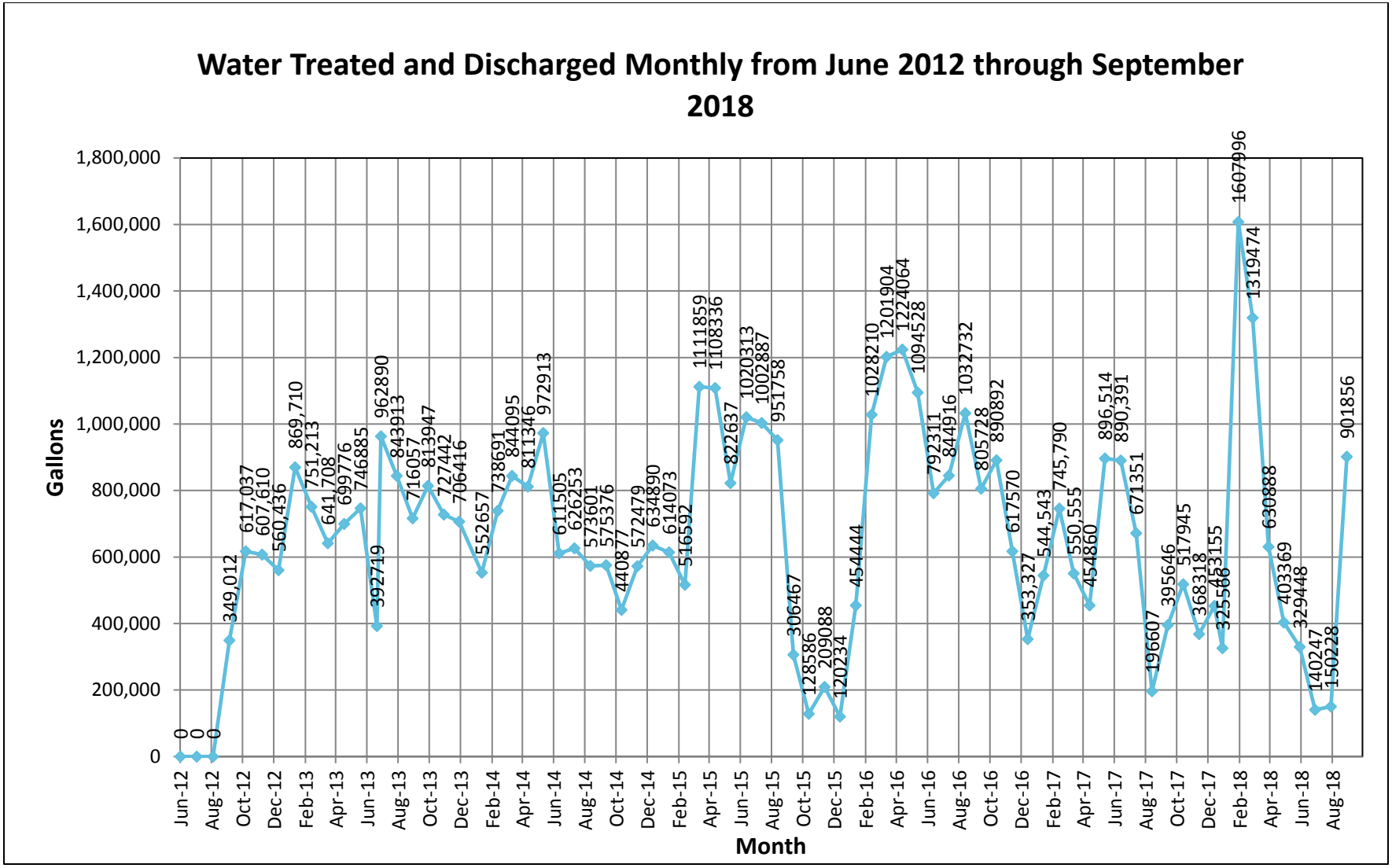
Oct-14	Nov-14	Dec-14	Jan-15	Feb-15	Mar-15	Apr-15	May-15	Jun-15	Jul-15	Aug-15	Sep-15
440,877	572,479	634,890	614,073	516,592	1,111,859	1,108,336	822,637	1,020,313	1,002,887	951,758	306,467

Oct-15	Nov-15	Dec-15	Jan-16	Feb-16	Mar-16	Apr-16	May-16	Jun-16	Jul-16	Aug-16	Sep-16
128,586	209,088	120,234	454,444	1,028,210	1,201,904	1,224,064	1,094,528	792,311	844,916	1,032,732	805,728

Oct-16	Nov-16	Dec-16	Jan-17	Feb-17	Mar-17	Apr-17	May-17	Jun-17	Jul-17	Aug-17	Sep-17
890,892	617,570	353,327	544,543	745,790	550,555	454,860	896,514	890,391	528,538	195,198	961,324

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

*Indicates Estimate


Water Treated and Discharged Monthly from June 2012 through September 2018
Gallons
Month
1,800,000
1,600,000
1,400,000
1,200,000
1,000,000
800,000
600,000
400,000
200,000
0
Jun-12
Aug-12
Oct-12
Dec-12
Feb-13
Apr-13
Jun-13
Aug-13
Oct-13
Dec-13
Feb-14
Apr-14
Jun-14
Aug-14
Oct-14
Dec-14
Feb-15
Apr-15
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Oct-15
Dec-15
Feb-16
Apr-16
Jun-16
Aug-16
Oct-16
Dec-16
Feb-17
Apr-17
Jun-17
Aug-17
Oct-17
Dec-17
Feb-18
Apr-18
Jun-18
Aug-18
0
0
0
349,012
617,037
607,610
560,436
869,710
751,213
641,708
699,776
746885
392719
962890
843913
716057
813947
727442
706416
552657
738691
844095
811346
972913
611505
626253
573601
575376
440877
572479
634890
614073
516592
1111859
1108336
822637
1020313
1002887
951758
306467
128586
209088
120234
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
325588
453155
1607996
1319474
630888
403369
329448
140247
150228
901856

Water Discharge Location and Volume (Gallons)

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

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	<1.0U	-	4	<4.0 U	<4.0 U	<4.0 U	-	2.65	<4.0 U	<4.0 U	<4.0 U
GPW-3	<1.0U	<4.0 U	17	8	<4.0 U	<4.0 U	-	2.28	<4.0 U	<4.0 U	<4.0 U
HBW-1	-	<80.0 U	310	23	-	-	<4.0 U	-	<4.0 U	<4.0 U	<4.0 U
HBW-7	-	<8.0 U	370	110	-	-	<4.0 U	-	<4.0 U	<4.0 U	<4.0 U
HBW-10	-	<8.0 U	905	650	<4.0 U	-	<4.0 U	-	<4.0 U	-	-

Quarter	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	<0.2U	<1.0 U	<1.0 U	122	<1.0 U
HBW-7	<4.0 U	<4.0 U	<4.0 U	-	<4.0 U	<4.0 U	<0.2U	<1.0 U	<1.0 U	1.02	<1.0 U
HBW-10	<4.0 U	<4.0 U	<4.0 U	-	<4.0 U	-	<0.2U	<1.0 U	<1.0 U	<1.0 U	<1.0 U

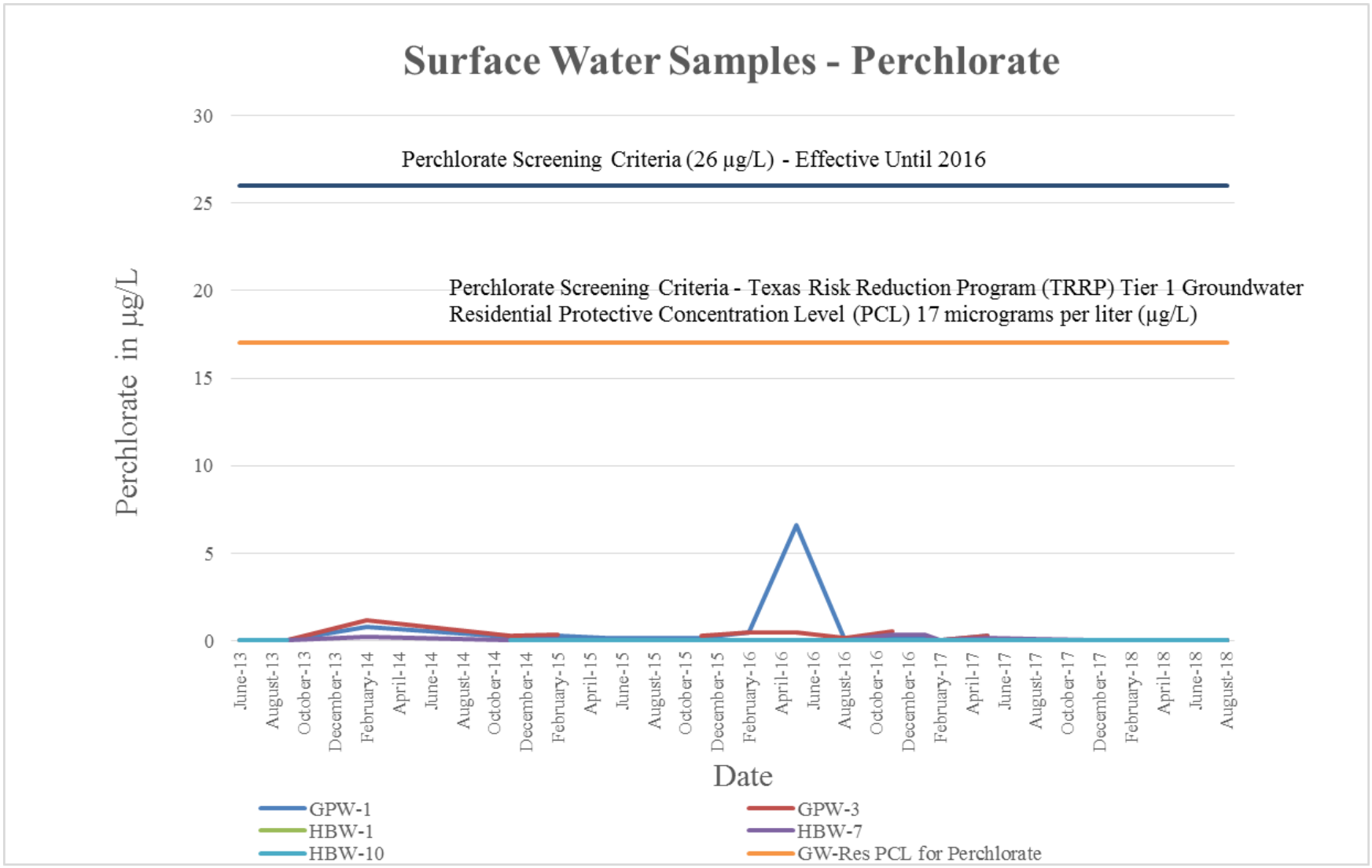
Quarter	1st	2nd	3rd	4th	2nd	3rd	3rd	3rd	4th	1st	2nd
Creek Sample ID	**Mar 2008**	**Jun 2008**	**Sep 2008**	**Dec 2008**	**May 2009**	**Jul 2009**	**Aug 2009**	**Sep 2009**	**Dec 2009**	**Mar 2010**	**Jun 2010**
GPW-1	27	<0.5U	<0.5U	<0.22U	16	<4U	NS	<1.2U	3.7	1.3J	<0.6U
GPW-3	21.9	9.42	1.1	<0.22U	8.9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

Quarter	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	<0.1U	8.7	dry	dry	1.76	0.163J	dry	NS	1.65	0.735
GPW-3	dry	0.199J	0.673	dry	dry	1.31	0.261	dry	NS	1.74	0.754
HBW-1	dry	<0.1U	<0.2U	dry	dry	<0.1U	0.1U	dry	NS	<0.2U	<0.2U
HBW-7	dry	<0.1U	<0.2U	dry	dry	0.171J	0.1U	dry	NS	<0.2U	<0.2U
HBW-10	dry	<0.1U	<0.2U	dry	dry	<0.1U	0.1U	dry	NS	<0.2U	<0.2U

Quarter	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	0.156J	dry	0.142 J
GPW-3	dry	<0.2 U	dry	1.15	dry	dry	0.276 J	0.344 J	dry	dry	0.311 J
HBW-1	<0.2U	<0.2 U	dry	<0.2 U	dry	dry	<0.2 U	<0.2 U	dry	dry	<0.2 U
HBW-7	<0.2U	<0.2 U	dry	0.201 J	dry	dry	<0.2 U	0.124 J	dry	dry	<0.2 U
HBW-10	<0.2U	<0.2 U	dry	<0.2 U	dry	dry	<0.2 U	<0.2 U	dry	dry	<0.2 U

Quarter	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**	**June 2018**	**August 2018**
GPW-1	0.447	6.59	<0.2 U	0.301 J	<1 U	0.263	dry	<4.0 U	<4.0 U	dry	<2.0 U
GPW-3	0.474	0.457	0.141	0.563	<1 U	0.274	dry	<4.0 U	<4.0 U	dry	<2.0 U
HBW-1	<0.2 U	<0.2 U	<0.2 U	<0.2 U	<1 U	<0.2 U	<0.2 U	1.1 J	<4.0 U	dry	<2.0 U
HBW-7	<0.2 U	<0.2 U	<0.2 U	0.318 J	<1 U	0.155	<0.2 U	<4.0 U	<4.0 U	dry	<2.0 U
HBW-10	<0.2 U	<0.2 U	<0.2 U	<0.2 U	<1 U	<0.2 U	0.111J	<4.0 U	<4.0 U	dry	<2.0 U

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


Surface Water Samples - Perchlorate
Perchlorate Screening Criteria (26 µg/L) - Effective Until 2016
Perchlorate Screening Criteria - Texas Risk Reduction Program (TRRP) Tier 1 Groundwater Residential Protective Concentration Level (PCL) 17 micrograms per liter (µg/L)
Perchlorate in µg/L
30
25
20
15
10
5
0
June-13
August-13
October-13
December-13
February-14
April-14
June-14
August-14
October-14
December-14
February-15
April-15
June-15
August-15
October-15
December-15
February-16
April-16
June-16
August-16
October-16
December-16
February-17
April-17
June-17
August-17
October-17
December-17
February-18
April-18
June-18
August-18
Date
GPW-1
GPW-3
HBW-1
HBW-7
HBW-10
GW-Res PCL for Perchlorate

Longhorn Army Ammuntion Plant Creek Sampling Locations