

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

Location of Meeting: Caddo Lake State Park Group Recreation Hall, Karnack, Texas

Date of Meeting: April 21, 2016, 6:00 – 7:30 PM

Meeting Participants:

LHAAP/BRAC: Rose M. Zeiler

U.S.ARMY/BRAC Tom Lederle

USACE: Aaron Williams, Richard Smith

USAEC: Nicholas Smith; Cathy Kropp

AECOM: Marwan Salameh, Steve Katz, Debra Richmann

TCEQ: April Palmie

USEPA Region 6: Carlos Sanchez, John Meyer, Rich Mayer, Kent Becher (USGS liaison),

USFWS: Paul Bruckwicki, Bob Sanders, Erik Duerkop

RAB: **Present:** Paul Fortune, Carol Fortune, Richard LeTourneau, John Pollard

Absent: Ken Burkhalter, Robert Cargill, Charles Dixon, Lee Guice, Judith Johnson, Ted Kurz, James Lambright, Judy Vandeventer, Nigel R. Shivers, Terry Britt, Tom Walker

Public: ---

An agenda for the RAB meeting, three handouts (Groundwater Treatment Plant [GWTP] Treated Groundwater Volumes, Surface Water Sampling Results, and LHAAP Perimeter Well Sampling Results), two Fact Sheets (LHAAP-29 TNT Production Area Group 2, and LHAAP-1,4-Dioxane Groundwater Sample Results), and a color copy of the AECOM slide presentation were provided for meeting attendees. In addition, RAB application forms were available at the sign-in table.

Welcome and Introduction

Dr. Rose Zeiler called the meeting to order and introduced Mr. Tom Lederle, U.S. Army/BRAC Division Chief; and Mr. Carlos Sanchez and Mr. John Meyer, U.S. EPA Section Supervisors, all of whom met earlier today to come to final resolution on the disputed LHAAP sites.

Open Items - Dr. Rose M. Zeiler

RAB Administrative Issues

Minutes

Dr. Zeiler asked the RAB members if anyone had comments on the meeting minutes from the October 2015 and/or January 2016 RAB meetings. Ms. Carol Fortune asked if and how the draft January 2016 minutes were distributed. Ms. Debra Richmann said the January 2016 and October 2015 minutes were emailed to RAB members with internet access and hard copies were mailed to any members who do not have access. Mr. Fortune made a motion to accept the October 2015 and January 2016 minutes and Mr. John Pollard seconded the motion. Ms. Richmann noted that the newly finalized RAB minutes will be posted on the LHAAP website.

Website Update

Ms. Richmann said that the changed meeting location was posted on the website prior to the RAB meeting. The website was also updated with recently completed and upcoming field activities, along with the preliminary field schedule – soil sampling using the DPT method at LHAAP-18/24; and installation of new monitoring wells at LHAAP-18/24, LHAAP-37, and LHAAP-67, respectively.

Site-wide Environmental Restoration Issues – Dr. Zeiler

Dispute Update

Dr. Zeiler referred the RAB to Slide 7 in the presentation, which identifies the four LHAAP sites with disputed RODs. Another five sites listed on the slide have experienced schedule impacts due to the dispute. Slide 8 shows the locations of the disputed sites, dispute impacted sites, and the other ERP sites that are being addressed under the current LHAAP PBR.

Dr. Zeiler told the group that prior to tonight's RAB, representatives of the Army, EPA, and TCEQ responsible for implementing the LHAAP remedial action met this afternoon to chart a clear path forward to move sites to closure, now that the dispute has been resolved. Participants at that meeting who were present at the RAB meeting agreed that the earlier meeting was very productive and laid the framework for finalizing the disputed RODs, targeted for this summer. Slide 9 provides a chronology of the dispute, which was initiated in October 2011 and continued until today, when the final decisions were made. Dr. Zeiler also reviewed an excerpt from the OMB findings letter (Slide 10).

The Army is committed to provide the redline RODs to the Agencies by May 12th and the Agencies are committed to prioritizing their review of the RODs. Dr. Zeiler indicated that the OMB findings letter in its entirety is available to the public, through the Administrative Record. Presentation Slide 11 was shown to convey where the disputed ROD sites are in the CERCLA corrective action process currently and the additional future phases that need to be completed to achieve remedy in place (RIP) for each of the sites.

Dr. Zeiler asked if there were any other questions about the dispute. Mr. Fortune asked what the cleanup level for perchlorate in the resolution is. Dr. Zeiler responded that it is 17µg/L, which is the TCEQ PCL. Ms. Fortune asked if that is a residential cleanup level and Dr. Zeiler responded that it is. Mr. Rich Mayer added that the PCL is the level that was used in the dispute.

Summary of CRP/CIP Questionnaire Responses

Dr. Zeiler directed the group's attention back to the CRP/CIP part of the presentation, beginning with Slide 12, which was skipped earlier to discuss the dispute status. The slide summarizes the questionnaire responses in three related points that reflect a general lack of public awareness of the RAB and the quarterly RAB meetings. The responses also indicate that past efforts by the Army to facilitate public involvement have not been very effective. Therefore, beginning with the January 2016 RAB, the Army began a concerted effort to expand its outreach. Ms. Richmann reviewed the additional efforts that were made to increase awareness of the April RAB meeting and reviewed the expanded means of notifying the public listed on Slide 13. Despite these efforts, the turnout for the RAB meeting was small and when asked, no one in the audience indicated they had seen or heard the Public Service Announcements on TV or radio. Mr. Pollard said he saw the ad for the RAB in the local paper, but no one mentioned seeing the fliers posted at the many locations in the community. Although a sign was posted at the Karnack Community Center indicating the meeting was moved to the Caddo Lake State Park Rec Hall and the new location was published in the newspaper, the change in venue, as well as the recent flooding may have contributed to the low turnout. Mr. Pollard suggested providing fliers to local churches in Karnack, Marshall, Jefferson and Longview and Mr. Fortune suggested posting the notice on the *EastTexasTownsOnline* website – Mr. Fortune said he would send information to Dr. Zeiler. As an aside, Mr. Fortune announced that Ms. Judy Johnson will be resigning from the RAB and that she will notify Dr. Zeiler.

Dr. Zeiler wrapped up this discussion by reiterating that the Army is committed to protecting human health and the environment and encouraged the attendees to continue to attend future RAB meetings and become a RAB member, if interested. She also encouraged them to make suggestions for improving communication and to visit the Longhorn environmental website.

1,4-Dioxane Results (November/December 2015 Sampling Event

Ms. Richmann reviewed the November/December 2015 sampling event for 1,4-dioxane in groundwater at LHHAP, including the sites where samples were collected and the number of samples collected. Dr. Zeiler added that earlier sampling at LHAAP did not indicate 1,4-

dioxane was a COC, because in the past the detection limits were much higher than they are now. 1,4-Dioxane is now considered a COC at LHAAP-18/24. Slide 16, a map showing the sampling sites and range of 1,4-dioxane concentrations detected in the groundwater samples at each site was shown. Ms. Richmann also indicated that a Fact Sheet on 1,4-dioxane at LHAAP was available at the sign-in table.

Defense Environmental Restoration Program (DERP) Update – AECOM (Deb Richmann)

MNA Site Updates (LHAAP-37, 46, 50, 58, 67)

Slide 17 provides an overview of the current status of the MNA sites at LHAAP. Dr. Zeiler used LHAAP-50 as an example of a site where progress was affected by the dispute. Even though the dispute prevented the RACR from being finalized, pending dispute resolution, the Army proceeded with groundwater sampling and drafting the RA-O reports (Year 1 and Year 2) to minimize the overall schedule impact. Ms. Richmann noted that additional monitoring wells are being installed at sites LHAAP-37 and -67 to expedite completion of the RACRs, but she also noted the schedule for installing the new wells had been delayed by the recent rain and flooding. The drilling crew was finally able to mobilize and began drilling today.

LHAAP-29 Update

Ms. Richmann briefed the current status of LHAAP-29 (Slide 17). She indicated that supplemental data were needed to support an FS Addendum; these data have been obtained and the results will be documented in an RI Addendum for LHAAP-29. She also indicated that a Fact Sheet for LHAAP-29 was available at the sign-in table.

Mr. Rich Mayer asked if TCE isn't also present in the Intermediate Zone groundwater – the EPA samples indicated its presence. Dr. Zeiler replied that it has been detected, but the main COC is MC and the main question was the extent of DNAPL. She further indicated that the extent of the DNAPL has been shown to be less than previously estimated.

LHAAP-18/24 Update

Ms. Richmann briefed the current status of the data gap investigation that is ongoing at LHAAP-18/24. In addition to the recently completed collection and analysis of soil samples for VOCs and perchlorate, seven additional monitoring wells (three shallow and four in the Wilcox) will be installed and samples from the well boreholes will be profiled for VOCs and perchlorate to confirm their vertical extent in unsaturated soil, in addition to collection of groundwater samples. The resulting data will be used to prepare a revised FS for the site, including evaluation of contingency technologies/alternatives to address 1,4-dioxane, if required. Dr. Zeiler asked Mr. LeTourneau if he had asked about this, but he said no.

Groundwater Treatment Plant (GWTP) Update

Mr. Marwan Salameh provided an update on the LHAAP GWTP operations (Slide 20). He indicated that the purpose of operating the GWTP is to contain the groundwater plumes sourced at LHAAP-18/24 and -16. He emphasized that the influent water is treated until the discharge standards are met; no effluent water is discharged to Harrison Bayou if it exceeds these standards. In such cases, it is released through the sprinkler system. Mr. John Meyer asked about the design of the sprinkler array; Mr. Salameh responded that it was developed in coordination with EPA and Mr. Mayer confirmed that. Mr. Carlos Sanchez asked if runoff samples have been collected and analyzed; Mr. Salameh said they have been and the samples are not impacted. Someone asked if the water applied to the site was sprinkled before or after treatment and Mr. Mayer said it is applied only after treatment; no untreated water is applied.

Mr. Salameh next described the monthly treated groundwater volume graph (Slide 21). It shows that the treated volumes decreased markedly from August 2015 to September 2015 and have remained low since that time through December 2015. This was in relation to partial groundwater extraction that was implemented after the stripper blower malfunctioned.

Surface Water and Perimeter Well Sampling Update

Ms. Richmann presented Slides 22 – 25, which identify surface water sampling locations, present perchlorate results for surface water samples, show perimeter well locations, and present perchlorate results for perimeter well samples, respectively. Mr. Fortune asked what the direction of groundwater is flowing, to the southeast, and where water within the preserve is migrating? Dr. Zeiler replied that surface water and shallow and intermediate groundwater generally flow toward Caddo Lake, except in the northwest area. She further explained that the upgradient wells are used to document the quality of the groundwater that's entering the installation. Mr. Fortune then asked why there is only one well along Caddo Lake. Dr. Zeiler replied that each of the groundwater plumes associated with a site gets monitored and delineated individually within the installation. He also asked why well 108 is installed where it is, and Dr. Zeiler replied she wasn't sure.

Other Environmental Restoration Issues – Dr. Zeiler

Ms. Cathy Kropp wanted to discuss the CERCLA process as shown by the CERCLA Site Investigation and Remediation Process flow chart on the easel. Ms. Kropp explained that a site moves through a series of remediation phases within the CERCLA process from the time it is identified until it is remediated and closed. Where a particular site is in the remediation process doesn't necessarily relate to the time it took to progress there and each step/phase doesn't take the same amount of time. It also depends on the complexity of a site. Dr. Zeiler said that LHAAP-18/24 is the worst and most complicated site at Longhorn. Mr. Fortune asked if it is about a third of the way to completion of the CERCLA process, based on where it is listed in the flow chart. Ms. Kropp said not necessarily, because some processes take longer.

Dr. Zeiler noted that there is a cluster of sites around the ROD phase on the flow chart. She said that is largely due to the dispute and where the sites were in the process when progress

was suspended. Mr. Mayer said it may also be because some of the sites are more complex than others. Ms. Kropp suggested that a picture of the flow chart be taken and included in the meeting minutes. Mr. Fortune requested that it be updated quarterly for future RAB meetings. Dr. Zeiler agreed and said the Army is happy to have reached this point. There were no further questions.

Next RAB Meeting Schedule and Closing Remarks

The next RAB meeting will be held on **July 21, 2016** at the same time (**6:00 – 7:30 p.m.**). If FEMA is done using the Karnack Community Center, the RAB will meet there; otherwise the meeting will be held at the Caddo Lake State Park Group Recreation Hall again. Check the website for updates.

Miscellaneous Information

Following the conclusion of the formal presentation, Mr. Bob Sanders was introduced by Mr. Paul Fortune and asked to address the group. Mr. Sanders lives on Big Cypress and is involved with the Caddo Lake Institute. Erik Duerkop (Refuge Manager) stated that Star Ranch house has deteriorated to the point where it poses a safety and health hazard to the community. The USFWS won't have the money to restore it and it is being vandalized routinely. The house will probably eventually be torn down.

Adjourn – Motion to adjourn was made by Ms. Fortune and seconded by Mr. LeTourneau.

April 2016 Meeting Attachments and Handouts:

- Meeting Agenda
- PowerPoint Presentation Slides
- GWTP Treated Groundwater Volumes Handout
- Surface Water Sampling Results Handout
- LHAAP Perimeter Well Sampling Results Handout
- LHAAP-29 Former TNT Production Area Fact Sheet
- LHAAP 1,4-Dioxane Fact Sheet

Acronyms

µg/L	micrograms per liter
AECOM	AECOM Technical Services, Inc.
BRAC	Base Realignment and Closure
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CIP	Community Involvement Plan
COC	Contaminant of Concern
CRP	Community Relations Plan
DERP	Defense Environment Response Program
DNAPL	Dense Non-Aqueous Phase Liquid
DPT	Direct Push Technology
ERP	Environmental Restoration Program
FEMA	Federal Emergency Management Agency
FS	Feasibility Study
GWTP	Groundwater Treatment Plant
LHAAP	Longhorn Army Ammunition Plant
MC	Methylene Chloride
MNA	Monitored Natural Attenuation
OMB	Office of Management and Budget
PBR	Performance-Based Remediation
PCL	Protective Concentration Level
RAB	Restoration Advisory Board
RACR	Remedial Action Completion Report
RA-O	Remedial Action Operations
RI	Remedial Investigation
RIP	Remedy in Place
ROD	Record of Decision
TCE	Trichloroethene
TCEQ	Texas Commission on Environmental Quality
TNT	Trinitrotoluene
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
VOC	Volatile Organic Compound



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

AGENDA

DATE: Thursday, April 21, 2016
TIME: 6:00 – 7:30 PM
PLACE: Caddo Lake State Park Group Recreation Hall, Karnack, Texas

- 06:00** Welcome and Introduction
- 06:05** Open Items {RMZ}
- RAB Administrative Issues
 - Minutes (October 2015 and January 2016 RAB meeting)
 - Website
- 06:15** Sitewide Environmental Restoration Issues {RMZ}
- Dispute Update
 - Summary of CRP/CIP Questionnaire Responses
 - 1,4-Dioxane Results (November/December 2015 Sampling Event)
- 06:35** Defense Environmental Restoration Program (DERP) Update {AECOM}
- MNA Site Updates
 - LHAAP-29 Update
 - LHAAP-18/24 Update
 - Groundwater Treatment Plant (GWTP) Update
 - Surface Water and Perimeter Well Sampling Update
- 07:20** Next RAB Meeting Schedule and Closing Remarks
- 07:30** Adjourn {RMZ}

Longhorn Army Ammunition Plant Restoration Advisory Board Meeting April 21, 2016

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AECOM Environment

Agenda

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- Surface Water and Perimeter Well Sampling Update
- 07:20** Next RAB Meeting Schedule and Closing Remarks
- 07:30** Adjourn {RMZ}

Open Items

- RAB Administrative Issues
- Minutes from October 2015 and January 2016 RAB Meetings
- Website Update

Minutes from Past RAB Meetings

- Discussion of October 2015 RAB Meeting Minutes/Motion to accept
- Discussion of January 2016 RAB Meeting Minutes/Motion to accept

Website Update

HOME BACKGROUND SITES ▾ REMEDIAL TECHNOLOGIES PLUME MAPS ADMIN RECORD GET INVOLVED ▾



Longhorn Army Ammunition Plant

Environmental Restoration Program

◀ The next RAB meeting will be Thursday, April 21, 2016 from 6:00-7:30PM [Click on Calendar for Meeting Agenda and Details.](#) ▶

Site-wide Environmental Restoration Issues

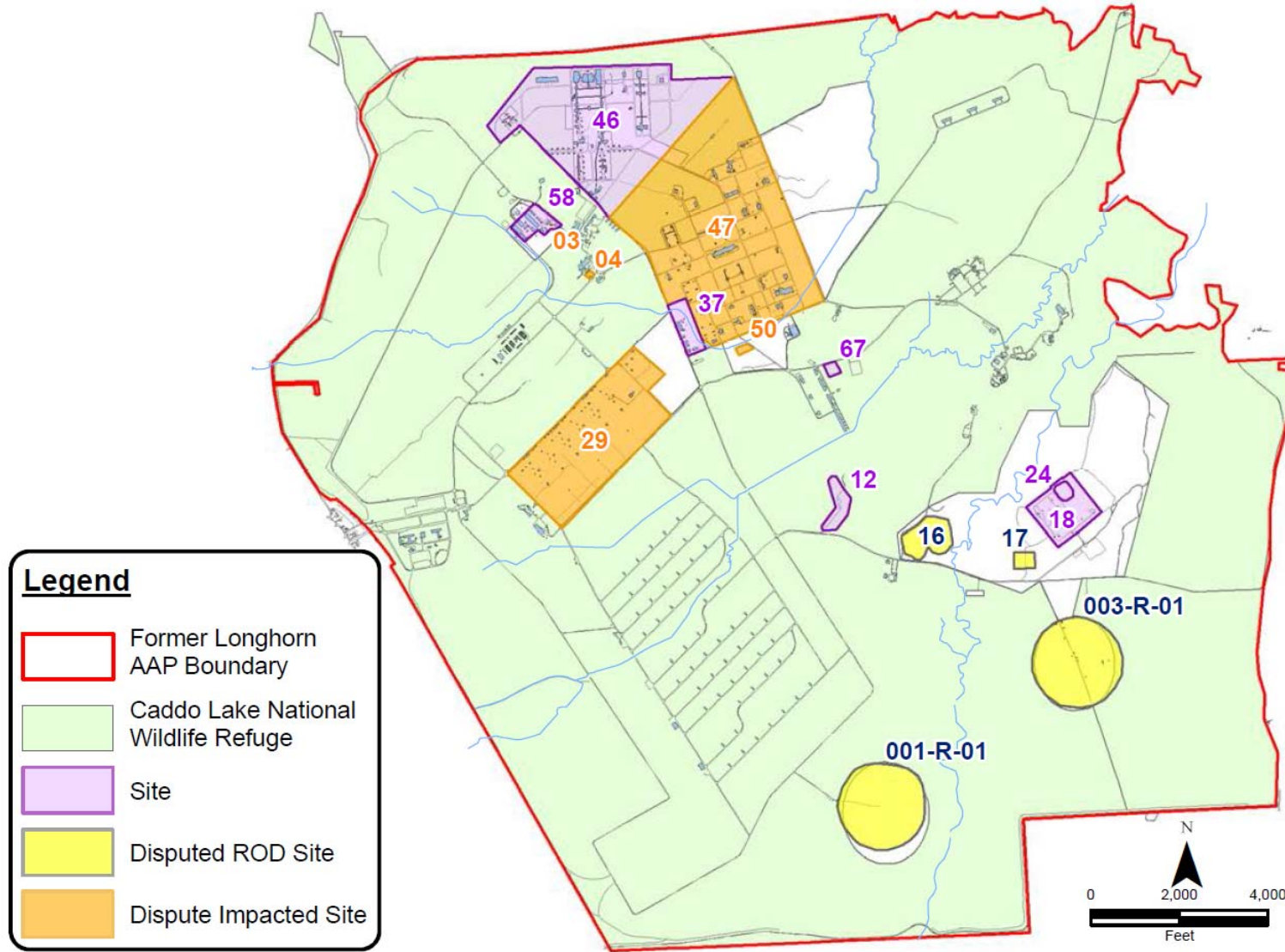
Active LHAAP Performance-Based Remediation Sites

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

Dispute Update

- Disputed Record of Decision (ROD) Sites
 - LHAAP-16 – Landfill 16
 - LHAAP-17 – Burning Ground No. 2/Flashing Area
 - LHAAP-001-R-01 – South Test Area/Bomb Test Area
 - LHAAP-003-R-01 – Ground Signal Test Area
- Dispute Impacted Sites
 - LHAAP-03 – Building 722 Paint Shop
 - LHAAP-04 – Pilot Wastewater Treatment Plant
 - LHAAP-29 – Former TNT Production Area
 - LHAAP-47 – Plant Area 3
 - LHAAP-50 – Former Sump Water Tank

Longhorn Performance-Based Remediation Sites Map



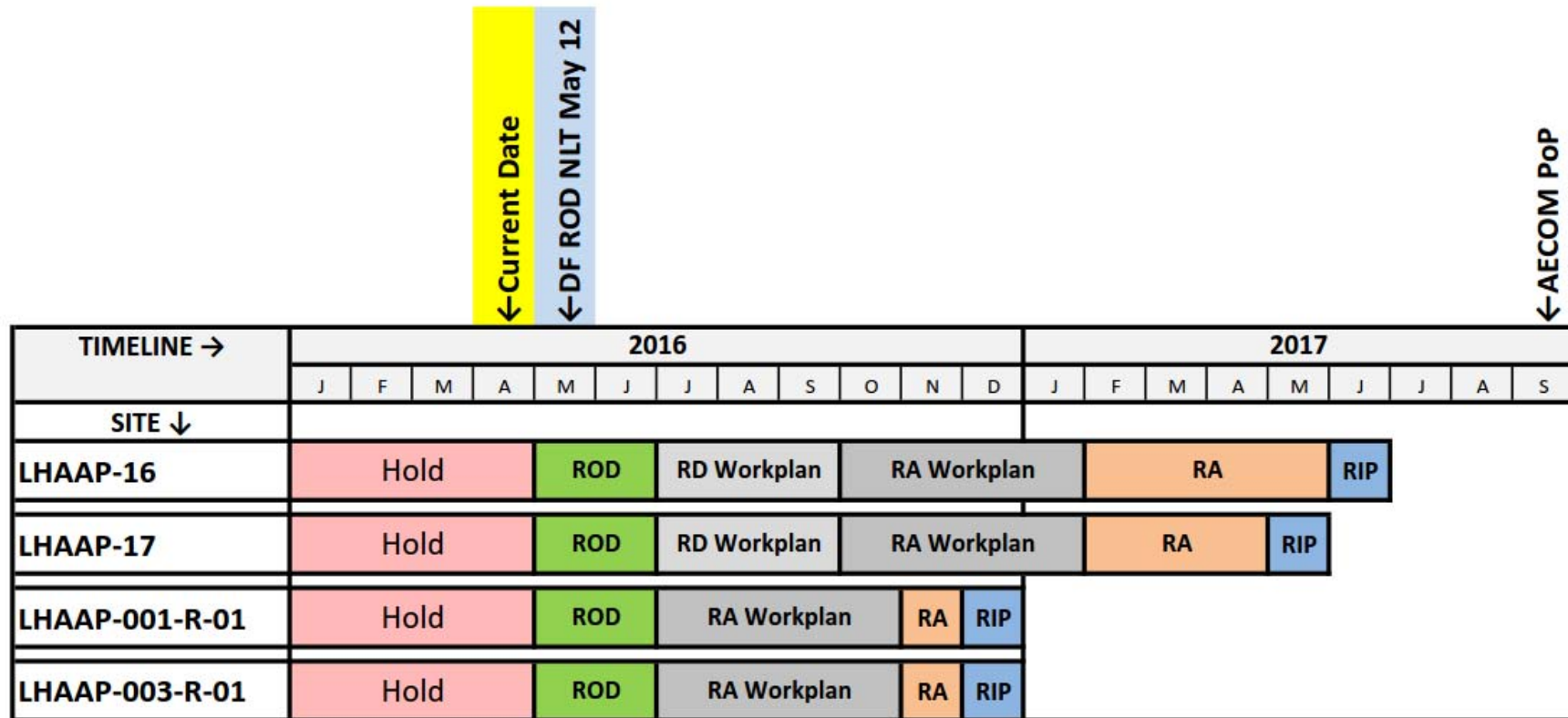
Dispute Chronology

- October 27, 2011 Initiation of dispute
- April 5, 2013 USEPA Region 6 Administrator's Decision
- October 31, 2014 USEPA Administrator's Decision
- March 11, 2016 Office of Management and Budget Findings

OMB Findings (Letter Excerpt)

“We understand that the Army and the Environmental Protection Agency (EPA) have come to agreement on the remedy for the contamination of the aquifer under the Longhorn site (Carrizo-Wilcox Aquifer) which includes in situ bioremediation followed by monitored natural attenuation. We also understand that the cleanup goals for perchlorate at the public health advisory levels are projected to be achieved in advance of the MCL-driven cleanup goals for trichloroethylene (TCE) at the site due to the nature of those two constituents and expect that the draft Record of Decision can be modified accordingly. Based on these developments, OMB is not revisiting the Administrator’s determination.”

Preliminary Schedule for Disputed ROD Sites (in Preparation)



Notes:

- | | | | |
|-------|----------------------------------|-----|--------------------|
| AECOM | AECOM Technical Services, Inc. | RA | Remedial Action |
| DF | Draft Final | RD | Remedial Design |
| LHAAP | Longhorn Army Ammunition Plant | RIP | Remedy in Place |
| NLT | No Later Than | ROD | Record of Decision |
| PoP | Period of Performance (end date) | | |

Summary of Community Relations Plan/Community Involvement Plan Questionnaire Responses

- Questionnaires sent out by mail in late October 2015 to over 1,500 addresses in the Karnack/Uncertain zip code
- 71 responses received, with several common themes:
 - Nearly 60% of respondents are aware of the LHAAP environmental restoration program, but less than 20% were aware of the RAB/RAB meetings
 - More than 80% of respondents have not seen public notices for RAB meetings
 - Almost 80% of respondents were unaware of the Longhorn website and another 12 % don't have computer access to it
- The Army hears you and is making changes to broaden community awareness and increase public participation in the LHAAP environmental restoration program and RAB – Following are some examples:

Expanded Notifications for April RAB Meeting

- Published RAB Meeting Announcement in Marshall News Messenger on April 12th
- Requested additional radio stations to air April RAB Meeting Public Service Announcement (PSA):
 - KMHT Radio 103.9 in Marshall
 - Alpha Media and Town Square Media – Multiple Shreveport Radio Stations
- Requested PSA to be placed on Channel 3 and Channel 6 TV Community/Local Events Calendar
- Sent RAB announcements by email or USPS to individual RAB members and other interested parties identified in questionnaires (with revised RAB meeting location)
- Posted RAB Meeting Fliers at multiple locations in the community:
 - Shady Glade Café, Caddo Grocery, Fyffes Corner Grocery, Caddo Lake State Park, Circle S Grocery, Family Dollar Store, Karnack Post Office, Convenience Store at FM9 and FM199

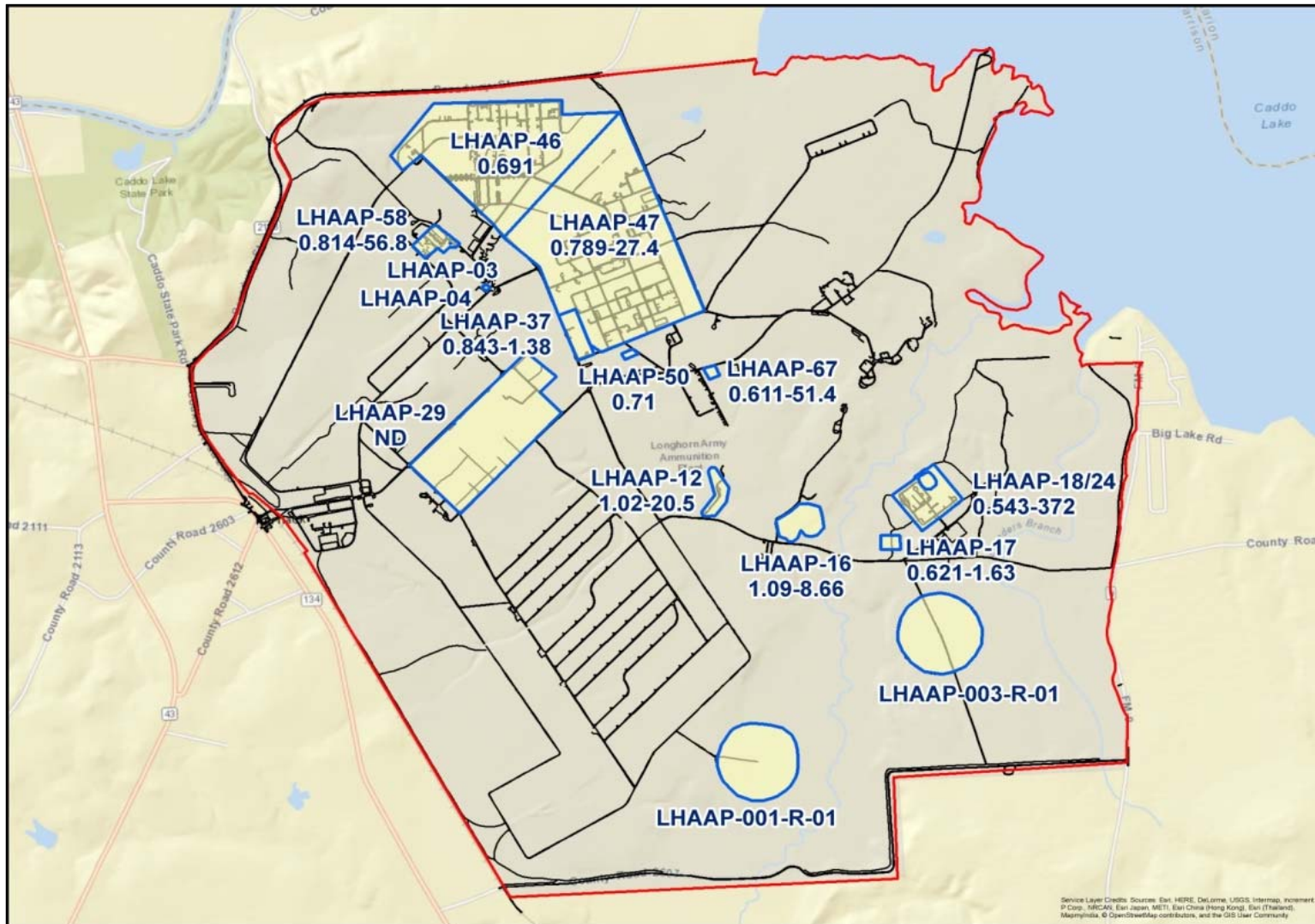
The Army Wants You to be Informed!

- 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
 - Make suggestions for improving communication – the Army welcomes and appreciates community feedback

1,4-Dioxane Results (November/December 2015) Sampling Event

- 77 groundwater samples were collected from LHAAP-18/24 to evaluate extent of 1,4-dioxane.
- 51 additional samples were collected from other LHAAP sites, including LHAAP-03, 12, 16, 17, 29, 37, 46, 50, 58, and 67 to determine the presence or absence of 1,4-dioxane.
- The following map shows the sites where 1,4-dioxane was detected and the range of 1,4-dioxane concentrations that were reported at each site.
- A Fact Sheet with additional information is available at the sign-in table

Ranges of 1,4-Dioxane Concentrations ($\mu\text{g/L}$) in Groundwater Samples from LHAAP Sites – November/December 2015



Defense Environmental Restoration Program (DERP) Update

- Monitored Natural Attenuation Sites Updates
 - LHAAP-35B (37) – Chemical Laboratory
 - LHAAP-46 – Plant Area 2
 - LHAAP-50 – Former Sump Water Tank
 - LHAAP-35A (58) – Shops Area
 - LHAAP-67 – Aboveground Storage Tank Farm
- Land Use Control Boundary Surveys for groundwater use restriction are complete for all sites
- Final Remedial Action Completion Reports (RACRs) are complete for LHAAP-46 and 58; working to finalize RACRs for LHAAP-35B(37), 50, and 67
 - Monitoring wells will be installed at LHAAP-37 and 67 in April/May to facilitate completion of RACRs; completion of LHAAP-50 RACR pending dispute resolution
- Year 1 Remedial Action Operation (RA-O) reports for all sites except LHAAP-35B(37) are drafted; reports for LHAAP-46 and LHAAP-58 are final
- Year 2 RA-O reports for LHAAP-46, 50, 58, and 67 are drafted
- Quarterly/Semi-Annual Groundwater Monitoring is ongoing (all sites except LHAAP-35B (37))

LHAAP-29 - Former TNT Production Area Update

To address remedy design and implementation questions at the Draft Final ROD stage, the Remedial Investigation (RI) and Feasibility Study (FS) were re-opened to fill data gaps and a Supplemental Investigation was performed:

- An RI Addendum based on the Supplemental Investigation results for LHAAP-29 has been reviewed by Army and responses to Army comments are being drafted. The supplemental sampling results achieved the following objectives:
 - Confirmed the extent of VOC, perchlorate, and explosives contamination in Shallow Zone groundwater; and MC in Intermediate Zone groundwater
 - Determined there is no continuing source of VOC contamination in site soil; however, further definition of explosive compounds in the vicinity of former building pad 812-F is required
 - Characterized physical properties (resistivity, hydraulic conductivity, etc.) and microbial activity in Intermediate Zone to support FS
 - A Fact Sheet with additional information is available at the sign-in table

LHAAP-18/24 Former Burning Ground No. 3 and Unlined Evaporation Pond Update

To evaluate remedy alternatives for LHAAP-18/24, a Revised FS is being prepared:

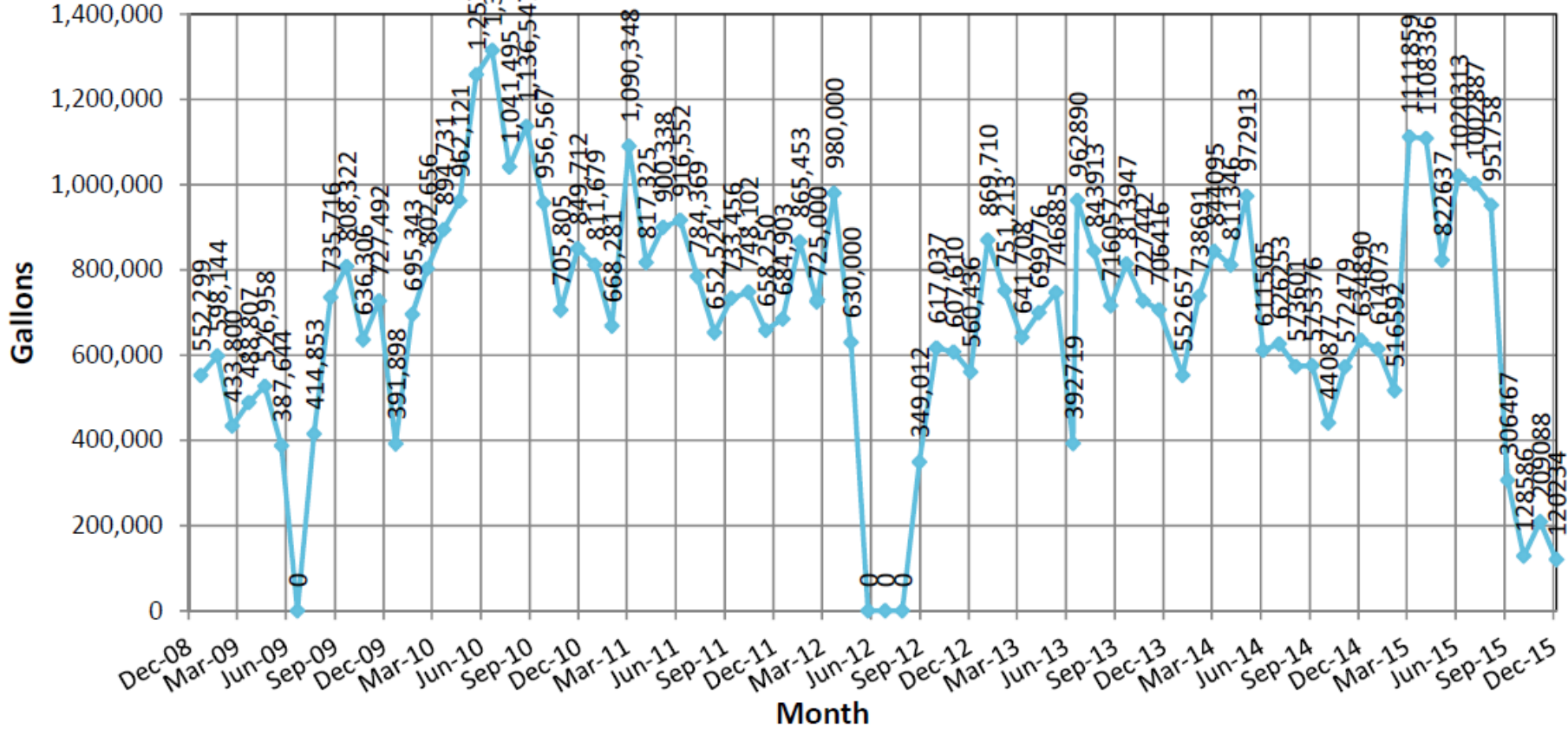
- Groundwater confirmation sampling for 1,4-dioxane will be performed along with regularly scheduled quarterly sampling at the site in June
- Additional data gap investigation is in progress:
 - DPT soil sampling at 17 locations and analysis for VOCs and perchlorate has been completed
 - Installation of seven additional monitoring wells (three screened in the Shallow Zone and four in the Wilcox Fm.) scheduled to begin April 18th; soil samples will be collected from well borings to create a vertical profile of VOCs and perchlorate in the unsaturated zone
- Above information will be used to help prepare the revised FS for LHAAP-18/24, including contingency remedies for 1,4-dioxane, if necessary

Groundwater Treatment Plant (GWTP) Update

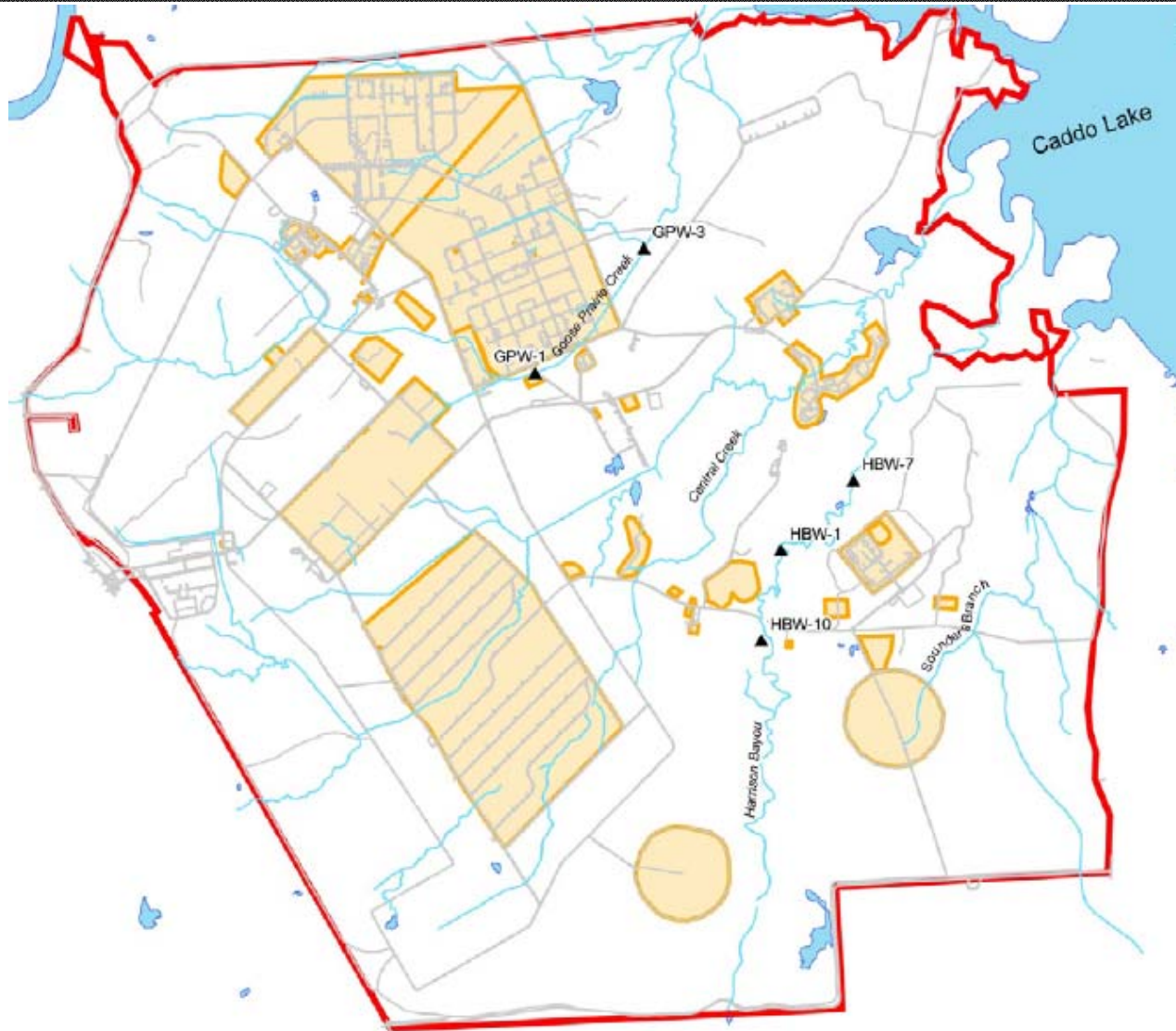
- The GWTP continues to operate to contain the plume at LHAAP-18/24 and LHAAP-16.
- Treated groundwater is returned to LHAAP-18/24 through the sprinkler array or to Harrison Bayou.
- LHAAP-18/24 groundwater compliance monitoring continues per existing sampling plan.
- Maintenance and repairs of wells, pumps, tanks, and ancillary equipment is ongoing. Repairs to the air stripper blower were recently completed (January 2016).
- TK-300, the stripper feed tank, accumulated filter sand over time. The sand was sampled and is being profiled. Once the landfill accepts the waste profile, the filter sand will be evacuated and disposed off-site.
- The FBR has had a few instances of perchlorate above the effluent limit. We are evaluating all potential causes and troubleshooting the system. The treated water was released to the burning grounds (no discharge to Harrison Bayou).

GWTP Update (continued)

Water Treated Monthly from January 2009 through December 2015

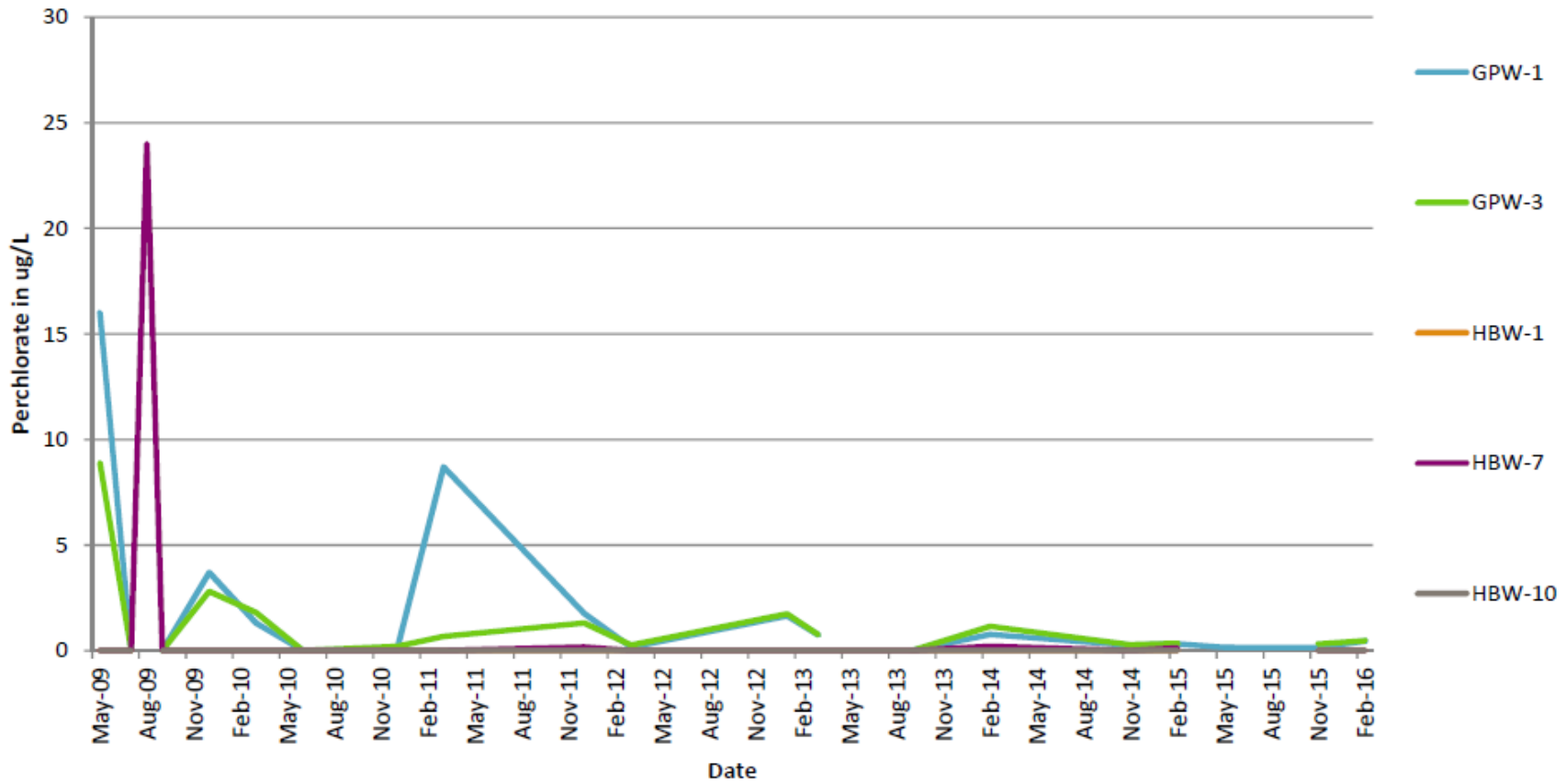


Surface Water Sampling Locations



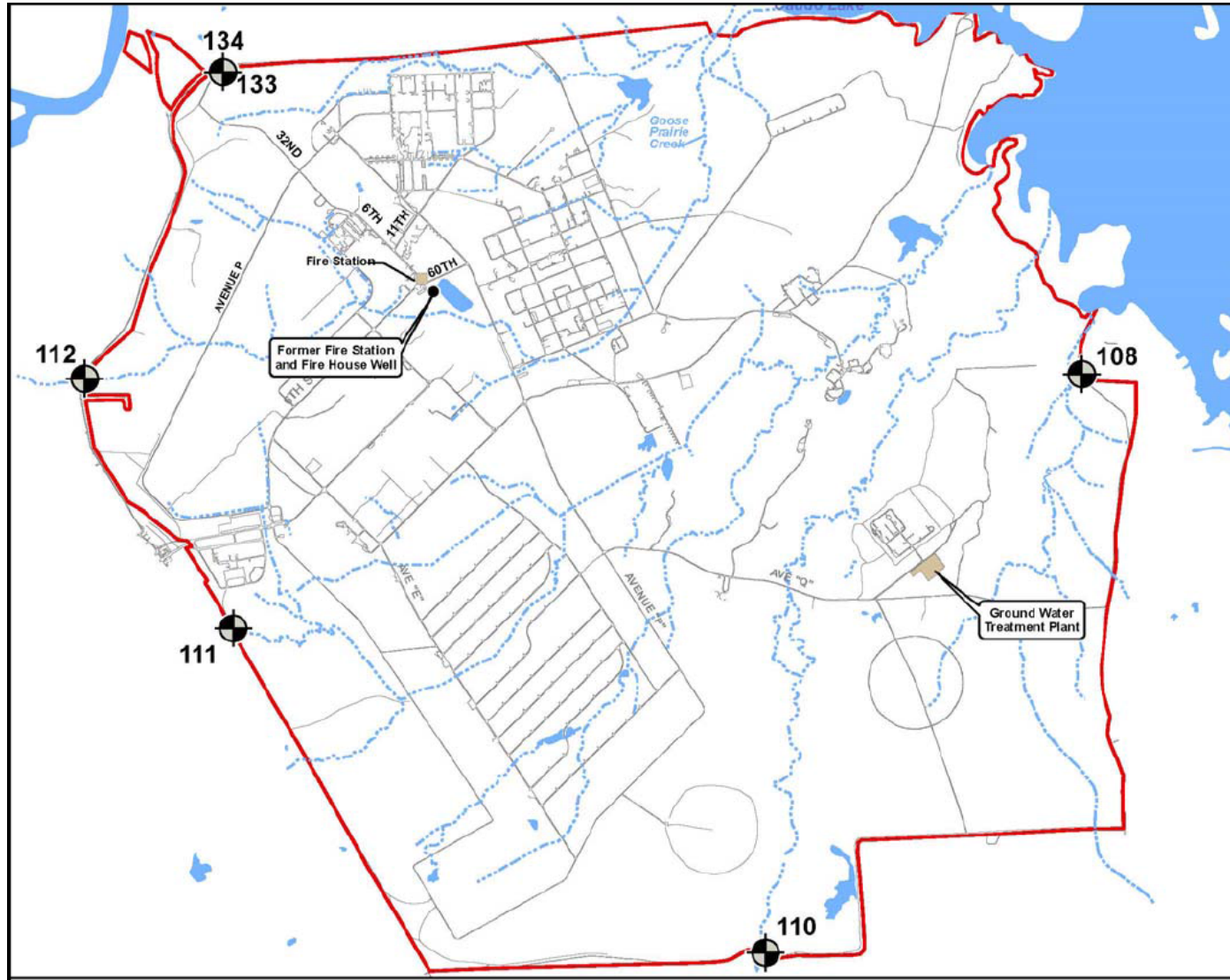
Surface Water Sampling Update

Surface Water Samples - Perchlorate



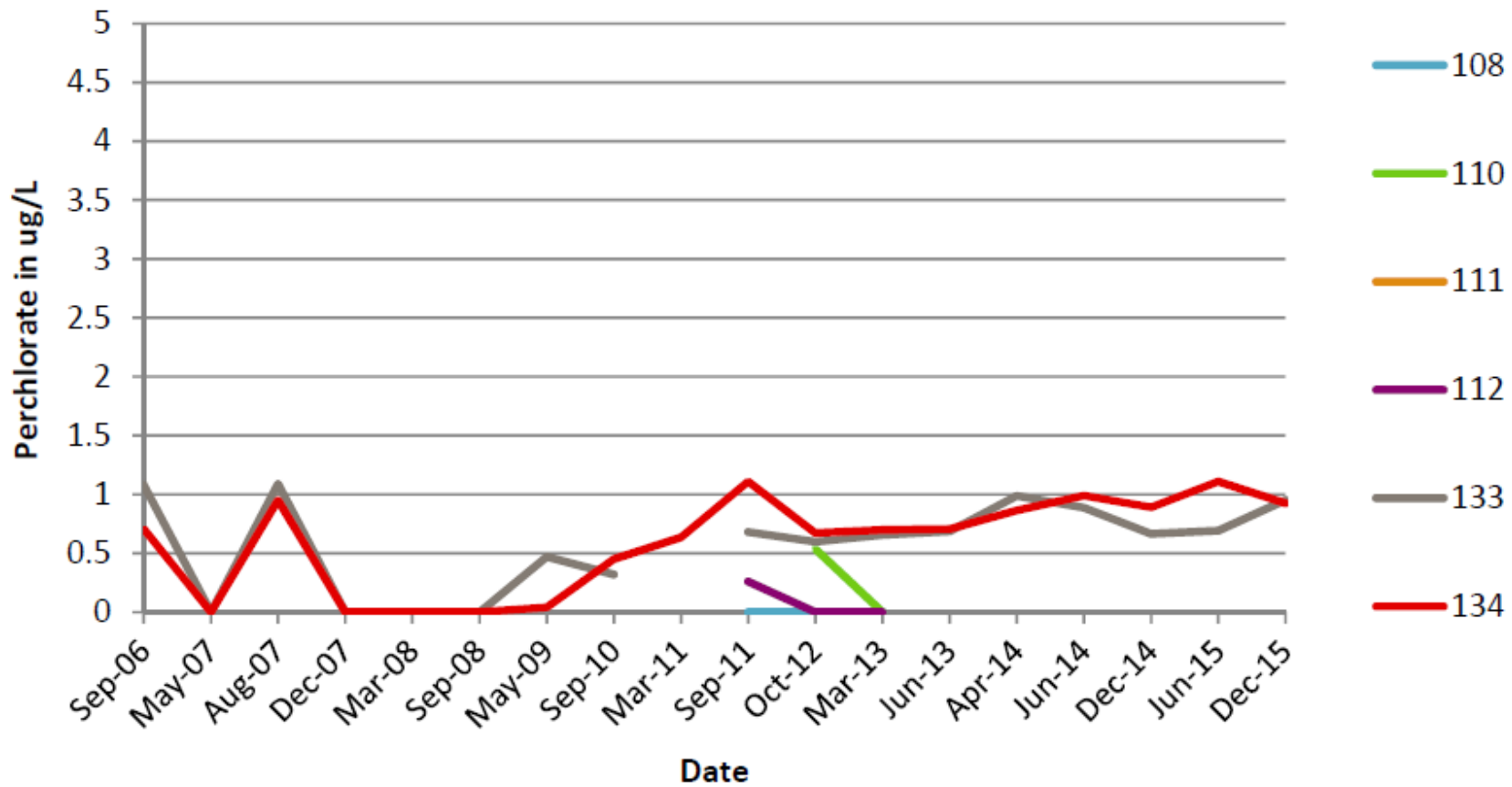
GPW – Goose Prairie Creek
HBW – Harrison Bayou

Perimeter Well Locations



Perimeter Well Sampling Update

Perimeter Wells - Perchlorate



Next RAB Meeting Schedule and Closing Remarks

- Third Thursday in July is the 21st
 - Next RAB Meeting is proposed for July 21, 2016 from 6:00 – 7:30 pm at the Karnack Community Center

Questions?



Groundwater Treatment Plant - Processed Groundwater Volumes

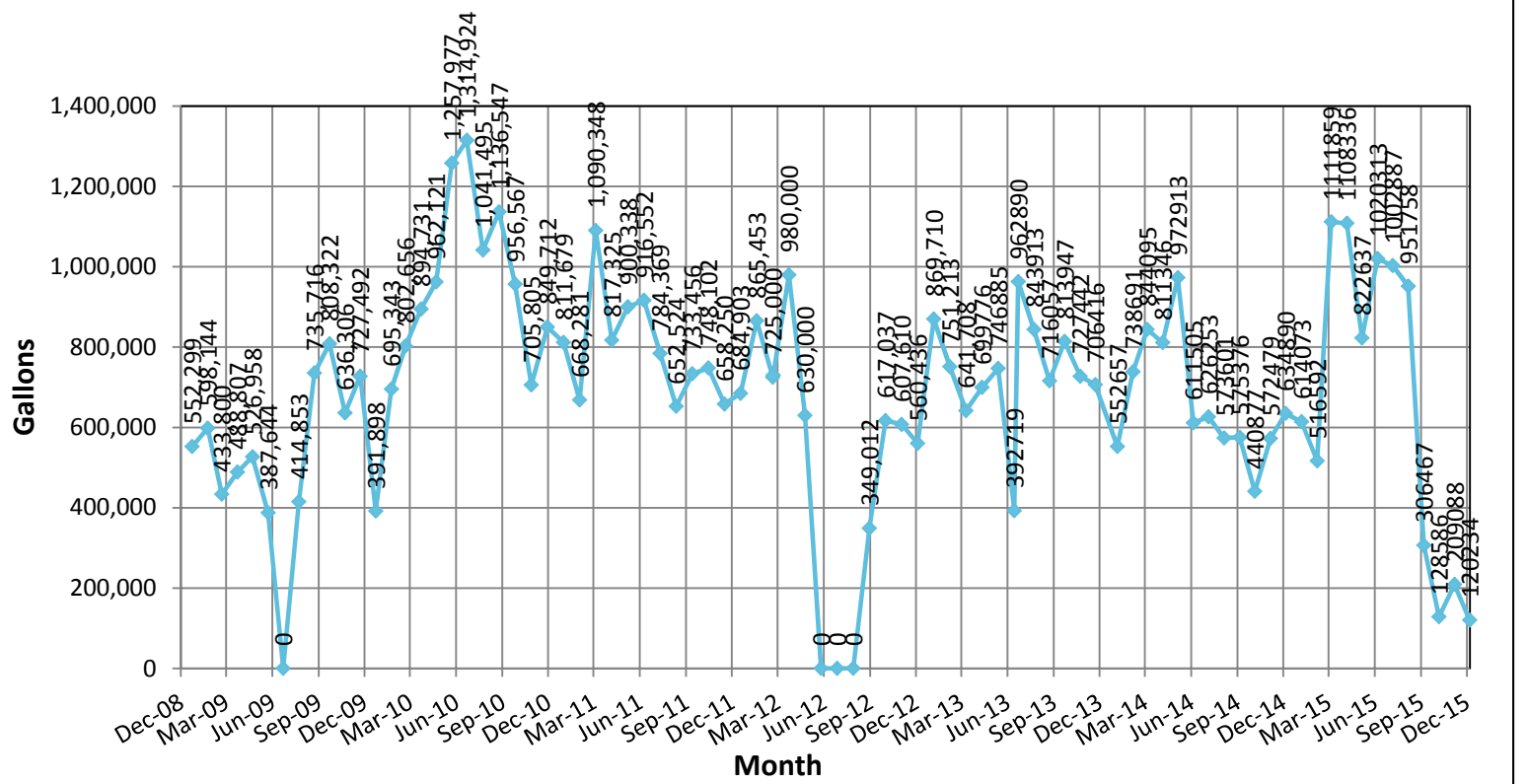
The amount of groundwater treated is determined by measuring the number of gallons of processed water.

Processed 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	843,913	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									
128,586	209,088	120,234									

*Indicates Estimate

Water Treated Monthly from January 2009 through December 2015

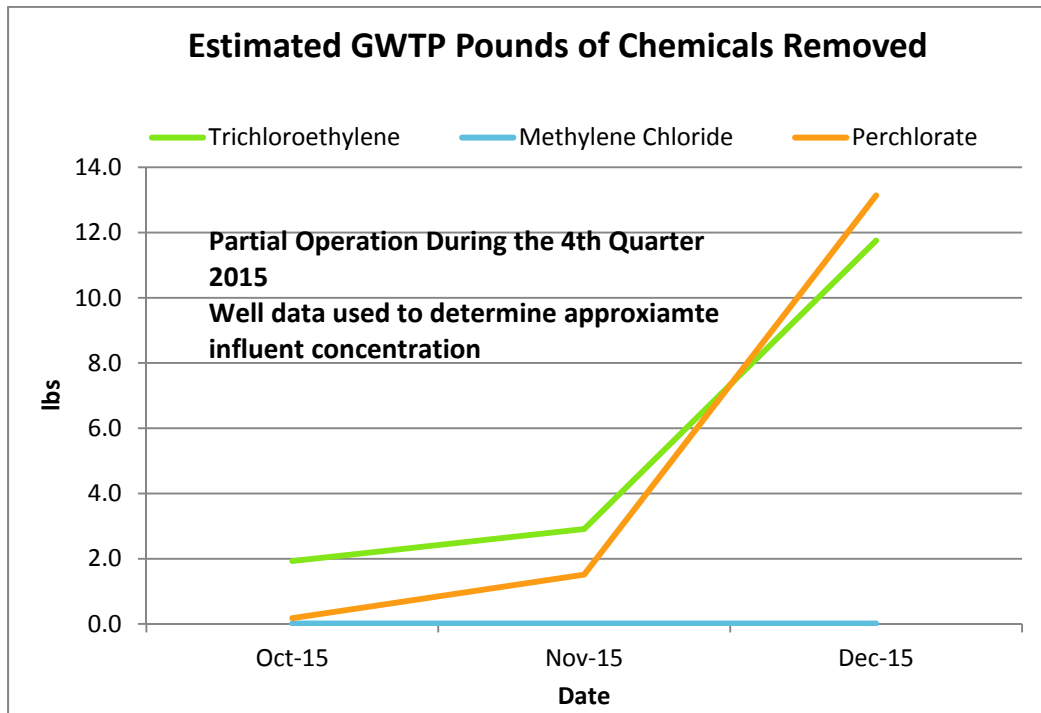


The pounds of chemicals removed for the 4th Quarter of 2015 can be found below and are calculated by the following formula:

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

**Approximate Amount of Pounds of Chemicals
Removed From
LHAAP-18/24, 4th Quarter 2015**

	Trichloroethylene	Methylene Chloride	Perchlorate
Oct-15	1.83	0	0.18
Nov-15	2.91	0	1.51
Dec-15	11.8	0	13.1



Water Discharge Location and Volume (Gallons)

Month	Harrison Bayou	LHAAP-18/24 Sprinklers	INF Pond
Oct-15	0	65,473	0
Nov-15	74,820	0	0
Dec-15	91,247	0	0

Harrison Bayou and Goose Prairie Creek – Perchlorate Data

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

Historical Surface Water Sample Data (in micrograms per liter)

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

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

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

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

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

Quarter	1 st
Creek Sample ID	Feb 2016
GPW-1	0.447
GPW-3	0.474
HBW-1	<0.2 U
HBW-7	<0.2 U
HBW-10	<0.2 U

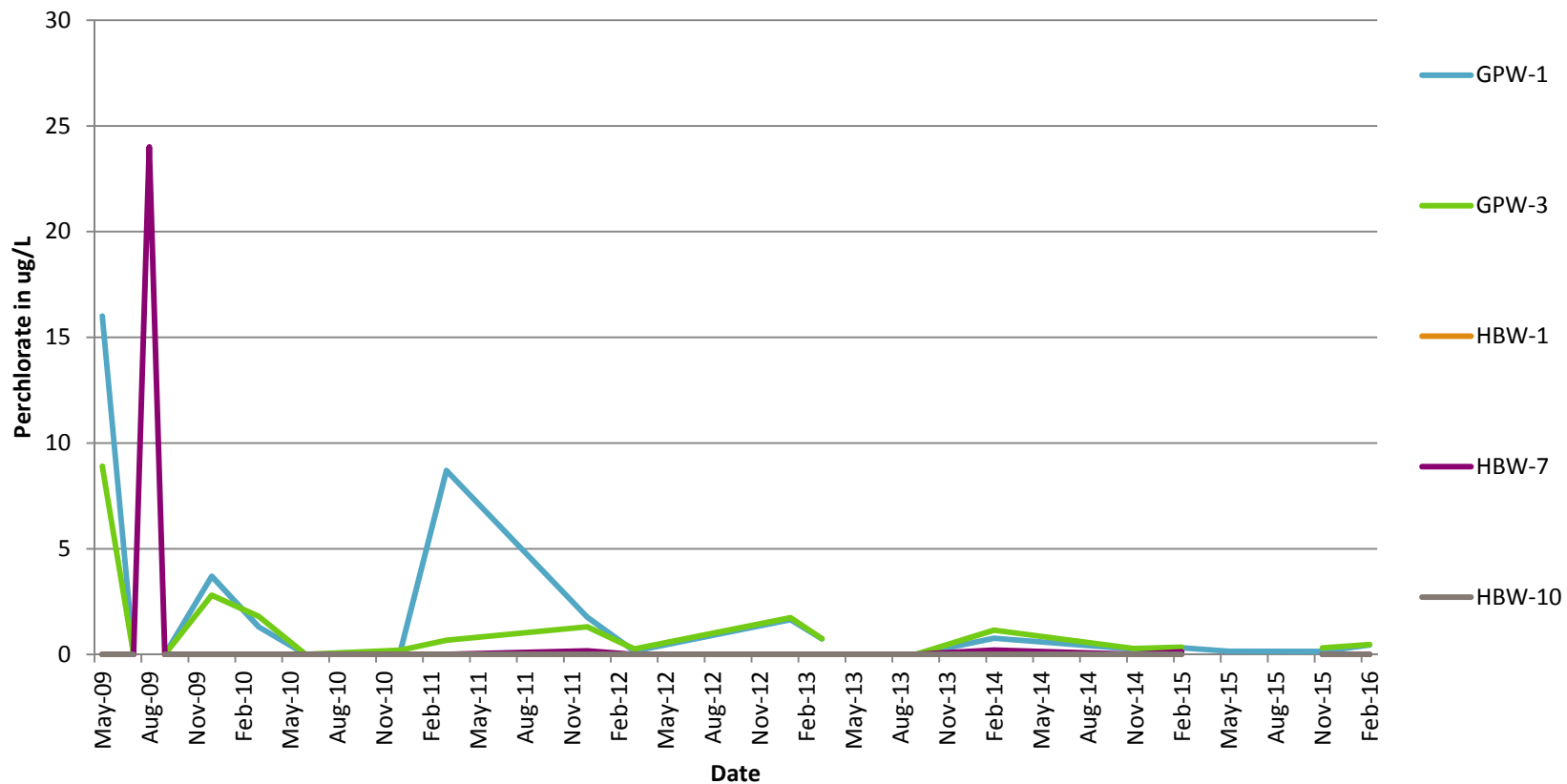
NS – not sampled

U – non-detect

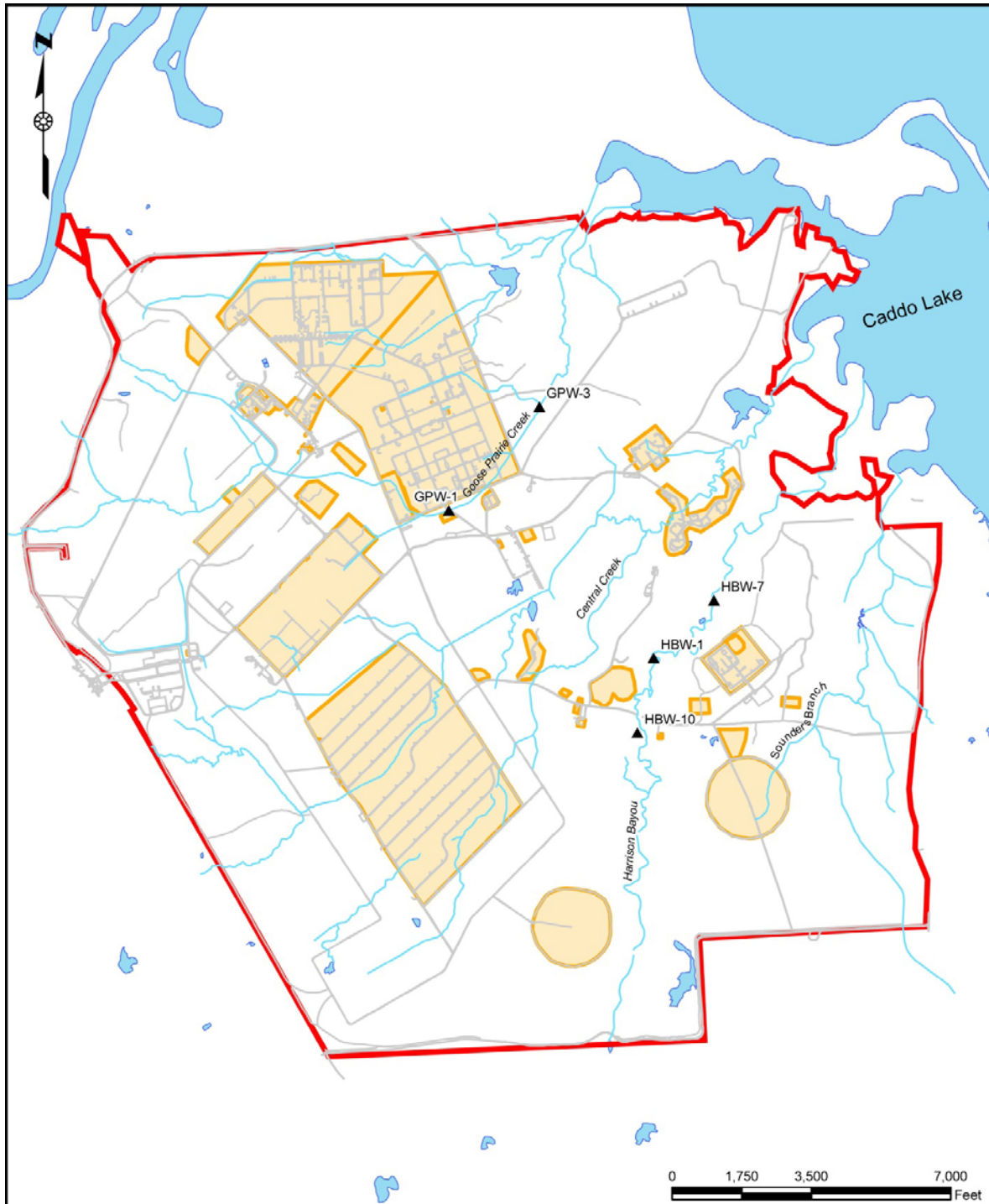
J – Estimated

Dry – no surface water

Surface Water Samples - Perchlorate



Longhorn Army Ammunition Plant Creek Sampling Locations



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

LHAAP Perimeter Well Monitoring – Perchlorate Data

Groundwater samples are currently collected annually from four wells and semi-annually from two wells on the LHAAP perimeter.

Historical Perimeter Well Sample Data (in micrograms per liter)

Well ID	Jun 2005	Sep 2005	Sep 2006	May 2007	Aug 2007	Dec 2007	Mar 2008	Sep 2008	May 2009	Sep 2009	Mar 2010
108	NS	NS	10 U	NS	0.5 U	NS	NS	2.5 U	NS	1.2 U	NS
110	NS	NS	10 U	NS	10 U	NS	NS	5.0 U	NS	6 U	NS
111	NS	NS	4 U	NS	0.5 U	NS	NS	0.5 U	NS	0.3 U	NS
112	NS	NS	5 U	NS	3 U	NS	NS	2.0 U	NS	3 U	NS
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	Jun 2013	Apr 2014	Jun 2014	Dec 2014	Jun 2015	Dec 2015
108	3 U	NS	0.1 U	0.2 U	0.2 U	NS	NS	0.2 U	NS	0.566	NS
110	Dry	NS	Dry	0.535	0.2 U	NS	NS	0.2 U	NS	2U	NS
111	Dry	NS	Dry	Dry	1.32	NS	NS	Dry	NS	0.2U	NS
112	3 U	NS	0.26	0.2 U	0.2 U	NS	NS	0.458	NS	2U	NS
133	0.32	Dry	0.68	0.598	0.655	0.685	0.988	0.887	0.665	0.692	0.952
134	0.45	0.636	1.11	0.671	0.698	0.706	0.863	0.989	0.890	1.11	0.925

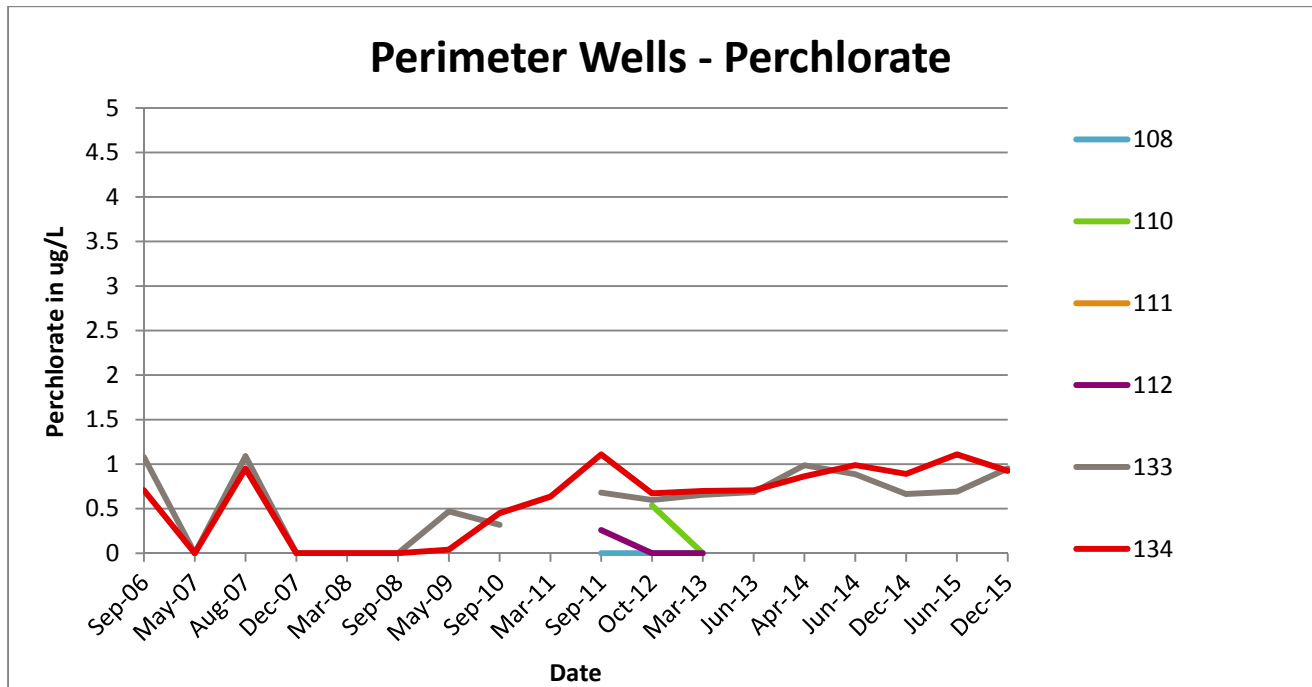
Notes:

J – Estimated

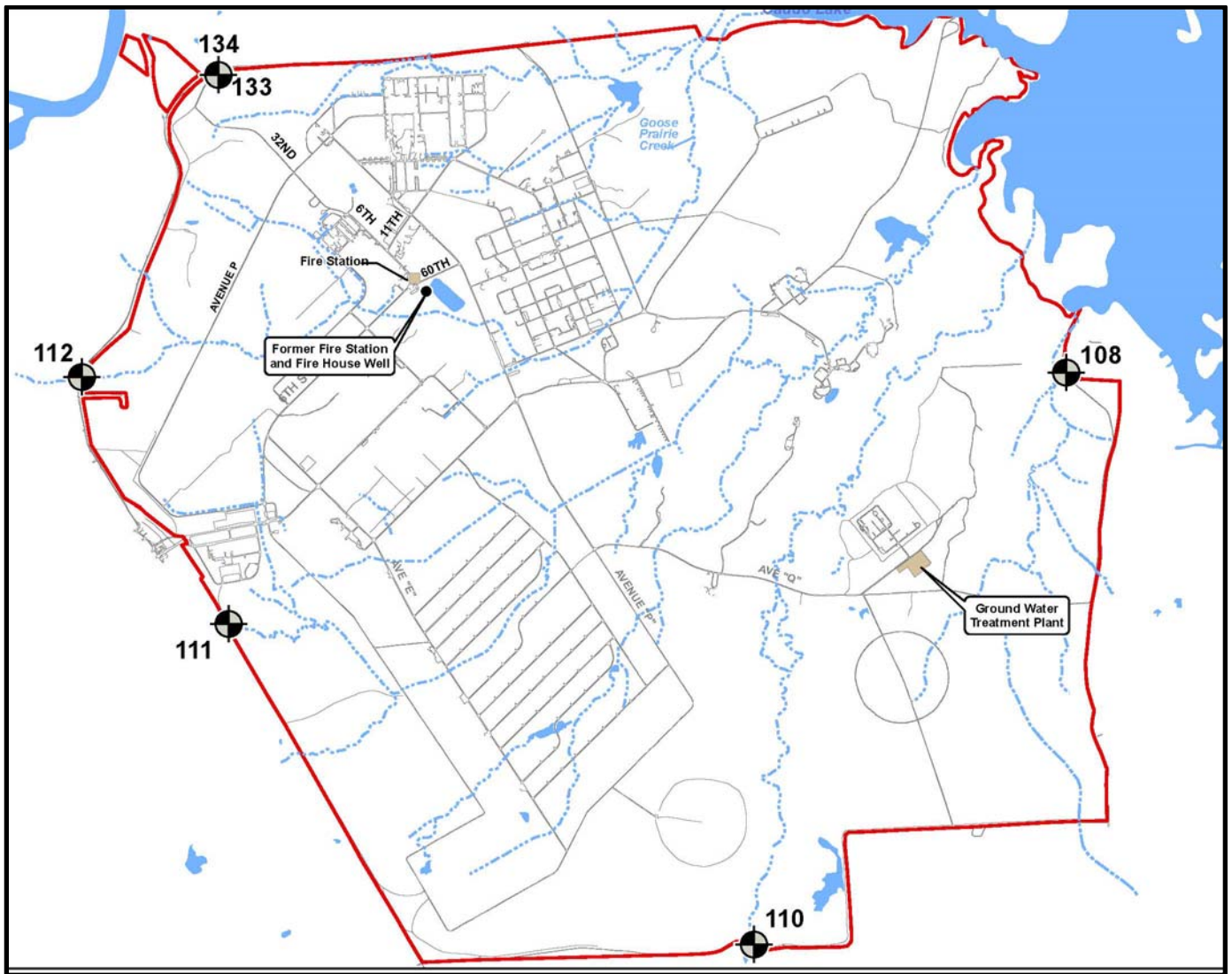
U – Non-Detect

Dry – Well Dry

NS – Not Sampled



Longhorn Army Ammunition Plant Map with Perimeter Well Locations



LHAAP-29 – TNT Production Area, Group 2

Site History

LHAAP-29 is an approximately 85 acre area, located in the west-central portion of the LHAAP (**Figure 1**). LHAAP-29 was used for the manufacturing of flake trinitrotoluene (TNT) from October 1942 to August 1945. From the end of World War II until the mid-1970s, tank 801-F at LHAAP-29 was used to bathe out-of-specification rocket motors using a methylene chloride (MC)-based industrial solvent.

Chemicals of Concern (COCs)

Numerous investigations have been conducted at LHAAP-29 to identify and quantify contamination from past site use in soil, groundwater, surface water, and sediment. Collectively these investigations identified perchlorate and explosive compounds as COCs in soil and volatile organic compounds (VOCs), mainly methylene chloride (MC), as COCs in Shallow and Intermediate Zone groundwater.

Supplemental Investigation 2014

A Supplemental Investigation was conducted in 2014 to address data gaps that remained after the RI/FS at the site was completed. The supplemental data will provide the basis for a Feasibility Study (FS) Addendum, a revised Proposed Plan, and a revised Record of Decision.

Conclusions

Based on the investigation results, the extent of explosives and perchlorate in shallow soil at the site are sufficiently defined. VOC results from 222 shallow soil samples further indicate that the likelihood of COC cross-contamination from shallow to deeper zones during a future proposed Intermediate Zone investigation (see Recommendations) is insignificant. The 2014 Supplemental Investigation also provided sufficient definition of the Shallow Zone groundwater VOC, perchlorate, and explosives plumes beneath LHAAP-29 to support the Final FS; therefore, no further investigation of Shallow Zone groundwater is required.

Based on Intermediate Zone groundwater sample results, the 2014 Supplemental Investigation defined the extent of the MC plume in Intermediate Zone groundwater at LHAAP-29. The MC plume is oval shaped and approximately 140 feet long by 80 feet wide. The supplemental data also indicate that MC concentrations attenuate rapidly with distance from the apparent source area near soil boring 29WW16, where dense non-aqueous phase liquid (DNAPL) is suspected. The extent of each of the COC plumes in Shallow Zone and Intermediate Zone groundwater at LHAAP-29 is shown in Figure 1 (NOTE: plume boundaries in the figure are dashed where inferred).

Recommendations

No additional sampling is recommended or necessary to support the FS Addendum, except in the vicinity of former building pad 812-F, where explosives were detected above cleanup levels in soil boring 29SG118. Therefore, additional soil sampling to define the lateral and vertical extent of explosives above the cleanup level in this area is recommended.

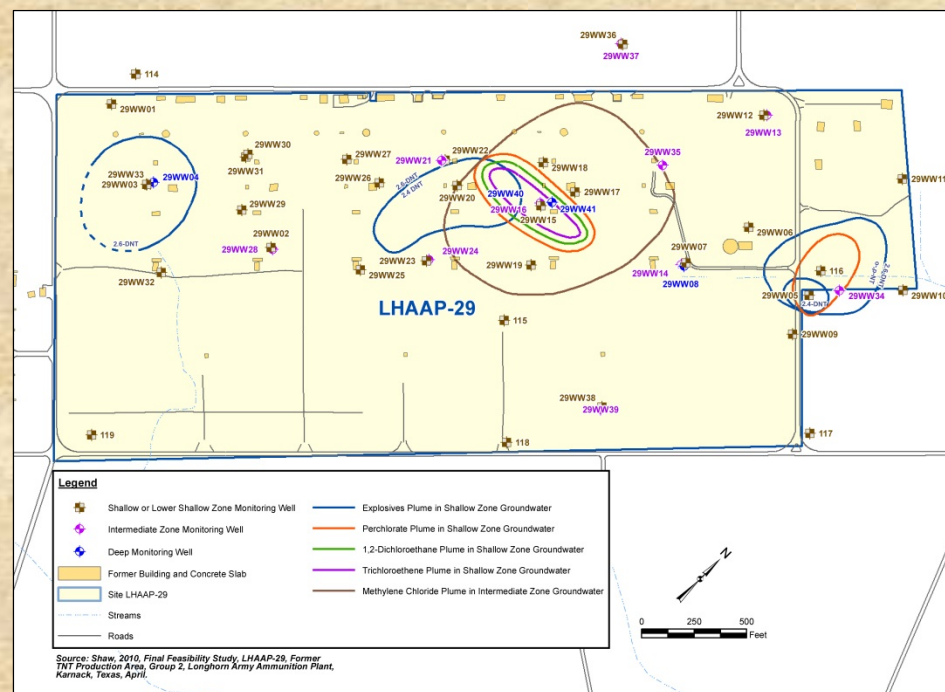


Figure 1: Extent of COC Plumes at LHAAP-29 in Shallow and Intermediate Zone Groundwater

1,4-Dioxane in Groundwater Samples from LHAAP DERP Sites

Site History

Longhorn Army Ammunition Plant (LHAAP) occupies 8,493 acres in the northeast corner of Harrison County, TX. LHAAP was established in October 1942 with the primary mission of producing 2,4,6-trinitrotoluene (2,4,6-TNT) flake and became inactive after the end of World War II. It was determined to be excess to the Army's needs and was closed in July 1997. An installation-wide RCRA Facility Assessment (RFA) identified 57 potential sites of concern, which were later reduced to 47 sites requiring RI/FS. Currently, 16 remaining sites are being actively addressed under the Environmental Restoration Program (ERP).

Site Remedial Investigations

Between 1980 and 2015, multiple investigations were conducted in a phased approach to evaluate the nature and extent of contamination in potentially affected environmental media at the LHAAP ERP sites. The target chemicals of concern (COCs) included volatile organic compounds (VOCs), heavy metals, perchlorate, and explosives in on-site groundwater, surface water, sediment and soil. A groundwater extraction system consisting of approximately 5,000 feet of interceptor-collection trenches (ICTs) and a groundwater treatment plant (GWTP) were installed in 1997 as an interim remedial action to control the migration of contaminated groundwater from LHAAP-18/24 and LHAAP-16.

1,4-Dioxane Investigations

Based on results from earlier sampling, 1,4-dioxane was not a target COC at Longhorn. However, the development of much lower screening criteria is driving a re-evaluation of its presence at key Longhorn sites. In 2013, and more recently in November/December 2015, sampling for 1,4-dioxane was performed at selected monitoring wells at 11 of the active sites (LHAAP-12, 16, 17, 18/24, 29, 35A [58], 35B [37], 46, 47, 50, and 67). 1,4-dioxane was also analyzed in groundwater at LHAAP 18/24 in 2014. Of the 11 sampled sites, the highest concentration of 1,4-dioxane (568 $\mu\text{g/L}$) was detected at LHAAP-18/24 during the August 2014 sampling event. The detected concentration ranges of 1,4-dioxane from the 2015 sampling events are shown at the sites where they occurred in Figure 1.

Potential Ecological and Human Health Risks of 1,4-Dioxane

1,4-Dioxane that is released to soil tends to migrate into groundwater and remains resistant to biodegradation. 1,4-Dioxane can also migrate in groundwater to surface water. However, 1,4-dioxane that is released to air breaks down into aldehydes and ketones within 1 to 3 days.

- Based on several toxicological studies of 1,4-dioxane, the U.S. EPA has identified 1,4-dioxane as a likely human carcinogen through exposure by ingestion, inhalation, and dermal contact. Short-term exposure may cause eye, nose and throat irritation; long-term exposure may cause kidney and liver damage.
- Based on U. S. EPA ECOTOX Report, 1,4-dioxane does not appear to be harmful to aquatic plants, fish, or other aquatic animals at levels currently found in the environment. Also, no impact of 1,4-dioxane on terrestrial plants has been documented.

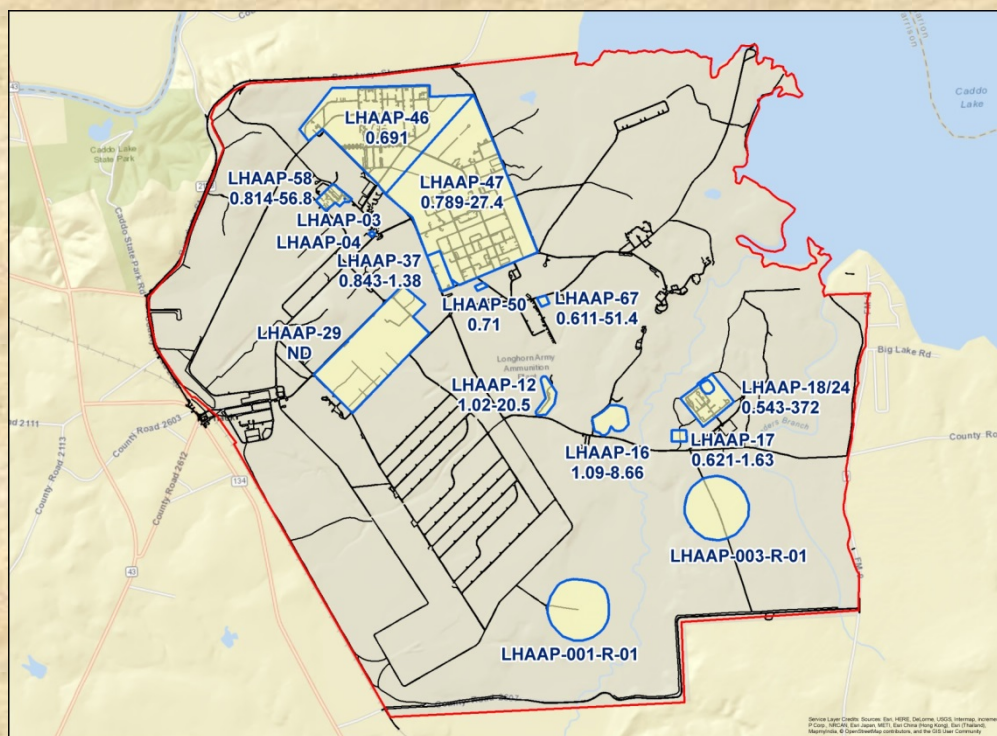


Figure 1: Ranges of 1,4-Dioxane Concentrations ($\mu\text{g/L}$) in Groundwater Samples from LHAAP Sites – November/December 2015