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:	**November 20, 2014, 6:00 – 7:00 PM**

Meeting Participants:

LHAAP/BRAC:	Rose M. Zeiler
USACE:	Aaron Williams, Rick Smith
USAEC:	Robin Paul
AECOM:	Dave Wacker, Gretchen McDonnell
TCEQ:	April Palmie
USEPA Region 6:	Rich Mayer, Steve Tzhone, Janetta Coats, Kent Becher (USGS liaison)
USFWS:	Paul Bruckwicki, Jason Roesner
RAB:	**Present:** Paul Fortune, Carol Fortune, Judy Vandeventer, Judith Johnson, Tom Walker, Nigel Shivers, John Pollard, Jr., Lee Guice **Absent:** Ken Burkhalter, Robert Cargill, Charles Dixon, Ted Kurz, James Lambright, Pickens Winters, Richard LeTourneau, Terry Britt
Public:	Hilary & Jim Saunders, William Echols, Marla & Bruce Mestad, George Rice, CLI-TAG, Lee Eisenberg

An agenda handout for the RAB meeting, fact sheets on the Groundwater Treatment Plant performance, Harrison Bayou and Goose Prairie Creek and Perimeter Well data, LHAAP-46 Remedial Action Operations, and LHAAP-67 Remedial Action Operations in addition to a hard copy of the AECOM slide presentation were provided for the meeting.

Welcome and Introduction

Mr. Fortune called the meeting to order and introduced guests in attendance: Bruce and Marla Mestad, and Jim and Hilary Saunders.

Open Items – Dr. Rose Zeiler

RAB Administrative Issues

Minutes
The motion for approval of the August 2014 RAB meeting minutes was tabled until the next meeting to provide more time for RAB members to review.

Website Update
Dr. Zeiler encouraged the group to visit the "Longhorn Army Ammunition Plant, Environmental Restoration Program" website at longhornaap.com, and asked for feedback from meeting attendees. Ms. Coats asked how residents would be aware the website exists. Mr. Wacker advised that the website had been announced by public notice in Shreveport, Louisiana and Marshall, Texas newspapers, and the website link was sent to everyone on the LHAAP interested parties roster. Additionally, the website address has been provided and website described during the last few RAB meetings. Dr. Zeiler noted that the site contains interactive maps with site information and a calendar showing meetings and planned field work. The full administrative record is also accessible through the website. Minutes from each RAB meeting will be posted to the website after finalization. Mr. Wacker further described how to use the interactive site map feature to access information about each site.

Mr. Echols asked whether the LHAAP site map presented by Mr. Wacker depicted the property transferred to USFWS. Dr. Zeiler and Mr. Wacker stated there are differences between the LHAAP site map and land transferred to USFWS. Mr. Echols stated that it would be of interest to see the map showing the property that has been transferred to USFWS. Dr. Zeiler indicated Army would work on placing a map showing the transferred property on the website.

Remedial Action Underway Sites – Fact Sheets
Two of the sites being remediated using monitored natural attenuation (MNA) are far enough along where site fact sheets have been updated to provide current site status. Hard copies of the fact sheets were made available for the meeting. For these two sites, LHAAP-46 and LHAAP-67, a groundwater monitoring well network has been installed and four quarters of groundwater monitoring has been conducted. The fact sheets provide a site background, historical site use, an explanation of MNA and land use control boundaries. Remedial Action Operations reports describing the first year of operations at these two sites will be coming out in the next few months. Three other MNA sites (LHAAP-37, 50 and 58) will likely have fact sheets presented at the next RAB meeting.

Defense Environmental Restoration Program (DERP) Update – AECOM (Dave Wacker)

Preliminary Findings for LHAAP-18/24
Mr. Wacker began the DERP Update discussion, informing the group that the majority of field work has been completed at sites LHAAP-18/24 and LHAAP-29 since the last RAB meeting. He explained that LHAAP-18/24, also known as Burning Grounds Number 3 and the Unlined Evaporation Pond (where the Groundwater Treatment Plant is located), is comprised of

approximately 34.5 acres, with the primary contaminants of concern (COCs) being: perchlorate, VOCs (TCE and MC) and metals. The interim remedy in place involves extraction and treatment of COC-impacted groundwater.

Two primary contamination source areas (areas with Dense Non-Aqueous Phase Liquid, or DNAPL) have been identified within groundwater at LHAAP-18/24: the Air Curtain Destructor area and the Unlined Evaporation Pond area. A prime objective of the Summer 2014 field work was to further delineate the extent of contaminant source material in groundwater in these two areas, providing an increased level of confidence in the size of the DNAPL source material areas requiring remediation for both locations.

In the Unlined Evaporation Pond area, this most recent investigation used a grid pattern sampling technique to identify the area of DNAPL source material as somewhat larger than previously estimated. Footprints of the pre-investigation estimated footprint and the post-investigation delineated footprint were presented by Mr. Wacker for comparison.

In the Air Curtain Destructor area, pre-investigation footprint of contamination source material in groundwater was estimated at 300 feet x 200 feet in area. Summer 2014 investigation indicated the source material area is actually significantly smaller, at approximately 70 feet x 70 feet in horizontal dimension, with a shallow depth range of approximately 30 feet to 50 feet below ground surface.

Treatability Studies for LHAAP-18/24 and LHAAP-29

Mr. Wacker explained that treatability studies are used to do small-scale evaluations of the effectiveness of potential different remedies at LHAAP-18/24 and LHAAP-29. Thermal treatability testing, in-situ microcosm testing, bench-scale microcosm testing, emulsified zero valent iron microcosm testing and zero-valent iron microcosm testing are being utilized. "Microcosm" testing uses material (soil and groundwater) collected from the contaminated area to set up a laboratory experiment where remedy effectiveness can be observed. Ms. McDonnell provided explanation and a summary of the preliminary results of treatability study work conducted at LHAAP-18/24.

Ms. McDonnell explained that one of the technologies to remediate subsurface contaminants is thermal treatment; essentially heating up the subsurface materials to break the chemical bonds within the contaminant molecules, thereby breaking down the contaminant. Treatability testing related to thermal treatment consisted of testing both groundwater and soil to estimate the amount of energy it might take to heat the subsurface to a temperature where contaminant bonds could be broken. While the testing done for LHAAP-18/24 indicated thermal treatment could be used, the critical part of the data relates to the estimate of energy required to complete thermal treatment. This information will assist in developing implementation details and cost estimates for remediation by this method, for comparison against other potential remedial methods.

In-Situ microcosm testing is done with devices called "bio-trap" passive samplers. The bio-traps are three-piece assemblies lowered into the screened interval of existing monitoring wells, and allowed to reside in the well for a period of time. For Longhorn sites, biotraps were

left in place for 60 days to collect information on how much the naturally-occurring microbes are doing to breakdown the contaminant. Each segment of the assembly examines conditions that are slightly different. The first segment delivers additional food to naturally-occurring microbes in the form of emulsified vegetable oil and collects information on how well the contaminant is degraded by the microbes in that segment. A second segment contains a material that releases oxygen into the groundwater and collects information on how well the contaminant is degraded under those conditions; the third segment simply collects information on natural microbial action without any additional food or oxygen sources. When retrieved after 60 days, the materials from these samplers are collected and analyzed in a laboratory. This type of study provides information on whether natural populations of microbes in the contaminated area are sufficient to break down the contaminants and how the microbes respond to different food source and oxygen level conditions. Preliminary results of this study indicate LHAAP-18/24 has favorable conditions for bioremediation.

Bench-scale microcosm testing is conducted in a laboratory, but uses soils and groundwater collected from the site to create experiments that determine the optimal mix of microbes, food sources and other amendments needed to apply to the site to do the best job of degrading the contamination.

Zero-valent iron and emulsified zero-valent iron are clean-up technologies which rely on the electron transfer between iron metal shavings/particles and the contaminant molecules to destroy the contaminant. Electron transfer from the iron metal puts excess energy into the contaminant molecules, breaking the chemical bonds within molecules, thereby breaking down the contaminant. Zero-valent iron remediation often consists of a "wall" of iron filings installed in the subsurface that, when contaminated groundwater passes through it, breaks down the contaminant molecules through electron transfer. Emulsified zero-valent iron consists of very small particles of iron suspended in an emulsion that can be injected to spread throughout the subsurface. The LHAAP-18/24 testing indicated zero-valent iron was effective in breaking down contaminants of interest, but that emulsified zero-valent iron was not.

Mr. Wacker stated that all the treatability study information will be included in reports prepared for each site.

Mr. Walker asked how fast the bacteria work to degrade the contamination. Mr. Wacker explained that Army has done similar microcosm testing work prior to implementing in-situ bioremediation at LHAAP-58, injecting both the "food" amendment and bacterial inoculation to work to degrade the contaminants. In that treatability testing, the concentrations of contaminants used were completely degraded within 60-90 days, but those results are not directly applicable to the pace of remediation in the field due to various factors, including the potential presence of residual DNAPL source that will continue to release contaminants for some time. Dr. Zeiler feels it will be a fairly long time to achieve clean-up on the sites with DNAPL, on the order of decades.

Mr. Walker asked whether there is natural occurring zero-valent iron at the site that could be acting to degrade the contaminants. Ms. McDonnell stated that there are iron oxides and iron oxyhydroxides in the subsurface soils at the site, but that the valence "charge" (energy

available for breaking contaminant molecule bonds) on those iron-containing materials is different than that provided by zero-valent iron metal.

Preliminary Findings for LHAAP-29

Mr. Wacker summarized that the primary issue at LHAAP-29 is intermediate zone groundwater impacted by VOCs. The estimated pre-investigation LHAAP-29 groundwater source (DNAPL) area footprint and the post-investigation delineated footprint were presented for comparison. The extensive investigation work done this summer revealed the actual extent of the groundwater DNAPL source area requiring remediation is much smaller than previously estimated, with a size of approximately 150 feet x 100 feet. Treatability tests have been performed for LHAAP-29 (thermal treatment and aquifer pumping test) with additional treatability testing (bio-trap) in progress.

Of note, during these activities, the subsurface was found to be comprised of a highly consolidated fine-grained material which was difficult to drill, and was impossible to investigate utilizing the planned CPT method. This material also was found to have very limited sustained groundwater production (~0.5 gallon per minute) during aquifer testing.

Monitored Natural Attenuation (MNA) Sites (LHAAP-46, 50, 58 and 67)

Groundwater monitoring is underway at these sites. Land Use Controls with agency concurrence are in place for LHAAP-46 and 67. Mr. Wacker showed maps of both sites depicting the LUC area (groundwater use restriction) and the plume footprints. Development of LUC boundaries and obtaining agency concurrence is underway for the three remaining MNA sites.

GWTP Update

Mr. Wacker advised that treated water from LHAAP-18/24 and LHAAP-16 sites continues to be returned to LHAAP-18/24 through the sprinkler system, or to Harrison Bayou when sufficient flow is present. (The INF Pond is present as a holding pond for treated water should neither of those options be available.) Due to the current lack of flow in the bayou, water is being discharged back to the ground surface of LHAAP-18/24 via the sprinkler system; this has been the case for approximately the last six months. The GWTP handout now includes a table to show how treated water is being discharged (returned to the site by sprinkler system, discharged to Harrison Bayou, or discharged to INF Pond).

Mr. Wacker stated that another round of LHAAP-18/24 compliance sampling of the well field will be conducted in December 2014.

Air emission monitoring for the GWTP has recently been reduced from monthly to quarterly events. Air monitoring had been conducted on a weekly basis for a year without any result approaching any limit/standard. Monitoring was subsequently reduced to monthly after that first year, and was just recently further reduced to quarterly based on no indication of air emissions issues over a long period of intensive observation and data collection.

GWTP O&M is ongoing. Pumps in three ICTs were recently replaced.

Surface Water and Perimeter Well Sampling

Although there has been some rainfall over the last quarter, it has been insufficient to produce flowing water for sampling at the surface water sampling locations. Hard copy handouts showing surface water and perimeter well sampling results were available during the meeting.

Other Environmental Restoration Issues – Rose Zeiler

Site LHAAP-37 Bioplug Demonstration

Mr. Wacker briefed that the final sampling round for the bioplug technology demonstration was conducted in October 2014, and the study was coming to an end. Dr. Zeiler explained that the technology consisted of automated feeding of oxygen and nutrients for aerobic bacterial degradation within a treatment area, but it did not perform well enough to consider extending the study or use of the technology. The system is in the process of being dismantled and removed.

Mr. Walker asked whether the type of bacteria needed for biodegradation are already present in LHAAP soils. Dr. Zeiler stated that Dehalococcoides is the typical bacteria used for anaerobic degradation. Mr. Wacker advised that Dehalococcoides has not typically been present for the sites where AECOM has looked for it, but Dr. Zeiler stated that this likely varies from site to site. As an example, LHAAP-67 has apparent contaminant degradation occurring without any augmentation of the bacterial population, suggesting that Dehalococcoides populations are naturally-occurring.

Because the Bio-Plug Technology demonstration was an aerobic system, the aquifer must return to anaerobic conditions before monitoring for the MNA remedy can be initiated. AECOM will conduct the monitoring to determine when the aquifer has returned to anaerobic baseline conditions.

Dispute Status Update

Mr. Wacker presented the list of sites where forward progress has stopped due to the dispute between EPA and Army. Mr. Fortune asked for an update on the dispute from each side of the dispute, Army and EPA.

EPA Update by Mr. Mayer. The EPA Administrator provided her decision on October 31, 2014, and Mr. Mayer had distributed to the RAB the 34-page Administrator's decision letter to the RAB members by email. In summary, the dispute involved LHAAP-16, LHAAP-17 and the two munitions sites, and related to three groundwater contaminants: manganese, nickel and perchlorate. There were three issues.

1. Should groundwater be remediated to residential standards or industrial standards? Army felt industrial drinking water standards were appropriate, while EPA maintained residential drinking water standards applied.
2. Use and duration of land use controls at sites with contamination.
3. Stipulated penalty assessed against Army.

The EPA Administrator's decision agreed with the earlier Regional EPA Administrator's decision which had been appealed by Army, and provided Army with 21 days to provide revised RODs meeting the requirements of the decision.

Mr. Fortune asked Dr. Zeiler what Army's response would be, as the deadline for response is tomorrow.

Army Update by Dr. Zeiler. Dr. Zeiler stated Army is reviewing the EPA Administrator's decision, but she did not have information on Army's planned response.

On the topic of groundwater remediation to residential or industrial standards, Dr. Zeiler stated that it appeared that EPA shifted from accepting RODs using the Texas Risk Reduction Rules (RRR) industrial standards under which Longhorn is grandfathered to requiring that Longhorn use the Texas Risk Reduction Program (TRRP) clean-up standards because the TRRP residential was closer to EPA's Health Advisory Level (HAL). However, the EPA HAL is not a promulgated standard and cannot be used as a basis for selection of clean-up goals. (No perchlorate MCL exists because peer review of the EPA's proposed 15 µg/L MCL indicated the risk calculations/scientific basis did not support the MCL value.) Dr. Zeiler stated that implementing the EPA Administrator's decision uses the EPA HAL (not a promulgated standard and not subjected to proper scrutiny) as a basis to justify use of the TRRP residential remediation goals, and results in moving LHAAP out of one Texas environmental program into another, with significant potential schedule impacts.

Mr. Tzhone stated that the issue with use of the industrial vs. residential remediation goals is that there is currently no Federal MCL, and that TCEQ has two standards (residential or industrial) that could be applied. Mr. Tzhone gave an example of the groundwater issue, using an analogy of a highway without a federal speed limit but two Texas speed limits. Mr. Tzhone stated that EPA will require all sites involving contaminants without MCLs to meet residential groundwater standards, regardless of what has been used as a remediation goal in the past and regardless of the land use of the site being examined.

Mr. Fortune asked that, if the EPA thinks this is the final decision, does Army acknowledge and agree. He further stated that there was a statement made by Tom Lederle during his last RAB visit that there may be another level of appeal for Army beyond the EPA Administrator. Dr. Zeiler stated that, under the FFA, the EPA Administrator's decision is the final decision. Mr. Tzhone agreed and stated that anything else is outside of the FFA process.

Mr. Echols stated he would like to see all of LHAAP turned over the USFWS as soon as possible, and this dispute impacts what "as soon as possible" means. He said that he understands there are two Texas remediation standards, industrial and residential, that relate to how clean the water has to be to say remediation is complete. Dr. Zeiler clarified that the State of Texas has two environmental programs, and that LHAAP is grandfathered into the older program, the Texas Risk Reduction Rule. Using Mr. Tzhone's speed limit analogy, Mr. Echols stated that sometimes the speed limit should be 55 and sometimes it should be 90. He feels the State of Texas is driving the use of residential groundwater standards. Ms. Palmie responded that State of Texas is not driving the remediation standards set forth in the EPA

Administrator's decision. Mr. Echols continued, asking why Army is being forced to remediate to a residential drinking water standard when the land will never be used for residential purposes?

Mr. Tzhone responded that transfer of land to USFWS is not contingent upon completion of the clean-up, so land could be transferred to USFWS before remediation is complete. He stated the decision whether to transfer land or any contaminated properties before completion of full remediation was a matter between USFWS and Army, but he felt the decision on groundwater clean-up levels was not a factor in whether land is or has been transferred to USFWS.

Mr. Echols asked again why EPA wants residential standards applied when the land will never be used as residential. Mr. Tzhone answered that EPA has a policy to restore groundwater to its highest beneficial use. The classification of groundwater here at LHAAP via the Texas classification process is Class II or "potential drinking water", so it must be remediated to that beneficial use, which requires achievement of the residential standards. Dr. Zeiler asked Mr. Tzhone why EPA changed course in October 2011, when they had previously signed five RODs indicating satisfaction with Risk Reduction Rule industrial groundwater remediation standards. Mr. Tzhone stated that the issue was likely recognized at a particular point in time, and that discovery drove the change in policy.

Mr. Fortune introduced Mr. George Rice as a technical resource funded by EPA through Caddo Lake Institute to keep the public informed on the LHAAP remediation, and asked for Mr. Rice's opinion on the EPA Administrator's decision. Mr. Rice stated that he did not have an opinion on the decision, but asked if, when the EPA finalizes development of the perchlorate MCL, will the question of what standard to follow be settled? Dr. Zeiler stated that, yes, Army follows the law, which includes MCLs (because MCLs are promulgated legal standards). She elaborated to say that Army is currently following the law with respect to perchlorate, State of Texas law, which is the law that all the FFA parties agreed to and under which Army has been conducting work since 2000. Army must follow State of Texas law regarding perchlorate because there is no Federal MCL (MCL of 15 µg/L proposed by EPA was withdrawn due to lack of scientific basis).

Mr. Rice then asked, if Army cleans up sites to state standards, but EPA develops a MCL that is lower, would Army have to go back and do more remediation? Both Dr. Zeiler and Mr. Tzhone responded that Army would likely be required to do more remediation. Dr. Zeiler stated protectiveness of the remedies are evaluated every 5 years during the CERCLA 5-year review process and a new MCL being issued could result in a determination that the remedy is no longer deemed adequately protective. At the point a determination is made that the remedy is no longer considered adequately protective, additional remediation work would have to be undertaken to reestablish a protective remedy. Mr. Mayer stated that state standards are typically the same as the MCL. Ms. Palmie added that Texas will not typically have a separate state standard if a MCL has been developed, and seldom would have a clean-up more protective than a MCL.

Dr. Zeiler asked Mr. Tzhone if the EPA Administrator's decision to require that Longhorn use the TRRP groundwater cleanup standards rather than the RRR groundwater cleanup standards puts Army in the position of essentially starting over on the site work, requiring all data to be screened against TRRP standards? Mr. Tzhone stated that there is an obligation to meet the residential groundwater standards regardless of what work was done historically. Dr. Zeiler noted that the EPA Administrator's decision effectively moves Longhorn from regulation under the RRR where a refuge is viewed as industrial to regulation under the TRRP where a refuge is considered equivalent to residential. As well, she advised the use of TRRP standards at this time would require rescreening of all historical data against the lower residential standards. Additionally, there will be changes to the risk evaluation work, as the existing risk work used an industrial land use scenario (suitable for future land use as a wildlife refuge per the RRR that has applied to Longhorn since the start of the environmental remediation work). Mr. Tzhone stated that, yes, data for all constituents without a MCL would need to be rescreened against TRRP residential standards. Dr. Zeiler noted that, although MCLs apply only to groundwater, some of the EPA Region VI comments on this subject refer to screening data against all residential TRRP standards, not just those standards for groundwater. She asked whether the EPA Administrator's decision regarding applicability of TRRP residential standards was intended to apply to soils as well as groundwater? Mr. Tzhone stated that the EPA Administrator's decision states that TRRP residential groundwater regulations will be used as the clean-up levels, so it is a groundwater issue at this time. Dr. Zeiler stated that, by switching the Texas program LHAAP is regulated under (from RRR to TRRP) rescreening of data may result in groundwater plumes that were not at issue previously. Dr. Zeiler summarized that the impact of the EPA Administrator's decision will be a significant schedule reset for the Longhorn remediation program.

Mr. Echols restated his question asking why a piece of land owned by the Federal government, that will continue to be owned by the Federal government, and will never be used for residential development is being held to residential groundwater remediation standards. Mr. Tzhone stated that there is a separate objective for remediation of groundwater (to restore it to highest beneficial use) that drives this decision. Mr. Echols asked if this policy is being applied across the board to all states. Mr. Tzhone stated that this is a national policy and the intent is for the policy to be applied across the board to all states. Dr. Zeiler noted that application of this policy is being driven by EPA Health Advisory Levels (HALs) that are not laws, and have not been subjected to either public scrutiny or evaluation by the scientific community. As such, this is a precedent setting case.

Mr. Echols stated that 6 years ago the community was in a major fight over whether Longhorn would be turned over to USFWS as a refuge or developed into an industrial park. He then asked, if the community had allowed the land to be used as an industrial park, would Army have been able to transfer this land? Mr. Tzhone stated Army would have been able to transfer the land in that scenario but, because the land transfer is not directly related to the groundwater clean-up standards, he feels there is nothing prohibiting Army from transferring the land to USFWS now.

Mr. Eisenberg said that, with water resources being scarce, it's probably only a matter of time before there is a need to use this water. Dr. Zeiler stated that the shallow water at Longhorn

would not be a desirable resource, and that the fine-grained aquifer materials result in water production rates so low as to be unfeasible for development. Mr. Tzhone advised that future land use is a separate issue and does not drive groundwater remediation goals; the only thing driving groundwater remediation goals is restoration of the water to highest beneficial use, of which the groundwater is designated "potential drinking water" via the Texas groundwater classification process. Dr. Zeiler said the problem with this approach is that the groundwater clean-up goals EPA wants to use are not driven by a promulgated standard that has been subjected to public review and scientific scrutiny, but driven by an unpromulgated HAL that was developed internally by EPA without outside validation.

Mr. Echols summarized that, regardless of whether industrial and residential standard is applied, it is going to be a very long time before the groundwater at Longhorn is completely remediated.

Mr. Mayer commented that EPA is working on development of a perchlorate standard, and has been working on it for many years. Although the first proposed perchlorate MCL of 15 µg/L was withdrawn due to lack of scientific basis, a new proposed perchlorate standard is anticipated next year. Ms. Palmie stated that work has not completely stopped at Longhorn in the absence of the perchlorate standard. Although Army and EPA have a dispute, it is at a high level in those organizations; the "local" Longhorn Army, EPA and TCEQ team members have continued to work together on everything that can possibly be moved forward.

Dr. Zeiler asked Ms. Palmie if other Federal perchlorate sites in Texas currently regulated under the RRR will now have to follow the new requirements set forth by precedent in the EPA Administrator's decision on Longhorn. Ms. Palmie stated that application of this policy to other Federal perchlorate sites in Texas will have to be evaluated as the Longhorn situation continues to develop.

Mr. Fortune advised the attendees that Mr. Rice will be available for a question and answer session after the RAB meeting is adjourned.

Upcoming Field Work, Meetings and Documents

Quarterly sampling at the MNA sites is ongoing and compliance sampling at LHAAP-18/24. Compliance reporting is underway on a number of sites. Mr. Wacker noted that LHAAP-29 and LHAAP-18/24 are the most contaminated sites and the fact that we are getting closer to having Feasibility Studies to move them forward is a positive thing.

Schedule

The next RAB meeting is scheduled for February 19th from 6:00PM to 7:30PM at the Karnack Community Center.

Adjourn

November Meeting Attachments and Handouts:

- *Meeting Agenda*
- *AECOM PowerPoint Presentation*

- *GWTP Treated Groundwater Volumes Handout*
- *Surface Water Sampling Results Handout*
- *LHAAP Perimeter Well Sampling Results Handout*
- *LHAAP-46 Remedial Action Operation Fact Sheet*
- *LHAAP-67 Remedial Action Operation Fact Sheet*

Acronyms

AECOM	AECOM Technical Services, Inc.
BRAC	Base Realignment and Closure
CERCLA	Comprehensive, Environmental Response, Compensation, and Liability Act
CLI	Caddo Lake Institute
COC	Contaminant of Concern
CPT	Cone Penetrometer Testing
DERP	Defense Environment Response Program
DNAPL	Dense Non-Aqueous Phase Liquid
FFA	Federal Facility Agreement
GWTP	Groundwater Treatment Plant
HAL	Health Advisory Level
ICT	interceptor-collector trench
INF	Intermediate-Range Nuclear Forces
ISB	In-Situ Bioremediation
LHAAP	Longhorn Army Ammunition Plant
LNAPL	Light Non-Aqueous Phase Liquid
MNA	Monitored Natural Attenuation
MC	Methylene Chloride
MCL	Maximum Contaminant Level
O & M	Operation and Maintenance
RAB	Restoration Advisory Board
ROD	Record of Decision
RRR	(Texas) Risk Reduction Rule
TAG	Technical Assistance Grant
TCE	trichloroethene
TCEQ	Texas Commission on Environmental Quality
TRRP	Texas Risk Reduction Program
USACE	United States Army Corps of Engineers
USAEC	United States Army Environmental Center
USEPA	United States Environmental Protection Agency
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
µg/L	micrograms per liter
VOC	volatile organic compound

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

AGENDA

DATE: Thursday, November 20, 2014
TIME: 6:00 – 7:30 PM
PLACE: Karnack Community Center, Karnack, Texas

06:00 Welcome and Introduction

06:05 Open Items {RMZ}
- RAB Administrative Issues
- Minutes
- Website
- Remedial Action Underway Sites – Fact Sheets

06:15 Defense Environmental Restoration Program (DERP) Update {AECOM}
- Preliminary Findings LHAAP 18/24, LHAAP 29
- MNA Site Updates (LHAAP-46, 50, 67)
- Groundwater Treatment Plant (GWTP) Update
- Surface Water and Perimeter Well Sampling

07:15 Other Environmental Restoration Issues {RMZ}
- Bioplug Demonstration at LHAAP-37
- Dispute Status Update

07:20 Next RAB Meeting Schedule and Closing Remarks

07:30 Adjourn {RMZ}

Longhorn Army Ammunition Plant Restoration Advisory Board Meeting November 20, 2014

AECOM Environment

Agenda

DATE:	Thursday, November 20, 2014
TIME:	6:00 – 7:30 PM
PLACE:	Karnack Community Center, Karnack, Texas

06:00 Welcome and Introduction

06:05 Open Items {RMZ}
- RAB Administrative Issues
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- Website
- Remedial Action Underway Sites – Fact Sheets

06:15 Defense Environmental Restoration Program (DERP) Update {AECOM}
- Preliminary Findings LHAAP 18/24, LHAAP 29
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07:15 Other Environmental Restoration Issues {RMZ}
- Bioplug Demonstration at LHAAP-37
- Dispute Status Update

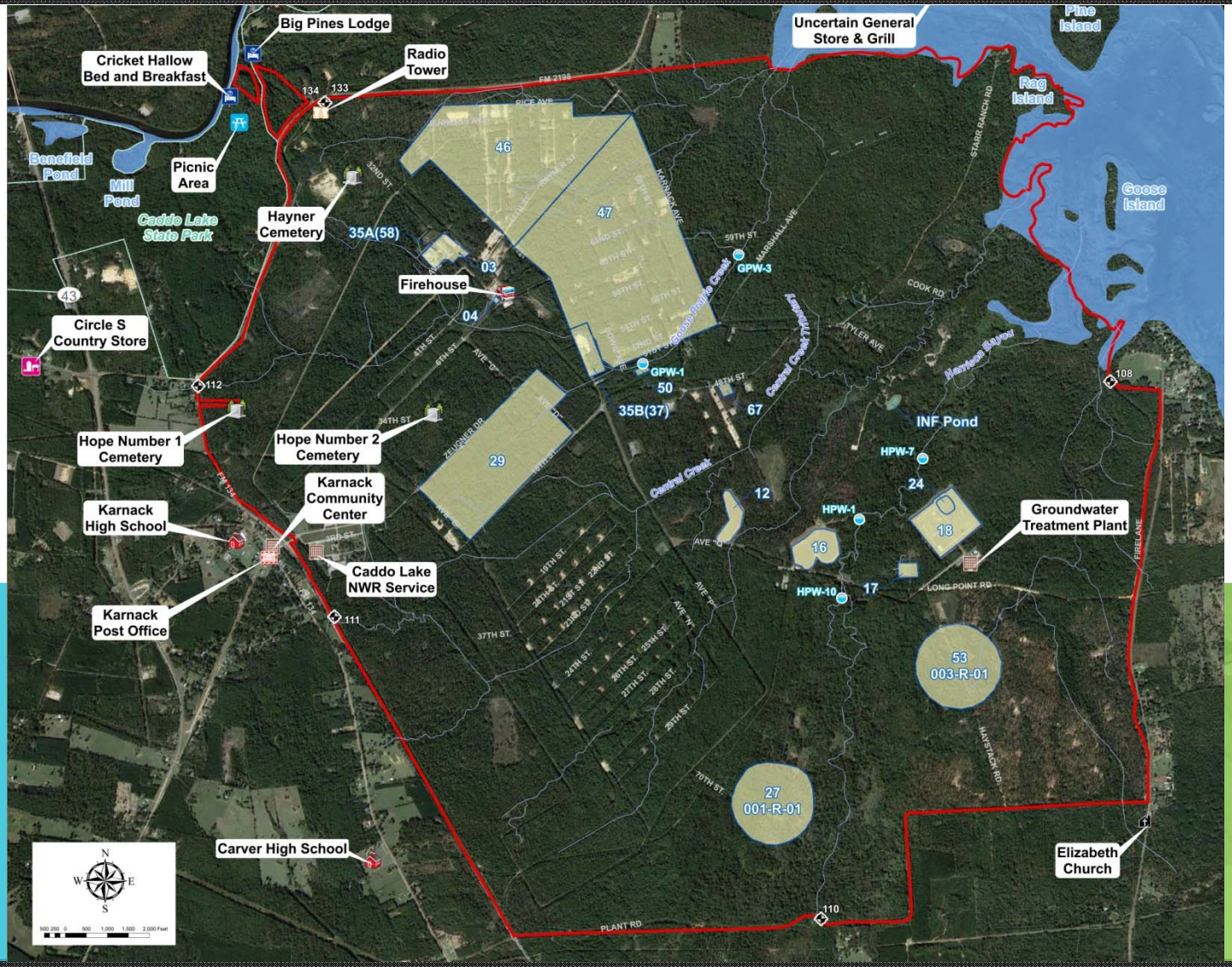
07:20 Next RAB Meeting Schedule and Closing Remarks

07:30 Adjourn {RMZ}

RAB Administrative Issues

- Minutes from May and August RAB Meetings
- Website Update
- "Remedial Action Underway" Fact Sheets
  - LHAAP-37 Chemical Laboratory Waste Pad
  - LHAAP-46 Plant 2 Area
  - LHAAP-50 Former Sump Water Tank
  - LHAAP-58 Maintenance Complex
  - LHAAP-67 Aboveground Storage Tank Farm

Longhorn Map



AECOM

Longhorn Active Site List

LHAAP-03	Building 722 Paint Shop
LHAAP-04	Pilot Wastewater Treatment Plant
LHAAP-12	Landfill 12
LHAAP-16	Landfill 16
LHAAP-17	Burning Ground No.2/Flashing Area
LHAAP-18	Burning Ground No.3
LHAAP-24	Unlined Evaporation Pond
LHAAP-29	Former TNT Production Area
LHAAP-37	Chemical Laboratory Waste Pad
LHAAP-46	Plant Area 2
LHAAP-47	Plant Area 3
LHAAP-50	Former Sump Water Tank
LHAAP-58	Maintenance Complex
LHAAP-67	Aboveground Storage Tank Farm
LHAAP-001-R-01	South Test Area/Bomb Test Area
LHAAP-003-R-01	Ground Signal Test Area

Status of Environmental Sites

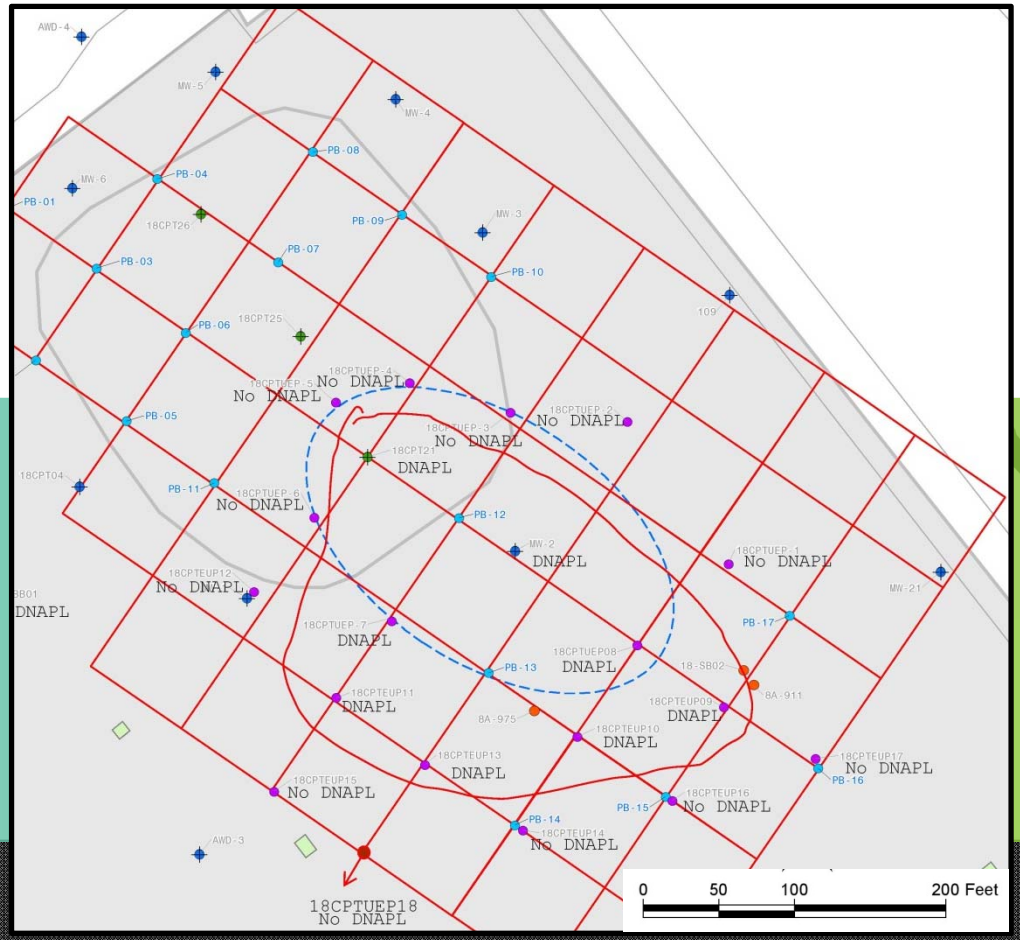
– Additional work activities completed since the last RAB meeting were for sites LHAAP-18/24 and LHAAP-29

– LHAAP-18/24 – Burning Grounds #3 and Unlined Evaporation Pond
  - Interim remedy: Continuous extraction and treatment of groundwater from collection trenches surrounding and within the site (green in image below)
  - Contaminants of Concern: Perchlorate, VOCs (TCE, MC), Metals

Status of Environmental Sites (cont)

LHAAP-18/24 – Burning Grounds #3 and Unlined Evaporation Pond

- Investigation of Dense Non-Aqueous Phase Liquid and Soil Source Material at Unlined Evaporation Pond
- DNAPL area extends farther south and east than previously estimated
- Work activities appear to have delineated extent of DNAPL

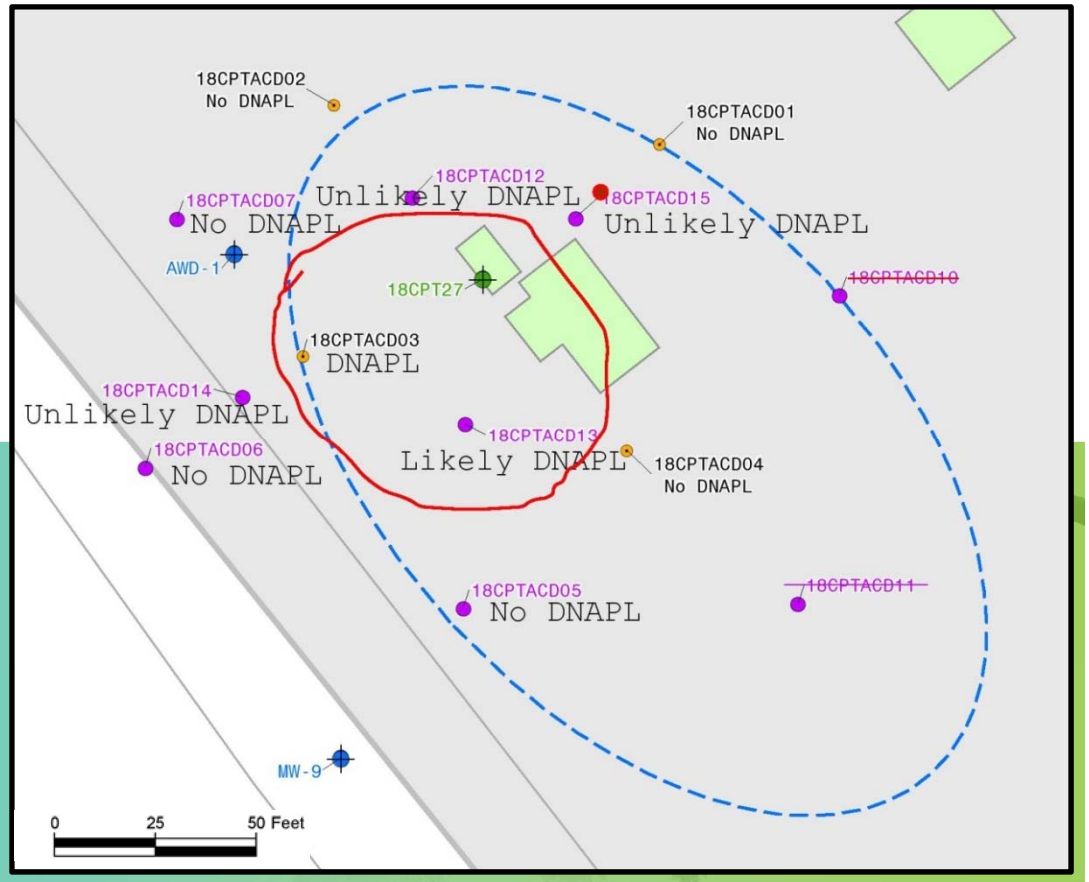


AECOM

Status of Environmental Sites (cont)

LHAAP-18/24 – Burning Grounds #3
and Air Curtain Destructor

- Investigation of Dense Non-Aqueous Phase Liquid and Soil Source Material at Air Curtain Destructor
- DNAPL area smaller than previously estimated
- Work activities appear to have delineated extent of DNAPL



AECOM

Treatability Studies Overview

Treatability testing is often conducted to:

1) Determine whether a potential remediation treatment technology should be successful in treating a specific contamination problem; and,

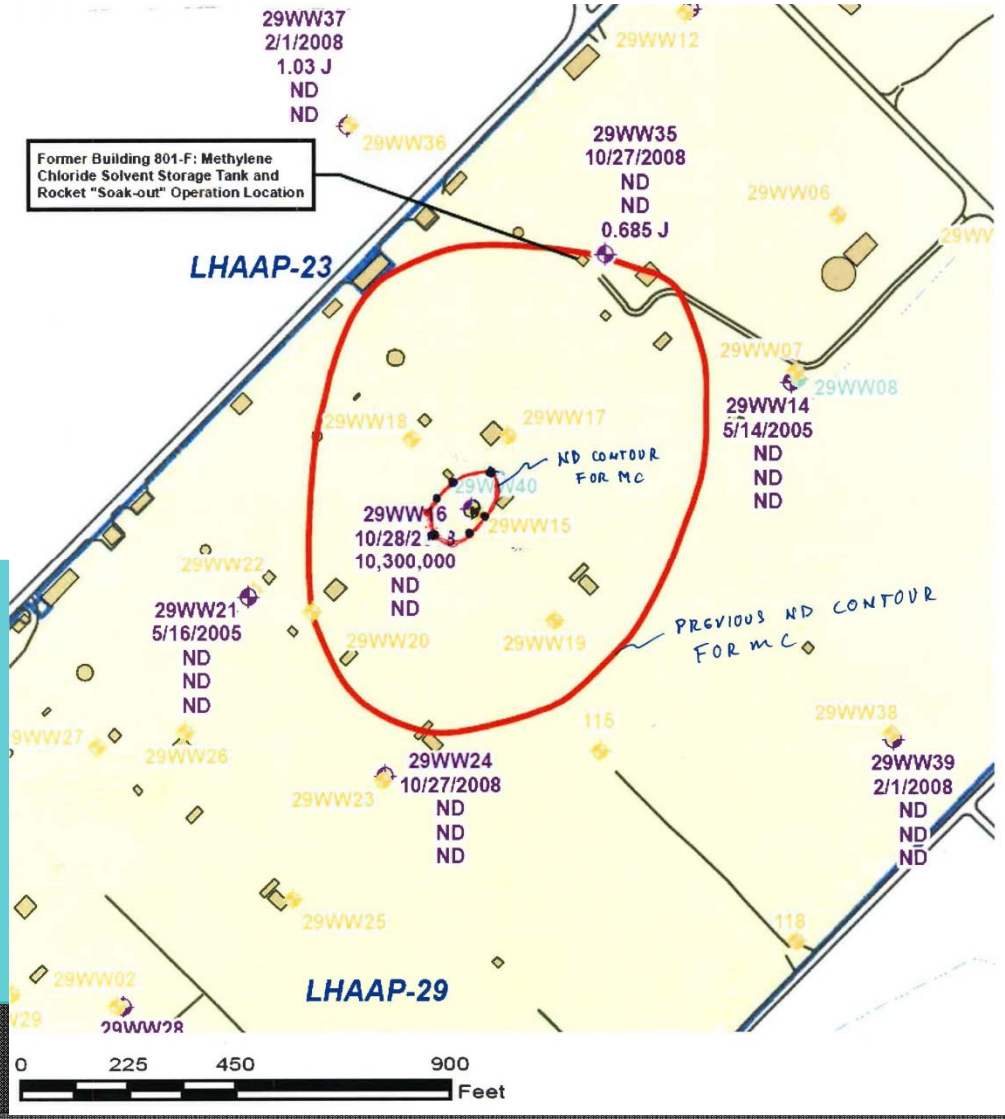
2) Evaluate site-specific characteristics that will impact the estimated cost to implement the remedy

LHAAP-18/24 Treatability Studies

- Thermal Treatability Testing – Determines the amount of electric current needed to heat soil or groundwater to break the bonds of contaminant molecules, allowing evaluation of whether thermal or electrokinetic remediation is suitable and cost effective
- In-Situ Microcosm Testing – evaluates the occurrence and extent of biodegradation in a groundwater plume; testing conducted in the field utilizing Bio-Trap® passive samplers that are submitted for laboratory analysis
- Bench-Scale Microcosm Testing – determines whether bacteria that can degrade the target contaminant are present at the site and demonstrates whether the natural biodegradation processes can be enhanced to remediate contamination; testing is conducted in the laboratory using soil and groundwater collected from the site
- Emulsified Zero Valent Iron Microcosm Testing – determines the optimum ZVI-to-soil ratio to degrade contaminants

Status of Environmental Sites (cont)

– LHAAP-29 Former TNT Production Area- Methylene Chloride in Intermediate GW



AECOM

LHAAP-29 Treatability Studies

- Thermal Treatability Testing – Determines the amount of electric current needed to heat soil or groundwater to break the bonds of contaminant molecules, allowing evaluation of whether thermal or electrokinetic remediation is suitable and cost effective

- In-Situ Microcosm Testing – evaluates the occurrence and extent of biodegradation in a groundwater plume; testing conducted in the field utilizing Bio-Trap® passive samplers that are submitted for laboratory analysis
- Aquifer Pumping Test – provides information on groundwater flow characteristics required to estimate costs for remedies that include a groundwater extraction or hydraulic control component

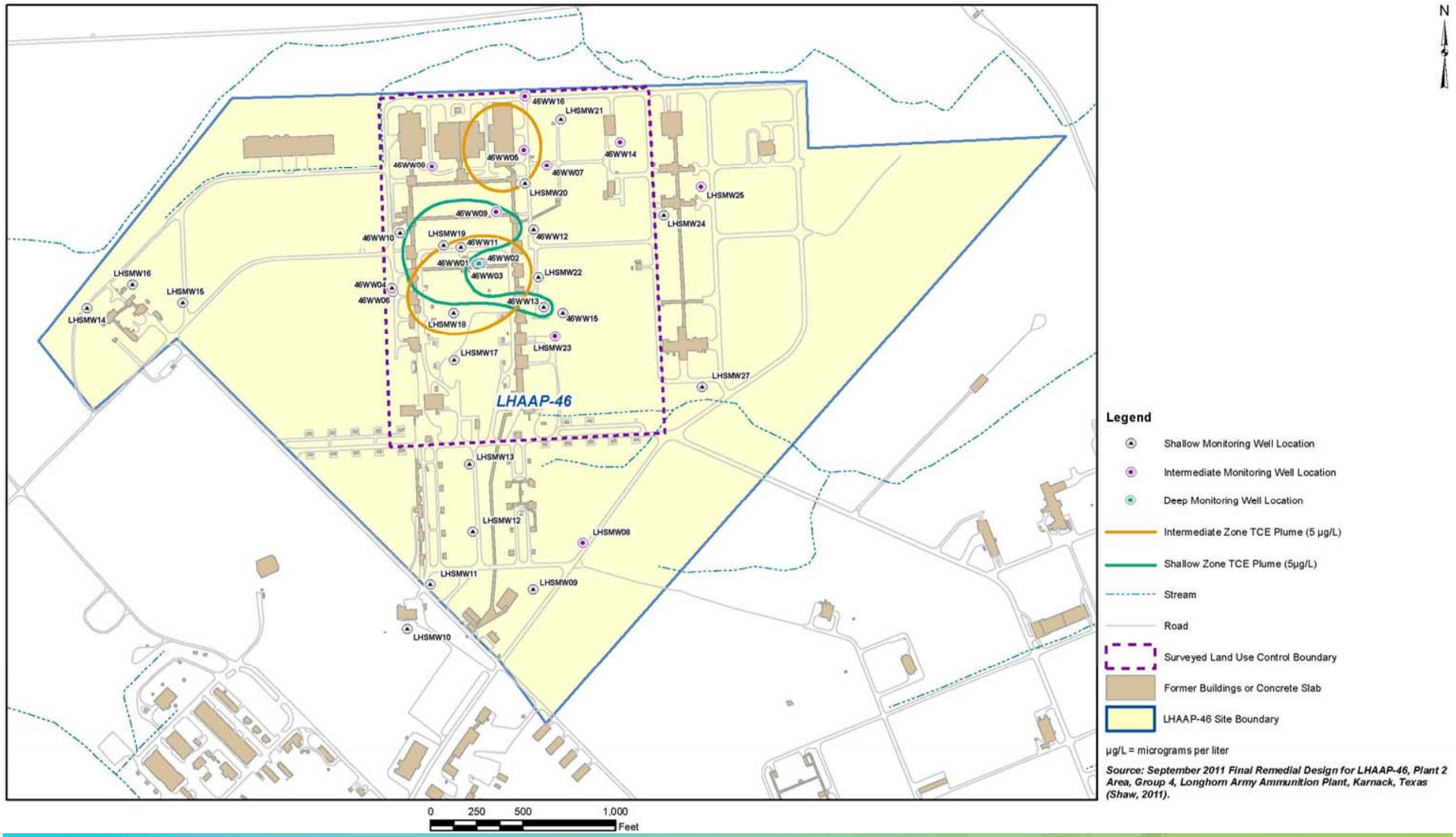
Status of Environmental Sites (cont)

- Monitored Natural Attenuation Sites
  - LHAAP-46 – Plant Area 2
  - LHAAP-35B (37) – Chemical Laboratory
  - LHAAP-50 – Former Sump Water Tank
  - LHAAP-58 – Shops Area
  - LHAAP-67 – Aboveground Storage Tank Farm

- 1st Annual Reports for these sites are being developed
  - Data from first four quarters of groundwater monitoring
  - Trend analysis

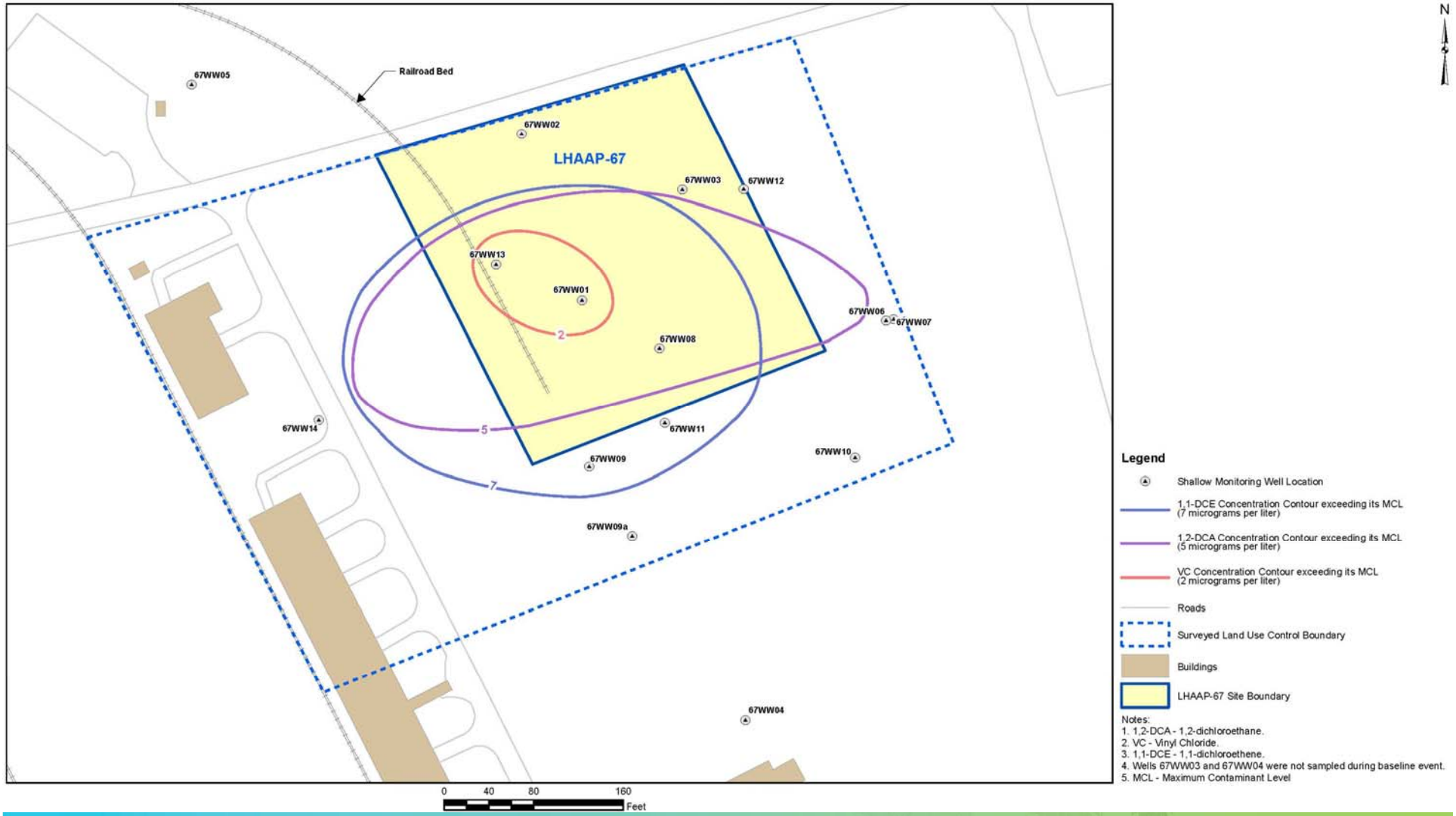
- Land Use Control boundary surveys for groundwater use restriction complete for LHAAP-46 and LHAAP-67

LHAAP-46 Land Use Control Boundary



AECOM

LHAAP-67 Land Use Control Boundary



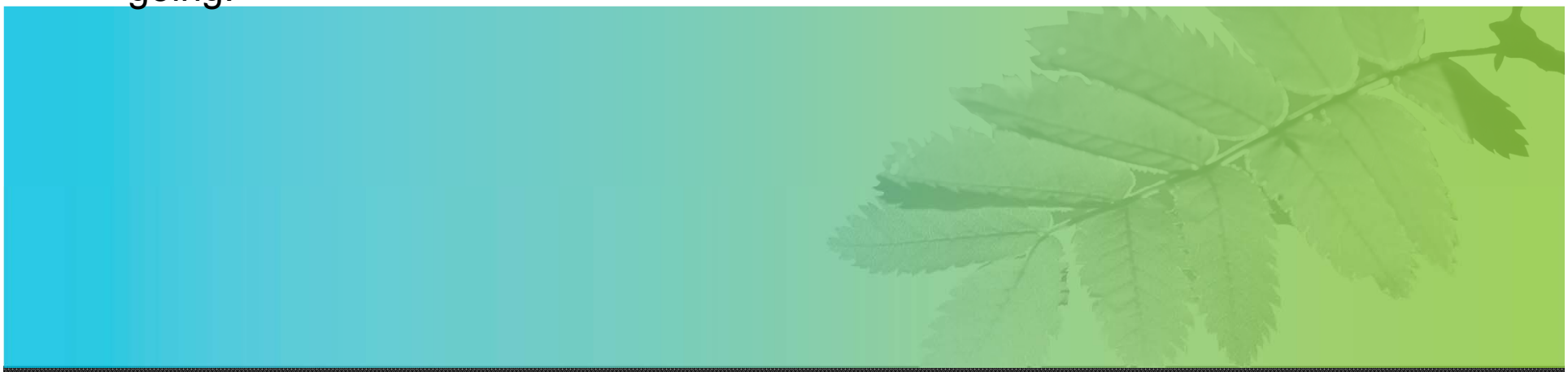
AECOM

Status of Environmental Sites (cont)

- LHAAP-03 - Record of Decision, Remedial Design/Remedial Action Work Plan On-hold Due to Dispute
- LHAAP-04 - Record of Decision, Remedial Design/Remedial Action Work Plan On-hold Due to Dispute
- LHAAP-16 - Record of Decision, Remedial Design/Remedial Action Work Plan On-hold Due to Dispute
- LHAAP-17 - Record of Decision, Remedial Design/Remedial Action Work Plan On-hold Due to Dispute
- LHAAP-47 - Record of Decision, Remedial Design/Remedial Action Work Plan On-hold Due to Dispute
- LHAAP-001-R-01 - Record of Decision, Remedial Design/Remedial Action Work Plan On-hold Due to Dispute
- LHAAP-003-R-01 - Record of Decision, Remedial Design/Remedial Action Work Plan On-hold Due to Dispute

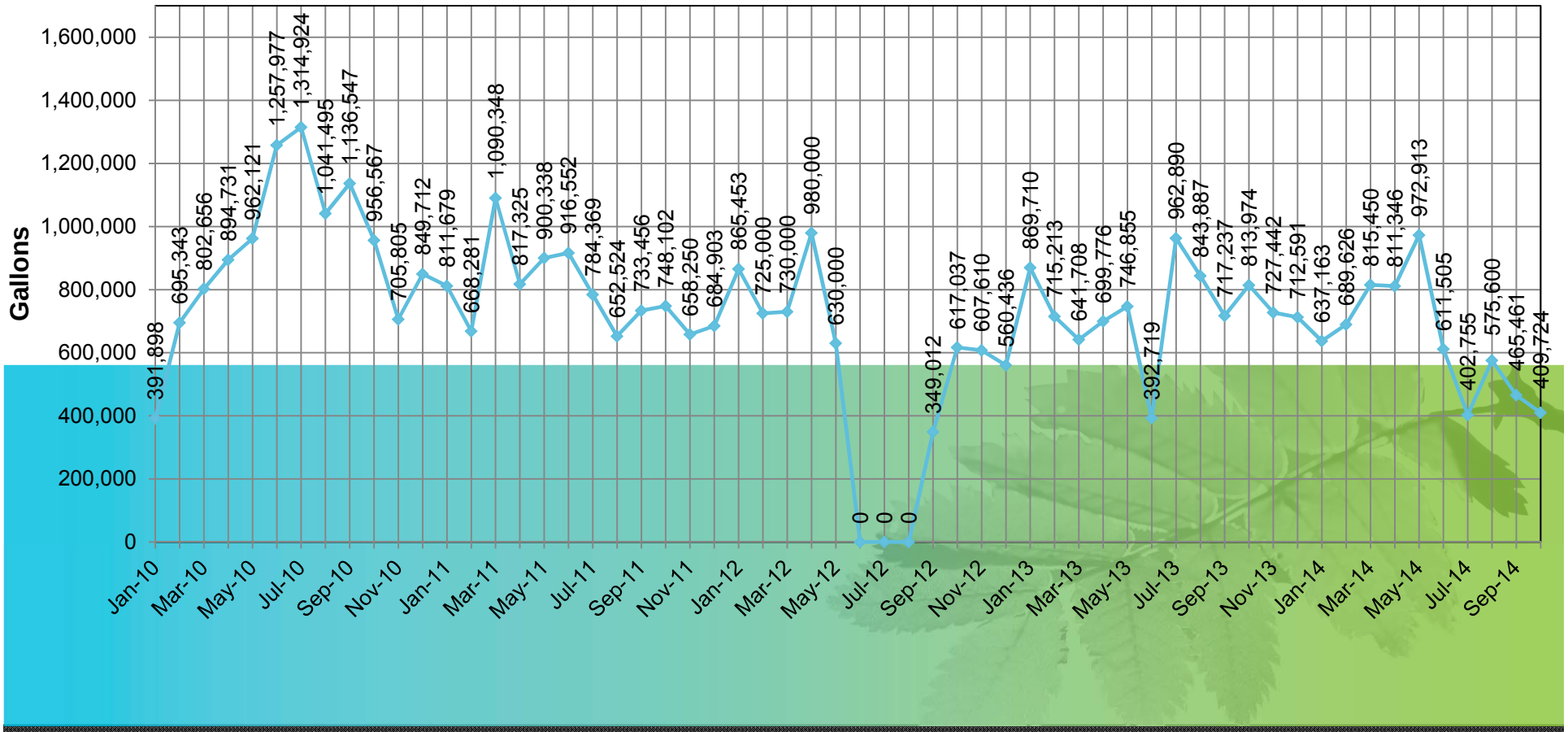
Groundwater Treatment Plant Operations and Management

- The Groundwater Treatment Plant continues to operate to contain the plume at LHAAP-18/24 and LHAAP-16.
- Water continues to be returned to LHAAP-18/24 or into Harrison Bayou, depending on the amount of water in the bayou.
- Compliance monitoring continues per existing sampling plan.
- Air monitoring frequency reduced after over a year of weekly data without any excursions.
- Maintenance and repairs of wells, pumps, tanks, and ancillary equipment is on-going.



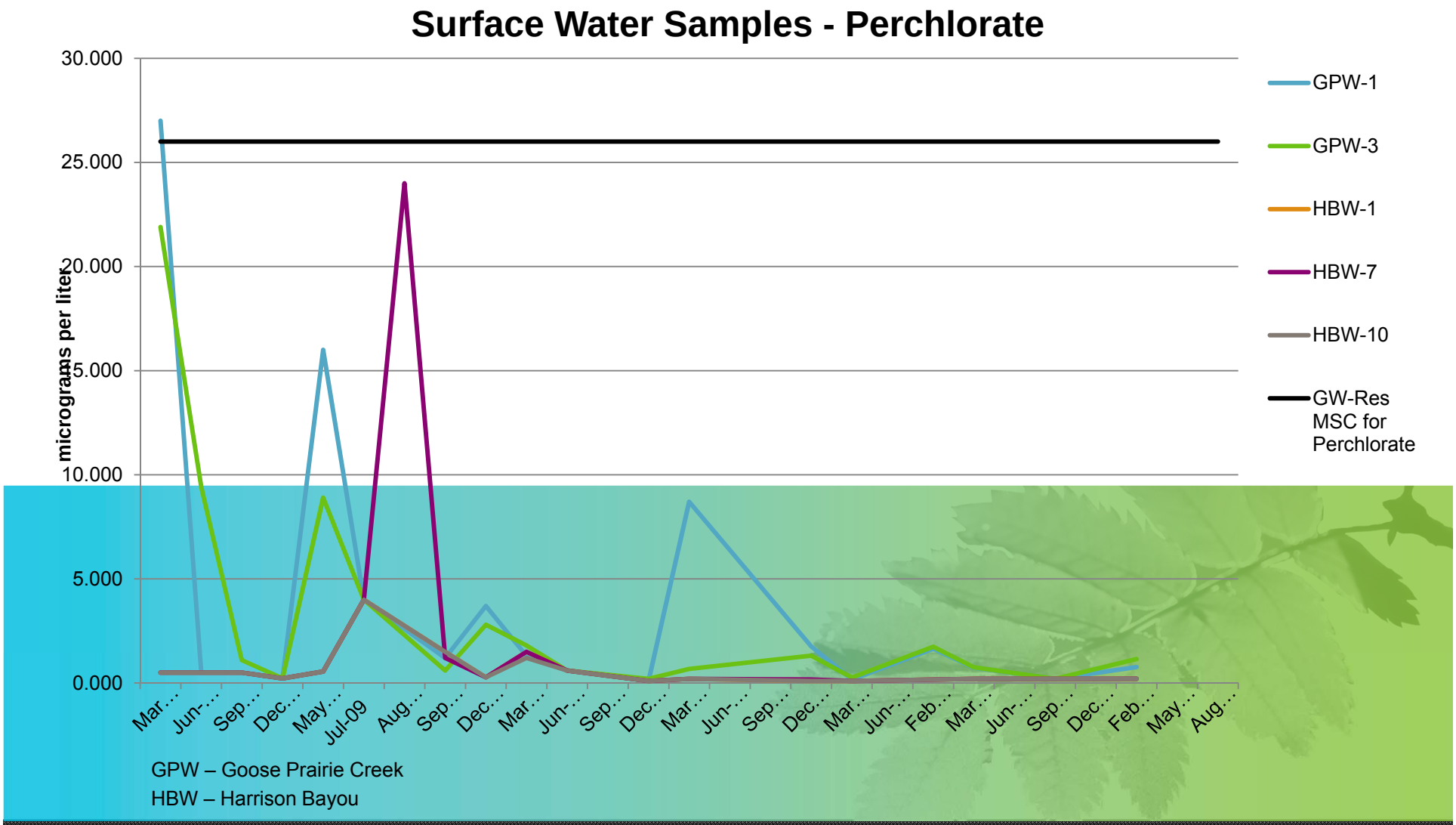
GWTP O&M (cont)

Figure ES-3
Water Treated Monthly from January 2010 through October 2014



AECOM

Surface Water Sample Results



GPW – Goose Prairie Creek
HBW – Harrison Bayou

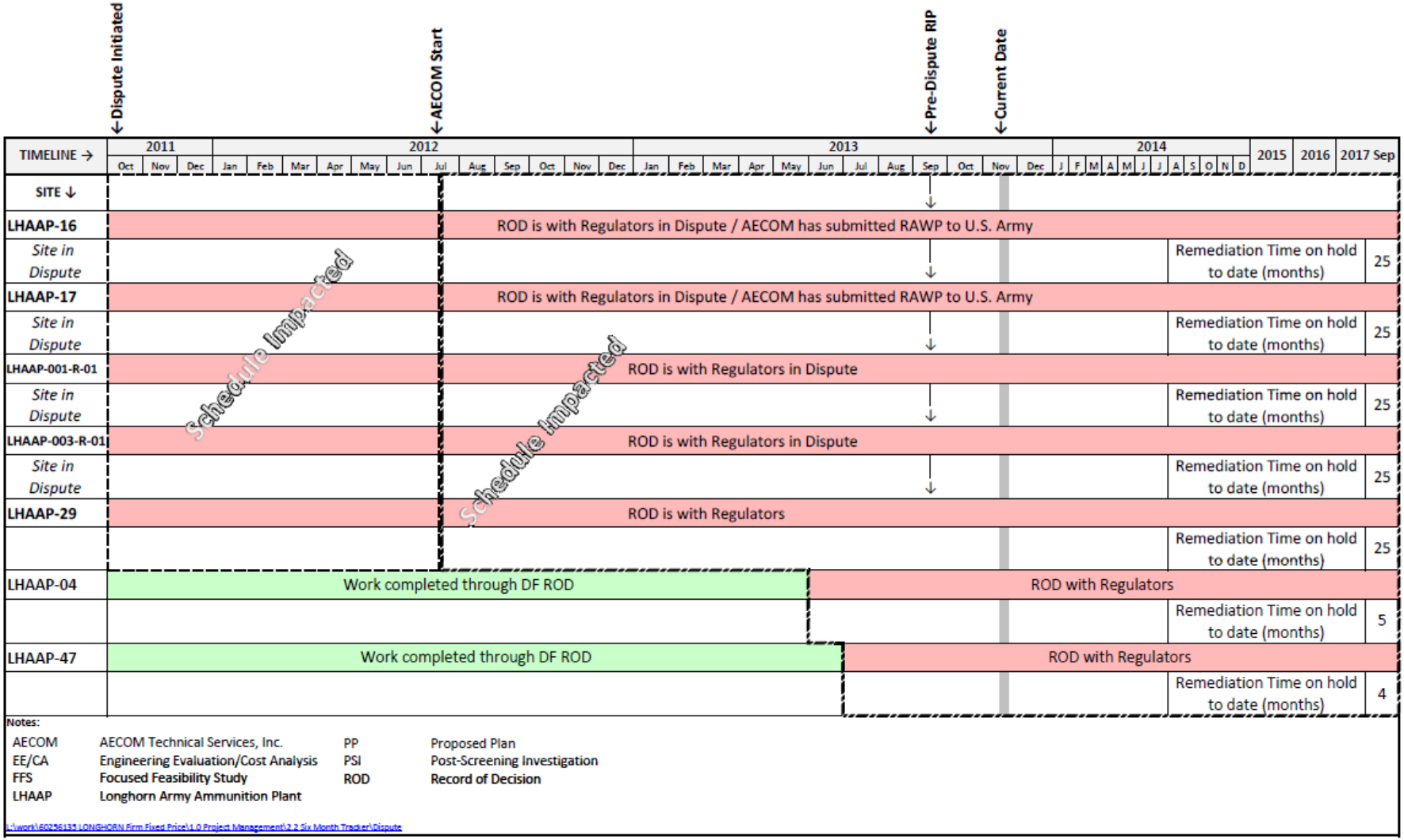
AECOM

LHAAP-37 Bioplug Demonstration Update

- Final demonstration sampling conducted October 2014.
- Data indicated the bioplug method was not particularly effective in reducing contaminant concentrations.
- System will be dismantled and removed.
- Groundwater monitoring for the remedy specified in the ROD (monitored natural attenuation) will begin when the aquifer has returned to pre-demonstration conditions.

Dispute Status

Sites at which Work has Ceased Pending Resolution of the Dispute



Notes:

AECOM	AECOM Technical Services, Inc.	PP	Proposed Plan
EE/CA	Engineering Evaluation/Cost Analysis	PSI	Post-Screening Investigation
FFS	Focused Feasibility Study	ROD	Record of Decision
LHAAP	Longhorn Army Ammunition Plant		

L:\work\60256135 LONGHORN Firm Fixed Price\1.0 Project Management\2.2 Six Month Tracker\Dispute

AECOM

Upcoming Fieldwork, Meetings, and Documents

1. Continue sampling for groundwater monitoring networks at LHAAP-46, 50, 58, 67, in addition to semi-annual compliance sampling for LHAAP-18/24.
2. Final Completion Reports in progress for LHAAP-37, 46, 50, 58, 67.
3. First annual Remedial Action Operation reports being developed for LHAAP-46 and LHAAP-67, followed by 50 and 58.
4. LHAAP-18/24 and LHAAP-29 – Reports for current activities leading to an FS for each site planned for spring 2015.
5. Sites where work has ceased pending dispute resolution:
    1. LHAAP-03
    2. LHAAP-04
    3. LHAAP-47
    4. LHAAP-16
    5. LHAAP-17
    6. LHAAP-29
    7. LHAAP-001-R-01
    8. LHAAP-003-R-01

Groundwater Treatment Plant - Treated Groundwater Volumes

The amount of groundwater treated is determined by measuring the number of gallons of treated water returned to LHAAP-18/24, released to the INF Pond, or discharged to Harrison Bayou.

Treated Water 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

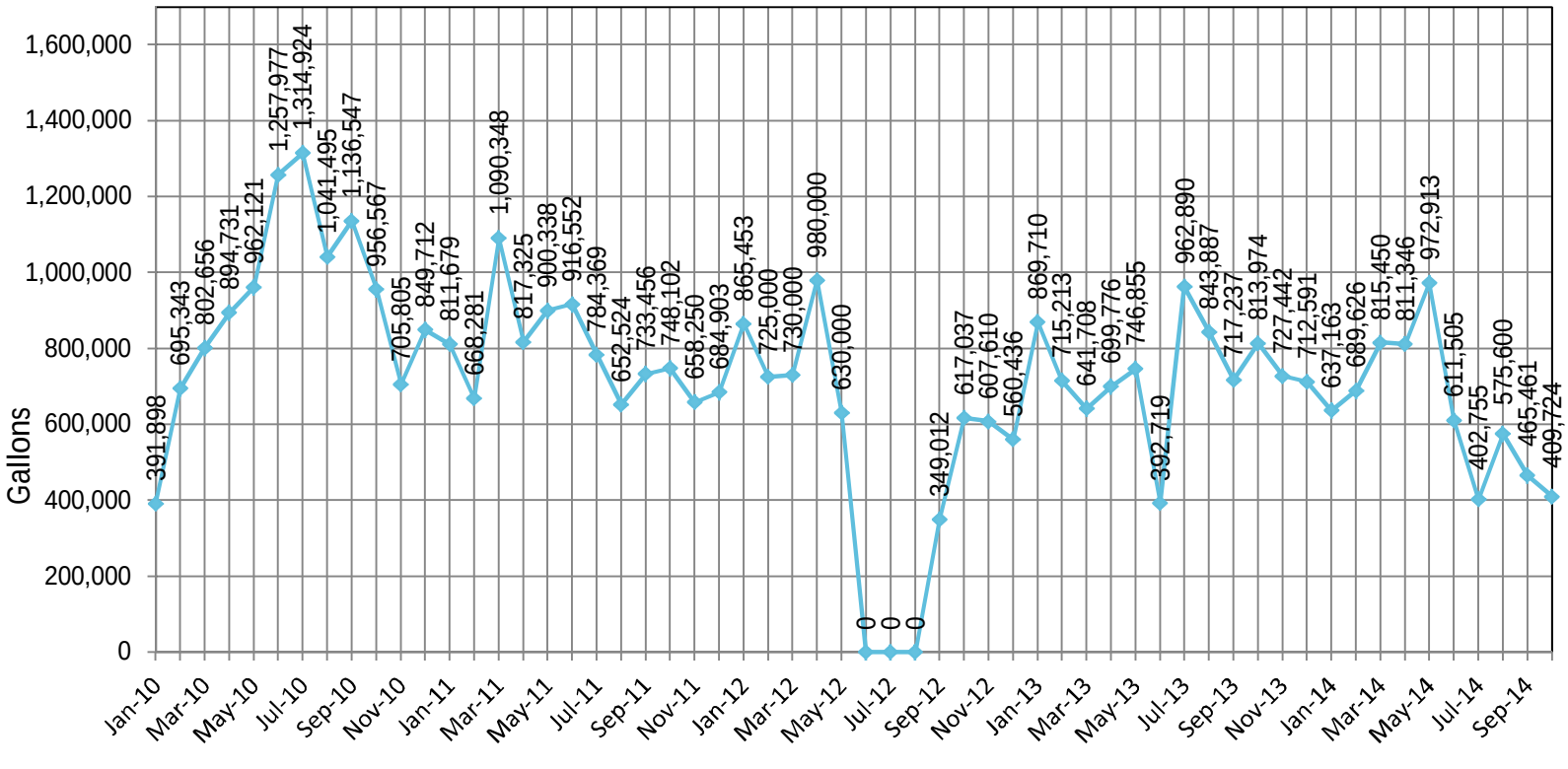
Oct-11	Nov-11	Dec-11	Jan-12	Feb-12	Mar-12	Apr-12	May-12	Jun-12	Jul-12	Aug-12	Sep-12
748,102	658,250	684,903	865,453	725,000*	730,000*	980,000*	630,000*	0	0	0	349,012

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	843,887	717,237

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	712,591	552,657	738,701	844,095	811,346	972,913	611,505	402,755	575,600	465,461

*Indicates Estimate

Figure ES-3
Water Treated Monthly from January 2010 through October 2014

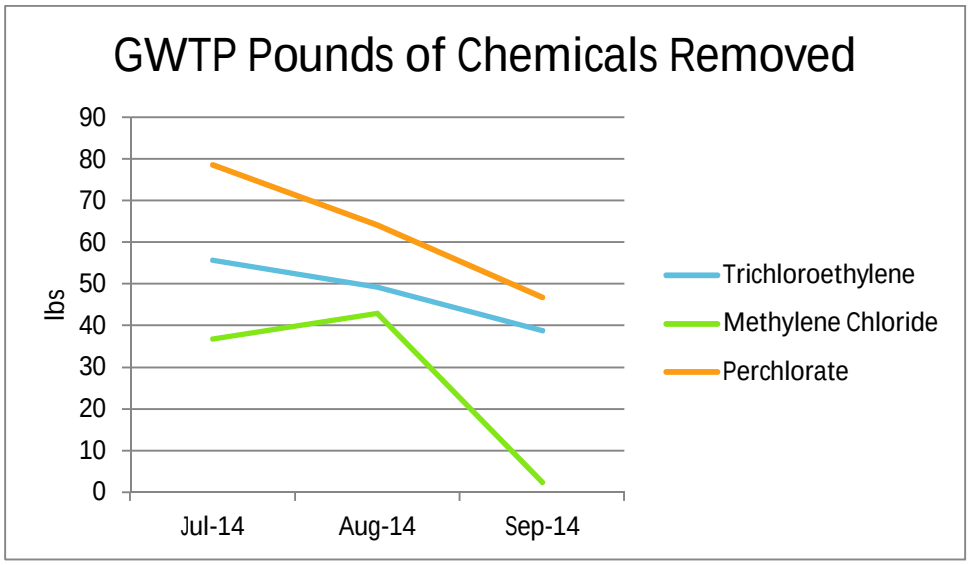


The pounds of chemicals removed for the 3rd Quarter of 2014 can be found below and are calculated by the following formula:

$$\frac{(\text{GWTP Influent Contaminant Concentration [µg/L] x Volume [gallons] x 3.785 [liters per gallon]})}{(453{,}600{,}000\ \mu g \text{ per pound})}$$

Pounds of Chemicals Removed From LHAAP-18/24, 3rd Quarter 2014

	Trichloroethylene	Methylene Chloride	Perchlorate
Jul-14	55.7	36.88	78.6
Aug-14	49.3	43.04	64.2
Sep-14	38.9	2.39	46.9



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 creek sampling location is dry.

Historic 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

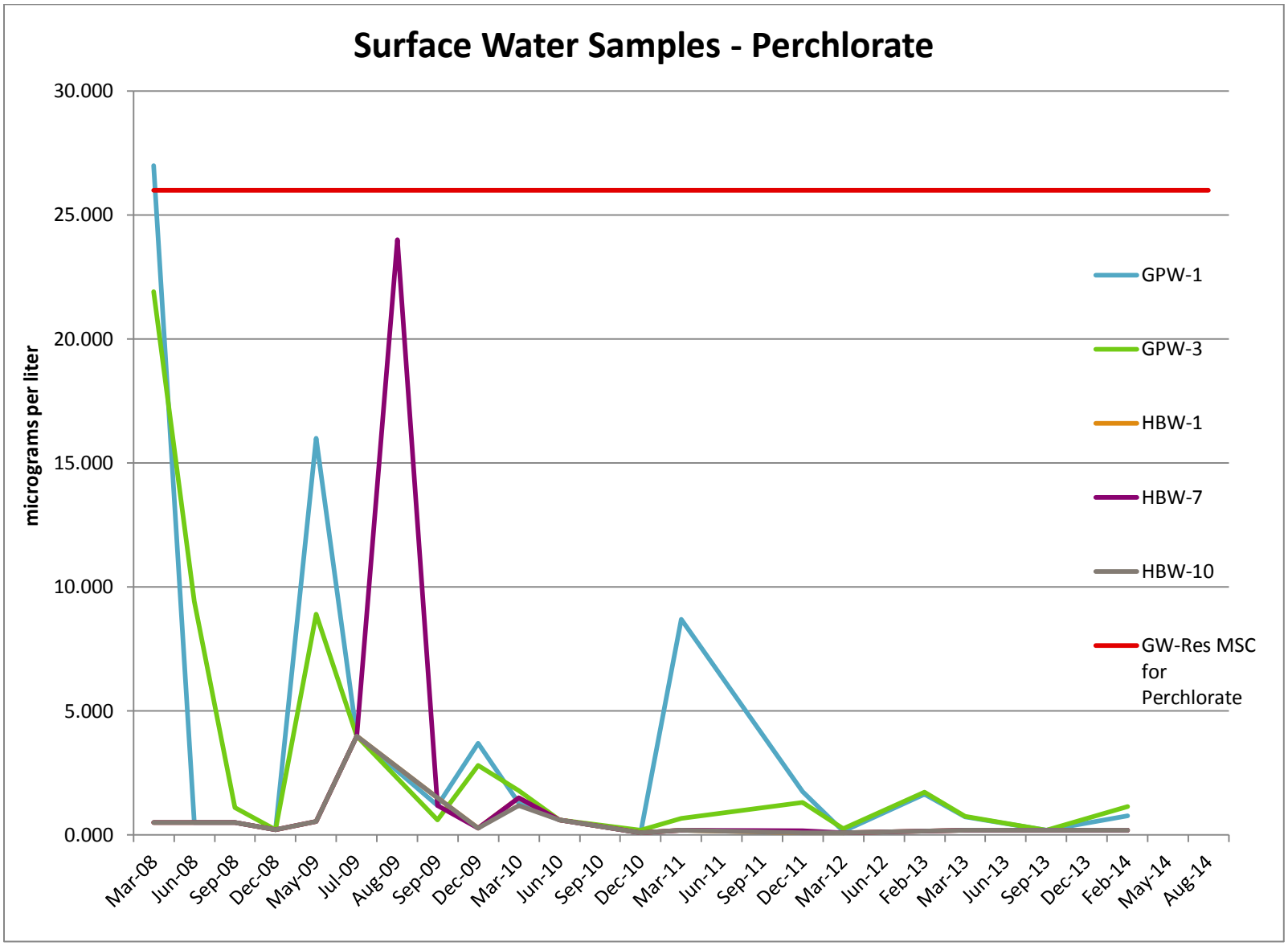
Quarter	1st	2nd	3rd	4th	2nd	3rd	3rd	3rd	4th	1st	2nd
Creek Sample ID	**Mar 2008**	**Jun 2008**	**Sep 2008**	**Dec 2008**	**May 2009**	**Jul 2009**	**Aug 2009**	**Sep 2009**	**Dec 2009**	**Mar 2010**	**Jun 2010**
GPW-1	27	<0.5U	<0.5U	<0.22U	16	<4U	NS	<1.2U	3.7	1.3J	<0.6U
GPW-3	21.9	9.42	1.1	<0.22U	8.9	<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	NC	1.65	0.735
GPW-3	dry	0.199J	0.673	dry	dry	1.31	0.261	dry	NC	1.74	0.754
HBW-1	dry	<0.1U	<0.2U	dry	dry	<0.1U	0.1U	dry	NC	<0.2U	<0.2U
HBW-7	dry	<0.1U	<0.2U	dry	dry	0.171J	0.1U	dry	NC	<0.2U	<0.2U
HBW-10	dry	<0.1U	<0.2U	dry	dry	<0.1U	0.1U	dry	NC	<0.2U	<0.2U

Quarter	2nd	3rd	4th	1st	2nd	3rd
Creek Sample ID	**Jun 2013**	**Sept 2013**	**Dec 2013**	**Feb 2014**	**May 2014**	**Aug 2014**
GPW-1	dry	<0.2 U	dry	0.766	dry	dry
GPW-3	dry	<0.2 U	dry	1.15	dry	dry
HBW-1	<0.2U	<0.2 U	dry	<0.2U	dry	dry
HBW-7	<0.2U	<0.2 U	dry	0.201J	dry	dry
HBW-10	<0.2U	<0.2 U	dry	<0.2U	dry	dry

Notes:

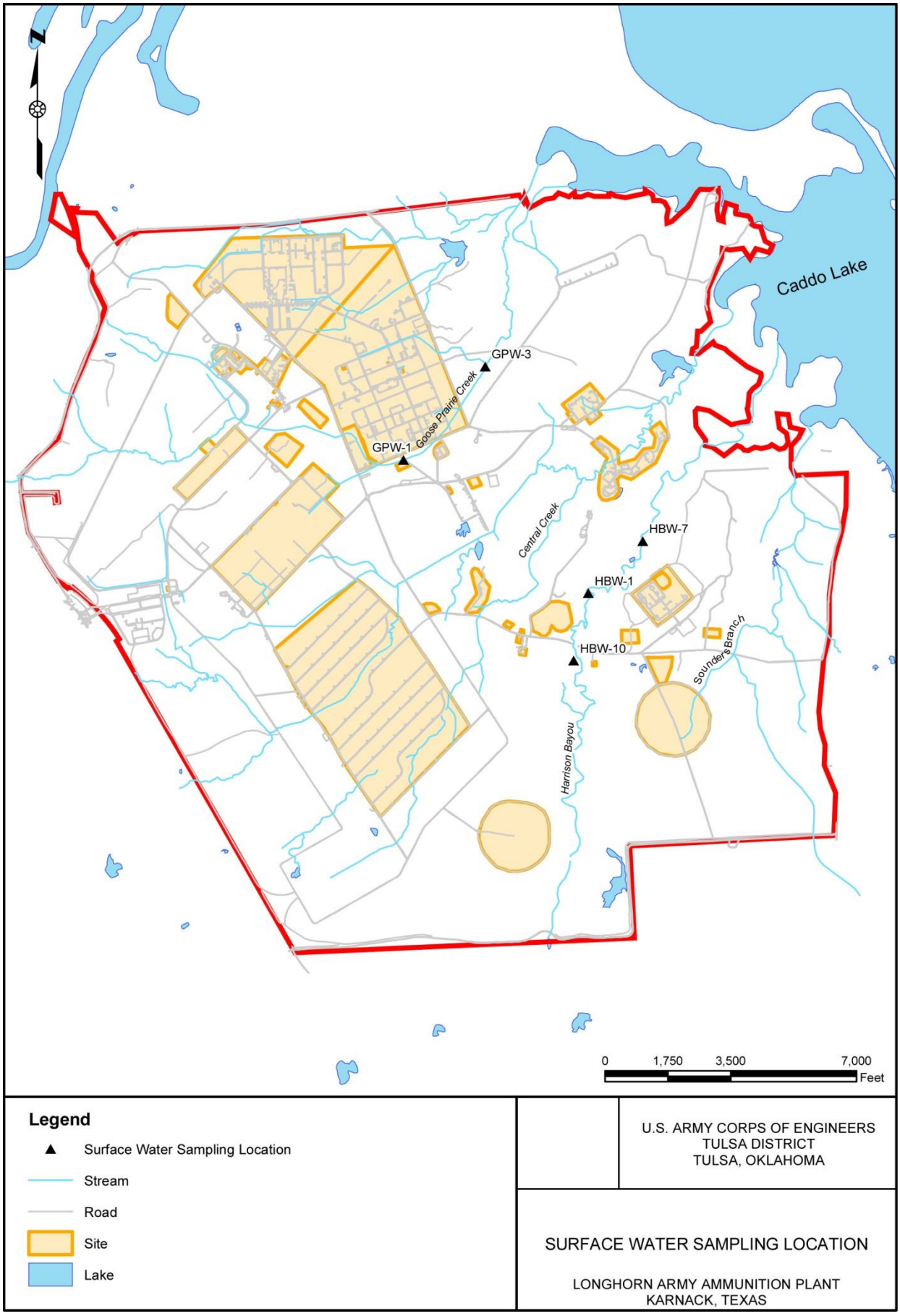
J	Estimated
U	Non-detect
NC	Not Collected
NS	Not Sampled
dry	Sampling location was dry
-	No historical data available



Notes:

Perchlorate Screening Criteria - TCEQ GW_{Res} (micrograms per liter) 26

Longhorn Army Ammuntion Plant Map with creek sampling locations.



LHAAP Perimeter Well Monitoring – Perchlorate Data

Groundwater samples are currently collected quarterly from six wells on the LHAAP perimeter.

Historic Perimeter Well Sample Data
(in micrograms per liter)

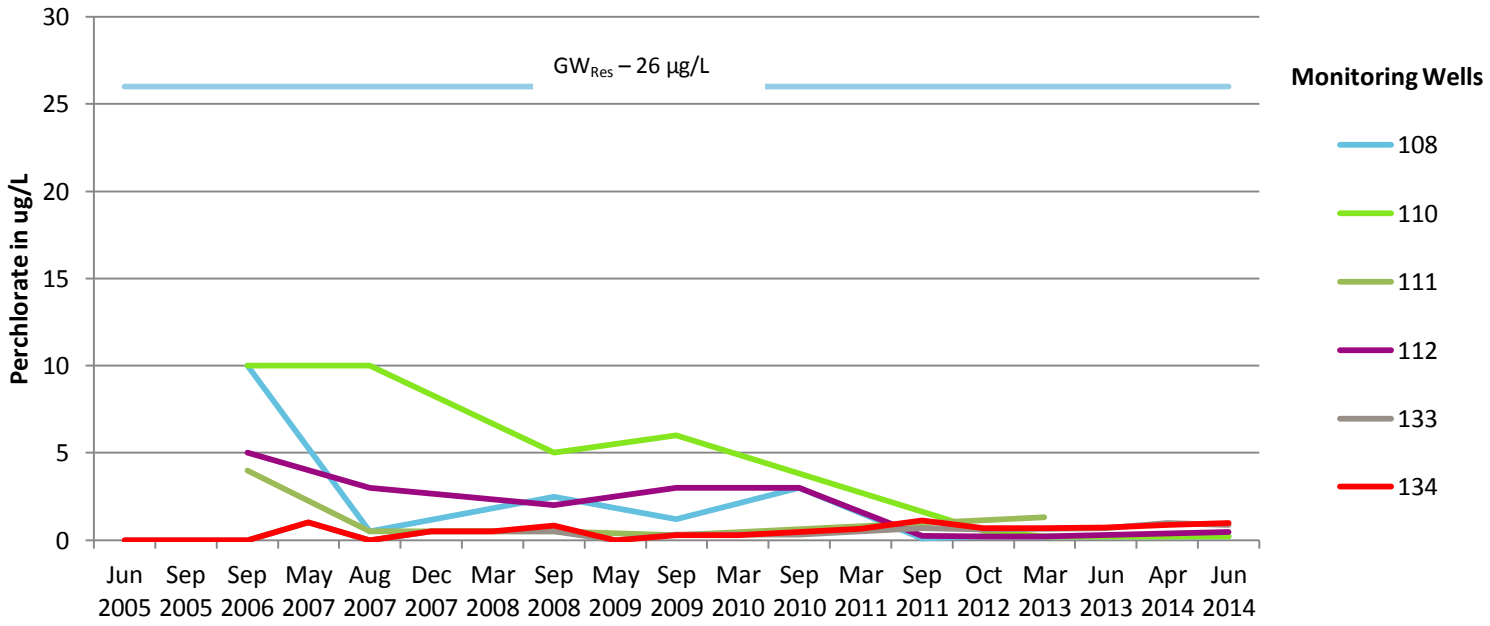
Well ID	June 2005	Sep 2005	Sep 2006	May 2007	Aug 2007	Dec 2007	Mar 2008	Sep 2008	May 2009	Sep 2009	Mar 2010
108	Dry	Dry	10 U	Dry	0.5 U	Dry	Dry	2.5 U	Dry	1.2 U	Dry
110	Dry	Dry	10 U	Dry	10 U	Dry	Dry	5.0 U	Dry	6 U	Dry
111	Dry	Dry	4 U	Dry	0.5 U	Dry	Dry	0.5 U	Dry	0.3 U	Dry
112	Dry	Dry	5 U	Dry	3 U	Dry	Dry	2.0 U	Dry	3 U	Dry
133	0.541	0.597	1.08	1 U	1.09	0.5 U	0.5 U	0.5 U	0.47 J	0.32	Dry
134	0.881	0.725	0.708 J	1 U	0.949 J	0.5 U	0.5 U	0.829 U	0.04 J	0.3 U	0.3 U

Well ID	Sep 2010	Mar 2011	Sep 2011	Oct 2012	Mar 2013	June 2013	Apr 2014	Jun 2014
108	3 U	Dry	0.1 U	0.2 U	0.2 U	Dry	Dry	0.2 U
110	Dry	Dry	Dry	0.535	0.2 U	Dry	Dry	0.2 U
111	Dry	Dry	Dry	Dry	1.32	Dry	Dry	Dry
112	3 U	Dry	0.26	0.2 U	0.2 U	Dry	Dry	0.458
133	0.32	Dry	0.68	0.598	0.655	0.685	0.988	0.887
134	0.45	0.636	1.11	0.671	0.698	0.706	0.863	0.989

Notes:

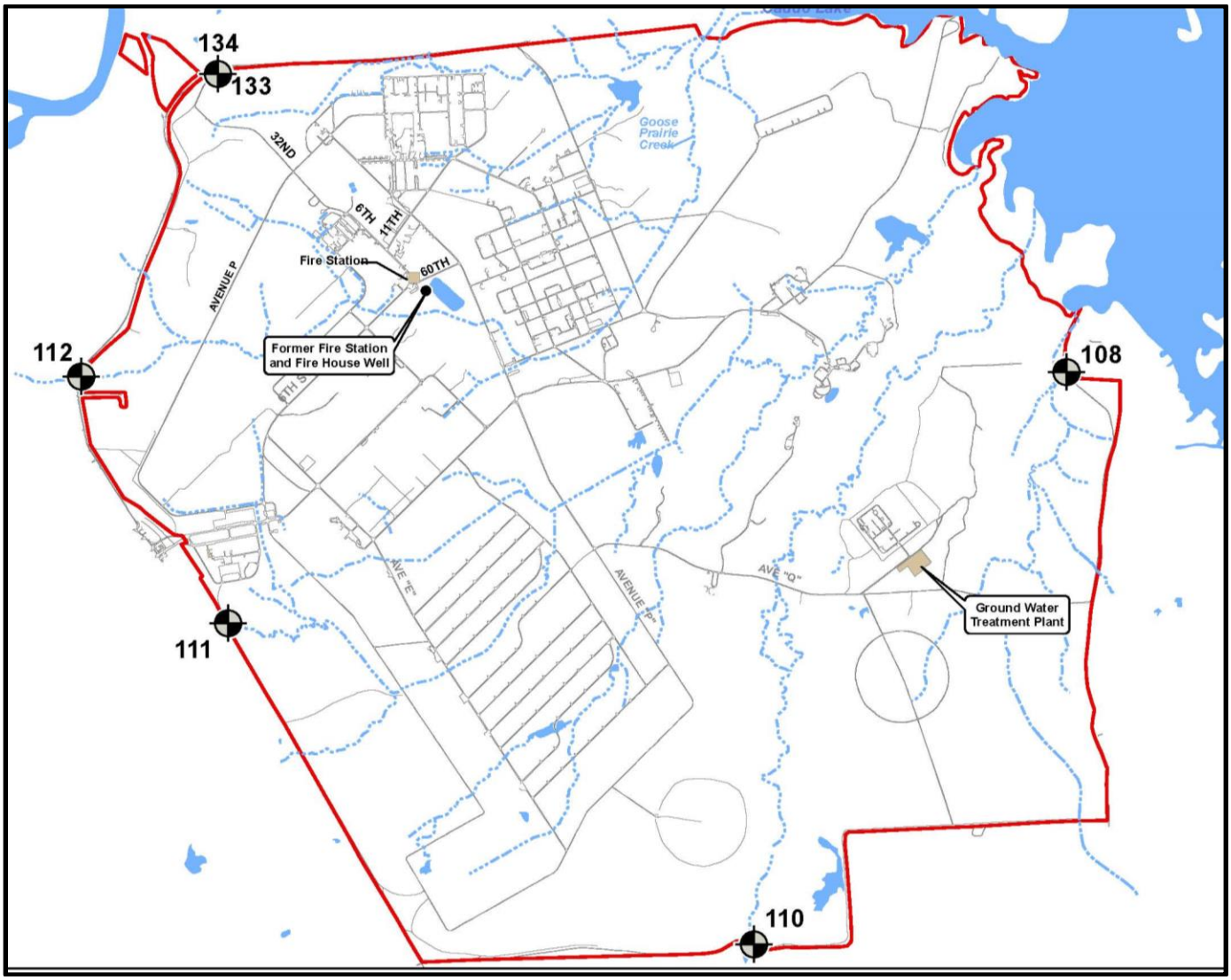
J	Estimated
U	Non-Detect
Dry	Well Dry

Perimeter Wells - Perchlorate



Note: Perchlorate Screening Criteria - TCEQ GW_{Res} (micrograms per liter) 26

Longhorn Army Ammuntion Plant Map with Perimeter Well Locations



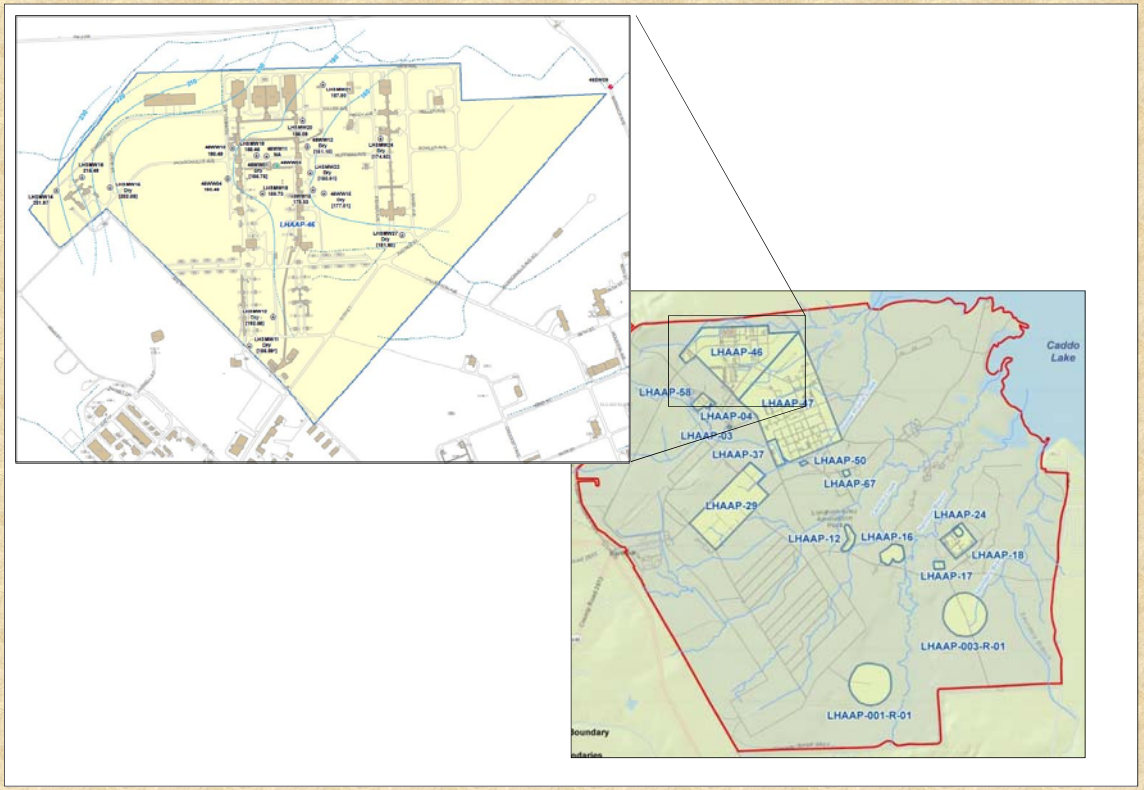
LHAAP-46, Plant 2 Area – Remedial Action Operations

Site History

LHAAP-46, (Plant 2 Area), is located in the north-central portion of LHAAP and covers approximately 190 acres. Facilities for producing JP-2 propellant fuel at LHAAP-46 began in 1944, but construction was halted in 1945 with the end of World War II. Plant 2 was used to produce pyrotechnic devices from February 1952 to 1956 and was reactivated to produce pyrotechnic and illumination devices in 1964 until approximately 1997.

Site Characteristics

The surface features at LHAAP-46 are a mixture of asphalt-paved roads, parking areas, building foundation remnants, old buildings, and overgrown wooded and grassy vegetation-covered areas. The topography in this area is relatively flat with the surface drainage flowing east into tributaries of Goose Prairie Creek, which eventually flows into Caddo Lake. The lake is a source of drinking water for several neighboring communities in Louisiana. Shallow zone groundwater is approximately 11 to 23 feet below ground surface (bgs) and flows to the east. Intermediate zone groundwater is approximately 23 to 30 feet bgs and flows to the Northeast.



Risk Assessment

A baseline human health risk assessment (BHHRA) and ecological risk assessment were conducted for LHAAP-46 to determine current and future effects of contaminants on human health and the environment. Based on the BHHRA the soil does not pose a cancer risk or noncancer hazard to the hypothetical future maintenance worker. However, the groundwater at LHAAP-46 poses an unacceptable non-cancer hazard to a hypothetical future maintenance worker under an industrial scenario with the exposure route of drinking the water or using the water for hand washing and showering. The ecological risk assessment concluded no action is needed at LHAAP-46 for the protection of ecological receptors.

Chemicals of Concern

Between 1992 and 2008 numerous investigations were conducted in a phased approach to determine the nature and extent of contamination at LHAAP-46. Media investigated included soil and groundwater. Additional data gathered since the risk assessment (2003) did not change its outcome. Chemicals of Concern (COCs) for LHAAP-46 identified in the Feasibility Study are the trichloroethene (TCE) in the shallow and intermediate groundwater zones. All daughter products of TCE are also considered COCs, which include dichlorothene and vinyl chloride.

LHAAP-46, Plant 2 Area – Remedial Action Operations (cont.)

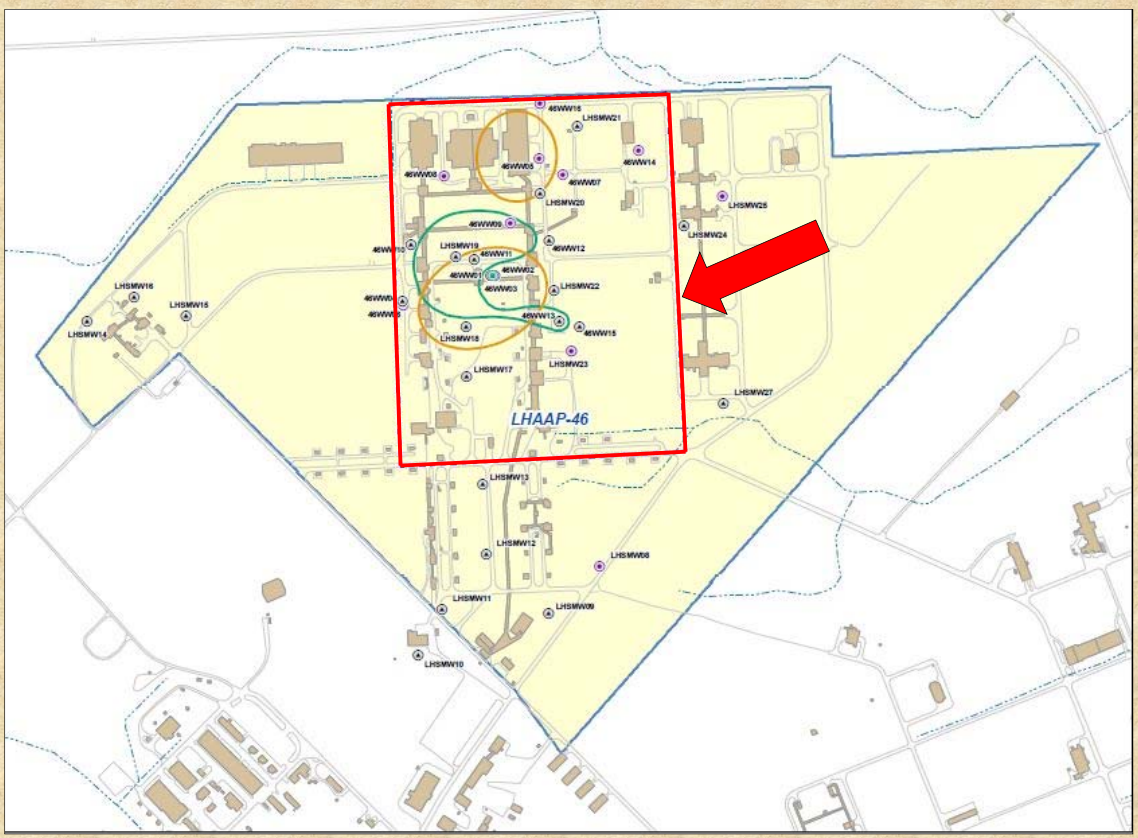
Remedial Action Objectives

The Remedial Action Objectives (RAOs) for LHAAP-46 which address contamination associated with the media at the site and take into account the future uses of LHAAP surface water, land, and groundwater are:

- Protect human health for the hypothetical future maintenance worker by preventing exposure to groundwater contaminated by VOCs (TCE and its daughter products).
- Return groundwater to its potential beneficial use as a drinking water, wherever practicable, within a reasonable time period given particular site circumstances.

Land Use Control Boundary

One element of the remedial action at LHAAP-46 is establishment of a land use control (LUC) area where withdrawal or use of groundwater is restricted to only environmental monitoring until groundwater at the site meets clean-up standards. Army, with TCEQ and EPA concurrence, has established a LUC area to restrict groundwater use at LHAAP-46, conducted a civil survey of that boundary was completed in October 2014, and the LUC notification will be recorded with the Harrison County Courthouse in November 2014.



LHAAP-46 Land Use Control Area and COC Plume Footprints

Monitored Natural Attenuation (MNA)

MNA at the LHAAP-46 site is implemented to monitor COCs and ensure protection of human health and the environment. Performance monitoring to evaluate remedy effectiveness includes groundwater and surface water monitoring. The groundwater monitoring program is designed to evaluate and monitor natural attenuation of COCs in shallow zone groundwater. The surface water monitoring program is designed to monitor potential migration of contaminated groundwater to surface water.

Quarterly groundwater samples were last collected from LHAAP-46 in November 2014, and will be collected again in February 2015.

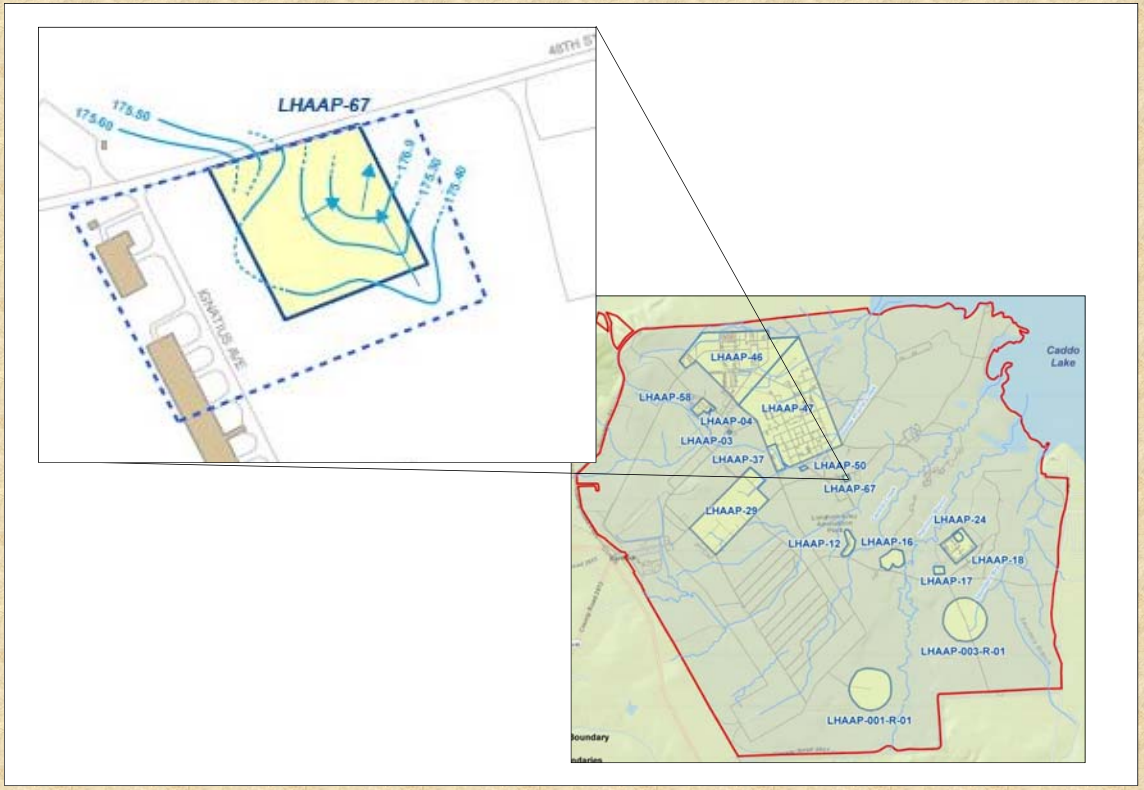
LHAAP-67, Former Aboveground Storage Tank Farm Remedial Action Operations

Site History

When operational, LHAAP-67 consisted of seven aboveground storage tanks of unknown size. The tanks were surrounded with earthen dikes designed to contain potential spills. Site personnel indicated that the tanks were used for solvent storage. The tanks have been removed and the only structure remaining at the site is a railroad bed.

Site Characteristics

LHAAP-67, a former aboveground storage tank farm is located in the central portion of LHAAP and covers approximately 1.91 acres. The site is relatively flat. The nearest significant surface water body is Central Creek located ~870 feet southeast of the site.



LHAAP-67 Site Location

Risk Assessment

A baseline human health risk assessment (BHHRA) and ecological risk assessment were conducted for and LHAAP-67 to determine current and future effects of contaminants on human health and the environment. Based on the BHHRA the soil does not pose a cancer risk or noncancer hazard to the hypothetical future maintenance worker. However, the groundwater at LHAAP-67 pose an unacceptable cancer risk and non-cancer hazard to a hypothetical future maintenance worker under an industrial scenario with the exposure route of drinking the water or using the water for hand washing and showering. The ecological risk assessment concluded no action is needed at LHAAP-67 for the protection of ecological receptors.

Chemicals of Concern

Between 1998 and 2006 numerous investigations were conducted in a phased approach to determine the nature and extent of contamination at LHAAP-67. Media investigated included soil and groundwater. Additional data gathered since the risk assessment (2003) did not change its outcome. Chemicals of concern (COCs) for LHAAP-67 identified in the Feasibility Study are 1,1-dichloroethene (DCE), 1,2 dichloroethane(DCA), 1,1,1-trichloroethane(TCA), 1,1,2-TCA and trichloroethene(TCE) in the shallow groundwater zone.

LHAAP-67, Former Aboveground Storage Tank Farm (cont.)
Remedial Action Operations

Remedial Action Objectives

The Remedial Action at the LHAAP-67 site must protect human health and meet applicable or relevant and appropriate requirements (ARARs). There are no ecological risks at the LHAAP-67 site (USACE, 2010). The RAOs for the LHAAP-67 site, consistent with the reasonably anticipated future use as a national wildlife refuge, are:

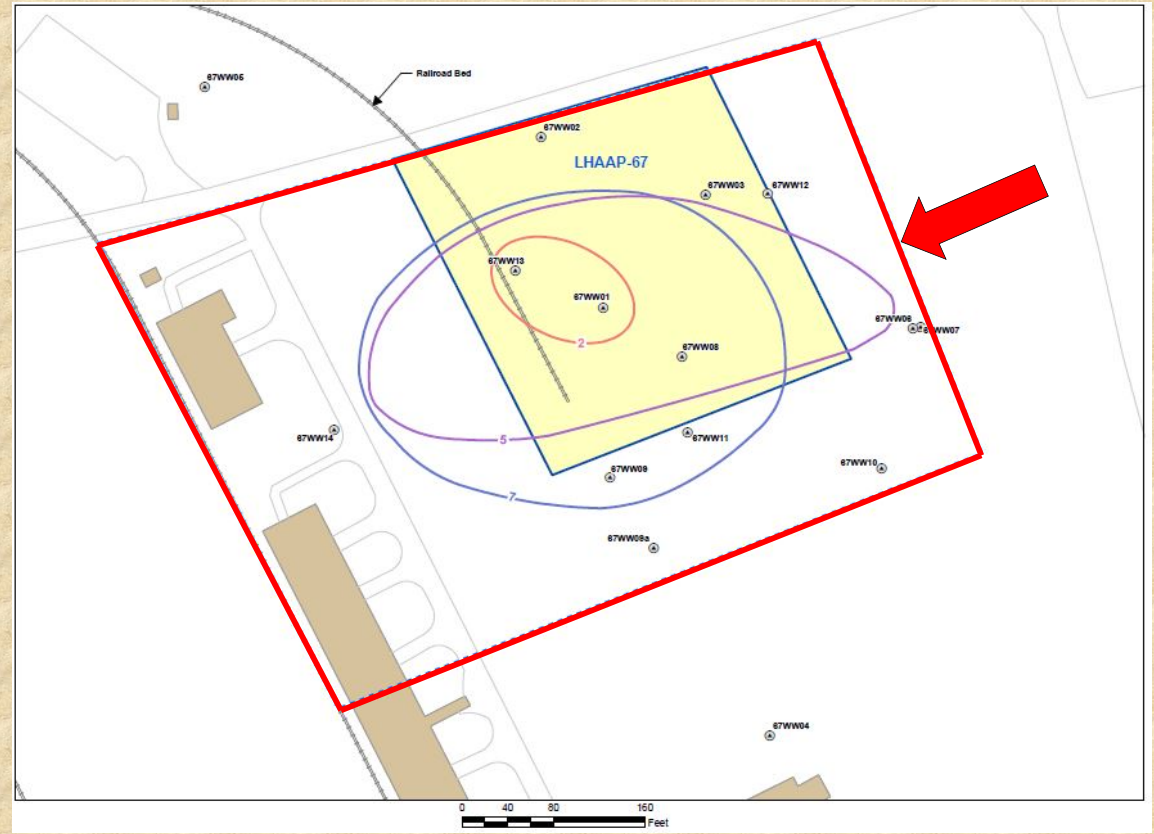
- Ensure protection of human health by preventing exposure to the contaminated groundwater;
- Ensure protection of human health and the environment by preventing contaminated groundwater from migrating into nearby surface water; and,
- Ensure return of groundwater to its potential beneficial use as drinking water, wherever practicable.

Land Use Control Boundary

One element of the remedial action at LHAAP-67 is establishment of a land use control (LUC) area where withdrawal or use of groundwater is restricted to only environmental monitoring until groundwater at the site meets clean-up standards. Army, with TCEQ and EPA concurrence, has established a LUC area to restrict groundwater use at LHAAP-67 conducted a civil survey of that boundary was completed in October 2014, and the LUC notification will be recorded with the Harrison County Courthouse in November 2014.

Monitored Natural Attenuation

MNA at the LHAAP-67 site is implemented to monitor COCs and ensure protection of human health and the environment. Performance monitoring to evaluate remedy effectiveness includes groundwater monitoring, designed to evaluate and monitor natural attenuation of COCs in shallow zone groundwater.



LHAAP-67 Land Use Control Area and Plume Footprints

Quarterly groundwater samples were last collected from LHAAP-67 in November 2014, and will be collected again in February 2015.