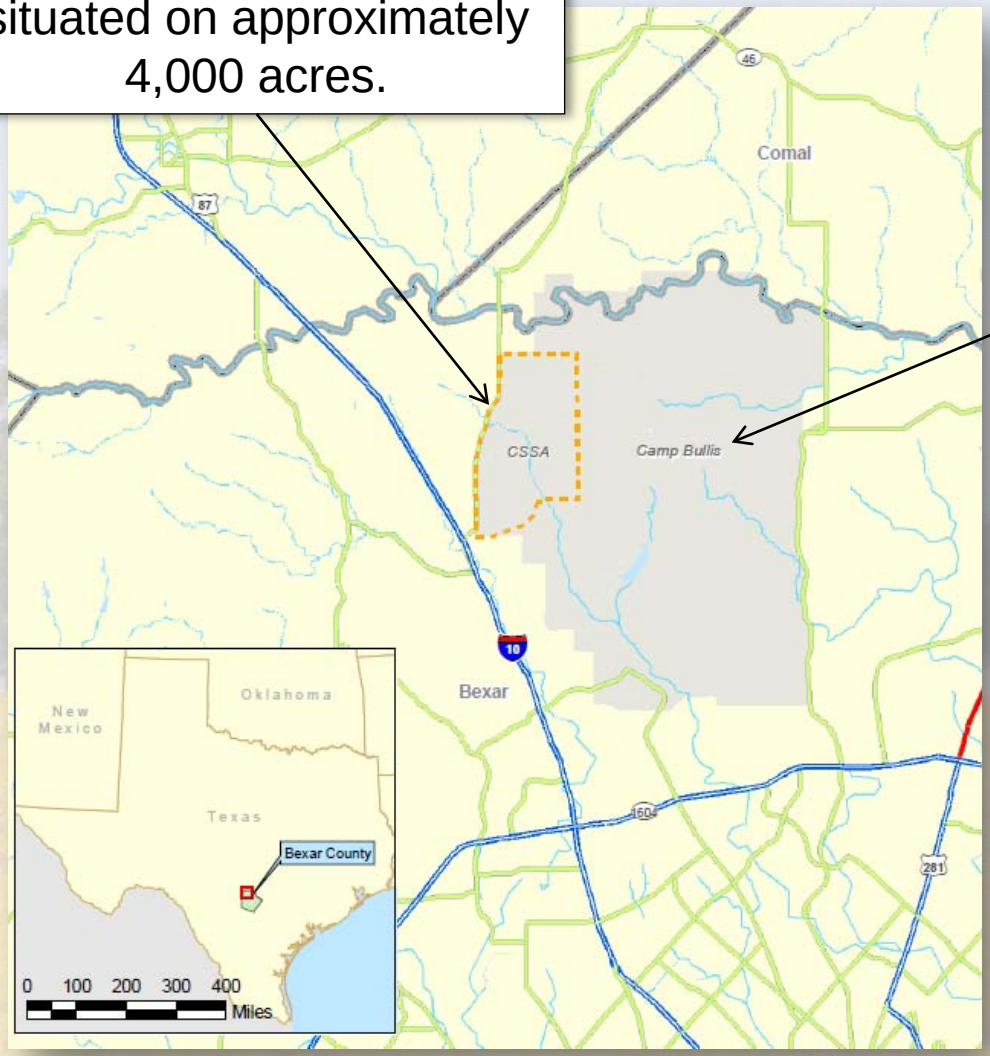
HISTORY OF CAMP STANLEY STORAGE ACTIVITY (CSSA)

CSSA LOCATION

CSSA is a U.S. Army post situated on approximately 4,000 acres.



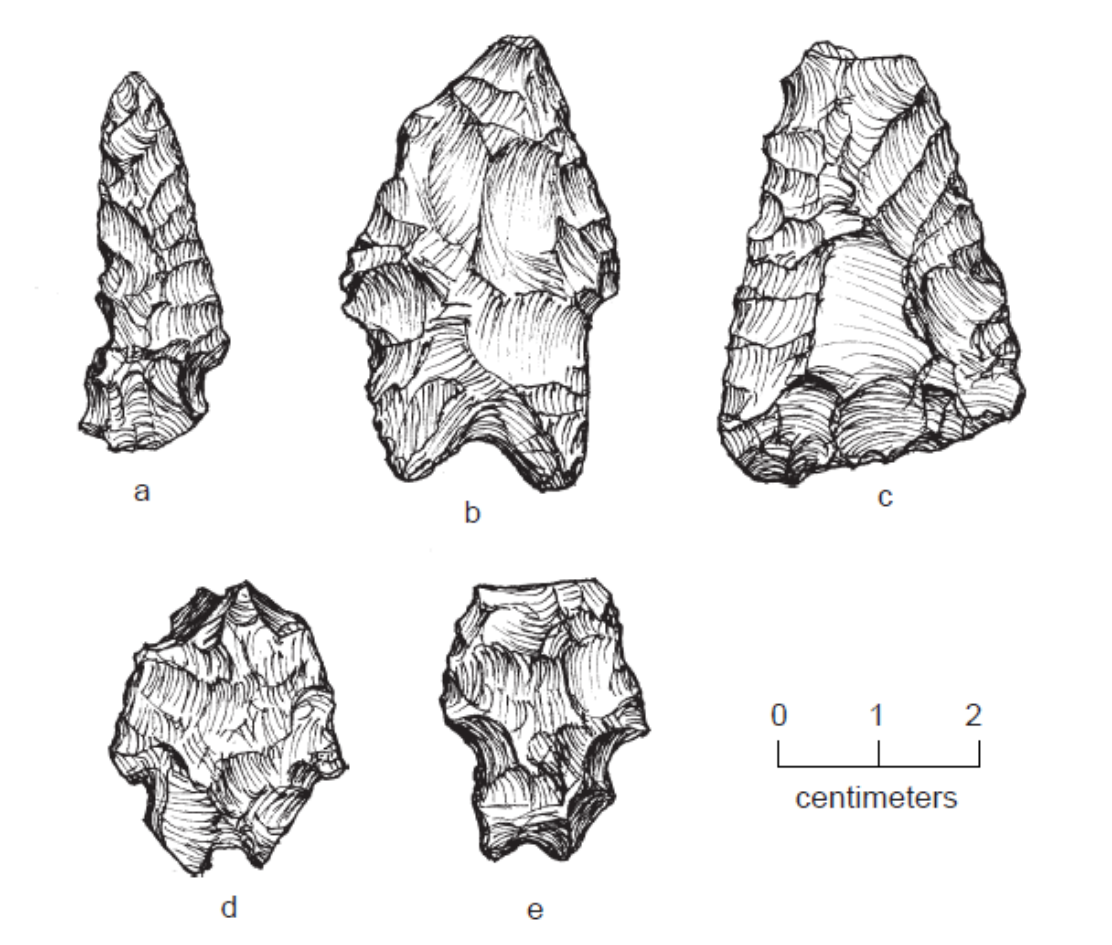
Camp Bullis is a separate facility managed by Joint Base San Antonio (U.S. Air Force) at Fort Sam Houston, and is not part of this presentation.

CSSA MISSION

Receipt, storage, and issuance of ordnance materiel as well as quality assurance testing and maintenance of military weapons and ammunition. Due to its mission, access to CSSA is restricted.

CSSA PREHISTORIC OCCUPANTS

A few small prehistoric campsites and lithic scatters have been documented on post.

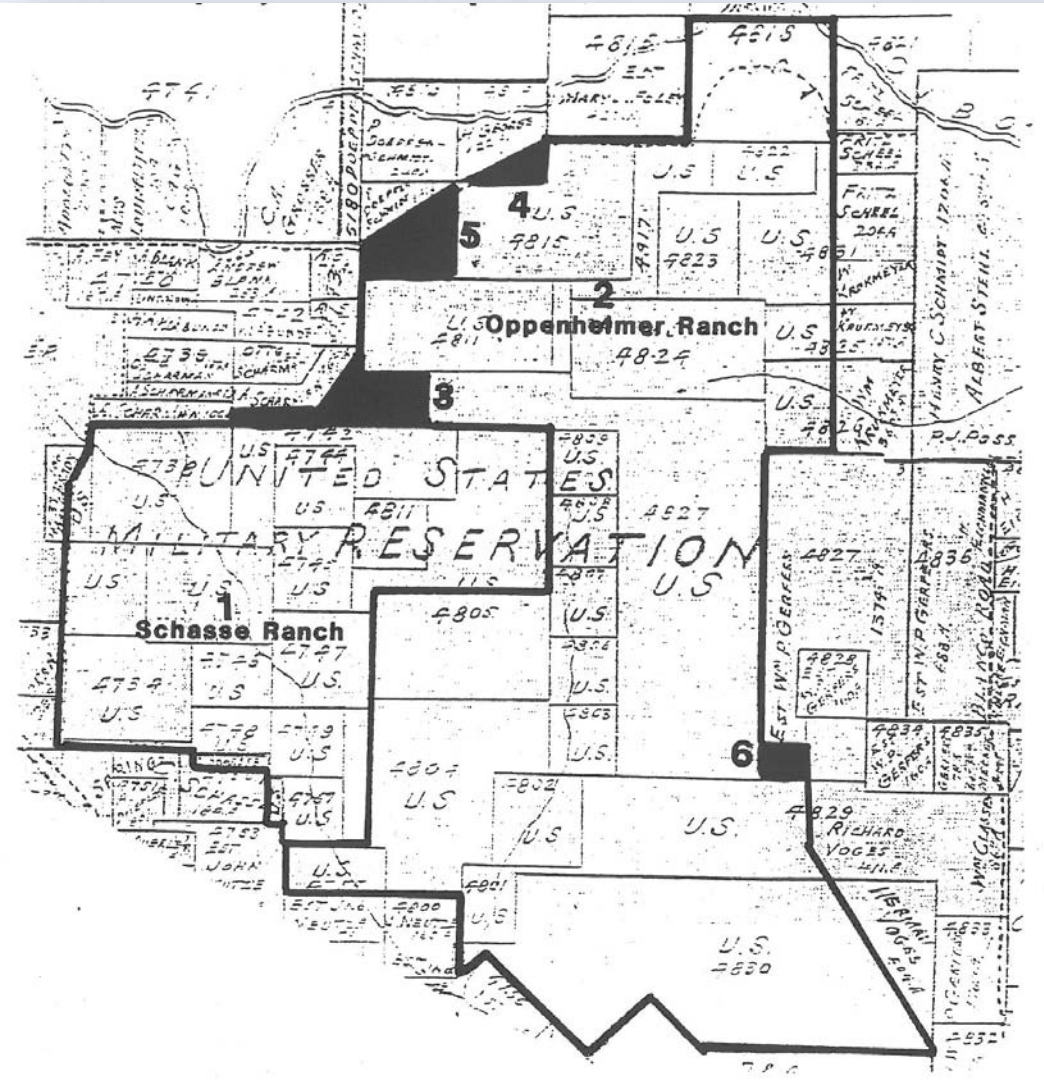


Examples of various types of dart points found on post.
(a) Ensor; (b) Pedernales; (c) Taylor; (d-e) Frio-like

CSSA HISTORY

Original settlers included Native Americans, Spaniards, Anglo-Americans, and European immigrants, particularly Germans. Land was used for ranching and agriculture.

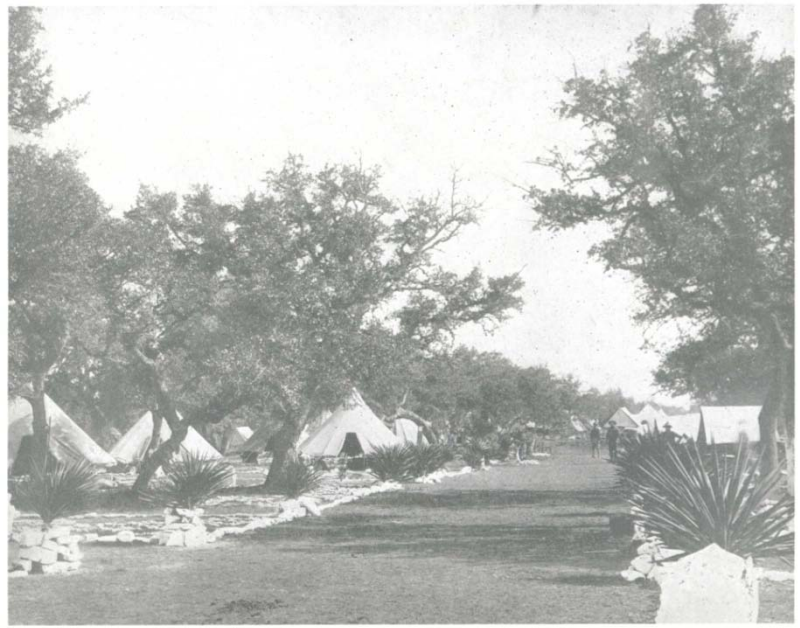
CSSA HISTORY



Initial Acquisition 1906 - 1907

In 1906 and 1907, six tracts of land were purchased and the Leon Springs Military Reservation was created.

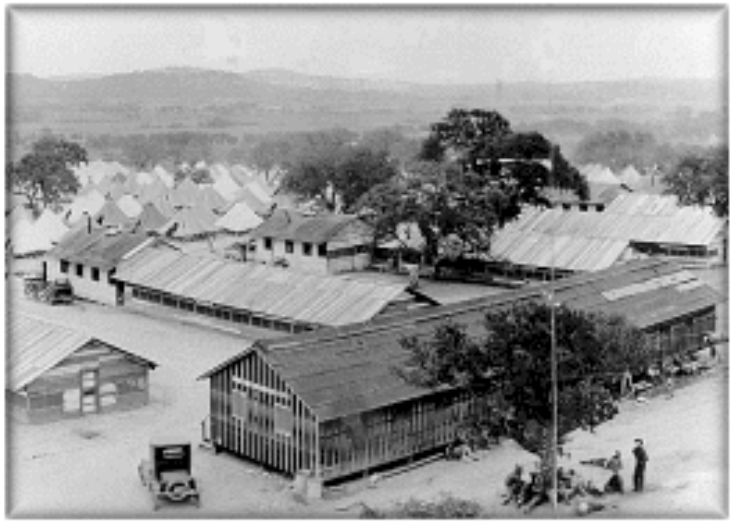
CSSA HISTORY



In the early years, the reservation was used for cavalry training.

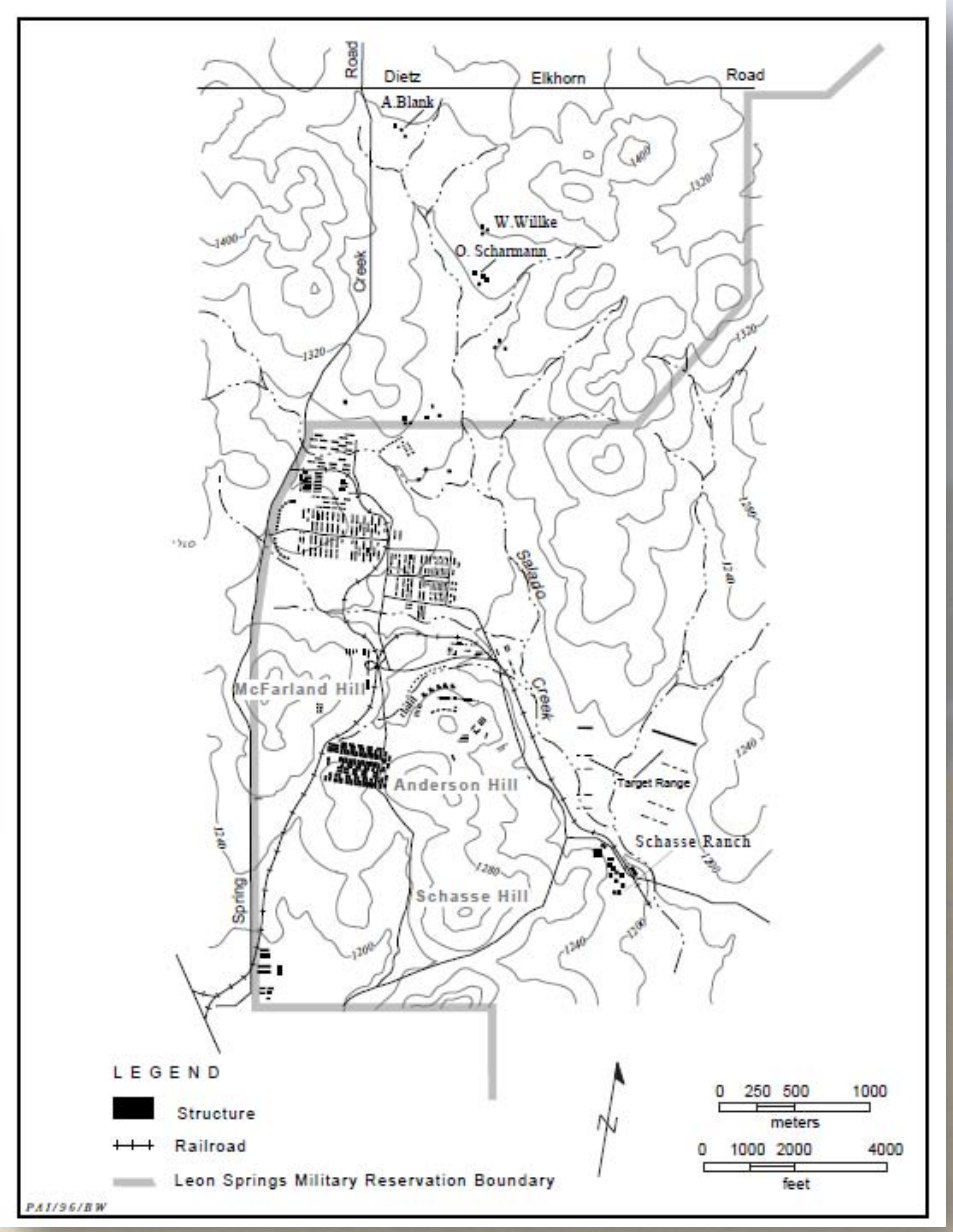
CSSA HISTORY

In 1917, the facility was renamed Camp Stanley.



Camp Stanley was a collection of cantonments for the training of officers, cavalry, and artillery units.

Military structures at Camp Stanley and outlying ranches/farmsteads, 1925



CSSA HISTORY

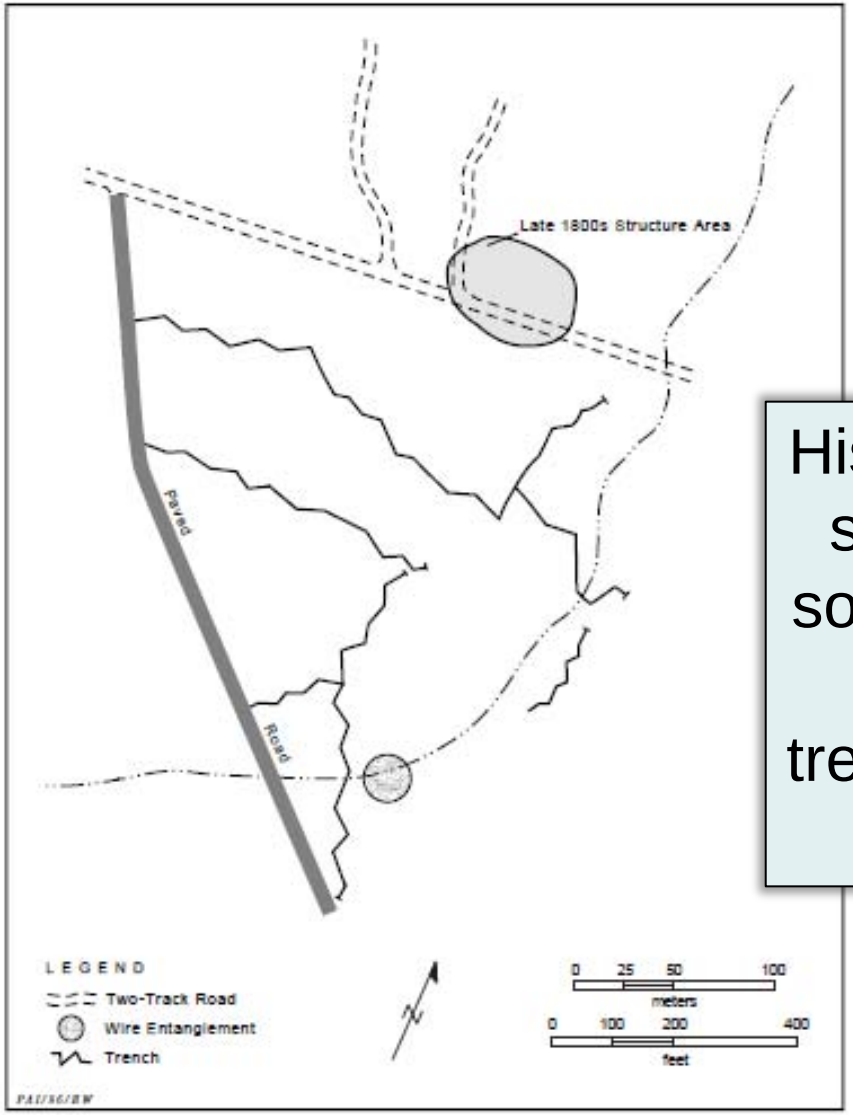
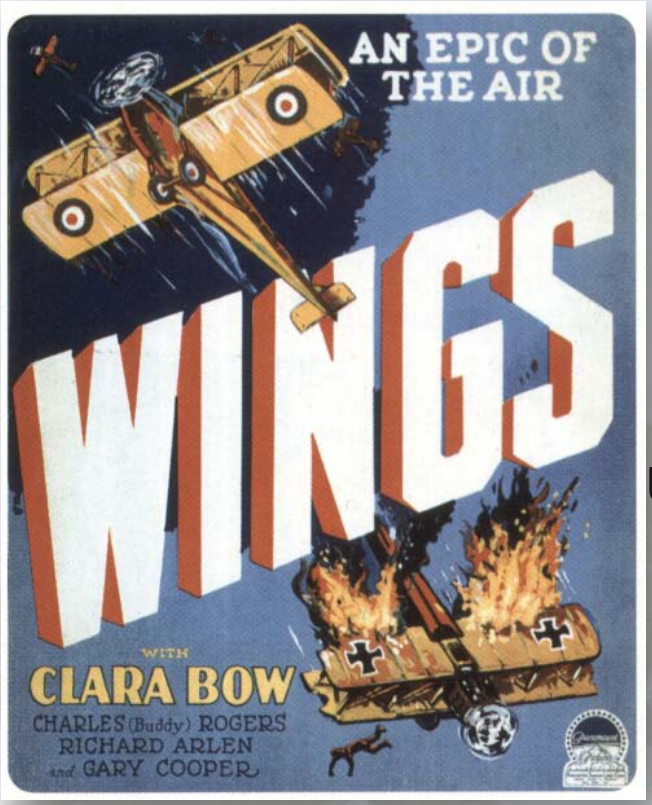


Figure 21. Site map, 41BX1189.

Historic military sites include some WWI-era training trenches dating to 1917.



CSSA HISTORY

The WWI era trenches were also used in 1926 for the filming of the movies *Wings* and *The Rough Riders*.

CSSA MISSION SUPPORT ACTIVITIES

Mission support activities have continued up to the present day.

Some of the past activities resulted in contamination of the environment.

CSSA ENVIRONMENTAL REMEDIATION ACTIVITIES

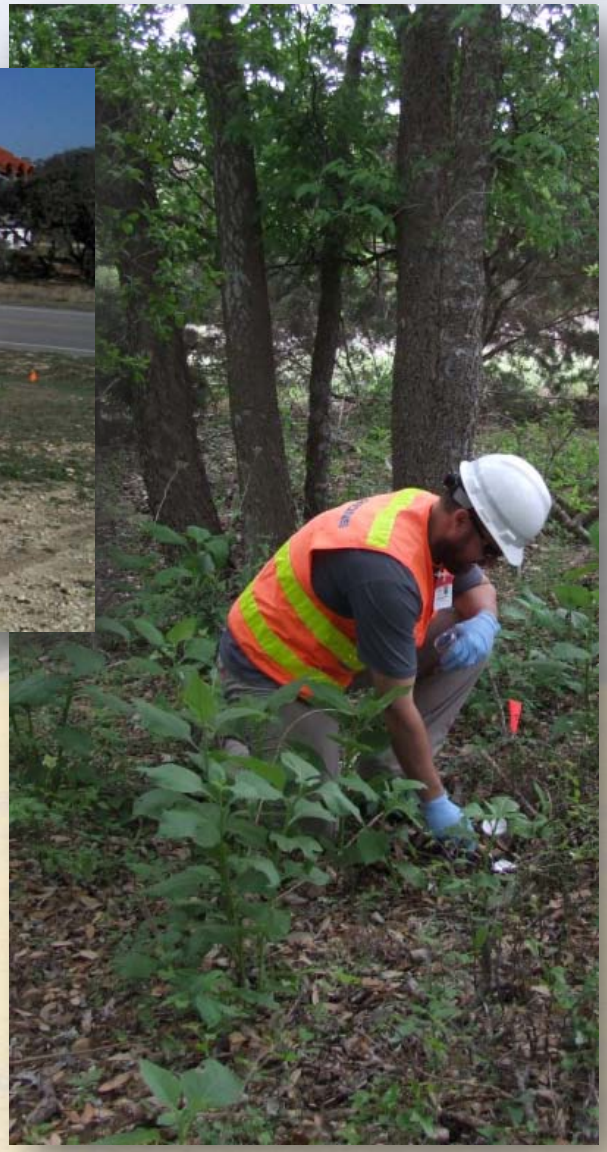
CSSA has performed environmental remediation at many sites throughout the post since 1994. Remediation activities may involve soil and/or groundwater cleanup, depending on the site.

Debris Removal

Soil Excavation

CSSA ENVIRONMENTAL REMEDIATION ACTIVITIES

Soil Sampling



CSSA ENVIRONMENTAL REMEDIATION ACTIVITIES

Groundwater Sampling
On- and Off-Post

Conducting
Groundwater Tests

Installation of Groundwater Monitoring Wells

CSSA ENVIRONMENTAL REMEDIATION ACTIVITIES

Once closed, sites are reseeded with native grasses or reworked for other purposes such as wildlife management or flood control ponds.

CSSA PUBLIC OUTREACH

CSSA takes its environmental role seriously and strives to keep the neighboring community informed.

CSSA PUBLIC OUTREACH

Informational Fact Sheets are sent out annually to keep the public informed about CSSA's Environmental Program.

Please let us know if you want to be on the mailing list!

Camp Stanley Storage Activity
Groundwater Contamination – 2012 Sampling

FACT SHEET

No. 33 – Annual Fact Sheet for 2012

The purpose of this Fact Sheet is to provide an overview of quarterly groundwater sampling conducted in 2012. ***The off-post groundwater contamination in a small area west of Camp Stanley Storage Activity (CSSA) continues to be stable and CSSA is making progress addressing contamination sources on-post.*** *Results for all groundwater sampling events are available in the CSSA Environmental Encyclopedia located at either the downtown San Antonio Public Library, (600 Soledad Street, on the 2nd floor behind the Reference Desk in the Government Documentation Section), the Patrick Heath Public Library in Boerne (451 North Main, see the Government Librarian for assistance), or on the internet at www.stanley.army.mil.*

On-post Groundwater Monitoring Plan

On-post groundwater monitoring has been conducted since 1991 as part of the CSSA environmental program. The wells sampled include drinking water, monitoring, and agriculture/livestock wells. Sampling frequencies for on-post wells are determined by the long-term monitoring optimization (LTMO) study completed in May 2005 and updated in 2010. This Plan, as approved by the U.S. Environmental Protection Agency (USEPA) and Texas Commission on Environmental Quality (TCEQ), sets the well sampling frequency at either quarterly (3 months), semi-annually (6 months), every nine months, or every 18 months. Currently, groundwater samples from monitoring wells are analyzed for chromium, cadmium, lead, and mercury, while the samples from the drinking water wells are analyzed for the additional metals arsenic, barium, copper, and zinc. All monitoring and drinking water wells were also analyzed for select volatile organic compounds (VOCs). VOCs make up substances such as paint thinners, dry cleaning solvents, and some constituents of petroleum fuels (*e.g.* gasoline and natural gas). Decades-old industrial practices sometimes accidentally release VOCs into the environment, where they can contaminate the soil and groundwater. CSSA ceased using VOC solvents in the mid-1990s. CSSA monitors for VOCs and metals associated with its past industrial processes. The CSSA Groundwater Monitoring Program Data Quality Objectives (DQO) that provides a description of the ongoing groundwater monitoring program and sampling frequencies is available in the Environmental Encyclopedia referenced above.

Off-post Groundwater Monitoring Plan

CSSA describes its groundwater monitoring program for off-post private wells in its *Off Post Monitoring Program and Response Plan*, July 2001 (Plan). The goals of this Plan are to confirm that off-post drinking water meets USEPA and TCEQ safe drinking water standards, determine where VOC contamination has migrated, assess if contaminant levels in those wells exceed standards, and define the appropriate response. As part of the Plan, 56 off-post wells were sampled in 2012.

Off-post water wells are selected for sampling based on CSSA's Plan to ensure protection of drinking water and to provide information for the environmental program. Factors considered in deciding if a well is sampled include where the well is located, how close it is to areas where VOCs have been detected, whether the well owner grants access for sampling, and results of previous sampling at the well. A well is initially sampled for four consecutive quarters (i.e., every three months for one year). Depending on the analytical results for the well, future sampling occurs as illustrated on Figure 1.

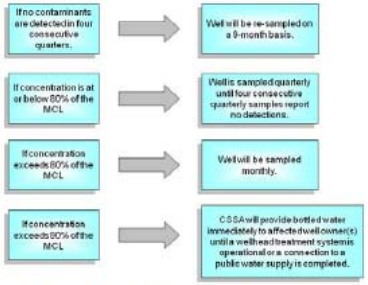


Figure 1. Off-Post Well Sampling Decision Chart

CSSA takes action if VOCs are detected in off-post wells at concentrations that begin approaching greater than 90 percent of the USEPA maximum contaminant level (MCL) of 5 parts per billion (ppb) for tetrachloroethene (PCE) and trichloroethene (TCE) (i.e., action is taken at concentrations greater than 4.5 ppb).

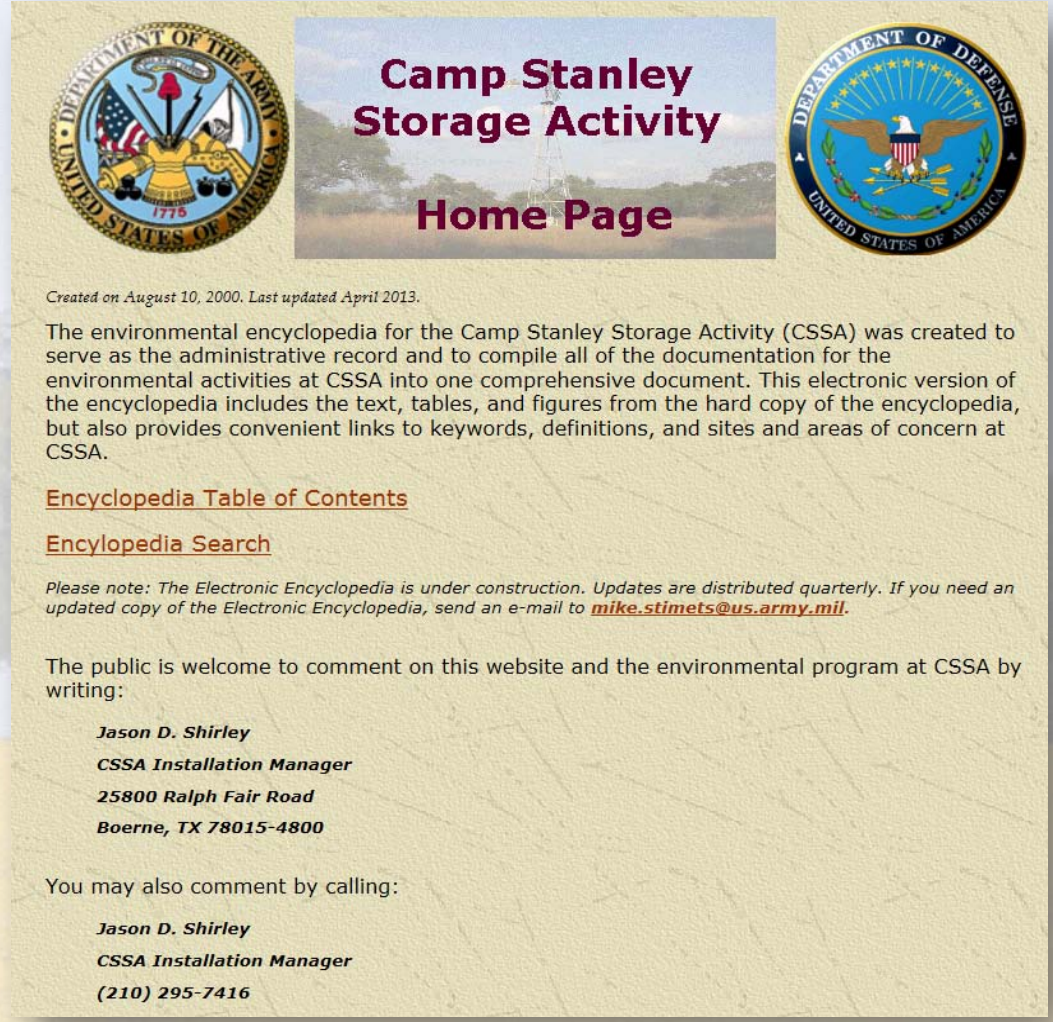
If a VOC exceedance occurs, CSSA will supply bottled water to affected residents within 24 hours of the detection and the well will be resampled to confirm the results. If additional sampling confirms previous test results, CSSA will either install a granular activated carbon (GAC) filtration system to remove contaminants from the water, or provide the well owner with an alternate water supply for as long as contaminant levels in the well exceed standards. Over the history of off-post sampling, eight off-post water wells have been fitted with GAC filtration systems: LS-7 (August 2001), LS-6 (August 2001), RFR-10 (two units, October 2001), RFR-11 (October 2001), LS-2 and LS-3 (installed April 2002, discontinued August 2007 when use of wells ceased), OFR-3 (April 2002), and LS-5 (October 2011).

2012 Groundwater Sampling Results

The locations of all on- and off-post wells sampled in 2012 are shown on Figure 2 (Page 2). According to the USEPA, concentrations below 5.0 ppb for PCE and TCE meet safe drinking water standards. Table 1 (Page 3) presents off-post groundwater data for PCE and TCE from all four 2012 sampling events (March, June, September, December). Three wells (I10-4, OFR-3, and RFR-10) exceeded the MCL for PCE, and two wells (OFR-3 and RFR-10) exceeded the MCL for TCE. In the past, four additional wells (LS-5, LS-6, LS-7, and RFR-11) had PCE and/or TCE detections at concentrations approaching or above the MCL (5.0 ppb). All in-use off-post wells with approaching or above-MCL detections have been equipped with GAC filtration systems, and samples of water collected after filtration for these wells had no detections of the VOC contamination. Well I10-4 is not currently being used and therefore is not equipped with a GAC filtration system. In all other wells

CSSA PUBLIC OUTREACH

The CSSA Administrative Record, or *Environmental Encyclopedia*, includes copies of documents, correspondence, and other environmental program information, and is available online, and at the Boerne and San Antonio Public Libraries.



Camp Stanley Storage Activity

Home Page

Created on August 10, 2000. Last updated April 2013.

The environmental encyclopedia for the Camp Stanley Storage Activity (CSSA) was created to serve as the administrative record and to compile all of the documentation for the environmental activities at CSSA into one comprehensive document. This electronic version of the encyclopedia includes the text, tables, and figures from the hard copy of the encyclopedia, but also provides convenient links to keywords, definitions, and sites and areas of concern at CSSA.

Encyclopedia Table of Contents

Encylopedia Search

Please note: The Electronic Encyclopedia is under construction. Updates are distributed quarterly. If you need an updated copy of the Electronic Encyclopedia, send an e-mail to mike.stimets@us.army.mil.

The public is welcome to comment on this website and the environmental program at CSSA by writing:

Jason D. Shirley
CSSA Installation Manager
25800 Ralph Fair Road
Boerne, TX 78015-4800

You may also comment by calling:

Jason D. Shirley
CSSA Installation Manager
(210) 295-7416

www.stanley.army.mil

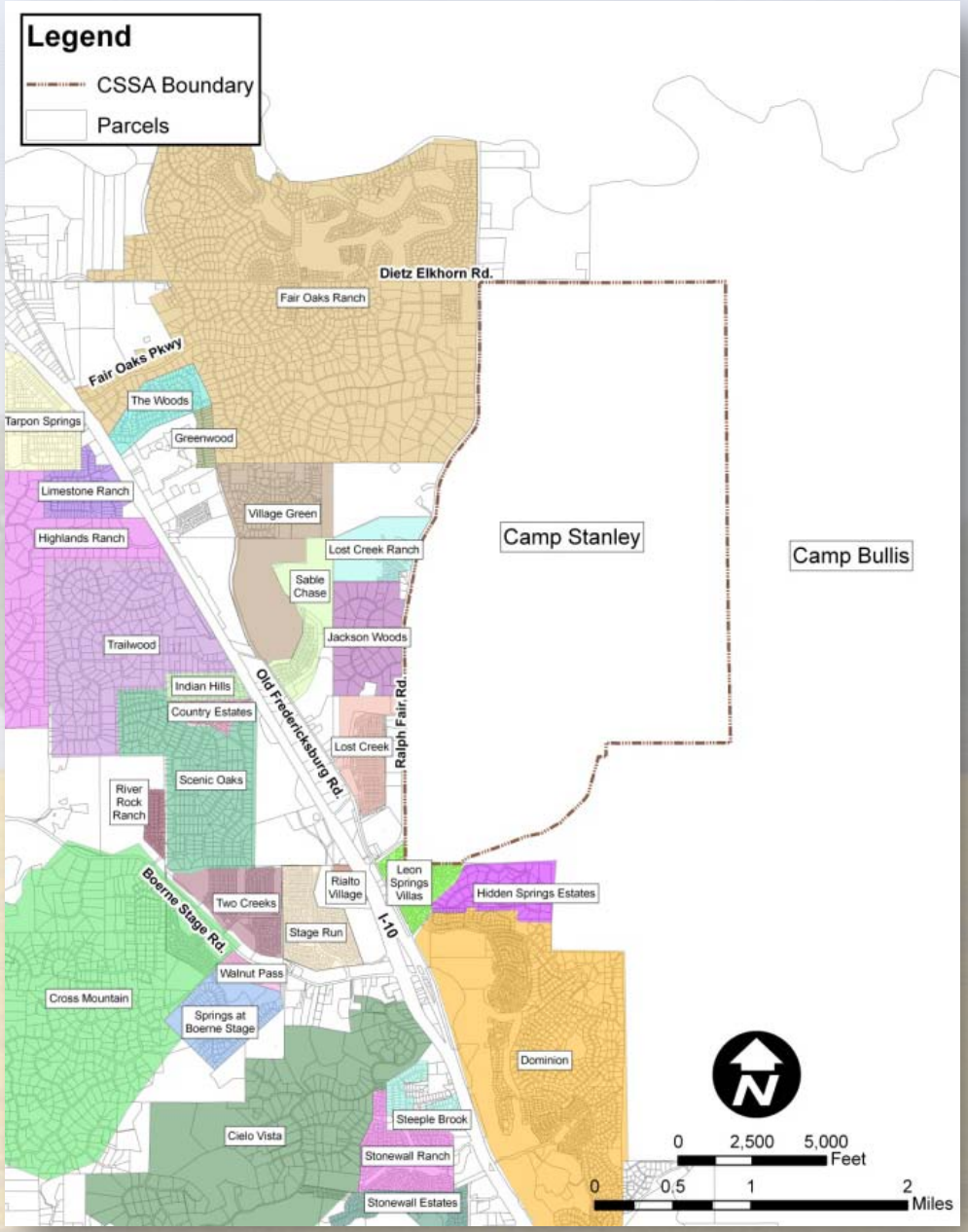
CSSA PUBLIC OUTREACH

Public meetings on CSSA's environmental program have been routinely held in 2001, 2002, 2006, and 2009.

Another meeting is scheduled for the end of 2015.

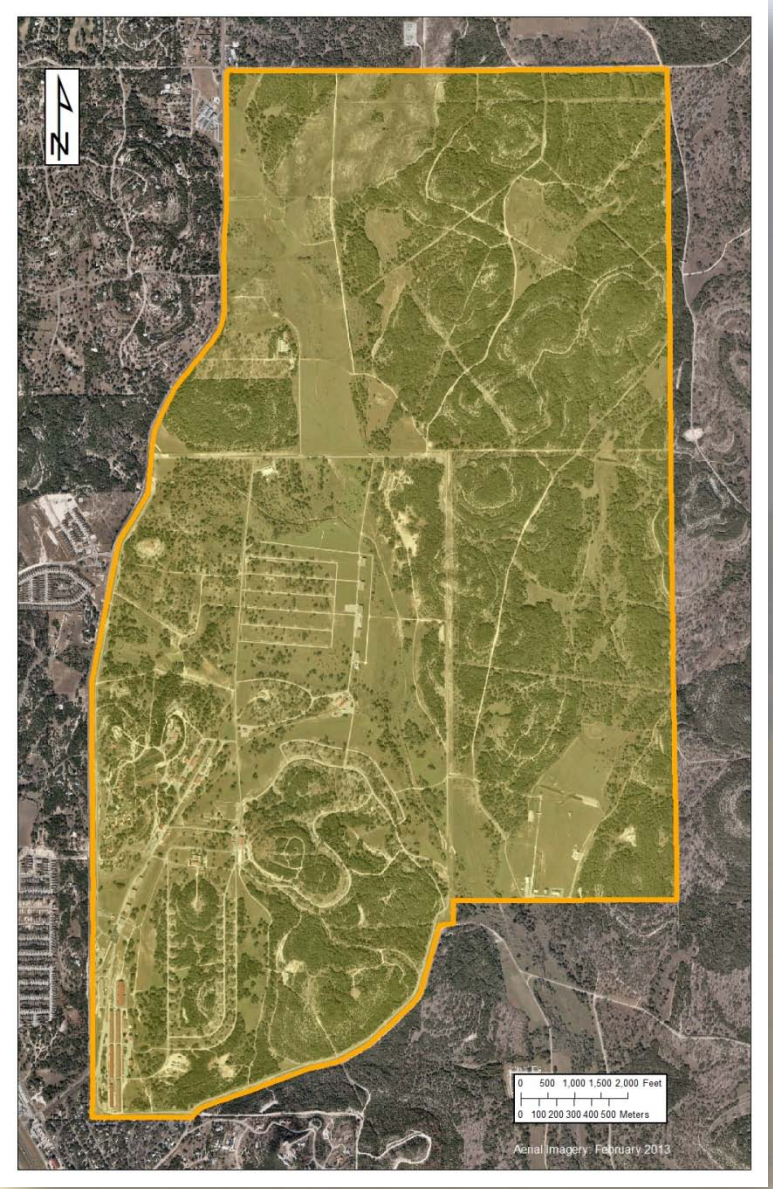
CSSA ENVIRONMENTAL SETTING

The area surrounding CSSA experienced rapid growth and development over the past 15 years.



CSSA ENVIRONMENTAL SETTING

Due to its mission, the majority of CSSA land is undeveloped.



CSSA ENVIRONMENTAL SETTING

Suitable habitat for two species of endangered birds is situated within CSSA.

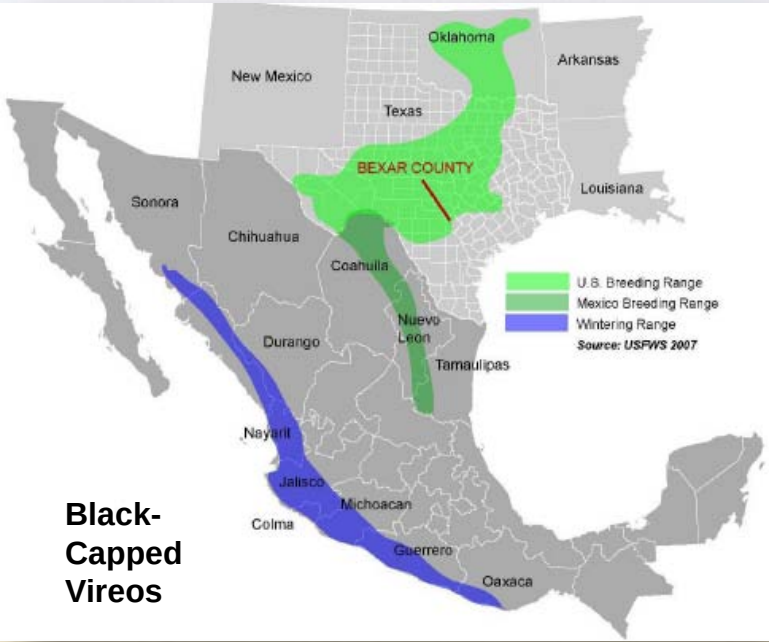
Habitat changes and nest parasitism by Brown-headed Cowbirds have caused **Black-capped Vireo** populations to vanish across much of the northern part of its historic range.

The rare and endangered **Golden-cheeked Warbler** nests only in the juniper-oak woodlands of central Texas.

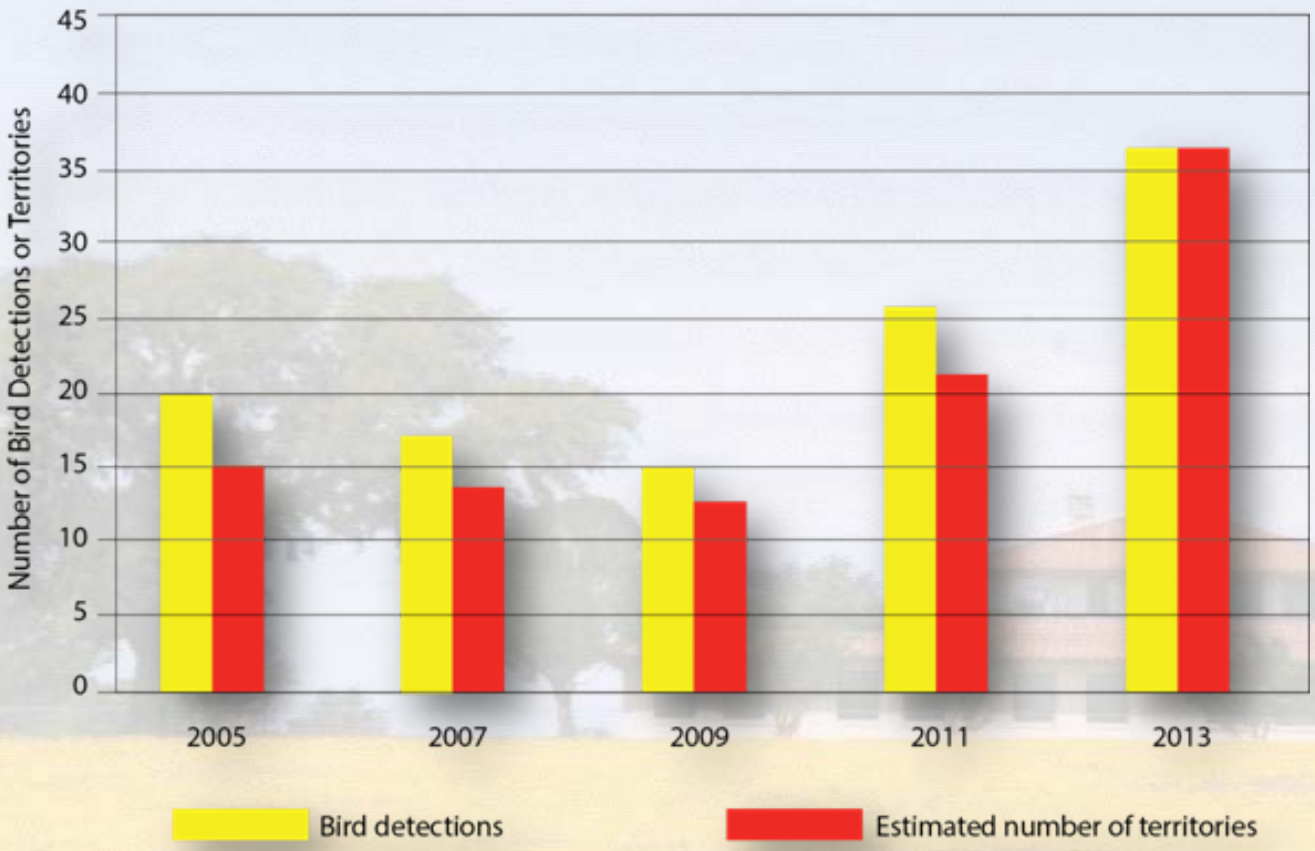
CSSA ENVIRONMENTAL SETTING

Golden-cheeked warblers have been documented at CSSA during every survey. While black-capped vireos have only been documented at CSSA in 1993 and 2005, suitable habitat is present on post.

Breeding and Wintering Ranges



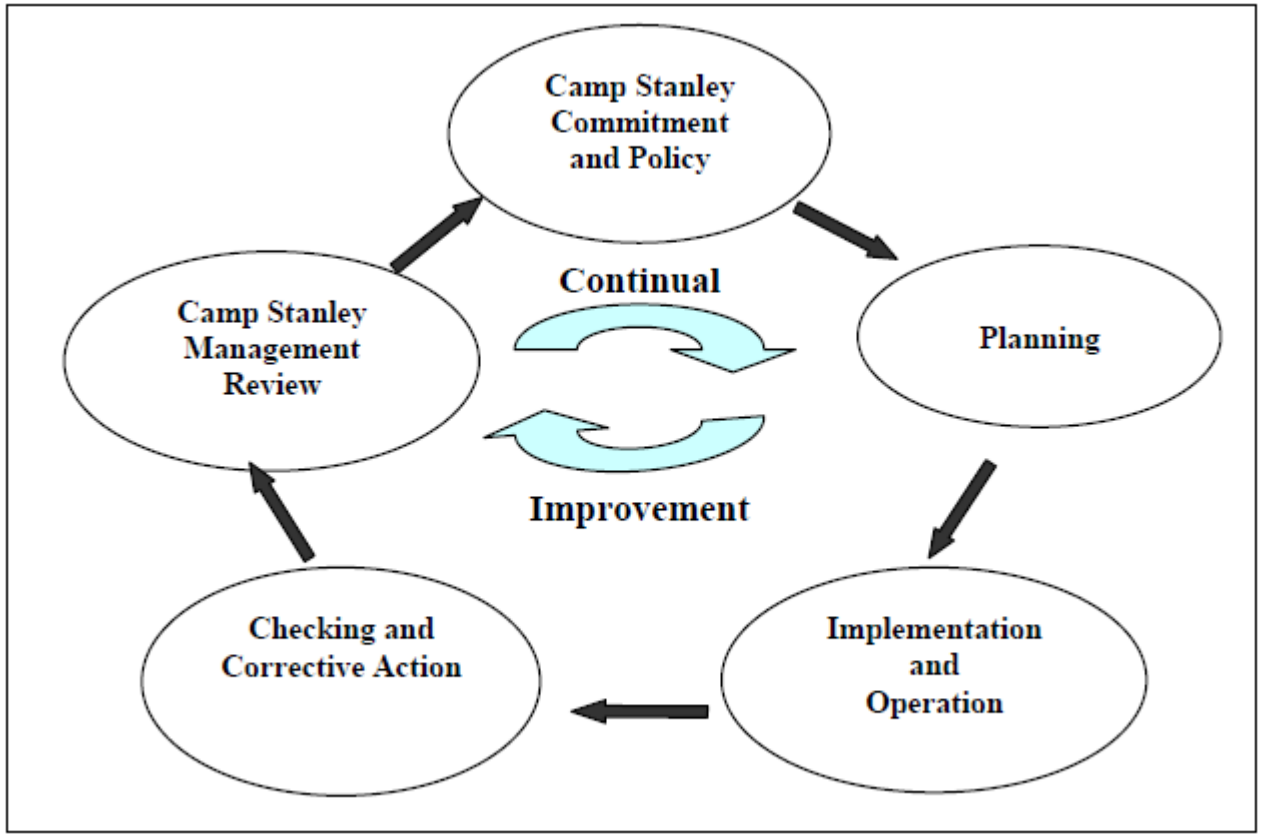
CSSA ENVIRONMENTAL SETTING



The number of golden-cheeked warblers at CSSA has increased significantly since 2005.

CSSA GREENING ACTIVITIES

CSSA is continuously fine-tuning operations that impact the environment.



CSSA GREENING ACTIVITIES

Electric vehicles are used within a number of the warehouses and by the public works department.

CSSA has a fleet of electric forklifts, Segways, Polaris Rangers, and other vehicles.

CSSA Greening Activities

Installation of a 56.4 kW Sundial© Military Transportable Solar Power System is expected to be completed by mid-2014.

CSSA GREENING ACTIVITIES

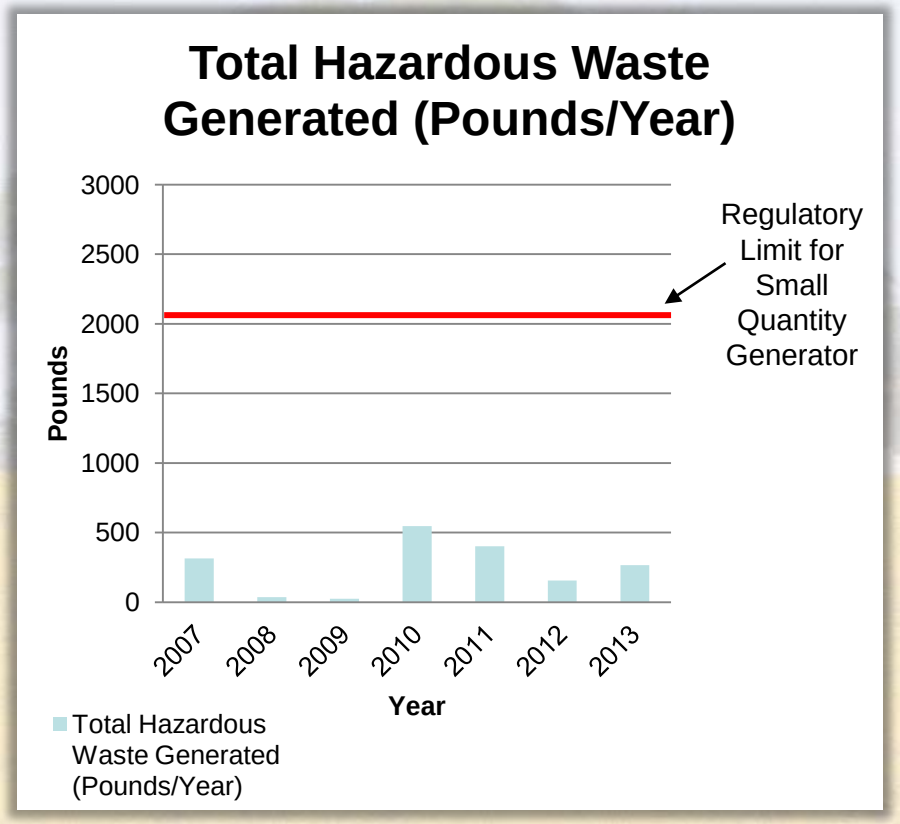
Rainwater harvesting is part of CSSA's Water Management Plan.

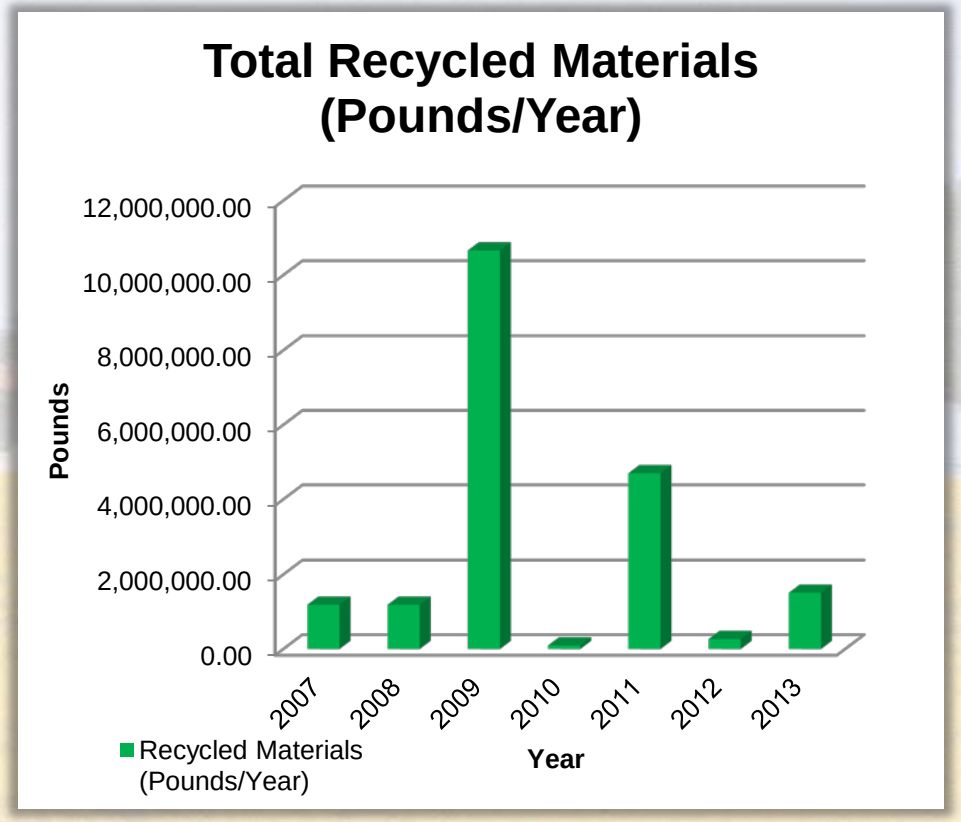
CSSA GREENING ACTIVITIES

Reduction of hazardous material use is accomplished through recycling, product substitution, issue control, redesign, and innovation.

CSSA GREENING ACTIVITIES

Comparison Between Waste Generated and Waste Recycled since 2007





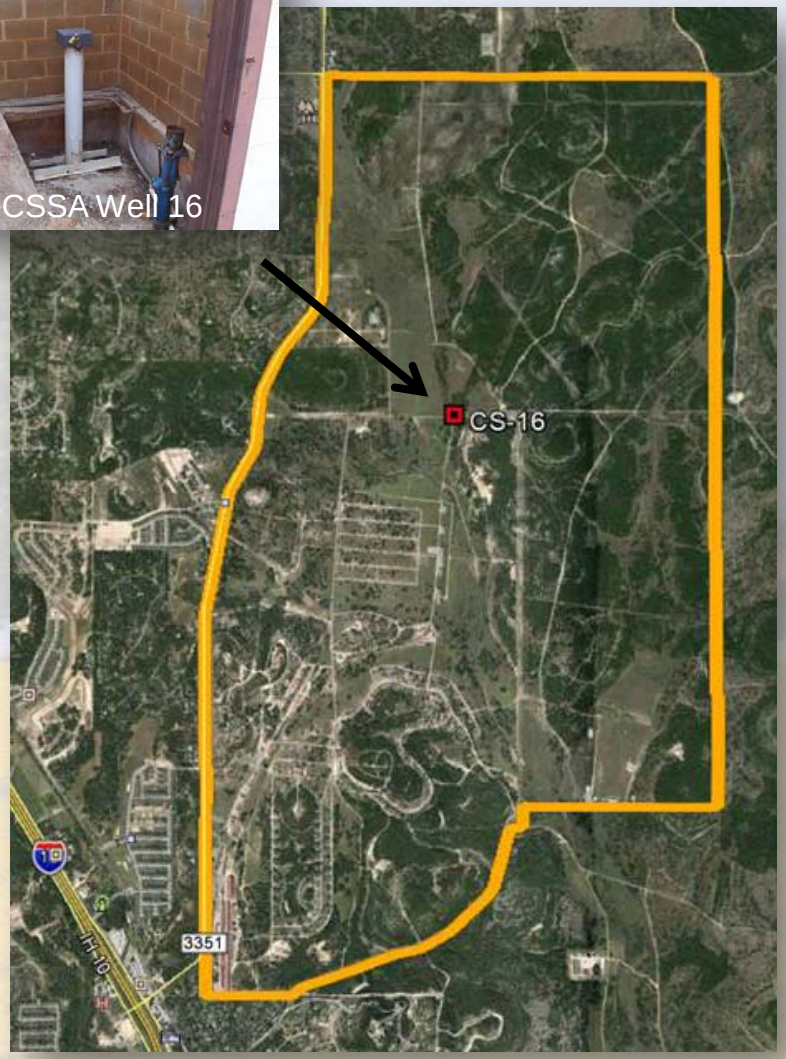
CSSA GREENING ACTIVITIES

Metal and construction debris removed during environmental remediation work is recycled.

Photograph taken at Monterey Iron & Metal, San Antonio

RESTORATION EFFORTS AT CAMP STANLEY STORAGE ACTIVITY (CSSA)

CSSA ENVIRONMENTAL PROGRAM



Routine testing of CSSA water supply wells in August 1991 indicated the presence of contamination in Well 16.

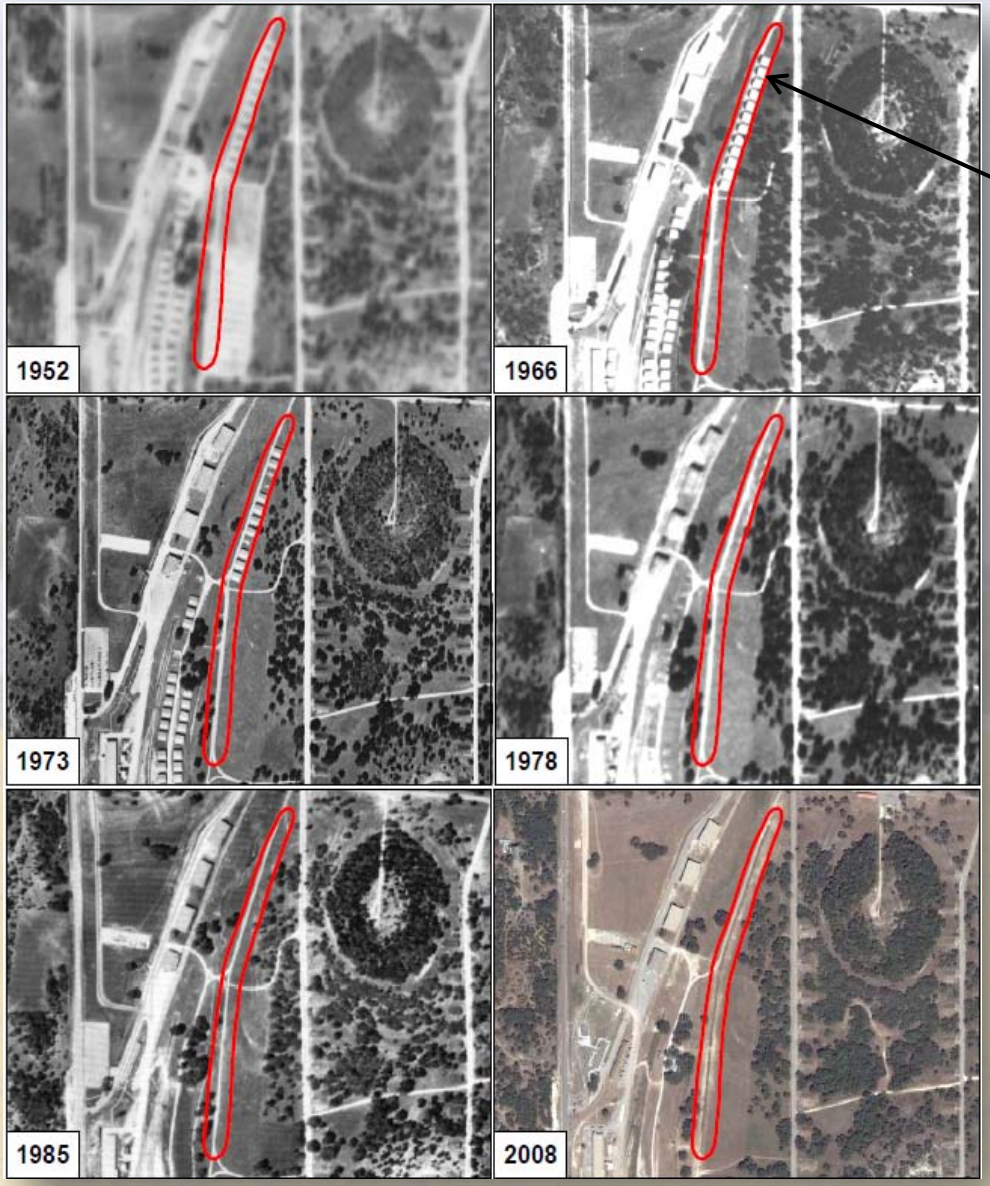
CSSA ENVIRONMENTAL PROGRAM

Since 1991, CSSA's Environmental Office has been actively identifying potential sites of contamination and engaging in cleanup and restoration activities.

SITE IDENTIFICATION

Potential sites were any areas on post that contained contaminated media (soil, sediment, surface water, groundwater) resulting from previous CSSA activities.

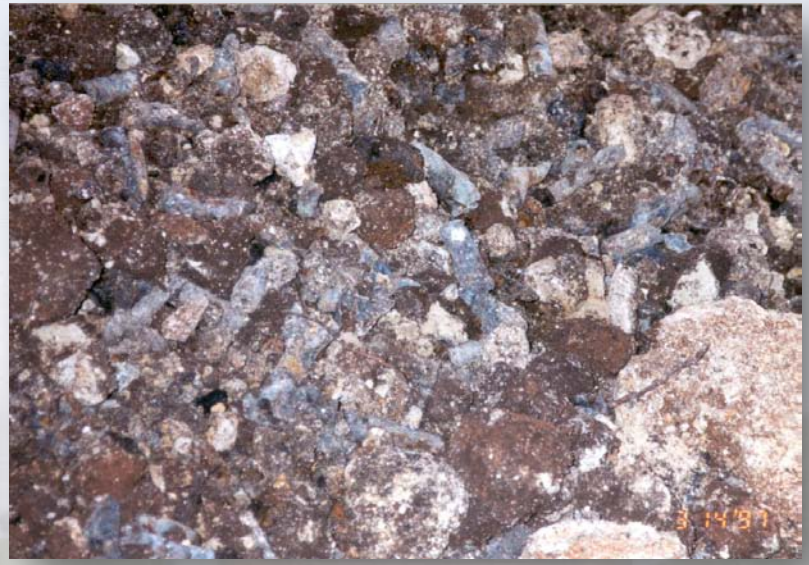
SITE IDENTIFICATION



Potential sites were identified through review of post records, personnel interviews, visual observations of ground disturbances, and research of historical aerial photographs.

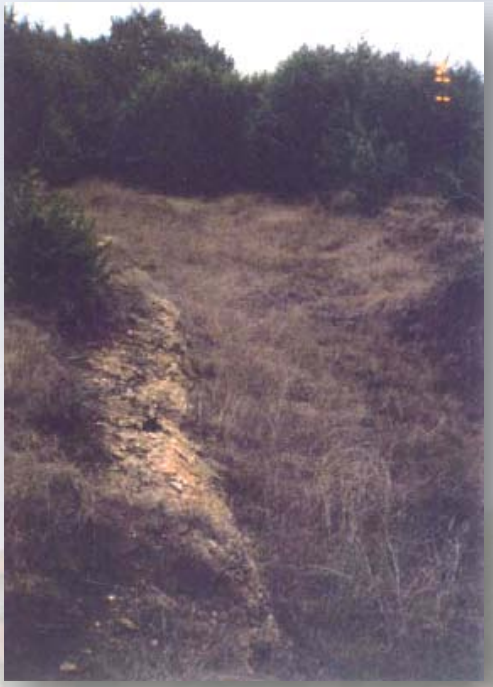
SITE IDENTIFICATION

Potential sites included inactive firing ranges.



These sites were identified as Range Management Units (RMUs).

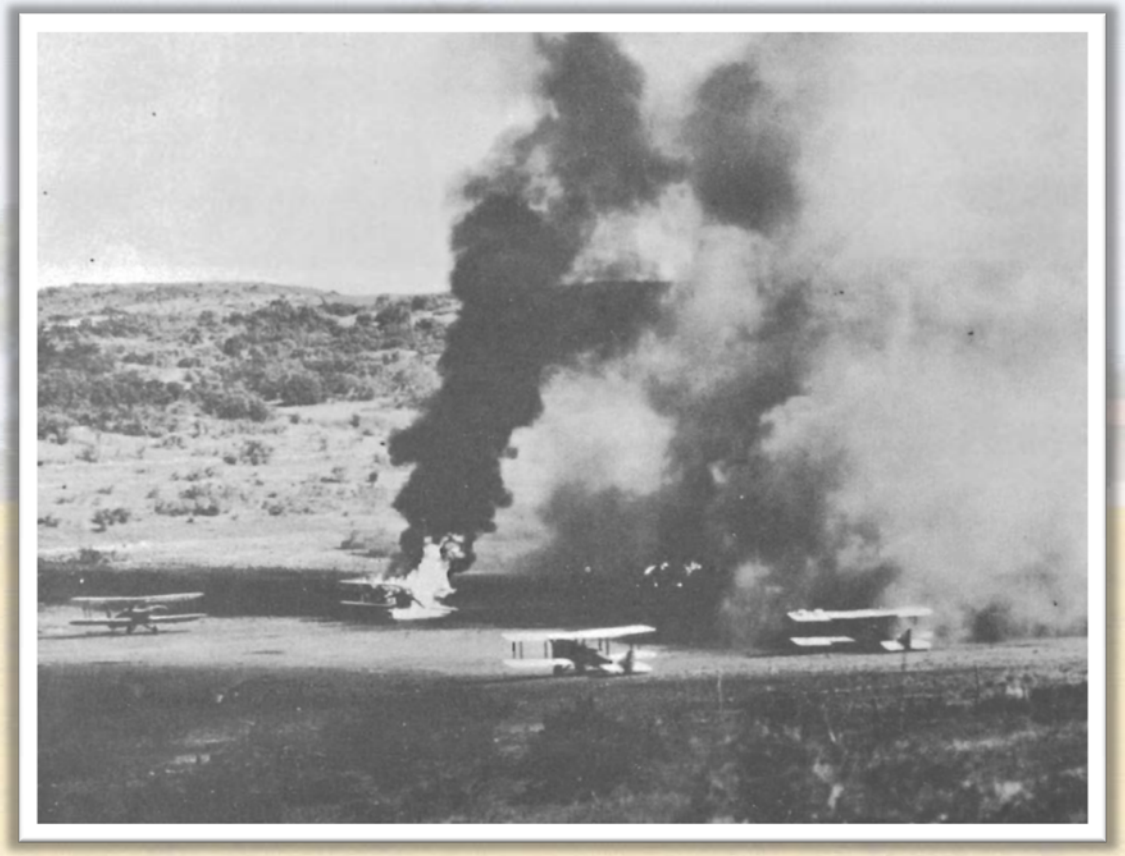
SITE IDENTIFICATION



Former landfills or burial sites were identified as areas of concern.

SITE IDENTIFICATION

Historical aerial testing performed at CSSA.



SITE CLOSURE PROCESS

CSSA works in close partnership with USEPA, TCEQ, and USGS to:

- Assess each site
- Remediate contamination
- Restore the land
- Permanently close each site

This process was used to close 81 sites.

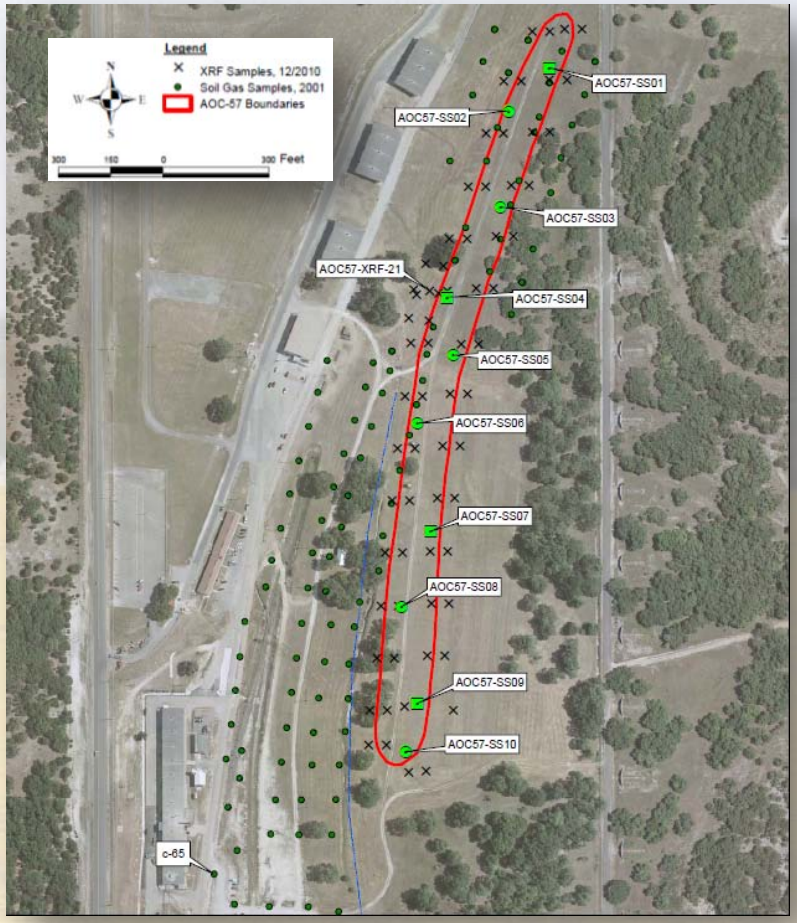
USGS
science for a changing world

TEXAS COMMISSION ON ENVIRONMENTAL QUALITY

SITE CLOSURE PROCESS

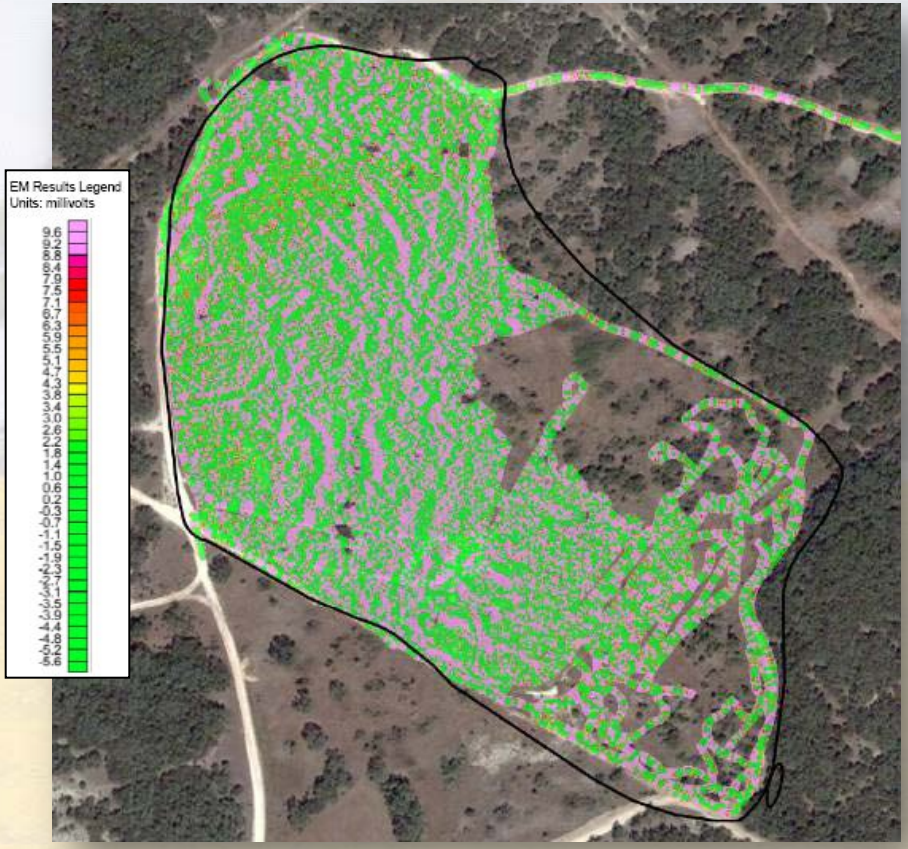
Initial Investigation → Site Remediation/ Restoration → Site Closure

Soil samples were collected to test for contamination and to help delineate the site boundaries.



SITE CLOSURE PROCESS

Initial Investigation → Site Remediation/ Restoration → Site Closure



When a site was suspected to contain buried waste, a geophysical survey was performed.

The survey measured the magnetic field below the ground surface and was used to locate buried metallic objects.

SITE CLOSURE PROCESS

Initial Investigation → Site Remediation/ Restoration → Site Closure

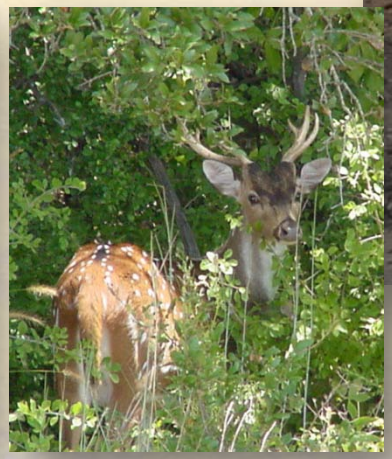
Once the extent of contamination was determined, contaminated soil and any associated debris were removed from the area.

SITE CLOSURE PROCESS

Initial Investigation → Site Remediation/ Restoration → Site Closure

Sites were then repurposed or restored to their original condition.

Some were reworked as wildlife protection and management areas.



SITE CLOSURE PROCESS

Initial Investigation → Site Remediation/ Restoration → Site Closure

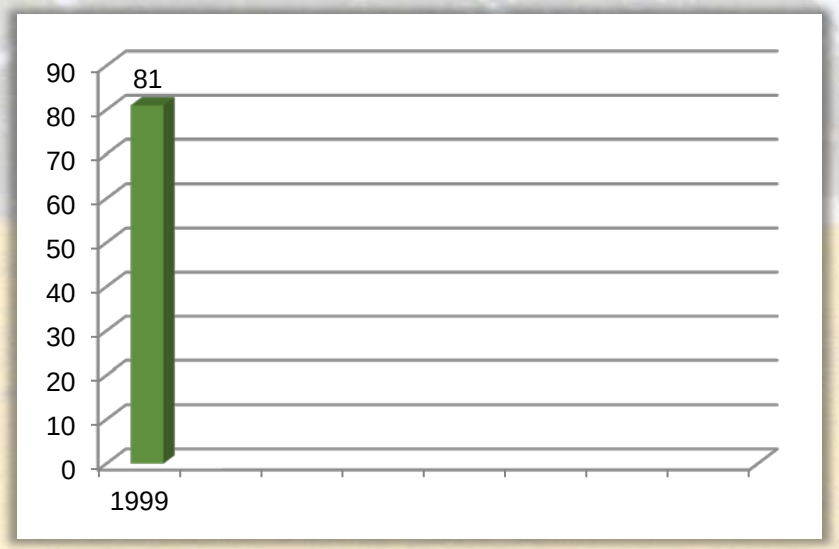
The TCEQ's Texas Risk Reduction Program (TRRP) is a risk based corrective action process that regulates the site closure process.

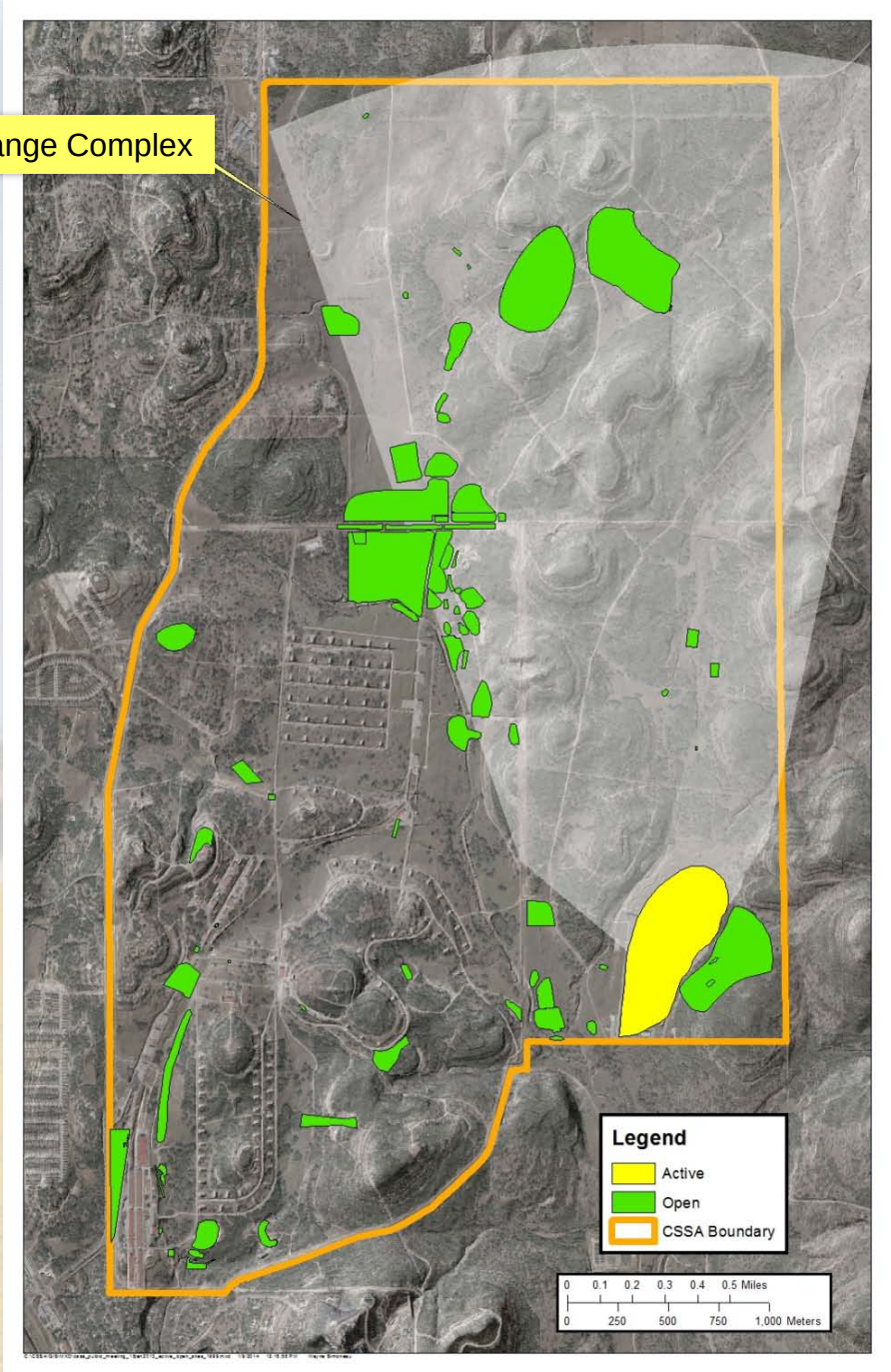
Once each site was remediated, closure documents were submitted to the TCEQ requesting final closure.

CSSA has closed as many sites as possible to residential land use standards with a request for 'No Further Action.'

SITE REMEDIATION PROGRESS

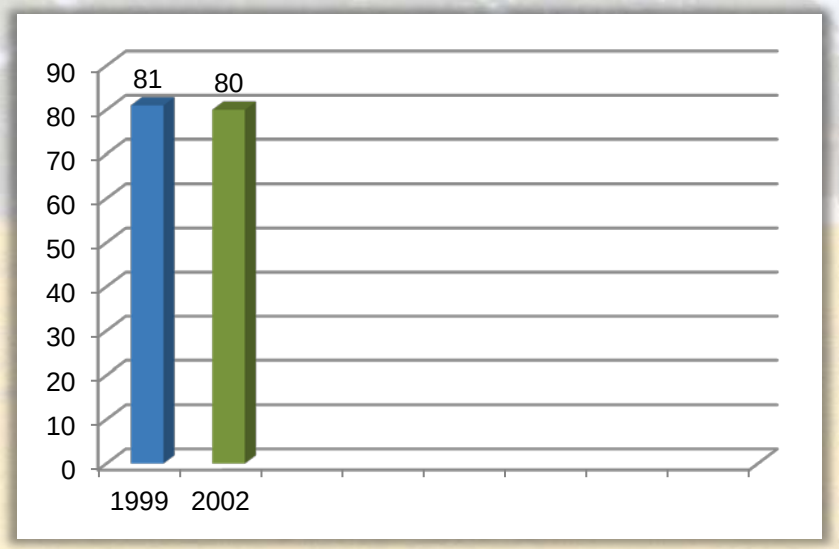
1999: 81 Open Sites

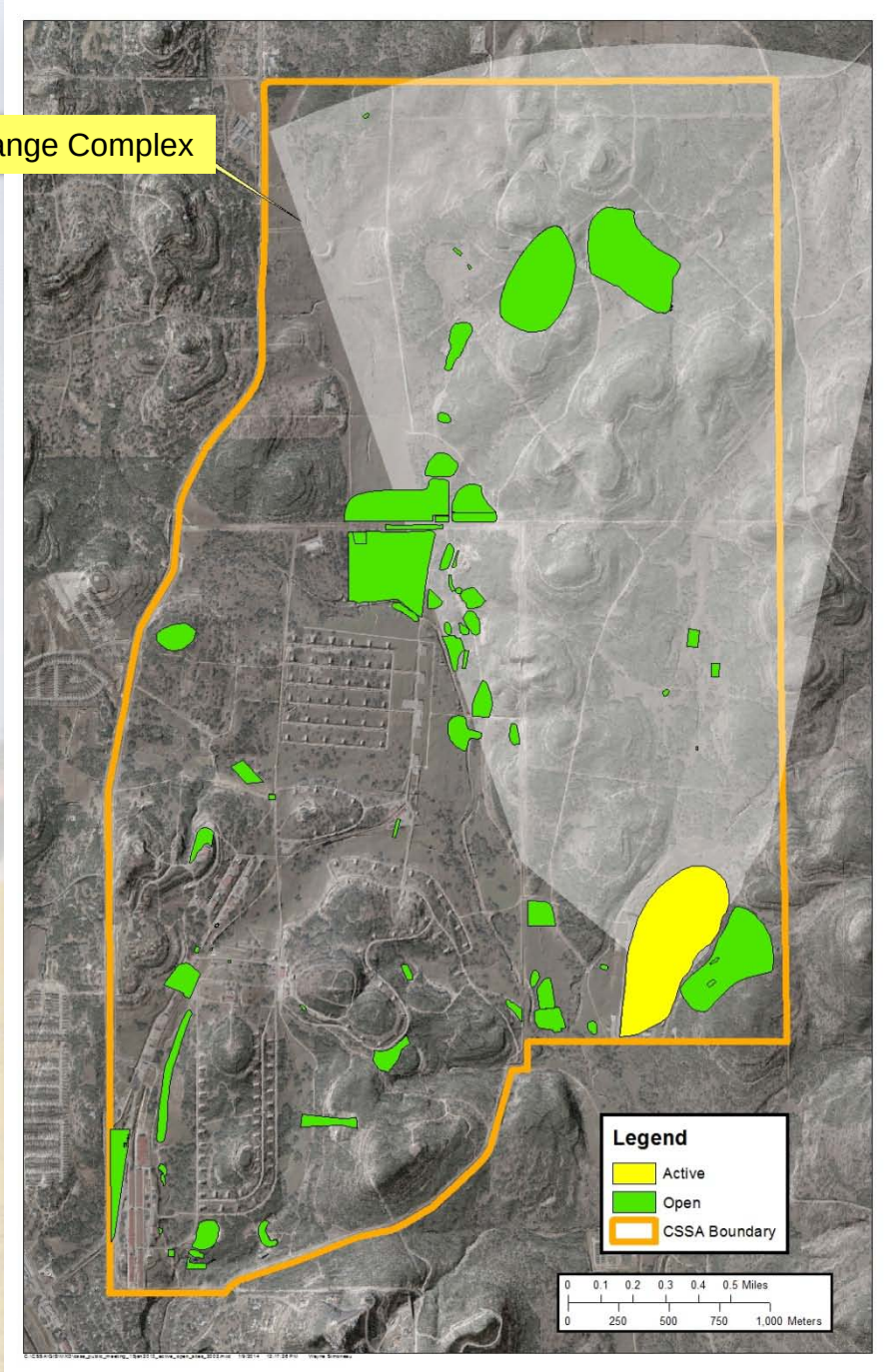




SITE REMEDIATION PROGRESS

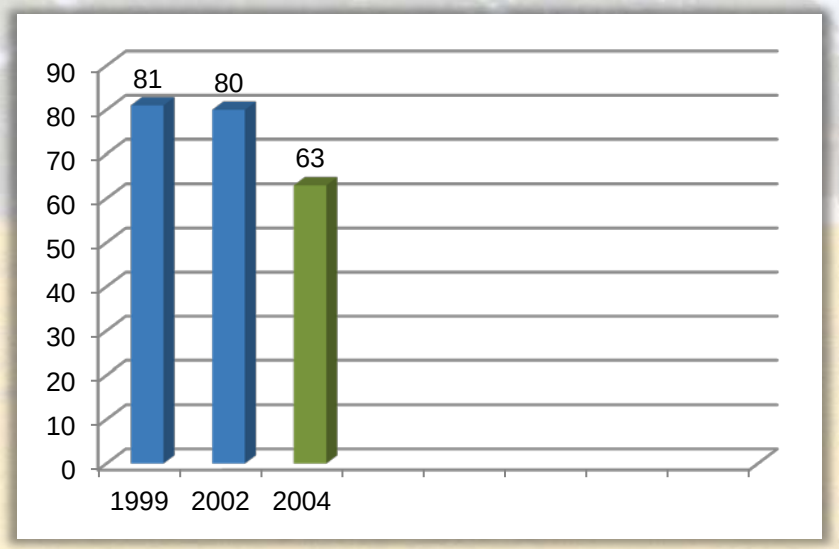
2002: 80 Open Sites

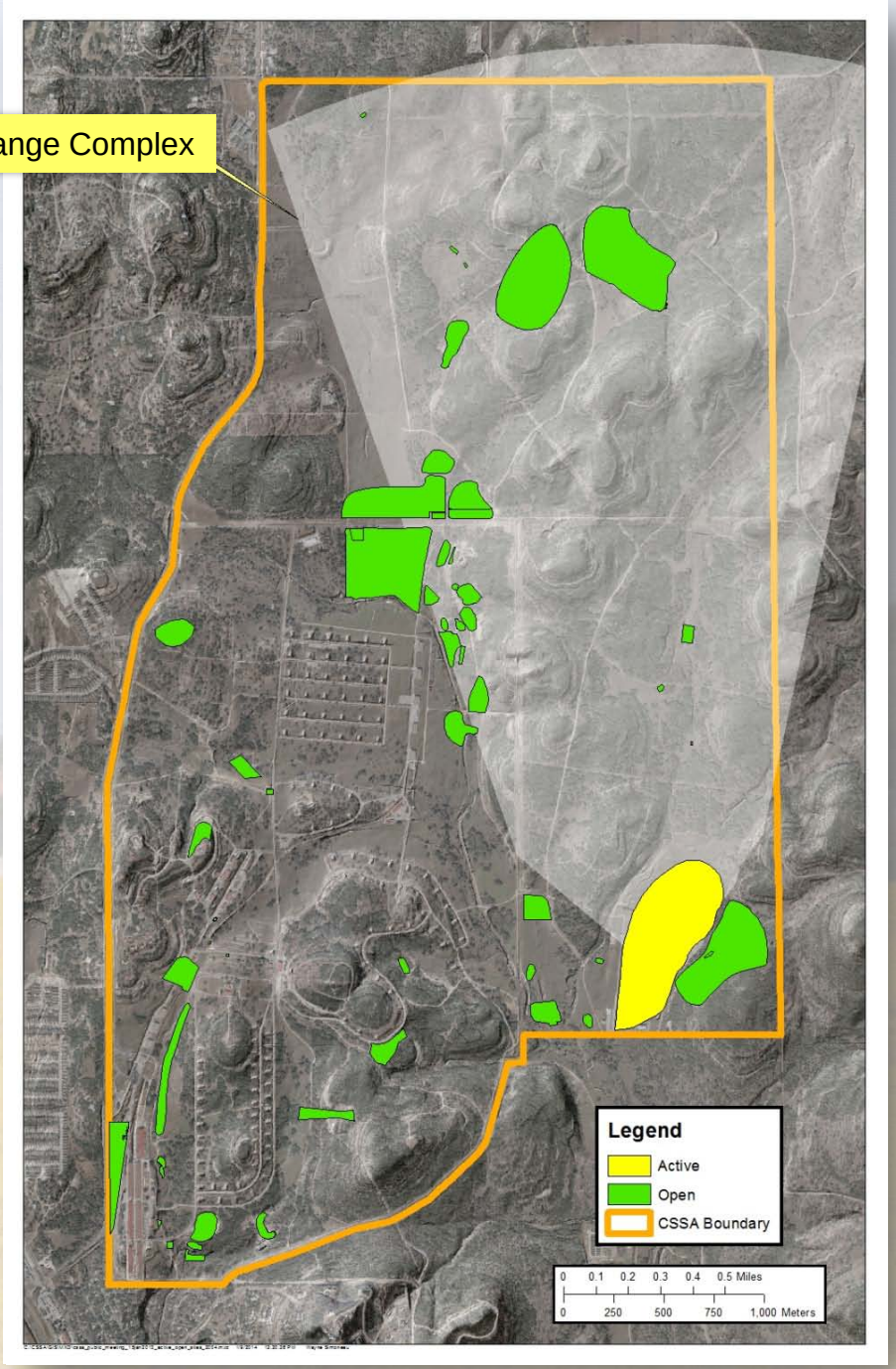




SITE REMEDIATION PROGRESS

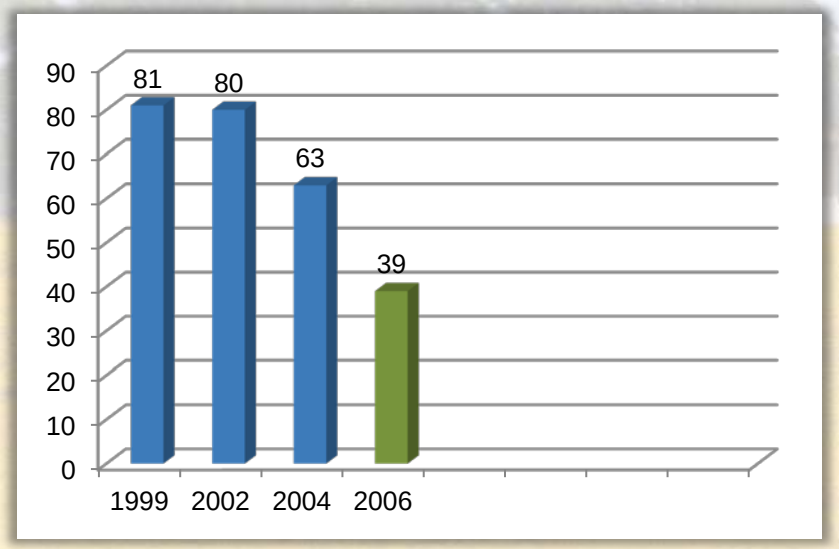
2004: 63 Open Sites

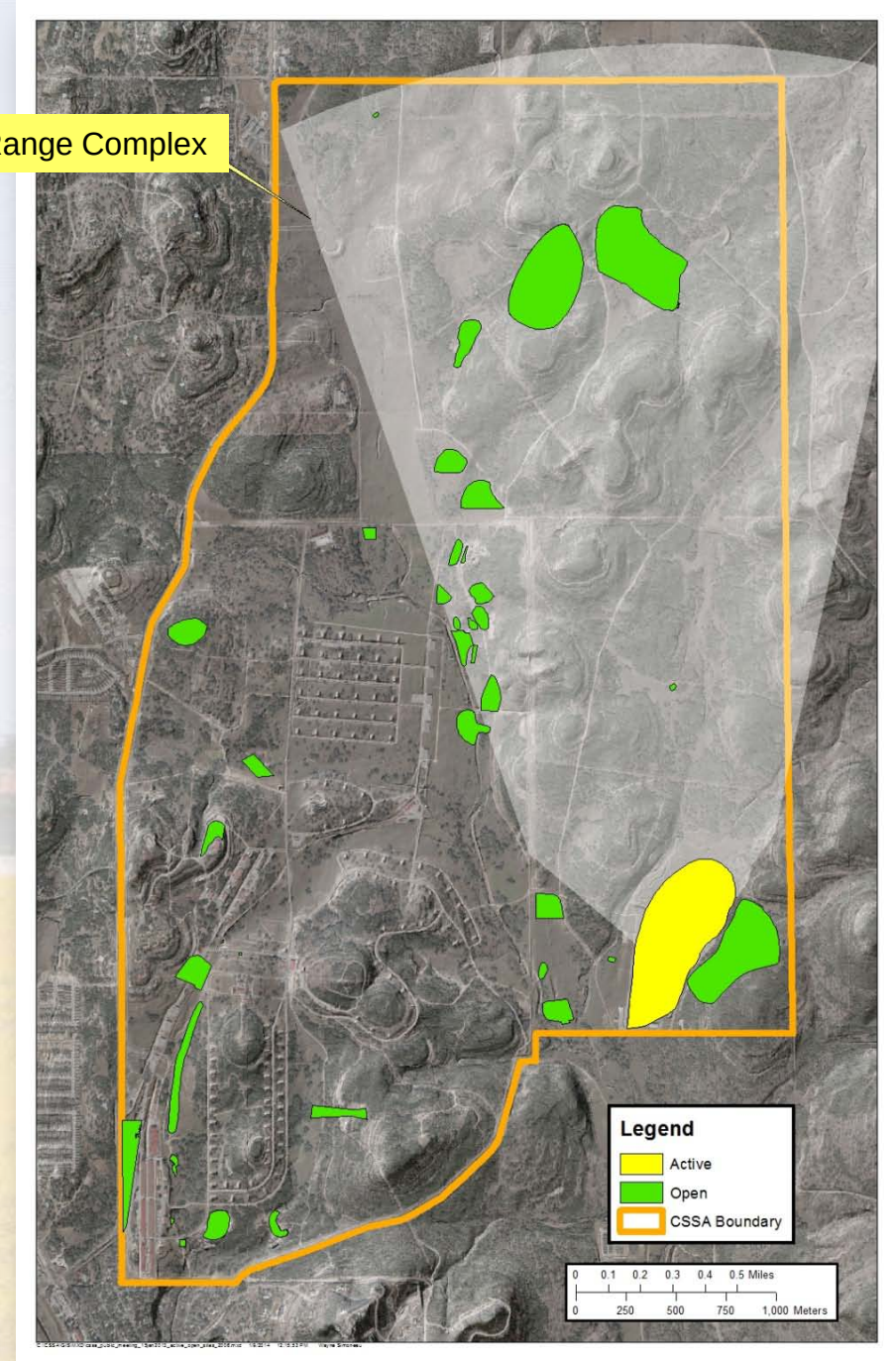




SITE REMEDIATION PROGRESS

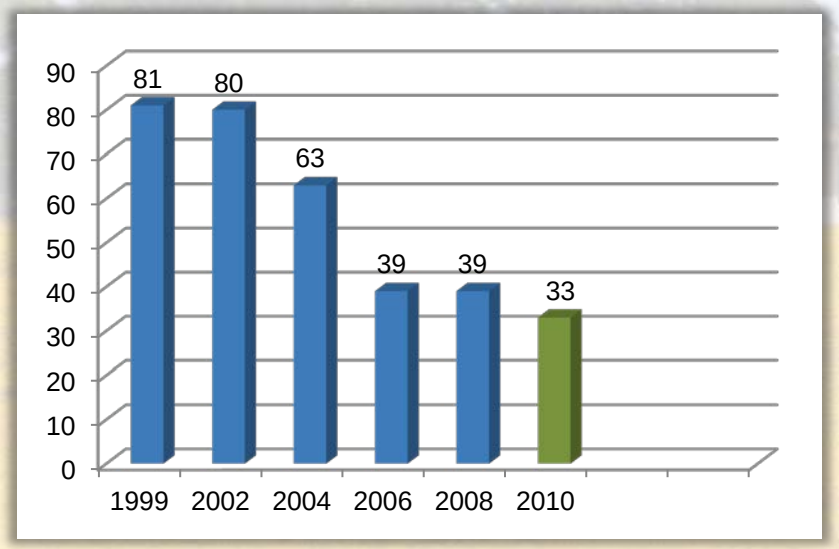
2006: 39 Open Sites

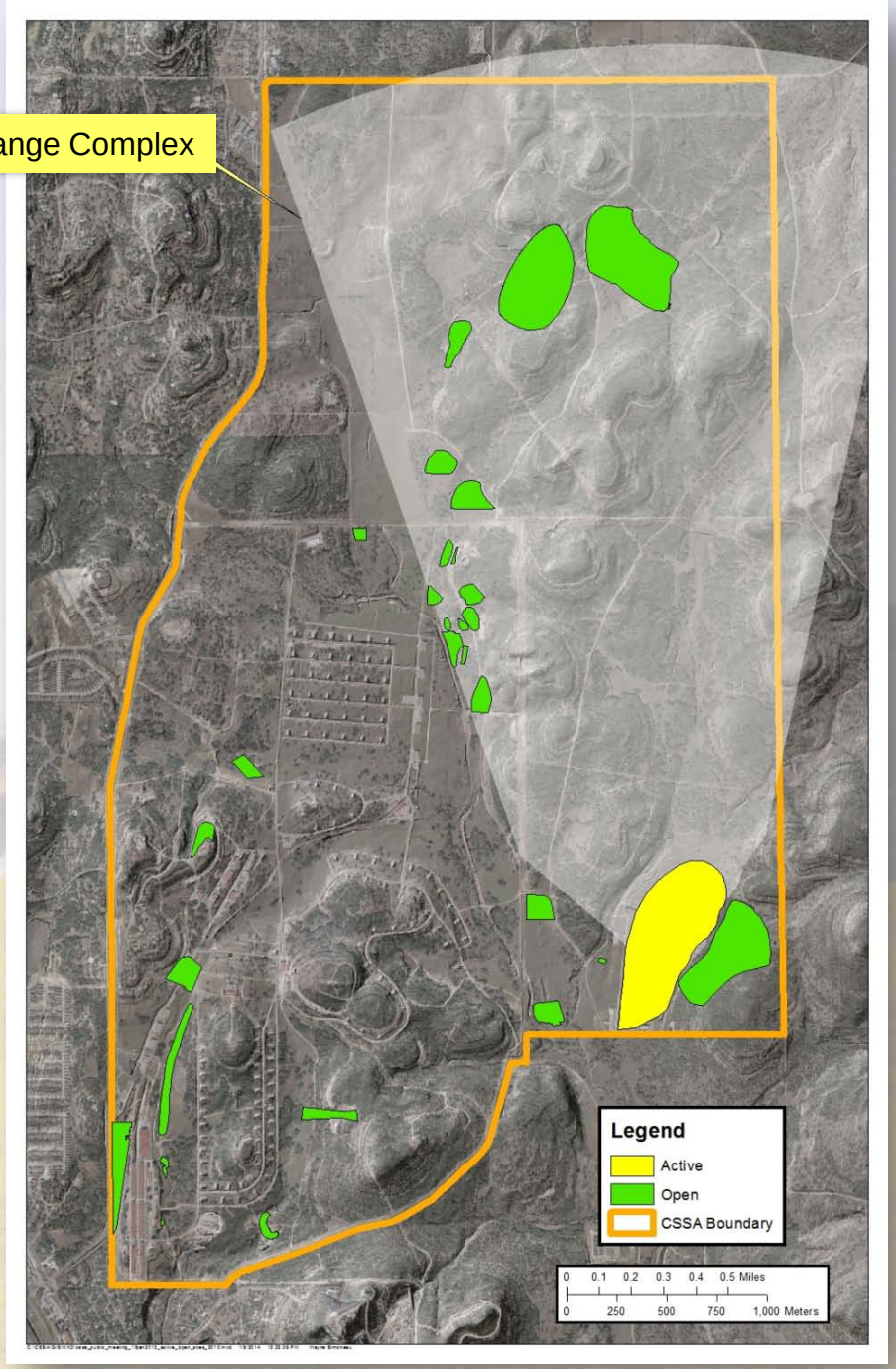




SITE REMEDIATION PROGRESS

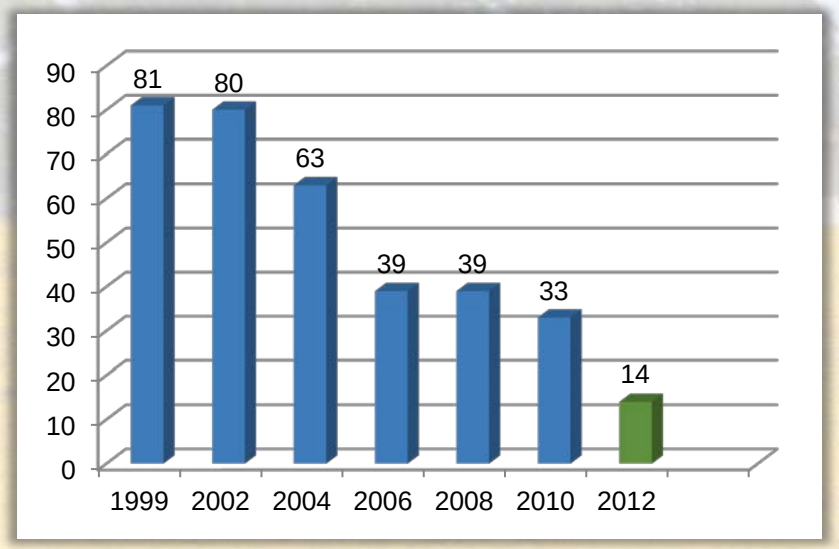
2010: 33 Open Sites



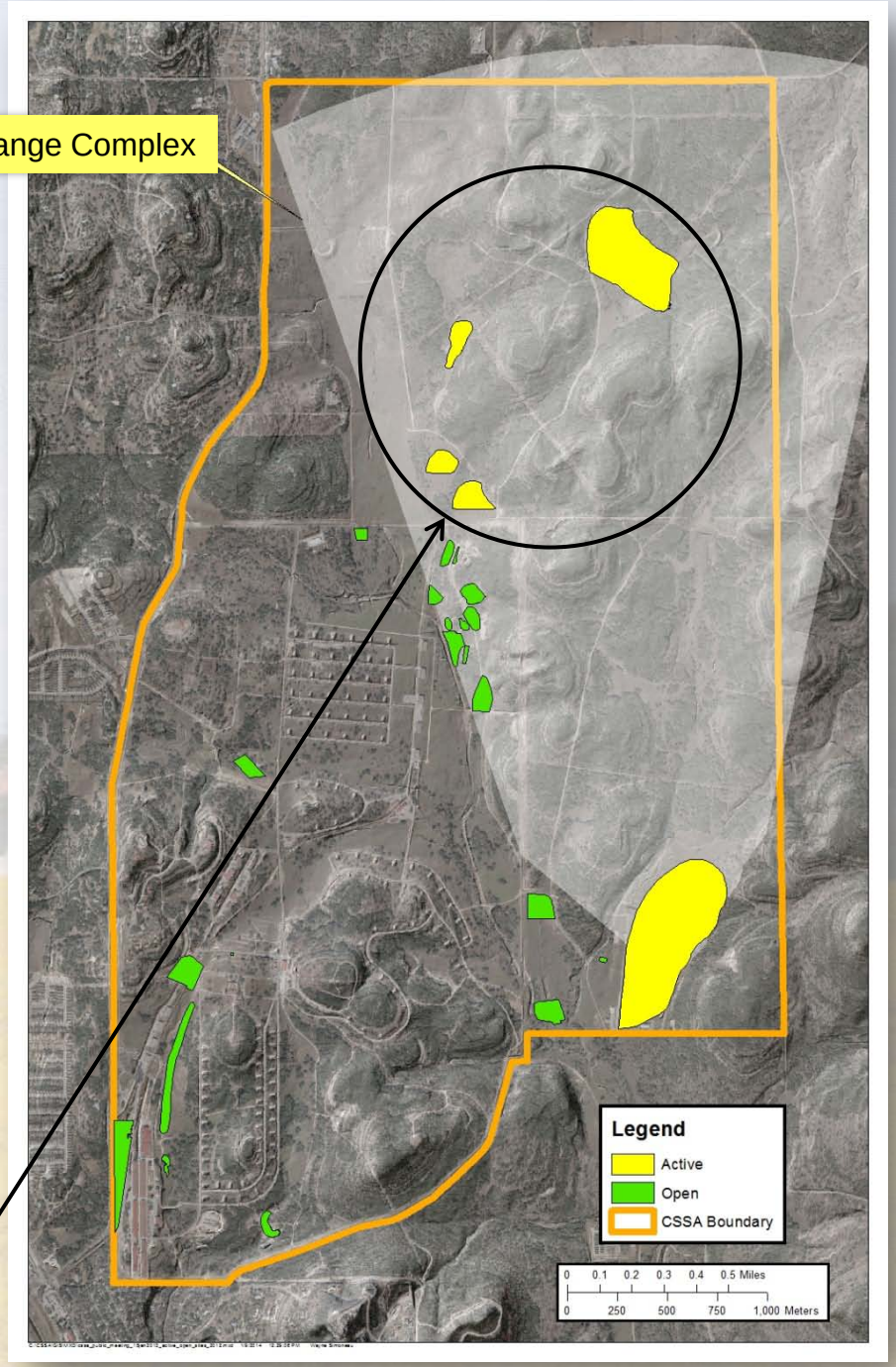


SITE REMEDIATION PROGRESS

2012: 18 Open Sites Including the Active Range*

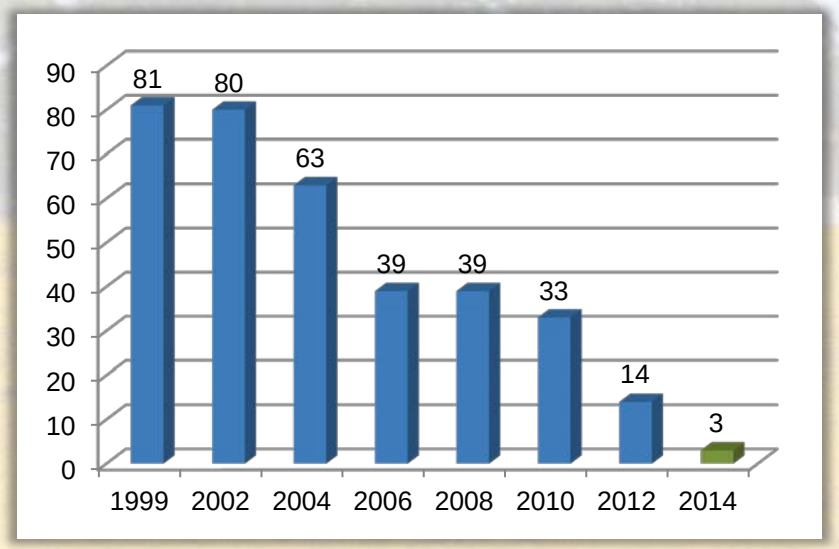


*Per agreement with the USEPA, the four munitions related sites located within the Active Range fan were consolidated into one site.

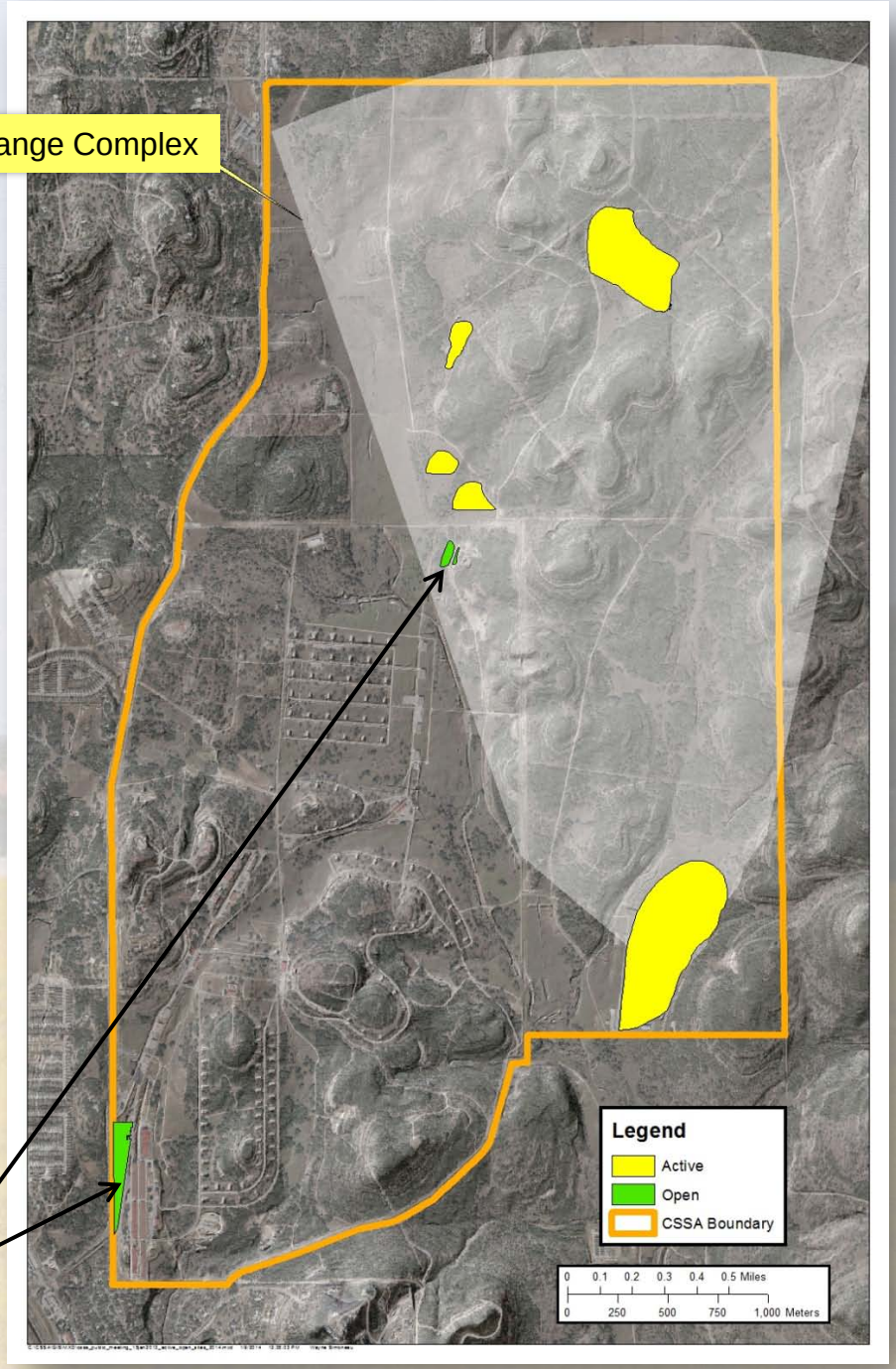


SITE REMEDIATION PROGRESS

2014: 3 Open Sites
Including the Active Range



Two remaining open sites are part of the long-term groundwater monitoring program.

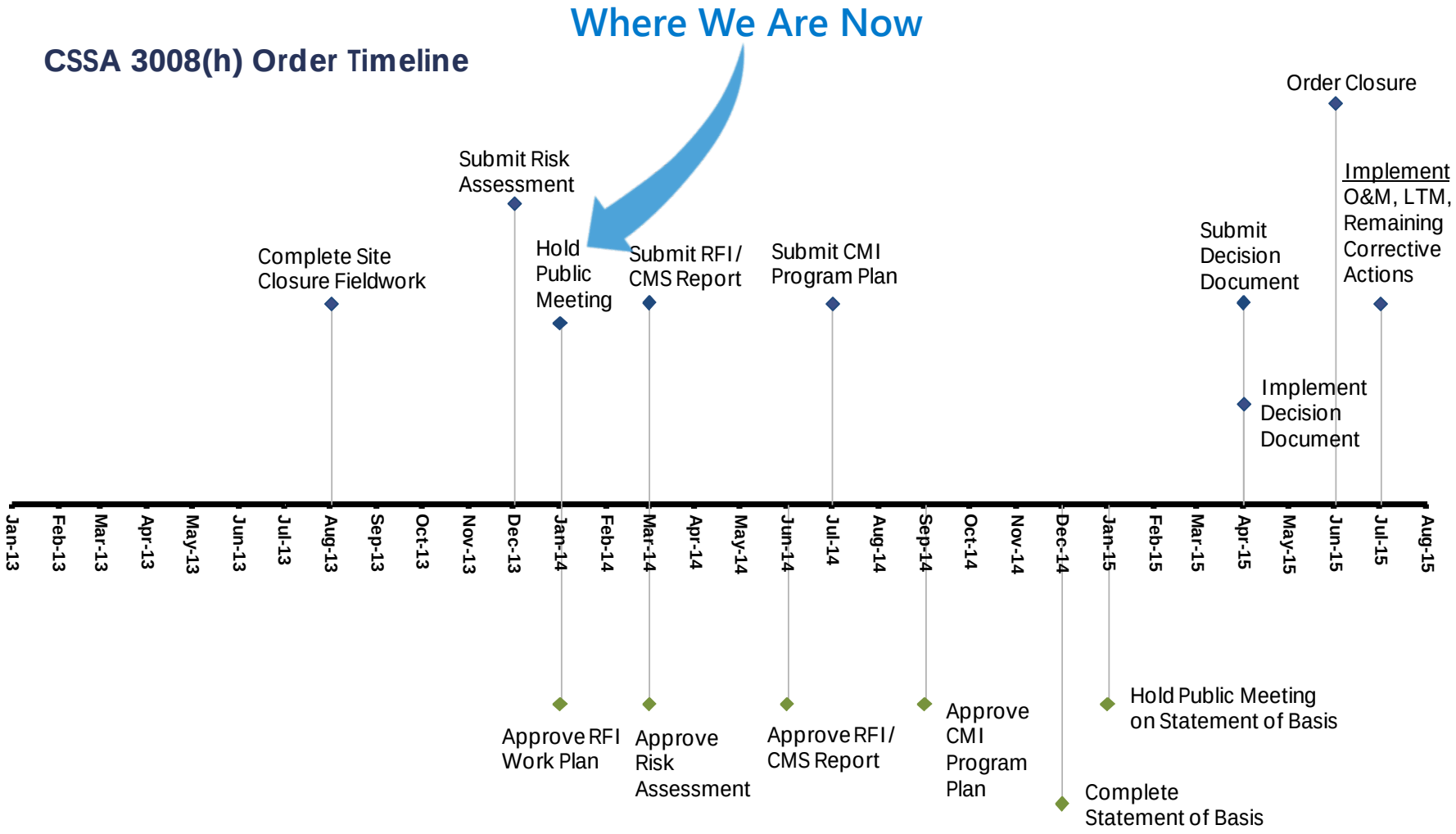


USEPA ORDER

CSSA continues to work closely with USEPA to close the RCRA §3008(H) Administrative Order issued in 1999.

The 1999 Order was put in place by USEPA to ensure that corrective action activities would be implemented to protect human health and the environment.

USEPA ORDER


Where We Are Now
CSSA 3008(h) Order Timeline
Complete Site Closure Fieldwork
Submit Risk Assessment
Hold Public Meeting
Submit RFI / CMS Report
Submit CMI Program Plan
Submit Decision Document
Implement Decision Document
Order Closure
Implement O&M, LTM, Remaining Corrective Actions
Approve RFI Work Plan
Approve Risk Assessment
Approve RFI / CMS Report
Approve CMI Program Plan
Complete Statement of Basis
Hold Public Meeting on Statement of Basis
Jan-13
Feb-13
Mar-13
Apr-13
May-13
Jun-13
Jul-13
Aug-13
Sep-13
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May-15
Jun-15
Jul-15
Aug-15

SUMMARY

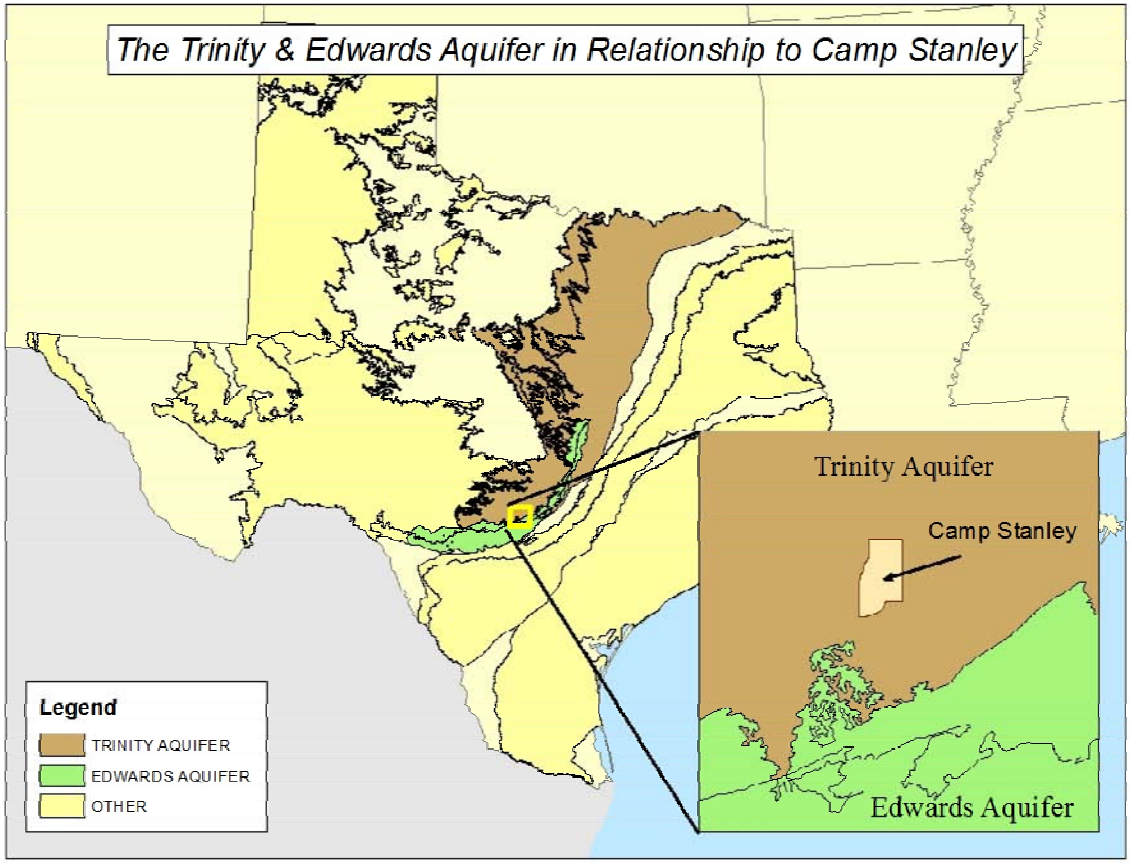
- Restoration of landfills and burial sites has been completed.
- Active range complex will be closed when it is no longer used.
- Two groundwater contamination sites will continue to be monitored and remediated.
- Agreed Order will be proposed for closure because corrective actions have been implemented.

GROUNDWATER COMPLIANCE AT CAMP STANLEY STORAGE ACTIVITY (CSSA)

SOURCES OF DRINKING WATER

In Central Texas, much of the water we drink is derived from groundwater. It is contained in “aquifers” beneath the surface in limestone bedrock. The water is pumped from wells and distributed by entities such as the **San Antonio Water System (SAWS)**.

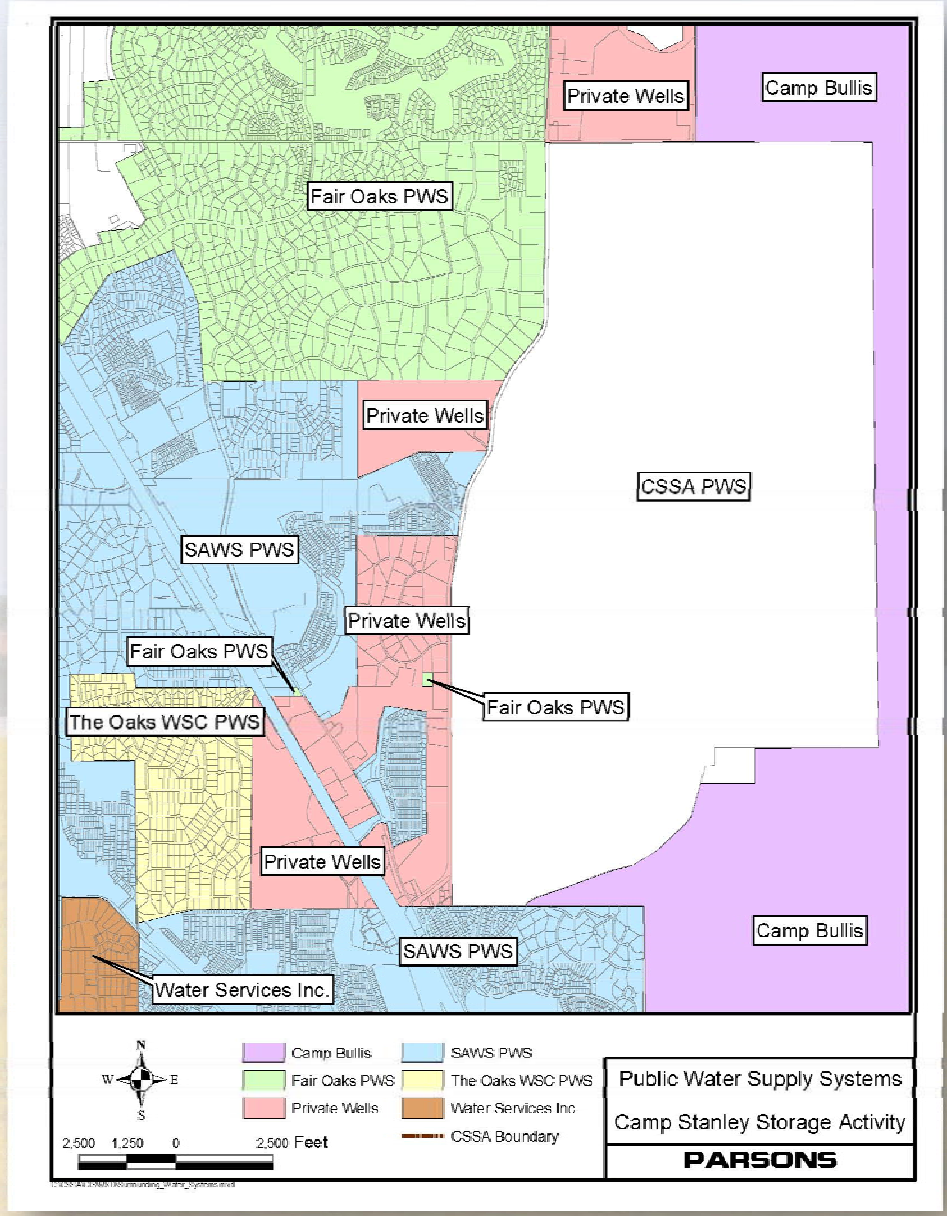
Around CSSA, groundwater water is derived from the **Middle Trinity Aquifer**. CSSA and the adjacent landowners rely on this water source. CSSA is not in the **Edwards Aquifer** and it is not present in our immediate vicinity.



SOURCES OF DRINKING WATER

There are many wells that get drinking water from the **Middle Trinity Aquifer**. This includes private landowners, commercial businesses, and independent Public Water Supply (PWS) systems including CSSA.

Wells in the **Middle Trinity Aquifer** located downgradient to the south and west are potentially at risk to be impacted by groundwater contamination from CSSA.



GEOLOGY AND HYDROGEOLOGY

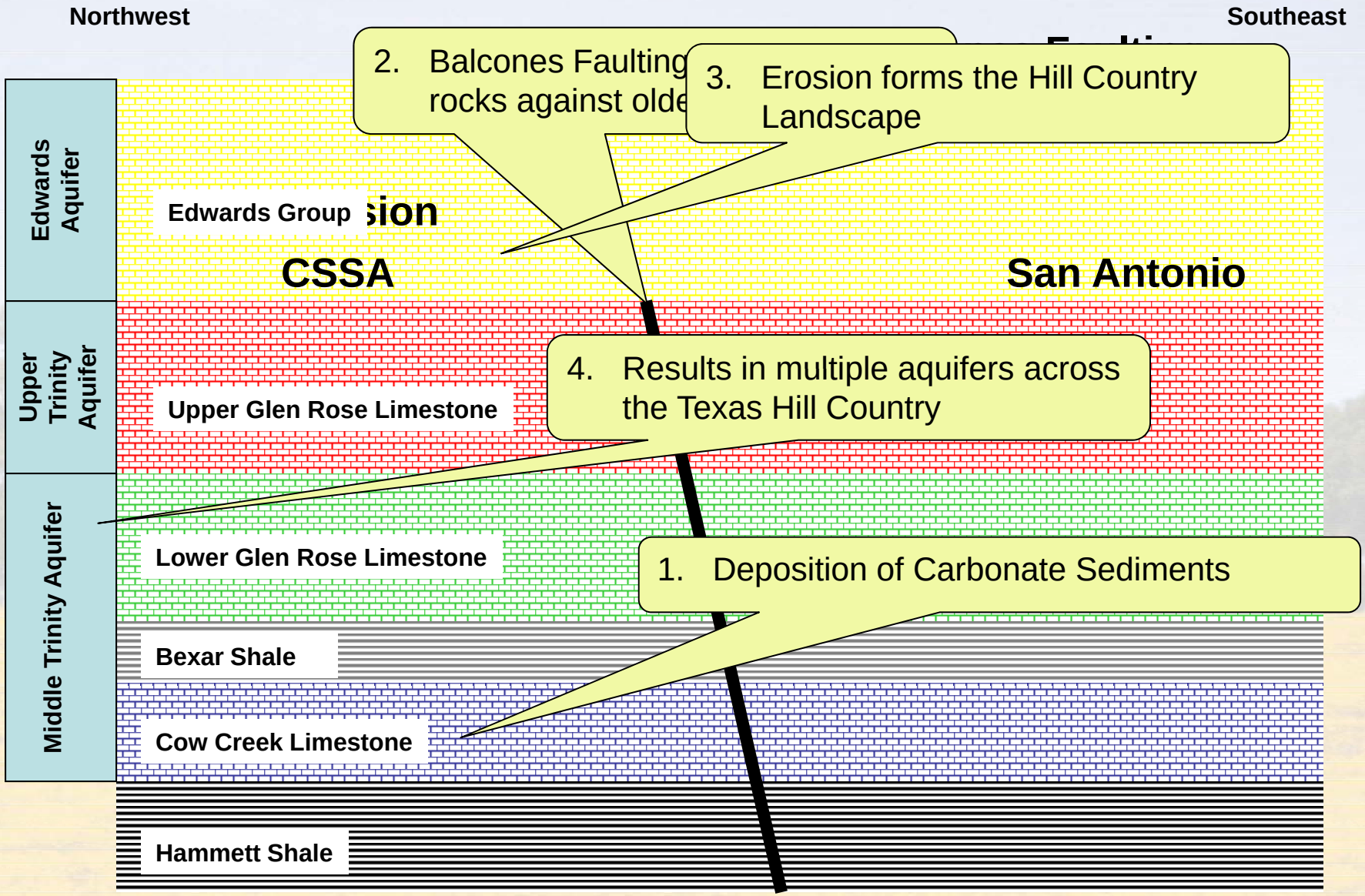
At CSSA and the adjacent properties, our groundwater is derived from the **Middle Trinity Aquifer**, which is located in older and deeper bedrock formations than those of the **Edwards Aquifer.**

The **Middle Trinity Aquifer** is made up of three geologic units:

- The Lower Glen Rose Limestone
- The Bexar Shale
- The Cow Creek Limestone

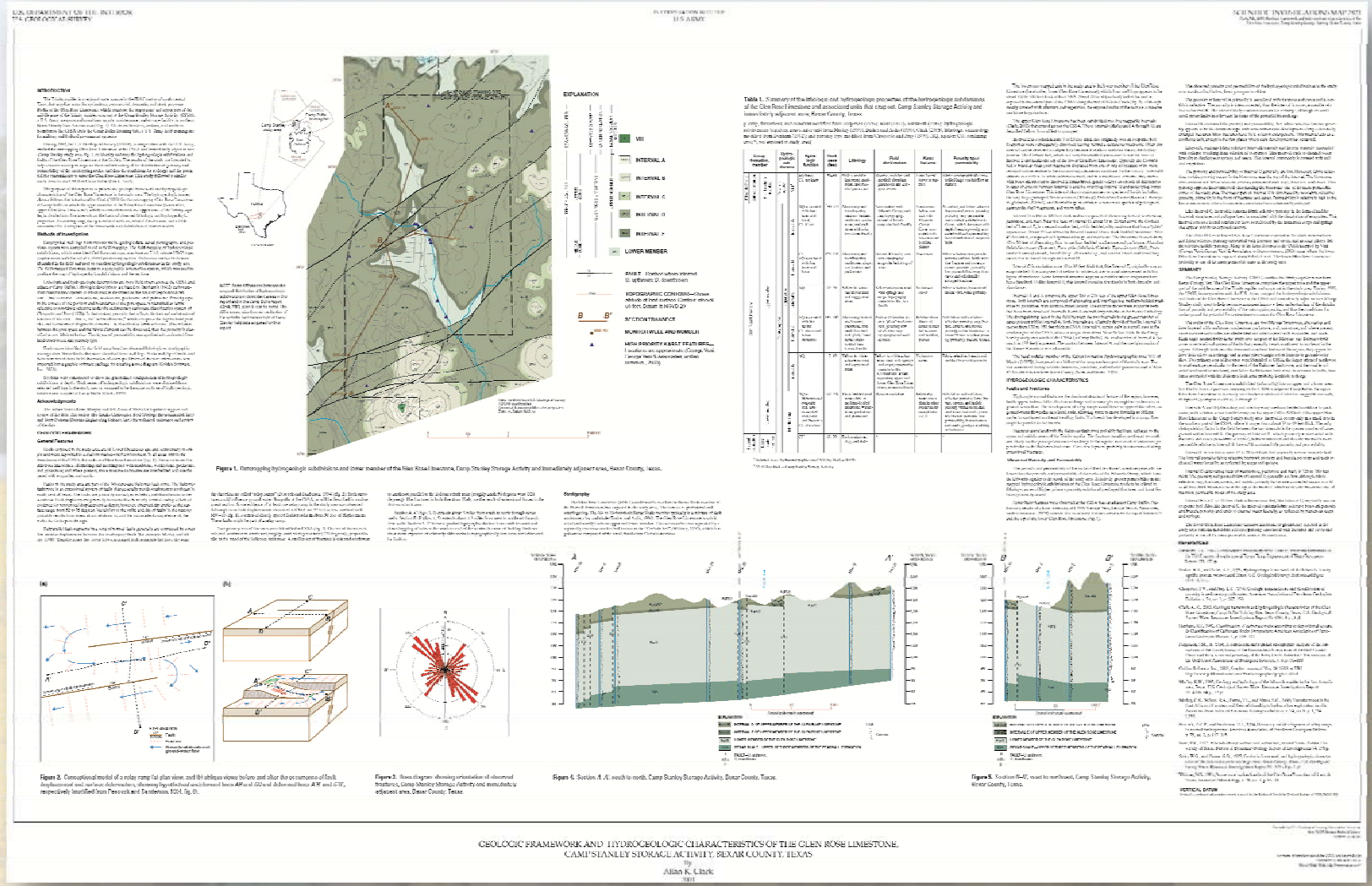
Contamination at CSSA has primarily impacted the **Lower Glen Rose** segment of the **Middle Trinity Aquifer**.

HYDROGEOLOGIC SETTING



HOW DO WE LEARN ABOUT THE GROUNDWATER SYSTEM?

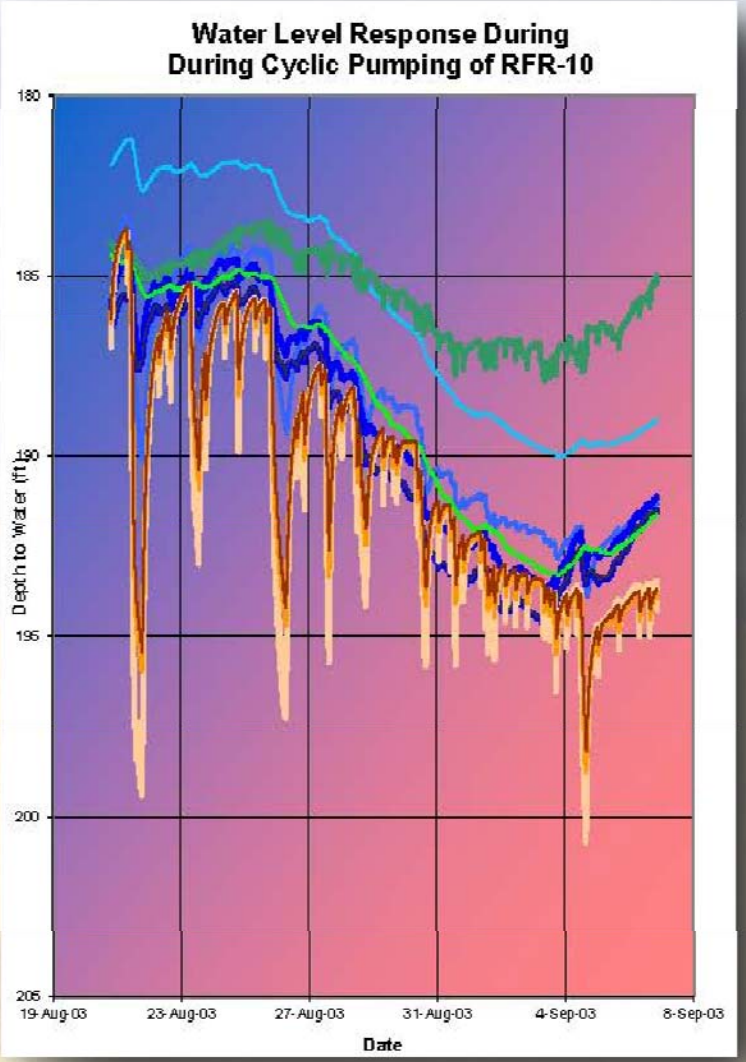
United States Geologic Survey (USGS) Surface Mapping



HOW DO WE LEARN ABOUT THE GROUNDWATER SYSTEM?

Subsurface Investigations

- Continuous Rock Coring
- Well Installations into the **Middle Trinity Aquifer**
- Aquifer Testing

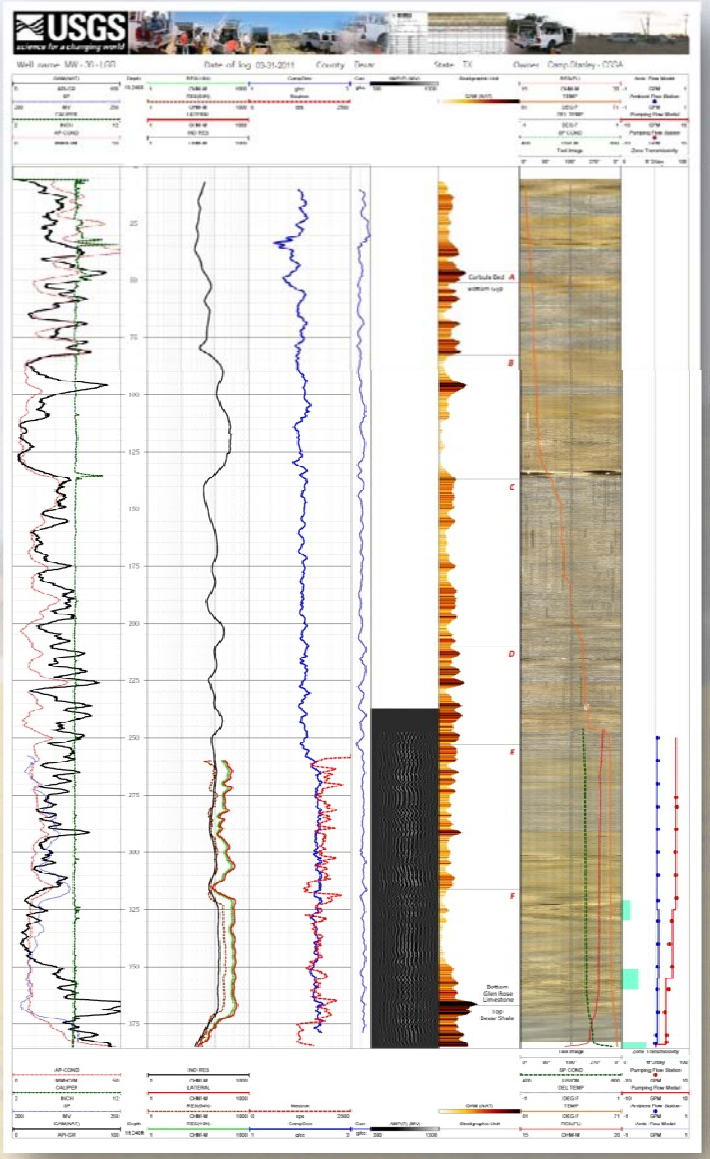


HOW DO WE LEARN ABOUT THE GROUNDWATER SYSTEM?

Subsurface Investigations

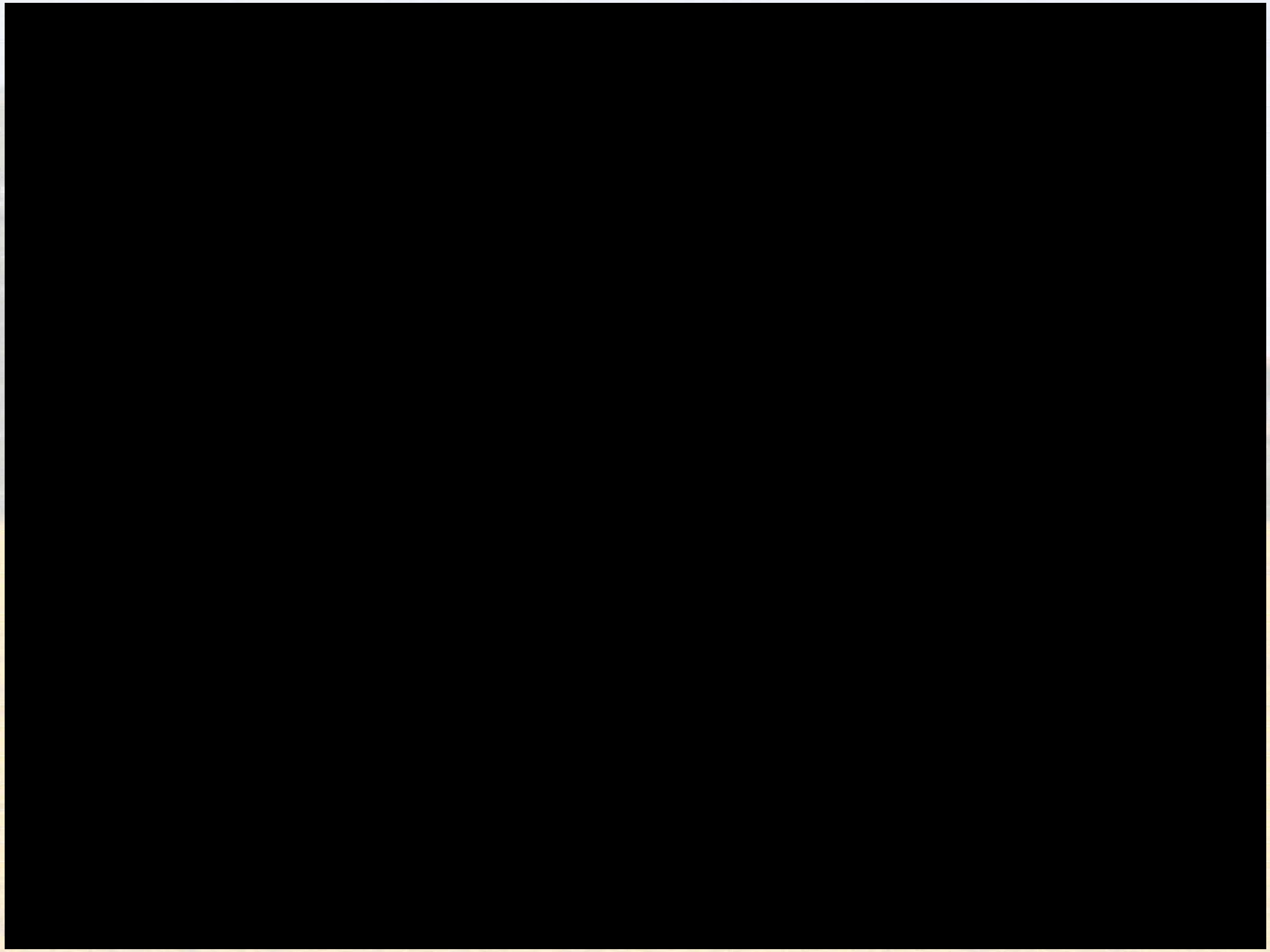
- Geophysical and Video Surveying

[redacted]



COMBINE THE INVESTIGATION TECHNIQUES TO DEVELOP A GEOLOGIC MODEL

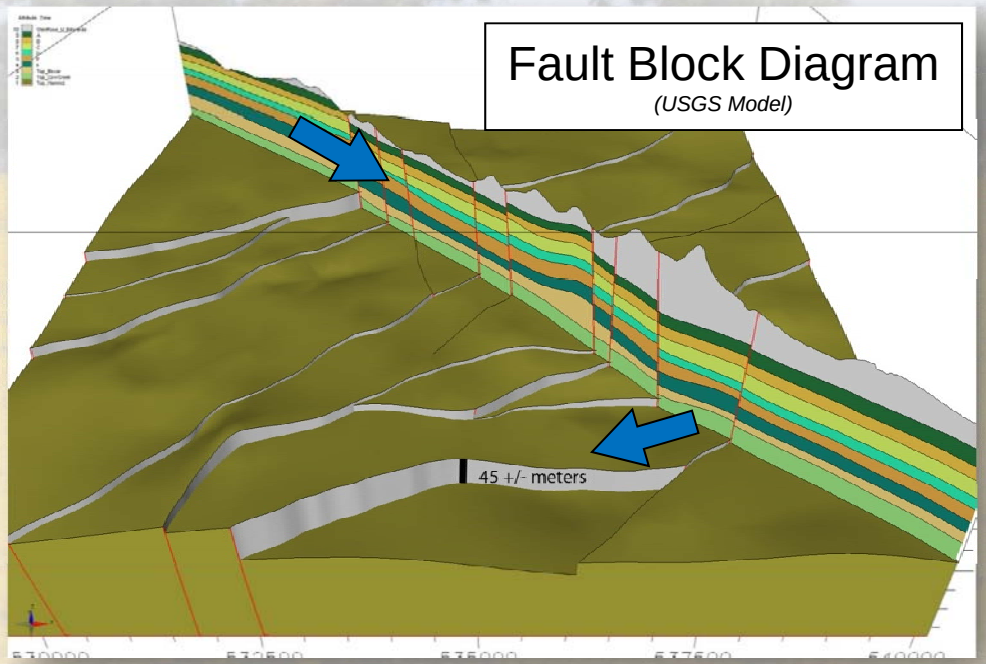
United States Geologic Survey (USGS) 3-Dimensional Modeling

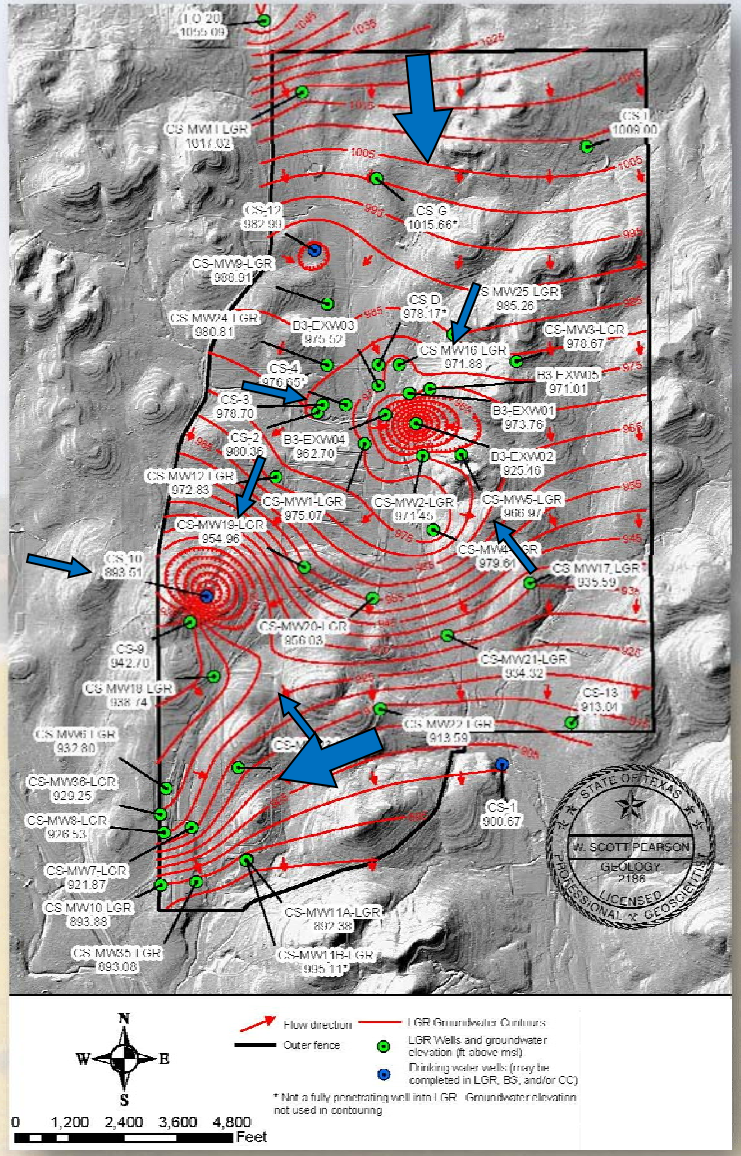


HOW DOES GROUNDWATER MOVE?

The Controlling Factors

- Groundwater movement follows the dip of rock bedding and fractures
- Influenced by pumping wells
- Faults, fractures, and karst (caves)

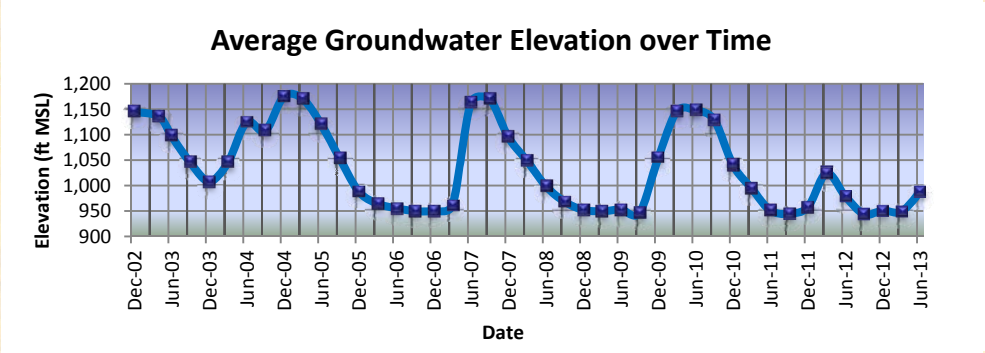


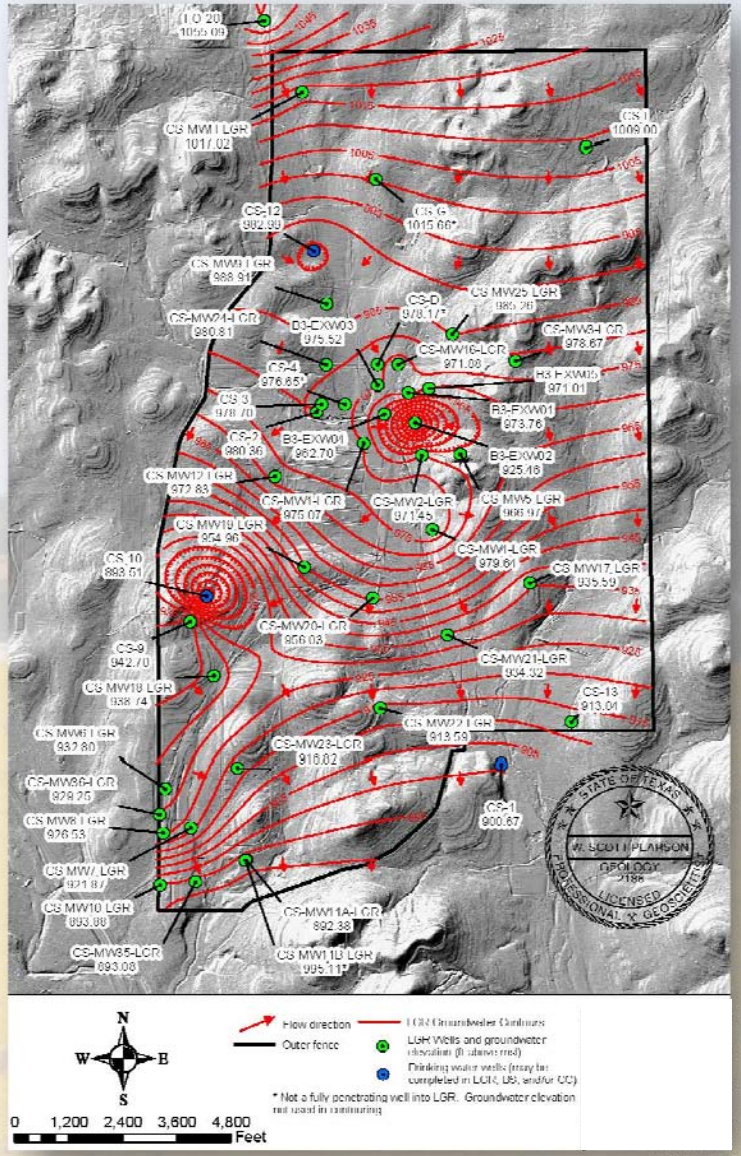


HOW DO WE DETERMINE THE CONDITION OF THE ENVIRONMENT?

Soil and Groundwater Sampling

- Surface and subsurface soil samples to identify source areas that contribute to groundwater contamination
- Groundwater samples to monitor for the presence and contaminant concentration and trends over time
- Grou e flow ns



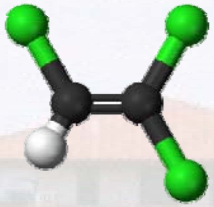


OVERVIEW OF GROUNDWATER CONTAMINATION AT CSSA

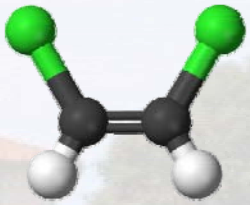
Contamination was caused by a metal-degreasing chemical commonly used by industry in the past called **tetrachloroethene (PCE)**.

PCE

PCE breaks down into other chemicals in the environment, including **trichloroethene (TCE)** and **dichloroethene (DCE)**.



TCE



cis-1,2-DCE

Collectively, these chemicals fall into a group referred to as **Volatile Organic Compounds (VOCs)**.

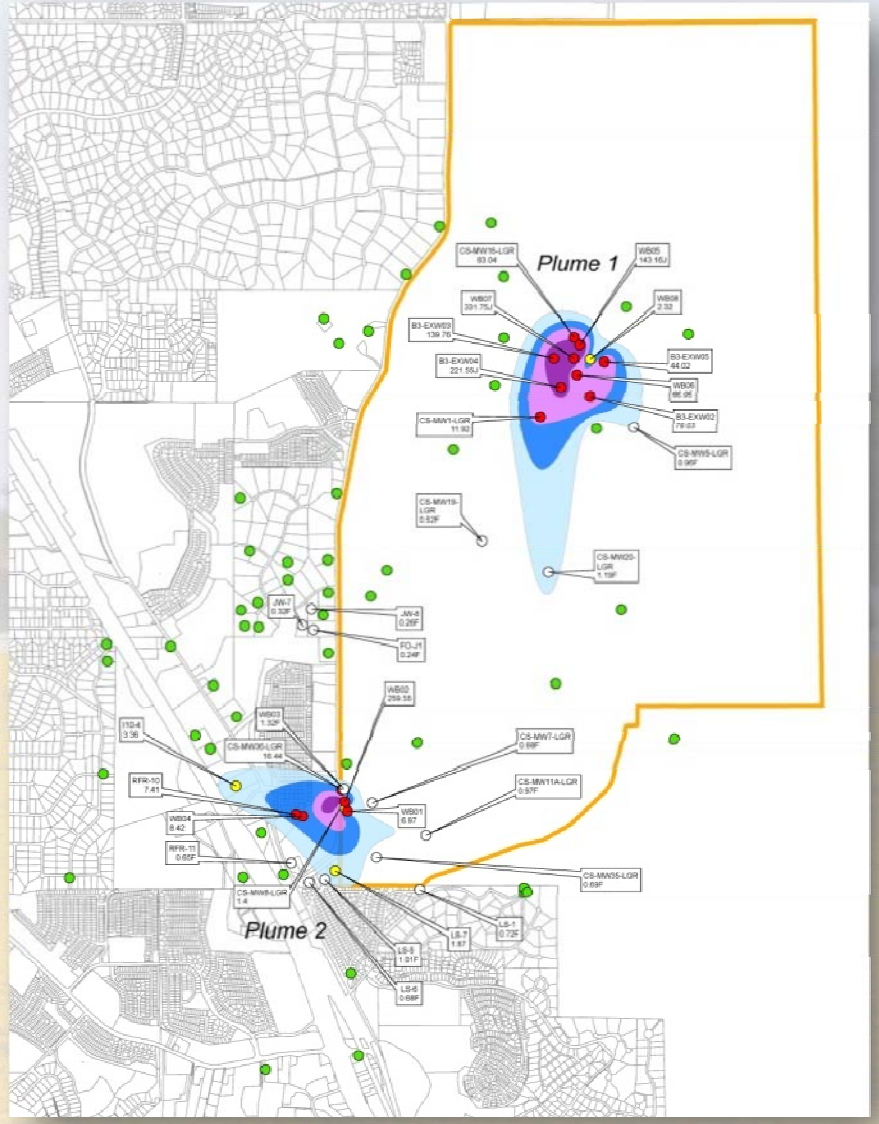
CSSA has replaced all chlorinated solvents with more environmentally friendly citrus-based cleaners.

OVERVIEW OF GROUNDWATER CONTAMINATION AT CSSA

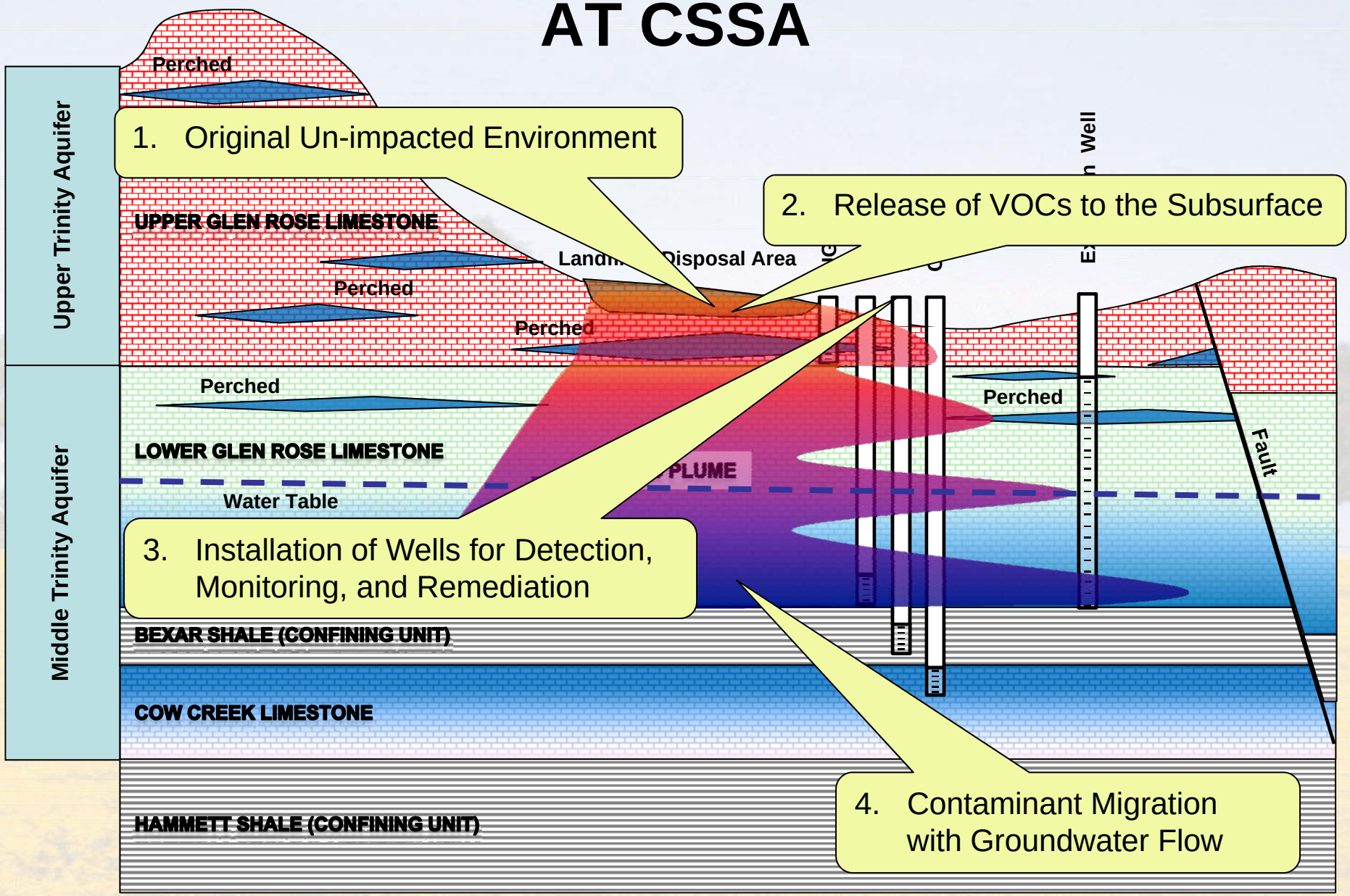
CSSA has two areas of **Volatile Organic Compound (VOC)** groundwater contamination – Plume 1 and Plume 2.

<u>Plume 1</u> originates within the central portion of CSSA, and is migrating south and southwestward.

<u>Plume 2</u> originates from the southwestern portion of CSSA, and has migrated off-post to the west and southwest.



HOW GROUNDWATER WAS CONTAMINATED AT CSSA

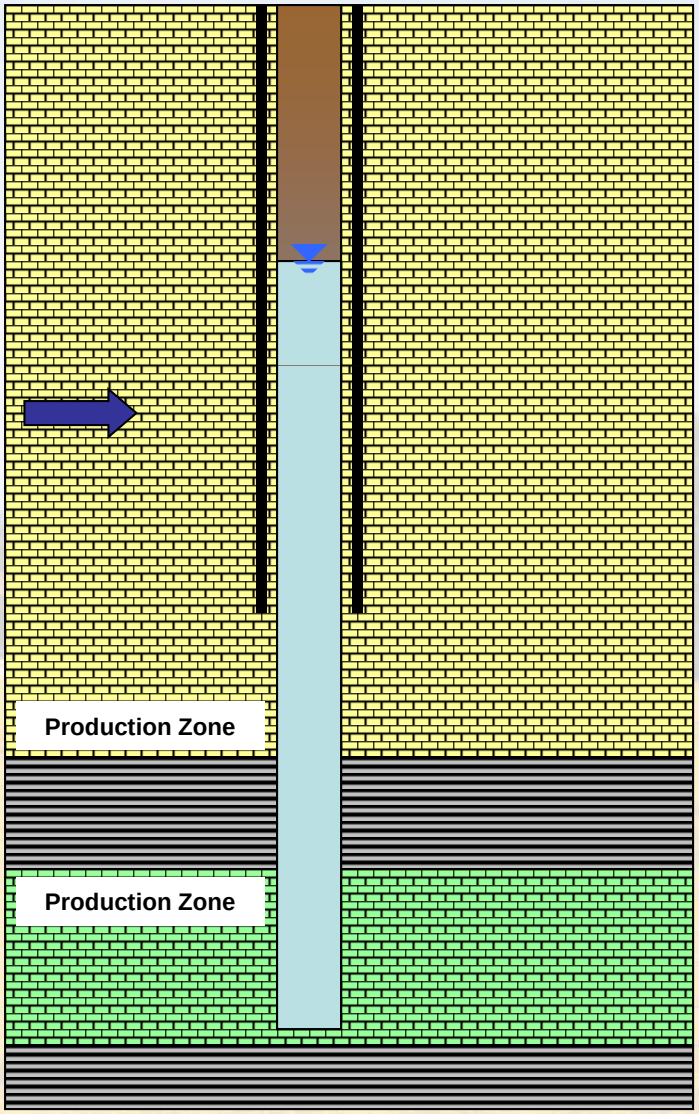


THE IMPORTANCE OF WELL CONSTRUCTION

Because the bedrock is stable, most wells in the area are drilled as "Open Borehole" completions.

A segment of pipe cemented into the earth is used as "Surface Casing" to prevent the collapse of soil into the well, or to prevent undesirable groundwater from entering the well.

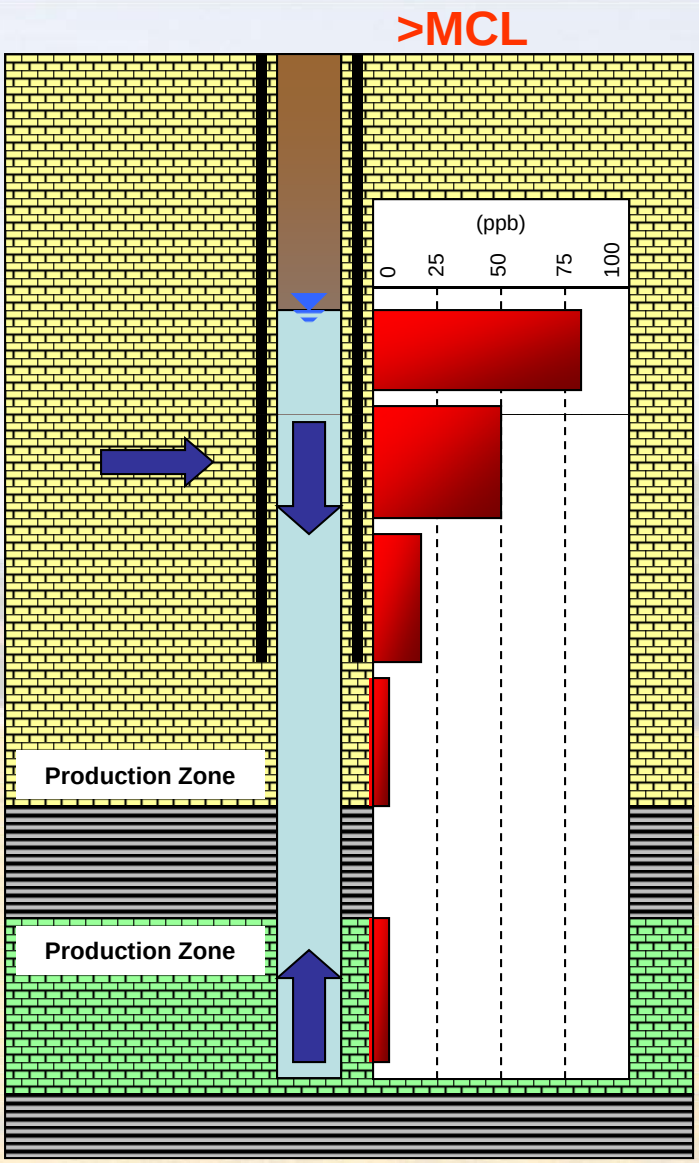
In some cases, the amount of surface casing present in a well can affect how much contamination may enter the borehole.



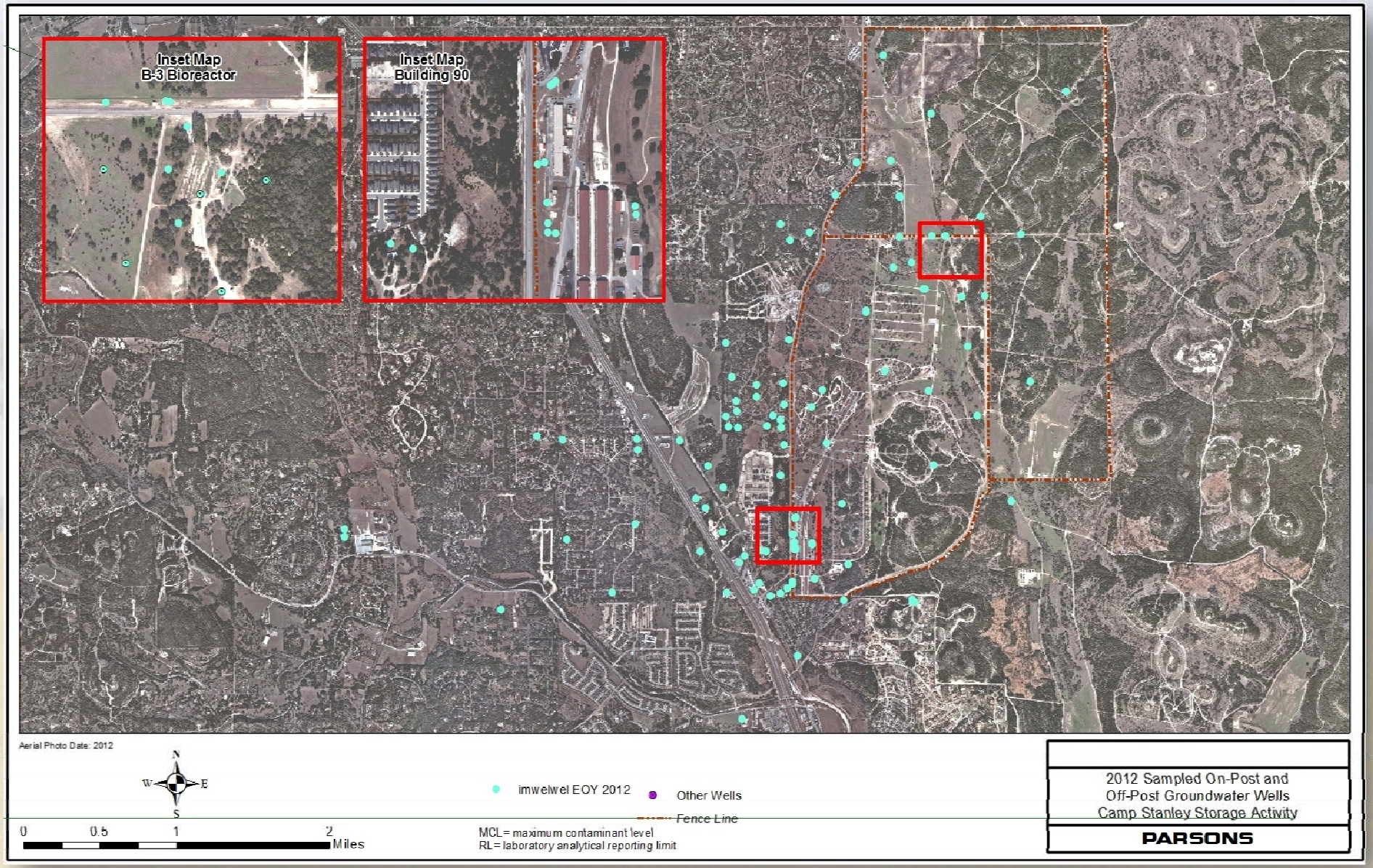
CONTAMINATION IN WATER SUPPLY WELLS

- **Scenario 1: Short Surface Casing**
- Open borehole completion with minimal surface casing
- Upper layer with significant contamination that enters borehole
- Downward flow in borehole contaminates production intervals
- Produced groundwater exceeds Maximum Contaminant Levels (MCLs)
- Older wells tend to have shorter lengths of surface casing

- **Scenario 2: Long Surface Casing**
- Sufficient surface casing to isolate contaminated upper layers
- Result with groundwater production with reduced contamination
- Newer wells tend to have longer lengths of surface casing



GROUNDWATER SAMPLING LOCATIONS



GROUNDWATER SAMPLING PROGRAM

Regulatory Standards

- CSSA compares sampling results against regulatory standards set forth the USEPA.
- These standards are known as Maximum Contaminant Levels (MCLs).
- At well locations above the MCL standards, CSSA is obligated to provide a safe and clean water supply.
- CSSA evaluates each sample result by the decision matrix shown at the right.

CSSA has developed decision rules to evaluate drinking water in wells:

If no contaminants are detected	Well will be resampled on a "as-needed" basis
If concentration is at or below 80% of the MCL	Well will be retained for future quarterly sampling
If concentration exceeds 80% of the MCL	Well will be sampled monthly
If concentration exceeds 90% of the MCL	CSSA will provide bottled water to affected well owner(s) until a wellhead treatment system is operational or a connection to a public water supply is completed

MCL Standards

PCE = 5 µg/L

TCE = 5 µg/L

cis-1,2-DCE = 70 µg/L

µg/L = micrograms per liter

GROUNDWATER SAMPLING PROGRAM

Granular Activated Carbon Treatment

- Filtration systems were installed at contaminated off-post drinking water wells for point-of-use cleanup.
- Seven granular activated carbon (GAC) units were installed at six off-post locations that exceeded drinking water standards.
- GAC units clean VOCs from the water pumped out the well before it is used.

GAC Treatment Results from Well RFR-10

	Pre-GAC Treatment		Post-GAC Treatment	
	PCE	TCE	PCE	TCE
	Units = µg/L			
Sample Date	MCL = 5 µg/L			
2/28/2011	30.98	13.03	ND	ND
9/6/2011	6.75	1.79	ND	ND
3/8/2012	15.95	10.15	ND	ND
8/30/2012	11.91	4.78	ND	ND
3/11/2013	8.44	3.21	ND	ND

ND = Not Detected

GROUNDWATER SAMPLING PROGRAM

Long-Term Monitoring Optimization (LTMO)

- The LTMO process statistically evaluates many years of groundwater sampling data to:
  - Identify areas where more or less data is needed.
  - Focus funding on efficient and thorough data collection.
  - Monitor any potential impacts to the public and environment.
  - Improves efficiency of monitoring while continuing to protect human health.
- TCEQ and USEPA approved the LTMO sampling for on- and off-post wells in 2010.

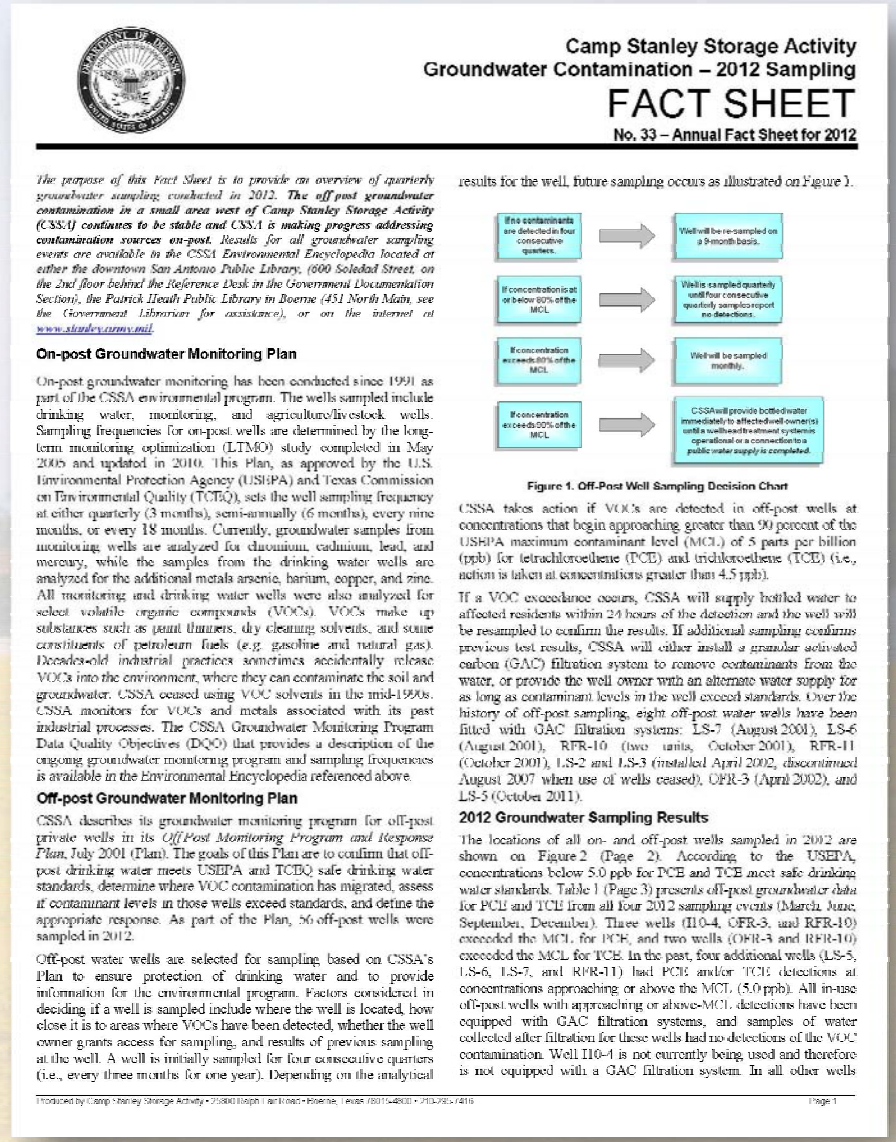
Typical Sampling Frequencies

ON-POST WELLS	
3 months (Quarterly):	Drinking Water Wells
6 months (Semi-Annual):	Perimeter wells at or above the MCL
9 months:	All LGR-zone wells
18 months:	All BS- and CC-zone wells
OFF-POST WELLS	
3 months (Quarterly):	All wells with GAC units or above 1 µg/L PCE or TCE in the previous sampling event
9 months:	All off-post wells

PUBLIC OUTREACH AND COMMUNITY RELATIONS

CSSA continues to:

- Install GAC treatment units if conditions meet the established decision rules. Only one new system installed since 2009.
- Be vigilant in identifying new sampling locations by canvassing the community and public records for new wells.
- Keep the community informed by notifying well owners of all sampling results and mailing annual fact sheets.



Camp Stanley Storage Activity
Groundwater Contamination – 2012 Sampling

FACT SHEET

No. 33 – Annual Fact Sheet for 2012

The purpose of this Fact Sheet is to provide an overview of quarterly groundwater sampling conducted in 2012. ***The off-post groundwater contamination in a small area west of Camp Stanley Storage Activity (CSSA) continues to be stable and CSSA is making progress addressing contamination sources on-post.*** *Results for all groundwater sampling events are available in the CSSA Environmental Encyclopedia located at either the downtown San Antonio Public Library, (600 Soledad Street, on the 2nd floor behind the Reference Desk in the Government Documentation Section), the Patrick Heath Public Library in Boerne (451 North Main, see the Government Librarian for assistance), or on the internet at www.stanley.army.mil.*

On-post Groundwater Monitoring Plan

On-post groundwater monitoring has been conducted since 1991 as part of the CSSA environmental program. The wells sampled include drinking water, monitoring, and agriculture/livestock wells. Sampling frequencies for on-post wells are determined by the long-term monitoring optimization (LTMO) study completed in May 2005 and updated in 2010. This Plan, as approved by the U.S. Environmental Protection Agency (USEPA) and Texas Commission on Environmental Quality (TCEQ), sets the well sampling frequency at either quarterly (3 months), semi-annually (6 months), every nine months, or every 18 months. Currently, groundwater samples from monitoring wells are analyzed for chromium, cadmium, lead, and mercury, while the samples from the drinking water wells are analyzed for the additional metals arsenic, barium, copper, and zinc. All monitoring and drinking water wells were also analyzed for select volatile organic compounds (VOCs). VOCs make up substances such as paint thinners, dry cleaning solvents, and some constituents of petroleum fuels (e.g. gasoline and natural gas). Decades-old industrial practices sometimes accidentally release VOCs into the environment, where they can contaminate the soil and groundwater. CSSA ceased using VOC solvents in the mid-1990s. CSSA monitors for VOCs and metals associated with its past industrial processes. The CSSA Groundwater Monitoring Program Data Quality Objectives (DQO) that provides a description of the ongoing groundwater monitoring program and sampling frequencies is available in the Environmental Encyclopedia referenced above.

Off-post Groundwater Monitoring Plan

CSSA describes its groundwater monitoring program for off-post private wells in its *Off-Post Monitoring Program and Response Plan*, July 2001 (Plan). The goals of this Plan are to confirm that off-post drinking water meets USEPA and TCEQ safe drinking water standards, determine where VOC contamination has migrated, assess if contaminant levels in those wells exceed standards, and define the appropriate response. As part of the Plan, 56 off-post wells were sampled in 2012.

Off-post water wells are selected for sampling based on CSSA's Plan to ensure protection of drinking water and to provide information for the environmental program. Factors considered in deciding if a well is sampled include where the well is located, how close it is to areas where VOCs have been detected, whether the well owner grants access for sampling, and results of previous sampling at the well. A well is initially sampled for four consecutive quarters (i.e., every three months for one year). Depending on the analytical results for the well, future sampling occurs as illustrated on Figure 1.

Figure 1. Off-Post Well Sampling Decision Chart

CSSA takes action if VOCs are detected in off-post wells at concentrations that begin approaching greater than 90 percent of the USEPA maximum contaminant level (MCL) of 5 parts per billion (ppb) for tetrachloroethene (PCE) and trichloroethene (TCE) (i.e., action is taken at concentrations greater than 4.5 ppb).

If a VOC exceedance occurs, CSSA will supply bottled water to affected residents within 24 hours of the detection and the well will be resampled to confirm the results. If additional sampling confirms previous test results, CSSA will either install a granular activated carbon (GAC) filtration system to remove contaminants from the water, or provide the well owner with an alternate water supply for as long as contaminant levels in the well exceed standards. Over the history of off-post sampling, eight off-post water wells have been fitted with GAC filtration systems: LS-7 (August 2001), LS-6 (August 2001), RFR-10 (two units, October 2001), RFR-11 (October 2001), LS-2 and LS-3 (installed April 2002, discontinued August 2007 when use of wells ceased), OFR-3 (April 2002), and LS-5 (October 2011).

2012 Groundwater Sampling Results

The locations of all on- and off-post wells sampled in 2012 are shown on Figure 2 (Page 2). According to the USEPA, concentrations below 5.0 ppb for PCE and TCE meet safe drinking water standards. Table 1 (Page 3) presents off-post groundwater data for PCE and TCE from all four 2012 sampling events (March, June, September, December). Three wells (H10-4, OFR-3, and RFR-10) exceeded the MCL for PCE, and two wells (OFR-3 and RFR-10) exceeded the MCL for TCE. In the past, four additional wells (LS-5, LS-6, LS-7, and RFR-11) had PCE and/or TCE detections at concentrations approaching or above the MCL (5.0 ppb). All in-use off-post wells with approaching or above-MCL detections have been equipped with GAC filtration systems, and samples of water collected after filtration for these wells had no detections of the VOC contamination. Well H10-4 is not currently being used and therefore is not equipped with a GAC filtration system. In all other wells

Produced by Camp Stanley Storage Activity • 25800 Ralph Fair Road • Boerne, Texas 78015-4800 • 210-295-1416 Page 1

SUMMARY

- CSSA will continue to remediate the source areas with proven and innovative technologies to reduce contamination in the subsurface.
- The VOC plumes in groundwater are stable.
- CSSA will continue to monitor to ensure your water is safe and keep you informed.

TEXAS COMMISSION ON ENVIRONMENTAL QUALITY

TREATMENT TECHNOLOGIES AT CAMP STANLEY STORAGE ACTIVITY (CSSA)

SOLID WASTE MANAGEMENT UNIT B-3

Solid Waste Management Unit 3 (SWMU B-3) Background

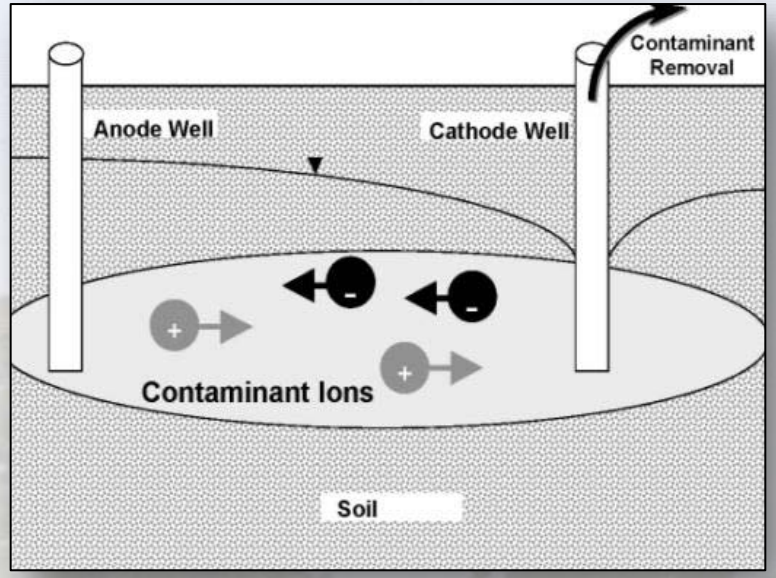
- Chlorinated solvents were used in the past to clean weapons and ammunition.
- Past waste management practices were not environmentally sound:
  - Drums once used to store waste solvents were managed at SWMUs O-1 and B-3.
  - Some of the solvents were inadvertently released to the ground.
- Chlorinated solvents were removed from the inventory in the early 1990s and are no longer used at CSSA.
- Groundwater contamination was first detected in 1991.
- Aggressive measures have been taken to control and remediate the site.

USEPA Order

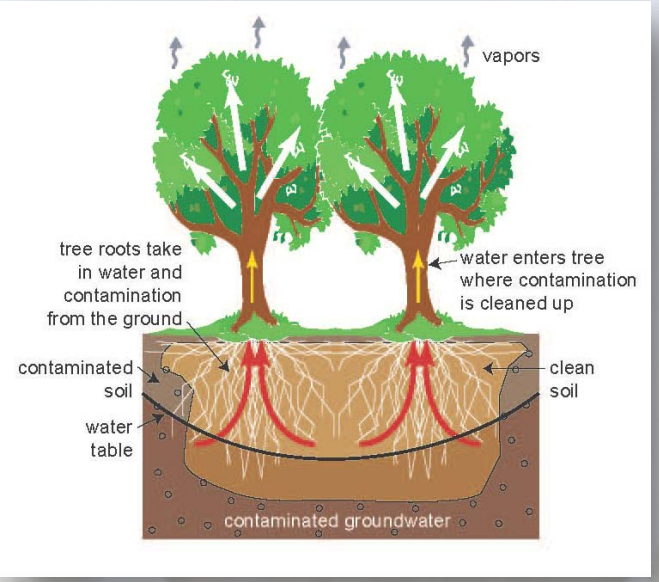
CSSA continues to work closely with USEPA to close the RCRA §3008(h) Administrative Order issued in 1999.

The 1999 Order was put in place by USEPA to ensure that corrective action activities would be implemented to protect human health and the environment.

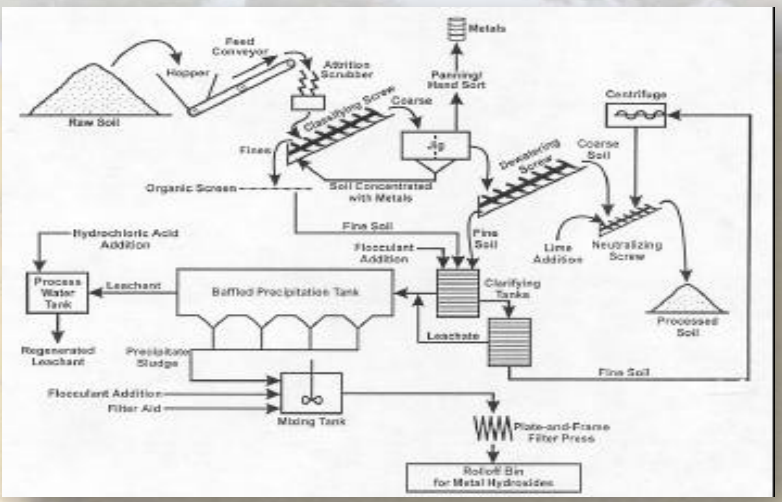
Remedial Technology Testing: Soils



Electrokinetics



Phytoremediation

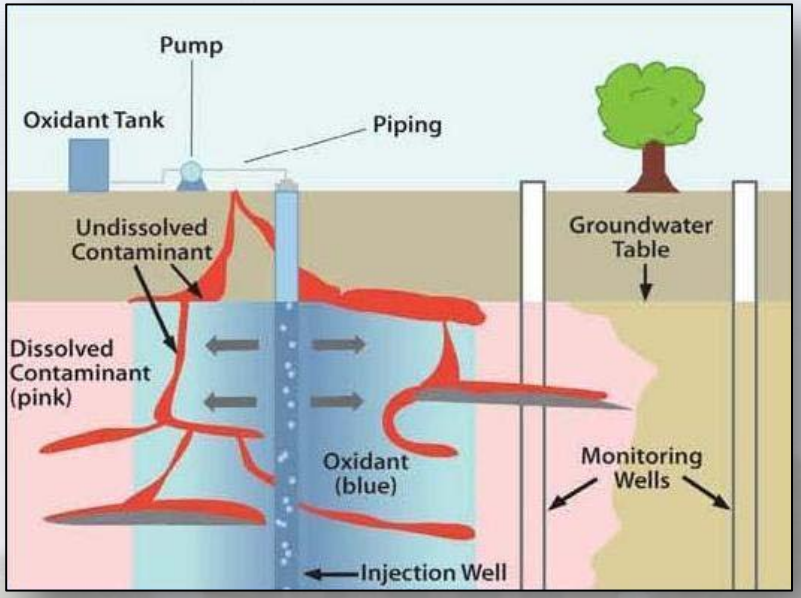


Soil Washing

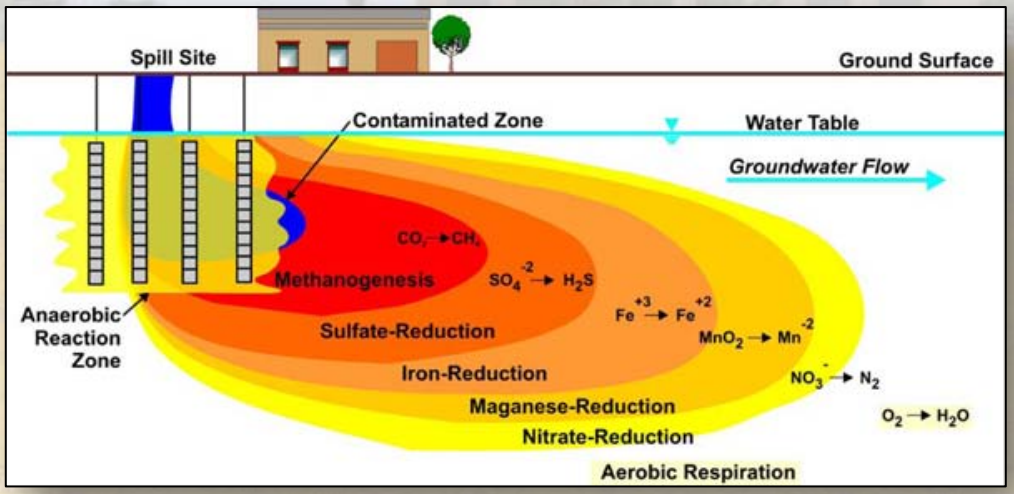
Phosphate Induced Metal Stabilization (PIMS)

Innovative Technologies Tested at CSSA for Groundwater Remediation

Soil Vapor Extraction



In-situ Chemical Oxidation

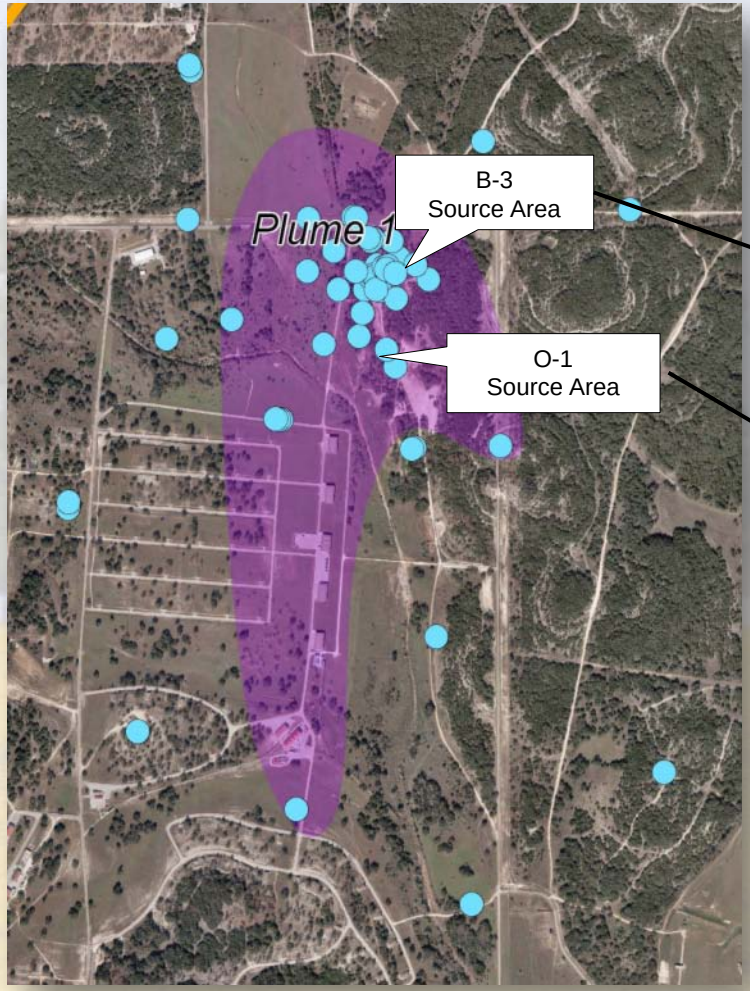


Bioremediation

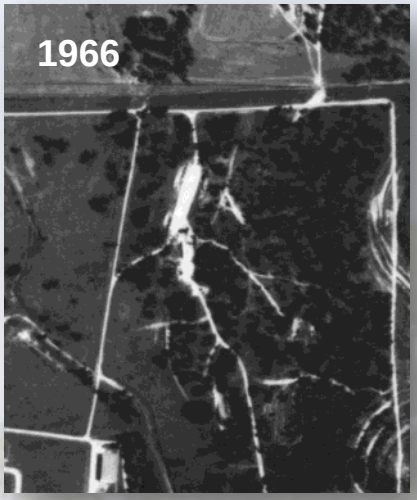
Soil Remediation: Phosphate Induced Metal Stabilization (PIMS)

PIMS uses fish bones as the stabilizing agent

Source Areas for Groundwater Plume 1



Source Areas for Groundwater Plume 1



Historical Aerial Photos

Record Reviews and Interviews

Plume 1 Source Identification
History

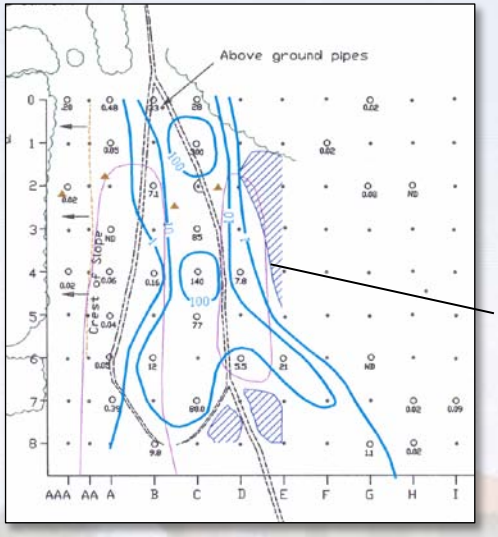
- **1991:** Groundwater contamination detected at CSSA's drinking water Well 16
- **1993:** SWMU B-3 and SWMU O-1 identified as potential sources
- **1995-1996:** Soil gas surveys to identify contamination
- **1996:** Soil vapor extraction (SVE) initiated at SWMU B-3

Plume 1 Source Identification
History

- **2001:** Source removal at SWMU O-1
- **2002-2006:** Source removal at SWMU B-3
- **2007:** Pilot-scale bioreactor study initiated at SWMU B-3
- **2012:** USEPA approved bioreactor as potential viable long-term remedy for groundwater
- **2012-2014:** Full-scale permanent bioreactor installed

Site Identification

Well 16 Groundwater Sampling



Soil gas samples collected within SWMUs B-3 and O-1

Soil Gas Survey

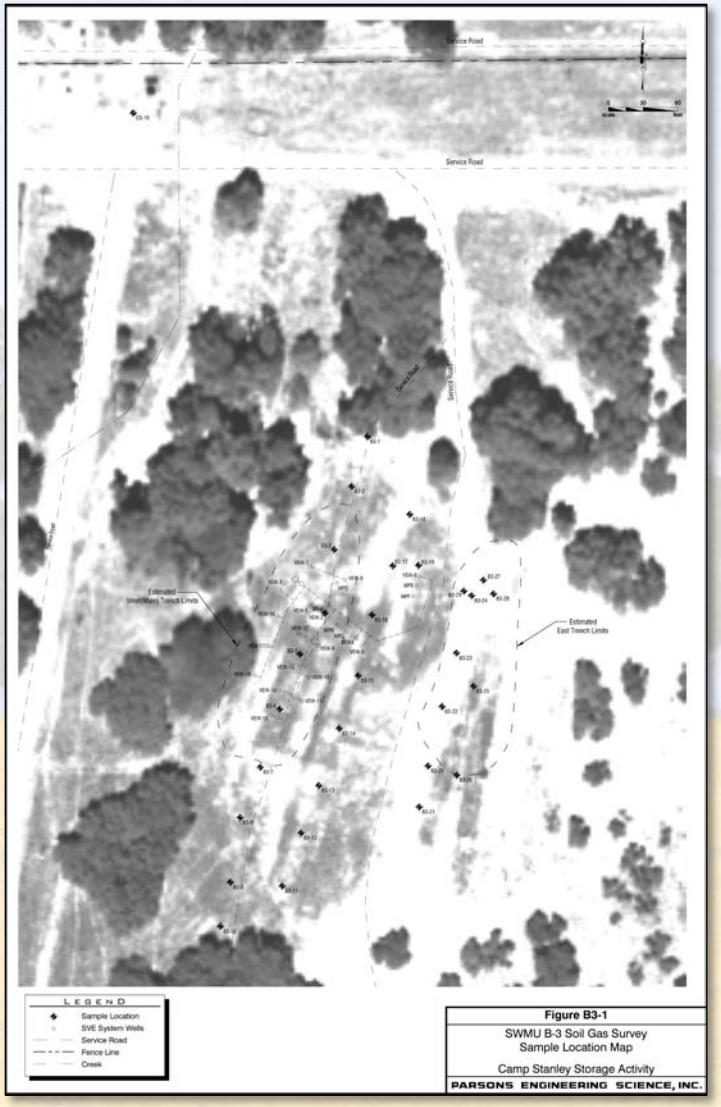
Preliminary Soil Sampling

- Electromagnetic
- Seismic Reflection
- Conductivity
- Ground Penetrating Radar

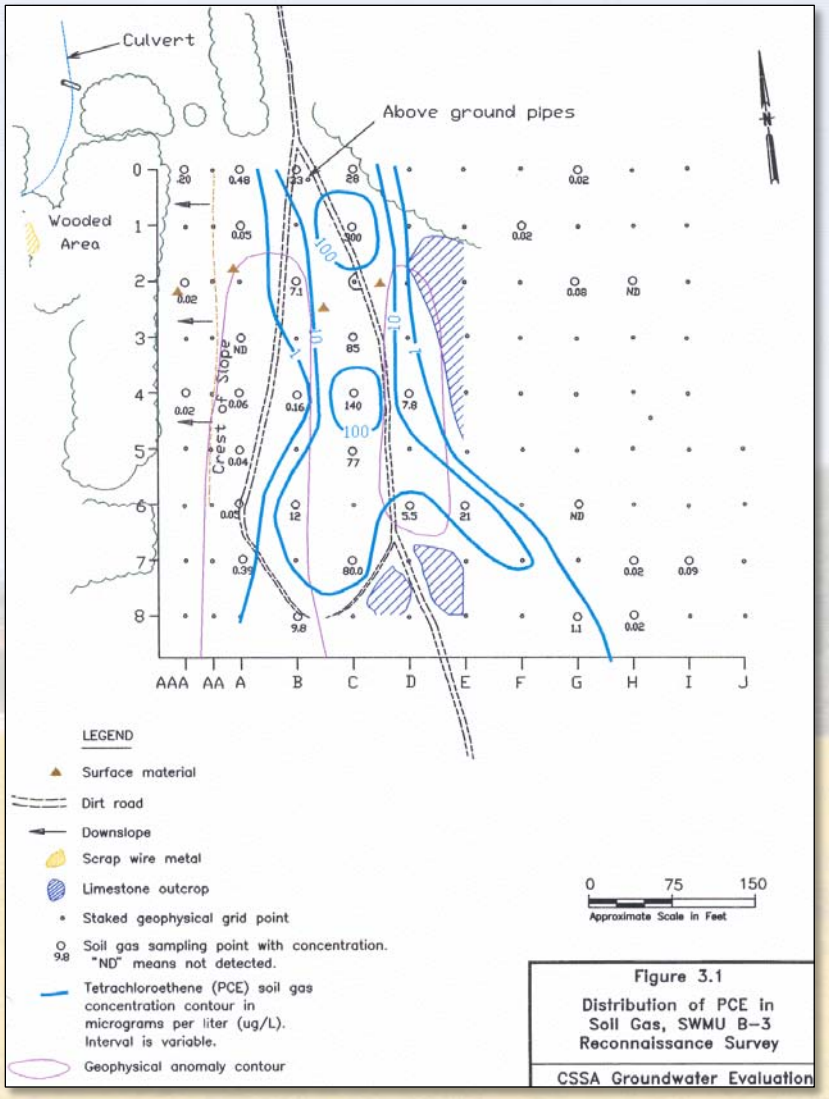
Geophysical Investigation

Site Identification: Well 16 Groundwater Sampling

Site Identification: Soil Gas Survey

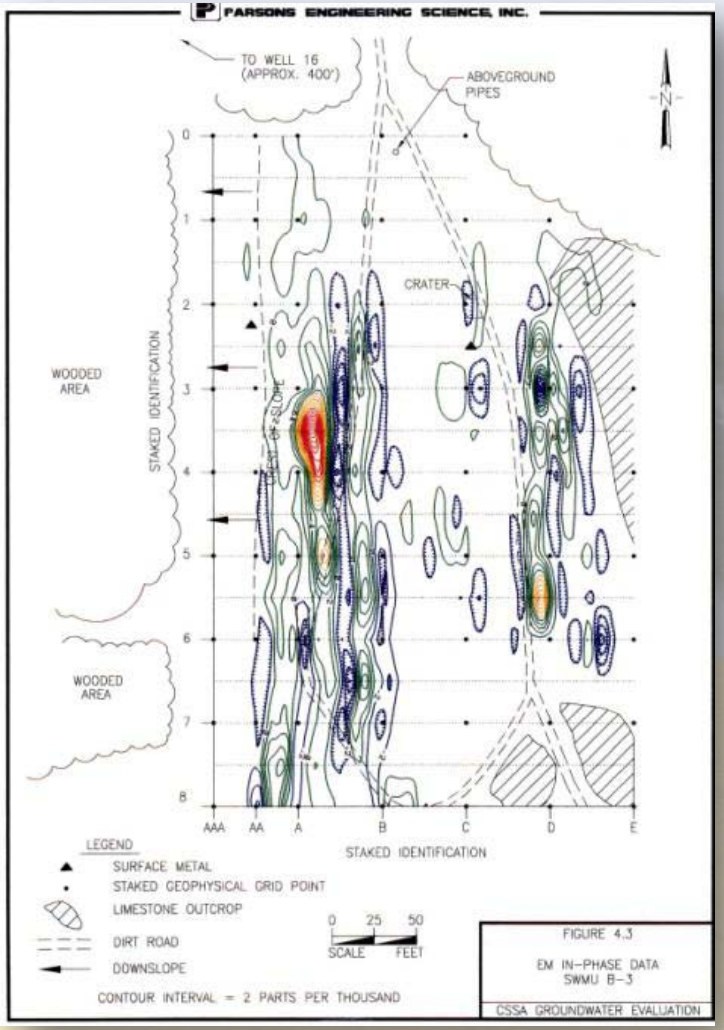


SWMU B-3 Soil Gas Survey Sample Locations

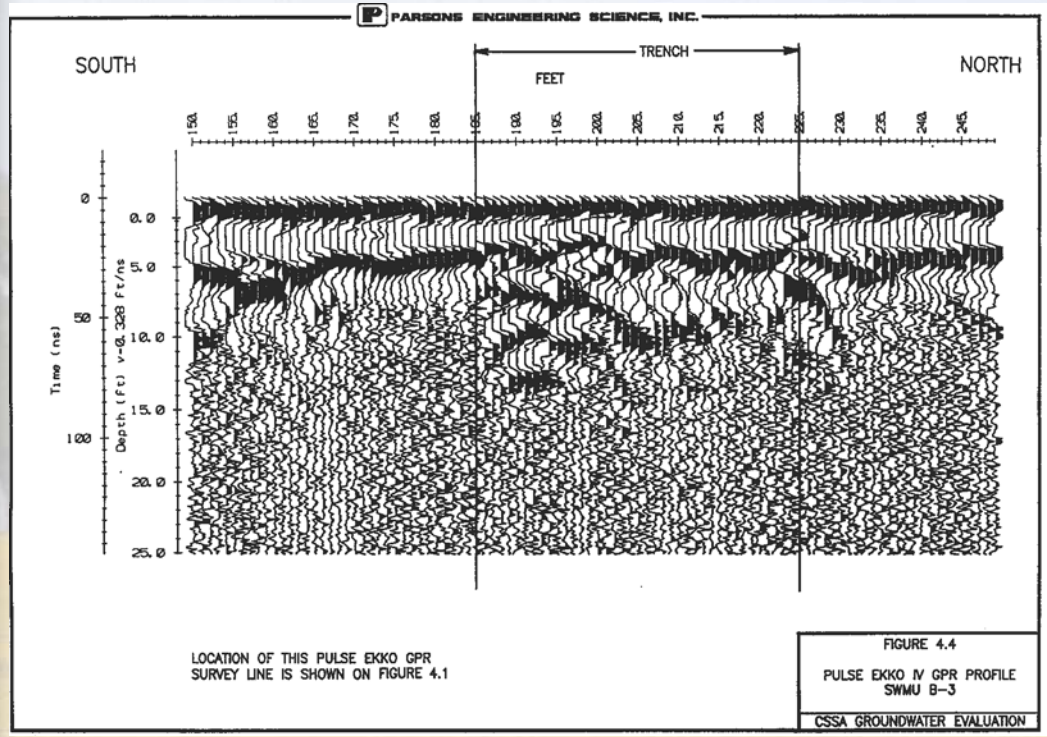


SWMU B-3 Soil Gas Survey PCE Results

Site Identification: Geophysical Investigation



Electromagnetic Survey



Ground Penetrating Radar

Interim Remedial Measures: Removal Actions

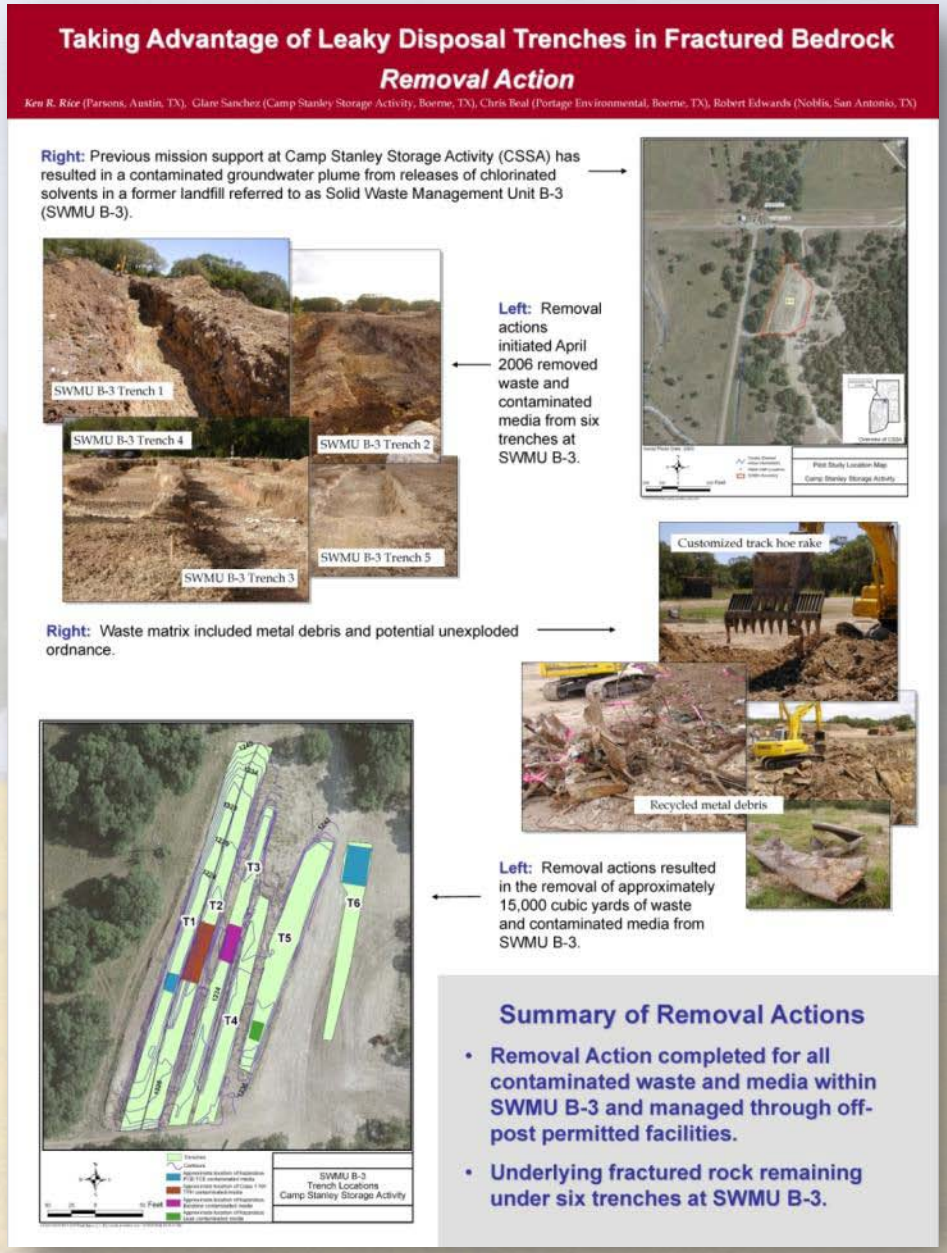
2001 SWMU O-1 Soil Excavation

2006 SWMU B-3 Trench Excavation

2001 SWMU O-1 Soil Excavation

2006 SWMU B-3 Trench Excavation

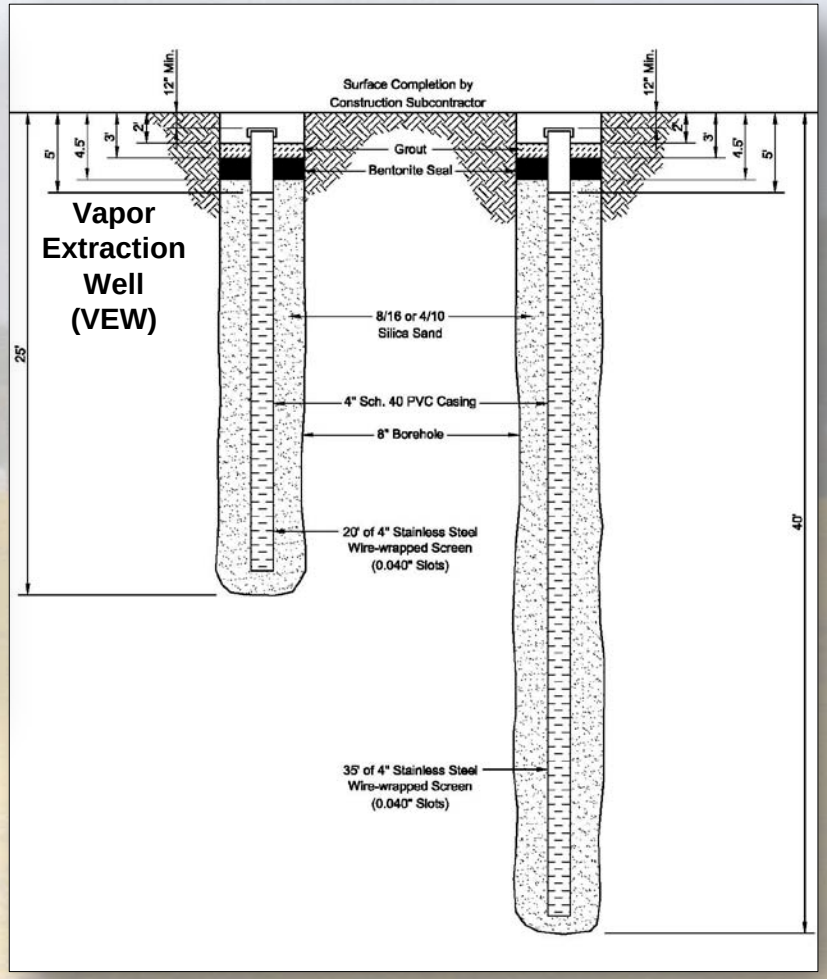
In 2006, the SWMU B-3 Bioreactor Project was showcased at the Battelle International Conference on Remediation of Chlorinated and Recalcitrant Compounds.



Soil Vapor Extraction (SVE)

SVE consists of a series of vapor extraction wells connected to blowers that remove vapors from the subsurface.

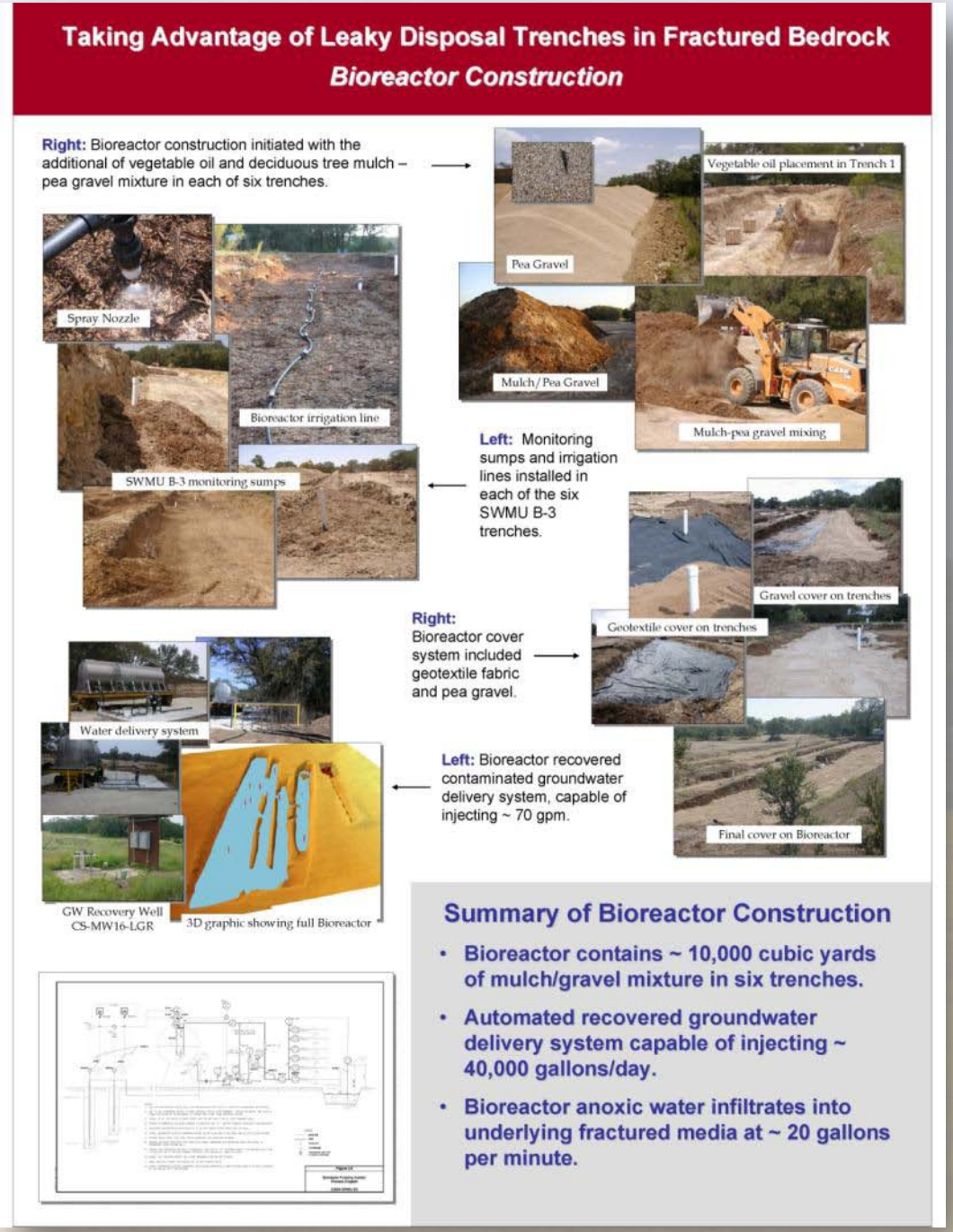
Tested at SWMU B-3 from 1996-2006



Bioremediation Study

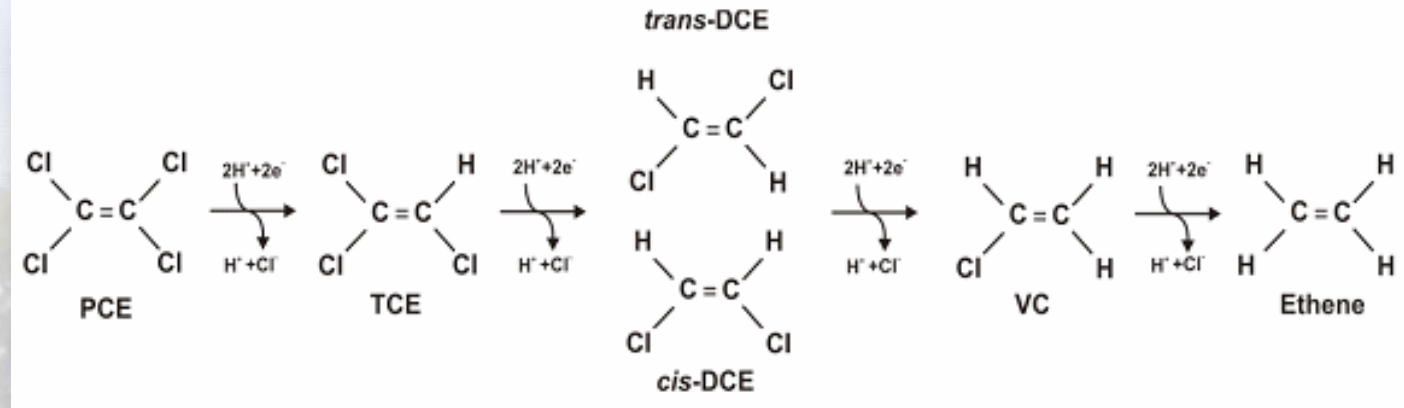
Construction of Pilot-Scale Bioreactor

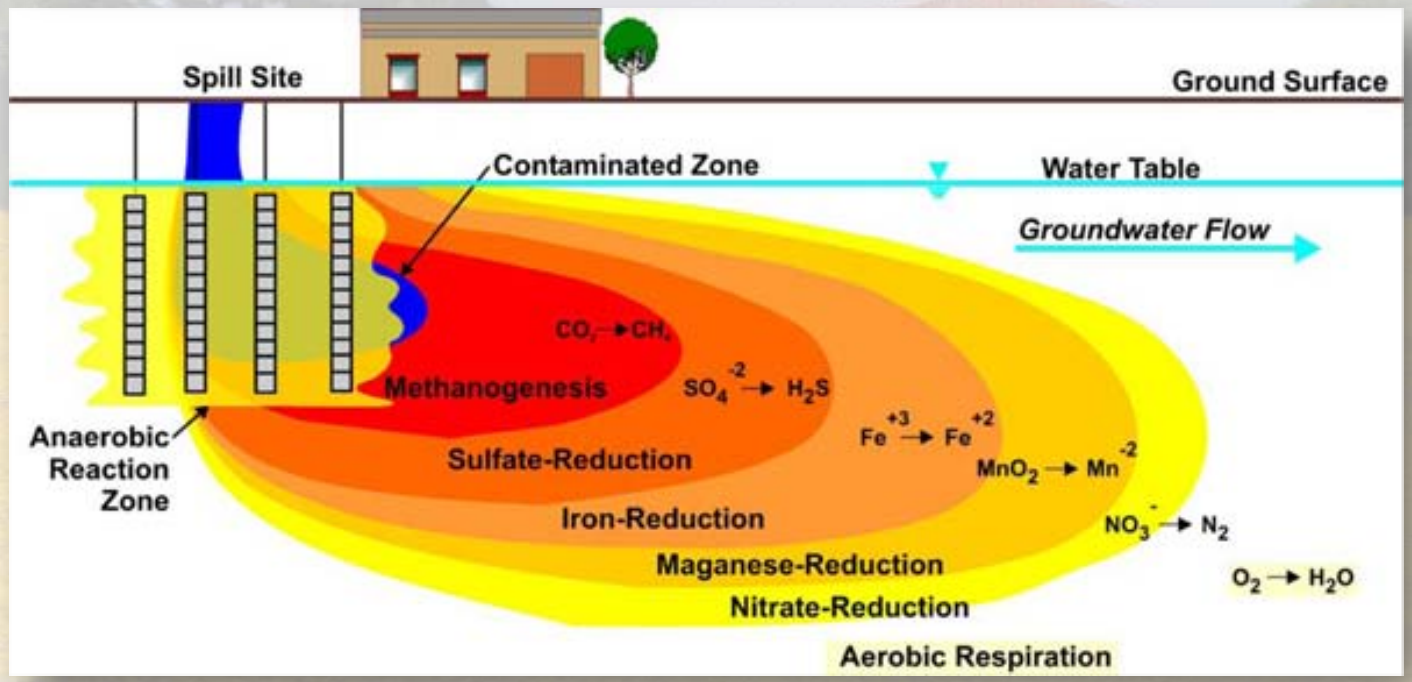
A bioreactor was constructed in the disposal trenches after waste and debris were removed.

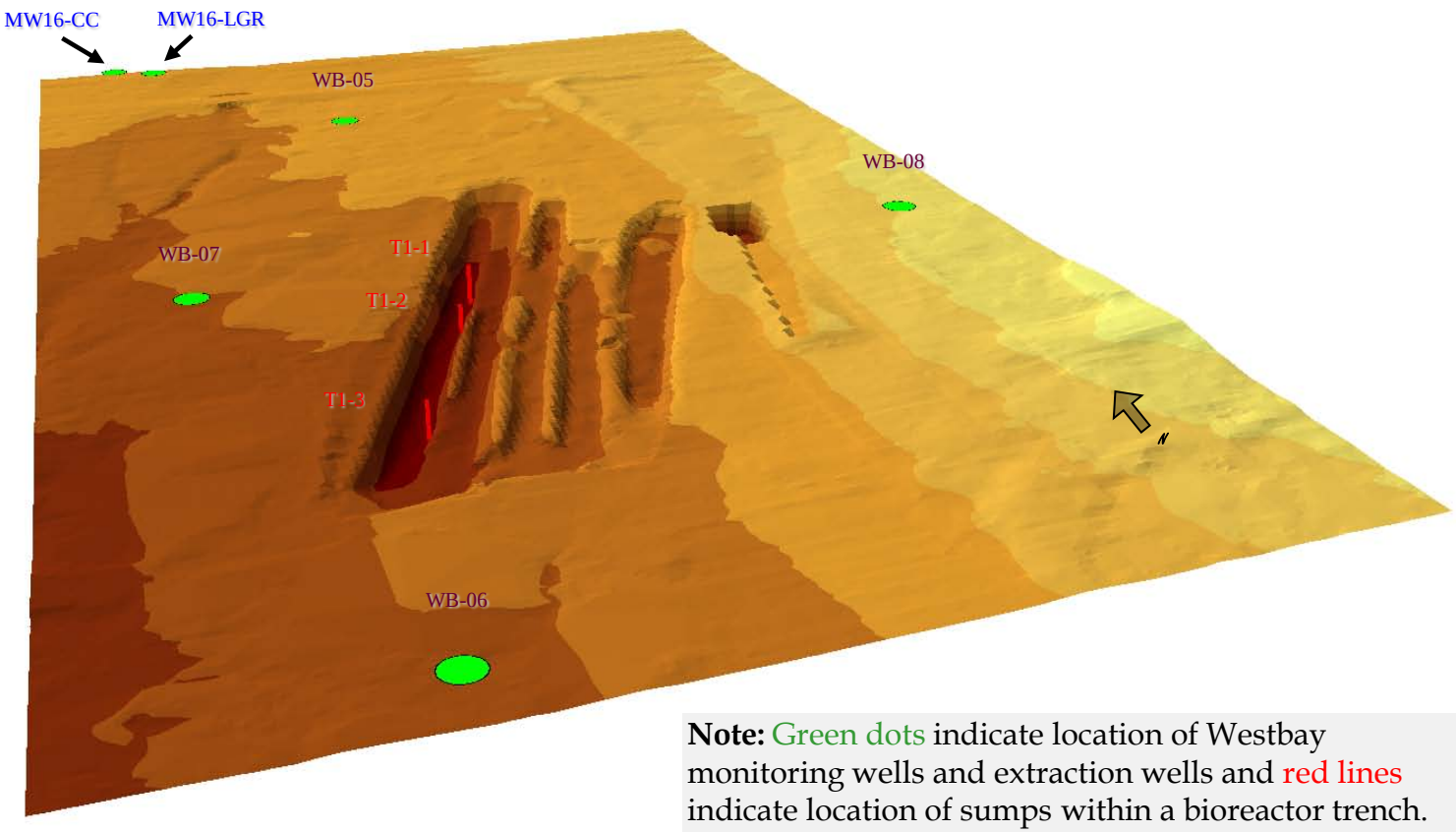


Bioremediation Process

Over time, bacteria break down contaminants into less hazardous substances.





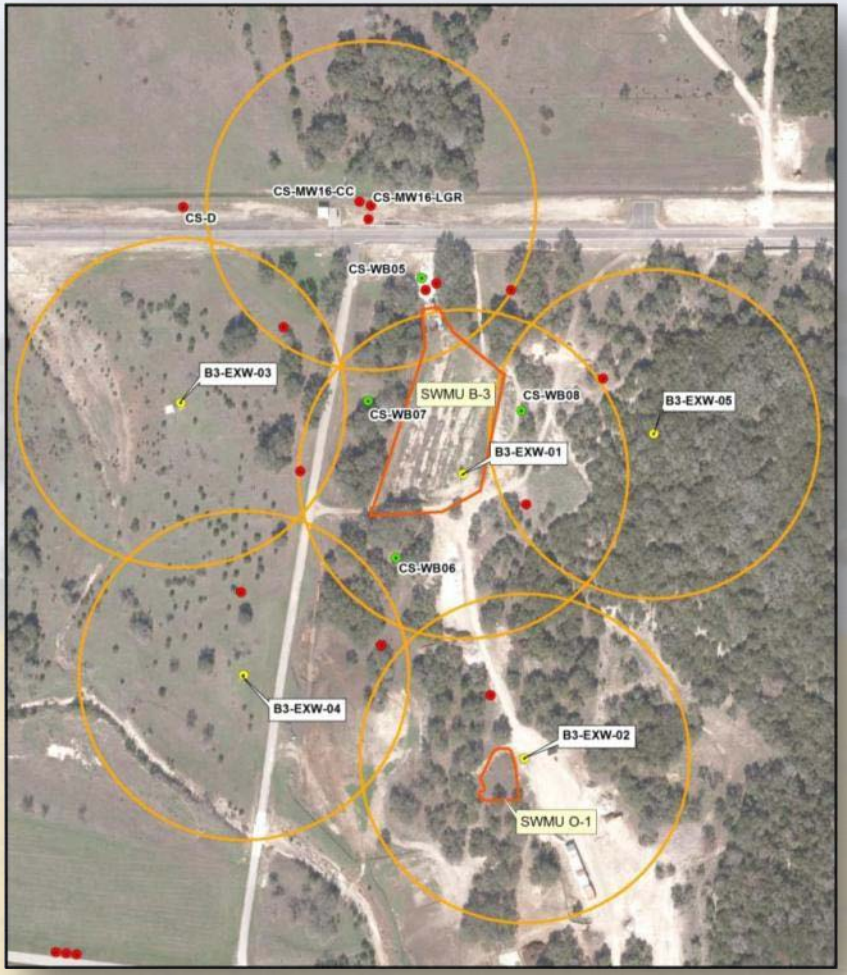


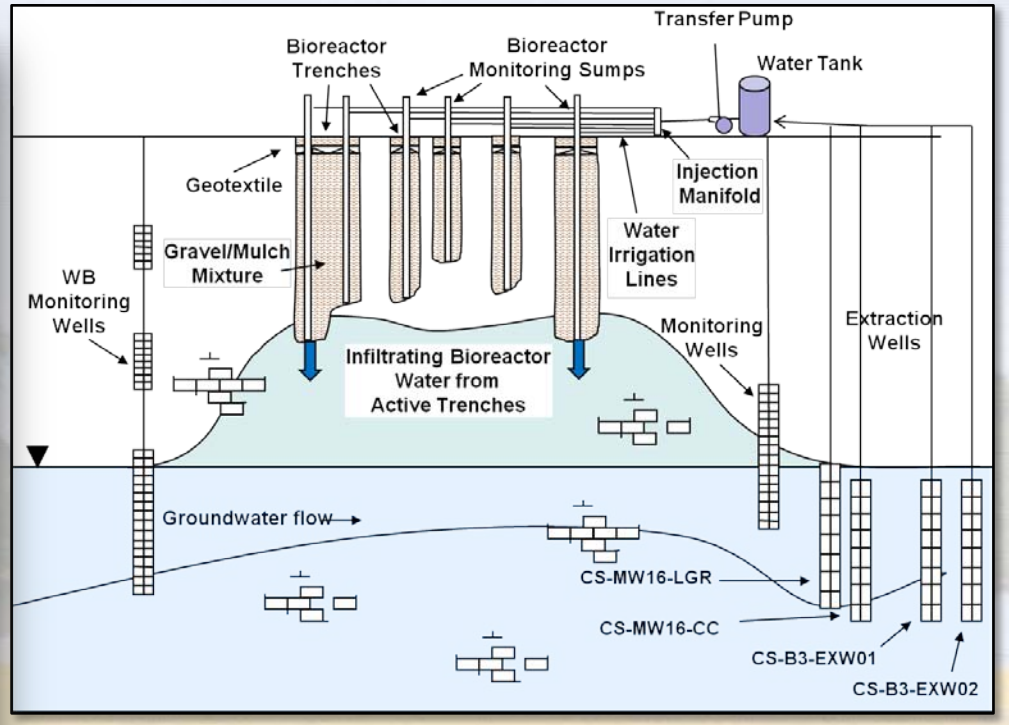
Note: Green dots indicate location of Westbay monitoring wells and extraction wells and red lines indicate location of sumps within a bioreactor trench.

Contour interval = 4 feet.

Image depicting the trenches and monitoring wells surrounding the bioreactor at CSSA.

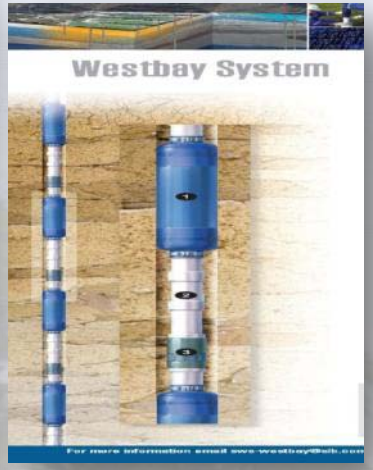
Bioremediation: Bioreactor



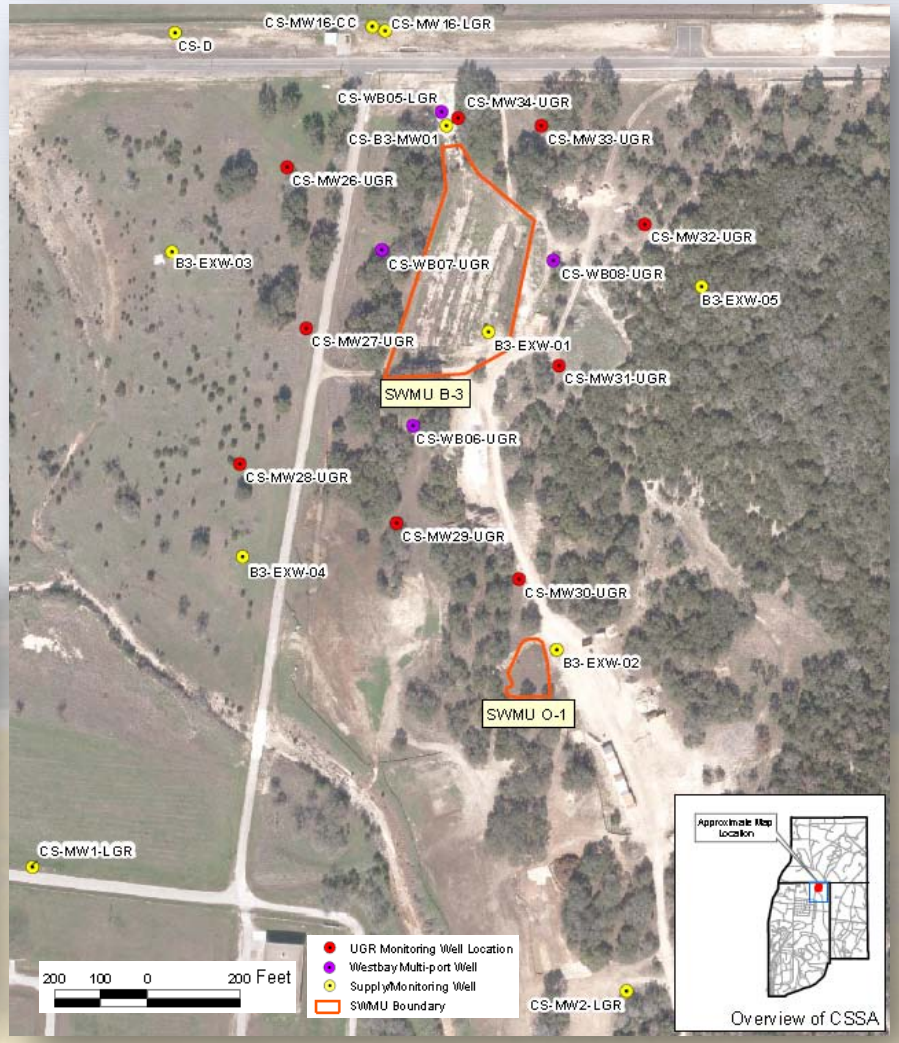


Contaminated groundwater is pumped out of the ground and placed back into the bioreactor for treatment.

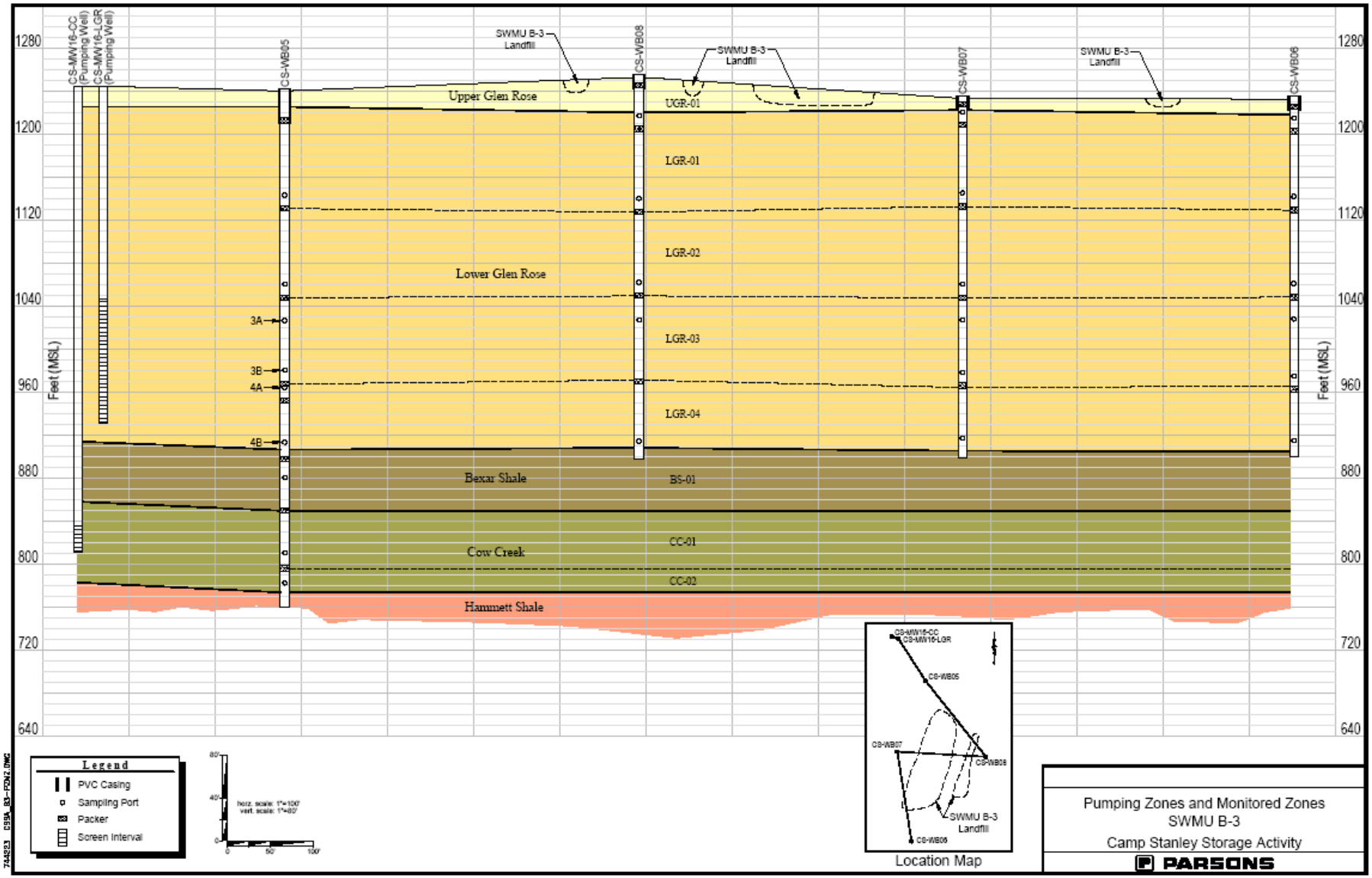
Continuous Monitoring of Bioreactor



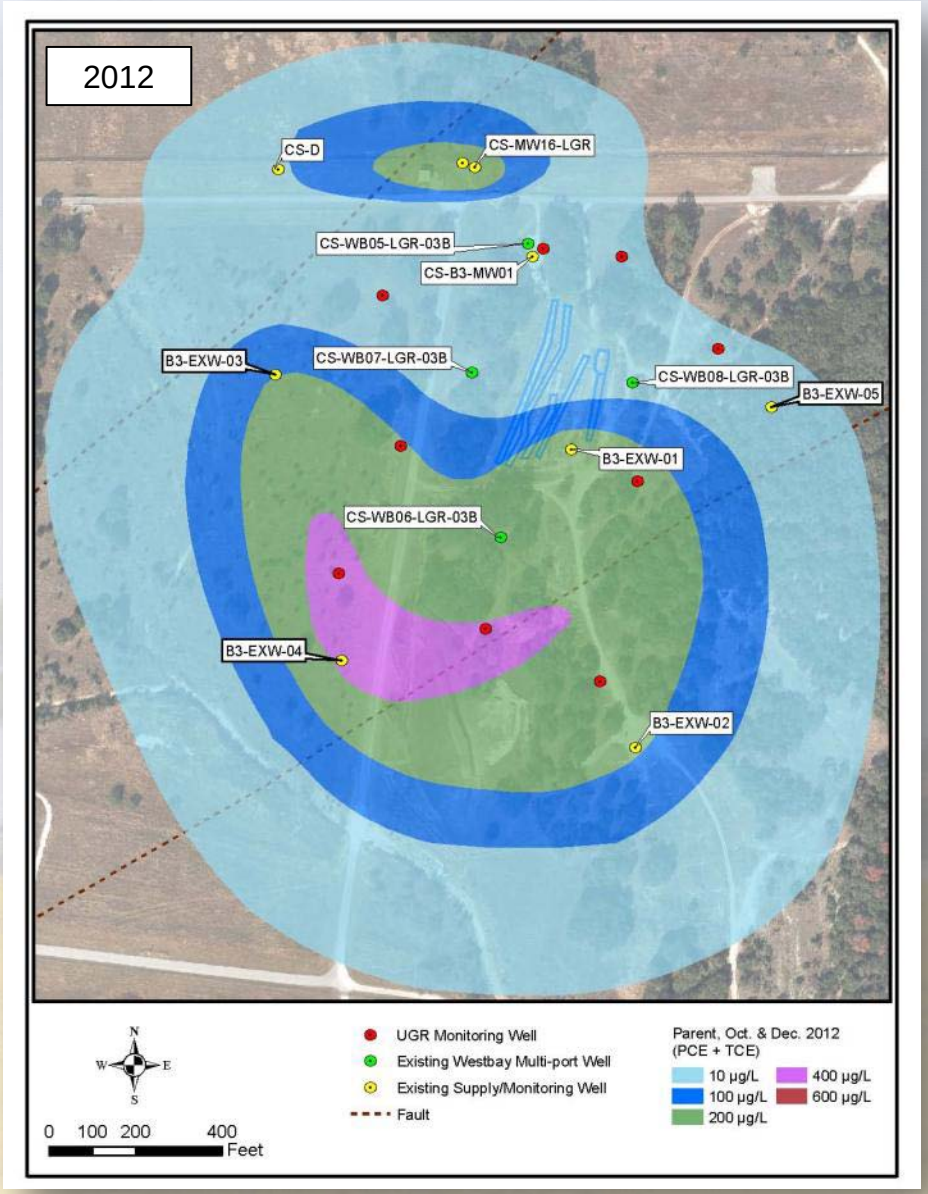
Westbay® Monitoring Equipment

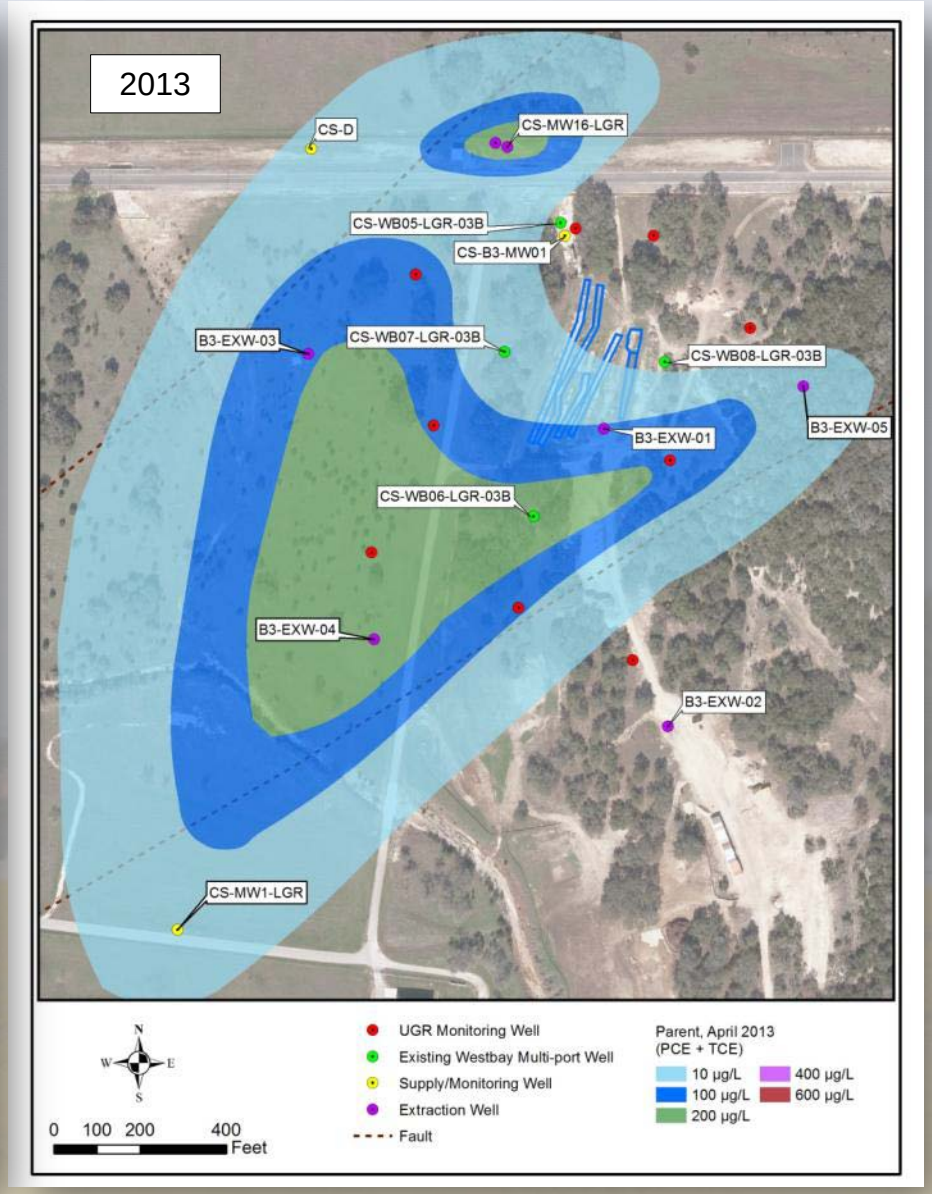


SWMU B-3 Monitoring Locations



Wells are completed at various depths around the bioreactor.

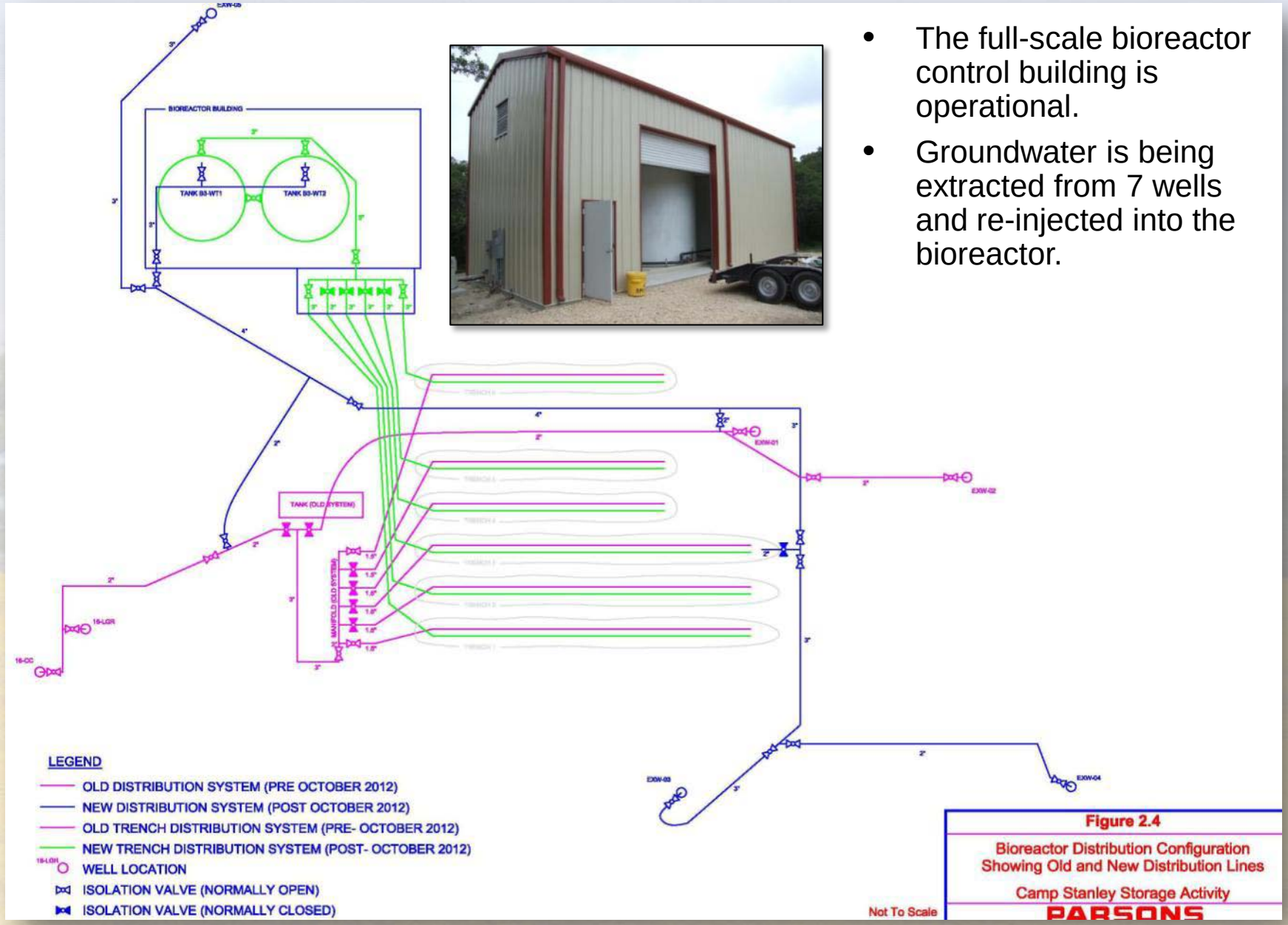




Groundwater plume contamination is being reduced in size and concentration.

Recent Bioreactor Activities

- The full-scale bioreactor control building is operational.
- Groundwater is being extracted from 7 wells and re-injected into the bioreactor.



B-3 Bioreactor
Conclusions

- Bioreactor is effectively treating approximately 50,000 gallons of re-injected contaminated groundwater per day at the site.
- Plume size and concentration has decreased in the source area.
- Contamination is being biodegraded and it is measured and monitored.
- Contamination which remains in the fractured bedrock formation is being treated as a remedial measure.
- Bioreactor is expected to continue to operate as a long-term solution into the coming years.

TREATMENT TECHNOLOGIES AT CAMP STANLEY STORAGE ACTIVITY (CSSA)

AREA OF CONCERN 65

Area of Concern 65 (AOC-65) Background

- Chlorinated solvents were used in the past to clean weapons and ammunition.
- Past chemical management practices were not environmentally sound.
- Solvents were utilized within metal vats inside floor-level concrete vaults at Building 90 (Old Armory).
- Some of the solvents were inadvertently released to the ground.
- Chlorinated solvents were removed from the inventory in the early 1990s and are no longer used at CSSA.
- Groundwater contamination was first detected off-post in 1999.
- Aggressive measures have been taken to control and remediate the site.

USEPA Order

CSSA continues to work closely with USEPA to close the RCRA §3008(h) Administrative Order issued in 1999.

The 1999 Order was put in place by USEPA to ensure that corrective action activities would be implemented to protect human health and the environment.

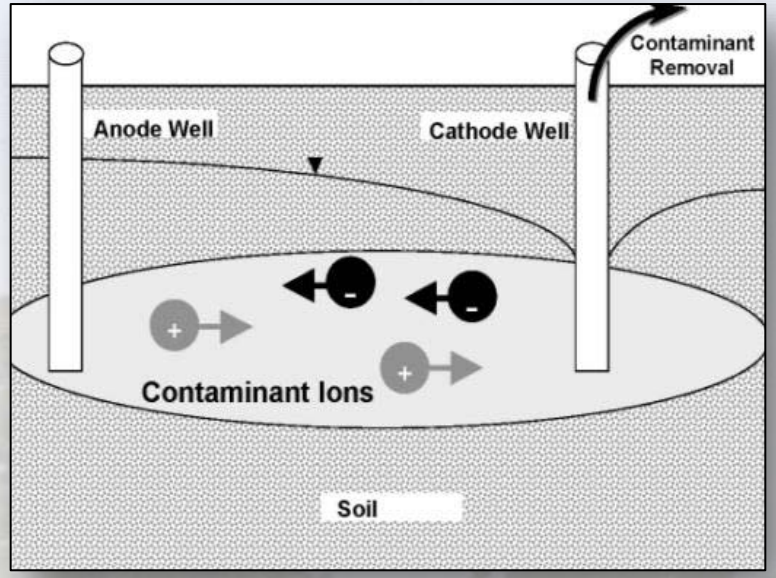
Plume 2 Source Identification
History

- **1999:** Groundwater contamination detected at off-post drinking water Well LS-07
- **2001:** Soil gas survey to identify contamination
- **2002:** Soil removal and installation of soil vapor extraction (SVE) system at AOC-65
- **2002-2012:** SVE performed at AOC-65

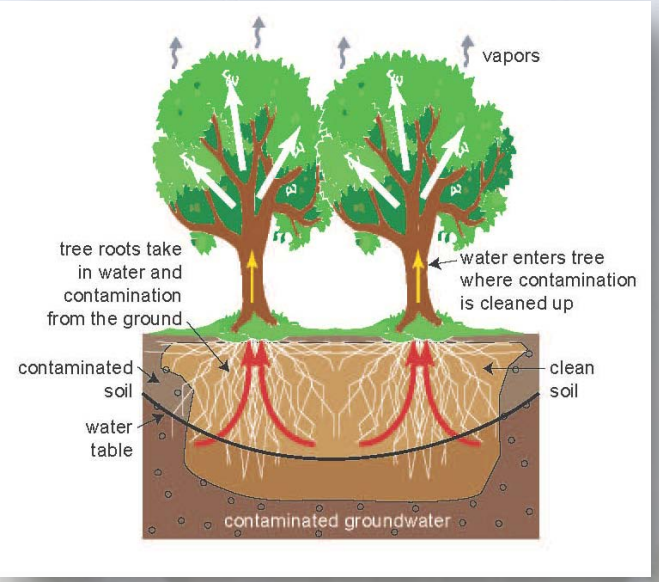
Plume 2 Source Identification
History

- **2011:** Enhanced steam extraction performed at AOC-65
- **2012:** Emergency repairs were performed on off-post GAC units during a freeze in February
- **2012:** Installation of in-situ chemical oxidation (ISCO) infiltration gallery
- **2012 & 2013:** ISCO injections at AOC-65

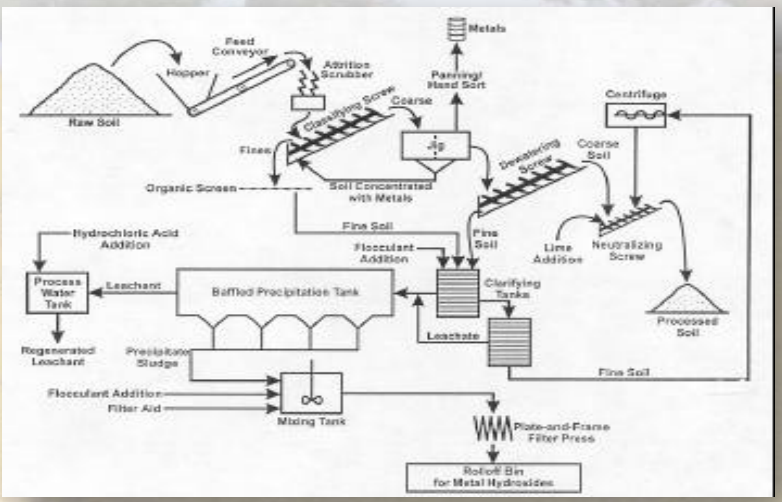
Remedial Technology Testing: Soils



Electrokinetics



Phytoremediation

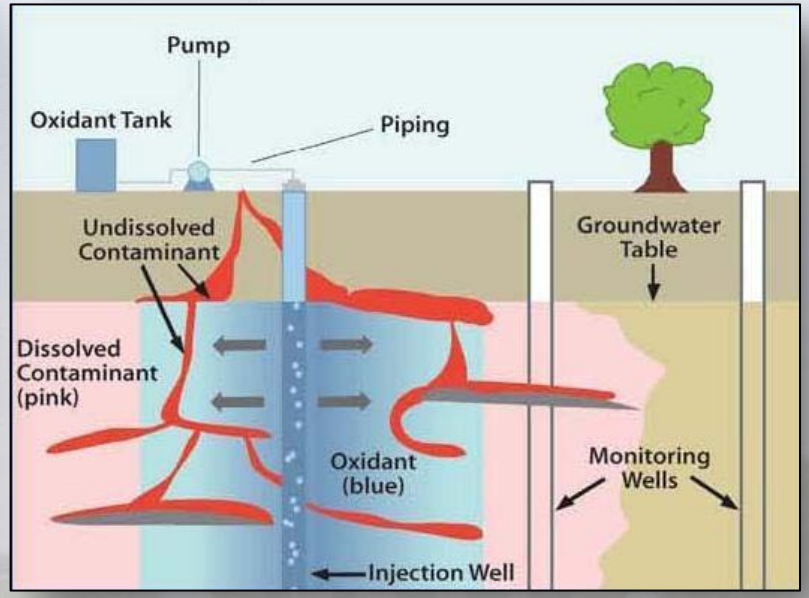


Soil Washing

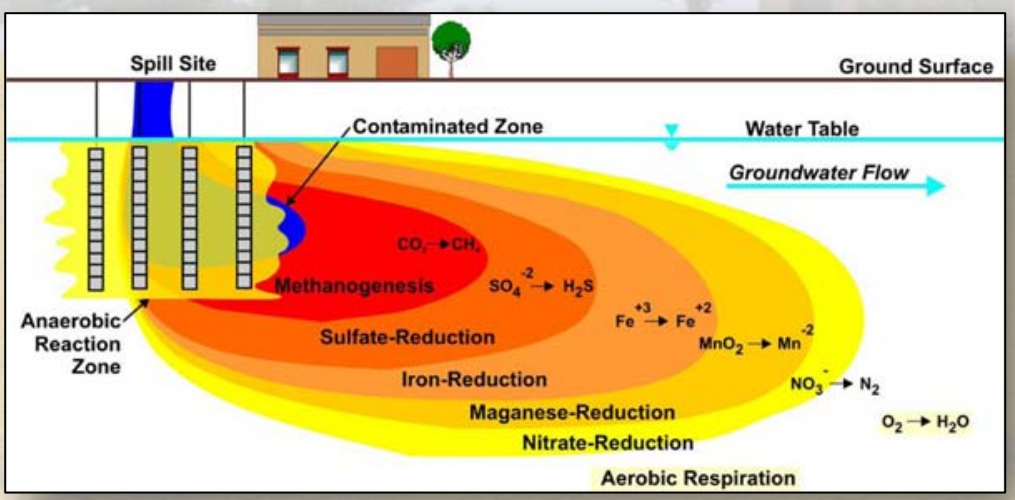
Phosphate Induced Metal Stabilization (PIMS)

Remedial Technology Testing: Groundwater

Soil Vapor Extraction



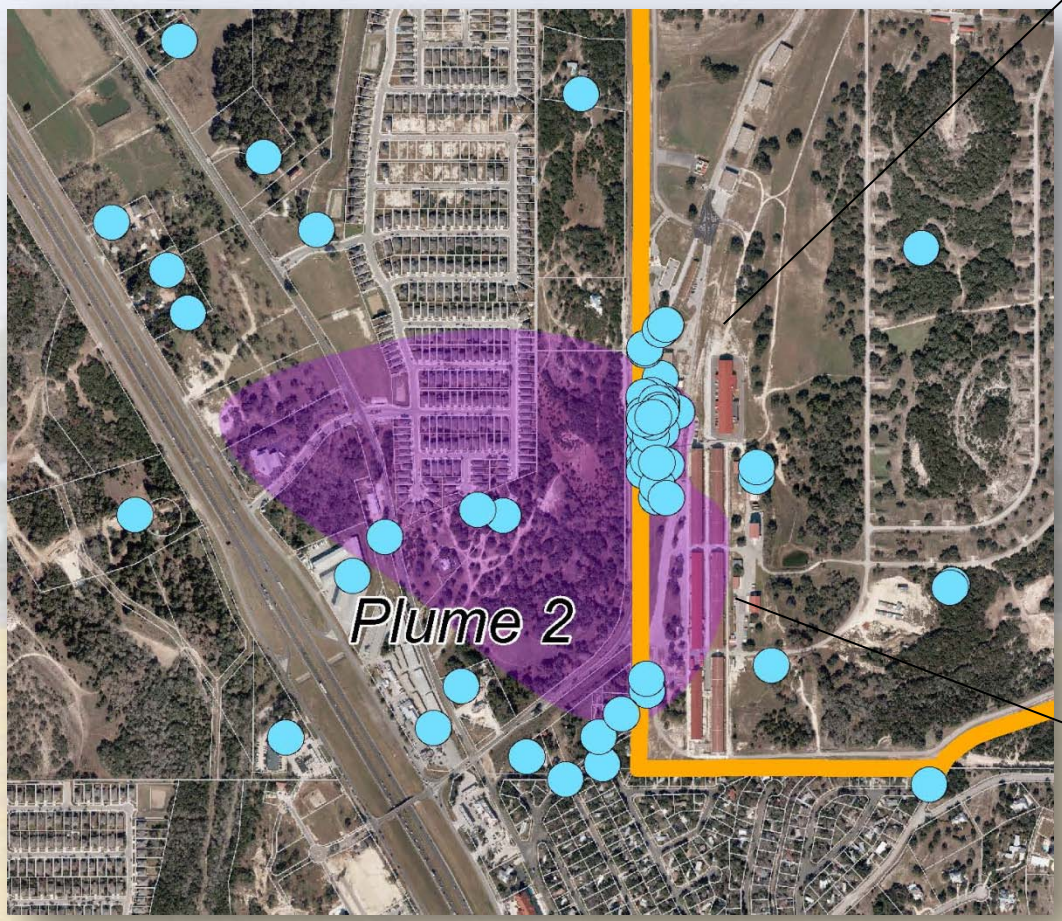
In-situ Chemical Oxidation

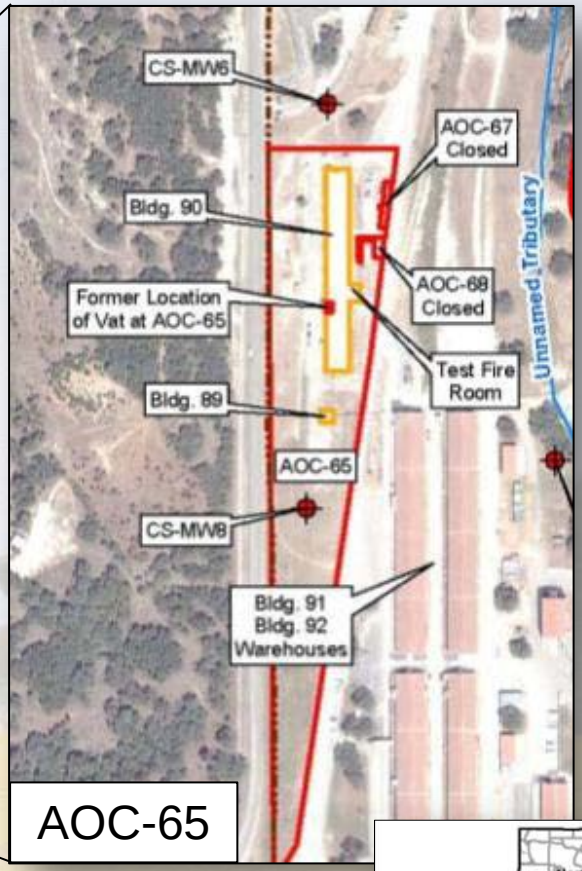


Bioremediation

Point of Use Treatment

Introduction to Plume 2 and AOC-65





AOC-65

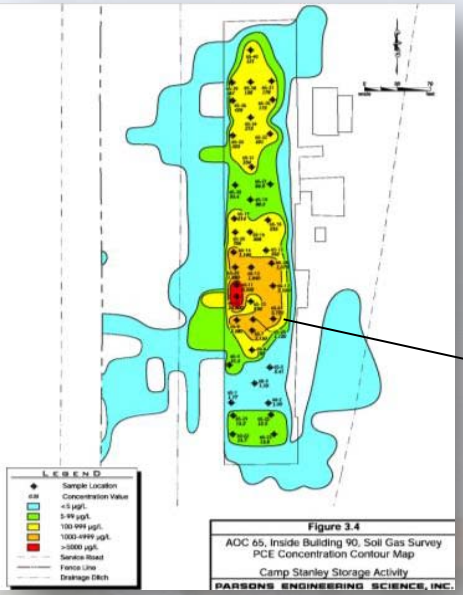
Introduction to Plume 2 and AOC-65

Historical Aerial Photos

Record Reviews and Interviews

Site Identification

Off-post Groundwater Sampling



Soil gas samples collected inside and around Building 90

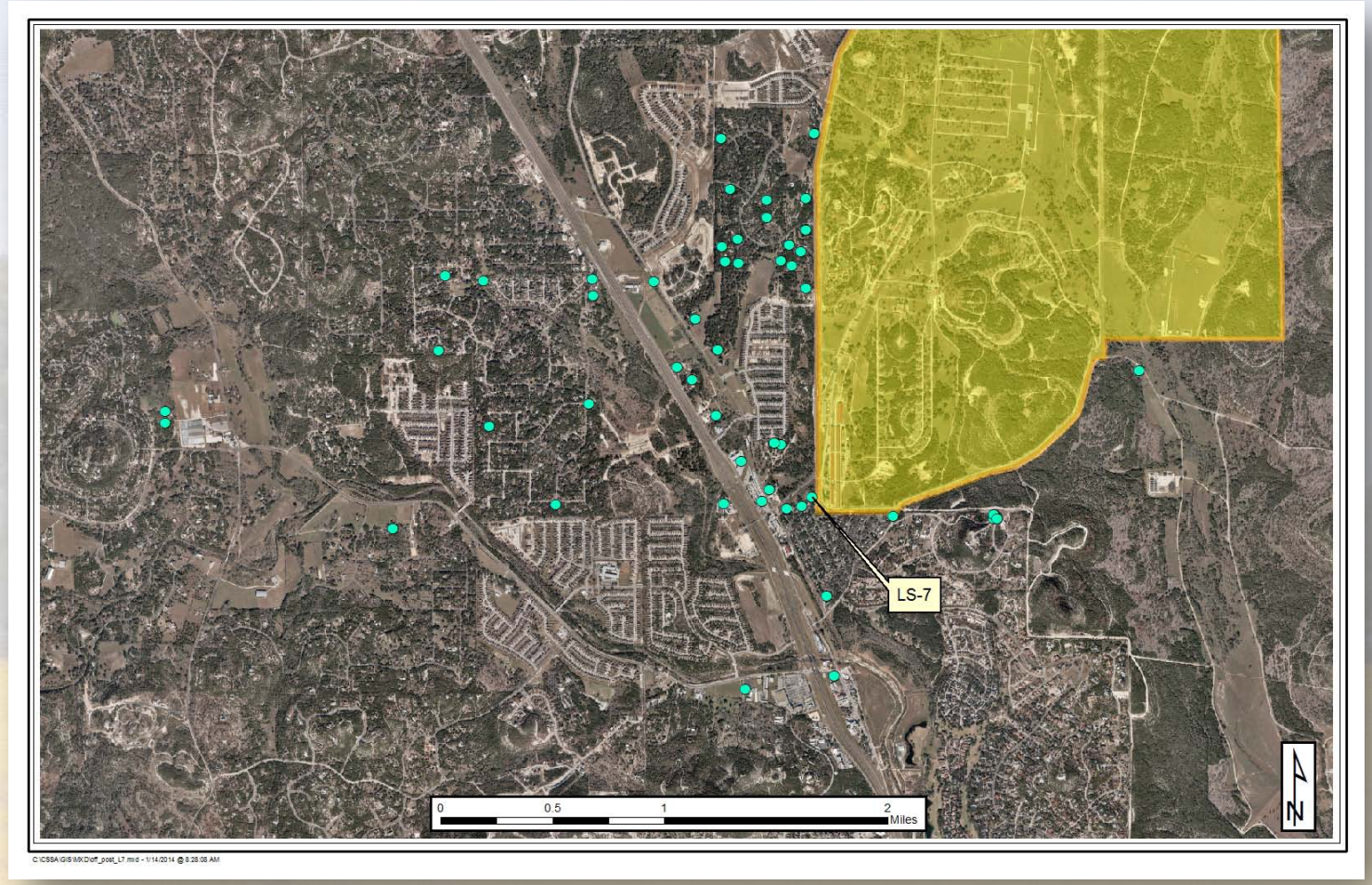
Soil Gas Survey

Preliminary Soil Sampling

- Resistivity
- Seismic Reflection
- Induced Polarization
- Microgravity
- Spontaneous Potential
- Very Low Frequency Electromagnetics

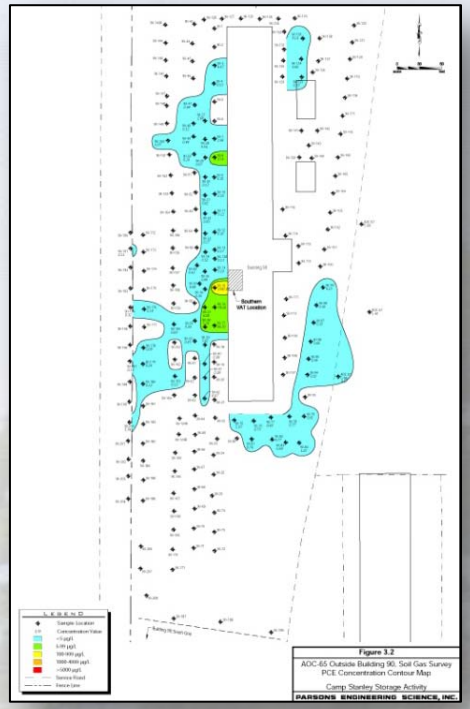
Geophysical Investigation

Site Identification: Off-post Groundwater Sampling



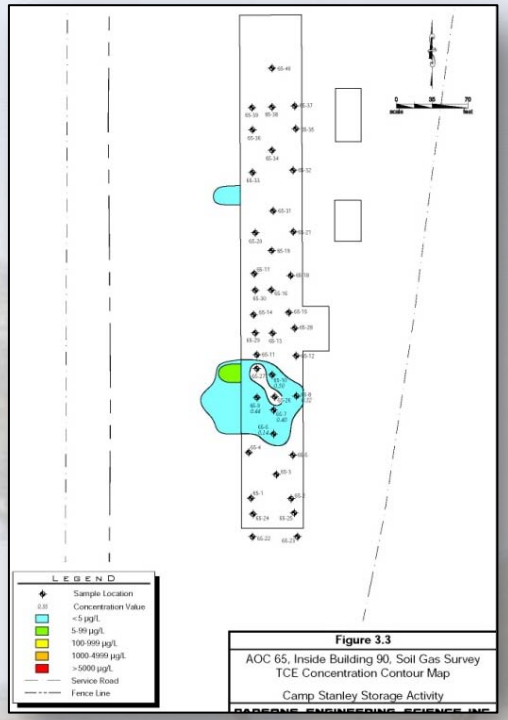
The first off-post well sampled that identified contaminants in groundwater was LS-7. This well was first sampled in 1999, and since then the off-post monitoring network has increased to sampling of 63 wells.

Site Identification: Soil Gas Survey



AOC-65
Exterior Soil Gas Sampling Locations
(PCE concentrations shown)

+

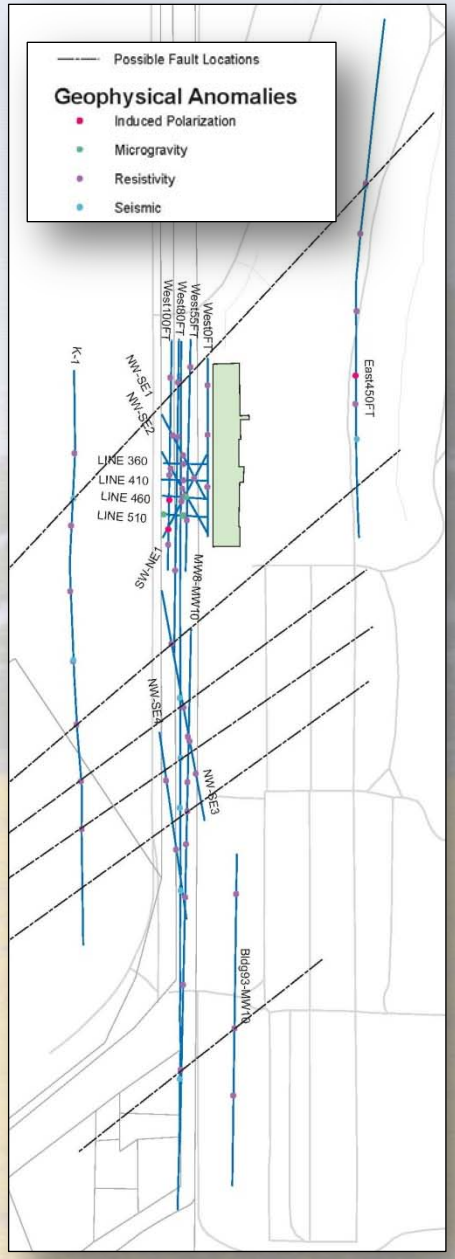


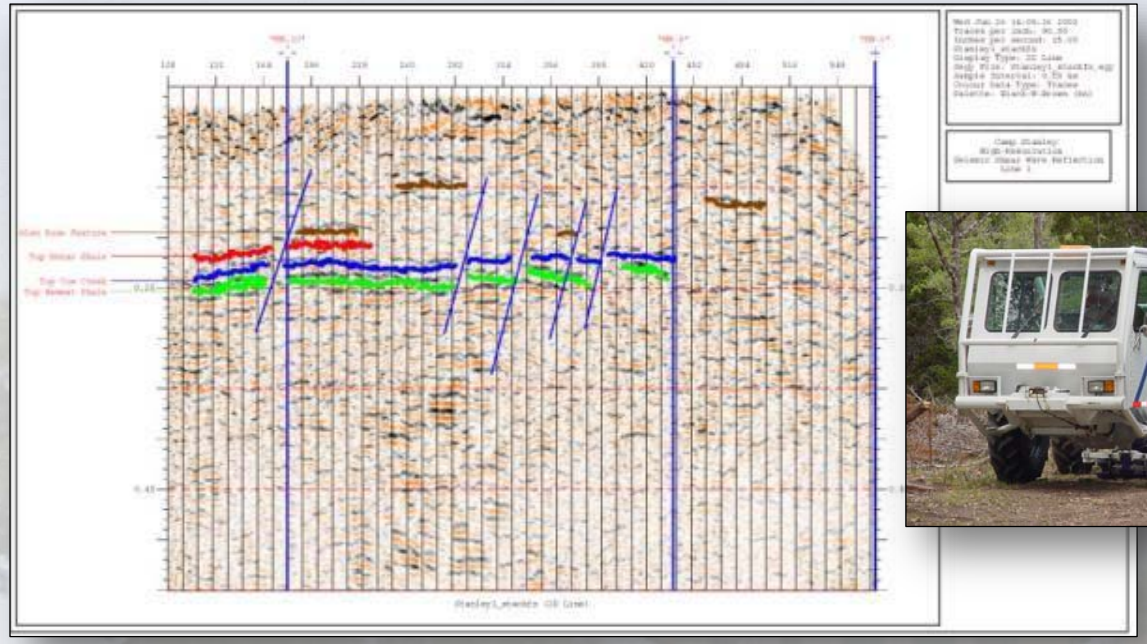
Building 90
Interior Soil Gas Sampling Locations
(TCE concentrations shown, though sampled for PCE as well)

=

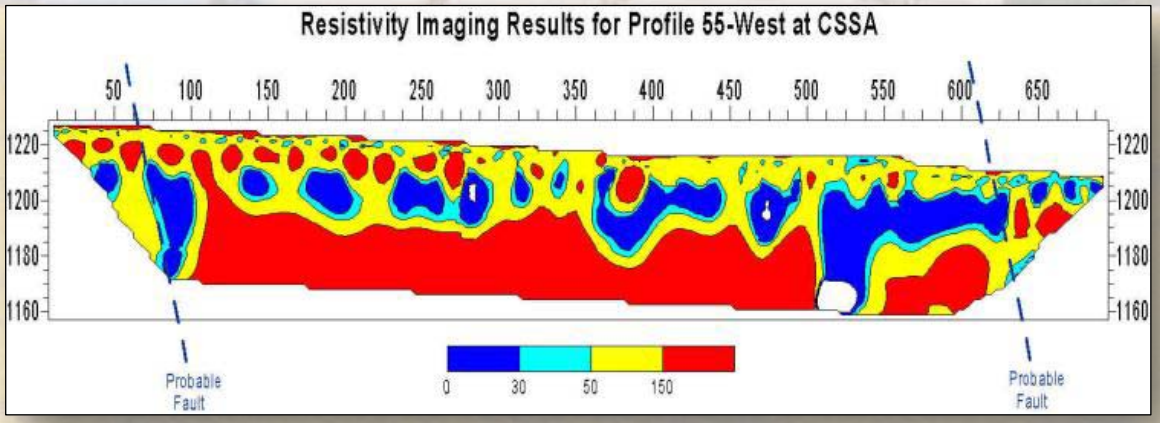
Complete AOC-65 Soil Gas Concentration Map for VOCs
(PCE and TCE)

Site Identification: Geophysical Investigation





Seismic Survey



Resistivity Survey

Interim Remedial Measures: Removal Actions

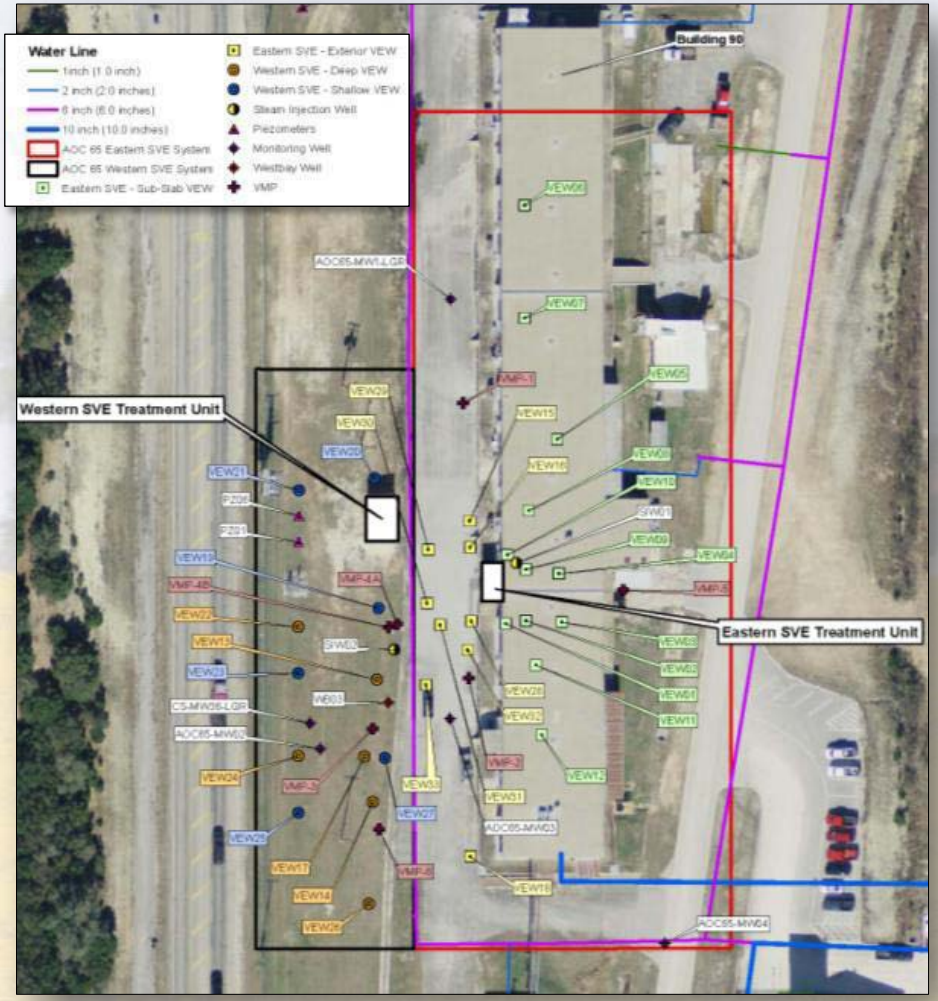
2002 Soil Excavation

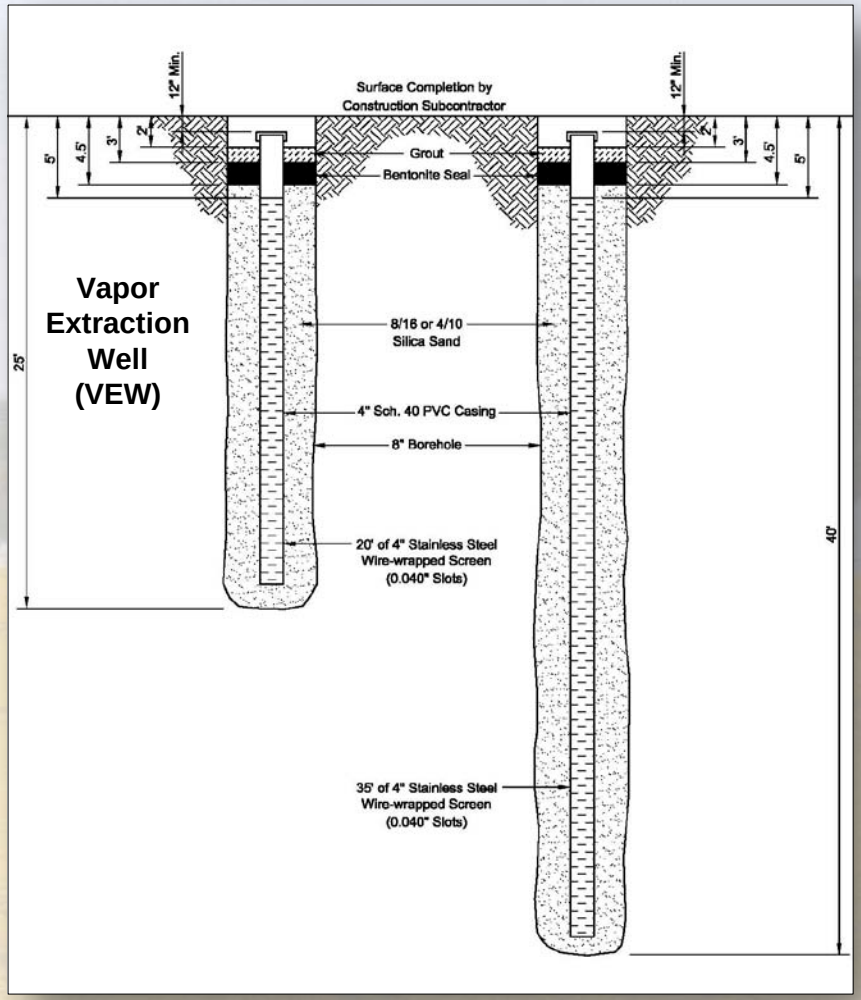
2012 ISCO Gallery Installation

2002 Soil Excavation

Soil Vapor Extraction

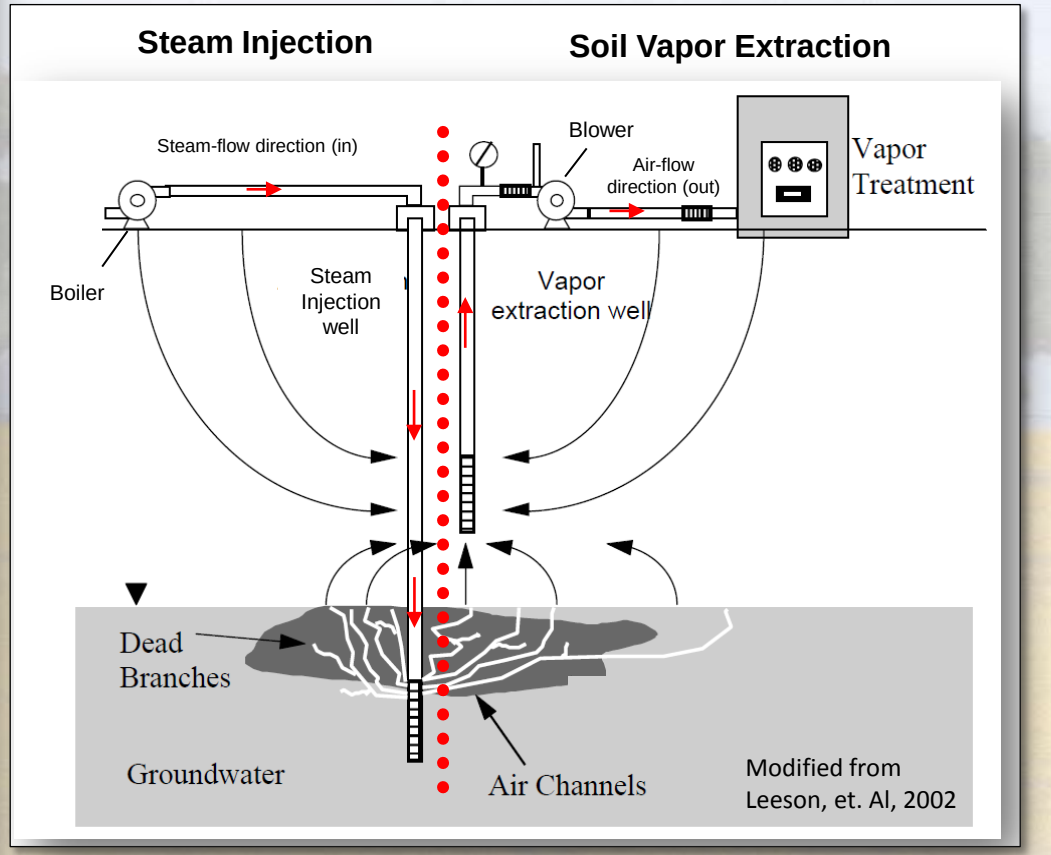
SVE consists of a series of vapor extraction wells connected to blowers that remove vapors from the subsurface.





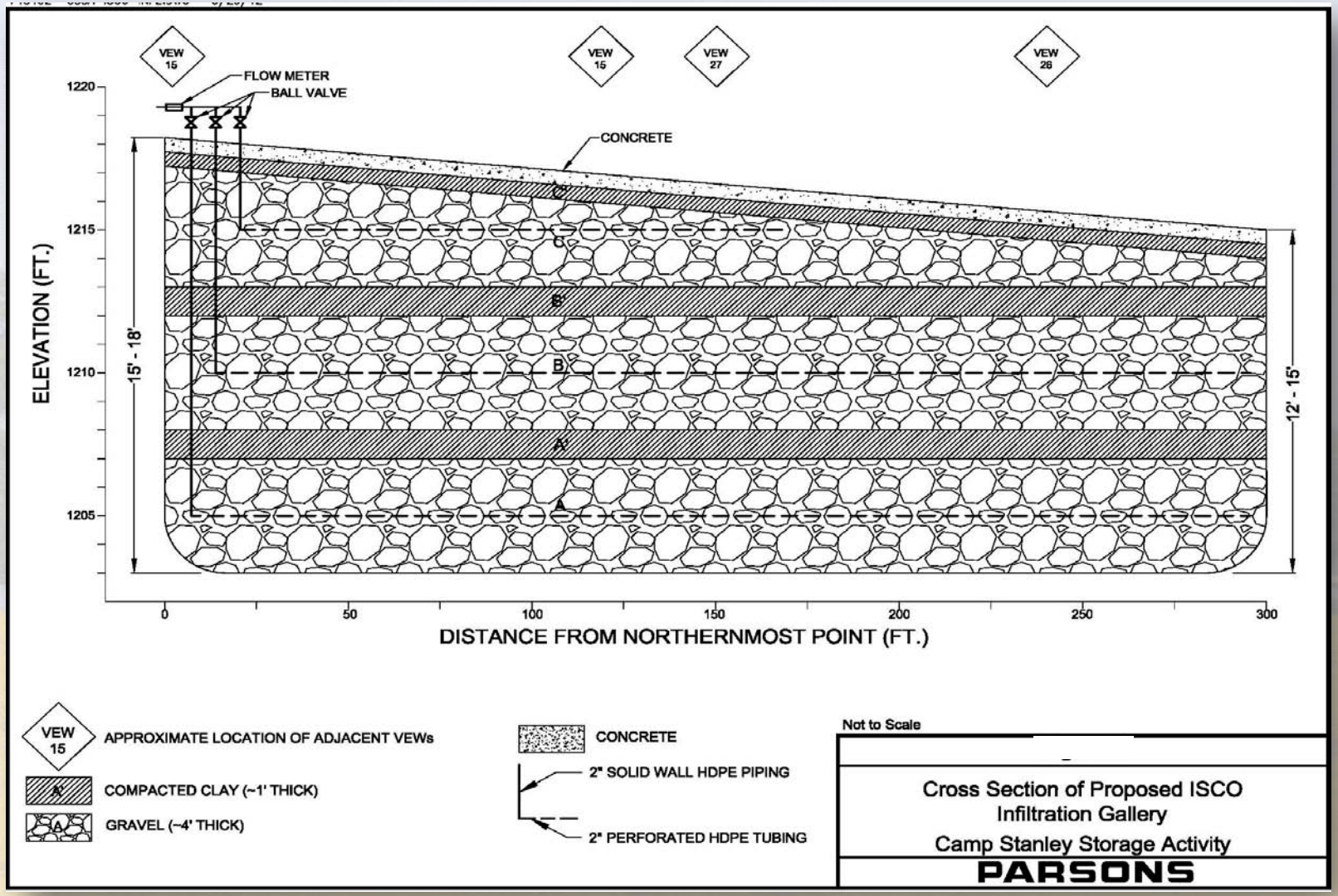
Soil Vapor Extraction (SVE): Enhanced Steam Extraction

Heat from steam increases contaminant volatilization, which is then removed by the SVE system.



2012 ISCO Gallery Installation

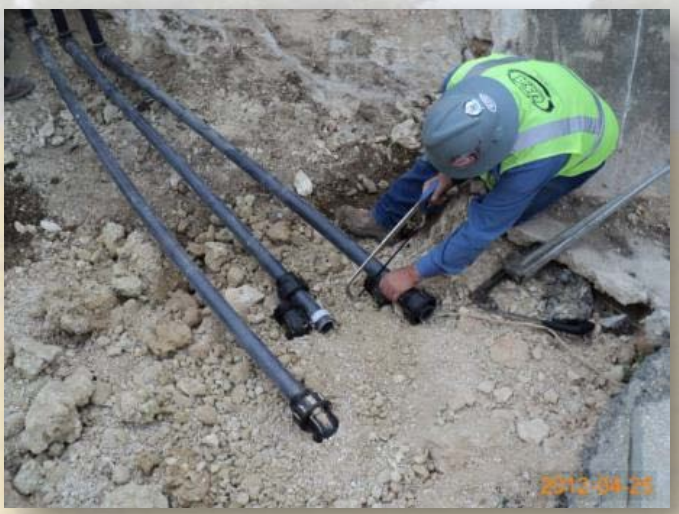
ISCO Gallery Design



ISCO Gallery Installation

Gravel added and leveled.

Clay layer added and compacted.



Injection line headers installed.

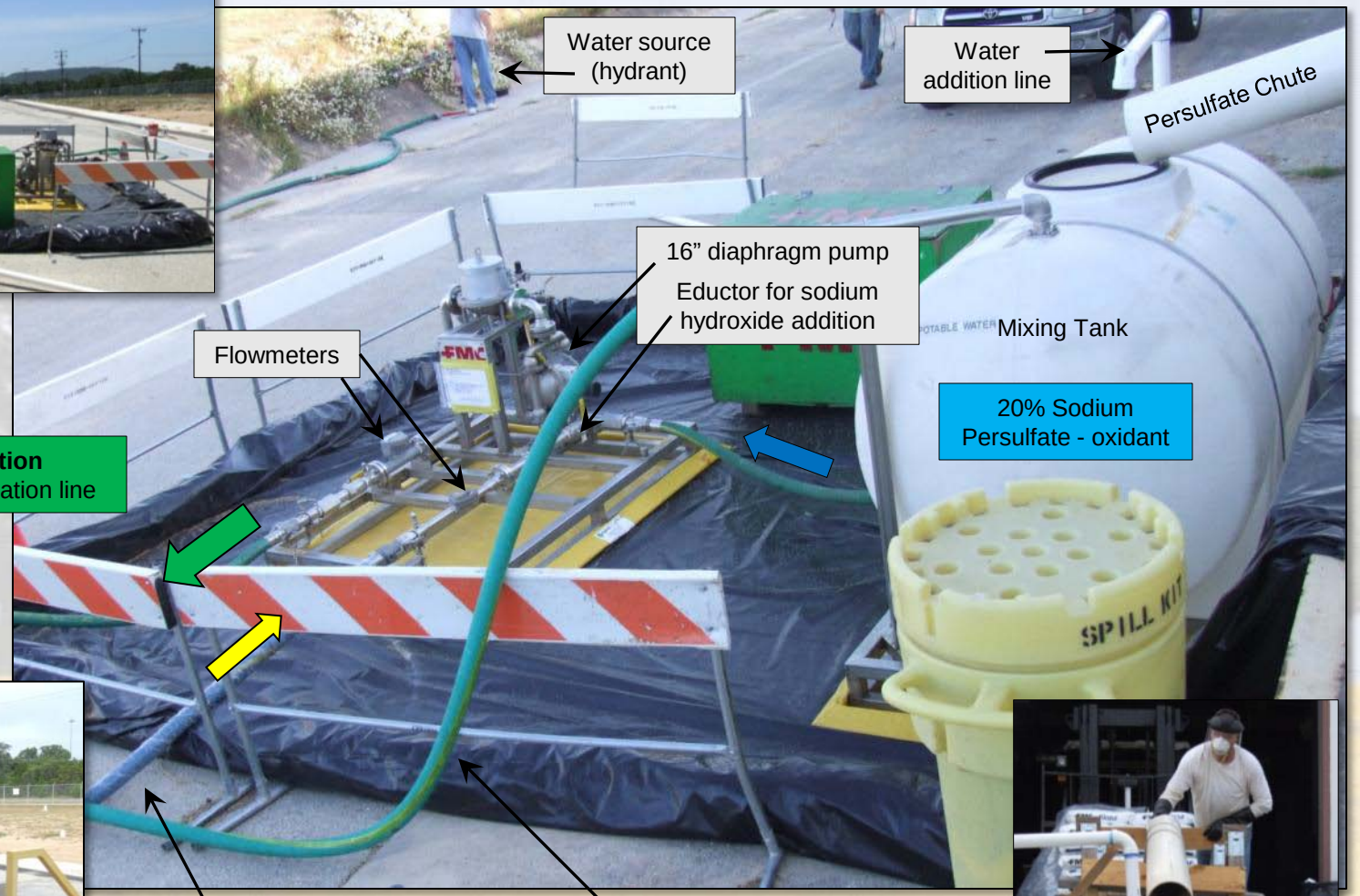
Completed infiltration gallery.

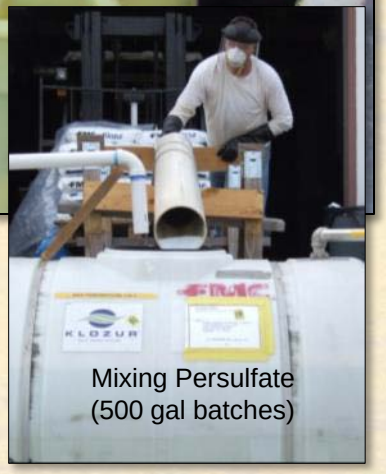
ISCO Injections

2012

2013

ISCO Injections



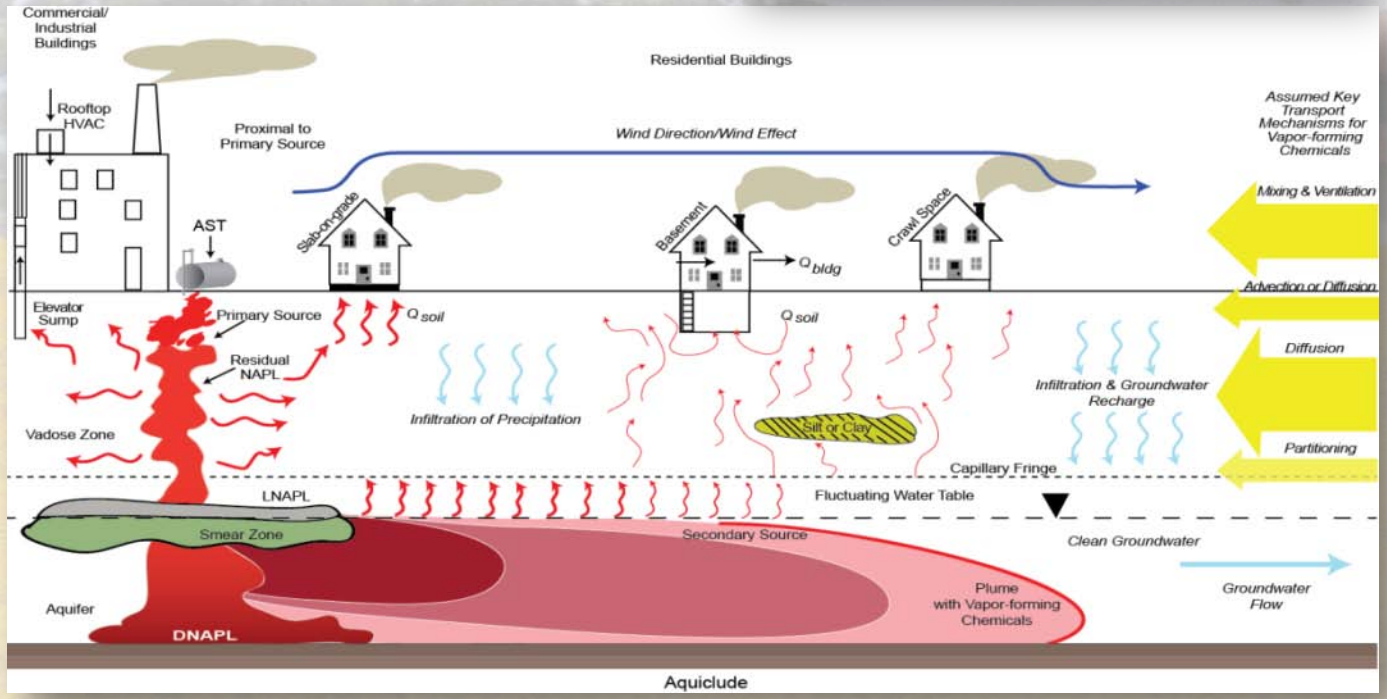


Point of Use Granular Activated Carbon (GAC) Filtration

Water is treated via GAC filtration prior to use at affected wells.

Vapor Intrusion Investigation

Air samples were collected for VOC analysis for a Vapor Intrusion Investigation.



Vapor Intrusion Investigation

- Investigation concluded that vapor intrusion from Plume 2 poses minimal risk to receptors.
- A letter describing results was sent to each investigation participant.
- A summary of results was included in the annual Fact Sheet.

Sample Location for RFR-11 House

Sample Location for Leon Springs Fire Department

Sample Location for RFR-11 Well House

Vapor Intrusion Investigation Results

Indoor Air Samples Collected in February 2013:

- Samples collected inside commercial, military, and residential homes; including new homes and older pier and beam residential homes.

- All sample results were below USEPA Residential Screening Levels.

AOC-65 Treatment Summary

- Contaminated soil has been removed from portions of AOC-65.
- ISCO is still being evaluated as an appropriate remediation technology for treating the Plume 2 source area.
- CSSA will continue to sample off-post wells in the area to monitor water quality.
- CSSA will continue to maintain off-post GAC units.
- Air sampling in both living and work environments show no vapor intrusion issues.