

**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:** July 21, 2016, 6:00 – 7:30 PM

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**Meeting Participants:**

**LHAAP/BRAC:** Rose M. Zeiler

**USACE:** Aaron Williams, Richard Smith

**USAEC:** Nicholas Smith

**AECOM:** Marwan Salameh, Steve Katz, Debra Richmann

**USEPA Region 6:** Rich Mayer, Janetta Coats

**USFWS:** Paul Bruckwicki

**RAB:** **Present:** Paul Fortune, Carol Fortune, Nigel R. Shivers, Terry Britt, Judy VanDeventer  
**Absent:** Ken Burkhalter, Robert Cargill, Charles Dixon, Lee Guice, Ted Kurz, James Lambright, Richard Le Tourneau, Tom Walker, John Pollard, Jr.

**Public:** Dan Murphy, Dawn Orsak

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An agenda for the RAB meeting, three handouts (Groundwater Treatment Plant [GWTP] – Processed Groundwater Volumes, Harrison Bayou and Goose Prairie Creek – Perchlorate Data, and LHAAP Perimeter Well Monitoring – Perchlorate Data), two Fact Sheets (LHAAP-16 Landfill 16 Remedial Design Update, and LHAAP-17 Burning Ground No. 2/Flashing Area Group 2 Remedial Design Update), 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**

Mr. Paul Fortune, RAB Co-Chair, called the meeting to order and turned it over to Dr. Rose Zeiler. Dr. Zeiler noted that the attendance was low again and asked Mr. Fortune if he had any ideas why. Mr. Fortune said he didn't know, but speculated that maybe people didn't know about it. He also noted that as time passes, fewer people remember the ammunition plant, so overall interest may be decreasing.

Ms. Carol Fortune said that she received one of the letters from AECOM with the RAB meeting notice that were mailed to churches in Karnack. However, she said it didn't arrive until Tuesday – only 2 days before the RAB, so there wasn't any time to spread the word at the church. Ms. Debra Richmann said she was surprised, because the notices were mailed to the churches over a week before the RAB meeting. Ms. Fortune said mail delivery is slow and in the future, mailings should be sent at least 3 – 5 days earlier. Ms. Richmann said AECOM will do that for the next RAB meeting.

## **Open Items - Dr. Rose M. Zeiler**

### ***RAB Administrative Issues***

#### Minutes

Dr. Zeiler asked the RAB members if anyone wanted to make a motion to approve the minutes from the April 2016 RAB meeting. Ms. Fortune made a motion to accept the July 2016 minutes and Ms. Judy VanDeventer seconded the motion. The approved July 2016 RAB minutes will be posted on the LHAAP website.

#### Website Update

Ms. Richmann said that the website was updated prior to the RAB meeting with July meeting agenda, and the RAB meeting location was changed back to the community center. The website was also updated with recently completed field activities. Dr. Zeiler said there are also upcoming field activities that should be posted.

#### Other Issues

Dr. Zeiler and Mr. Rick Smith discussed the period of performance remaining on the current performance-based remediation (PBR) contract with AECOM. The contract ends on 9/30/17, however, Mr. Smith said that the outstanding major documents are due before December 1, 2016. The groundwater treatment plant and other operations will continue to the end of the contract (through September 2017), with the new contract picking up without any interruption. Dr. Zeiler said the Army is focusing on LHAAP-18/24, because it is the most contaminated site and a priority for remedial action. LHAAP-29 is another high priority site where the schedule is being accelerated to complete as many milestones as possible before the December 1<sup>st</sup> cutoff.

There was some discussion with Mr. Fortune and other attendees about what firm might be awarded the next PBR contract. Mr. Fortune asked if Shaw might be returning and Mr. Smith responded that he has no way of knowing; the new PBR contract will be awarded based on Best Value and there are no restrictions on who can propose on it. In response to a question, Dr. Zeiler said it is possible that AECOM could propose on and win the contract, but the selection will be determined based on evaluation of all the proposals that are submitted. Mr.

Smith added that the plan is to have the new PBR contract awarded by July 2017, to allow for an adequate transition period.

## **Site-wide Environmental Restoration Issues – Dr. Zeiler**

### *Dispute Update*

Dr. Zeiler discussed the status of the disputed RODs with input from Mr. Rich Meyer. It is expected that some of the RODs will be finalized soon. Two of the disputed ROD sites are LHAAP-16 and LHAAP-17; Ms. Richmann went over the remedial designs and status of these sites, which are summarized in the presentation slides and fact sheets for each site. Seven remedial alternatives were developed and evaluated to address landfill waste/contaminated soil and groundwater at LHAAP-16. Alternative 7 was selected and includes maintenance of the existing landfill cap, land use controls, and in-situ enhanced bio-remediation, passive bio-barriers, and monitored natural attenuation for volatile organic compounds and perchlorate in groundwater. Dr. Zeiler asked Dr. Marwan Salameh to explain how the bio-barriers and in-situ treatment work, which he did. Dr. Zeiler stated that although these remedies were selected in the pre-dispute Proposed Plan, the fundamental design is not expected to change when the revised ROD is signed. Ms. Richmann also reviewed the remedial design for LHAAP-17. For this site, four alternatives were evaluated and Alternative 4 was selected. Alternative 4 includes excavation and off-site disposal of soil contaminated with perchlorate and explosives; and extraction, land use controls, and monitored natural attenuation for groundwater contaminated with volatile organic compounds and perchlorate. Dr. Zeiler explained that groundwater extraction is needed to reduce contaminant concentration in the groundwater remaining in place to levels low enough that monitored natural attenuation will be effective. For perchlorate, the goal is to be able to convert to MNA in about a year and a half. Mr. Terry Britt asked if there is adequate groundwater flow at this site to move the contaminants. Dr. Zeiler said that we think so, but will find out soon.

The remedial actions for the other two disputed ROD sites, LHAAP-001-R-01, the South Test Area/Bomb Test Area; and LHAAP-003-R-01, the Ground Signal Test Area, were also discussed by Dr. Zeiler and Ms. Richmann. The main remedial technology for both sites is land use controls with limited groundwater sampling for perchlorate – three annual rounds at LHAAP-001-R-01 and a single round at LHAAP-003-R-01. Dr. Zeiler said that because the sampling will be performed over a 3-year period, it will be conducted under the next PBR contract. One of the attendees said several bombs were found in the area. Dr. Zeiler said that munitions had been removed previously from LHAAP-001-R-01 and the site was cleared, and no munitions were found at LHAAP-003-R-01. However, Mr. Aaron Williams noted that clearance doesn't provide 100% certainty that munitions are not present. Mr. Mayer added that there are land use controls in place that prohibit digging at the site and Dr. Zeiler agreed and added there are also signs posted at the site.

When the dispute impacted sites were discussed, Dr. Zeiler stated that because of the limited time remaining to complete milestones under the current contract, the Army is focusing on completing the RODs for the simpler of these sites. She said that as a result, the Army will

move forward with LHAAP-04, but postpone LHAAP-03 until the next contract because it is relatively more complex.

### ***Ongoing Outreach – Notifications for July RAB Meeting***

Ms. Richmann reviewed the outreach activities listed in the presentation slide, which included the activities done for the previous RAB meeting, except we were not allowed to put a notice at the Post Office as we had done previously. Ms. Richmann explained when Mr. Scott Beesinger tried to post the notice, he was told he could not because of a new Post Office policy that had taken effect. Mr. Fortune said that was the first he'd heard of it and Ms. VanDeventer and Ms. Fortune said they would look into the reason for the change. As already mentioned, we also mailed notice to churches we identified, which will be mailed earlier for the next RAB meeting. Ms. Richmann said she could provide a list of those churches to Ms. VanDeventer and Ms. Fortune to see if we are missing any.

### ***1,4-Dioxane Confirmation Sampling at LHAAP-18/24***

Ms. Richmann provided a brief recap of the initial round of 1,4-dioxane sampling at LHAAP-18/24, which was performed in December 2015. She said the purpose of the second round of sampling performed in June 2016 was to confirm the first round results and determine if a contingency remedy for 1,4-dioxane in groundwater will be needed. In June, a total of 53 monitoring wells at the site were sampled. The results are not yet available, but are planned to be presented at the October RAB meeting.

### **Defense Environmental Restoration Program (DERP) Update – AECOM (Debra Richmann)**

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

Ms. Richmann provided an overview of the current status of the MNA sites at LHAAP. Since the last RAB, the Final RACR for LHAAP-50 was approved and the Year 2 RA-O reports for LHAAP 46 and LHAAP-58 became final. She also noted that groundwater monitoring is going on at all of the sites except LHAAP-37, and sampling there will be commencing shortly. Dr. Zeiler added that at LHAAP-37, the Army is waiting for groundwater to return to baseline conditions, following the Bio-Plug testing, before beginning the quarterly MNA monitoring.

#### ***LHAAP-29 Update***

Ms. Richmann updated the current status of LHAAP-29, indicating that the Draft RI Addendum has now been reviewed by TCEQ and EPA, and responses to the agency comments are being prepared.

### LHAAP-18/24 Update

Ms. Richmann updated the current status of LHAAP-18/24, indicating that the data gap investigation has now been completed. The results will be presented in a revised and updated addendum to the final LHAAP-18/24 Post-Screening Investigation (PSI) Report.

### Groundwater Treatment Plant (GWTP) Update

Dr. Salameh provided an update on the LHAAP GWTP operations. He indicated that the cause of previous sporadic concentrations of perchlorate that were above the discharge limit in FBR effluent samples has been investigated and perchlorate exceedances are no longer occurring. Ms. VanDeventer asked about samples with the high concentrations. Dr. Salameh explained that under normal conditions, the GWTP is operated continuously; however, while the blower on the air stripper was down and being replaced, contaminated groundwater was treated in batches as opposed to continuously, and the bacteria have to adjust to each new batch. The basic cause of the perchlorate excursions was found to be insufficient nutrients to support the bacteria. Once that was adjusted, the excursions ceased and perchlorate has not been detected in effluent samples collected through June 20<sup>th</sup>. Ms. VanDeventer responded that we're getting back to good operation and Dr. Salameh confirmed that. Dr. Zeiler also confirmed that no water was discharged during the time the effluent concentrations exceeded the discharge limits. Dr. Salameh added that we typically can't discharge to the creek this time of year due to the low flows.

Dr. Salameh described the monthly treated groundwater volume graph. He noted that based on the most recent data, the treated water volumes have returned to normal after the blower on the air stripper was replaced.

### Surface Water and Perimeter Well Sampling Update

Ms. Richmann showed the slides with the surface water and perimeter well sampling locations. Perchlorate was not detected in any of the samples collected in May 2016 from Harrison Bayou. A trace amount was detected in the sample from GPW-3, but the highest concentration was detected in sample GPW-1. Although the concentration is higher than perchlorate concentrations in samples from GPW-1 since August 2011, it is still well below the screening criteria (residential groundwater PCL of 17 µg/L). Dr. Salameh said there is no readily apparent explanation for this increased concentration, but the result is valid; future sampling should reveal if there is any developing trend. Ms. Richmann said that groundwater samples were collected in June from the perimeter wells that are sampled semiannually (133 and 134). Results will be discussed at the next (October 2016) RAB meeting.

### **Next RAB Meeting Schedule and Closing Remarks**

The next RAB meeting will be held on **October 20, 2016** at the same time (**6:00 – 7:30 p.m.**) at the Karnack Community Center.

- Mr. Fortune introduced Mr. George Rice, who is an advisor to the RAB and asked him to comment on the information presented during the RAB meeting. He said he thought it was good and he's just coming up to speed. He was particularly interested in LHAAP-16 – he said the approach seems reasonable, but he would like to see the cleanup documents themselves, considering the cleanup time is projected to be a couple of centuries. Dr. Zeiler said there are two types of remedies for groundwater at the site – MNA and active remedial technologies. Mr. Williams added that there is an active source at the landfill, which Dr. Zeiler identified as most likely residual DNAPL. Mr. Rice asked about seep sampling at LHAAP-16, and said that past sampling had detected contaminants. Dr. Zeiler said that's why the Army selected the residential cleanup levels as the surface water screening criteria and designed the Bayou bio-barrier. The Army doesn't have any recent data on seeps, but is collecting surface water samples from Harrison Bayou regularly and COCs have not been detected. Mr. Rice asked about the schedule for the RD document – Dr. Zeiler said it would be 1-2 months before it is sent to EPA and TCEQ. Mr. Mayer said he would talk to Ms. Janetta Coates to see if Mr. Rice could get access to review the documents.
- Dr. Zeiler says she has some old photos from the 1940s and will bring them for the next meeting.
- Ms. Fortune asked if a letter should be sent to the RAB members, asking if they want to remain on the RAB; if they don't respond, they should be dropped from the membership roster. She added that a lot of RAB members haven't attended a meeting in years. She said that Ms. Judith Johnson should be removed because she is moving into an assisted living facility soon, and Mr. Robert Cargill should be removed because he now lives in Dallas. The other RAB members present agreed. Dr. Zeiler said she will look into getting a letter drafted.

### **Miscellaneous**

- A request was made to Ms. Richmann to add an item to the agenda for the next RAB to vote on starting the meetings 30 minutes later. This is because several of the active RAB members are also members of the Water Board, which meets the third Thursday of the month and meets from 5:30 – 6:30, so overlaps with the RAB meeting time from 6:00 – 7:30. Ms. Richmann said she would add the item to the October RAB meeting agenda.

**Adjourn** – Motion to adjourn was made by Ms. VanDeventer and seconded by Ms. Fortune.

### **July 2016 Meeting Attachments and Handouts:**

- Meeting Agenda
- PowerPoint Presentation Slides
- Groundwater Treatment Plant [GWTP] – Processed Groundwater Volumes Handout
- Harrison Bayou and Goose Prairie Creek – Perchlorate Data Handout
- LHAAP Perimeter Well Monitoring – Perchlorate Data Handout
- LHAAP-16 Landfill 16 Remedial Design Update Fact Sheet
- LHAAP-17 Burning Ground No. 2/Flashing Area Group 2 Remedial Design Update Fact Sheet

## Acronyms

AECOM	AECOM Technical Services, Inc.
BRAC	Base Realignment and Closure
COC	Contaminant of Concern
DERP	Defense Environment Response Program
DNAPL	Dense Non-Aqueous Phase Liquid
FBR	Fluidized Bed Reactor
GWTP	Groundwater Treatment Plant
LHAAP	Longhorn Army Ammunition Plant
MNA	Monitored Natural Attenuation
PBR	Performance-Based Remediation
PCL	Protective Concentration Level
PSI	Post-Screening Investigation
RAB	Restoration Advisory Board
RACR	Remedial Action Completion Report
RA-O	Remedial Action Operations
RI	Remedial Investigation
ROD	Record of Decision
TCEQ	Texas Commission on Environmental Quality
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



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

**AGENDA**

**DATE:** Thursday, July 21, 2016  
**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 (April 2016 RAB meeting)
  - Website
- 06:15** Sitewide Environmental Restoration Issues {RMZ}
- Dispute Sites Update
    - LHAAP-16 Remedial Design (Fact Sheet)
    - LHAAP-17 Remedial Design (Fact Sheet)
  - Ongoing Outreach - Public Notification Efforts for the July 2016 RAB
  - 1,4-Dioxane Confirmation Sampling at LHAAP-18/24 (June 2016)
- 06:35** Defense Environmental Restoration Program (DERP) Update {AECOM}
- MNA Sites Update
  - LHAAP-29 Update
  - LHAAP-18/24 Update
  - CERCLA Progress Chart 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 July 21, 2016**

A faint, light green graphic of a leafy branch is positioned on the right side of the slide, partially overlapping the main text area. The background of the slide is a gradient from light blue on the left to light green on the right.

AECOM Environment

# Agenda

## AGENDA

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  - CERCLA Progress Chart 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}

# Open Items

- RAB Administrative Issues
- Minutes from April 2016 RAB Meetings
- Website Update

# Ongoing Outreach - Notifications for July RAB Meeting

- Published RAB Meeting Announcement in Marshall News Messenger on Saturday, July 9th
- Requested the following radio stations to air July RAB Meeting Public Service Announcement (PSA):
  - KMHT Radio 103.9 (Karnack)
  - 98 Rocks (Alpha Media, Shreveport) and
  - Kiss Country 93.7 (Town Square Media, Shreveport)
- Requested PSA to be placed on KTBS Channel 3 and KTAL Channel 6 TV Community/Local Events Calendar
- Sent RAB announcement/agendas by email or USPS to individual RAB members and other interested parties
- Posted RAB Meeting Fliers at multiple locations in the community:
  - Shady Glade Café, Caddo Grocery, Fyffes Corner Store, Caddo Lake State Park, Circle S Grocery, Run In Grocery, Family Dollar Store, Karnack Post Office\*, Convenience Store at FM9 and FM199
- Mailed RAB announcement to churches located in Karnack (identified from [www.yellowpages.com](http://www.yellowpages.com))

\* New policy in effect that did not allow posting of the July RAB meeting notice at the Karnack Post Office, as planned.

# 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](http://www.longhornaap.com)
  - Make suggestions for improving communication – the Army welcomes and appreciates community feedback

## Minutes from Past RAB Meetings

- Discussion of April 2016 RAB Meeting Minutes/Motion to accept

# Website Update



# Longhorn Army Ammunition Plant

Environmental Restoration Program

The next RAB meeting will be Thursday, July 21, 2016 from 6:00-7:30PM at the Karnack Community Center, Karnack, Texas [Click on Calendar for Meeting Agenda and Details.](#)

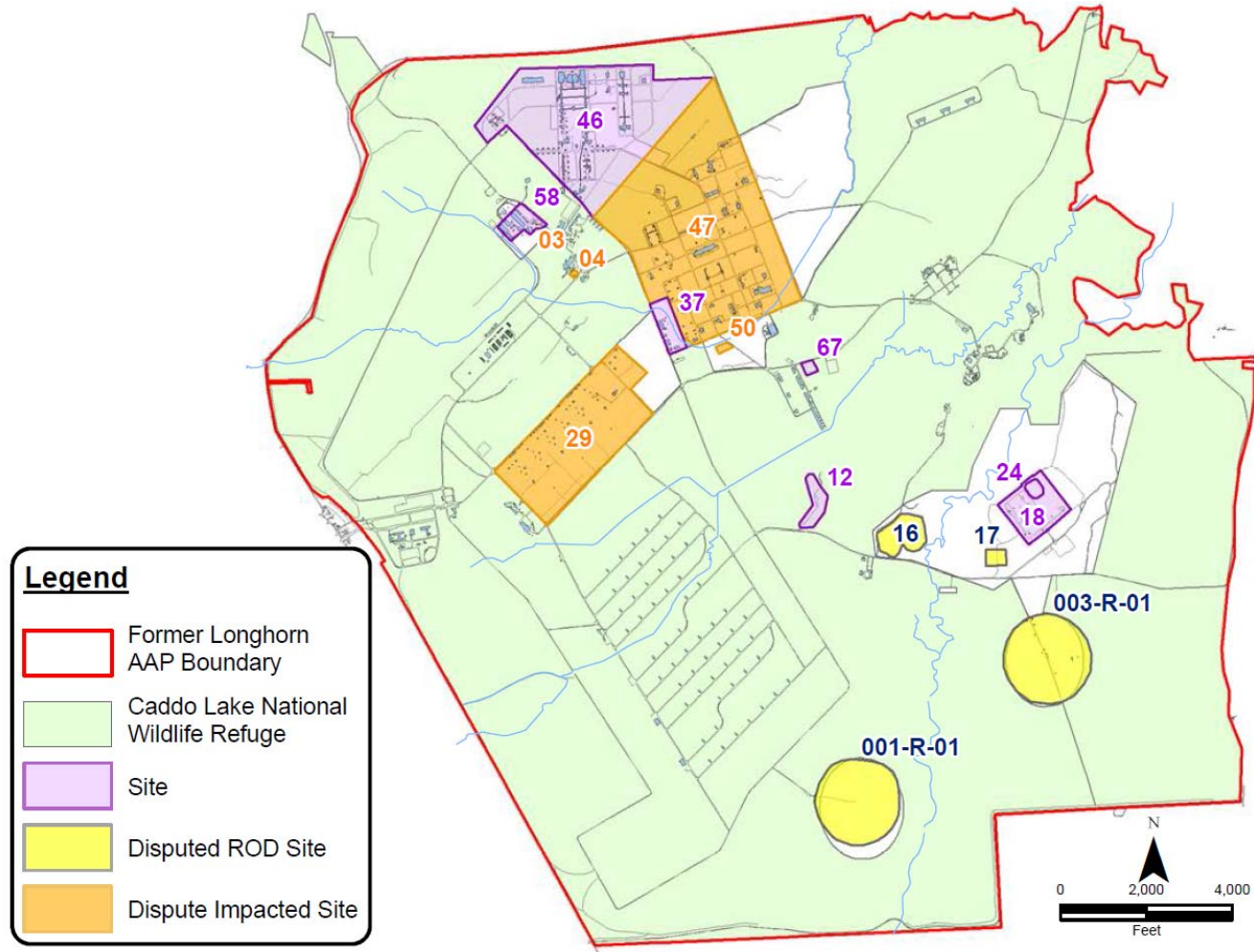
# Site-wide Environmental Restoration Issues

## 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



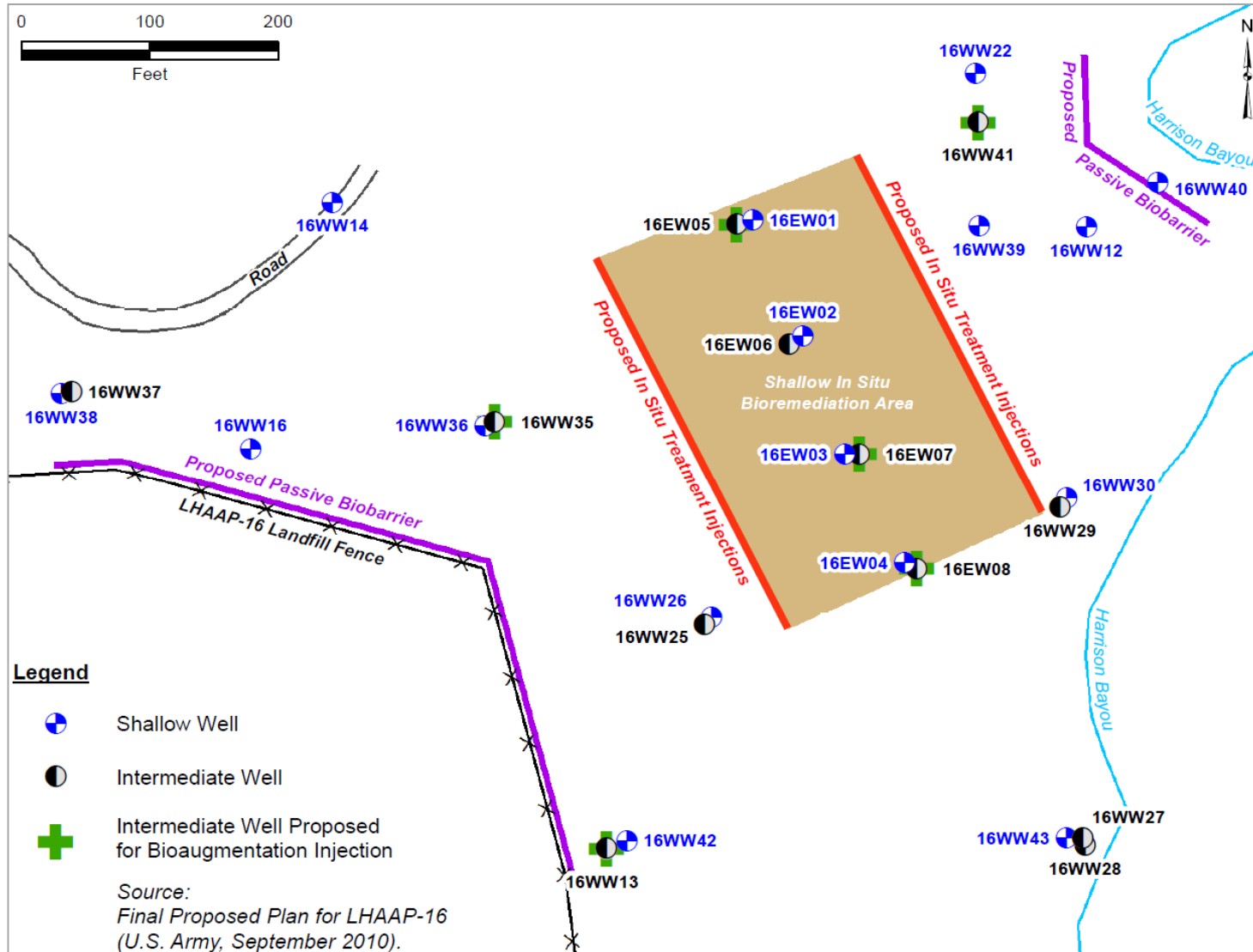
# Longhorn Performance-Based Remediation Sites Map



# Disputed Sites Update

- Disputed Record of Decision (ROD) Sites
  - LHAAP-16 – Landfill 16: Draft Revised ROD undergoing EPA/TCEQ review
    - ✓ Draft Revised Remedial Design/Remedial Design Work Plan (RD/RDWP) completed and currently undergoing Army review
    - ✓ Basis for LHAAP-16 Remedial Design is **Alternative 7 - Maintenance of Landfill Cap, LUC, In-Situ Enhanced Bio-remediation, Passive Bio-barriers, and MNA**, which is the Selected Alternative presented in the LHAAP-16 Proposed Plan
    - ✓ A **Fact Sheet** that summarizes the site history, environmental conditions, and the remedial alternatives development, evaluation, and selection process under CERCLA is available at the sign-in table

# LHAAP-16 Selected Remedial Alternative 7 - Maintenance of Landfill Cap, Land Use Controls, In-situ Enhanced Bio-Remediation, Passive Bio-barriers, and Monitored Natural Attenuation



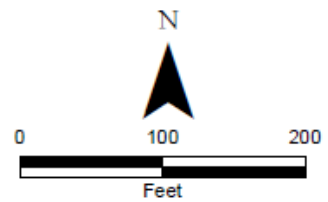
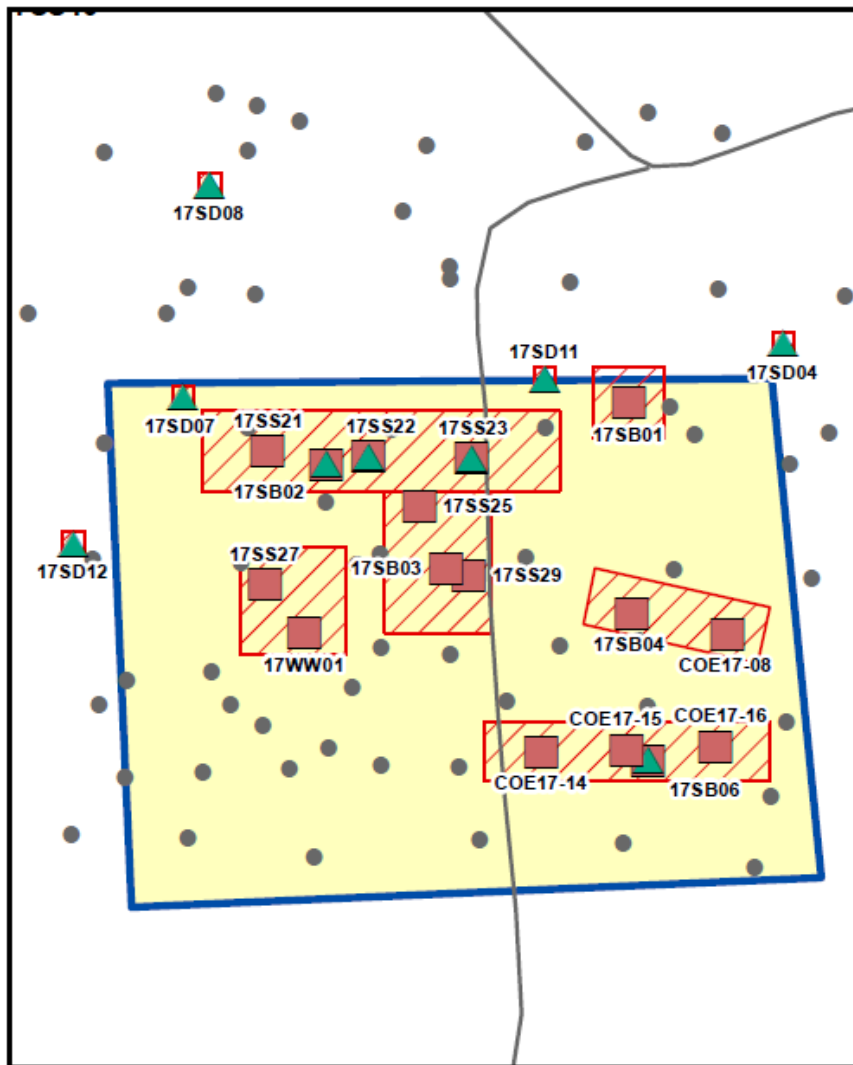
# Disputed Sites Update (continued)

- Disputed ROD Sites

- LHAAP-17 – Burning Ground No. 2/Flashing Area

- ✓ Draft Revised Remedial Design/Remedial Design Work Plan in preparation
- ✓ Basis for LHAAP-17 Remedial Design is **Alternative 4 - Excavation and Off-site Disposal of Soil, Groundwater Extraction, Monitored Natural Attenuation, and Land Use Control for groundwater**, which is the Selected Alternative presented in the LHAAP-17 Proposed Plan
- ✓ A Pre-Design Investigation will be performed before the detailed remedial design for Alternative 4 can be completed. The pre-design investigation will include soil sampling to fully define the limits of contaminated soil for excavation and off-site disposal, and groundwater pump testing to support design of the groundwater extraction system.
- ✓ A **Fact Sheet** that summarizes the site history, environmental conditions, and the remedial alternatives development, evaluation, and selection process under CERCLA is available at the sign-in table

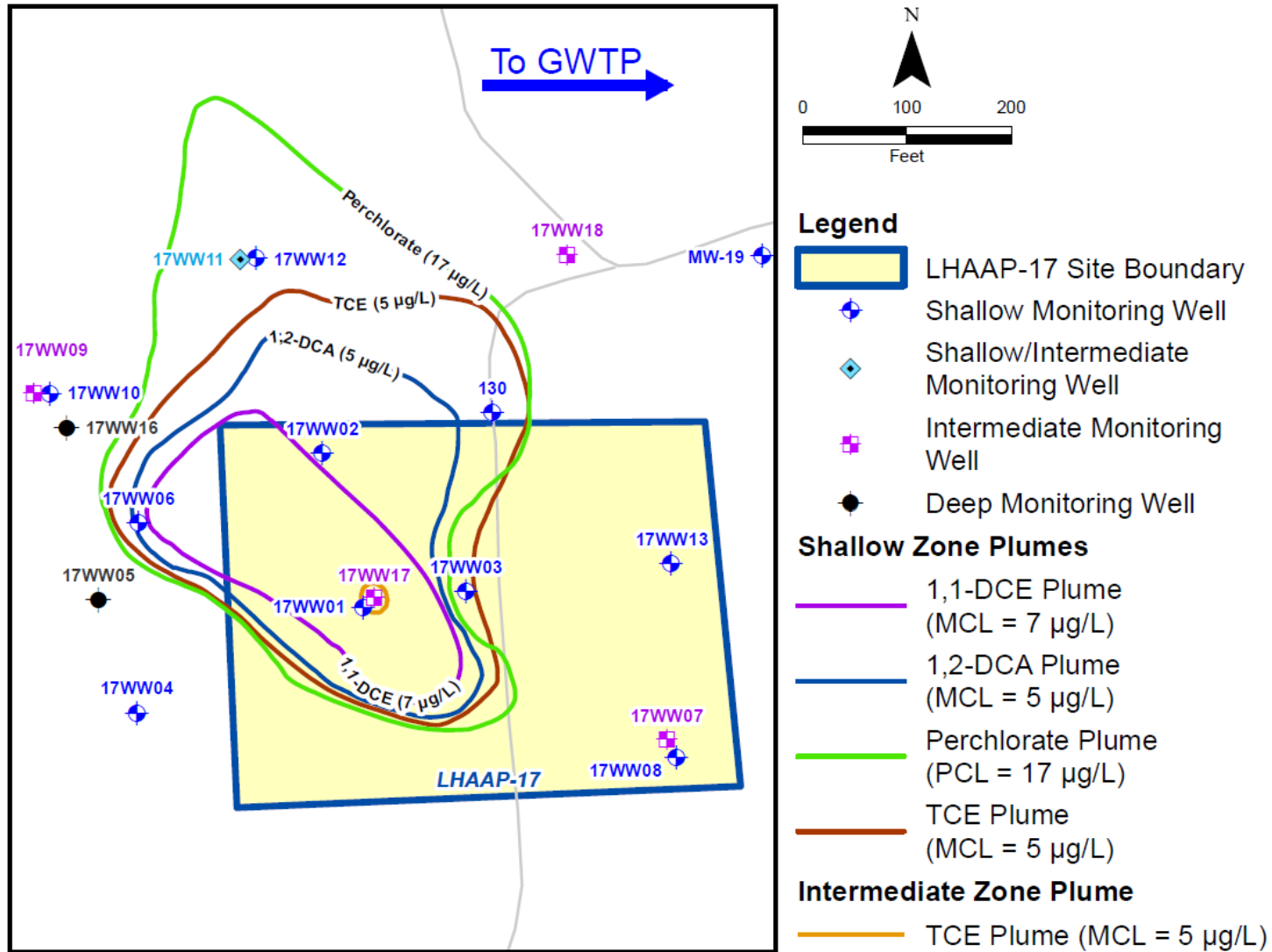
# LHAAP-17 Extent of Contaminated Soil and Proposed Excavation Areas



- Legend**
- LHAAP-17 Site Boundary
  - Proposed Excavation Areas
  - Sample Location with Contamination that Poses Ecological Risk.
  - Sample Location with Contamination that Poses Ecological and Human Health Risk
  - Sample Location with Contamination that Poses Human Health Risk
  - Soil Sample Location not Posing a Risk

Note:  
Soil COCs are explosives and percholate,  
and chemicals of potential ecological concern  
(COPECs) are explosives, dioxin, and barium.

# LHAAP-17 Extent of VOC and Perchlorate Plumes in Groundwater



## Disputed Sites Update (continued)

- Disputed ROD Sites
  - LHAAP-001-R-01 – South Test Area/Bomb Test Area
  - LHAAP-003-R-01 – Ground Signal Test Area

# Disputed Sites Update (continued)

- 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



## 1,4-Dioxane Confirmation Sampling at LHAAP-18/24 (June 2016)

- RECAP:
  - In Dec 2015, groundwater samples were collected from 66 monitoring wells and 7 ICTs at LHAAP-18/24 to evaluate extent of 1,4-dioxane. 1,4-dioxane was detected (>1 ug/L) in 40 samples. The detected concentrations exceeded the Texas Risk Reduction Program Protective Concentration Limit (PCL) for residential groundwater (of 9.1 ug/L) in samples from 6 wells (120, 18CPTMW23, AWD-1, MW-12, MW-14, and MW-16) and 4 ICTs (ICT-12E, 13A, 13B, and 14B)
- In June 2016, a total of 52 monitoring wells at LHAAP-18/24 were re-sampled for 1,4-dioxane and one new monitoring well (18WW26SW) was sampled
- Sample results will determine the need for groundwater contingency remedies for 1,4-dioxane at LHAAP-18/24
- Analytical results from the June sampling event will be presented at the next (October 2016) RAB meeting

# 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) and 67
  - Monitoring wells were installed at LHAAP-37 and 67 in April/May to facilitate completion of RACRs; scheduled to submit RACRs to EPA and TCEQ this month
- Year 1 Remedial Action Operation (RA-O) reports for all sites except LHAAP-35B(37) are drafted; reports for LHAAP-46, LHAAP-50 and LHAAP-58 are final
- Year 2 RA-O reports for LHAAP-50 and LHAAP-67 are drafted; reports for LHAAP-46 and LHAAP-58 are final
- Quarterly/Semi-Annual Groundwater Monitoring is ongoing (all sites except LHAAP-35B (37) – four rounds of quarterly sampling to begin soon)

## 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 EPA and TCEQ and responses to comments are currently being drafted. The supplemental sampling results achieved the following objectives:
  - Confirmed the extent of methylene chloride DNAPL in the Intermediate Zone groundwater
  - Confirmed the extent of VOC, perchlorate, and explosives contamination in the Shallow Zone groundwater
  - Determined there is no continuing source of VOC contamination in site soil
  - Characterized physical properties (resistivity, hydraulic conductivity, etc.) and microbial activity in Intermediate Zone to support FS

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

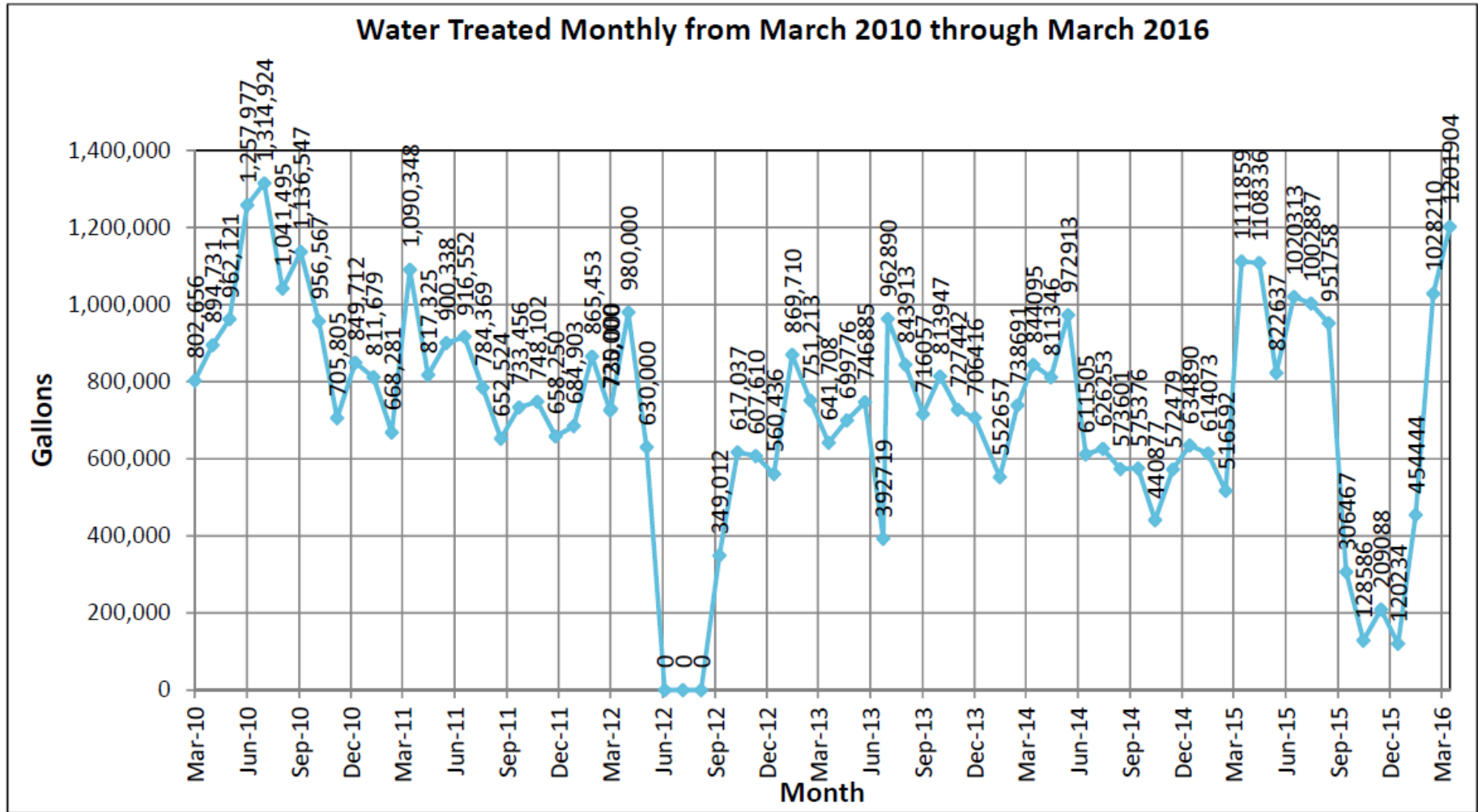
To evaluate remedy alternatives for LHAAP-18/24, a Revised FS is being prepared:

- In addition to groundwater confirmation sampling for 1,4-dioxane, semi-annual sampling for VOCs, perchlorate, total metals (varies by well) was completed in June 2016
- The data gap investigation at LHAAP-18/24 has been completed:
  - DPT soil sampling at 17 locations and analysis for VOCs and perchlorate
  - Installation of seven additional monitoring wells (three screened in the Shallow Zone and four in the Wilcox Fm.), with soil samples collected from well borings to create a vertical profile of VOCs and perchlorate in the unsaturated zone
- Above information will be used to prepare the Revised FS for LHAAP-18/24, including contingency remedies for 1,4-dioxane, if necessary

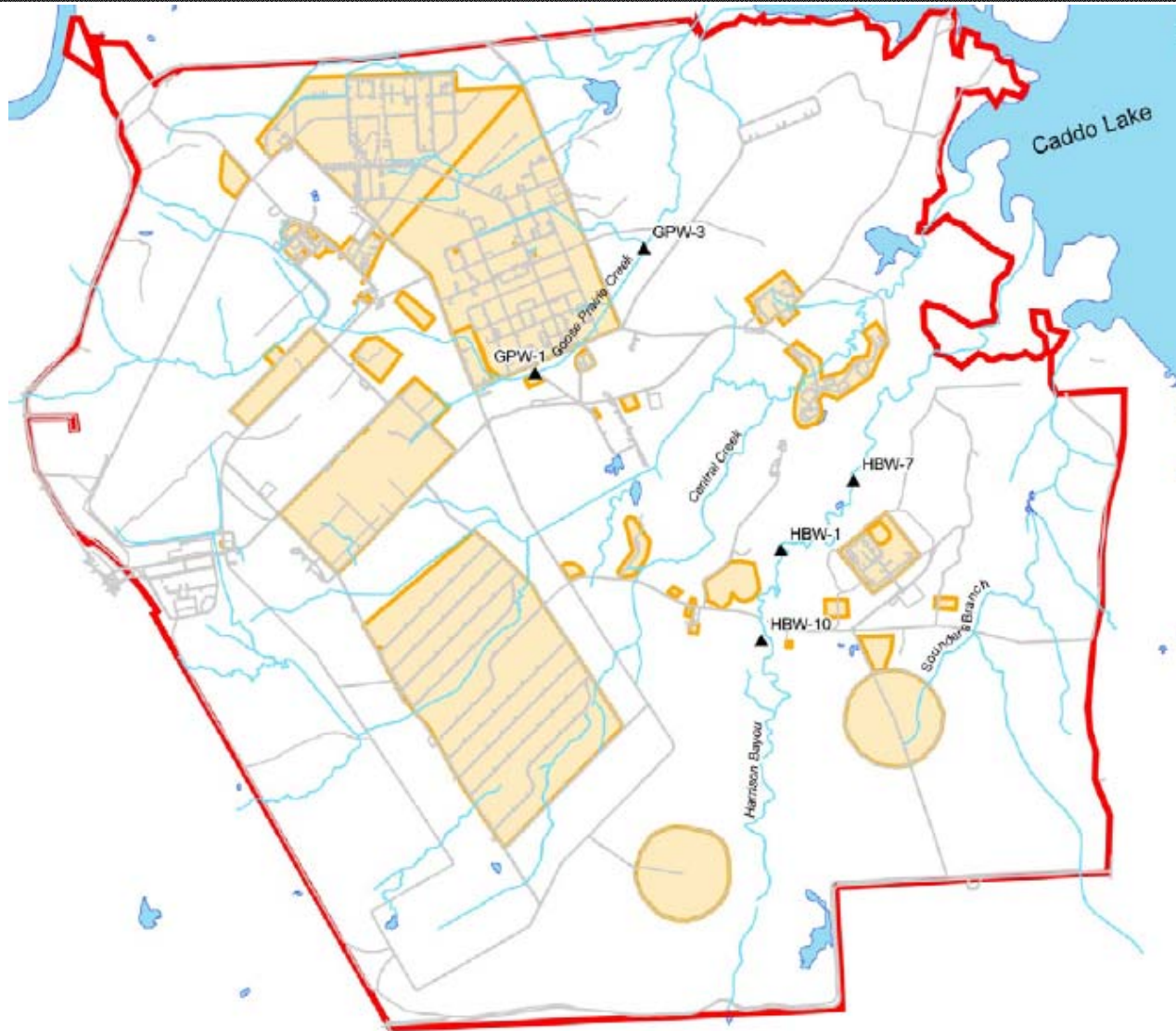
# Groundwater Treatment Plant (GWTP) Update

- 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 on-going. Repairs to the air stripper blower were completed in January 2016.
- The FBR had a number of instances of perchlorate above the effluent limit from January to May 2016. The treated water was released to the burning grounds (no discharge to Harrison Bayou). Potential causes for these excursions were investigated and addressed; weekly effluent samples were collected beginning May 16<sup>th</sup> – perchlorate concentrations have been ND through June 20<sup>th</sup>.

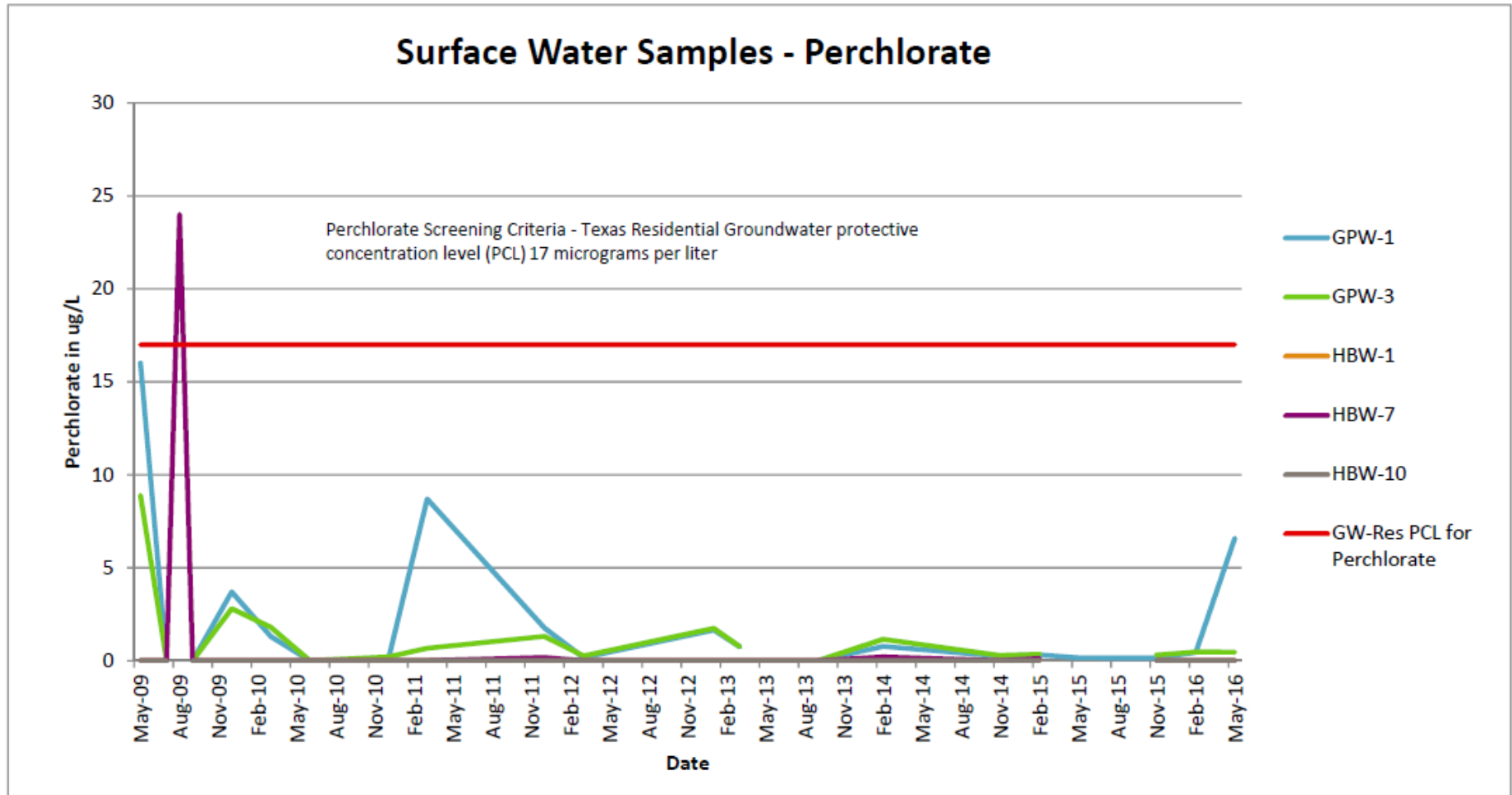
# GWTP Update (continued)



# Surface Water Sampling Locations



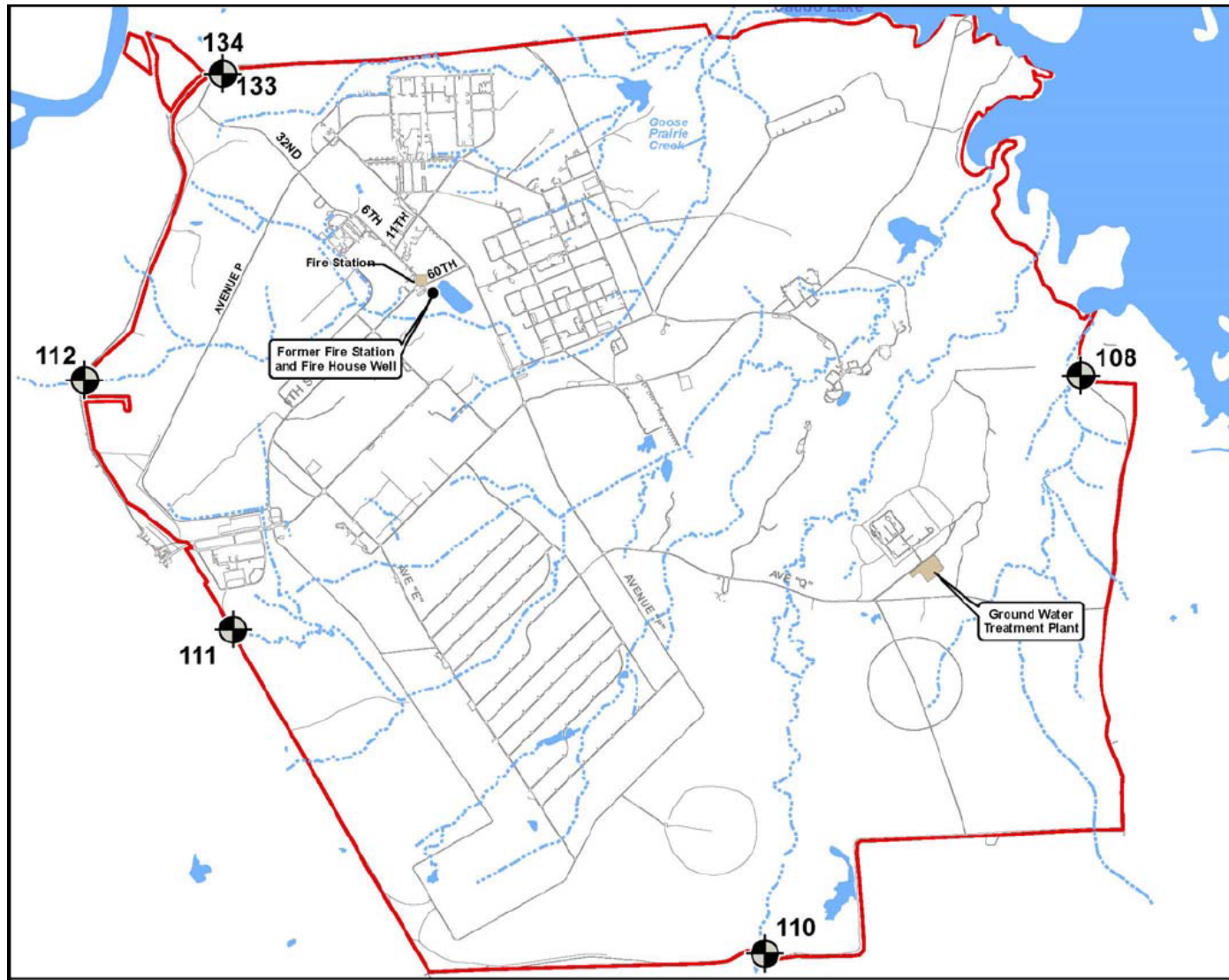
# Surface Water Sampling Update



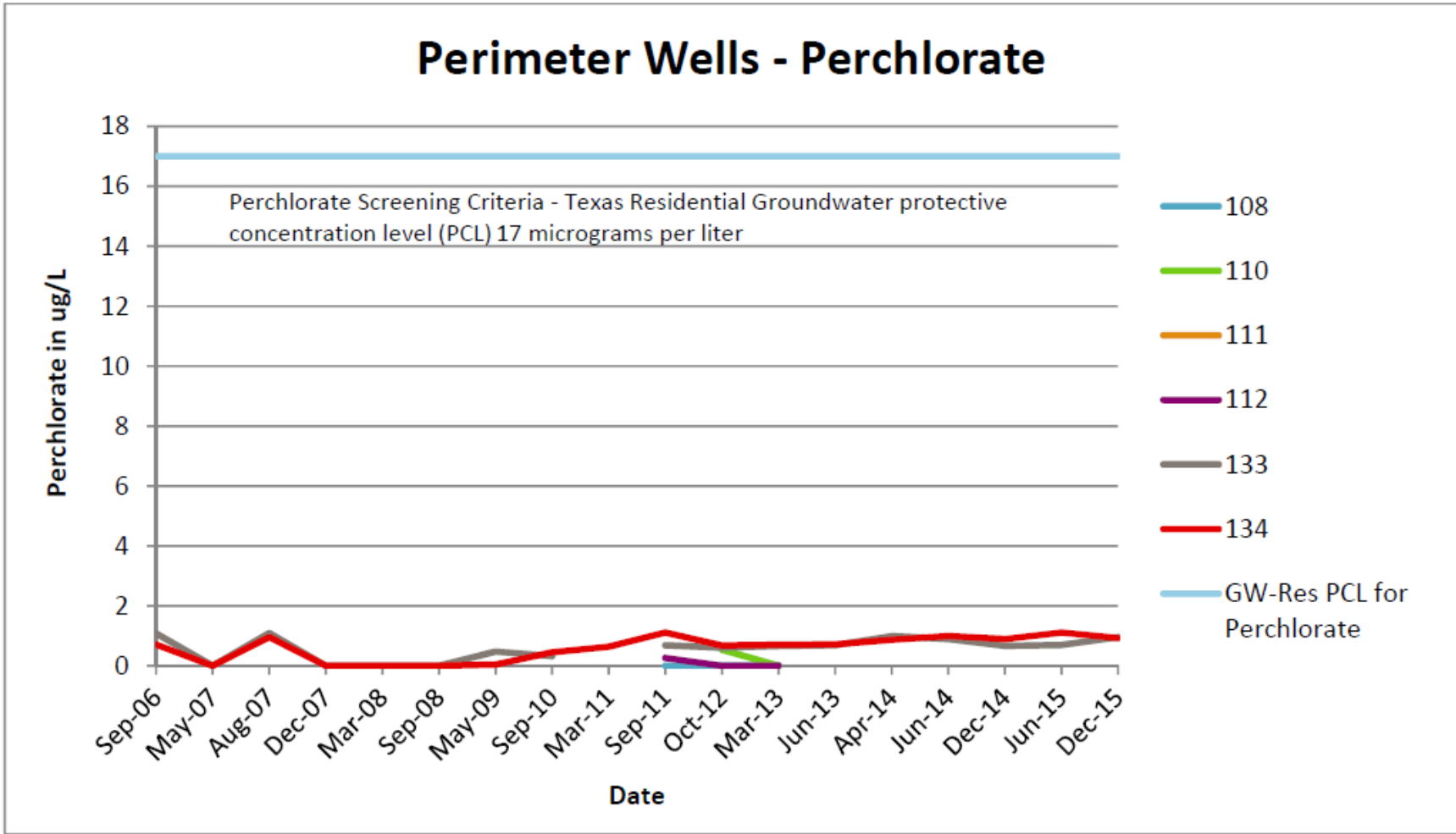
GPW – Goose Prairie Creek  
 HBW – Harrison Bayou



# Perimeter Well Locations



# Perimeter Well Sampling Update



# Next RAB Meeting Schedule and Closing Remarks

- Third Thursday in October is the 20th
  - Next RAB Meeting is proposed for October 20, 2016 from 6:00 – 7:30 pm at the Karnack Community Center

# Questions?



# Groundwater Treatment Plant - Processed Groundwater Volumes

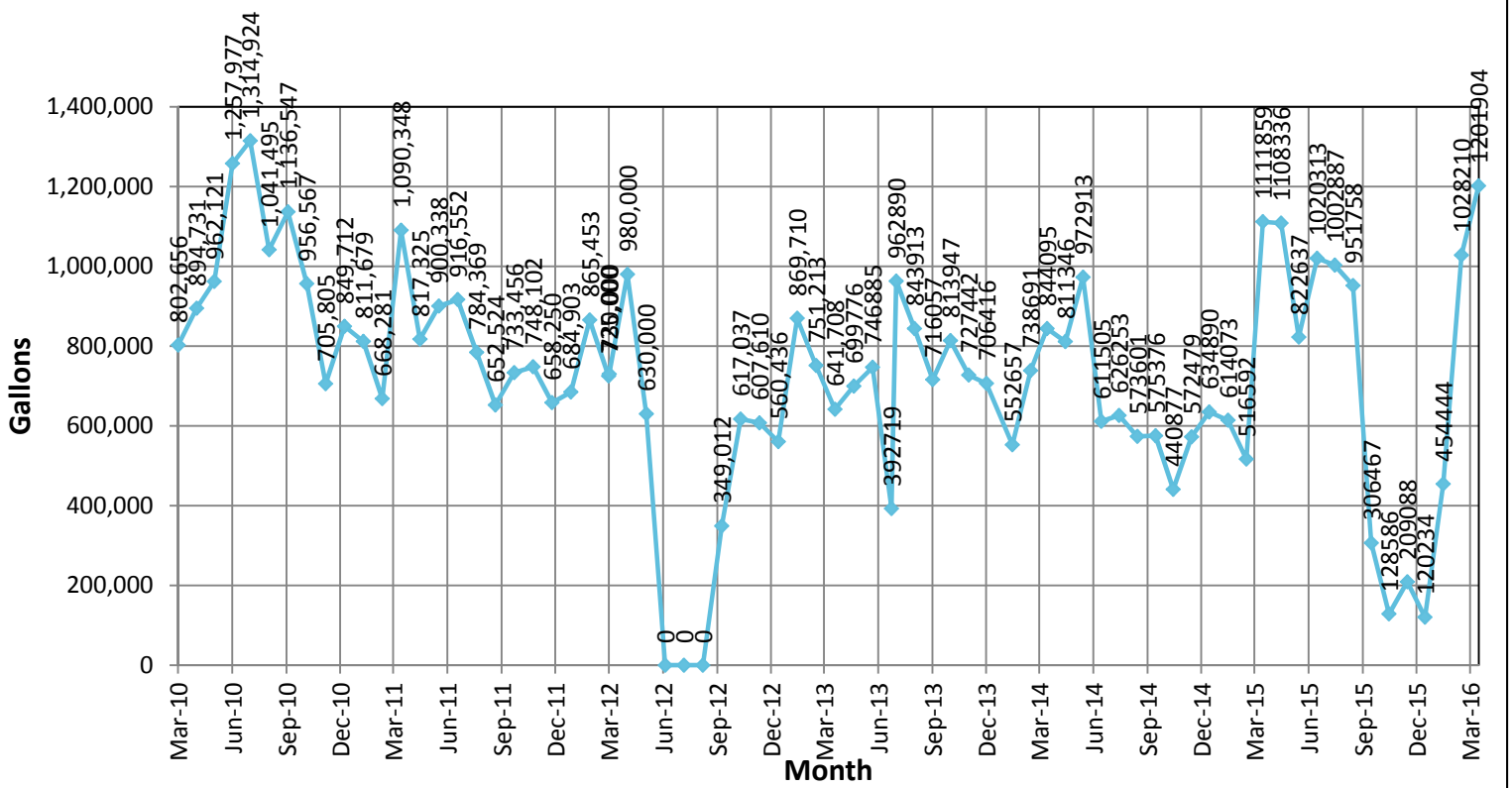
The amount of groundwater treated is determined by measuring the number of gallons of processed water.

## 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	Jan-16	Feb-16	Mar-16						
128,586	209,088	120,234	454,444	1,028,210	1,201,904						

\*Indicates Estimate

### Water Treated Monthly from March 2010 through March 2016



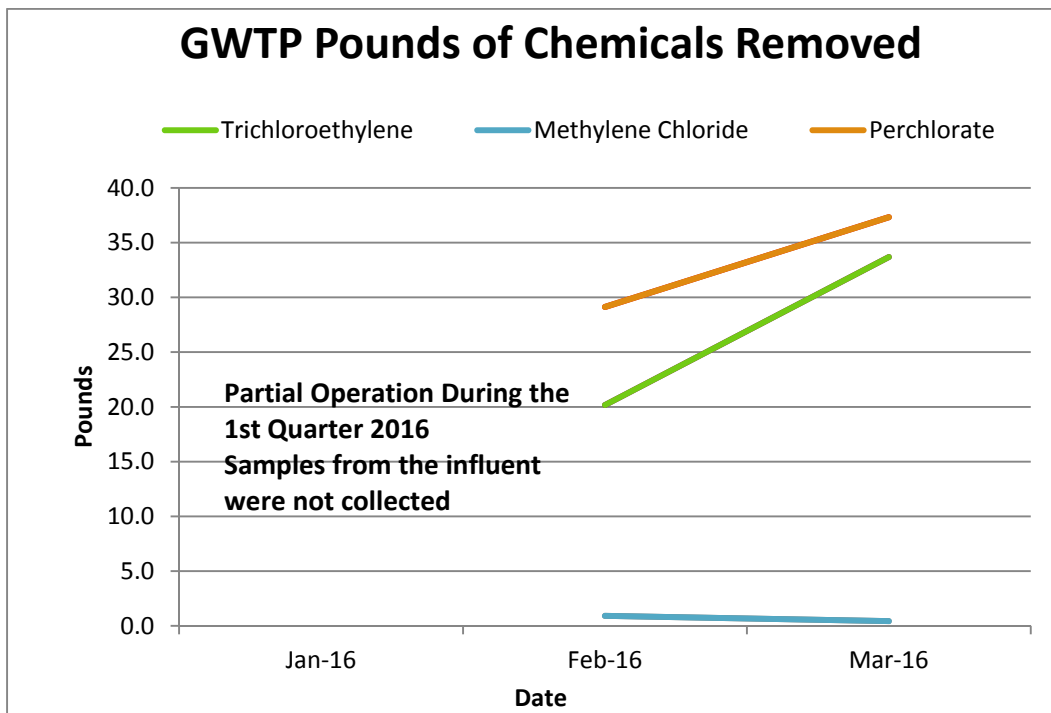
The pounds of chemicals removed for the 1<sup>st</sup> Quarter of 2016 can be found below and are calculated by the following formula:

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

**Approximate Amount of Pounds of Chemicals  
Removed From  
LHAAP-18/24, 1<sup>st</sup> Quarter 2016**

	Trichloroethylene	Methylene Chloride	Perchlorate
Jan-16	ND	ND	ND
Feb-16	20.2	0.91	29.1
Mar-16	33.7	0.43	66.4

ND – no data available



**Water Discharge Location and Volume (Gallons)**

Month	Harrison Bayou	LHAAP-18/24 Sprinklers	INF Pond
Jan-16	147,230	241,550	0
Feb-16	0	967,416	0
Mar-16	0	1,017,164	0

# Harrison Bayou and Goose Prairie Creek – Perchlorate Data

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

## Surface Water Sample Data (in micrograms per liter)

Quarter	3 <sup>rd</sup>	4 <sup>th</sup>	1 <sup>st</sup>	2 <sup>nd</sup>	3 <sup>rd</sup>	4 <sup>th</sup>	1 <sup>st</sup>	2 <sup>nd</sup>	3 <sup>rd</sup>	4 <sup>th</sup>	1 <sup>st</sup>
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 <sup>nd</sup>	3 <sup>rd</sup>	4 <sup>th</sup>	1 <sup>st</sup>	2 <sup>nd</sup>	3 <sup>rd</sup>	3 <sup>rd</sup>	4 <sup>th</sup>	2 <sup>nd</sup>	3 <sup>rd</sup>	4 <sup>th</sup>
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 <sup>st</sup>	2 <sup>nd</sup>	3 <sup>rd</sup>	4 <sup>th</sup>	2 <sup>nd</sup>	3 <sup>rd</sup>	3 <sup>rd</sup>	3 <sup>rd</sup>	4 <sup>th</sup>	1 <sup>st</sup>	2 <sup>nd</sup>
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 <sup>rd</sup>	4 <sup>th</sup>	1 <sup>st</sup>	2 <sup>nd</sup>	3 <sup>rd</sup>	4 <sup>th</sup>	1 <sup>st</sup>	2 <sup>nd</sup>	3 <sup>rd</sup>	4 <sup>th</sup>	1 <sup>st</sup>
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 <sup>nd</sup>	3 <sup>rd</sup>	4 <sup>th</sup>	1 <sup>st</sup>	2 <sup>nd</sup>	3 <sup>rd</sup>	4 <sup>th</sup>	1 <sup>st</sup>	2 <sup>nd</sup>	3 <sup>rd</sup>	4 <sup>th</sup>
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 <sup>st</sup>	2 <sup>nd</sup>
Creek Sample ID	Feb 2016	May 2016
GPW-1	0.447	6.59
GPW-3	0.474	0.457
HBW-1	<0.2 U	<0.2 U
HBW-7	<0.2 U	<0.2 U
HBW-10	<0.2 U	<0.2 U

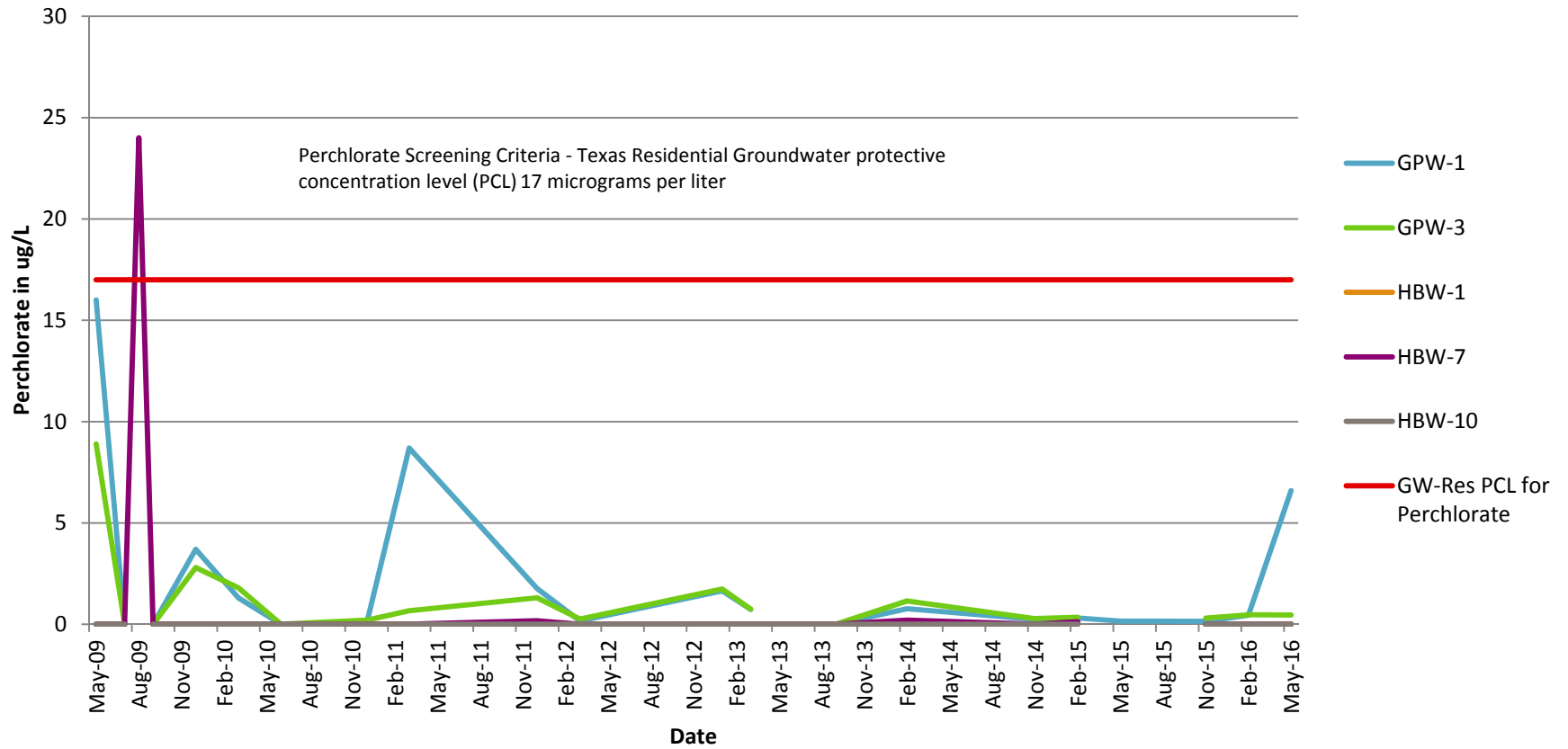
NS – not sampled

U – non-detect

J – Estimated

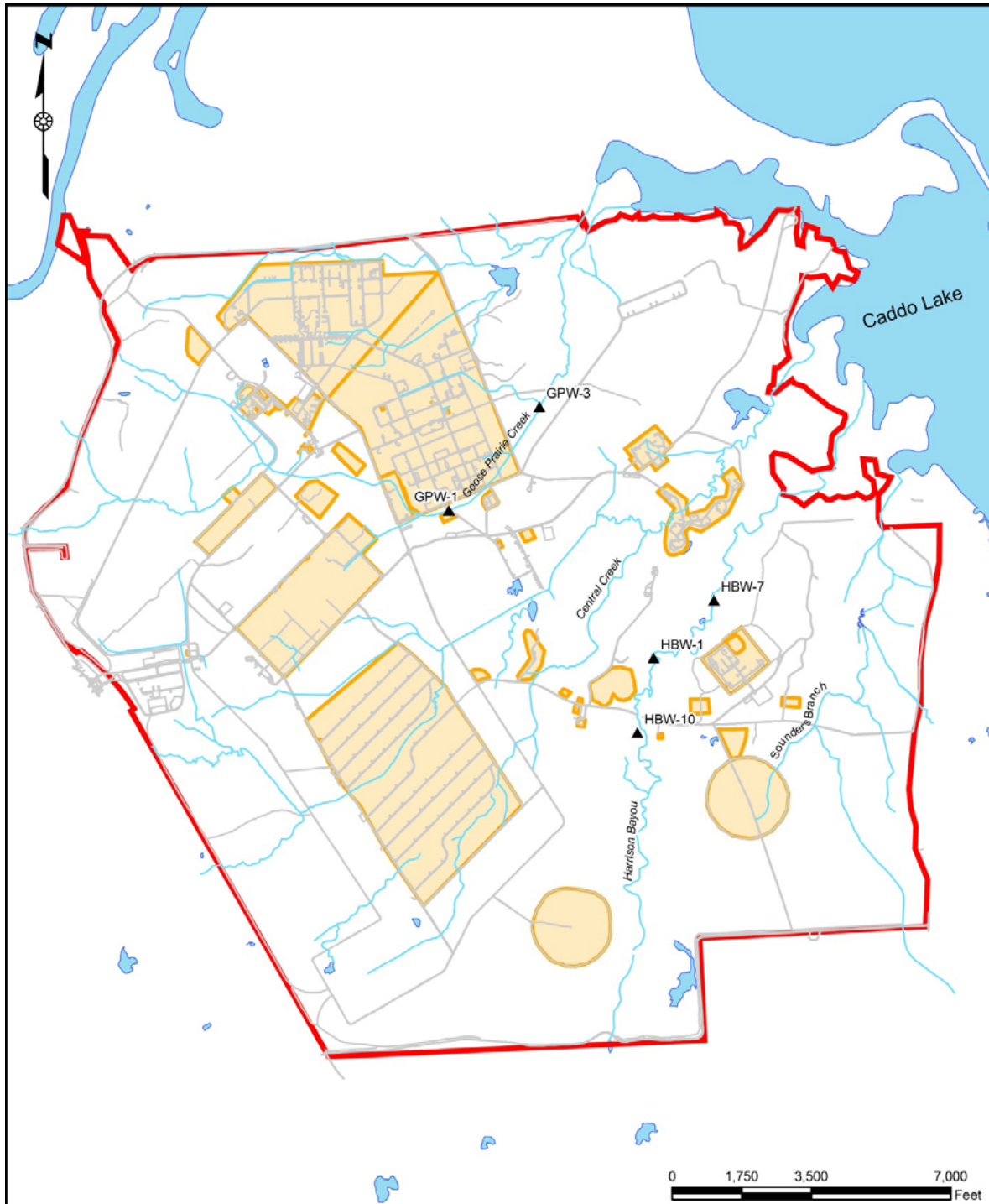
Dry – no surface water

# Surface Water Samples - Perchlorate





# Longhorn Army Ammunition Plant Creek Sampling Locations



<b>Legend</b> <ul style="list-style-type: none"><li>▲ Surface Water Sampling Location</li><li>— Stream</li><li>— Road</li><li>■ Site</li><li>■ Lake</li></ul>	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.

## 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

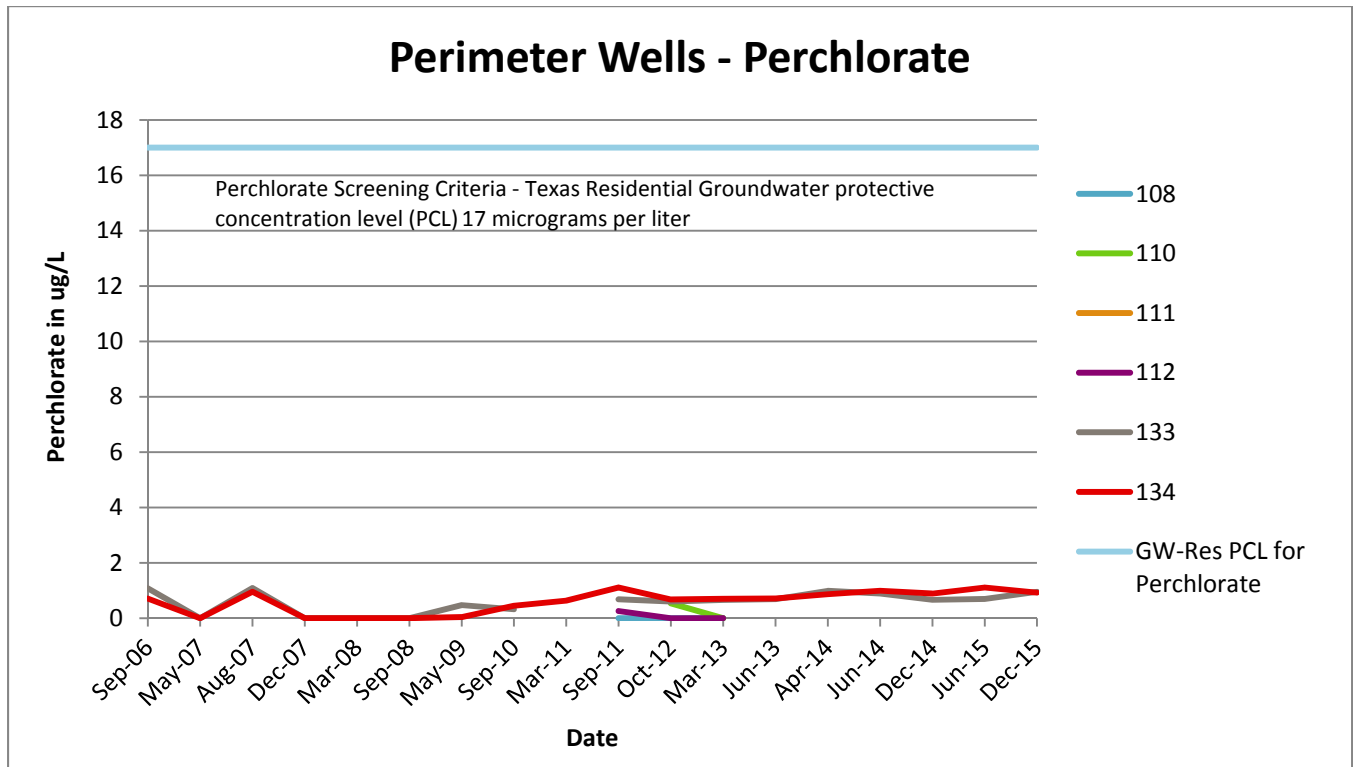
Notes:

J – Estimated

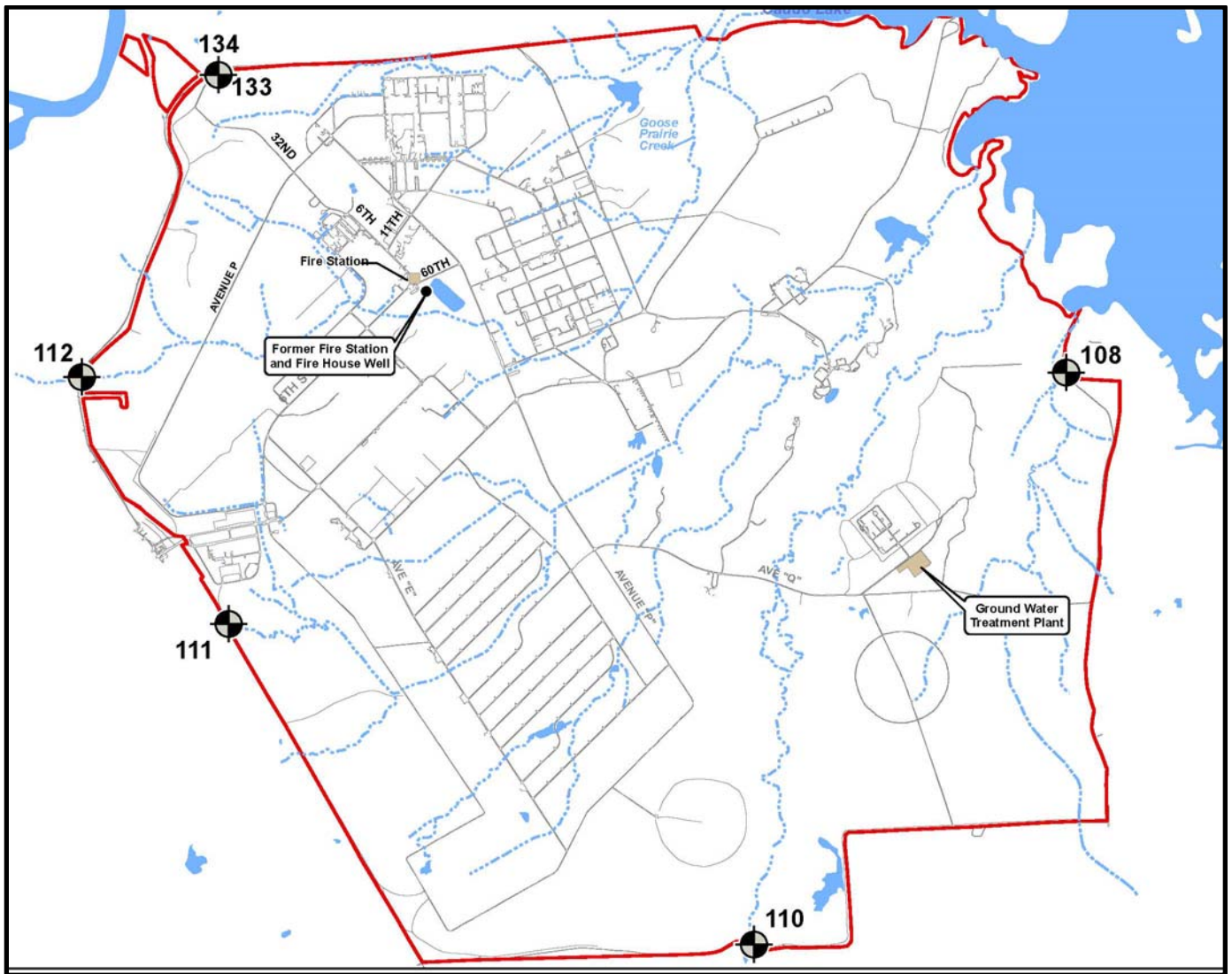
U – Non-Detect

Dry – Well Dry

NS – Not Sampled



# Longhorn Army Ammunition Plant Map with Perimeter Well Locations



# LHAAP-16 Landfill 16 Remedial Design Update

## Site History and Current Remedial Design Status

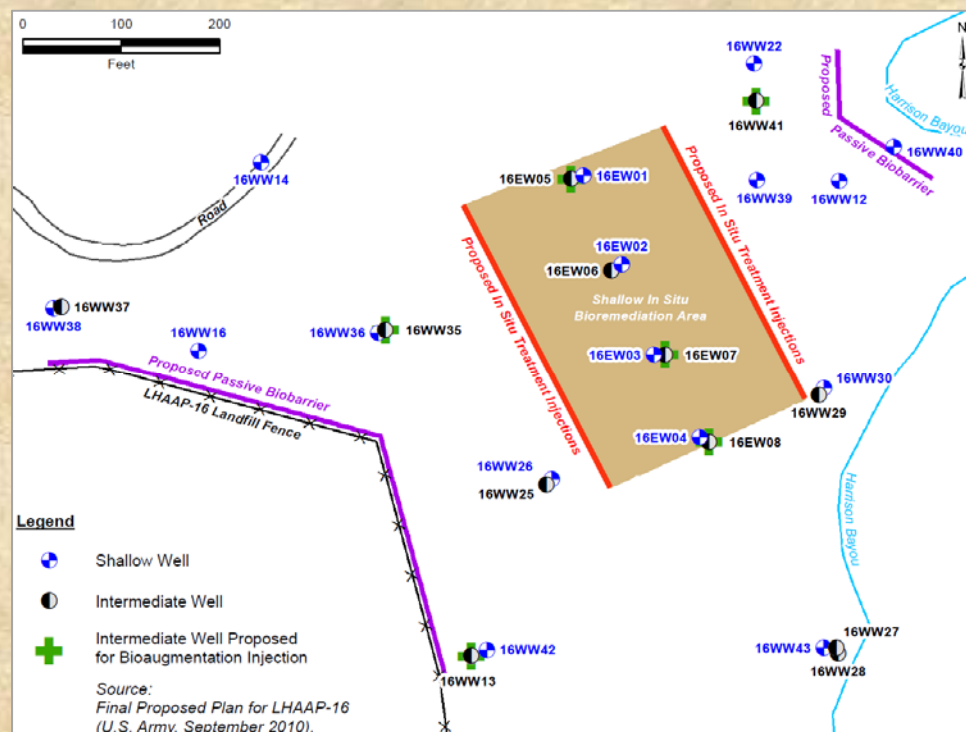
LHAAP-16 is a capped landfill located in the south-central portion of the Longhorn Army Ammunition Plant (LHAAP). The site encompasses approximately 20 acres, of which approximately 13 acres are covered by the cap. The landfill was established in 1940s and was used for disposal of solid and industrial wastes until the 1980s. The Army and the U.S. Environmental Protection Agency (EPA) signed a Record of Decision (ROD) in 1995 approving an interim remedial action, which consisted of a multilayer landfill cap that was completed in 1998. In 1996 and 1997, a groundwater extraction system was voluntarily installed by the Army as part of a treatability study to prevent contaminated groundwater from migrating to Harrison Bayou. Development of the remedial design for the final remedial action presented in the ROD was placed on hold from October 2011 to March 2016 as a result of a dispute between the Army and EPA over the ROD. Following dispute resolution, the Army prepared a draft revised ROD that is currently undergoing EPA and Texas Commission on Environmental Quality (TCEQ) review. Concurrently, the draft remedial design is being developed based on the draft revised ROD.

## Site Chemicals of Concern and Potentially Affected Environmental Media

Surface drainage from LHAAP-16 is carried in small gullies and ditches to Harrison Bayou, which flows along the northeastern edge of the site and discharges into Caddo Lake. The subsurface soil at the site consists of medium plastic sandy silt and fine sands, separated by clay layers that create four distinct groundwater-bearing units identified as the Shallow, Intermediate, Upper Deep, and Deep Zones. The groundwater flow direction is northeast toward Harrison Bayou in the Shallow, Intermediate and Deep Zones, and southeast toward Harrison Bayou in the Upper Deep Zone. The contaminated media include the buried waste and soil under the cap and groundwater in the Shallow and Intermediate Zones. The main chemicals of concern (COCs) at LHAAP-16 are volatile organic compounds (VOCs) including trichloroethene (TCE), cis-1,2-dichloroethene (DCE), vinyl chloride (VC); and perchlorate.

## Human Health and Ecological Risk

Construction of the landfill cap under the interim remedial action eliminated the direct exposure pathway to source area waste material, prevented contaminant transport to surface water via surface runoff, and reduced leaching of contaminants to the groundwater, resulting in an overall reduction of risk to human health and the environment. The reasonably anticipated future use of this site is non-residential as part of the Caddo Lake National Wildlife Refuge. However, groundwater at the site is considered a potential future source of drinking water. Concentrations of some groundwater COCs have exceeded cleanup levels. The site currently does not pose an unacceptable risk to potential ecological receptors.



**Figure 1: LHAAP-16 Selected Remedial Alternative 7 includes maintenance of landfill cap, land use controls, in-situ enhanced bio-remediation, passive bio-barriers, and monitored natural attenuation**

## Remedial Action Objectives (RAOs)

The RAOs for LHAAP-16 are:

- Preventing exposure to landfill contents.
- Reducing leaching and migration of landfill hazardous substances into the groundwater.
- Preventing human exposure to groundwater contaminated with COCs.
- Preventing groundwater contaminated with COCs from migrating into nearby surface water.
- Returning groundwater in the Shallow and Intermediate Zones to its potential beneficial use as drinking water.

## Remedial Alternatives

A total of seven remedial alternatives (plus two slight variations on Alternatives 3 and 5) were developed to address the LHAAP-16 RAOs. Alternative 1 is the No Further Action alternative, which is always evaluated to represent site baseline conditions. Land use control is a technology that is common to Alternatives 2 through 7. Monitored natural attenuation is common to Alternatives 3, 6, and 7; and inspection/long-term monitoring is common to all Alternatives, except Alternatives 5a and 5b. In addition to these common technologies, Alternatives 2 and 3b include groundwater extraction; Alternatives 4, 5a, and 5b include passive groundwater treatment; Alternatives 5a and 5b include landfill waste removal and off-site disposal; Alternative 6 includes in-situ treatment of landfill waste; and Alternative 7 includes in-situ enhanced bio-remediation and passive bio-barriers.

## Evaluation of Remedial Alternatives and Selection of Proposed Alternative

All of the seven remedial alternatives identified for LHAAP-16 were evaluated individually and comparatively against the nine criteria identified in the National Oil and Hazardous Substances Pollution Contingency Plan. Based on these evaluations, the Army identified Alternative 7 as the preferred alternative for LHAAP-16. It achieves the RAOs and is consistent with the reasonably anticipated future use of the site as a wildlife refuge. **Alternative 7 includes maintenance of the landfill cap, land use controls, in situ enhanced bio-remediation, passive bio-barriers, and monitored natural attenuation.** This satisfies the Remedial Action Objectives for LHAAP-16 for the protection of human health and the environment. All seven alternatives were evaluated in the Feasibility Study and are summarized in Final Proposed Plan. Both documents are located in the Administrative Record. **Figure 1** shows the active remedy components of Alternative 7, as presented in the Final Proposed Plan for the LHAAP-16 site. The remedial design will be subject to change, based on updated data and requirements of the revised Final ROD.

# LHAAP-17 Burning Ground No. 2/Flashing Area Group 2 Remedial Design Update

## Site History and Current Remedial Design Status

LHAAP-17 is located in the southeastern portion of the Longhorn Army Ammunition Plant (LHAAP). The site encompasses approximately 3.9 acres and was used as a burning ground from 1959 through 1980. The materials removed from the TNT Production Area (LHAAP-29) and the TNT Waste Disposal Plant (LHAAP-32) during demolition were burned and/or flashed at LHAAP-17. Bulk trinitrotoluene (TNT), photo flash powder, and reject material from Universal Match Corporation operations were burned at LHAAP-17. The site was used as a flashing area to decontaminate recoverable metal byproducts until 1980, when it became inactive. The Final Proposed Plan identifies Alternative 4 – excavation and off-site disposal of soil, groundwater extraction, monitored natural attenuation, and land use control for groundwater as the selected alternative. Development of the remedial design for the final remedial action presented in the ROD was placed on hold from October 2011 to March 2016 as a result of a dispute between the Army and EPA over the ROD. Following dispute resolution, the Army prepared a draft revised ROD that is currently undergoing EPA and Texas Commission on Environmental Quality (TCEQ) review. Concurrently, the draft remedial design is being developed based on the draft revised ROD.

## Site Chemicals of Concern and Potentially Affected Environmental Media

Surface drainage from LHAAP-17 flows to ditches along the eastern and western boundaries of the site to Harrison Bayou, which is located approximately 1,200 feet northwest of the site and discharges into Caddo Lake. The shallow subsurface soil at the site (up to 20 feet below ground surface) consists of silty clay /clayey silt and silty sand. These shallow deposits are underlain by up to 100 feet of silty sand and poorly sorted sand. The silty sand is interbedded with clay and silty clay lenses that result in two groundwater-bearing units identified as the Shallow Zone and Intermediate Zone. Groundwater at the site also occurs in a Deep Zone, but it is more than 150 feet below ground surface and is not impacted. The groundwater flow direction in both the Shallow and Intermediate Zones is generally toward Harrison Bayou to the northwest. The contaminated media include soil, and groundwater in the Shallow and Intermediate Zones. The main chemicals of concern (COCs) in soil at LHAAP-17 are explosives and perchlorate (potential soil COC based on groundwater concentrations) and chemicals of potential ecological concern (COPECs) are explosives, dioxin, and barium. Shallow Zone groundwater COCs are perchlorate and volatile organic compounds (VOCs) including trichloroethene (TCE), 1,1-dichloroethene (DCE), cis-1,2-DCE, 1,2-dichloroethane (DCA) and vinyl chloride (VC). Intermediate Zone groundwater COCs are TCE and its daughter products DCE and VC.

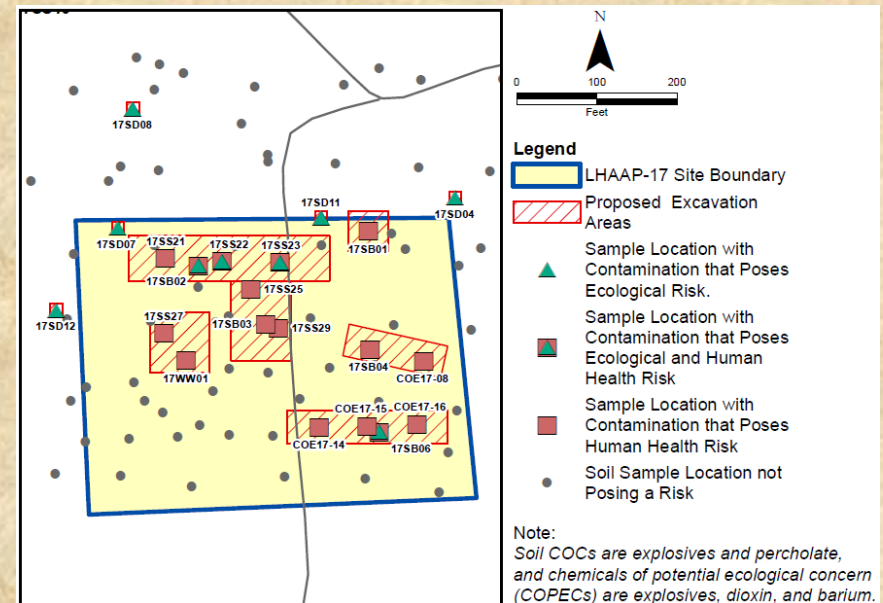


Figure 1: LHAAP-17 Proposed Contaminated Soil Excavation Areas

## Human Health and Ecological Risk

The reasonably anticipated future use of LHAAP-17 is non-residential as part of the Caddo Lake National Wildlife Refuge. Human health risk was evaluated for a hypothetical future maintenance worker at the wildlife refuge. Under this scenario, the soil poses an unacceptable human health risk. It also poses a risk to groundwater through soil-to-groundwater cross-media contamination and to potential ecological receptors in the sub-area of the installation where LHAAP-17 is located.

Groundwater also poses an unacceptable health risk to a maintenance worker under the anticipated future land use scenario.

## Remedial Action Objectives (RAOs)

The RAOs for LHAAP-17 are:

- Preventing exposure of the hypothetical future maintenance worker to contaminants in soil and groundwater.
- Preventing migration of contaminants to groundwater from potential sources in soil.
- Preventing exposure of ecological receptors to contaminated soil.
- Returning groundwater in the Shallow and Intermediate Zones to its potential beneficial use as drinking water.

## Remedial Alternatives

A total of four remedial alternatives were developed to address the LHAAP-17 RAOs. Alternative 1 is the No Further Action alternative, which is always evaluated to represent site baseline conditions. Land use controls, monitored natural attenuation, inspection/long-term monitoring, and excavation with off-site disposal are technologies that are common to Alternatives 2, 3, and 4. In addition, Alternative 3 includes in-situ bio-remediation for groundwater contamination in the Shallow Zone, and Alternative 4 includes extraction of contaminated groundwater from the Shallow Zone.

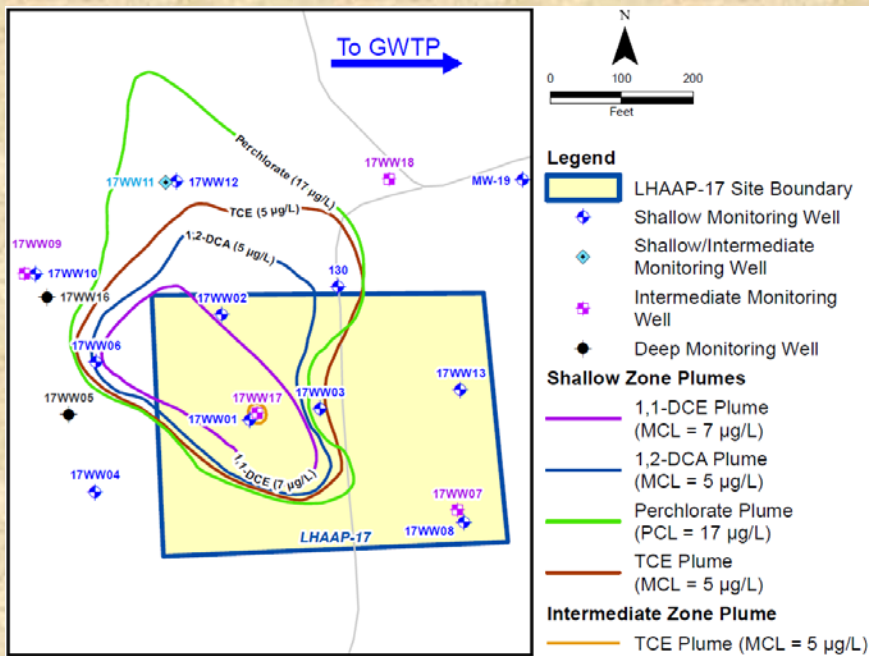


Figure 2: LHAAP-17 Groundwater COC Plumes in the Shallow Zone and Intermediate Zone

## Evaluation of Remedial Alternatives and Selection of Proposed Alternative

All of the four remedial alternatives identified for LHAAP-17 were evaluated individually and comparatively against the nine criteria identified in the National Oil and Hazardous Substances Pollution Contingency Plan. Based on these evaluations, the Army identified Alternative 4 as the preferred alternative for LHAAP-17. It achieves the RAOs and is consistent with the reasonably anticipated future use of the site as a wildlife refuge. **Alternative 4 includes excavation and off-site disposal of soil, groundwater extraction, monitored natural attenuation, and land use controls for groundwater, with a contingency remedy of in-situ bioremediation if performance objectives are not met.** This satisfies the RAOs for LHAAP-17 for the protection of human health and the environment. All four alternatives were evaluated in the Feasibility Study and are summarized in the Final Proposed Plan for the LHAAP-17 site. Both documents are located in the Administrative Record. **Figures 1 and 2** show the areas of soil and groundwater contamination at LHAAP-17 that will be addressed by Alternative 4. A Pre-Design Investigation will be conducted at LHAAP-17 before the detailed remedial design for Alternative 4 can be completed. The pre-design investigation will include soil sampling to fully define the limits of contaminated soil for excavation and off-site disposal, and groundwater pump testing to support design of the groundwater extraction system. The remedial design will be subject to change, based on updated data and requirements of the revised Final ROD.