Pantex Plant

2013 Annual Progress Report

Remedial Action Progress

In Support of Compliance Plan 50284 and
Pantex Plant Interagency Agreement

June 2014

Pantex Plant
FM 2373 and U.S. Highway 60
P.O. Box 30030
Amarillo, TX 79120

Pantex Plant Remedial Action Systems

CERTIFICATION STATEMENT

2013 Annual Remedial Action Progress Report
Pantex Plant, June 2014

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision according to a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

6/24/14

J. David Crump — Date
Acting Division Manager
Projects
Babcock & Wilcox Technical Services Pantex, LLC

6/24/14

Craig A. Snider — Date
Deputy Assistant Manager for
Environment, Safety, Health, and Quality
U. S. Department of Energy
NNSA Production Office - Pantex

2013 Annual Remedial Action Progress Report
in Support of Compliance Plan No. 50284
and Pantex Plant Interagency Agreement
for the Pantex Plant, Amarillo, Texas
June 2014

Prepared by:

Babcock & Wilcox Technical Services Pantex, LLC (B&W Pantex)
P.O. Box 30020
Amarillo, Texas 79120

In accordance with 30 TAC §335.553 (g), this report has been prepared and sealed by an appropriately qualified licensed professional engineer or licensed professional geoscientist.

Matthew W. Jones, Ph.D., P.E.
B&W Pantex

6/18/14
Date

Project Team

B&W Pantex: Clifton Britten
Andrew Espinoza
Barry Guidry
Michelle Jarrett
Dr. Matthew Jones
Chad McGarry
Tammy Vincent

E.0 Executive Summary

The Pantex Plant, located in the Texas Panhandle 17 miles northeast of Amarillo, is implementing a remedial action to remediate perched groundwater and soils. Two types of systems have been installed for the groundwater response action: pump and treat systems in two areas and in situ bioremediation (ISB) systems in two areas. A soil vapor extraction (SVE) system has been installed to remediate volatile organic compounds (VOCs) in soils at the Burning Ground area. Other soil remedies (fencing, soil covers, and ditch liner) and institutional controls are also maintained as part of the soil remedy for Pantex. This annual report satisfies requirements in the Pantex Interagency Agreement (IAG) and Compliance Plan (CP) 50284 to provide information on the remedial action system performance and components. The focus for this report is the data and information collected for the soil and groundwater remedies during 2013. Data are evaluated according to criteria outlined in the *Long-Term Monitoring System Design Report* (B&W Pantex, 2009a), CP-50284, the IAG, Land and Groundwater Use Control Implementation Plan, and various Operation and Maintenance (O&M) Plans for the remediation systems.

Annual Progress Report Outline

- Background Information
- O&M of Remedial Actions
- Groundwater Remedial Action Effectiveness
- Soil Remedial Action Effectiveness
- Recommendations and Conclusions

E.1 Remedial Actions

Pantex has implemented soil and groundwater remedial actions. Those actions and their objectives are described in the highlight box below.

Groundwater Remedial Actions

Two Pump & Treat Systems
- Reduce saturated thickness
- Reduce contaminant mass
- Plume stabilization

Two In Situ Bioremediation Systems
- Reduce contaminant concentrations as groundwater migrates through the treatment zone

Institutional Controls
- Control perched groundwater usage and drilling in contaminated areas

Soil Remedial Actions

Ditch Liner and Soil Covers on Landfills
- Protect future groundwater

Institutional Controls
- Protect workers

Soil Vapor Extraction System
- Clean up soil gas and residual non-aqueous phase liquid (NAPL) in soil at the Burning Ground

Fencing
- Prevent traffic and control access

E.2 O&M of Remedial Actions

E.2.1 Pump and Treat Systems

To reach the goal of reducing saturated thickness, the pump and treat systems have a goal of operating 90% of the time and at 90% of design capacity. The pump and treat system performance for 2013 is depicted in Figure E-1.

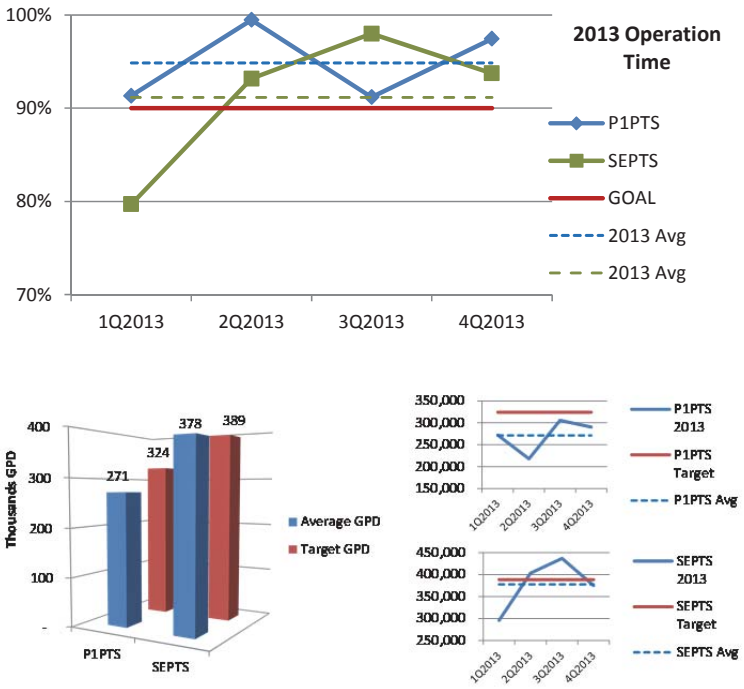

Figure E-1. Pump and Treat Systems Performance

Both pump and treat systems exceeded operational goals for the year. Both systems exceeded the operational goal of 90%. Although the systems operated consistently, treatment throughput was below goal due to reduced flow while repairs were made to the WWTF, irrigation system, or system wells. As depicted in Figure E-1, P1PTS operated 97% of the year with an average gallon per day (gpd) throughput over 271,000 gpd. SEPTS operated 94% of the year, with an average throughput near 378,000 gpd.

Overall, the systems have operated efficiently to treat contamination and reduce saturated thickness. Pantex has treated more than 1.8 billion gallons since the startup of the systems. Pantex reached a significant goal in 2013 with the treatment and removal of over 1 billion gallons perched groundwater (see Figure E-2) to align with the goal of reducing saturated thickness. Pantex continues to reduce reliance on injection of treated water, and as recommended in the Five-Year Review, Pantex has developed new throughput goals to align operations with the goal of reducing saturated thickness. Those goals are provided in the recommendations section at the end of this report.

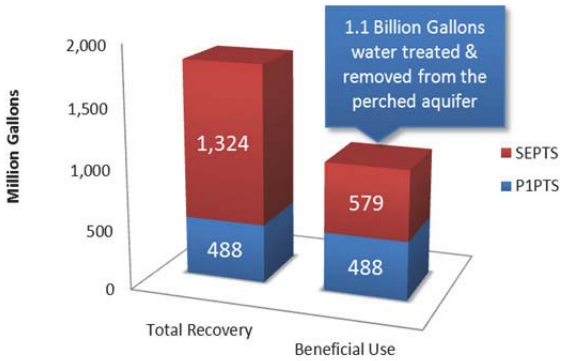

Figure E-2. Pump and Treat Recovery

In addition to removing impacted water from the perched aquifer, the pump and treat systems remove contaminant mass from the groundwater that is extracted from the aquifer. The P1PTS primarily removes the high explosive RDX and the SEPTS primarily removes RDX and hexavalent chromium (CR(VI) in Figure E-3). The figures below provide the mass removal for high explosives (HEs) and chromium for 2013, as well as totals since startup of the systems. The SEPTS has been operating longer than the P1PTS and the greatest concentrations of HEs are found in the SEPTS extraction well field, so mass removal is much higher at that system.

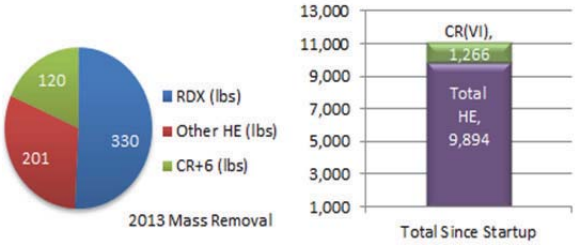

Figure E-3. SEPTS Mass Removal

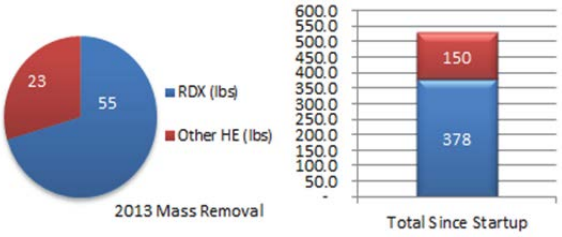

Figure E-4. P1PTS Mass Removal

E.2.2 In Situ Bioremediation Systems

For the treatment zone wells, this report evaluates whether the reducing conditions are present to degrade the contaminants of concern (COCs) in each area, as well as the presence of a continued food source for the bacterial reduction of COCs. Downgradient monitoring wells are evaluated to determine if COCs are being reduced to the GWPS and that complete degradation is occurring.

Installation of the Zone 11 ISB Remedial Action was completed in 2009, with initial amendment injection completed in 2009 and yearly injections thereafter. Data indicate that a reducing zone has been established and a fair to good food source is available for continued biologic growth. A fifth injection was completed in July 2013. All downgradient monitoring wells demonstrated continued treatment of perchlorate below the groundwater protection standard (GWPS) during 2013. Trichloroethene (TCE) concentrations continue to demonstrate a reducing trend at downgradient wells, and concentrations decreased to values lower than the GWPS in one well by the end of the year. If these trends continue, TCE concentrations in all downgradient wells will be below GWPS in 1 – 2 years. However, data collected in and around the treatment zone suggests that complete TCE treatment may be constrained by a lack of *Dehalococcoides sp.* (DHC) that are necessary for complete dechlorination of TCE. Pantex has developed a plan for bioaugmenting the system.

The Southeast ISB was installed in 2007, with injection completed by March 2008. This system has established an adequate reducing zone for HEs and chromium, based on

geochemical conditions monitored at the treatment zone. A fourth injection was completed at this system by September 2013. The system has adequately treated the primary COCs (RDX and hexavalent chromium) at three downgradient monitoring wells to concentrations below their respective GWPS by 4th quarter 2012. Pantex continues to investigate why one downgradient well, PTX06-1153, has not responded as strongly to treatment of RDX and hexavalent chromium. Two other performance monitoring wells (one upgradient and one farther downgradient) were dry and could not be sampled during 2013. This condition is expected to continue as the pump and treat systems operate.

E.2.3 Soil Remedial Actions

A new, more efficient, small-scale Catalytic Oxidation SVE system was installed at the Burning Ground in early 2012. This small-scale system focuses on treating residual non-aqueous phase liquid (NAPL) and soil gas at soil gas well SVE-S-20. The system was continuously operated except for maintenance, repairs, or freezing weather that affects influent flow. Mass removal calculated for 2013 for VOCs contributing more than 1% of the total VOC concentration is presented in Figure E-5 along with total mass removed since the SVE was installed as an interim action in 2002.

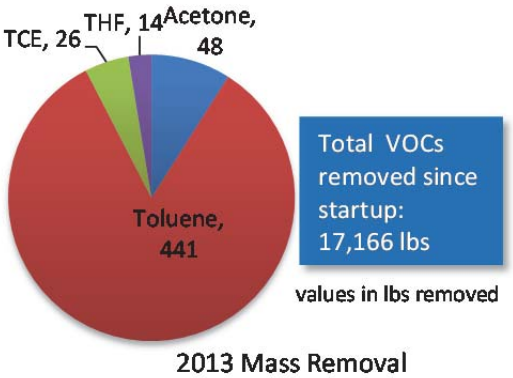

Figure E-5. Burning Ground SVE Mass Removal

In addition to the active soil remediation at the Burning Grounds, Pantex maintains institutional controls in accordance with deed restrictions and to protect workers and the environment. Pantex provides long-term control of any type of soil disturbance in the solid waste management units (SWMUs) to protect human health and to prevent spread of contaminated soils. SWMU interference was approved for one project that required work in a SWMU in 2013. Pantex also regularly inspects and maintains all soil covers, fences, signs, postings, and ditch liners. Minor deficiencies in soil covers and the ditch liner were observed and corrected in 2013.

Additionally, two deficiencies identified in the Five-Year Review inspections were addressed in 2013. In order to address the low spots and distressed vegetation, reseeding was completed at several landfill covers and a ClosureTurf™ synthetic landfill cover was installed at Landfill 1 (SWMU 68b). Pantex plans to evaluate the reseeding effort and the ClosureTurf™ to determine the most effective way to control erosion and infiltration of water into the landfills.

E.3 Groundwater Remedial Action Effectiveness

E.3.1 Plume Stability

Plume stability was evaluated through examination of water level and concentration data. Water levels were used to generate hydrographs and trends for individual wells, maps of water elevations and contours, and water level trends. Concentration data were used to perform concentration trend analysis. The concentration data were also combined with the water level data to generate plume maps for each COC. The maps and trends together formed the basis for an evaluation of overall plume stability. In addition, a comparison of observed versus expected conditions from the *Long Term Monitoring System Design Report* (B&W Pantex, 2009a) was conducted as part of the evaluation process.

Overall, calculated concentration and groundwater level trends were consistent with expected conditions defined in the LTM Design Report. Of the 43 monitor wells with expected water level conditions defined in the LTM Design Report, only three wells did not exhibit trends (last two years of data) consistent with the expected conditions. These wells are all located at the fringe of the perched aquifer extent and are not under the influence of a remedial action. Figure E-6 depicts recent water level trends in the perched aquifer LTM wells.

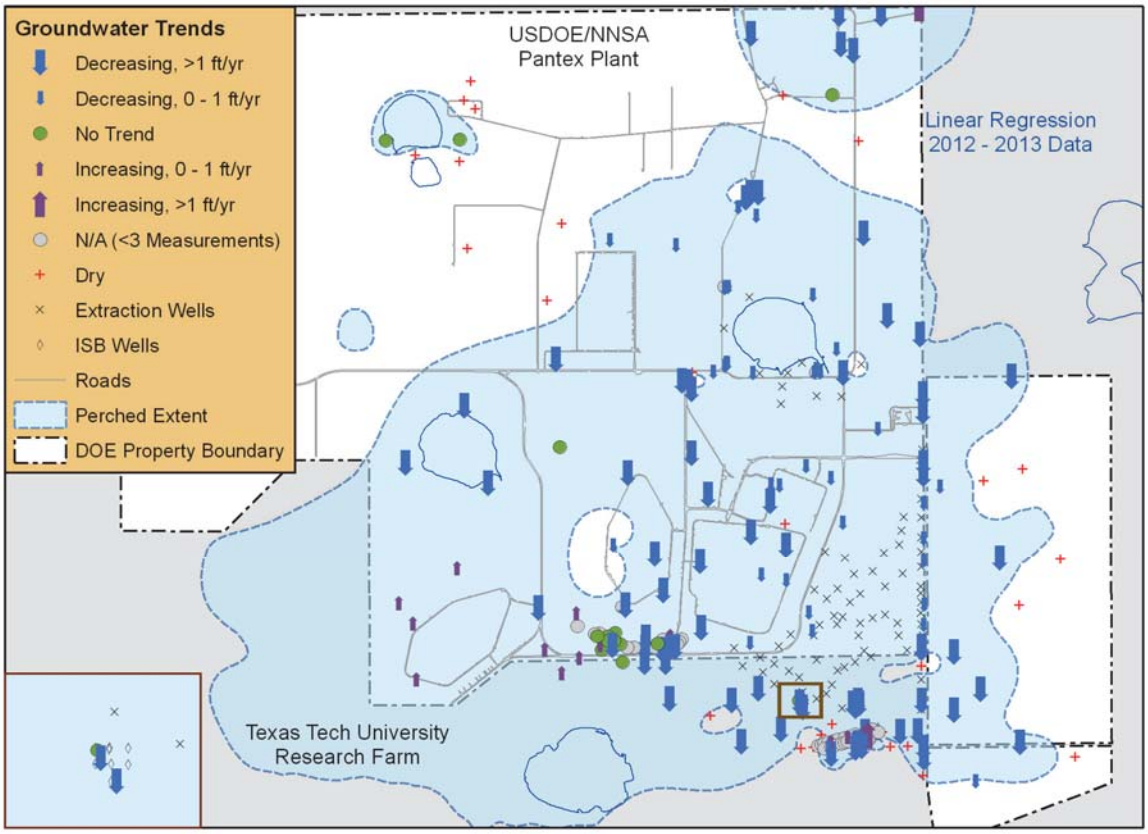

Figure E-6. Perched Aquifer Water Level Trends

Of the 103 monitor wells with expected COC concentration conditions defined in the LTM Design Report, only 19 wells did not exhibit trends (since the remedial action began in July 2009) consistent with the expected conditions. It is anticipated for these trends to meet expected conditions as the corrective actions continue to operate in the perched aquifer. Figure E-7 depicts RDX trends since the remedial action began in the perched aquifer LTM wells. Wells in the southeast lobe of the perched aquifer are not under the influence of a remedial action.

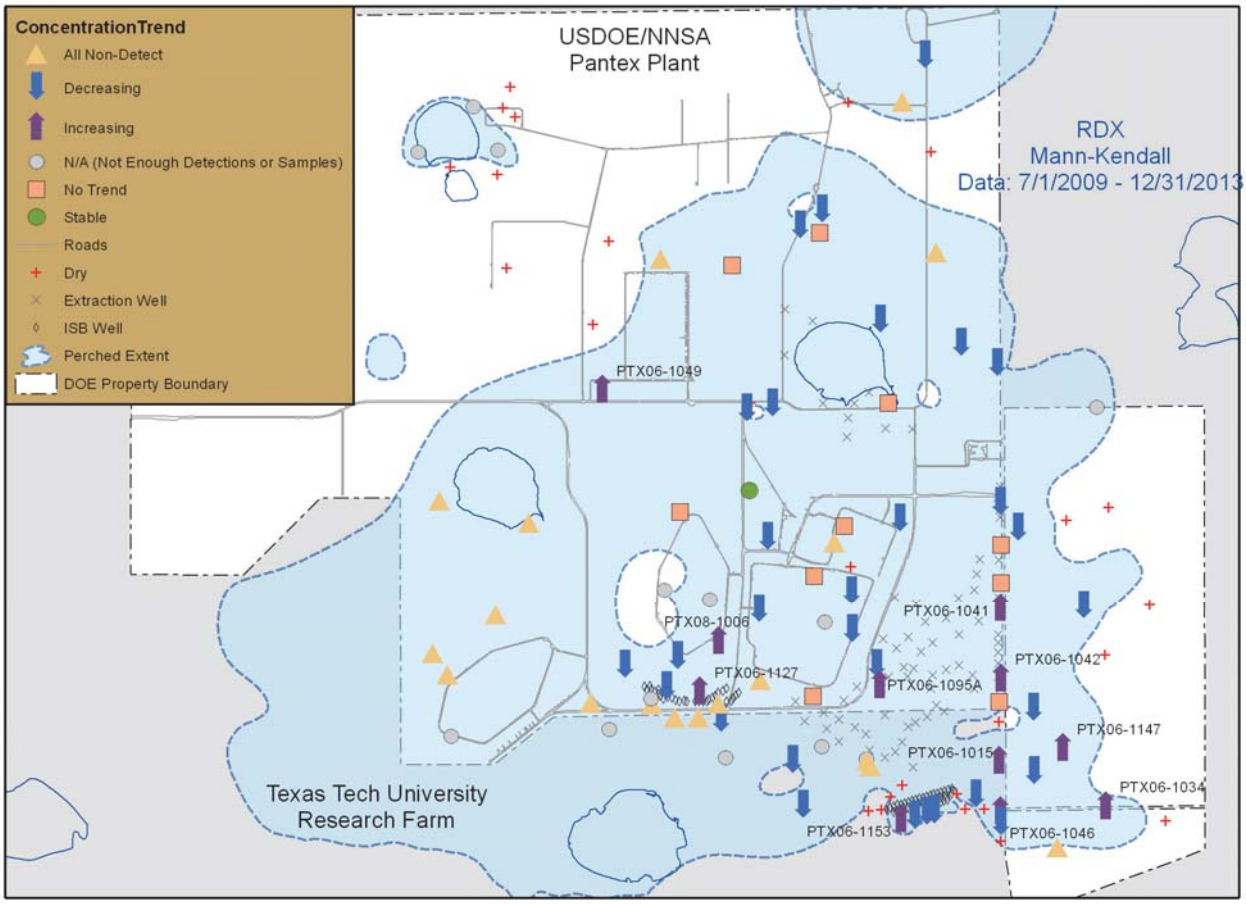

Figure E-7. RDX Trends in the Perched Aquifer

Generally, 2013 plume shapes are similar to the 2012 COC plumes. The major changes in plume size and shape were due to general plume movement downgradient, slight changes in concentrations that define the boundaries of the plumes, or effects of the pump and treat systems. The major COC plumes of interest are depicted in Figure E-8.

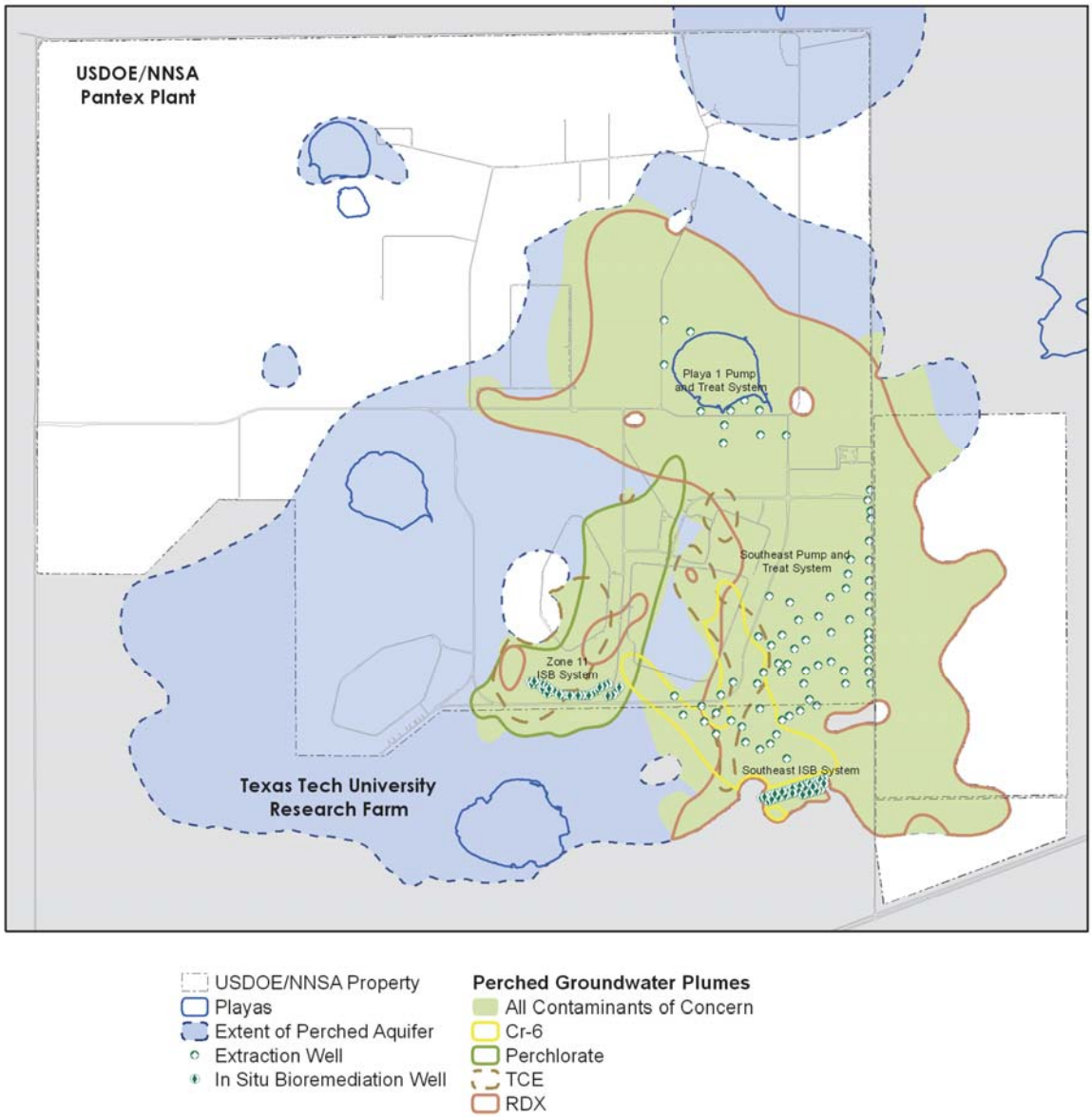

Figure E-8. Major COC Plumes in the Perched Aquifer

E.3.2 Remedial Action Effectiveness

Considering that one goal of both pump and treat systems is to affect plume movement, the plume stability evaluation can be used to determine the effectiveness of these systems. To this end, the pump and treat systems have been very effective in 2013. When comparing the 2013 conditions to LTM Design expected conditions, the majority are meeting expected conditions in the fifth year of the remedial action. Most wells not yet meeting expected conditions are in locations that have not yet been affected by the systems.

The Southeast ISB system data collected in 2013 indicates that it is effective in meeting the treatment objectives set in the *Remedial Design/Remedial Work Plan* (B&W Pantex, 2009c). Based on geochemical conditions monitored at the treatment zone, the Southeast ISB system has established an adequate reducing zone for the contamination that is present. A fourth injection of amendment was completed in September 2013 for this system to ensure continued reducing conditions and food source availability for degradation of COCs. The three closest downgradient monitoring wells (PTX06-1037, 1123, and 1154) for this system demonstrate the ISB system has been effective in treating HEs and hexavalent chromium. Concentrations of both RDX and hexavalent chromium were below their respective GWPS throughout 2013 in these three wells. Pantex is continuing to investigate the cause of the persistent RDX and hexavalent chromium concentrations in a fourth downgradient well (PTX06-1153). Data collected in 2013 revealed inconsistent flow patterns in the western end of the ISB system. Pantex will continue to evaluate data collected and develop a path forward for this area as needed.

Monitoring data collected in 2013 also indicate the Zone 11 ISB system has been effective in its fourth year of operation. Data indicate that an adequate reducing zone has been established for perchlorate and high explosives and conditions appear to be favorable for reductive dechlorination. Perchlorate concentrations remained non-detect in all downgradient ISPM wells in 2013. TCE concentrations significantly decreased in the two wells with measured concentrations in 2013 and one was below GWPS by the fourth quarter. If the current trends continue, TCE is expected to be below GWPS in all downgradient wells by 2015. However, recent data suggest that TCE treatment may be limited by a lack of the proper bacterial strains necessary for complete TCE dechlorination and bioaugmentation will likely be necessary.

E.3.3 Uncertainty Management/Early detection

The purpose of uncertainty management wells in High Plains Aquifer (commonly and hereafter referred to as the Ogallala Aquifer) and perched aquifer is to confirm expected conditions identified in the Resource Conservation and Recovery Act (RCRA) Facility Investigations and ensure there are not any deviations, fill potential data gaps, and fulfill long-term monitoring requirements for soil units evaluated in a baseline risk assessment. The

purpose of early detection wells is to identify breakthrough of constituents to the Ogallala Aquifer from overlying perched groundwater, if present, or potential source areas in the unsaturated zone before potential points of exposure have been impacted. These wells were proposed in the LTM Design Report for purposes of evaluating the effectiveness of the soil and groundwater remedial actions.

Group 1 wells are located where contamination has not been detected or confirmed, or in previous plume locations where concentrations have fallen below GWPS, background, or practical quantitation limit (PQL). These wells were evaluated in the quarterly reports. No Group 1 perched aquifer wells had unexpected conditions in 2013.

Several Ogallala Aquifer Group 1 wells had nickel and boron detections exceeding background levels. However, these exceedences are likely due to stainless steel well screen corrosion, influence from deeper formations, sample turbidity, or background variability. All of these metals detections are significantly lower than their respective GWPS.

Hexavalent chromium was detected in five wells (PTX06-1033, PTX06-1043, PTX06-1056, PTX06-1138, and PTX06-1140) in 2013 below the laboratory PQL of 10 ug/L and well below the GWPS of 100 ug/L. These detections are likely a result of one or more of the following:

- Low-level background of hexavalent chromium in the Ogallala aquifer as suggested in a recent Texas Tech study. As presented in the 3rd quarter Progress Report, Pantex worked with the Texas Tech University Water Resources Center to investigate the occurrence, distribution, and speciation of chromium in the Ogallala Aquifer system in the Texas Panhandle. Study results suggest that the oxidized conditions in the Ogallala Aquifer are converting naturally occurring chromium to the hexavalent oxidation state, creating a possible low-level hexavalent chromium background in the aquifer.

- Lower detection limits for Method SW-7196 based on improvements to the method. MDLs dropped from 5 ug/L to 3.3 ug/L and the PQL dropped from 15 ug/L to 10 ug/L in June 2013. The new detection limits allow low-level background concentrations to be estimated above the new MDL and below the PQL.

- Corrosion of stainless steel screen/casing. Specific wells at Pantex have documented evidence of corrosion and conversion of total chromium to hexavalent chromium is possible due to oxidized conditions in the Ogallala Aquifer.

- False positive detections near the MDL due to the colorimetric analytical method. Typically, these detections are not confirmed by total chromium results.

It is likely that most of these sporadic detections are related to the lower detection limits and the ability to quantify low-level background detections as all hexavalent chromium detections

in 2013 occurred after lower detection limits were achieved in June. PTX06-1033 has documented evidence of corrosion. No evidence of screen corrosion was discernable from data collected from the other wells.

Group 2 wells are perched wells near source areas and generally have contamination above the GWPS. The purpose of the Group 2 well evaluation is to determine if source strength is declining. The ditches and playas are expected to continue to source contaminants to the perched aquifer for a long period of time (20 years or more), but at much lower concentrations than in the past. For many of these wells, it is expected that concentrations will stabilize with an eventual long-term decreasing trend below the GWPS.

Most of the Group 2 wells that have detections of COCs already meet expected conditions at the well. There are ten wells that do not yet meet expected conditions, i.e., increasing trends (since remedial actions began in 2009) when long-term decreasing trends are expected. Several of these wells are experiencing more recent decreasing trends while some could be due to increased mass flux and/or plume movement away from the source. Pantex will continue to evaluate these trends over time. Several other Group 2 wells had metals detections above their site-specific backgrounds, but were below GWPS. These metals detections are likely due to either well screen corrosion or variation in background.

E.3.4 Natural Attenuation

Natural attenuation is the result of processes that naturally lower concentrations of contaminants over time. Data are collected at Pantex to help determine where natural attenuation is occurring, under what conditions it is occurring, and to eventually estimate a rate of attenuation. This is an important process for RDX, the primary risk driver in perched groundwater, because it is widespread and extends beyond the reach of the groundwater remediation systems in some areas. Pantex started monitoring for RDX degradation products in all monitoring wells by July 2009, after testing analytical methods to ensure they can reliably detect and quantify those products. Because analytical methods are readily available, Pantex has monitored for degradation products of 2,4,6-trinitrotoluene (TNT) and TCE in the past and continues to monitor for those in key areas.

Based on monitoring results for TNT and its breakdown products, TNT has naturally attenuated over time. TNT has been manufactured at Pantex since the 1950s, yet is only present in the central portion of the overall southeastern plume - within the SEPTS well field and near Playa 1. The first breakdown product, 2-amino-4,6-dinitrotoluene (DNT), occurs near the TNT plume and extends slightly beyond. The final monitored breakdown product, 4-amino-2,6-DNT, extends out to the edges of the perched saturation at low concentrations. Only TNT breakdown products are present in perched groundwater beneath Zone 11 and

north of Playa 1. Concentrations of the breakdown products are still above GWPS, but most wells with detections are recently showing a decreasing or stable trend.

Pantex has monitored for breakdown products of TCE for many years; however, a strong indication of natural attenuation of TCE has not been observed in perched groundwater. TCE has started degrading in the Zone 11 ISB treatment zone. The TCE plumes at Pantex are being actively treated by the SEPTS and the ISB treatment zones.

Perched groundwater sampling results for RDX and breakdown products (MNX, DNX, and TNX) indicate that the breakdown products are present throughout most of the RDX plume, with TNX being the most widespread. TNX, the final degradation product, is a better indicator of degradation because the other intermediate products (MNX, DNX) degrade rapidly and do not accumulate in the environment (SERDP, 2004). If complete biodegradation of RDX is occurring, RDX and all breakdown products would be expected to decrease over time.

Overall, it appears that natural attenuation of HEs may be occurring at Pantex. More data will be required over time to determine trends and estimate rates of attenuation.

E.4 Soil Remedial Action Effectiveness

The small-scale SVE system at the Burning Ground is the only active soil remediation system at Pantex. The GAC vapor treatment system was replaced in early 2012 by a small-scale CatOx/wet scrubber system. The new system continues to focus on treating residual NAPL and soil gas at well SVE-S-20.

E.5 Recommendations and Conclusions

Pantex plans to continue the current approved remedial actions. The groundwater remedies are considered protective for the short-term as untreated perched groundwater use is controlled to prevent human contact and Ogallala Aquifer data continues to indicate no contamination. The systems are proving to be effective in reaching long-term established objectives for cleanup. Soil remedies have been effective at Pantex as workers and the public are protected from exposure to contaminated soils and data do not indicate that new contamination is migrating to the underlying groundwater from soil source areas. The SVE system is actively removing soil gas and residual NAPL in soils at the Burning Ground thereby mitigating vertical movement of VOCs to the Ogallala Aquifer.

Based on the information in this report and the Five-Year Review (B&W Pantex 2013), Pantex recommends the changes described below to the remedial actions and monitoring network. Pantex will also continue to improve and optimize the operation of remedial actions.

E.5.1 Recommended changes to the Pump and Treat Systems

As discussed in the Five Year Review and 2012 Annual Progress Report, injection of treated groundwater into the perched aquifer conflicts with the goal of reducing the saturated thickness of the aquifer and has likely affected nearby COC plumes. Because of these impacts, the pump and treat system operational goals (currently 90% operational time and 90% treatment system design flow) should be revised to emphasize beneficial use of treated water and eventual elimination of injection. Additionally, Pantex recognizes that, over time, the reduction of saturation in the perched aquifer will lead to reduced production of the extraction well field and the inability to meet design flow at the treatment systems.

Based on these constraints, the following prioritized goals were developed for both systems:

Priority 1: 90% plant operational time

Priority 2: No injection at SEPTS, as long as minimum system flow rates (125 gpm to prevent channeling in the GAC vessels) can be maintained in both systems without injection. Since P1PTS can only discharge to the WWTF, injection will be required when flow has been restricted to values less than 250 gpm. When flow to the WWTF is greater than 250 gpm, injection will be suspended and flow will be split between the two systems.

Priority 3: 90% of system capacity, defined as either treatment system or well field, whichever is lower.

E.5.2 Recommended Changes to the ISB Systems

E.5.2.1 Southeast ISB

Since no clear reason for the unexpected conditions in PTX06-1153 has been identified, it is recommended to continue monitoring the water level and analytical data collected in and around the Southeast ISB to continue to attempt to discern groundwater flow patterns. If the line of dry wells north and west of the treatment zone continue to exhibit dry conditions throughout 2014, the installation of a well further to the east may be necessary to both define the extent of the perched groundwater in the area and estimate COC mass flux into the treatment system. If these dry conditions upgradient of the system continue, it may also be necessary to revise the conceptual model and design basis for the system.

E.5.2.2 Zone 11 ISB

In order to address the identified issue of plumes extending north and west of the current treatment zone, Pantex has secured funding and is planning to expand the Zone 11 ISB system to the northwest. The expansion includes the following components:

- Installation of up to 18 additional injection wells
- Installation of three downgradient ISPM wells
- Installation of four ISPM wells located within the treatment zone (two in the current treatment zone and two in the expansion treatment zone)
- Installation of two upgradient monitoring wells
- Design/construction of a new equipment pad and water line to service the expanded system

The injection well placement will follow the original Design Basis Document for the Zone 11 ISB System (Aquifer Solutions 2008) as well as incorporate two of the wells installed in the area in 2012 for pump testing purposes. Initial amendment injection into the expanded treatment zone will occur in 2015.

As discussed in Section 5.1, it also appears that complete dechlorination may not be occurring due to a lack of the proper bacterial strains in the treatment zone and bioaugmentation is recommended. A bioaugmentation plan was completed in March 2014 and bioaugmentation will be included in the new ISB O&M contract, which is expected to be in place by September 2014. Bioaugmentation for the current treatment zone will most likely take place during the 2015 injection event, depending on availability of funding. However, bioaugmentation for the expanded treatment zone cannot occur until at least 2016, after the reducing conditions required for DHC have been established.

E.5.3 Recommended Changes to the Monitoring Network

Several changes were recommended to the LTM network in the Five-Year Review or subsequent reports. Most of the changes have been implemented with the exception of two recommendations from the Ogallala Aquifer Sampling Improvement Plan:

- The transition to micropurge sampling for Ogallala Aquifer monitoring wells has not yet occurred. A micropurge pilot study is currently in progress, and if the resulting data evaluation indicates that micropurge sampling improves the detection monitoring program, it is anticipated this change will be implemented starting in CY 2015.
- Planning is currently underway for installing diverters in the three Ogallala Aquifer wells identified in the Plan. Diverters are expected to be in place by December 2014.

E.5.4 Recommended Changes to Soil Remedies

Vegetative loss on landfill covers was identified as an issue in the Draft Final Five-Year Review Report, primarily due to the recent drought conditions in the Texas panhandle. Therefore, Pantex proposed to develop and implement a phased plan to revegetate the landfill covers as outlined in Section 2.3.2. Pantex completed reseeding in 2013 and is now evaluating its effectiveness. Evaluation will continue for several years as the areas were overseeded and the seeds will remain viable for three years. Additional reseeding, if necessary, is scheduled for 2017.

The small-scale SVE system continues to remove VOCs from SVE-S-20 and the VOC source area may be slowly decreasing. As discussed in the Five-Year Review and 2012 Annual Progress Report, no expected conditions or path toward closure were defined for the SVE system, other than "significant reduction in soil gas VOCs". Therefore, Pantex recommended the development of a Burning Ground SVE Performance Monitoring Plan, which will define expected conditions of the system performance as well as a clear path towards an end point of active SVE operations and potential transition to a passive system. The SVE Performance Monitoring Plan is in progress and scheduled for completion in December 2014.

E.5.5 Other Recommended Changes Based on the Five-Year Review Report

Several other changes were recommended in the Five-Year Review Report which do not have a direct impact on a remedial action or the monitoring network. However, these changes are presented to describe all completed and upcoming tasks recommended in the report. The recommendations have been completed in 2013, with the exception of updating worker protection values used to evaluate soil data for SWMU interferences and to assess worker protection. These updates are scheduled for completion in August 2014.

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List of Acronyms

amsl	above mean sea level
AOC	Area of Concern
bgs	below ground surface
btoc	below top of casing
CatOx	Catalytic Oxidation
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
COC	contaminant of concern
CP-50284	Compliance Plan 50284
CR(VI)	hexavalent chromium
DCE	dichloroethene
DHC	*Dehalococcoides sp.*
DNT	dinitrotoluene
DNX	hexahydro-1,3-dinitroso-5-nitro-1,3,5-triazine
DO	dissolved oxygen
EDTA	Ethylenediaminetetraacetic acid
EPA	Environmental Protection Agency
FM	Farm-to-Market Road
FS	Firing Site
ft	feet
FGZ	fine-grained zone
GAC	granular activated carbon
gpm	gallons per minute

gpd	gallons per day
GWPS	groundwater protection standard
HE	high explosive
HMX	octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine
in	inches
IAG	Interagency Agreement
IRAR	Interim Remedial Action Report
IRPIM	Installation Restoration Program Information Management System
ISB	in situ bioremediation
ISM	interim stabilization measure
ISPM	in situ performance monitoring
LTM	long-term monitoring
Mgal	million gallons
MAROS	Monitoring and Remediation Optimization System
MCL	Maximum Contaminant Limit
MNX	hexahydro-1-nitroso-3,5-dinitro-1,3,5-triazine
mV	millivolts
NAPL	non-aqueous phase liquid
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
O&M	operation and maintenance
ORP	oxidation reduction potential
OSTP	Old Sewage Treatment Plant
P&A	plugging and abandonment
P1PTS	Playa 1 Pump and Treat System
PCA	1,1,2,2 - tetrachloroethane
PCE	perchloroethene
PID	photoionization detector
POC	point of compliance
POE	point of exposure
ppmv	parts per million by volume
PQL	practical quantitation limit
RCRA	Resource Conservation and Recovery Act
RDX	hexahydro-1,3,5-trinitro-1,3,5-triazine
ROD	Record of Decision
SAP	Sampling and Analysis Plan
SEP/CBP	Solvent Evaporation Pit/Chemical Burn Pit
SEPTS	Southeast Pump and Treat System
SERDP	Strategic Environmental Research and Development Program
SVE	soil vapor extraction
SWMU	Solid Waste Management Unit
TCE	trichloroethene
TCEQ	Texas Commission on Environmental Quality

THF	tetrahydrofuran
TLAP	Texas Land Application Permit
TNB	trinitrobenzene
TNX	hexahydro-1,3,5-trinitroso-1,3,5-triazine
TNT	trinitrotoluene
TOC	total organic carbon
TWDB	Texas Water Development Board
TTU	Texas Tech University
USDOE/NNSA	United States Department of Energy/National Nuclear Security Administration
VFA	volatile fatty acid
VOC	volatile organic compound
WMG	waste management group
WWTF	Wastewater Treatment Facility

1.0 Introduction

The Pantex Plant, located in the Texas Panhandle approximately 17 miles northeast of Amarillo (see Figure 1-1), was established in 1942 to build conventional munitions in support of World War II. The Plant was deactivated in 1945, and was sold to Texas Tech University (TTU). In 1951, it was reclaimed for use by the Atomic Energy Commission to build nuclear weapons. Pantex continues with an active mission to support the nuclear weapons stockpile for the United States Department of Energy/National Nuclear Security Administration (USDOE/NNSA).

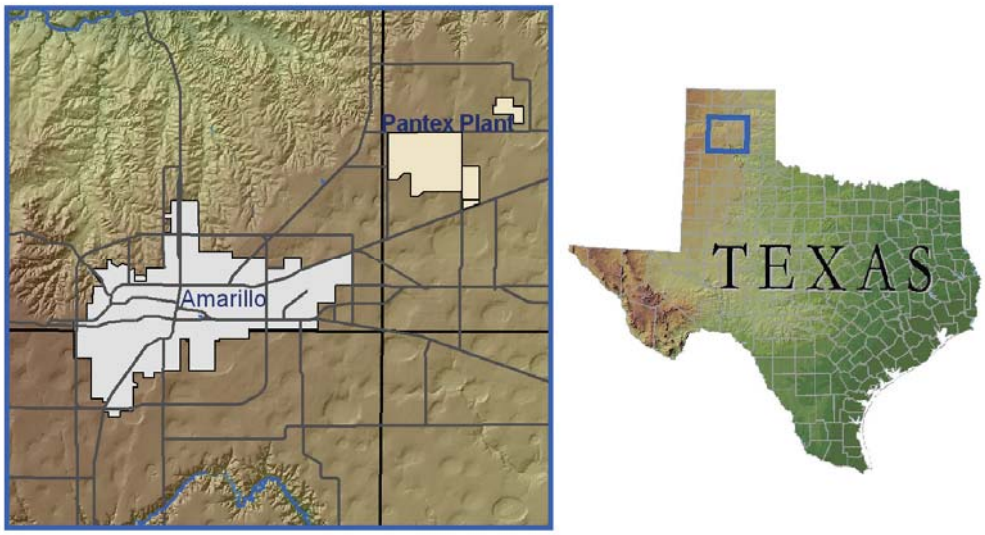

Figure 1-1. Location of Pantex Plant

The main Pantex Plant site encompasses approximately 9,100 acres. Approximately 2,000 acres of the USDOE/NNSA-owned property are used for industrial operations at Pantex, excluding the Burning Ground, Firing Sites, and other outlying areas. The Burning Ground and Firing Sites occupy approximately 489 acres. Remaining USDOE/NNSA-owned land serves safety and security purposes. Approximately 1,526 acres east of FM2373 was purchased in 2008 to provide better access and control of perched groundwater areas included in the Remedial Action. USDOE/NNSA also owns a detached piece of property, called "Pantex Lake," approximately 2.5 miles northeast of the main Plant. This property, comprised of 1,077 acres, includes the playa lake itself. No industrial operations are conducted at the Pantex Lake property.

Historical waste management practices at Pantex resulted in the release of contaminants through various waste streams. Treated and untreated industrial wastewater released to the ditches and playas resulted in the contamination of perched groundwater beneath Playa 1, parts of Zone 11, Zone 12, to the south on Texas Tech University property, and to the east of FM 2373. The extent of perched groundwater and the major contaminant plumes are depicted in Figure 1-2. Pantex has implemented remedial actions to mitigate perched groundwater contamination and to prevent contamination of the deeper drinking water aquifer.

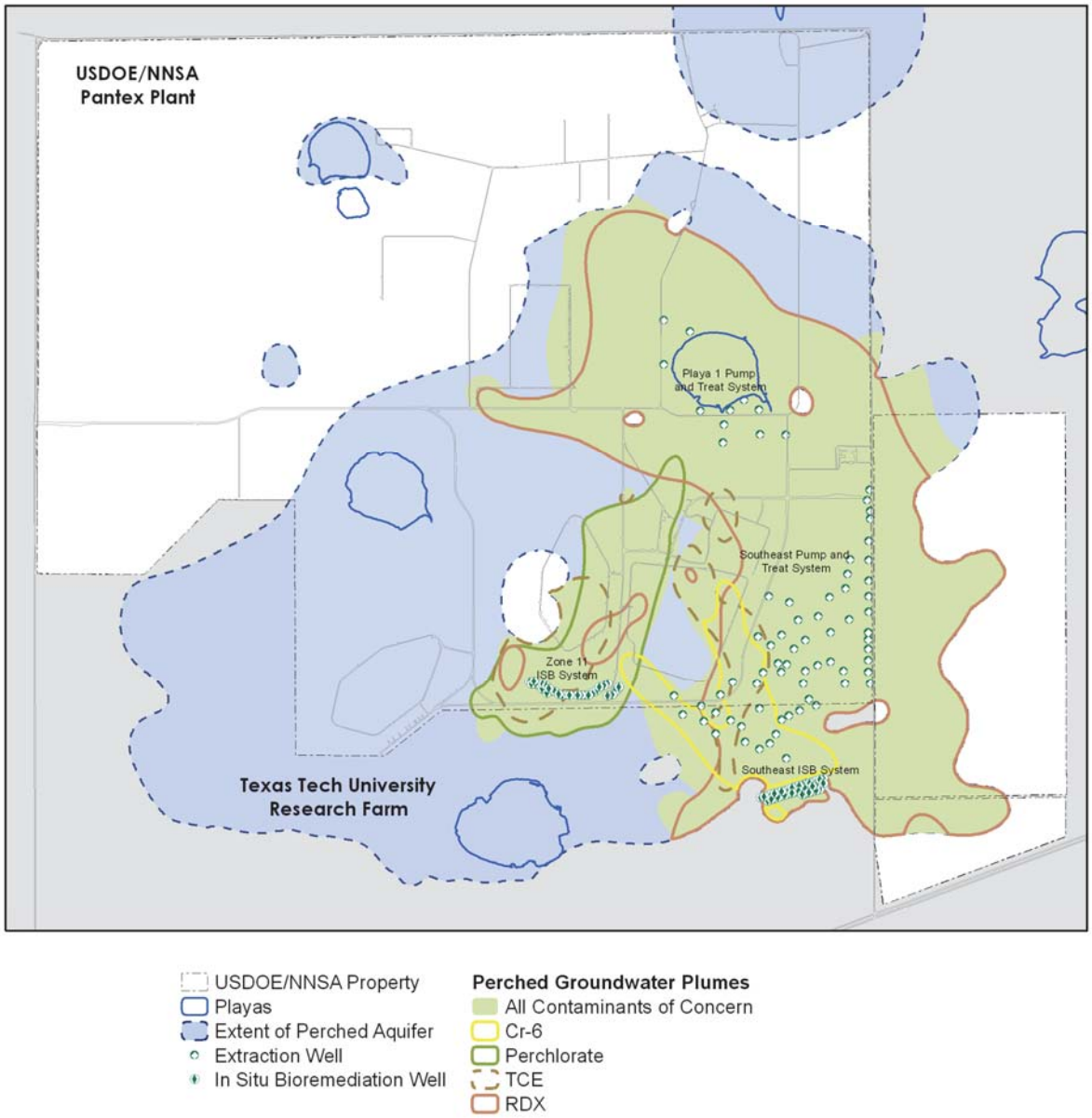

Figure 1-2. Extent of Perched Groundwater and Contaminant Plumes

Impacted perched groundwater is not used for residential purposes; however, the perched aquifer overlies the Ogallala Aquifer, a drinking water source for the Texas Panhandle and Pantex. This aquifer system, which is dominated by the Ogallala Formation, includes the Dockum formation in the Pantex vicinity.

Historical waste management practices also resulted in the contamination of soil sites at Pantex. Landfills and specific soil sites require institutional controls to ensure continued use of the land for industrial purposes. In addition, some areas require maintenance of soil covers and ditch liners to prevent infiltration of water and downward migration of contaminants to groundwater. Fencing and signs are also maintained to control worker use and traffic in the soil units.

1.1 Regulatory Background

Pantex implemented its remedial actions in accordance with the Compliance Plan for Industrial Solid Waste Management Sites, issued on October 21, 2003, and updated on September 16, 2010 to include final remedial actions, under the provisions of Texas Health and Safety Code Annotated, Chapter 361 and Chapter 26 of the Texas Water Code. The Compliance Plan (CP-50284) is a Texas Commission on Environmental Quality (TCEQ) permit, which delineates the requirements for conduct of corrective actions and groundwater monitoring programs according to Resource Conservation and Recovery Act (RCRA). Pantex was listed on the National Priorities List in 1994, requiring Pantex to also investigate and cleanup according to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). Pantex meets the requirements of CERCLA through the Pantex Interagency Agreement (IAG), effective February 22, 2008. The IAG is issued through the US Environmental Protection Agency (EPA). Table 1-1 lists the Compliance Plan and IAG, date of issuance, modifications, and descriptions of each issue or modification.

Table 1-1. Regulatory Compliance Documents

Document	Date of Issue	Description
CP-50284	10/21/2003	Interim stabilization measure compliance plan issued to describe interim measures for stabilization of groundwater plumes and monitoring of that action.
Interagency Agreement for the Pantex Superfund Site	2/22/2008	Established an agreement between EPA, TCEQ, and USDOE for the final remedial actions, framework for responding to and implementing CERCLA requirements, and framework for participation and exchange of information between parties.
CP-50284	9/16/2010	Modification issued to remove interim stabilization requirements and incorporate final corrective/remedial actions for Pantex and required monitoring and reporting of those actions.

A Compliance Plan was issued in 2003 that defined the requirements for conducting corrective actions and groundwater monitoring associated with the defined interim stabilization measures (ISMs) and provided the operating requirements for ISMs that were in place for Pantex. The final corrective action/remedy has been approved through the Pantex Site-Wide Record of Decision (ROD) (B&W Pantex and Sapere Consulting, 2008) and the final remedy was incorporated into CP-50284 effective September 16, 2010. The *Long-Term Monitoring System Design Report* (B&W Pantex, 2009a) and *Sampling and Analysis Plan* (B&W Pantex, 2009b) are approved through the Compliance Plan as the bases for monitoring and reporting of the remedies. The 2009 documents were updated and submitted in January 2014 (B&W Pantex, 2014a and 2014b). The updated reports were approved by the TCEQ in March 2014 so those changes will be fully implemented by July 2014.

CP-50284 requires reporting of information pertaining to effectiveness of the remedies, treatment of perched groundwater, contaminant data and plumes, and monitoring. Information on operation and maintenance of corrective action systems and components, new construction, condition and status of corrective actions/remedies, and recommendations for change is also required.

Pantex is in the process of renewing the site hazardous waste permit (HW-50284). The renewal will also incorporate CP-50284. The application to renew the permit was submitted to the TCEQ in April 2013 and was issued effective May 31, 2014. No significant changes were requested for the new permit. Any changes to the permit will be reflected in the 2014 Annual Report.

The IAG is a legally binding agreement between the USDOE, EPA, and the TCEQ to accomplish the cleanup of hazardous substances contamination at and from the Pantex Plant, pursuant to CERCLA, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), and Executive Order 12580, as amended by Executive Order 13016. The general purpose of the IAG is to:

1. Ensure that the environmental impacts associated with past and present activities at Pantex Plant have been analyzed, tested, and thoroughly evaluated, and appropriate remedial action is taken as necessary to protect the public health, welfare, and the environment.

2. Establish a procedural framework and schedule for developing, implementing, and monitoring appropriate response actions in accordance with CERCLA, the NCP, Superfund policy, RCRA, RCRA policy, and applicable, relevant, and appropriate environmental laws.

3. Facilitate continued cooperation, exchange of information and participation of the Parties (USDOE, EPA, and TCEQ) in such actions.

The IAG provides requirements for developing schedules, remedial design and remedial action implementation and reporting, record preservation, public participation, budget review, notification requirements, and periodic progress reports. Progress reports are required semi-annually and are combined with the Compliance Plan reports to fulfill the requirements of both RCRA and CERCLA.

Table 1-2 provides a detailed crosswalk of the Compliance Plan and IAG requirements to specific chapters or section of the annual or quarterly report where the requirements are fulfilled. The requirements are from Table VIII of CP-50284. The specific Articles in the IAG that contain reporting requirements are listed in the table. Although not included in the crosswalk, other requirements in the ROD and final documents supporting the design of the Remedial Actions were also considered in the development of this report.

Table 1-2. Crosswalk of Regulatory Requirements to Quarterly and Annual Progress Reports

Item	Program	Reporting Frequency	Requirements	Location of Information in Progress Reports
Compliance Plan 50284 Requirements from Table VIII:				
1.	All programs	Annual June 30	Each report shall be certified by a qualified engineer and/or geologist.	See certification page inside front cover of Quarterly and Annual Progress Reports.
2.	Corrective Action	Annual June 30	A table of all modifications and amendments made to this Compliance Plan with their corresponding approval dates by the executive director or the Commission and a brief description of each action;	Section 1.1, Table 1-1.
3.	Corrective Action	Annual June 30	A summary of any activity within an area subject to institutional control.	Section 2.3.2.
4.	Corrective Action	Annual June 30	Tabulation of well casing elevations in accordance with Attachment B;	Section 2.4.2.
5.	Corrective Action	Annual June 30	Certification and well installation diagram for any new well installation or replacement and certification for any well plugging and abandonment;	When applicable, certifications and diagrams are included as an appendix. See List of Appendices.
6.	Corrective Action	Annual June 30	Recommendation for any changes to the program;	Chapter 5.0 of annual report. Chapter 4.0 of quarterly reports.

Item	Program	Reporting Frequency	Requirements	Location of Information in Progress Reports
7.	Corrective Action	Annual June 30	Any other items requested by the executive director;	Crosswalk of requirements to information contained in report. Section 1.1. Information will be added as requested.
8.	Corrective Action	Annual June 30	Water table maps shall be prepared from the groundwater data collected pursuant to Provision VII and shall be evaluated by the Permittee with regard to the following parameters: a. Development and maintenance of a cone of depression during operation of the system; b. Direction and gradient of groundwater flow; c. Effectiveness of hydrodynamic control of the contaminated zone during operation; and, d. Estimation of the rate and direction of groundwater contamination migration.	Sections 3.1.5, 3.1.7, and 3.2.
9.	Corrective Action	Annual June 30	The Permittee shall submit a report to each recipient listed in Provision X.C, which includes the information in items 3 through 26 determined since the previously submitted report, if those items are applicable. If both Corrective Action and Compliance Monitoring [Reserved] Programs are authorized, then the June 30th report shall contain information required for both programs.	Reports submitted as required. See items 3 through 26 of this table for location of report information.

Item	Program	Reporting Frequency	Requirements	Location of Information in Progress Reports
10.	Corrective Action	Annual June 30	The Corrective Action System(s) authorized under Provision II in operation during the reporting period and a narrative summary of the evaluations made in accordance with Provisions V, VI, and VII of this Compliance Plan for the preceding reporting period. The reporting periods shall be annual, January 1 through December 31, for Corrective Action Monitoring, unless an alternative schedule is approved by the Commission. The period for Compliance Monitoring [Reserved] shall be based on the calendar year;	Chapter 2.0 Chapter 3.0 Chapter 4.0 Appendices containing extraction well flow information, data tables, data evaluation tables, expected condition evaluation, COC trending, and hydrographs.
11.	Corrective Action	Annual June 30	The method(s) utilized for management of recovered/purged groundwater shall be identified in accordance with Provision II.H. The Permittee shall maintain this list as part of the facility operating record and make it available for inspection upon request.	Section 2.5
12.	Corrective Action	Annual June 30	An updated table and map of all monitoring and corrective action system wells. The wells to be sampled shall be those wells proposed in the Compliance Plan Application referenced in Provision I.G. and any changes subsequently approved by the executive director pursuant to Provision II.C. Provide in chronological order, a list of those wells which have been added to, or deleted from, the groundwater monitoring and remediation systems since original issuance of the Compliance Plan. Include the date of the Commission's approval for each entry;	Section 1.4.

Item	Program	Reporting Frequency	Requirements	Location of Information in Progress Reports
13.	Corrective Action	Annual June 30	The results of the chemical analyses, submitted in a tabulated format acceptable to the executive director which clearly indicates each parameter that exceeds the GWPS. Copies of the original laboratory report for chemical analyses showing detection limits and quality control and quality assurance data shall be provided if requested by the executive director;	See List of Appendices for data evaluation tables and electronic data. A summary of the POC/POE well detections above GWPS is included in Section 3.5.
14.	Corrective Action	Annual June 30	Tabulation of all water level elevations required in Provision VI.C.4 depth to water measurements, and total depth of well measurements collected since the data that was submitted in the previous monitoring report;	Section 2.4. Appendix containing electronic data tables.
15.	Corrective Action	Annual June 30	Potentiometric surface maps showing the elevation of the water table at the time of sampling, delineation of the radius of influence of the Corrective Action System, and the direction of groundwater flow gradients outside any radius of influence;	Section 3.1.
16.	Corrective Action	Annual June 30	Tabulation of all data evaluation results pursuant to Provision V.D and status of each well with regard to compliance with the Corrective Action objectives and compliance with the GWPS;	These evaluations are summarized in Section 3.4 and 3.5. See List of Appendices for complete electronic data tables and expected conditions evaluation.
17.	Corrective Action	Annual June 30	An updated summary as required by CP Table VIII;	Chapters 1.0 through 4.0.
18.	Corrective Action	Annual June 30	Summary of any changes made to the monitoring/ corrective action program and a summary of well inspections, repairs, and any operational difficulties;	Chapters 2.0 and 5.0.

Item	Program	Reporting Frequency	Requirements	Location of Information in Progress Reports
19.	Corrective Action	Annual June 30	A notation of the presence or absence of NAPLs, both light and dense phases, in each well during each sampling event since the last event covered in the previous monitoring report and tabulation of depth and thickness of NAPLs, if detected;	Section 3.4.
20.	Corrective Action only	Annual June 30 Quarterly 90 days after end of quarter	Quarterly tabulations of quantities of recovered groundwater and NAPLs, and graphs of monthly recorded flow rates versus time for the Recovery Wells during each reporting period. A narrative summary describing and evaluating the NAPL recovery program shall also be submitted;	Annual Report: Section 2.1 and see List of Appendices for detailed extraction well flow information. See Section 2.3.1 for soil vapor extraction of residual NAPLs in soils at the Burning Ground. Quarterly Report: Section 2.1 and 2.3.
21.	Corrective Action only	Annual June 30 Quarterly 90 days after end of quarter	Tabulation of the total contaminant mass recovered from each recovery system for each reporting period;	Annual Report: Section 2.1. Quarterly Report: Section 2.1.
22.	Corrective Action only	Annual June 30	Maps of the contaminated area where GWPSs are exceeded depicting concentrations of CP Table IIIA constituents and any newly detected CP Table III constituents as isopleth contours or discrete concentrations if isopleth contours cannot be inferred. Areas where concentrations of constituents exceed the GWPS should be clearly delineated. Depict the boundary of the plume management zone (PMZ), if applicable;	Section 3.1.6.
23.	Corrective Action only	Annual June 30	Maps and tables indicating the extent and thickness of the NAPLs both light and dense phases, if detected;	No detected NAPLs in groundwater.

Item	Program	Reporting Frequency	Requirements	Location of Information in Progress Reports
24.	Corrective Action only	Quarterly 90 days after end of quarter	Corrective Measures Implementation (CMI) Progress Report or Response Action Effectiveness Report or Response Action Completion Report to be submitted as a section of the Compliance Plan report in accordance with Provision VIII.F, if necessary. The Permittee will include a narrative summary of the status of the approved final corrective measures conducted in accordance with the approved CMI Workplan or Response Action Plan (RAP), and that the requirements of Provision VIII.G are being met. The report shall include the following information: a. Information required for Item 20 of this table. b. Information required for Item 21 of this table. c. Trend charts of target COCs and degradation products at downgradient performance monitoring locations for the in-situ bioremediation systems. d. Summary of unexpected conditions, if found, at monitoring wells.	Annual Report: a. Section 2.1 and see List of Appendices for detailed extraction well flow information. See Section 2.3.1 for soil vapor extraction of residual NAPLs in soils at the Burning Ground. b. Section 2.1 c. See List of Appendices for COC concentration trends. Information is summarized in Section 3.2.3 of this report. d. Section 3.4. Quarterly Report: a. Section 2.1 and 2.3. b. Section 2.1. c. See Appendix A. d. Section 3.0 and 4.0.
25.	Corrective Action only	Annual June 30	The Permittee will include a narrative summary of the status of each Solid Waste Management Unit (SWMU) and/or Area of Concern (AOC) subject to the requirements of Provision VIII and ICMs Program for a SWMU and/or AOC which documents that the objectives of Provision VIII.H.2 are being achieved. This summary shall be included as a section of the Compliance Plan annual report.	No units at Pantex are subject the ICM requirements in Prkovision VIII.

Item	Program	Reporting Frequency	Requirements	Location of Information in Progress Reports
26.	Corrective Action only	5-Year Review	Conduct five-year review to be consistent with CERCLA §121(c) and the NCP (40 CFR Part 300.430(f)(4)(ii)). The five-year review will be conducted to evaluate the need to adjust corrective actions and associated monitoring.	The five-year review was conducted in 2012 with a Final Report approved in 2013. A summary of the major conclusions and recommendations from the Five-Year Review is included in Chapter 5 of the 2013 Annual Progress Report. A summary of complete and outstanding action items are included in Chapter 5 of this report.
IAG Progress Report Requirements:				
16.4.	Remedial Action	Quarterly Annual	All results of sampling or other monitoring results obtained during the previous quarter.	Chapter 3.0 of quarterly report summarizes the quarterly data. Annual Report: These data are summarized in Section 3.4 and 3.5. See List of Appendices for complete electronic data tables and expected conditions evaluation.
16.4	Remedial Action	Annual and Quarterly	Describe the actions which DOE has taken during the previous quarter to implement the requirements of this Agreement.	Section 1.5 provides a schedule of activities.
16.4	Remedial Action	Annual	Include a detailed statement of how the requirements and time schedules set out in the attachments to this Agreement are being met, identify any anticipated delays in meeting time schedules, including the reason(s) for each delay and actions taken to prevent or mitigate the delay, and identify any potential problems that may result in a departure from the requirements and time schedules.	Section 1.5.

1.2 Remedial Action Background

Pantex has implemented soil and groundwater remedial actions to mitigate contamination that resulted from historical waste management practices.

1.2.1 Soil Remedial Actions

In accordance with RCRA and CERCLA, Pantex and regulatory agencies identified 254 units at the Pantex Plant for further investigation and cleanup. Investigations that identified the nature and extent of contamination at solid waste management units and associated groundwater were submitted to the TCEQ and EPA in the form of RCRA Facility Investigation Reports. Those investigation reports closed many units through interim remedial actions and no further controls other than deed recordation are necessary for those units. Other units were evaluated in human health and ecological risk assessments to identify units that required further remedial actions to protect human health and the environment. Figure 1-3 depicts the location and status of the 254 units. The 16 units still in active use will be closed in accordance with CERCLA and RCRA permit provisions when they become inactive and are determined to be of no further use. A detailed summary of actions for the 254 units can be found in the ROD (B&W Pantex and Sapere Consulting, 2008).

Those units requiring further remedial actions were then assessed in a corrective measures study to identify and recommend final remedial actions. The final approved remedial actions are detailed in the ROD. A detailed status table of the SWMUs is included in Appendix A of this report.

Soil remedial actions focus on:

- Cleanup of soil gas and NAPL in soil at the Burning Ground for future protection of groundwater resources,
- Institutional controls to protect workers,
- Fencing to prevent traffic and control access to Firing Site 5 (FS-5), and
- Maintenance of soil remedies (ditch liner and soil covers) for future protection of groundwater resources.

Soil Remedial Actions

Ditch Liner

Soil Covers on Landfills

Institutional Controls

Soil Vapor Extraction System

Fencing

In addition to the remedial actions, Pantex has deed recorded all soil units where contamination was identified. Those areas are restricted to industrial use to ensure future use of the area is in agreement with cleanup assumptions.

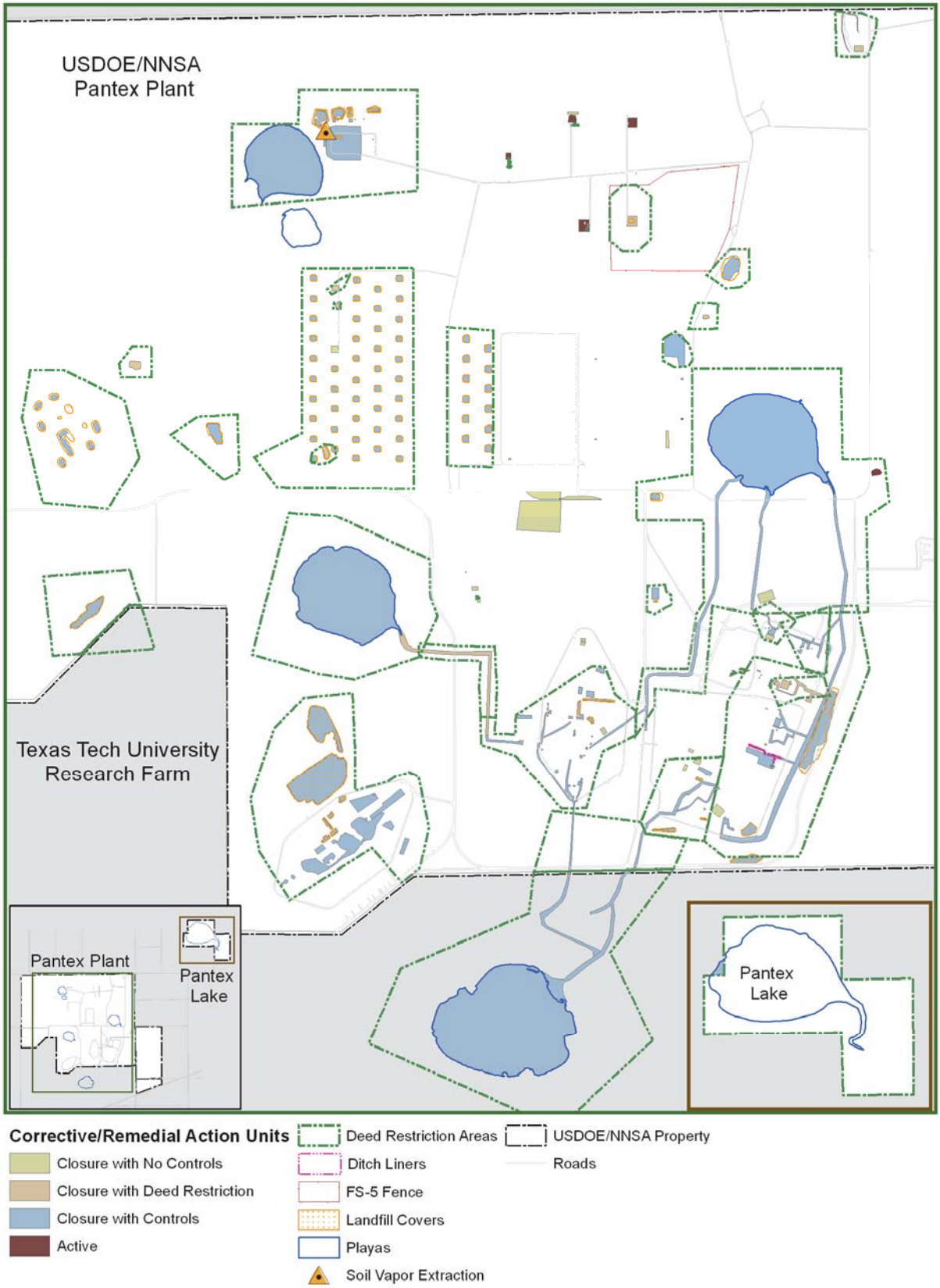

Figure 1-3. Status of Corrective/Remedial Action Units

1.2.2 Groundwater Remedial Actions

In accordance with the IAG and CP-50284, Pantex has implemented remedial actions to remediate the contaminated perched groundwater. Two types of active remediation systems (see Figure 1-4) were installed to address the contamination: pump and treat systems and in situ bioremediation (ISB) systems. Institutional controls are also part of the final remedy for groundwater.

Groundwater remedial actions focus on:

- Cleanup of perched aquifer to the GWPS,
- Reduction of perched water levels to protect the underlying drinking water aquifer and to prevent growth of plumes; and
- Institutional controls to restrict perched groundwater use without treatment and to control drilling into and through the perched aquifer to prevent cross contamination.

Groundwater Remedial Actions

Pump & Treat Systems
- Playa 1 Pump and Treat
- Southeast Pump and Treat

In situ Bioremediation Systems
- Zone 11 ISB
- Southeast ISB

Institutional Controls

The pump and treat systems were installed to address contamination in areas where there is generally greater than 15 ft of saturation in the perched aquifer. These systems are designed to remove and treat perched groundwater to achieve contaminant mass reduction and reduction in the saturated thickness of the perched aquifer. Reduction in saturated thickness should significantly reduce the migration of contaminants both vertically and horizontally so that natural breakdown processes can occur over time.

Pantex has installed in situ bioremediation systems to reduce the concentration of contaminants as they migrate through the remediation zone in targeted areas of the groundwater plumes.

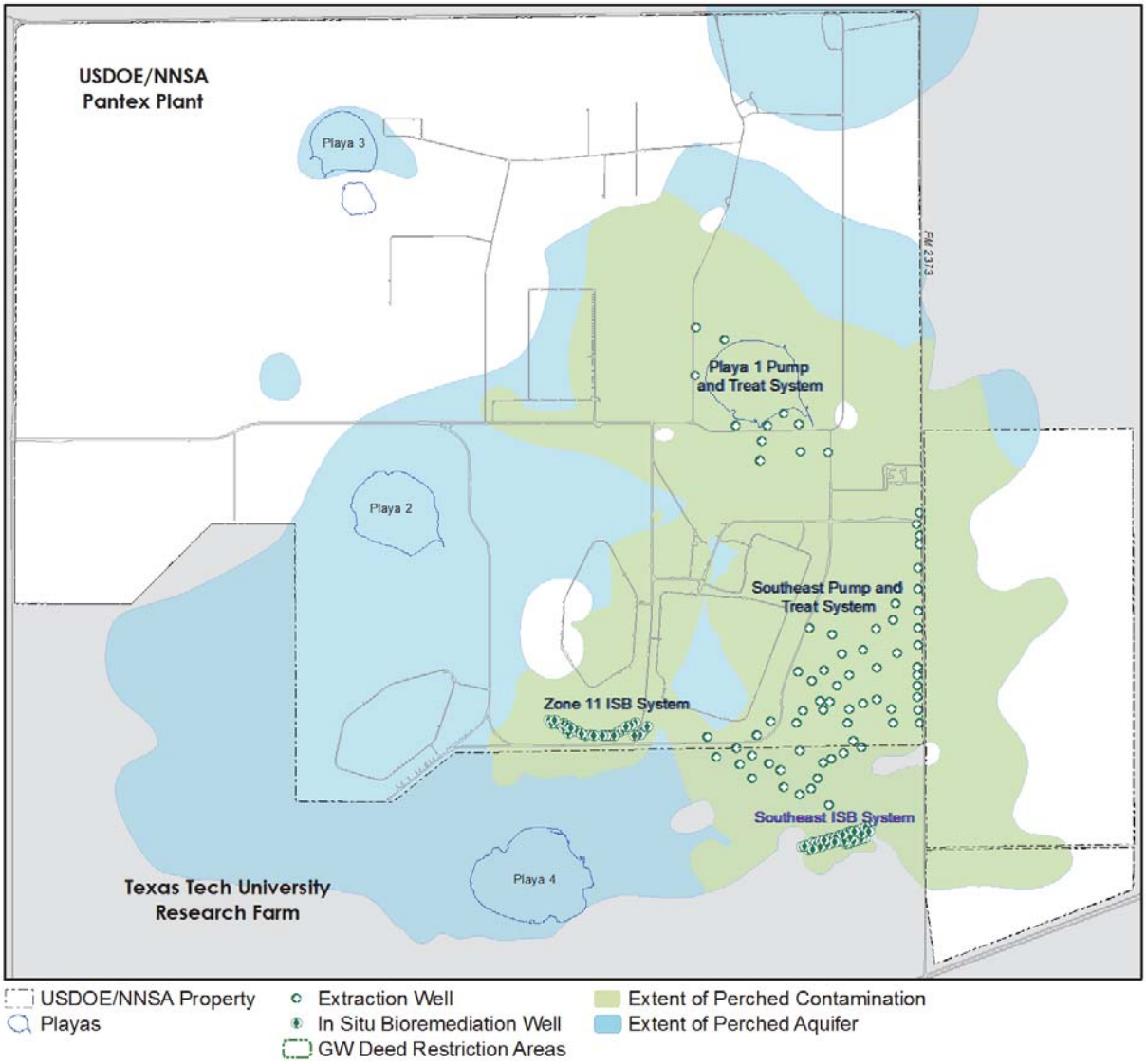

Figure 1-4. Groundwater Remedial Actions

1.3 Purpose and Objectives

This report satisfies requirements in the IAG and CP-50284 to provide information on the remedial system performance and components. The focus for this report is the data and information collected for the soil and groundwater remedies during the previous year. The objective is to provide a more detailed account of the remedies than the quarterly reports.

The only active soil remedy is the Burning Ground SVE system. This report provides information on its operation, mass removal, and effluent readings during 2013. This report also provides information on the inspection and maintenance of the ditch liner, soil covers, and fencing that are part of the remedial action. In addition, information on site control in accordance with institutional controls and deed restrictions is provided.

This progress report provides information for the maintenance and operation of the groundwater remediation systems and components. Data are evaluated according to criteria outlined in the *Long-Term Monitoring System Design Report* (B&W Pantex, 2009a). Those criteria are included in the highlight box and are detailed in the appropriate sections of this report.

Groundwater Remedial Action Evaluation Criteria

- Plume Stability
- Remedial Action Effectiveness
- Uncertainty Management
- Early Detection
- Natural Attenuation of COCs

This report is organized to present detailed information in a summary form in the main report along with appropriate supporting detail to provide an understanding of the conclusions of the report. Detailed information such as statistical trending of concentrations and water levels at each well, electronic data, SWMU status, and data usability review is included in the appendices.

1.4 Long-Term Monitoring of Remedial Actions

Pantex has developed a long-term monitoring network to evaluate the effectiveness of the remedial actions, ensure that remedial action objectives (from the ROD) are achieved, and to confirm expected future conditions within the perched aquifer and the Ogallala Aquifer. The long-term monitoring design and evaluation criteria are provided in the *Long-Term Monitoring System Design Report* (B&W Pantex, 2009a). The final system design was incorporated into CP-50284 when it was issued effective September 16, 2010. The design was further detailed in CP-50284 to include point of exposure and point of compliance wells where the GWPS is required to be met.

1.4.1 Perched Aquifer Long-Term Monitoring Network

The final perched aquifer LTM network is divided into four areas defined by indicator COC monitoring lists for wells in each area. The network consists of:

- 118 perched wells – 17 of those wells were monitored for continued dry or limited water conditions, with 92 sampled for indicator COCs and other applicable analytes including natural attenuation products, corrosion indicators, and general water quality indicators, and 9 are monitored as in situ performance monitoring (ISPM) wells for the ISB systems. The ISPM wells are monitored for COCs, degradation products, and ISB treatment zone parameters. All 118 perched LTM wells and 35 additional wells not included in the LTM network have water levels measured semi-annually. It is anticipated that more wells within the influence of the pump and treat systems will go dry as the systems continue to remove water from the perched aquifer.

- 56 wells are sampled semi-annually, 29 wells annually, 9 wells quarterly, and 7 wells are sampled every five years. The five-year sampling will occur again in 2016.

- 41 of the regularly sampled wells are sampled every five years using a modified 40 CFR Part 264 Appendix IX groundwater list to satisfy uncertainty management requirements. The next sampling for this purpose will occur in 2016 (Figure 1-5).

- Four indicator areas were defined for the perched groundwater. COCs to be monitored are defined for each of those areas.

- Water was observed in 1 well that has historically been dry or had water levels measured in the sump. PTX06-1073A in Zone 11 had the highest historic water level (~5 ft of saturated thickness) measured in December 2012. Water persisted in this well during 2013 so a sample was collected during 4th quarter.

- 5 wells were added to the LTM network in 2013. PTX06-1167 was installed in July 2013. This well has only been monitored for water conditions as the well was dry when installed and during the final water level measurement event in 2013. PTX06-1158, 1159, 1160, and 1166 installed during 2012 were included in the LTM network for sampling. PTX06-1158 remains dry but is evaluated for water conditions. Pantex added these five wells to the updated SAP provided to regulatory agencies in January 2014 for approval.

- 3 LTM wells were replaced during 2013. Problems were encountered when trying to sample PTX06-1149. A well video identified a separation in the casing so a replacement well was installed in September 2013. PTX08-1001 and PTX08-1002 were found to be dry when sampling was attempted. These wells are near Playa 1 where water levels are declining rapidly due to the remedial action. The original wells were not completed to the depth of the FGZ, so replacement wells were installed in

August and September 2013. Wells were installed in accordance with CP-50284 requirements.

Table 1-3 lists all wells in the perched LTM network and CP-50284, their LTM objective, indicator monitoring area, Compliance Plan objective (point of compliance/point of exposure (POC/POE) well), date of inclusion or removal from CP-50284, and coordinates. The wells are listed in chronological order according to the date of inclusion in CP-50284, in accordance with Table VII requirements. Figure 1-5 depicts the current active LTM wells listed in Table 1-3.

Table 1-3. Perched LTM Network and ISM Compliance Plan Wells

Well ID	Indicator Area	ISM Well	LTM Well	CP Approval Date	CP Removal Date	Well Status	LTM Objectives	POC/ POE	Northing	Easting
PTX-BEG3		Y	N	6/9/2003	9/16/2010	Inactive			3773380.09	643702.32
PTX01-1008	Burning Ground	Y	Y	6/9/2003		Active	UM	POC	3770782.89	629942.97
PTX01-1001	Burning Ground	Y	Y	6/9/2003		Active	UM	POC	3769641.90	630592.95
PTX01-1002	Burning Ground	Y	Y	6/9/2003		Active	UM		3769596.99	628496.92
PTX06-1012	ISPM Zone 11	Y	Y	6/9/2003		Active	PS, RA		3755068.80	634640.91
PTX04-1002	Miscellaneous	Y	Y	6/9/2003		Active	UM		3772165.27	641818.01
PTX06-1080	Miscellaneous	Y	Y	6/9/2003		Active	UM		3772643.95	638901.00
PTX06-1081	Miscellaneous	Y	Y	6/9/2003		Active	UM		3770912.33	641222.41
PTX08-1010	Miscellaneous	Y	Y	6/9/2003		Active	UM		3773206.74	641401.47
PTX06-1048A	North	Y	Y	6/9/2003		Active	PS, RA		3766957.63	642103.43
PTX06-1015	Southeast	Y	Y	6/9/2003		Active	RA		3753617.00	643765.00
PTX06-1023	Southeast	Y	Y	6/9/2003		Active	RA	POC	3764603.10	642773.84
PTX06-1030	Southeast	Y	Y	6/9/2003		Active	RA		3755008.03	644670.42
PTX06-1031	Southeast	Y	Y	6/9/2003		Active	RA	POC	3753348.03	644674.92
PTX06-1034	Southeast	Y	Y	6/9/2003		Active	RA	POC	3752434.98	646555.62
PTX06-1036	Southeast	Y	Y	6/9/2003		Active	PS		3752455.56	638615.43
PTX06-1038	Southeast	Y	Y	6/9/2003		Active	RA		3760426.35	643802.04
PTX06-1040	Southeast	Y	Y	6/9/2003		Active	RA		3758262.93	643811.23
PTX06-1042	Southeast	Y	Y	6/9/2003		Active	RA	POC	3755779.88	643812.20
PTX06-1046	Southeast	Y	Y	6/9/2003		Active	RA	POC	3752292.55	643802.63
PTX06-1052	Southeast	Y	Y	6/9/2003		Active	RA	POC	3753957.66	639100.91
PTX06-1069	Southeast	Y	Y	6/9/2003		Active	PS		3762879.60	646317.00
PTX06-1053	Southeast, Zone 11	Y	Y	6/9/2003		Active	PS, UM		3753672.06	636576.74
PTX08-1008	Southeast, Zone 11	Y	Y	6/9/2003		Active	UM, RA		3755695.51	637485.10
PTX06-1035	Zone 11	Y	Y	6/9/2003		Active	PS		3755092.64	633027.45
PTX10-1014	Southeast, Zone 11	N	Y	8/26/2010		Active	UM		3759769.72	639701.73
PTX01-1004	Burning Ground	N	Y	9/16/2010		Dry	PS		3770768.71	630729.82
PTX01-1009	Burning Ground	N	Y	9/16/2010		Dry	PS		3769018.50	630594.67
PTX06-1037	ISPM Southeast	N	Y	9/16/2010		Active	RA		3752194.06	641549.25
PTX06-1045	ISPM Southeast	N	Y	9/16/2010		Dry	RA	POC	3752300.00	642697.65
PTX06-1118	ISPM Southeast	N	Y	9/16/2010		Dry	RA		3752736.07	641644.92

Well ID	Indicator Area	ISM Well	LTM Well	CP Approval Date	CP Removal Date	Well Status	LTM Objectives	POC/ POE	Northing	Easting
PTX06-1123	ISPM Southeast	N	Y	9/16/2010		Active	RA		3752319.94	642051.96
PTX06-1153	ISPM Southeast	N	Y	9/16/2010		Active	RA	POC	3752089.44	641184.13
PTX06-1154	ISPM Southeast	N	Y	9/16/2010		Active	RA	POC	3752278.90	641870.52
PTX06-1155	ISPM Zone 11	N	Y	9/16/2010		Active	RA	POC	3755215.62	634603.74
PTX06-1156	ISPM Zone 11	N	Y	9/16/2010		Active	RA	POC	3755076.47	636378.92
PTX04-1001	Miscellaneous	N	Y	9/16/2010		Active	UM		3772334.66	641458.10
PTX06-1049	Miscellaneous	N	Y	9/16/2010		Active	PS, UM		3763376.96	633343.53
PTX06-1055	Miscellaneous	N	Y	9/16/2010		Dry	PS		3767254.87	633521.90
PTX06-1071	Miscellaneous	N	Y	9/16/2010		Active	UM		3773219.43	642601.46
PTX06-1082	Miscellaneous	N	Y	9/16/2010		Active	UM		3780321.59	653856.27
PTX06-1083	Miscellaneous	N	Y	9/16/2010		Active	UM		3779777.76	658643.46
PTX06-1085	Miscellaneous	N	Y	9/16/2010		Active	UM		3760418.31	629059.82
PTX06-1086	Miscellaneous	N	Y	9/16/2010		Active	UM		3759843.32	631411.81
PTX06-1096A	Miscellaneous	N	Y	9/16/2010		Dry	PS, UM		3766548.35	630823.57
PTX06-1097	Miscellaneous	N	Y	9/16/2010		Dry	PS, UM		3765068.63	633104.35
PTX06-1131	Miscellaneous	N	Y	9/16/2010		Active	UM		3754232.91	629371.68
PTX07-1Q01	Miscellaneous	N	Y	9/16/2010		Active	UM		3755836.12	629274.83
PTX07-1Q02	Miscellaneous	N	Y	9/16/2010		Active	UM		3756408.66	628876.97
PTX07-1Q03	Miscellaneous	N	Y	9/16/2010		Active	UM		3757408.87	630542.61
PTX07-1R03	Miscellaneous	N	Y	9/16/2010		Active	UM		3764501.80	627664.39
OW-WR-38	North	N	Y	9/16/2010		Active	UM, RA		3765214.16	640649.01
PTX06-1050	North	N	Y	9/16/2010		Active	UM, RA	POC	3766622.06	636746.04
PTX06-1136	North	N	Y	9/16/2010		Active	PS		3766771.76	634860.83
PTX07-1O01	North	N	Y	9/16/2010		Active	PS, UM, RA		3767695.22	638532.53
PTX07-1O02	North	N	Y	9/16/2010		Active	PS, UM, RA	POC	3768117.46	639106.56
PTX07-1O03	North	N	Y	9/16/2010		Active	PS, UM, RA		3767462.56	639046.64
PTX07-1O06	North	N	Y	9/16/2010		Active	PS, UM, RA		3768536.81	638814.40
PTX06-1002A	Southeast	N	Y	9/16/2010		Active	UM, RA		3759984.00	641161.56
PTX06-1003	Southeast	N	Y	9/16/2010		Active	UM, RA		3758711.05	641498.93
PTX06-1005	Southeast	N	Y	9/16/2010		Active	UM, RA		3756139.87	640545.44
PTX06-1010	Southeast	N	Y	9/16/2010		Active	UM		3758067.00	639886.62
PTX06-1013	Southeast	N	Y	9/16/2010		Active	RA		3764075.09	643710.38
PTX06-1014	Southeast	Y	Y	9/16/2010		Active	RA		3755125.71	643758.88

Well ID	Indicator Area	ISM Well	LTM Well	CP Approval Date	CP Removal Date	Well Status	LTM Objectives	POC/ POE	Northing	Easting
PTX06-1039A	Southeast	N	Y	9/16/2010		Active	RA		3759272.56	643807.47
PTX06-1041	Southeast	N	Y	9/16/2010		Active	RA		3757622.78	643803.61
PTX06-1047A	Southeast	N	Y	9/16/2010		Active	RA		3752004.39	643817.46
PTX06-1051	Southeast	N	Y	9/16/2010		Dry	PS		3752279.10	640332.91
PTX06-1088	Southeast	N	Y	9/16/2010		Active	UM, RA		3757059.42	639902.10
PTX06-1089	Southeast	N	Y	9/16/2010		Dry	PS		3760258.95	646637.32
PTX06-1090	Southeast	N	Y	9/16/2010		Dry	PS		3757684.39	647727.51
PTX06-1091	Southeast	N	Y	9/16/2010		Dry	PS		3756363.40	646554.01
PTX06-1093	Southeast	N	Y	9/16/2010		Dry	PS		3759922.32	645529.01
PTX06-1094	Southeast	N	Y	9/16/2010		Dry	PS		3751494.55	643813.77
PTX06-1095A	Southeast	N	Y	9/16/2010		Active	UM, RA		3755598.65	640634.87
PTX06-1098	Southeast	N	Y	9/16/2010		Active	RA		3753628.43	640266.14
PTX06-1100	Southeast	N	Y	9/16/2010		Active	RA		3753579.52	640285.97
PTX06-1101	Southeast	N	Y	9/16/2010		Active	RA		3753437.09	640383.57
PTX06-1102	Southeast	N	Y	9/16/2010		Active	RA		3754532.94	642751.09
PTX06-1103	Southeast	N	Y	9/16/2010		Dry	RA	POC	3752963.37	641222.64
PTX06-1119	Southeast	N	Y	9/16/2010		Dry	PS		3752739.01	642646.10
PTX06-1120	Southeast	N	Y	9/16/2010		Active	PS		3752735.03	643152.43
PTX06-1121	Southeast	N	Y	9/16/2010		Active	PS		3752750.09	643645.57
PTX06-1122	Southeast	N	Y	9/16/2010		Dry	PS		3752308.74	640677.35
PTX06-1124	Southeast	N	Y	9/16/2010		Dry	PS		3752327.45	642877.91
PTX06-1125	Southeast	N	Y	9/16/2010		Dry	PS		3752331.14	643377.53
PTX06-1130	Southeast	N	Y	9/16/2010		Active	RA	POC	3759745.02	644270.36
PTX06-1133A	Southeast	N	Y	9/16/2010		Active	PS		3751315.73	645287.37
PTX06-1135	Southeast	N	Y	9/16/2010		Active	PS		3753631.93	638343.76
PTX06-1146	Southeast	N	Y	9/16/2010		Active	PS	POC	3757691.87	645978.91
PTX06-1147	Southeast	N	Y	9/16/2010		Active	PS		3753953.21	645431.85
PTX08-1002	Southeast	N	Y	9/16/2010		Active	UM, RA		3763003.22	640859.00
PTX08-1009	Southeast	N	Y	9/16/2010		Active	UM, RA		3755275.01	638866.95
PTX06-1008	Southeast, Zone 11	N	Y	9/16/2010		Active	UM		3759325.25	639441.93
PTX06-1011	Southeast, Zone 11	N	Y	9/16/2010		Active	UM		3757219.75	639178.93
PTX08-1007	Southeast, Zone 11	N	Y	9/16/2010		Active	UM		3758440.46	638900.04
1114-MW4	Zone 11	N	Y	9/16/2010		Active	UM		3757809.40	636151.93

Well ID	Indicator Area	ISM Well	LTM Well	CP Approval Date	CP Removal Date	Well Status	LTM Objectives	POC/ POE	Northing	Easting
PTX06-1006	Zone 11	N	Y	9/16/2010		Active	PS		3757599.75	637450.19
PTX06-1007	Zone 11	N	Y	9/16/2010		Active	UM		3759513.00	637679.37
PTX06-1073A	Zone 11	N	Y	9/16/2010		Dry	PS		3758072.00	634963.34
PTX06-1077A	Zone 11	N	Y	9/16/2010		Active	UM		3760689.50	637201.80
PTX06-1126	Zone 11	N	Y	9/16/2010		Active	PS, UM	POC	3755562.85	635034.72
PTX06-1127	Zone 11	N	Y	9/16/2010		Active	PS, UM	POC	3755432.03	635901.90
PTX06-1134	Zone 11	N	Y	9/16/2010		Active	PS		3754409.17	633520.06
PTX06-1148	Zone 11	N	Y	9/16/2010		Active	PS, RA		3754719.67	636467.02
PTX06-1149	Zone 11	N	Y	9/16/2010		Active	PS		3754717.64	635864.13
PTX06-1150	Zone 11	N	Y	9/16/2010		Active	PS, RA		3754718.24	635233.98
PTX06-1151	Zone 11	N	Y	9/16/2010		Active	PS		3756123.62	633935.95
PTX07-1P02	Zone 11	N	Y	9/16/2010		Active	UM	POC	3763019.08	637817.70
PTX07-1P05	Zone 11	N	Y	9/16/2010		Active	UM		3762886.83	637136.13
PTX08-1001	Zone 11	N	Y	9/16/2010		Active	UM, RA		3762976.26	638941.45
PTX08-1003	Zone 11	N	Y	9/16/2010		Active	PS		3760136.56	635385.36
PTX08-1005	Zone 11	N	Y	9/16/2010		Active	UM		3756346.19	635316.66
PTX08-1006	Zone 11	N	Y	9/16/2010		Active	UM		3756761.86	636400.41
PTX06-1167[1]	Southeast	N	Y	7/9/2013		Active	RA		3752653.00	640913.72
PTX06-1158[2]	Zone 11	N	Y	10/8/2013		Active	PS		3752025.93	648137.99
PTX06-1159[2]	Zone 11	N	Y	10/8/2013		Active	PS, RA		3754843.46	634015.04
PTX06-1160[2]	Zone 11	N	Y	10/8/2013		Active	PS		3756274.13	632835.73
PTX06-1166[2]	Southeast	N	Y	10/8/2013		Active	PS		3752799.74	639750.35

Wells with no designation in the POC/POE column are considered as observation wells. These wells are not listed in CP-50284 Table V, so the corresponding date of CP-50284 approval corresponds to either the date of inclusion in a CP modification or approval letter date for the corresponding progress report where the recommendation was made to include the well in the monitoring network.

ISM – interim stabilization monitoring (from CP-50284 issued 10/21/2003)

LTM –Long-term monitoring POC – point of compliance POE – point of exposure

PS – plume stability RA – Remedial Action effectiveness UM – uncertainty management

[1]Well was recommended for inclusion to the network in the *2012 Annual Progress Report* (B&W Pantex, June 2013).

[2]Wells were recommended for inclusion to the network in the *Five Year Review Report* (B&W Pantex, August 2013).

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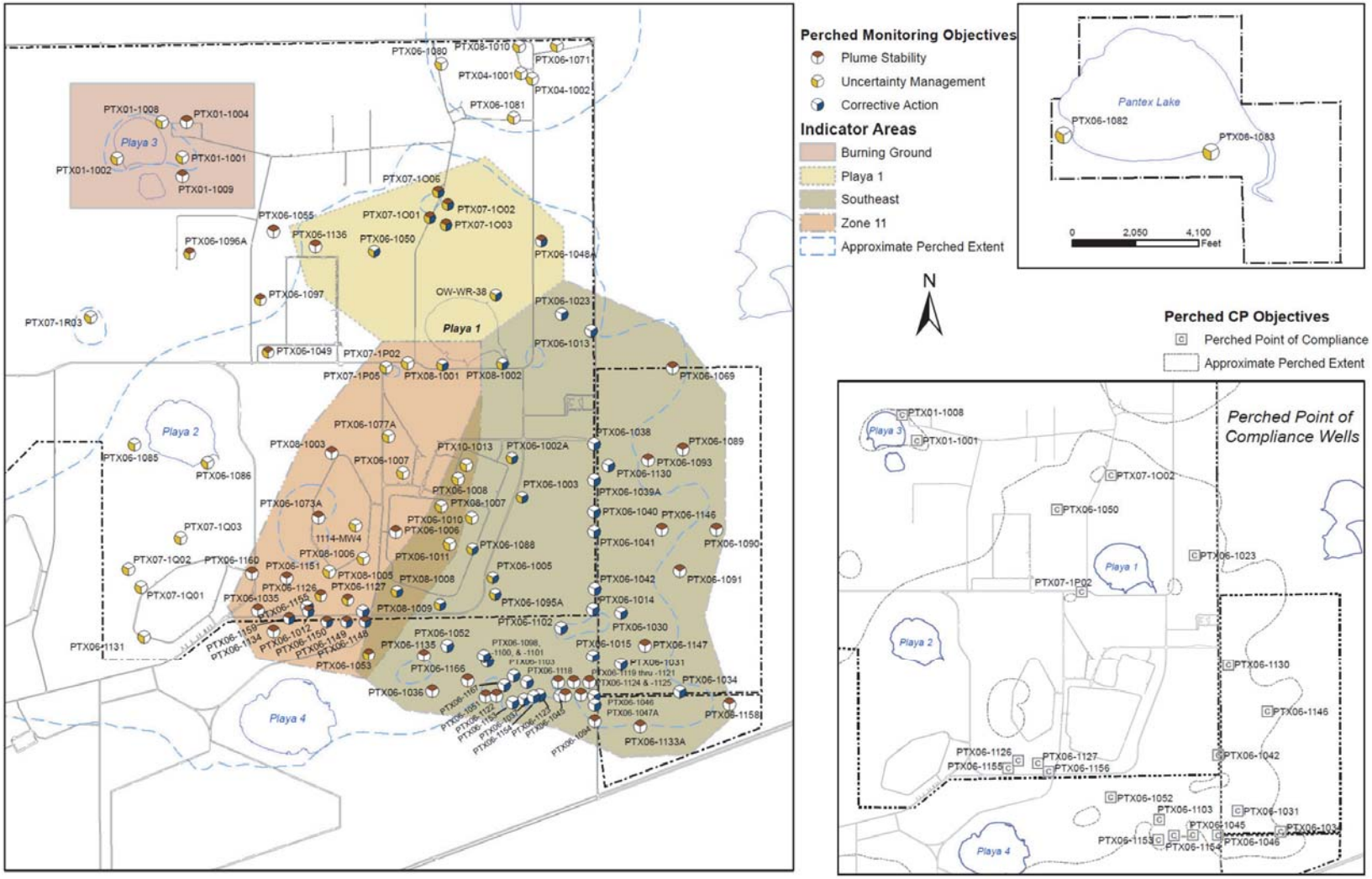

Figure 1-5. Perched LTM Network and Compliance Plan Wells

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1.4.2 Ogallala Aquifer Long-Term Monitoring Network

The final Ogallala Aquifer LTM network consists of:

- 26 LTM wells are monitored for indicator COCs and water levels. An additional well is used for monitoring water levels in the Ogallala Aquifer.

- 23 wells are sampled semi-annually and 3 are sampled annually.

- 7 wells are sampled at multiple levels every five years. The baseline multi-level sampling was conducted after the wells were installed. All other multi-level sampling will be conducted for future five-year reviews. The next 5-year sampling event will be conducted in 2016. PTX06-1137A was installed with two sampling intervals; however, water levels dropped below the first interval so the well is now only sampled in the deeper interval.

- 10 wells are sampled every five years using a modified 40 CFR Part 264 Appendix IX groundwater list to satisfy uncertainty management requirements. That sampling will be conducted again in 2016.

- 2 indicator areas were defined for the Ogallala wells and indicator COC monitoring lists were developed for each of those areas.

- 4 additional monitoring wells along the southern and western boundaries are also monitored annually to evaluate the quality of groundwater upgradient of the Plant.

Table 1-4 lists all wells in the LTM network and CP-50284, with the corresponding LTM objective, indicator monitoring area, CP objective (POC/POE well), date of inclusion or removal from CP-50284, and coordinates. Figure 1-6 depicts the current active monitor wells listed in Table 1-4, as well as the additional four wells monitored along the southern and western boundaries. The wells are listed in chronological order according to the date of inclusion in CP-50284, in accordance with Table VII requirements.

Table 1-4. Ogallala Aquifer LTM and Compliance Plan Wells

Well ID	Indicator Area	ISM Well	LTM Well	CP Approval Date	CP Removal Date	Current Status	LTM Objectives	POC/ POE	Multi-Level Well	Easting	Northing
PTX01-1010	Northwest	Y	Y	6/9/2003		Active	ED, UM	POC		630576.88	3771397.26
PTX01-1011	Northwest	Y	Y	6/9/2003		Active	ED, UM			629986.45	3771397.29
PTX01-1012	Northwest	Y	Y	6/9/2003		Active	ED, UM	POE		632664.21	3773264.13
PTX01-1013	Northwest	Y	Y	6/9/2003		Active	UM	POE		628976.89	3773218.25
PTX06-1033	Southeast/Northwest	Y	Y	6/9/2003		Active	ED, UM			642614.48	3759581.41
PTX06-1044	Southeast/Northwest	Y	Y	6/9/2003		Active	ED, UM			642706.18	3764538.54
PTX06-1054		N	N	6/9/2003	8/11/2004	P&A					
PTX06-1056	Southeast	Y	Y	6/9/2003		Active	ED, UM	POC		643767.03	3754642.87
PTX06-1057A	Northwest	Y	Y	6/9/2003		Active	UM			629630.04	3768142.23
PTX06-1058	Northwest	Y	Y	6/9/2003		Active	UM			624894.00	3759747.11
PTX06-1059[1]		Y	N	6/9/2003	9/16/2010	Active				628129.98	3760459.31
PTX06-1061	Northwest	Y	Y	6/9/2003		Active	UM			625651.61	3773186.59
PTX06-1062A	Northwest	Y	Y	6/9/2003		Active	ED, UM			633017.18	3771685.22
PTX06-1063A		Y	N	6/9/2003	9/16/2010	Inactive				639265.11	3775502.62
PTX06-1064	Northwest	Y	Y	6/9/2003		Active	UM	POE		635900.45	3773557.90
PTX06-1065		Y	N	6/9/2003	9/16/2010	Inactive				633197.45	3775896.50
PTX06-1066		Y	N	6/9/2003	9/16/2010	Inactive				632838.71	3773430.45
PTX06-1067		Y	N	6/9/2003	9/16/2010	Inactive				622714.85	3773696.89
PTX06-1068	Northwest	Y	Y	6/9/2003		Active	ED, UM	POE		643403.70	3773360.30
PTX06-1074[1]		Y	N	6/9/2003	9/16/2010	Active				620994.02	3765626.52
PTX06-1075[1]		Y	N	6/9/2003	9/16/2010	Active				630512.54	3753624.01
PTX06-1076	Southeast/Northwest	Y	Y	6/9/2003		Active	ED, UM			637327.32	3752978.41
PTX-BEG2	Northwest	Y	Y	6/9/2003		Active	UM			632652.49	3756906.56
PTX06-1157	Southeast	N	Y	2/10/2010		Active	ED, UM		Y	647100.00	3753700.00
PTX06-1043	Southeast/Northwest	N	Y	9/16/2010		Active	ED, UM			640711.00	3765225.21
PTX06-1072	Northwest	N	Y	9/16/2010		Active	ED, UM			635047.45	3758434.63
PTX06-1137A	Southeast	N	Y	9/16/2010		Active	ED, UM			647900.89	3758635.67
PTX06-1138	Southeast	N	Y	9/16/2010		Active	ED, UM	POE	Y	646285.31	3760503.82
PTX06-1139	Southeast	N	Y	9/16/2010		Active	ED, UM	POE	Y	646768.73	3756376.08

Well ID	Indicator Area	ISM Well	LTM Well	CP Approval Date	CP Removal Date	Current Status	LTM Objectives	POC/ POE	Multi-Level Well	Easting	Northing
PTX06-1140	Southeast	N	Y	9/16/2010		Active	ED, UM		Y	646959.38	3762807.67
PTX06-1141	Northwest	N	Y	9/16/2010		Active	UM		Y	633445.44	3766872.94
PTX06-1143	Northwest	N	Y	9/16/2010		Active	ED, UM	POE	Y	639244.72	3770496.78
PTX06-1144	Northwest	N	Y	9/16/2010		Active	ED, UM	POE	Y	640252.98	3773320.45
PTX07-1R01	Northwest	N	Y	9/16/2010		Active	ED, UM			627914.28	3764159.91
PTX06-1032	Southeast	N	Y		2/10/2010	P&A	ED, UM			646004.29	3752640.94
PTX06-1060[1]		N	N			Active				620969.93	3758599.72

[1]These wells will be retained for monitoring water upgradient to Pantex Plant but are not considered as LTM wells.

ED – early detection

POC – point of compliance

POE – point of exposure

RA – Remedial Action effectiveness

UM – uncertainty management

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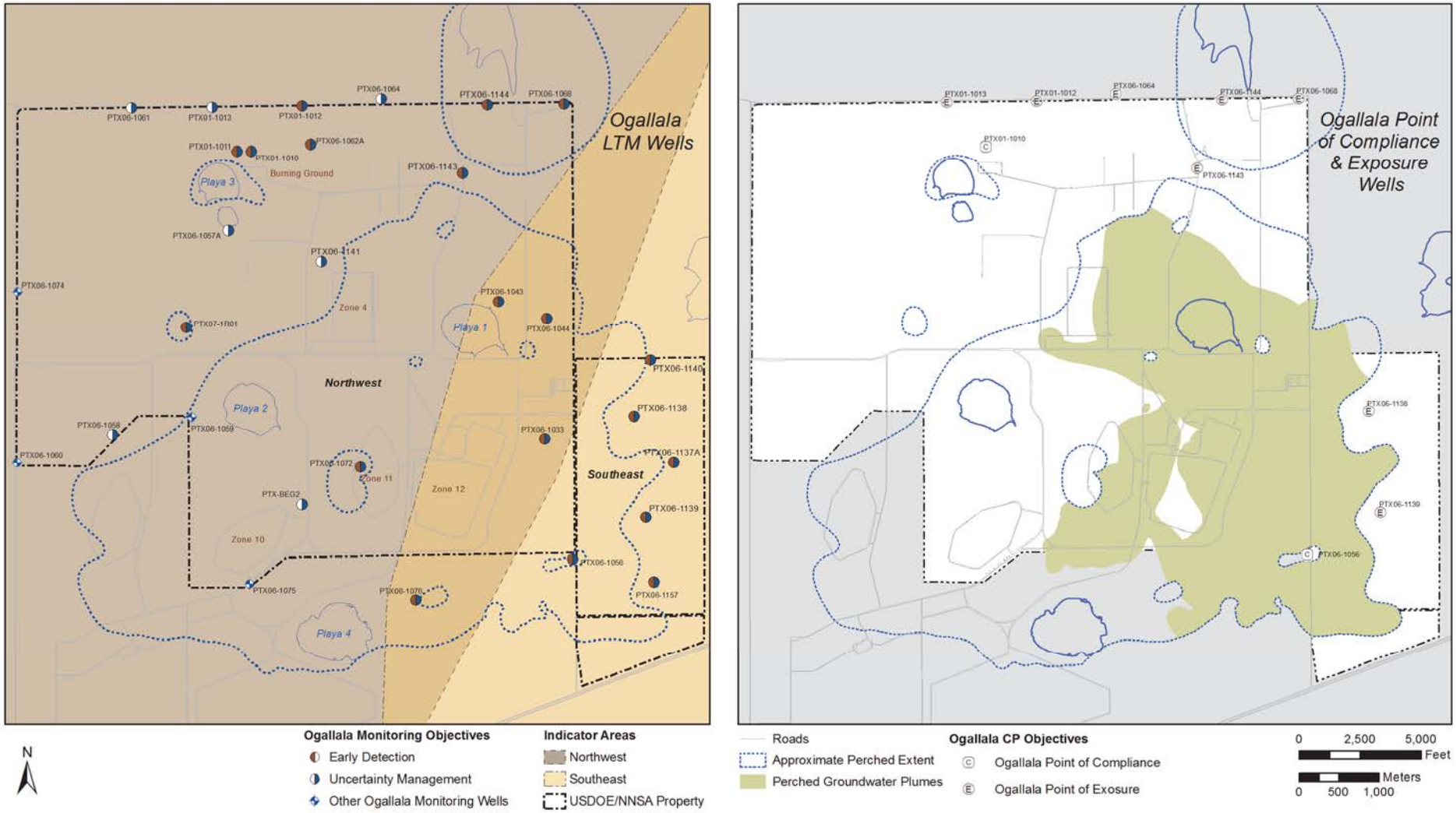

Figure 1-6. Ogallala Aquifer LTM and Compliance Plan Wells

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1.4.3 Remedial Action Wells

Two groundwater remedial actions and one soil remedial action are being performed at Pantex. Wells have been installed for two pump and treat systems, two ISB systems, and an SVE system.

Table 1-5 details all installed wells for the pump and treat systems, as well as their current status, date of plugging and abandonment, and coordinates. Table 1-6 details all installed wells for the ISB systems, as well as their current status, date of plugging and abandonment, and coordinates. Table 1-5 details all installed wells for the SVE system, their current status, plugging and abandonment dates, well depths, and coordinates. Figures depicting the active well systems follow each table. The following changes to the Remedial Action Systems occurred during 2013:

- 1 extraction well (PTX06-EW-47) at the SEPTS was removed from the SEPTS in early 2014, as recommended in the *2012 Annual Progress Report* (B&W Pantex, June 2013c). It is listed in the following table to account for the well.
- 1 new extraction well (PTX06-EW-81A) was installed at P1PTS, as recommended in the *2012 Annual Progress Report* (B&W Pantex, June 2013c). This well remains inactive as the well has not yet been connected to the system. Connection to the system is planned to be complete during fiscal year 2015.

Table 1-5. Pump and Treat System Wells

Well ID	Completion/ Replacement Date	Current Status	P&A Date	Easting	Northing
Southeast Pump and Treat System					
PTX06-EW-01	9/13/1995	Active		641278.87	3756038.24
PTX06-EW-02	8/30/1995	Active		641528.4	3756005.28
PTX06-EW-03	9/8/1995	Active		641366.55	3755801.72
PTX06-EW-04	8/23/1996	Active		643755.08	3756426.14
PTX06-EW-05	8/23/1996	P&A	12/30/2011	643358.11	3755061.32
PTX06-EW-06	9/15/1996	Active		641510.19	3753404.52
PTX06-EW-07	8/26/1996	Active		643751.83	3756882.87
PTX06-EW-08A[1]		Converted to PTX06-1102		642751.09	3754532.94
PTX06-EW-09	9/28/1996	Active		639170.49	3754843.18
PTX06-EW-10	8/17/1996	Active		638430.01	3755126.91
PTX06-EW-11	9/18/1996	P&A	12/28/2011	643761.85	3754217.08

Well ID	Completion/ Replacement Date	Current Status	P&A Date	Easting	Northing
PTX06-EW-12	8/26/1996	Active		643756.48	3755796.66
PTX06-EW-13[1]		Converted to PTX06-1108		643764.04	3754617.19
PTX06-EW-14	9/24/1996	P&A	12/28/2011	643767.08	3753367.23
PTX06-EW-15	8/19/1996	Active		639694.26	3755163.6
PTX06-EW-16	9/8/1998	Active		643801.7	3759993.02
PTX06-EW-17	9/11/1998	Active		643801.02	3760200.19
PTX06-EW-18	9/14/1998	Active		643731.32	3760496.47
PTX06-EW-19	9/18/1998	Active		643797.5	3760790.28
PTX06-EW-20	2/23/2000	Active		641025.56	3757877.46
PTX06-EW-21	8/1/1999	Active		641586.01	3757701.14
PTX06-EW-22A	8/26/1999	Active		641838.18	3757228.36
PTX06-EW-23A	9/26/1999	Active		643234.37	3757243.67
PTX06-EW-24	9/12/1999	Active		640724.28	3756777.19
PTX06-EW-25	8/9/1999	Active		641383.9	3756817.82
PTX06-EW-26	9/24/1999	Active		642723.35	3756878.53
PTX06-EW-27	8/13/1999	Active		643750.35	3756680.87
PTX06-EW-28	6/20/1999	Active		640036.65	3755513.98
PTX06-EW-29	7/28/1999	Active		640696.41	3755476.57
PTX06-EW-30	9/1/1999	Active		641973.98	3755476.99
PTX06-EW-31	8/30/1999	Active		642024.65	3755827.25
PTX06-EW-32	8/28/1999	Active		642374.99	3755975.61
PTX06-EW-33	8/25/1999	Active		642726.52	3756075.79
PTX06-EW-34	8/18/1999	Active		643080.1	3755826.59
PTX06-EW-35	8/14/1999	Active		643750.86	3756128.69
PTX06-EW-36	9/24/1999	Active		640775.89	3754778.09
PTX06-EW-37	1/25/2000	Active		639573.03	3754667.07
PTX06-EW-38C	4/6/2000	Active		639987.21	3754454.74
PTX06-EW-39	9/29/1999	Active		640275.11	3754278.61
PTX06-EW-40	3/28/2000	Active		640372.77	3753865.67
PTX06-EW-41	3/15/2000	Active		640775.16	3753666.41
PTX06-EW-42A	3/10/2000	Active		641052.06	3753818.72
PTX06-EW-43	9/15/1999	Active		641223.53	3754077.05
PTX06-EW-44	3/9/2000	Active		641376.89	3754474.61
PTX06-EW-45	9/23/1999	Active		641575.19	3754577.81
PTX06-EW-46	3/12/2000	Active		641876.25	3754724.89
PTX06-EW-47[2]	9/11/1999	Parked		642128.78	3755035.31

Well ID	Completion/ Replacement Date	Current Status	P&A Date	Easting	Northing
PTX06-EW-48	9/12/1999	Active		643124.45	3755475.11
PTX06-EW-49	2/28/2000	Active		642325.53	3754868.53
PTX06-EW-50	9/1/2005	Active		643762.45	3759386.42
PTX06-EW-51	9/9/2005	Active		638670.18	3754606.95
PTX06-EW-52[1]		Converted to PTX06-1103	10/28/2010	641248.7	3752987.68
PTX06-EW-53	5/14/2001	Active		643813.98	3755471.87
PTX06-EW-54	2/21/2007	Active		643766.44	3758870.74
PTX06-EW-55	2/22/2007	Active		643763.99	3758298.96
PTX06-EW-56	2/24/2007	Active		643763.8	3757875.83
PTX06-EW-57	2/25/2007	Active		643766.32	3757453.43
PTX06-EW-58	2/12/2007	Active		643262.82	3758881.53
PTX06-EW-59	2/8/2007	Active		643197.17	3758490.03
PTX06-EW-60	2/1/2007	Active		643131.98	3758083.47
PTX06-EW-61	1/30/2007	Active		642700.95	3757847.08
PTX06-EW-62	1/28/2007	Active		642379.35	3757323.3
PTX06-EW-63	1/27/2007	Active		642028.64	3756678.15
PTX06-EW-64	1/25/2007	Active		641727.44	3756431.79
PTX06-EW-65	1/17/2007	Active		641081.67	3756535.05
PTX06-EW-66	1/11/2007	Active		640868.51	3755784.1
PTX06-EW-67	3/6/2007	Active		639249.6	3754428.77
PTX06-EW-68	3/6/2007	Active		639566.17	3754095.17
PTX06-INJ-1	1/12/1993	P&A	9/24/2004	641043	3757545
PTX06-INJ-2	9/8/1996	P&A	11/23/2011	641155.36	3758791.57
PTX06-INJ-3	2/10/2000	P&A	10/25/2004	643226.15	3756469.63
PTX06-INJ-4	2/26/2000	P&A	3/26/2008	640126.87	3755016.27
PTX06-INJ-5	2/10/2000	P&A	10/25/2004	641482	3755164.77
PTX06-INJ-6	2/26/2000	P&A	10/26/2004	642521.57	3755369.02
PTX06-INJ-7	3/7/2000	P&A	10/27/2004	640774.75	3754319.02
PTX06-INJ-8	2/27/2000	P&A	3/25/2008	640419.84	3756164.91
PTX06-INJ-9	2/17/2000	P&A	10/26/2004	642024.8	3756518.86
PTX06-INJ-10	9/12/2004	Active		641005.96	3757505.73
PTX06-INJ-11	8/28/2004	Active		641752.09	3758137.05
PTX06-INJ-12A	1/24/2008	Active		640737.15	3756104.67
Playa 1 Pump and Treat System					
PTX06-EW-69	7/22/2007	Active		638869.86	3765146.41

Well ID	Completion/ Replacement Date	Current Status	P&A Date	Easting	Northing
PTX06-EW-71	7/24/2007	Active		638139.57	3764250.42
PTX06-EW-72	8/20/2007	Active		639152.16	3762973.95
PTX06-EW-73	8/10/2007	Active		639962.23	3762980.08
PTX06-EW-74	8/18/2007	Active		640354.99	3763274.66
PTX06-EW-75	8/19/2006	Active		640751.11	3763004.67
PTX06-EW-76[1]		Converted to PTX06-1128		641330.75	3763667.42
PTX06-EW-77[1]		Converted to PTX06-1129		641330.75	3763667.42
PTX06-EW-78A	8/23/2007	Active		639800.79	3762590.92
PTX06-EW-79	8/18/2007	Active		640784.57	3762323.44
PTX06-EW-80	8/14/2007	Active		641490.31	3762305.03
PTX06-EW-81A[3]	9/21/2013	Inactive		639773.41	3762095.77

P&A = plugging and abandonment

[1]Due to low well yield and need for monitoring data, extraction well was converted to monitoring well rather than plugged and abandoned.

[2]This well has been removed from service at the SEPTS, as recommended in the 2012 Annual Progress Report. This well may eventually be converted to a monitoring well to evaluate water levels in the area.

[3]This well was drilled in 2013. Contracting for design to add to P1PTS is scheduled for 2014 and the well is planned to be operational in 2015.

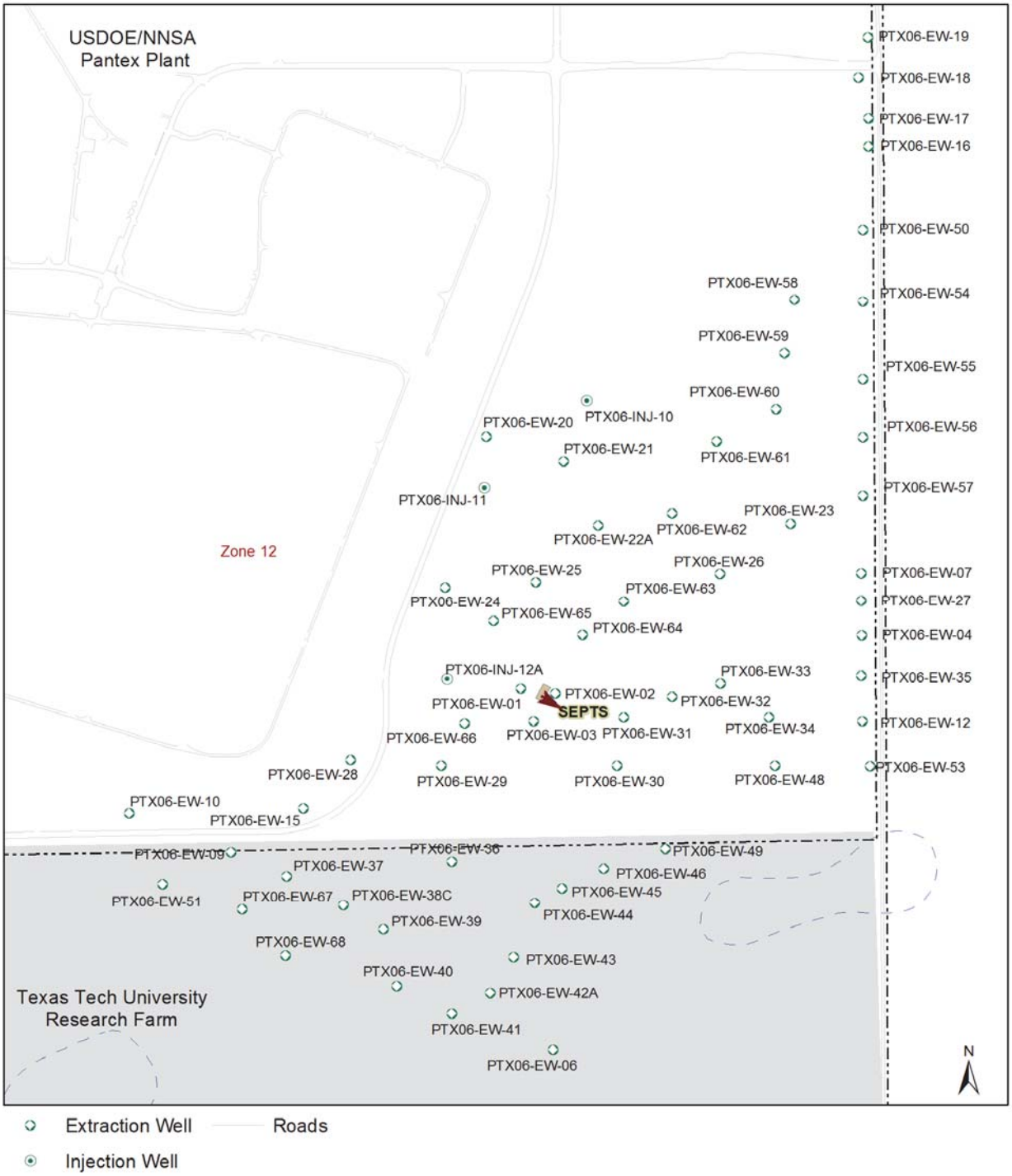

Figure 1-7. SEPTS Wells

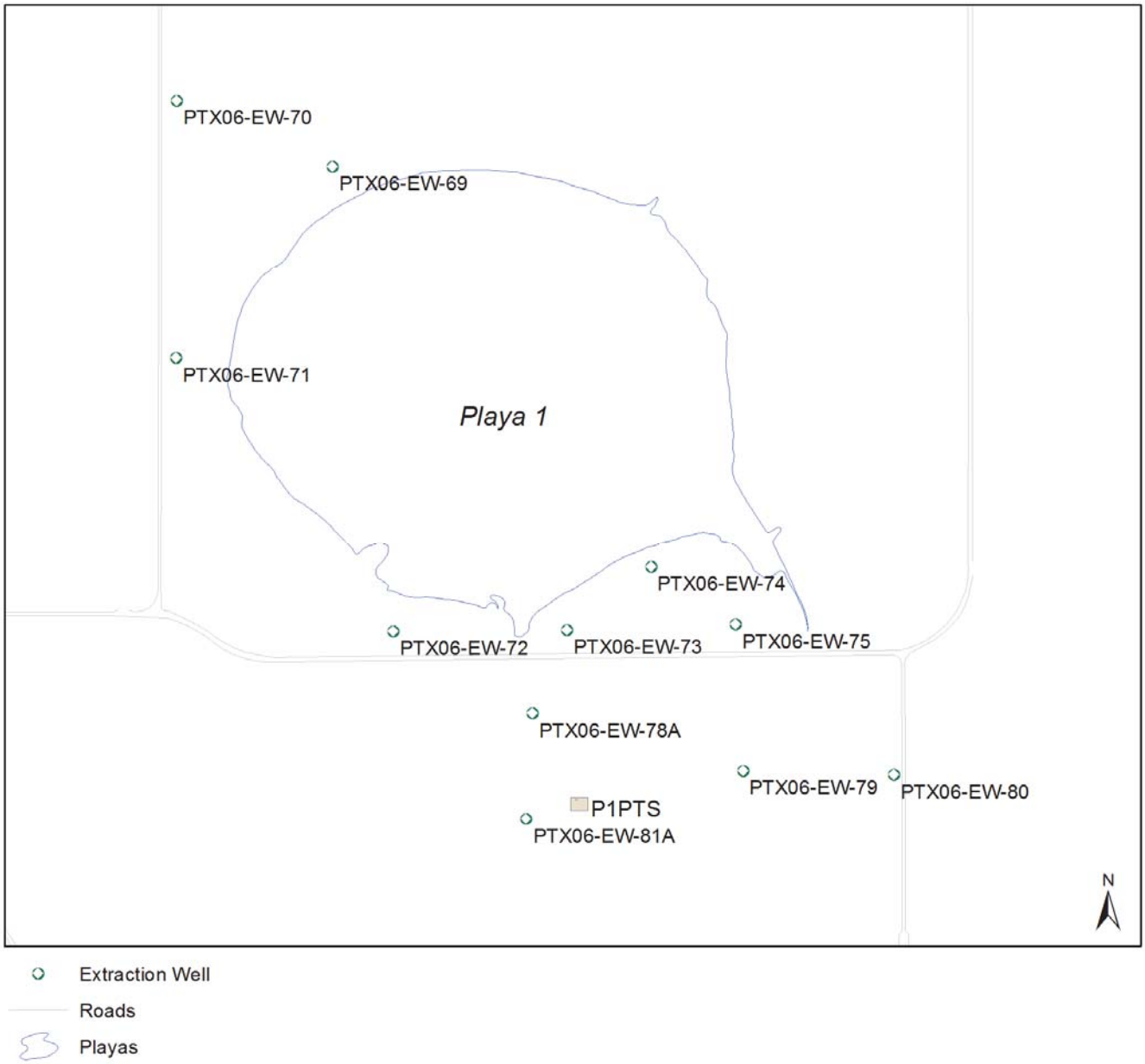

Figure 1-8. P1PTS Wells

Table 1-6. ISB System Wells

Well ID	Completion Date	Current Status	Replacement Date	P&A Date	Easting	Northing
			Southeast ISB System			
PTX06-ISB010	10/4/2007	Active			640805.43	3752335.36
PTX06-ISB011	8/6/2007	Active			640901.34	3752364.37
PTX06-ISB012	10/3/2007	Active			640997.33	3752392.85
PTX06-ISB013	10/2/2007	Active	6/17/2011		641094.48	3752437.36
PTX06-ISB014	10/1/2007	Active			641188.34	3752451.45
PTX06-ISB015	10/1/2007	Active			641282.85	3752478.49
PTX06-ISB016	8/4/2007	Active			641379.46	3752509.22
PTX06-ISB017	10/4/2007	Active			641476.26	3752538.73
PTX06-ISB018	9/18/2007	Active			641570.69	3752567.95
PTX06-ISB019	9/19/2007	Active			641666.28	3752597.62
PTX06-ISB020	9/24/2007	Active			641762.34	3752625.80
PTX06-ISB021	9/24/2007	Active			641857.77	3752657.45
PTX06-ISB022	10/1/2007	Active			641955.44	3752684.48
PTX06-ISB023A	10/22/2007	Active			642048.63	3752724.53
PTX06-ISB024	7/18/2007	Active			642144.65	3752737.70
PTX06-ISB025	9/14/2007	Active			642241.84	3752770.49
PTX06-ISB026	9/13/2007	Active			642336.93	3752798.27
PTX06-ISB027	8/22/2007	Active			642431.36	3752828.68
PTX06-ISB028	8/20/2007	Active			642527.37	3752858.27
PTX06-ISB029A	9/27/2007	Active			640994.88	3752253.46
PTX06-ISB030B	9/17/2007	Active			641094.72	3752286.25
PTX06-ISB031	7/11/2007	Active			641176.52	3752313.22
PTX06-ISB032	8/15/2007	Active			641277.51	3752351.41
PTX06-ISB033	8/16/2007	Active			641370.09	3752378.35
PTX06-ISB034	9/9/2007	Active			641467.88	3752407.71
PTX06-ISB035	9/7/2007	Active			641563.65	3752435.15
PTX06-ISB036	9/6/2007	Active			641657.73	3752465.76
PTX06-ISB037	9/11/2007	Active			641753.03	3752494.63
PTX06-ISB038	8/14/2007	Active			641850.23	3752524.17
PTX06-ISB039	9/26/2007	Active			641945.73	3752552.70
PTX06-ISB040	8/31/2007	Active			642035.47	3752578.67
PTX06-ISB041	8/29/2007	Active			642136.52	3752608.90
PTX06-ISB042	8/25/2007	Active			642233.39	3752640.96
PTX06-ISB043	10/24/2007	Active			642329.34	3752670.29

Well ID	Completion Date	Current Status	Replacement Date	P&A Date	Easting	Northing
PTX06-ISB044	8/3/2007	P&A		7/27/2011	642425.15	3752698.59
PTX06-ISB044A	6/12/2011	Active			641891.24	3752479.24
PTX06-ISB045	8/24/2007	Active			642521.05	3752726.81
PTX06-ISB046	10/24/2007	Active			641939.34	3752422.69
PTX06-ISB047	10/10/2007	Active			642035.50	3752450.45
PTX06-ISB048	10/24/2007	Active			642131.84	3752479.89
PTX06-ISB049	10/24/2007	Active			642227.63	3752509.10
PTX06-ISB050	10/24/2007	Active			642323.05	3752537.46
PTX06-ISB051	10/19/2007	Active			642419.78	3752567.70
Zone 11 ISB System						
PTX06-ISB055	3/4/2009	Active			636606.08	3755477.40
PTX06-ISB056A	3/3/2009	Active			636503.22	3755414.42
PTX06-ISB057	2/27/2009	Active	6/15/2011		636381.76	3755371.18
PTX06-ISB058	2/26/2009	Active			636320.75	3755299.58
PTX06-ISB059	2/25/2009	Active			636234.22	3755246.12
PTX06-ISB060A	2/24/2009	Active			636136.74	3755200.44
PTX06-ISB061	2/23/2009	Active			636085.48	3755140.80
PTX06-ISB062	2/20/2009	Active			635986.17	3755141.57
PTX06-ISB063	2/19/2009	Active			635886.33	3755141.05
PTX06-ISB064	2/18/2009	Active			635785.77	3755140.34
PTX06-ISB065	2/17/2009	Active			635563.31	3755140.57
PTX06-ISB066	2/17/2009	Active	9/21/2012		635495.33	3755164.83
PTX06-ISB067	2/13/2009	Active			635364.80	3755140.76
PTX06-ISB068	2/12/2009	Active			635263.93	3755181.61
PTX06-ISB069A	2/11/2009	Active			635170.02	3755241.04
PTX06-ISB070	2/10/2009	Active			635064.71	3755266.05
PTX06-ISB071	11/25/2008	Active			634991.20	3755334.12
PTX06-ISB072	11/20/2008	Active			634917.45	3755401.42
PTX06-ISB073	11/19/2008	Active	9/29/2011		634821.31	3755453.71
PTX06-ISB074	11/18/2008	Active			634722.57	3755411.00
PTX06-ISB075	11/17/2008	Active	9/28/2012		634813.17	3755333.92
PTX06-ISB076A	11/26/2008	Active			634867.07	3755287.08
PTX06-ISB077	11/13/2008	Active			634942.76	3755207.57
PTX06-ISB078	9/18/2009	Active			636919.77	3755377.85
PTX06-ISB079	9/18/2009	Active			636854.05	3755302.76
PTX06-ISB080	9/18/2009	Active			636787.42	3755227.38
PTX06-ISB081	8/26/2009	Active			636729.13	3755162.74

Well ID	Completion Date	Current Status	Replacement Date	P&A Date	Easting	Northing
PTX06-ISB082	8/26/2009	Active			636597.92	3755139.36
PTX06-ISB083	9/8/2009	Active			634632.29	3755455.37
PTX06-ISB084	9/8/2009	Active			634585.86	3755544.14
PTX06-ISB085A	9/17/2009	Active			634511.57	3755458.25
PTX06-ISB086	9/8/2009	Active			634452.91	3755531.59

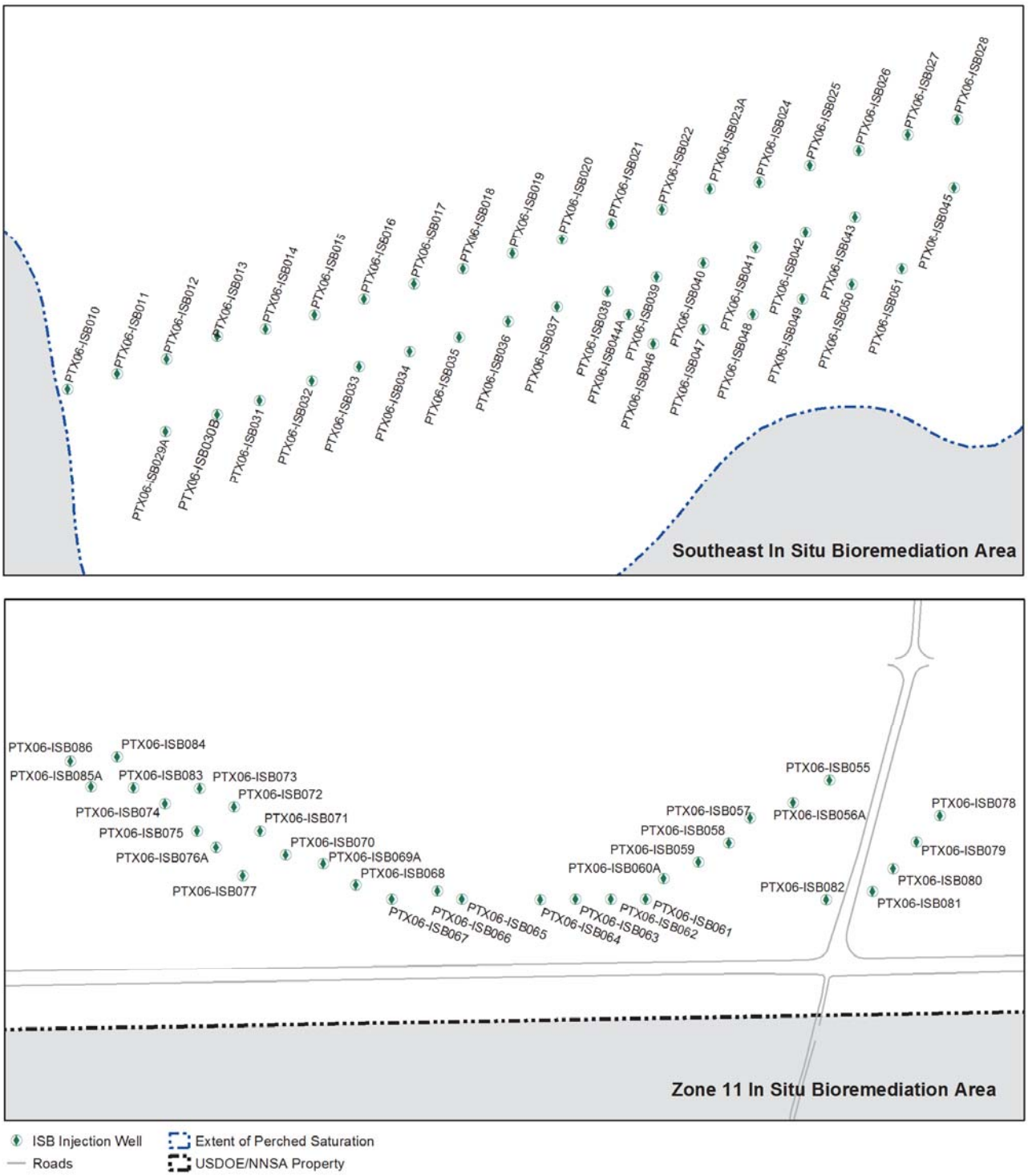

Figure 1-9. ISB System Wells

Table 1-7. Burning Ground SVE System Wells

Name	Well Depth[1]	Completion Date	Current Status	Easting	Northing
SVE-I-06	Intermediate	12/1/2001	Inactive	630006.43	3771358.79
SVE-I-11	Intermediate	12/24/2001	Inactive	630140.42	3771223.11
SVE-I-13	Intermediate	11/10/2001	Inactive	630024.96	3770909.40
SVE-I-16	Intermediate	12/10/2001	Inactive	630264.66	3770916.85
SVE-I-21	Intermediate	12/10/2001	Inactive	630142.72	3770795.37
SVE-I-26	Intermediate	11/17/2001	Inactive	630022.91	3770678.74
SVE-I-29	Intermediate	11/13/2001	Inactive	630245.81	3770680.38
SVE-S-05	Shallow	11/20/2001	Inactive	629996.81	3771361.24
SVE-S-07	Shallow	11/20/2001	Inactive	630130.43	3771359.23
SVE-S-08	Shallow	11/20/2001	Inactive	630070.51	3771300.84
SVE-S-09	Shallow	11/19/2001	Inactive	630005.69	3771220.82
SVE-S-10	Shallow	11/21/2001	Inactive	630131.84	3771220.90
SVE-S-12	Shallow	11/12/2001	Inactive	630016.08	3770920.93
SVE-S-13	Shallow	11/10/2001	Inactive	630024.96	3770909.40
SVE-S-14	Shallow	11/12/2001	Inactive	630133.76	3770915.03
SVE-S-15	Shallow	11/9/2001	Inactive	630254.26	3770915.75
SVE-S-17	Shallow	11/12/2001	Inactive	630074.42	3770855.43
SVE-S-18	Shallow	11/9/2001	Inactive	630194.14	3770855.08
SVE-S-19	Shallow	11/11/2001	Inactive	630012.77	3770795.38
SVE-S-20	Shallow	11/9/2001	Active	630133.75	3770795.37
SVE-S-22	Shallow	11/10/2001	Inactive	630254.47	3770794.59
SVE-S-23	Shallow	11/11/2001	Inactive	630074.68	3770735.48
SVE-S-24	Shallow	11/10/2001	Inactive	630194.80	3770735.89
SVE-S-25	Shallow	11/11/2001	Inactive	630015.03	3770678.85
SVE-S-27	Shallow	11/12/2001	Inactive	630134.13	3770679.10
SVE-S-28	Shallow	11/19/2001	Inactive	630238.26	3770681.91
SVE-S-30	Shallow	11/20/2001	Inactive	630077.40	3771163.35
SVE-S-31	Shallow	11/19/2001	Inactive	630005.18	3771080.74
SVE-S-32	Shallow	11/21/2001	P&A	630147.02	3771079.12
SVE-S-32A	Shallow	11/26/2001	Inactive	630153.88	3771082.13

[1]The shallow depth wells are screened from 20-45 ft and 50-90 ft bgs. The intermediate depth wells are screened from 95-180 ft and 190-275 ft bgs.

This well list represents the final configuration for the full-scale SVE system. SVE pilot test wells that were not appropriate for use in the final system were not included in this list.

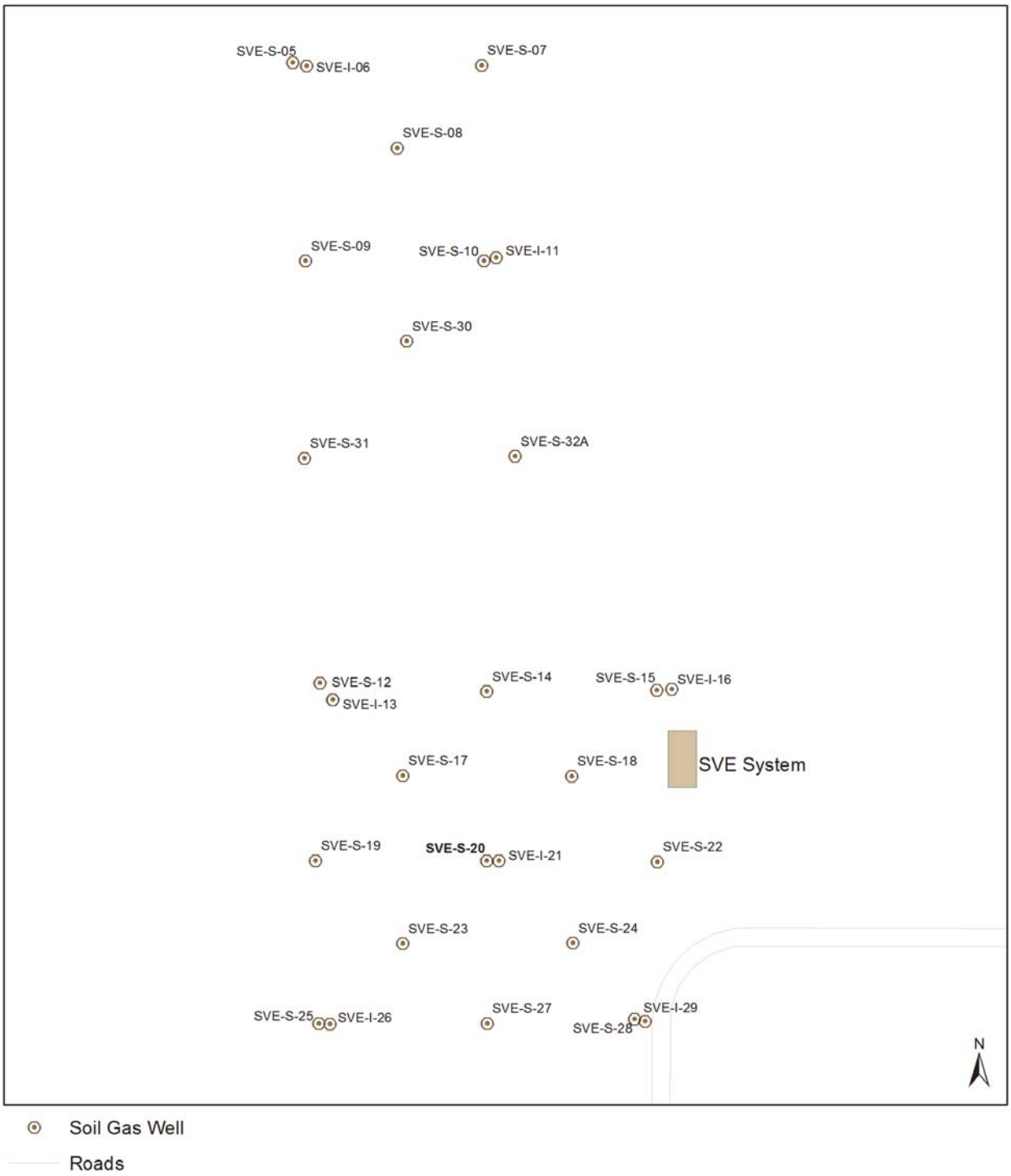

Figure 1-10. Burning Ground SVE Wells

1.5 Schedule of Activities

Pantex must meet requirements under CERCLA and RCRA, as detailed in CP-50284 and the IAG. Pantex has submitted a Site Management Plan (SMP) in accordance with the IAG that provides a list of required activities and planned dates of completion. Activities completed in 2013, in 2014 to the date of this report, and projected completions for 2014-2015 are summarized in Table 1-8.

Pantex completed a significant amount of activities related to the Five-Year Review during 2013 and the first half of 2014 as well as normally scheduled monitoring and operation of remedial actions. The significant actions completed include the revised Community Involvement Plan, update of the LTM System Design Report, revised Sampling and Analysis Plan, submittal of the FS-5 ecological risk assessment, revision of operation and maintenance metrics for the pump and treat systems to emphasize treatment and beneficial use of the treated water, installation of a new extraction well for the P1PTS, reseeding and installation of an artificial cover on landfills to reduce risk of erosion and water infiltration, and development and implementation of a well maintenance plan. The Five-Year Review was also finalized and approved by regulatory agencies by October 2013. Pantex is continuing to complete actions from the Five-Year Review as scheduled. Pantex has also implemented several other recommendations made in the 2012 annual report and 2013 quarterly reports including:

- Special sampling of the Zone 11 ISB to assess the possible lack of *Dehalococcoides sp.* (DHC) and increasing concentrations of 1,2-dichloroethene. Based on the results of the DHC samples, Pantex also proactively prepared a Bioaugmentation Plan and began preparations (identification of funding and contracting) for injection of a DHC culture to completely degrade TCE.
- The continuing assessment of the western end of the Southeast ISB by installing an additional upgradient well and assessing water levels across the area.
- A plan was developed to address the plumes that extend beyond the Zone 11 ISB to the northwest.
- LTM wells were replaced as needed during 2013.
- Implemented a micropurge study to evaluate this change in sampling methods for the Ogallala Aquifer.

In-progress and upcoming activities continue to focus on operation, maintenance, and monitoring of the remedial actions. Several projects are also scheduled over the next year to address actions from the First Five-Year Review including development of an SVE monitoring plan, expansion of the Zone 11 ISB system to address plumes to the northwest of the existing

system, updating worker protection values for use in SWMU interference decisions, continued evaluation of Ogallala well sampling, continued evaluation of the treatment at the western end of the Southeast ISB, continued evaluation of options for treatment of the groundwater plume east of FM2373, and continued assessment of the reseeded and artificial landfill covers. Pantex has also scheduled other projects for the optimization of the pump and treat systems and development of hexavalent and total chromium groundwater backgrounds to address detections in the Ogallala Aquifer. Some of the reporting and plans will require regulatory review and approval and are provided in bold in Table 1-8.

Table 1-8. Complete, In-Progress and Upcoming Activities

Activity	Start Date	Scheduled Complete Date	Actual Completion	CP Provision or Requirement	Origin of Recommended Action
Completed Work					
Injection of Amendment at Zone 11 ISB System	Mar-2013	Jul-2013	Jul-2013	IAG Provision 8 CP-50284 Provision V.A	
Injection of Amendment at Southeast ISB System	Jun-2013	Sep-2013	Sep-2013	IAG Provision 8 CP-50284 Provision V.A	
Resurvey well elevations on the western end of the Southeast ISB	Apr-2013	May-2013	May-2013		2013A
Final Five-Year Review Report	Jan-2012	Jul-2013	Aug-2013	IAG Provision 21 and CP-50284 Table VII, Item 26	
Phased Plan to restore vegetation coverage on Landfills				IAG Provision 21 and CP-50284 Table VII, Item 26	FYR
Phase I – Reseeding of landfills identified in the Five-Year Review	Jul-2013	Sep-2013	Oct-2013		
Pantex Well Maintenance Plan	Jun-2013	Dec-2013	Oct-2013	CP-50284 Provision VI	FYR
Updated Community Involvement Plan	Sep-2013	Dec-2013	Nov-2013	IAG Provision 21 and CP-50284 Table VII, Item 26	FYR
Update Pantex Mailing Lists for Community Involvement	Oct-2013	Dec-2013	Dec-2013	IAG Provision 21 and CP-50284 Table VII, Item 26	FYR
Publish Annual Neighbor Newsletter	Sep-2013	Dec-2013	Apr-2014	IAG Provision 21 and CP-50284 Table VII, Item 26	FYR
Semi-Annual Water Level Measurement Event	Jun-2013	Dec-2013	Dec-2013	CP-50284 Provision VI.C.4	

Activity	Start Date	Scheduled Complete Date	Actual Completion	CP Provision or Requirement	Origin of Recommended Action
Conduct comprehensive water level measurement event for the western side of the Southeast ISB.	Mar-2013	Jul-2013	Jul-2013	CP-50284 Provision VI.C.4	2013A
Replace wells PTX06-1149, PTX08-1001, and PTX08-1002	Aug-2013	Sep-2013	Sep-2013	CP-50284 Provision VI.C.3.e and CP-50284 Attachment B.4	2Q2013
Update Sampling and Analysis Plan	Oct-2013	Jan-2014	Jan-2014	IAG Provision 21 and CP-50284 Table VII, Item 26	FYR
Update LTM System Design Report	Oct-2013	Jan-2014	Jan-2014	IAG Provision 21 and CP-50284 Provision VI.B.1	FYR
1st SVE Rebound Test (Preparation for SVE Performance Monitoring Plan)	Dec-2013	Jan-2014	Jan-2014	IAG Provision 21 and CP-50284 Table VII, Item 26	
Upgrade of SEPTS electrical and mechanical components and bulk water station for beneficial reuse – Design	Sep-2013	Jan-2014	Jan-2014	CP-50284 Table VII, Item 24 and Provision II, IAG Provision 8	
Special sampling of Zone 11 ISB to evaluate presence of *Dehalococcoides sp.*	Jan-2014	Mar-2014	Mar-2014	IAG Provision 8 CP-50284 Provision V.A	3Q2013
FS-5 Ecological Risk Assessment	Jan-2014	Mar-2014	Mar-2014	IAG Provision 21 and CP-50284 Table VII, Item 26	FYR
Bioaugmentation Plan	Jan-2014	Mar-2014	Mar-2014	IAG Provision 21 and CP-50284 Table VII, Item 26	4Q2013
Design for Zone 11 ISB Expansion - Infrastructure	Mar-2014	Jun-2014	Jun-2014	CP-50284 Provision V.A.4 IAG Provision 8	3&4Q2013
Revise O&M metrics for Pump and Treat Systems	Mar-2014	Jul-2014	Jun-2014	IAG Provision 21 and CP-50284 Table VII, Item 26	FYR

Activity	Start Date	Scheduled Complete Date	Actual Completion	CP Provision or Requirement	Origin of Recommended Action
Draft Final Site Management Plan – Submittal	May-2014	Jun-2014	Jun-2014	IAG Provision 8	
2013 Quarterly Reports	Feb-2013	Mar-2014	Mar-2014	CP-50284 Provision VII.C and IAG Provision 16.4	
1st Quarter 2014 Progress Report	Apr-2014	Jun-2014	Jun-2014	CP-50284 Provision VII.C and IAG Provision 16.4	
1st Semi-Annual 2014 Groundwater Sampling - Monitoring Wells	Jan-2014	Jun-2014	May-2014	CP-50284 Provision VI	
1Q2014 Groundwater Sampling - ISB System Wells	Jan-2014	Mar-2014	Mar-2014	CP-50284 Provision VI	
2Q2014 Groundwater Sampling - ISB System Wells	Apr-2014	Jun-2014	May-2014	CP-50284 Provision VI	
Work In-Progress					
Update Worker Protection Values for SWMU Interference	Mar-2014	Aug-2014		IAG Provision 21 and CP-50284 Table VII, Item 26	FYR
2nd SVE Rebound Test (Preparation for SVE Performance Monitoring Plan)	Jun-2014	Jul-2014		IAG Provision 21 and CP-50284 Table VII, Item 26	
Aquifer Testing of PTX06-1146 and PTX06-1147 (to determine potential for extraction east of FM2373)	May-2014	Jul-2014		IAG Provision 21 and CP-50284 Table VII, Item 26	FYR and 2013A
Zone 11 ISB Injection	Mar-2014	Jul-2014		IAG Provision 8 CP-50284 Provision V.A	
Upgrade of P1PTS components and connection of PTX06-EW-81A to the system - Design	Jun-2014	Nov-2014		CP-50284 Provision V.A.4 IAG Provision 8	FYR
Ogallala Well Micropurge Pilot Study (Recommended as potential sampling Improvement - Five Year Review)	Nov-2013	Aug-2014		IAG Provision 21 and CP-50284 Table VII, Item 26	2013A
Well Maintenance Program	Jan-2014	Dec-2014		CP-50284 Provision VI.C.4	

Activity	Start Date	Scheduled Complete Date	Actual Completion	CP Provision or Requirement	Origin of Recommended Action
Upcoming Work					
2nd Semi-Annual 2014 Groundwater Sampling - Monitoring Wells	Jul-2014	Dec-2014		CP-50284 Provision VI	
3Q2014 Groundwater Sampling - ISB System Wells	Jul-2014	Sep-2014		CP-50284 Provision VI	
4Q2014 Groundwater Sampling - ISB System Wells	Oct-2014	Dec-2014		CP-50284 Provision VI	
Semi-Annual Water Level Measurement Event	Jun-2014	Dec-2014		CP-50284 Provision VI.C.4	
Electrical Upgrades at the Burning Ground SVE to address freezing issues. Construction	Jul-2014	Nov-2014		CP-50284 Provision VI	4Q2013
Install packers/diverters in Ogallala wells with an upper screened level less than 100 ft saturated thickness (wells without diverters)	Jan-2014	Dec-2014		CP-50284 Provision VI	2013A
Develop SVE Performance Monitoring Plan	**Sep-2014**	**Dec-2014**		IAG Provision 21 and CP-50284 Table VII, Item 26	FYR
Phased Plan to restore vegetation coverage on Landfills				IAG Provision 21 and CP-50284 Table VII, Item 26	FYR
Phase II – Assess the effectiveness of landfill reseeding	Aug-2014	3/1/2014 Revised to annually through Sep-2016			
Phase III – Additional seeding of targeted areas	Jul-2017	Sep-2014 Revised to Sep-2017			
Upgrade of SEPTS electrical and mechanical components and bulk water station for beneficial reuse – Construction	Jun-2014	Dec-2014		CP-50284 Table VII, Item 24 and Provision II, IAG Provision 8	

Activity	Start Date	Scheduled Complete Date	Actual Completion	CP Provision or Requirement	Origin of Recommended Action
Upgrade of P1PTS components and connection of PTX06-EW-81A to the system - Construction	Jan-2015	May-2015		CP-50284 Provision V.A.4 IAG Provision 8	FYR
Installation of Zone 11 ISB Expansion - Wells	Jun-2014	Sep-2014		CP-50284 Provision V.A.4 IAG Provision 8	3&4Q2013
Construction of Zone 11 ISB Expansion - Infrastructure	Jul-2014	Dec-2014		CP-50284 Provision V.A.4 IAG Provision 8	3&4Q2013
2nd Quarter 2014 Progress Report	Aug-2014	Sep-2014		CP-50284 Provision VII.C and IAG Provision 16.4	
3rd Quarter 2014 Progress Report	Nov-2014	Dec-2014		CP-50284 Provision VII.C and IAG Provision 16.4	
4th Quarter 2014 Progress Report	Feb-2015	Mar-2015		CP-50284 Provision VII.C and IAG Provision 16.4	
1st Quarter 2015 Progress Report	Apr-2015	Jun-2015		CP-50284 Provision VII.C and IAG Provision 16.4	
2014 Annual Progress Report	Mar-2015	Jun-2015		CP-50284 Provision VII.C and IAG Provision 16.4	
1st Semi-Annual 2015 Groundwater Sampling - Monitoring Wells	Jan-2015	Jun-2015		CP-50284 Provision VI	
1Q2015 Groundwater Sampling - ISB System Wells	Jan-2015	Mar-2015		CP-50284 Provision VI	
2Q2015 Groundwater Sampling - ISB System Wells	Apr-2015	Jun-2015		CP-50284 Provision VI	

Activity	Start Date	Scheduled Complete Date	Actual Completion	CP Provision or Requirement	Origin of Recommended Action
CR(VI) and Total Cr Groundwater Background Study				CP-50284 Provision VI.A	4Q2013
Prepare Background Development Plan	Apr-2014	Aug-2014			
Meet with Regulatory Agencies for Background Plan Approval	**August 5, 2014**	**August 15, 2014**			
Field Sampling/Analysis	Aug-2014	Oct-2014			
Prepare Draft Final Cr Groundwater Background Report	Nov-2014	Dec-2014			
Regulatory Meeting and Review of Background Report	**January 13, 2015**	**February 17, 2015**			
Prepare Final Cr Groundwater Background Report	**Feb-2015**	**Mar-2015**			

FYR=Five-Year Review

Upcoming or In-Progress Activities in bold require regulatory review/approval.

2.0 Operation and Maintenance of Remedial Actions

Operation of the remedial actions is critical to meeting the remedial action objectives established in the ROD. Maintenance activities (routine and unscheduled) ensure that the systems continue to operate in an optimal manner. A summary of the operation and maintenance (O&M) of the remedial action systems is provided to aid in understanding the effectiveness of the remedy.

2.1 Pump and Treat Systems

Pantex has installed two pump and treat systems, with 72 operating extraction wells and 3 injection wells that are currently treating up to a total of 550 gallons per minute (gpm) of contaminated perched groundwater. The pump and treat systems were installed to address contamination in areas where there is generally greater than 15 ft of saturation in the perched aquifer. These systems are designed to remove and treat groundwater to achieve contaminant mass reduction and reduction in the saturated thickness of the perched aquifer. Reduction in saturated thickness will significantly reduce the migration of contaminants both vertically and horizontally so that natural attenuation processes can occur over time. To achieve mass reduction and reduction in saturated thickness, the pump and treat systems treat the extracted water to remove contaminants from the water before the effluent is sent to the WWTF and irrigation system for beneficial use. While the primary use option is irrigation, the SEPTS retains the capability for injection back into the perched zone, as necessary.

The P1PTS was started in late 2008, and the system became fully operational in January 2009. The SEPTS has been operating since 1995 when it started as a treatability study. It has been expanded with more extraction wells and the capacity to treat boron and hexavalent chromium to become the final remediation system for the southeastern portion of the groundwater plumes. A list of the extraction and injection wells and their status is included in Section 1 of this report. Appendix B contains the monthly flow calculations for each active well.

Pantex reached several significant milestones for the pump and treat systems during 2013. With the implementation of an extra irrigation tract and management of water, Pantex was able to beneficially use 98% of the treated water from the pump and treat systems. More than 700 lbs of high explosives and hexavalent chromium were removed from groundwater in 2013. Over 1 billion gallons of water has been treated and beneficially used since inception of the pump and treat systems and installation of the irrigation system. These milestones demonstrate the system is effective at removing mass and water from the perched aquifer and system operation continues to move towards meeting remedial action objectives for Pantex.

2.1.1 Playa 1 Pump and Treat System

The P1PTS extracts water from ten wells near Playa 1 and treats the water through a series of granular activated carbon (GAC) beds and ion exchange process units to reduce HEs and metals below the GWPS established in the ROD and CP-50284. This system focuses on reducing the mound of perched groundwater associated with Playa 1, affecting the movement of the southeast plume by reducing the hydraulic head, as well as achieving mass removal.

P1PTS Operational Goals

Operational time of 90%

Treat at 90% of maximum design throughput capacity
- 225 gpm
- 324,000 gpd

Beneficially use all treated water

P1PTS beneficially uses all treated water by sending it through the WWTF to the irrigation system. Because this system does not have the capability to inject the treated water back into the perched aquifer, the treatment throughput must be adjusted or discontinued based on the demands of the WWTF or irrigation system.

Figure 2-1 depicts the P1PTS wells and conveyance. The system operated 10 wells during 2013. Eleven extraction wells are depicted as the newest well, PTX06-EW-81A, has been installed but is not operational. The new well will be connected to the system by the end of FY 2015.

The goals for the P1PTS provide for about 107 million gallons of perched groundwater to be removed and treated each year, considering the 90% goal for operation and treatment. The system was designed with a treatment capacity of 250 gpm or 360,000 gpd and could potentially treat up to 131 million gallons of water per year running at design capacity and 100% operation.

P1PTS Milestones

2013	Since Startup (2008)
• Over 99 Million Gallons treated	• Over 488 Million Gallons treated
• All water beneficially used	• All water beneficially used
• Over 77 lbs of HEs removed	• Over 528 lbs of HEs removed

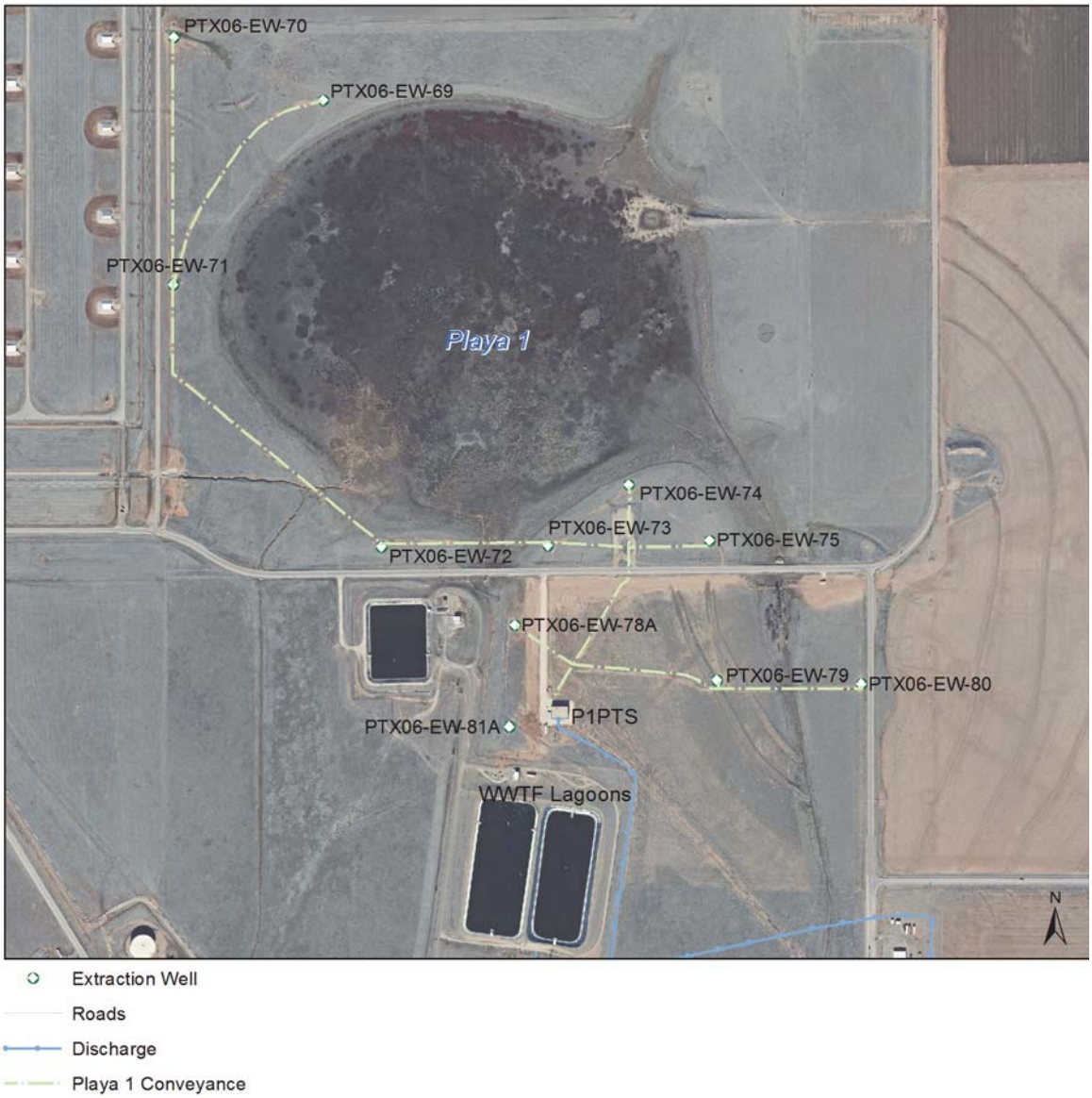

Figure 2-1. P1PTS Wells and Conveyance Lines

The P1PTS exceeded annual operational goals by operating 354 days during 2013 with an average annual operational rate of 95%, based on total hours operated versus total possible operation time. The actual percentage operational time versus target is depicted in Figure 2-2.

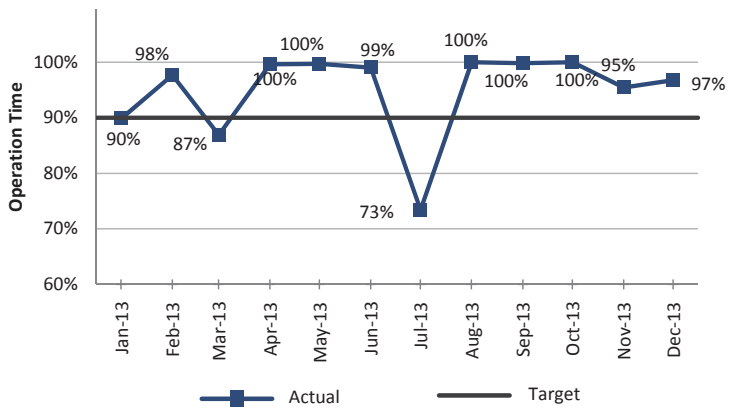

Figure 2-2. P1PTS Operation Time vs Target

The monthly system operation was primarily affected by GAC change-out in July and March. In all other months, the system met or exceeded the operational goal of 90%.

The P1PTS system extracted an average of 199 gpm (about 80% of design throughput) from the well field while operating during 2013. Figure 2-3 depicts the average gpm extracted from all wells by month, the percentage of design capacity achieved, and the goal for the system. The calculated gpm accounts for water extracted from the well field during the time the system operates and is affected by the yield from each well, well downtime, or reduced flow required by the WWTF/irrigation system.

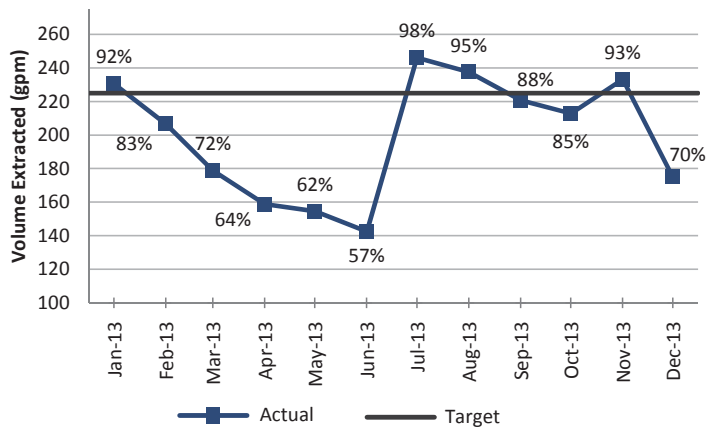

Figure 2-3. P1PTS Average GPM and % Capacity

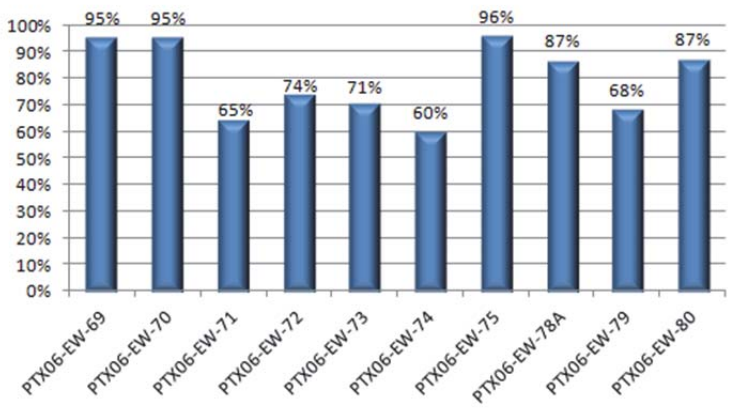

Figure 2-4. P1PTS Well Operation Time

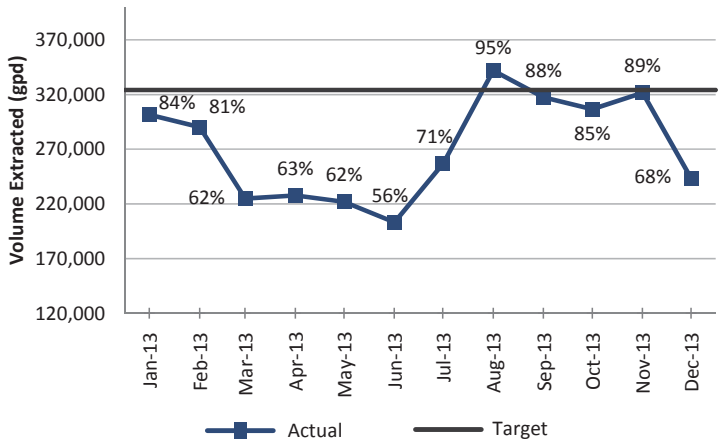

Figure 2-5. P1PTS Average GPD and % Capacity

As depicted in Figure 2-4, the primary contributor to monthly reduction in flow from the well field was due to wells not operating during 1st, 2nd, and 4th quarter. Reduced flow to the WWTF was the primary contributing factor in December. The average annual well operation was about 80%. Individual wells operated variably during 2013. The well percent operation time (based on number of days operated) was below goal for most wells, with the lowest operation time at PTX06-EW-71 through PTX06-EW-74. These wells all experienced problems that required troubleshooting and repair. As noted in the Five-Year Review (B&W Pantex, 2013a), P1PTS is unable to consistently operate at the design goal of 90% when multiple extraction wells are down. Based on recommendations from the Five-Year Review, Pantex identified two new extraction well locations to address this issue. Using a phased approach, Pantex installed one of the wells during 2013. That well will be connected to the system during upgrades that will be complete in 2015 (see Section 1.5 for Schedule of Activities). The other well will be added if needed to ensure consistent operation and throughput for P1PTS.

The system treated an average of about 272,000 gpd during 2013, which is about 75% of design capacity. Figure 2-5 depicts the average gpd by month, the percentage of design capacity achieved, and the goal for the system. The calculated gpd accounts for flow from the well field as well as system operation time during the day. Therefore, the gpd is affected by system operational time, ability to extract water from the wells, and reduced flow to the WWTF and irrigation system. The most significant contributor to decreased monthly gpd is due to reduced flow from extraction wells. The system's throughput was also affected by

reduced flow during December due to freezing conditions that affected the irrigation system and low operational time in July due to system maintenance.

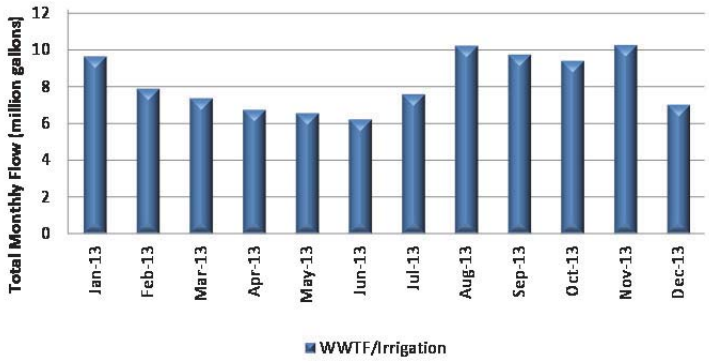

Figure 2-6. P1PTS System Monthly Total Flow

The system treated approximately 99 million gallons during 2013, with an average treatment volume of about 8.2 million gallons per month. The monthly treatment flow volumes are depicted in Figure 2-6. As discussed above, monthly total flow was low due to well downtime and reduced flow to the WWTF/irrigation system.

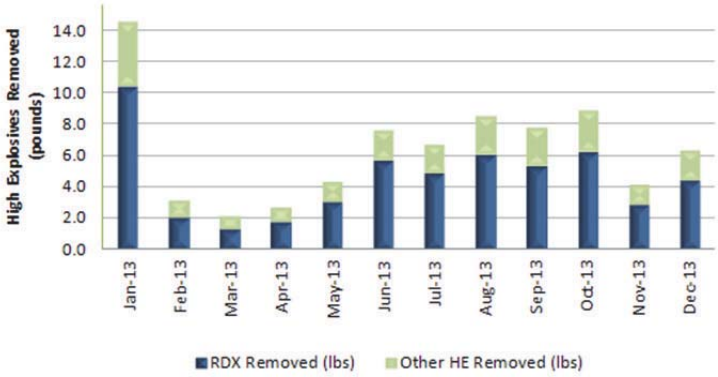

Figure 2-7. P1PTS Mass Removal by Month

During 2013, the system removed approximately 55 lbs of RDX and 23 lbs of all other HEs (see Figure 2-7). The average removal rate of HEs was about 0.8 lbs per million gallons (lbs/Mgal) of treated water. The system has removed a total of 378 lbs of RDX and 150 lbs of all other HEs since startup in September 2008. HE mass removal is affected by the wells operated within the system which affect the influent concentrations as well as throughput. The mass removal was significantly affected by reduced throughput. Three wells (PTX06-EW-75, 79, and 80) at the P1PTS have the greatest effect on the influent concentrations of HEs because they are in a more heavily contaminated portion of the plume. PTX06-EW-79 was not operated from February to April and PTX06-EW-80 was down during most of June, July and October. As depicted in Figure 2-8, influent concentrations are also declining over time. The average influent concentration of RDX was 148 ug/L in 2009, while the average influent concentration in 2013 was 65.6 ug/L. Maximum influent RDX concentrations in 2009 were 200 ug/L and 130 ug/L in 2013.

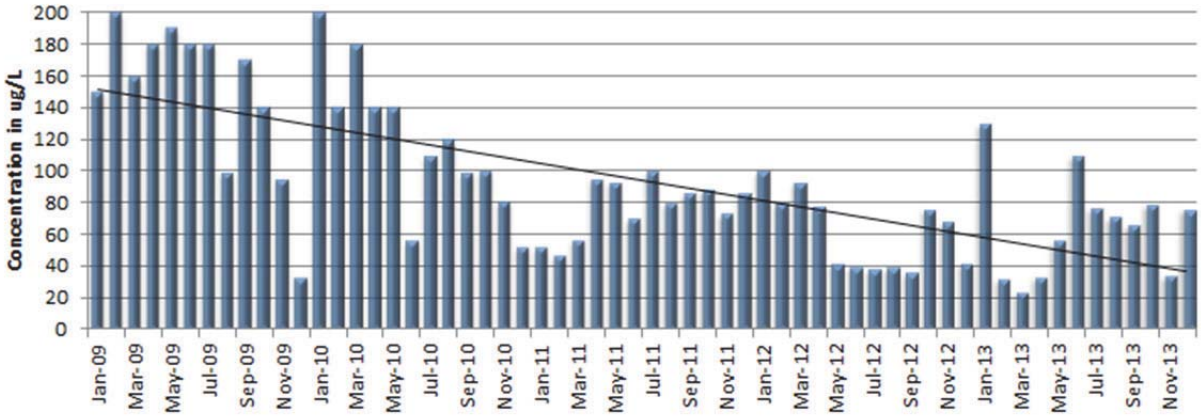

Figure 2-8. Influent RDX Concentrations at P1PTS

Evaluation of effluent data indicates the system treated the recovered groundwater to concentrations below the laboratory PQL and the GWPS provided in the SAP. The summary of effluent detections for COCs at the P1PTS is included in Table 2-1. The complete set of effluent data collected during 2013 is included in Appendix C electronic data tables.

Table 2-1. Summary of Effluent Detections at P1PTS

Sample Date	Analyte	Measured Value (ug/L)	Bkgd (ug/L)	> Bkgd?	PQL (ug/L)	> PQL?	GWPS (ug/L)	> GWPS?
11/7/2013	RDX	0.061J	NA	NA	0.2	N	2	N
11/7/2013	TNX	0.033J	NA	NA	0.5	N	2	N

J - Estimated value representing a concentration detected less than the practical quantitation limit and equal to or greater than the method detection limit (MDL).

During 2013, the P1PTS was in its fifth year of operation. Operational performance and throughput was primarily affected by facility and well maintenance problems, with freezing temperatures at the irrigation system also contributing during December. Although this system was not designed for injection, it can be affected by the SEPTS when flow is restricted to the WWTF/irrigation system. In order to continue operating the SEPTS, flow can also be restricted at P1PTS so that injection is limited at SEPTS. Pantex has reevaluated goals for these systems to emphasize beneficial use of treated water while continuing to meet remedial action goals. The new goals are discussed in Section 5.3. Pantex is also in the process of adding a new extraction well to ensure continued throughput when other wells are not operating.

2.1.2 Southeast Pump and Treat System

The SEPTS was originally installed at Pantex in 1995 as part of a treatability study. Since then, the pump and treat system has been expanded to meet the objectives of the environmental restoration project and final remedy established in the ROD and CP-50284. The SEPTS currently consists of a treatment building, 62 extraction wells, and 3 injection wells (see Figure 2-9). This system treats the water through a series of GAC vessels and ion exchange resin beds to reduce concentrations below the GWPS established in the ROD and CP-50284.

SEPTS Operational Goals

Operational time of 90%

Treat at 90% of maximum throughput capacity
- 270 gpm
- 388,800 gpd

The objective of the SEPTS is to remove contaminated perched groundwater and treat it for industrial and/or irrigation use. While the capability is being maintained for injection of treated water back into the perched zone, the intent is to permanently remove perched groundwater to gradually reduce the saturated thickness in this zone. This will achieve two important objectives:

(1) Gradual reduction of the volume of perched groundwater (and contamination) moving downgradient toward the extent of the perched aquifer, and

(2) A reduction in the head (driving force) for vertical migration of perched groundwater into the fine-grained zone (FGZ) and to the drinking water aquifer.

To meet these objectives, operational goals for this system were established, as presented in the highlight box. The system is designed to treat up to 300 gpm or 432,000 gpd. The goals provide for about 128 million gallons of perched groundwater to be removed and treated through the SEPTS each year.

SEPTS Milestones

2013	Since Startup (1995)
• Over 137 Million Gallons treated	• Over 1.3 Billion Gallons treated
• Over 132 Million Gallons beneficially used	• Over 579 Million Gallons of the treated water beneficially used
• Over 670 lbs of HEs removed	• Over 9,800 lbs of HEs removed
• Over 119 lbs of Cr(VI) removed	• Over 1,200 lbs of Cr(VI) removed

Figure 2-9. SEPTS Wells and Conveyance Lines

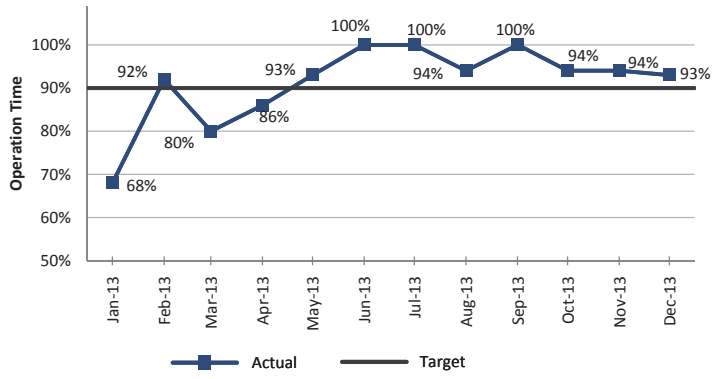

Figure 2-10. SEPTS Operation Time vs Target

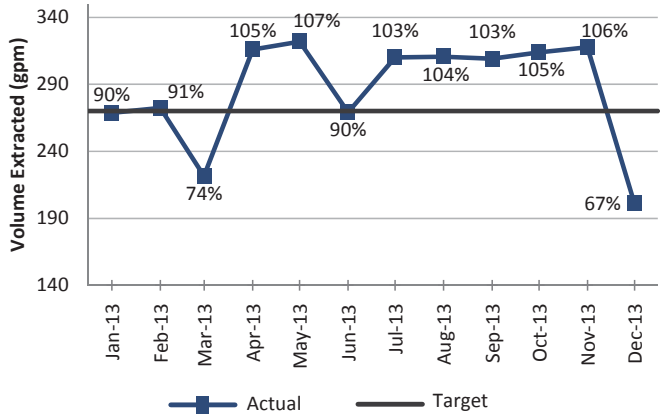

Figure 2-11. SEPTS Average GPM and % Capacity

The SEPTS exceeded the operational goal of 90% for the year by operating 349 days during 2013 with an average operational rate of 91% based on total hours operated versus total possible operation time. The percent operation time (hours/day) versus target is depicted in Figure 2-10.

The system extracted an annual average of 286 gpm from the well field while operating. Figure 2-11 depicts the average gpm extracted from all wells by month, the percentage of total capacity achieved, and the goal for the system. The calculated gpm accounts for water extracted from the well field during the time the system operated and is affected by the yield from each well, well downtime, or reduced flow required by the WWTF/irrigation system. The SEPTS met extraction goals for most months, with the only exceptions occurring in March and December. The WWTF/irrigation system was unable to receive full flow from the pump and treat systems during those months, so flow was reduced to avoid excessive injection into the perched aquifer. Pantex has realigned goals for the pump and treat systems so that operational goals align with remedial action goals to treat and reduce saturated thickness. The change in goals is discussed in the recommendations for change included in Section 5.

Because the SEPTS has 61 operating wells, it is capable of extracting more water than the maximum treatment capacity of the system. For this reason, not all wells are pumping within the SEPTS on a daily basis. Estimated flow volumes for each well in the SEPTS are included in Appendix B.

Until perched groundwater levels decline, requiring the use of more wells to meet operational goals, the system currently extracts from the well field according to set priorities that best meet long-term objectives. The well extraction priorities are depicted in Figure 2-12. Seven priorities were set:

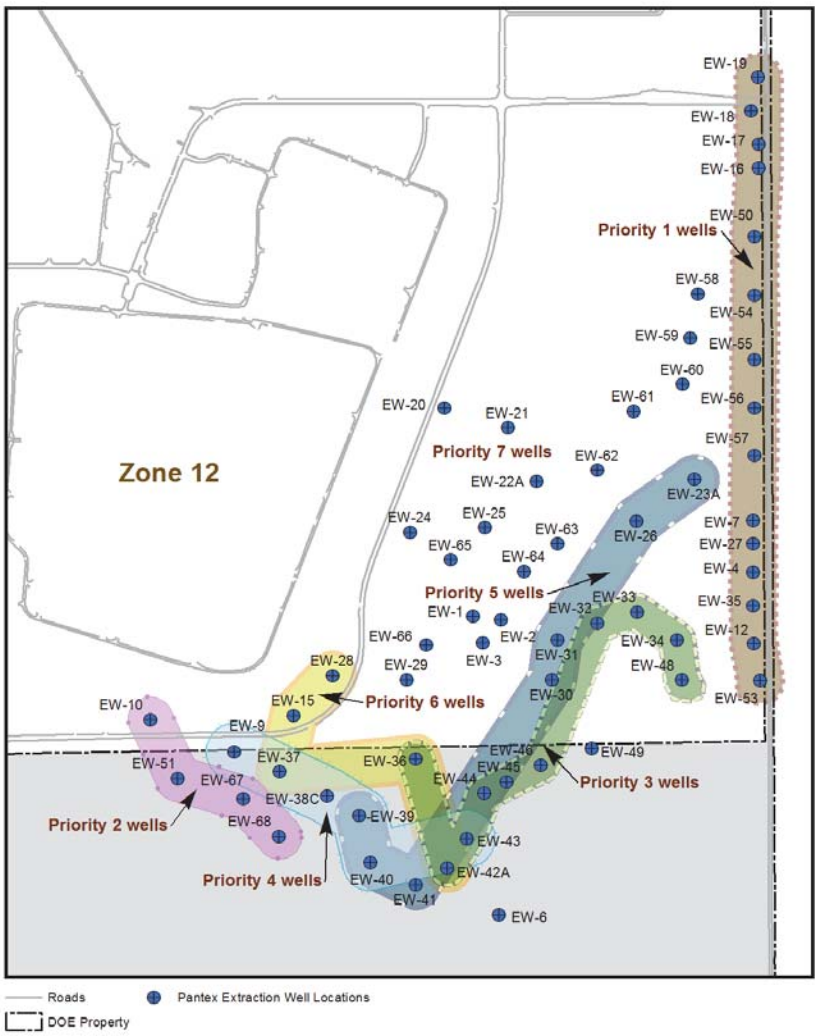

Figure 2-12. SEPTS Well Field Extraction Prioritization

- Priority 1 Wells: Wells along the eastern edge of the well field (along the eastern fence line) to control the continued movement of water and contamination to thinner saturated zones at the margin of the perched aquifer where pump and treat technology is ineffective.
- Priority 2 Wells: Wells along the southern edge of the system that were installed to capture the highest concentrations of hexavalent chromium and to prevent further migration of the plume into areas where the FGZ is more permeable or to thinner saturated zones.
- Priority 3 Wells: Wells along the southeastern edge of the system that capture the highest concentrations of RDX and prevent further migration of the plume into areas where the FGZ is more permeable or to thinner saturated zones.
- Priority 4 Wells: Wells along the northern edge of the hexavalent chromium plume from the Zone 12 South area.

- Priority 5 Wells: Wells close to the highest concentrations of RDX. These wells will continue to capture movement of the RDX plume when the priority 3 wells are not pumping.
- Priority 6 Wells: Wells that capture the center of the hexavalent chromium plume from the former cooling tower on the eastern side of Zone 12.
- Priority 7 Wells: All other wells in the SEPTS. With the exception of EW-6 and 49, these wells will help with reducing saturated thickness in the perched aquifer and removing head that pushes the groundwater horizontally and vertically, but will not be as effective at controlling plume movement. EW-6 and 49 are in a low-transmissive zone so are very low-producing wells. For this reason, they were not placed in a high priority for pumping.

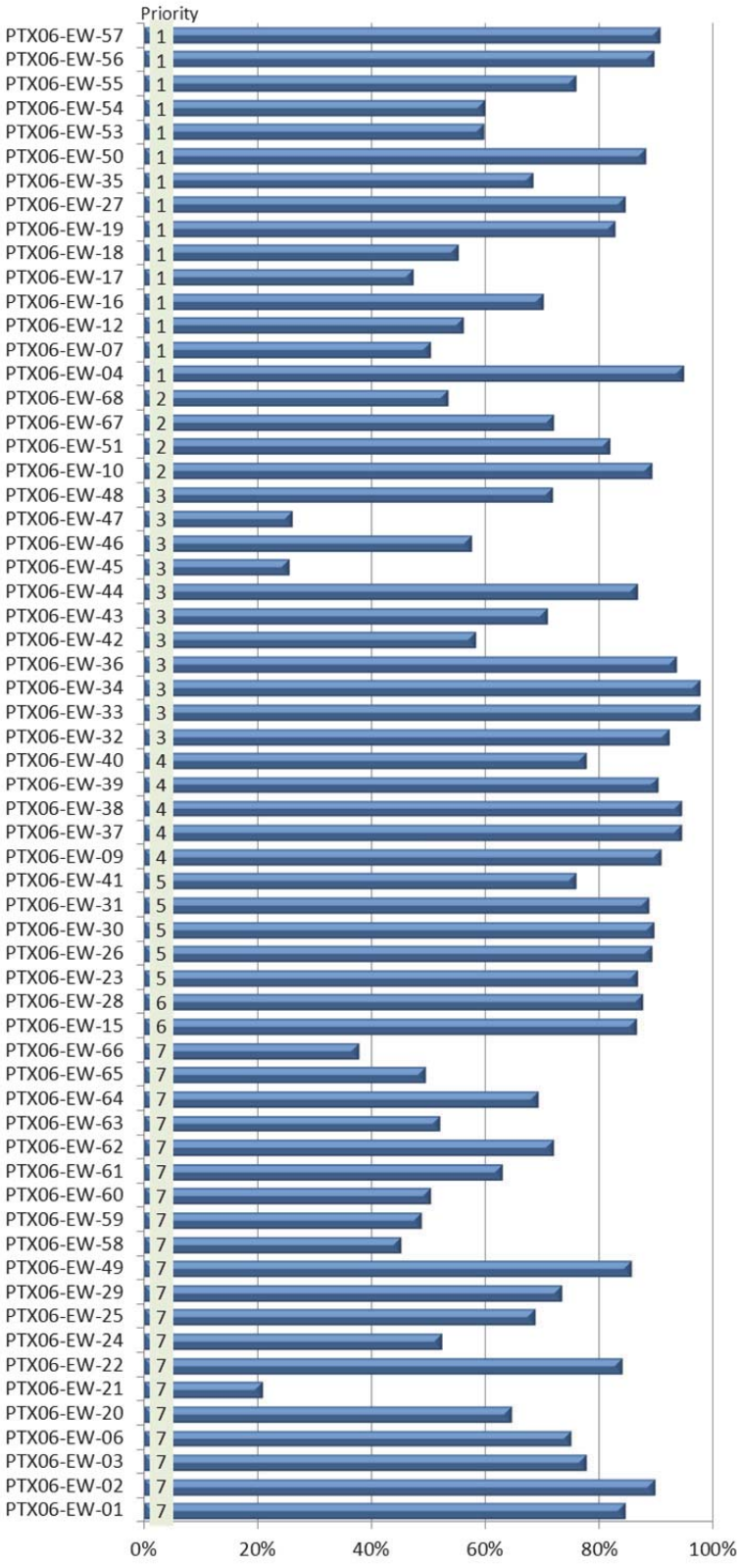

Figure 2-13. 2013 SEPTS Well % Operation

This prioritization was implemented in 2009 after the newly installed extraction wells were placed into operation. Figure 2-13 provides the percentage of days operated for wells in the SEPTS. Priority 1-5 wells are operated at a higher frequency with the exception of a few wells that experience electrical, mechanical, or pumping problems that affected operation of the well. Priority 6 and 7 extraction wells are operated periodically to ensure that wells are operational. Priority 6 and 7 wells within the highest saturated zones are also operated at a higher frequency to meet the goal of reducing the saturated thickness in those areas and to meet throughput goals for the system. Some of the high priority wells are in areas that have rapidly declining water levels and/or are in low-yield portions of the formation so pumps are cycling on and off causing the well to be operated intermittently. This effect is becoming more prominent in many of the higher priority wells as the system continues to remove water from the perched aquifer. Because PTX06-EW-47 is in a very low-yield zone and water levels are declining, Pantex discontinued use of that well during the last half of 2013. As recommended in the 2012 Annual Progress Report, Pantex removed that well from the system in early 2014.

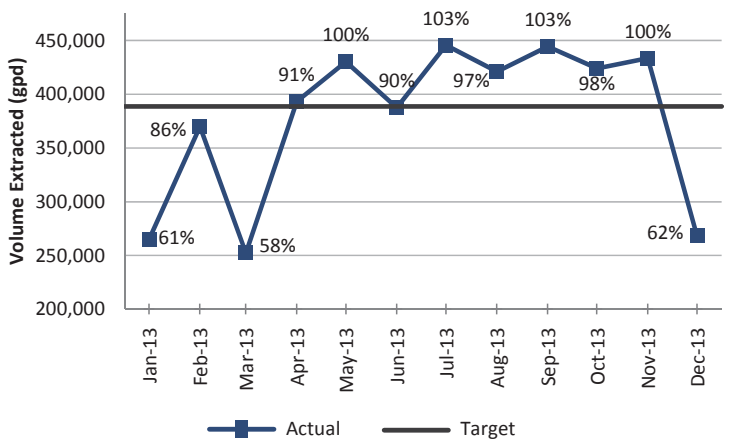

Figure 2-14. SEPTS Average GPD and % Capacity

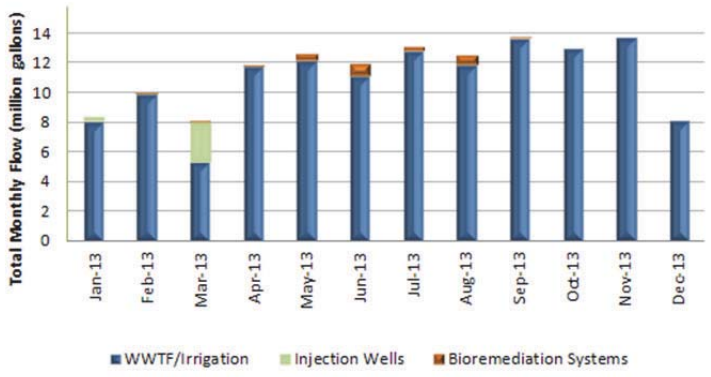

Figure 2-15. SEPTS Total Flow Volume and Disposition of Effluent

The SEPTS treated an annual average of about 378,000 gpd during 2013 based on total possible hours of operation and total inflow from the well field. Figure 2-14 depicts the monthly average treatment rate (gpd), target, and percentage of total capacity achieved at the SEPTS. The calculated gpd accounts for flow from the well field as well as system operation time during the day. Therefore, the gpd is

affected by system operational time, ability to extract water from the wells, and reduced flow to the WWTF and irrigation system. The system operated above goal during most of 2013. Operational time was affected by system failures and the WWTF/irrigation system downtime. As stated above, this system was affected by the reduced flow to the WWTF/irrigation system in March and December.

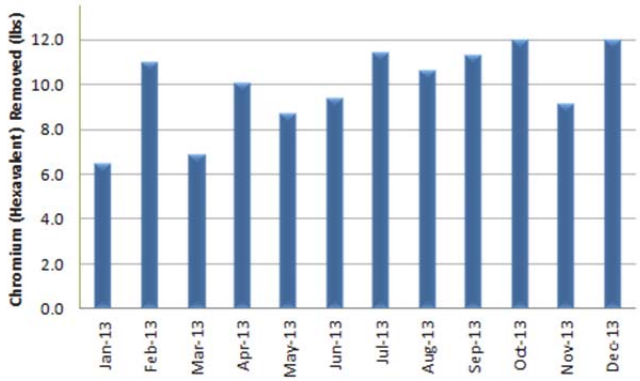

Figure 2-16. SEPTS Chromium Mass Removed by Month

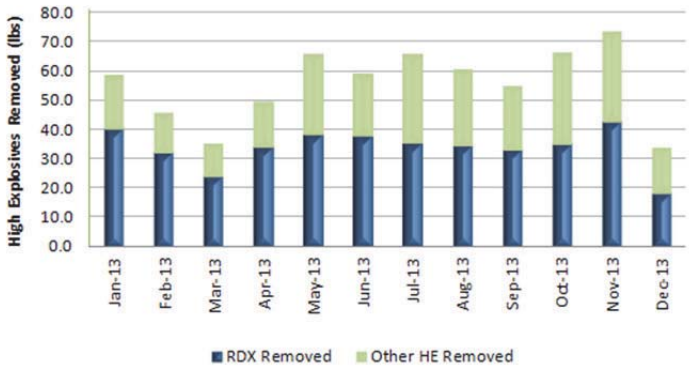

Figure 2-17. SEPTS High Explosive Mass Removed by Month

The system treated about 138 million gallons of extracted water during 2013. The total volume treated by month and the final disposition of the treated water is depicted in Figure 2-15. This system released about 96% of the treated water to the WWTF for use in the irrigation system, injected about 2% into the perched zone, and the remainder was beneficially used for injection of amendment in the ISB systems. Injection of treated water back into the perched zone was greatly reduced in 2013, as compared to 2011 where 34% of treated water was injected while a new 100-acre irrigation system tract was being installed. In 2013, about 3 Mgal was injected, while about 37 Mgal was injected during 2011. The extra 100-acre irrigation tract became available in 2012 allowing for reduced injection for over half of the year. Only 9% of treated water was injected in 2012.

The SEPTS primarily removes RDX and hexavalent chromium from the perched groundwater. The system removed about 120 lbs of hexavalent chromium, 408 lbs of RDX, and 263 lbs of all other HEs during 2013. The total mass removed by month is depicted in Figure 2-16 and Figure 2-17. The average removal rate of hexavalent chromium was 0.9 lbs/million gallons (Mgal) of water, and the average removal rate for HEs was 4.9 lbs/Mgal of water. Mass removal of RDX and chromium declined slightly during 2013. Hexavalent chromium mass removal is declining primarily because concentrations in PTX06-EW-51 are declining over

time. This well was located in the heart of the hexavalent chromium plume south of Zone 12 and contributes heavily to the hexavalent chromium influent concentrations at the SEPTS. HE mass removal is affected by the wells that operate in the higher concentration portions of the RDX plume. This year's data reflect a higher mass removal of other HEs, but a lower mass removal of RDX. Average concentrations of RDX in the SEPTS influent were about 567 ug/L in 2009, the first year of the full remedial action. RDX average influent concentrations in 2013 were about 361 ug/L. Hexavalent chromium average influent concentrations in 2009 were about 214 ug/L while they were about 118 ug/L in 2013.

This system has treated approximately 9,894 lbs of HEs and 1,266 lbs of hexavalent chromium since it started operating. Evaluation of effluent data indicates the system treated the recovered groundwater to concentrations below the PQL and the GWPS provided in the SAP.

The summary of COC effluent detections at the SEPTS is included in Table 2-2. The complete set of effluent data collected during 2013 is included in Appendix C.

Table 2-2. Summary of Effluent Detections at SEPTS

Sample Date	Analyte	Measured Value (ug/L)	Bkgd (ug/L)	> Bkgd?	PQL (ug/L)	> PQL?	GWPS (ug/L)	> GWPS?
1/2/2013	Total Chromium	11	31.8	N	10	NA	100	NA
2/6/2013	Total Chromium	3.8J	31.8	N	10	NA	100	NA
3/6/2013	Total Chromium	8.7J	31.8	N	10	NA	100	NA
4/3/2013	Total Chromium	7J	31.8	N	10	NA	100	NA
6/5/2013	Total Chromium	3.7J	31.8	N	10	NA	100	NA
7/8/2013	Total Chromium	6.1J	31.8	N	10	NA	100	NA
8/5/2013	Total Chromium	5.7J	31.8	N	10	NA	100	NA

J = Estimated value representing a concentration detected less than the practical quantitation limit and equal to or greater than the method detection limit (MDL).

This system continues to operate near goals overall because of the completion of the WWTF/irrigation system upgrade and repair 2011. Treatment throughput was low in January, March, and December because of system repairs and impacts from the WWTF/irrigation system when repairs were needed or freezing weather impacted the system. The system treated a similar volume of water and decreased the amount of injection of treated water into the perched aquifer by 9 Mgal so that only about 2% of the total treated water was injected. The goal is to eliminate injection. Based on recommendations from the Final Five-Year Review to revise the operational goals for the pump and treat systems to emphasize focus on beneficial use of treated water and eventual elimination of injection, Pantex has included those new goals in the recommendations in Section 5.

2.2 ISB Systems

Pantex has installed and operates two ISB systems as part of the final Remedial Action for groundwater. One system is southeast of Pantex Plant on TTU property and one is south of Zone 11. The ISB systems consist of 74 treatment zone wells and nine in situ performance monitoring wells.

The objective of the ISB systems is to establish an anaerobic biodegradation treatment zone capable of reducing COC concentrations to the GWPS by injecting the necessary amendments and nutrients to stimulate resident bacteria. The bacteria first consume oxygen and then in turn consume other electron acceptors, creating reducing geochemical conditions. Under reducing conditions, biotic and abiotic treatment mechanisms are carried out to remove contaminant mass from groundwater. Regular injections of amendment are key to maintaining the health of the treatment zone.

2.2.1 Zone 11 ISB

2.2.1.1 History of Zone 11 ISB

The Zone 11 ISB system is on Pantex Property, south of Zone 11 (see Figure 2-18). The current system consists of 32 injection wells and 3 downgradient performance monitoring wells installed in a zone of saturated thickness of approximately 15-20 ft. The Zone 11 ISB, originally consisting of 23 wells, was installed by March 2009. An additional nine wells were installed in September 2009 to better treat the perchlorate plume on the eastern side and the TCE plume on the western side of the ISB. As provided in the SAP, eight treatment zone wells and three downgradient performance monitoring wells are used to evaluate the Zone 11 ISB (see Figure 2-18). Pantex also monitors three treatment zone wells in the second row to better evaluate conditions in higher concentration and/or flow areas. Based on a recommendation in the 3rd Quarter 2013 Progress Report, Pantex will discontinue further injections into PTX06-ISB082. This well will be used to monitor the effectiveness of treating only the first row on the perchlorate (eastern) side. This well was unable to be sampled during 2013 because of excessive residual amendment and/or bacterial biomass. This well is planned for rehabilitation during the 2014 injection event to improve sampling conditions.

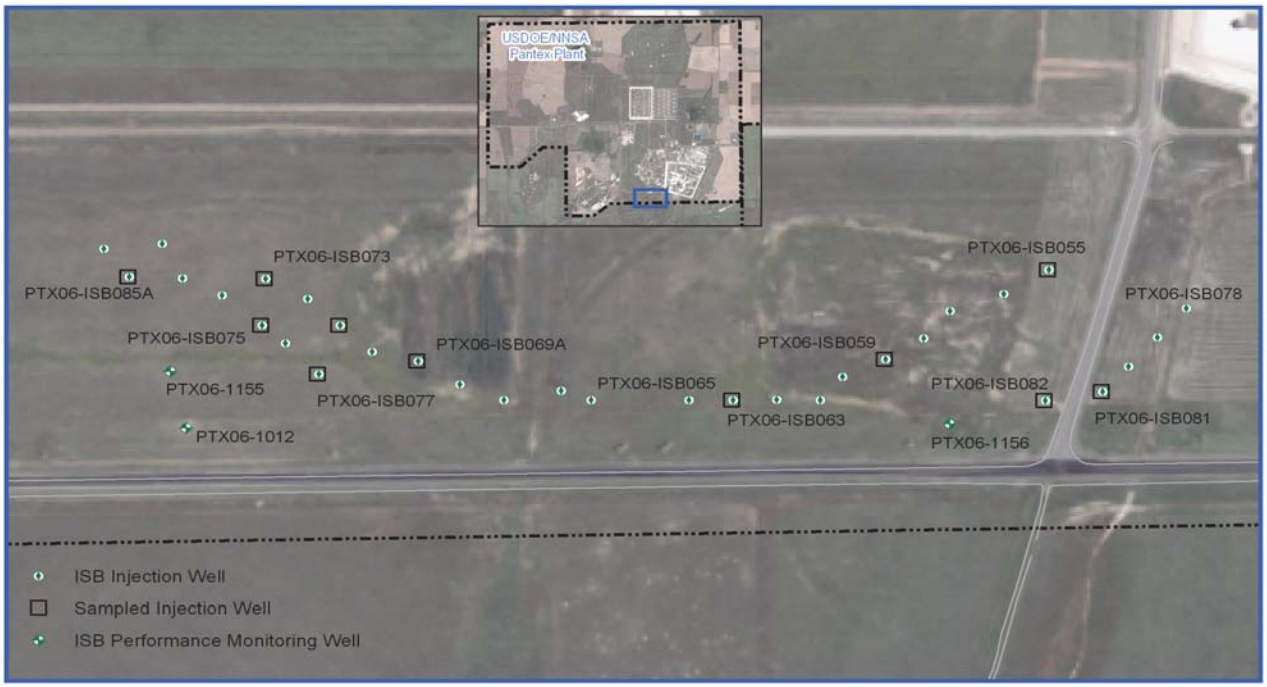

Figure 2-18. Zone 11 ISB Treatment Zone and Performance Monitoring Wells

planned to address plumes of VOCs that extend to the northwest beyond the current system. This remedial alternative was the most practical solution to the treatment of the plume extending beyond the current system. That remedial alternative evaluation and discussion was included in the 2nd and 3rd quarter 2013 progress reports (B&W Pantex, 2013c and 2013d). Reports documenting the implementation of the expanded system will be included in the next annual progress report. As seen in the schedule included in Section 1, this project is scheduled for completion by the end of 2014 and will undergo injection in 2015.

2.2.1.2 Operation of Zone 11 ISB

Pantex completed a fifth injection in the Zone 11 ISB during 2013. The 12-month injection schedule was shortened to accommodate a shorter time-frame for injection of the Southeast ISB. Rehabilitation of wells was performed from February to April and injection was performed from May through July 2013.

To prepare for the injection, several activities were performed to determine if the well screens and/or the sand filter pack may be impaired due to biofouling. The following rehabilitation activities were performed from February to April 2013:

1. Pre-maintenance hydraulic testing of 33 wells to quantify the transmissivity of the formation immediately surrounding injection wells. Constant-rate injection testing was used to calculate transmissivity.

2. Well maintenance at 31 injection wells including Welgicide® reagent application followed by physical development using surging/brushing and airlifting techniques. PTX06-ISB066 and PTX06-ISB075 were replaced in 2012 after injection, so the wells did not require maintenance for the 2013 injection. The old PTX06-ISB075 well was maintained as it will continue to be used for injection until the well fails. The newly installed well is used to monitor the treatment zone.

3. Follow-up hydraulic testing at the 31 wells where maintenance was performed.

Results of hydraulic testing indicate that transmissivity improved in more than half of the wells after well maintenance. The others showed no change in transmissivity. This may indicate that those wells with no change have not been impacted as greatly by biofouling.

After rehabilitation was complete at each well, injection activities were started at the wells. Dosing of amendment was calculated according to the volume of groundwater to be treated and a target amendment concentration of at least 5% per the design basis. To optimize the amendment injection, a ranking procedure was used at each well that considered groundwater flux and COC concentration. A higher ranking represented higher flux and COC concentration. Since the flux and COC concentration would dictate potentially faster rates of amendment consumption, the amendment dosage was optimized considering these parameters. Injection activities at each well consisted of the injection of mixed amendment, targeted at the concentration calculated as described, followed by a period of a water-only flush. The flush water represented approximately 10% of the target injection volume at each well. The intent of the water-only flush is to increase the radius of influence of the amendment delivery and to transport more of the amendment away from the direct vicinity of the well to potentially lessen the degree of biofouling. The target percentages and volumes also accounted for the water-only flush.

The target amendment concentration was optimized and increased as described above and the target dosage for the wells ranged from 5.7% to 7.8%. As calculated after completion of injection, the actual dosage range for most wells exceeded the target, with a range of 5.7% to 8.6% in all wells. The target volume of water and amendment was exceeded in most wells. Injection started May 17 and was complete July 12. The well maintenance and post-injection reports for the Zone 11 ISB can be found in Appendix G of this report.

2.2.2 Southeast ISB

2.2.2.1 History of Southeast ISB

The Southeast ISB System is on TTU property south of Pantex. The system was installed in 2007 as an early action and consists of 42 injection wells within the treatment zone and 6 performance monitoring wells (see Figure 2-19). The injection wells were drilled in a line

perpendicular to the hydraulic gradient so the water flowing through the treatment zone will be treated before reaching the area beneath Texas Tech property where the FGZ becomes less resistant to vertical migration.

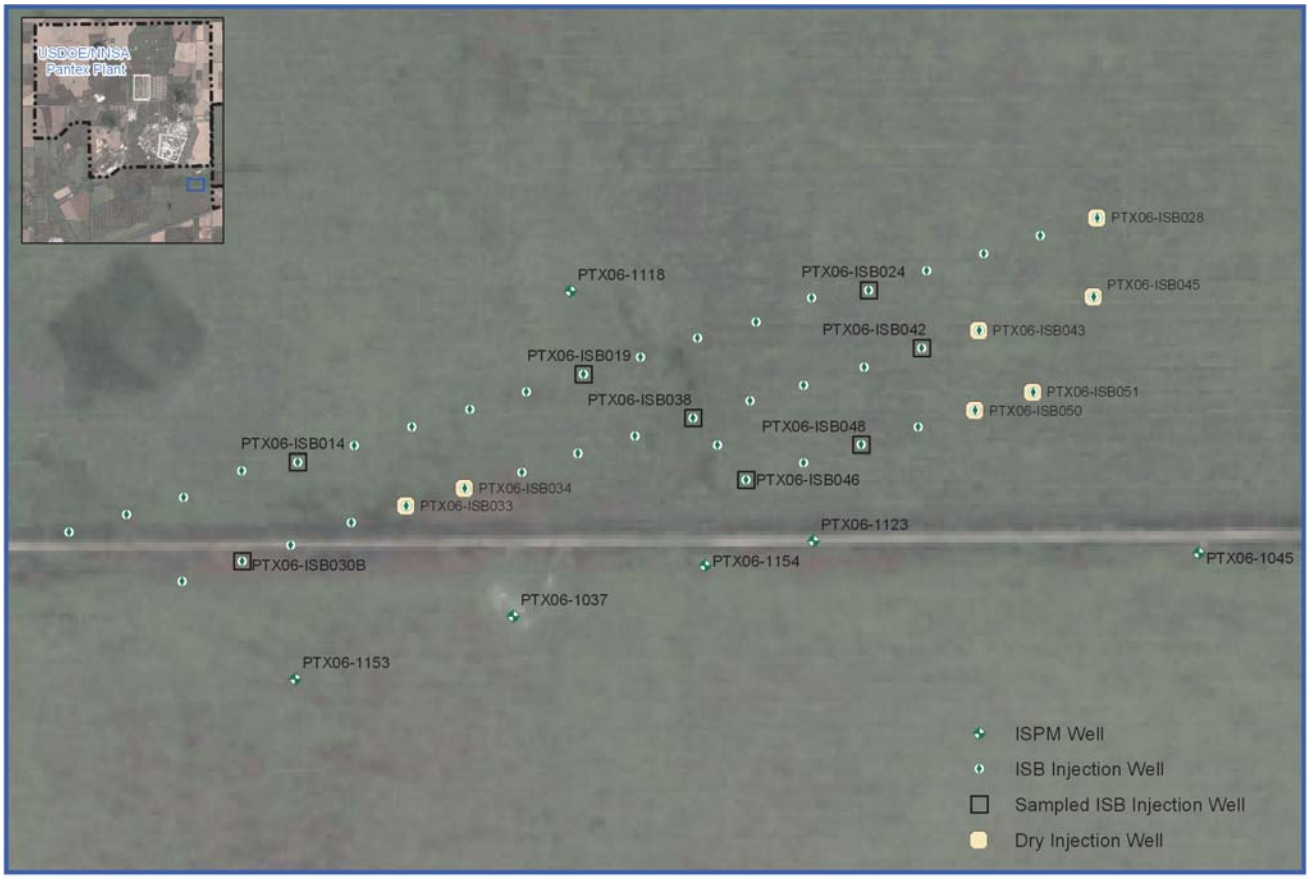

Figure 2-19. Southeast ISB Treatment Zone and Performance Monitoring Wells

Based on the rate of perched groundwater flow and estimated amendment longevity, injections were estimated to be necessary about every 12 to 24 months. Pantex has scheduled injections about 18 months apart as data indicate that 24 months may be too long between injections. Four injection events have been completed for the Southeast ISB as provided in Table 2-4. As provided in the SAP, eight treatment zone wells, five downgradient performance monitoring wells, and one upgradient performance monitoring well are used to evaluate the Southeast ISB. Two performance monitoring wells (PTX06-1045 and PTX06-1118) for the Southeast ISB have gone dry and have not been monitored since 2009 and 2010, respectively.

Table 2-4. Southeast ISB Injection Events

Injection Event	Completion Date
1	March 2008
2	April 2010
3	May 2012
4	September 2013

The *Revised Implementation Report, Southeast Plume In Situ Bioremediation Corrective Measures Design and Construction* (Aquifer Solutions, 2009b) documents the design and construction of the Southeast ISB. That report was included in the *Final Pantex Interim Remedial Action Report* (IRAR) (B&W Pantex, 2010a).

2.2.2.2 Operation of Southeast ISB

Pantex completed a fourth injection in the Southeast ISB during 2013. To prepare for the injection, several activities were performed to determine if the well screens and/or the sand filter pack may be impaired due to biofouling. Of the 42 wells present, 35 were maintained and 7 have continued to remain dry so maintenance was not performed at those wells. The following rehabilitation activities were performed from March 23 to July 1:

1. Pre-maintenance hydraulic testing of 35 wells to quantify the transmissivity of the formation immediately surrounding injection wells. Constant-rate injection testing was used to calculate transmissivity.

2. Well maintenance at 35 injection wells including Welgicide® reagent application followed by physical development using surging/brushing and airlifting techniques.

3. Follow-up hydraulic testing after rehabilitation.

Transmissivity increased after maintenance in most wells that had low transmissivity prior to maintenance. Specific capacity calculated from the steady-state amendment injection demonstrates that the maintenance program has been effective overall. Two wells, PTX06-ISB022 and PTX06-ISB029A, were anomalous and show a downward trend in injection rates and specific capacity over time.

After rehabilitation was complete at each well, injection activities were started in July and completed in September. A total of 37 wells received amendment injection (5 dry wells did not receive amendment). Two dry wells, PTX06-ISB033 and PTX06-ISB034, were injected with mixed amendment to attempt to influence nearby saturated zones including downgradient monitoring well PTX06-1153 where treatment is not evident. Dosing of amendment was calculated according to the volume of groundwater to be treated and a target amendment concentration of at least 5% per the design basis. To optimize the amendment injection, a ranking procedure was used at each well that considered groundwater flux and COC concentration. A higher ranking represented higher flux and COC concentration. Since the flux and COC concentration would dictate potentially faster rates of amendment consumption, the amendment dosage was optimized considering these parameters. Injection activities at each well consisted of the injection of mixed amendment, targeted at the concentration calculated as described, followed by a period of a water-only flush. The flush water represented approximately 10% of the target injection volume at each well. The intent of the water-only flush is to increase the radius of influence of the

amendment delivery and to transport more of the amendment away from the direct vicinity of the well to potentially lessen the degree of biofouling. The target percentages and volumes also accounted for the water-only flush.

The target amendment concentration was increased as described above and the target dosage for the wells ranged from 5.6% to 7.5%. As calculated after completion of injection, the actual dosage range for most wells exceeded or was close to target, with a range of 5.7% to 8.5% in all wells. Injection started in July and was complete before the end of September 2013. PTX06-ISB022 and PTX06-ISB029 amendment injection volumes were lower than target due to the low rates at which these two locations would accept injected fluids. However, the amendment volume in these wells was above design basis. To compensate for the lower amendment volume, amendment volume was increased at nearby wells (downgradient or cross-gradient). The well maintenance and post-injection reports for the Southeast 11 ISB can be found in Appendix G of this report.

2.3 Soil Remedial Actions

Soil remedial actions at Pantex include the Burning Ground SVE system, landfill covers, ditch liners, and institutional controls (see Section 1.2.1). The O&M of the soil remedies are discussed in these sections.

2.3.1 Burning Ground SVE

The Burning Ground SVE system was installed in February 2002 as an interim remedial action and became the final remedial action with the issuance of the ROD and CP-50284. The SVE system was installed to address the remediation of VOCs present in the shallow and intermediate depth vadose zone at the Burning Ground (SWMUs 47 and 38). The system was designed to remediate soil gas in the areas beneath the solvent evaporation pit/chemical burn pit (SEP/CBP) and the Landfills north of the SEP/CBP. From the RCRA Facility Investigations, original VOC concentrations at the Burning Ground were as high as 962 parts per million by volume (ppmv) in the shallow zone (20-90 ft bgs), based on wells in place at that time. However, higher concentrations were found in well SVE-S-20 when the SVE system was installed in 2001. Concentrations in the intermediate zone (95-275 bgs) were as high as 1845 ppmv (Stoller, 2002). The goal was to reduce the mass of VOC contaminants in soil gas significantly, thus mitigating impacts to the underlying groundwater. That goal has been achieved in all but a single extraction well, SVE-S-20. Rebound testing conducted in October 2005 indicated that all wells, except SVE-S-20, yielded field-measured VOC concentrations less than 100 ppmv. A small-scale SVE was installed at the Burning Ground in late 2006 after the large-scale catalytic oxidation and scrubber system became inefficient at continued removal of soil gas and residual NAPL within the soil pore space once the larger area had been remediated. The small-scale system focused on treating residual NAPL and soil gas at a single soil gas well (SVE-S-20), where soil gas concentrations continue to remain high. The

system consisted of a series of activated carbon drums and a smaller blower motor for extraction. The activated carbon system was shut down at the end of January 2012 to allow installation of a small-scale CatOx system that continues to focus remediation on SVE-S-20. The new system is more cost efficient and will effectively treat all detected COCs at the Burning Ground. System construction and installation began in February 2012. System startup and testing began on April 5, with normal operations commencing on April 19, 2012.

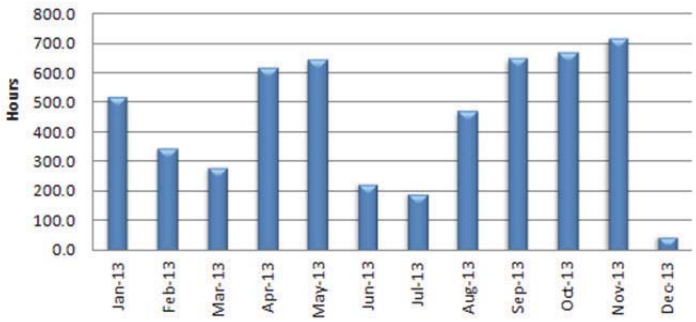

Figure 2-20. SVE System Operation

The system was continuously operated except for maintenance, repairs, or freezing weather that affects influent flow. The system experienced shutdowns due to freezing temperatures and faulty pH/conductivity sensors in first quarter. During June and July, problems were encountered with the blower unit that required repair. Freezing temperatures affected several components in December, requiring the replacement of components. After repairs were conducted, the system was intentionally left off-line to conduct a baseline rebound test to support the development of the SVE Performance Monitoring Plan identified during the Five-Year Review.

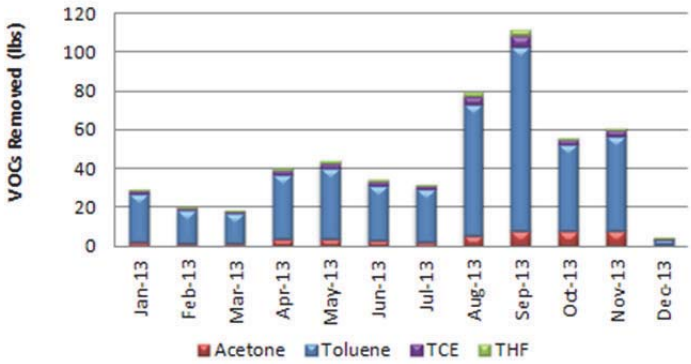

Figure 2-21. Burning Ground SVE Mass Removal

Calculated mass removal for 2013 is presented in Figure 2-21. Mass removal was estimated based on concentrations reported from analytical sampling, system operation time, and system flow rates. VOC constituents contributing more than 1% of the total VOC concentration were included in the calculation. Mass removal has been impacted by the shutdowns and inflow concentrations. Influent concentrations have remained low since the start-up of the new system; however, concentrations increased in August as indicated by the increase in mass removal.

The SVE system has been effective at removing VOCs from soils. The system removed about 529 lbs of VOCs during 2013. Since inception, the SVE system has removed over 17,100 lbs of VOCs.

As reported in the monthly Air Quality Monitoring Reports to the Regional TCEQ office, all 2013 effluent PID readings for the new system indicate that destruction efficiency was greater than 94%, exceeding the permit-by-rule limit of 90%.

2.3.2 Engineered and Institutional Controls

The soil remedial actions at Pantex are discussed in Chapter 1. The SVE system is the only active soil remedy; however, other soil remedies require long-term stewardship to maintain controls. Pantex drafted all deed restrictions required as part of the final remedy during 2009 and submitted them to TCEQ and EPA as part of the draft final Interim Remedial Action Report (IRAR). Those deed restrictions were filed in 2010 in conjunction with the approval of the final IRAR (B&W Pantex, 2010a). All remedial action units at Pantex are restricted to industrial use. To support the deed restrictions, Pantex maintains long-term control of any type of soil disturbance in the SWMUs to protect human health and to prevent spread of contaminated soils. Pantex also regularly inspects and maintains soil covers on landfills to prevent infiltration of water into the landfill contents and migration of impacted water to groundwater. Pantex installed and inspects and maintains a fence around FS-5 to control access and use of an area that is impacted by depleted uranium. Pantex installed a synthetic liner along a ditch system in Zone 12 where investigations indicate that the ditches continue to act as a source to perched groundwater. Installation of the ditch liner will minimize migration of contaminants because it prevents rain water from infiltrating into soils. Pantex regularly inspects this ditch liner. Maintenance is either contracted, as necessary, or work orders are placed with the onsite Maintenance Department.

2.3.2.1 Soil Remedial Action Inspections

During 2013, Pantex conducted quarterly inspections of landfills as well as after rainfall events of greater than ½ inch. Inspections were also conducted for the ditch liner and SWMU signs and postings at various times during 2013. The FS-5 fence was installed during 2009 and the fencing is inspected quarterly. Key findings of the inspections and resulting actions are included in Table 2-5.

Table 2-5. 2013 Key Findings and Corrective Actions for Soil SWMUs

Findings	Corrective Actions
Depressions and low spots identified in SVS 5 landfill.	Identified low areas/depressions were filled by Pantex Maintenance personnel.
SWMU signs missing from FS-5 fence.	Signs were placed on the fence surrounding FS-5.
SWMU 68c, SWMU 54, SWMU 64, SWMUs 37-44, and SVS 6 landfills (Landfills 2, 3, 13, Burning Ground, and Zone 7, respectively) had low spots and distressed vegetation.	These areas were identified during the Five-Year Review as needing erosion control. The work was contracted and low areas were backfilled, seed applied per the landfill reseeding plan, and erosion control mats were applied on sloped areas.
SWMU 68b landfill had low spots and distressed vegetation.	This landfill was also identified during the Five-Year Review as needing erosion control. This landfill served as the pilot study for ClosureTurf™ installation. The ClosureTurf™ was installed by October 2013 and will be evaluated against other landfill areas for long-term control of water infiltration.

The bare ground/stressed vegetation at the landfills was noted during the inspection for the Five-Year Review. Drought conditions in the Texas Panhandle have caused considerable loss of vegetation on the covers. As part of the recommendations from the Draft Final Five-Year Review, Pantex developed and implemented a plan to control erosion on the landfill covers. The plan was detailed in the *2012 Annual Progress Report* (B&W Pantex, 2013b). The reseeding of the landfills was complete in October 2013.

Figure 2-22 depicts the landfills that require erosion control due to loss of vegetation.

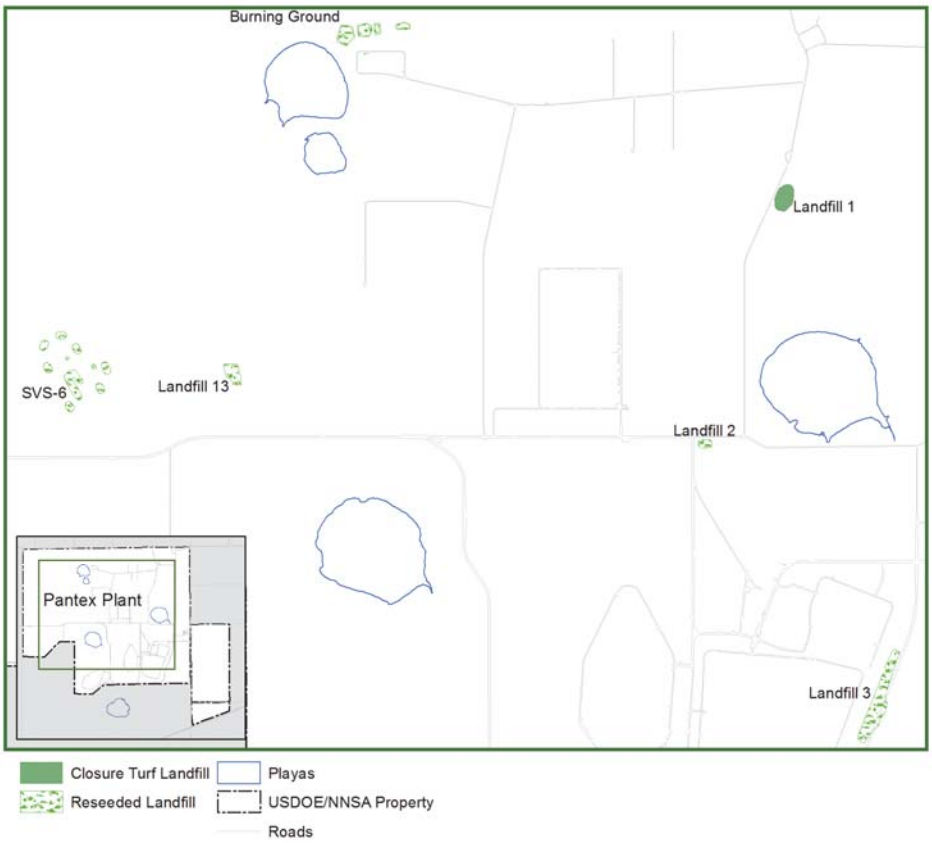

Figure 2-22. Landfills identified for Erosion Control

Highlights of the reseeding include:

- Low areas were filled in at Landfills 2 and 3 and SVS 6.
- Landfills 2, 3, and 13, Burning Ground landfills (SWMUs 37-44), and SVS 6 were planted with a nurse crop and then drill seeded with native grasses.
- The nurse crop and native grass seeding was applied at double the minimum rate recommended in the erosion control plan.
- Erosion control blankets were placed on the slopes of Landfill 3 and the Burning Ground landfills.

Due to severe drought conditions over the last few years, Pantex increased the seeding rate to provide a better opportunity for the seeds to sprout. Because the seeds are viable for at least three years, Pantex proposes to lengthen the amount of time to evaluate the effectiveness of the reseeding. Pantex plans to evaluate reseeding efforts yearly, by the end of September, for the next three years (through 2016), then plan and perform further measures if needed. Please see Section 1.5 for the revised schedule.

Figure 2-23. Filling Low Areas in Landfills

Figure 2-24. Drill Seeding of Soils

Figure 2-25. Installing Retention Blankets on Landfill Slopes

Figure 2-26. ClosureTurf Anchor Trenching and Soil Preparation

Figure 2-27. Liner and Duraturf Installation

Figure 2-28. Sand Application on ClosureTurf

As part of the effort to control landfill erosion, a ClosureTurf™ system was installed at SWMU 68b, Landfill 1. This system consists of a 50 Mil linear low-density polyethylene grip-net geomembrane liner installed directly over the prepared subgrade surface, duraturf installed over the geomembrane liner, and a 1/2 –inch thick sand ballast layer placed and spread evenly over the duraturf. The installation of the ClosureTurf™ is depicted in the adjacent figures. The ClosureTurf™ installation consisted of the following steps:

- Site preparation: site vegetation removal, filling low areas, compaction of added soils, leveling of soils, inspection of smoothness to ensure protection of the liner, excavation of a 1′ x 2′ anchor trench, and final evaluation of slope to ensure positive drainage.
- Liner installation: rolling out liner, draping liner into anchor trenches, fusion welding of side seams, extrusion welding of end seams, destructive and non-destructive testing of the liner, and testing of welds.
- Duraturf installation: rolling out duraturf, sewing seams, anchor trench backfill and compaction, application of sand ballast, and verification of sand thickness.

Details of the ClosureTurf™ installation are included in Appendix G. Pantex plans to evaluate the reseeding effort and the ClosureTurf™ to determine the most effective way to control erosion and infiltration of water into the landfills. While the ClosureTurf™ is more expensive to install, costs are expected to be offset with time by lack of maintenance costs associated with settling of landfills and loss of vegetation that requires continued maintenance.

2.3.2.2 Review of Soil Disturbance

Pantex also conducts reviews of projects (referred to as SWMU interference) that will disturb SWMU soils. Project plans or work requests for repairs were reviewed to ensure that workers used necessary protective equipment and that soils were managed appropriately during execution of the work. In 2013, one SWMU interference permit for new construction projects in or near remedial action units was approved. That project is ongoing. Older listed projects from the completed project areas were inspected after completion of work to ensure all soils were returned to the excavation or kept within the contamination extent. Long-term projects are reviewed periodically to ensure that contractors are adhering to SWMU interference permit requirements.

Table 2-6 provides information on projects that were not complete by the last annual report as well as new SWMU interference projects from 2013. Three in-progress projects were not complete by the end of 2012. One of the three were completed in 2013; others are still in progress or have been placed on hold.

Table 2-6. SWMU Interference Log

Log #	State Approval Date	SWMU #	Explanation of Work
Current Projects			
SIN09-006	5/26/2009	5/6a, 5/6b, 5/7, 55, 68a, 103, 135, and WMG 5 & 6/7 extents	Scope: This project installed the High Pressure Fire Loop (HPFL). A trench 2 ft wide by 6 ft deep was dug to lay the piping. Borings were required under roadways, ramps, and sidewalks. This system was flushed before being put into service. The flush velocity was about 10 feet per second with a minimum flow time of 5 minutes. This resulted in each flush discharging approximately 18,312 gallons of water for a maximum pipe size of 16 in. Discharge was to a sanitary sewer, drainage ditch, or other approved location. The total number of flushes is estimated at 162 for all projects. Flushes were intermittent throughout each project and were coordinated with Environmental Programs personnel. The trenching and boring encountered several SWMUs located in Zone 12. Status: Complete. All disturbed soils were returned to the SWMU.

Log #	State Approval Date	SWMU #	Explanation of Work
SIN12-002	4/23/2012	WMG 1 and 2 (SWMU 147, AOC 8b, SVS 5, and 12)	Scope: Corp of Engineers: Army Corp of Engineers tied into various buildings within Zone 11 in order to provide communication capabilities to the new HEPF building. In order for this to take place an open trench excavation was required which impacted SWMU areas located in Zone 11. The trench was about 24 to 30 inches wide, 48 inches deep and 2800 linear feet long. Hydro-excavating was used to locate existing utilities along the path of the trench. All disturbed SWMU soil was returned to the excavation as backfill and no soil left the area. Status: Work is complete, soil returned to SWMU, but waiting for reseeding before project is complete.
SIN12-003	7/24/2012	WMG 1 (SWMU 60, 147, and SVS 5)	Scope: Zone 11 Steam Line. This SWMU permit covered the removal of the concrete steam trench located in Zone 11 and the replacement of the steam line, condensate line, and air line with an above ground system. Piers were dug to support the anchoring of the T-Pole Pipe Supports. Each pier was approximately 2 ½ feet in diameter and a depth of 6 feet and filled with concrete. The above ground system crossed Landfill 9 (SWMU 60) and was achieved by placing a PVC membrane in the pier holes that go through the landfill cover (up to 4 piers). The PVC membrane was covered with 6 inches of soil sloped away from each pier to promote positive drainage from the pier and off of the landfill cover. All disturbed SWMU soil was returned to the respective SWMU as backfill and no excess soil was removed from the site. Status: Complete. All disturbed soils were returned to the SWMU.
SIN12-004	9/18/2012	WMG 6/7 (SWMU 137 and 5/7 ditch)	Scope of 12-41 HVAC: The existing air handler and the two evaporative air conditioners were replaced with two new chillers and three new air handling units. The new air handling units would utilize chilled water for cooling and steam for heating. Heavy equipment, hand tools, and a hydro-excavator were used to install the new equipment. The soil disturbance for this project consisted of the following: 1. 5 - 8 inch concrete pads of various size with 24" footers 2. Protective bollards (1 foot 4 inch diameter by 3 feet 6 inches deep) 3. Pipe supports for the chilled water and steam lines (2 ½ feet in diameter by 6 feet deep) Status: Complete All disturbed soils were returned to the SWMU.

Log #	State Approval Date	SWMU #	Explanation of Work
SIN13-001	8/5/2013	WMG 10 and 11	Scope of Network infra-red (IR) Real-Time Air Monitoring System (RAMS): A new conduit system is required to support the new RAMS and IR Detection equipment that is located at the Plant. Open trench and/or directional boring will be used to install a Network Single Mode Fiber Optic Backbone in portions of the Plant. The path that was selected to install the network will have to cross or come in close proximity to SWMU extents or ditches. It is expected that all disturbed SWMU soil will be returned to the respective SWMU as backfill and no excess soil will need to be removed from the site. Status: In progress.
Projects On Hold			
SIN10-005	6/18/2010	SWMU 102,108,109	Scope: Maintenance personnel will excavate around two valves, 12NV2 and 12EV2, which are part of the water distribution system in Zone 12 North to gain access for replacement. Following completion of the work, the soil staged from excavation around the valves will be used to backfill the area. Status: Work pending.
SIN 11-002	3/10/2011	FS-10 (SWMU 72)	Scope: The yard group will excavate around valve AFSV7 and repair/replace the leaking domestic water valve. The excavation will be approximately 10′ wide x 10′ long x 3′ deep. The valve is located 20 feet southeast of FS-10. The water has been turned off to this valve since November 2009 and the soil should be dry. All excavated soil shall be returned to the excavation. Status: Work pending.

2.4 Long-Term Monitoring Well Network

2.4.1 Well Maintenance

An inspection and maintenance program is in place to routinely inspect the monitor wells during each semi-annual water level sampling event, visually inspect wells during sampling, and perform maintenance and repairs, as needed. Additional program activities, such as redevelopment, down-hole videos, pump and tubing bundle replacements, vegetation control, and other associated tasks, are completed when requested by the groundwater media scientist or identified by the field technicians. Water depths are measured at each sampling event and twice annually and total well depths are only measured when dedicated equipment is not present in the well.

Pantex also developed a new Well Maintenance Plan, as recommended in the Five-Year Review. That plan was completed in October 2013 and was implemented in January 2014. This plan formalized the well surveillance and inspection process already in place, and incorporated analytical and empirical data collected over time to develop a well maintenance schedule. Significant components of the plan include:

- Assigning an inspection and maintenance frequency of three years to all active Ogallala Aquifer monitoring wells as recommended in the Ogallala Aquifer Sampling Improvement Plan (B&W Pantex, 2013b).
- Assigning a maintenance frequency of two years for all wells with stainless steel screens that have documented well corrosion and elevated chromium concentrations.
- Assigning a default inspection frequency of five years for all perched aquifer LTM wells to comply with total depth measurement requirements in the Compliance Plan.

The 2013 maintenance log for groundwater wells is summarized in Table 2-7. This log contains all entries for well inspections, redevelopment of wells, changes in sample intake depths, and Bennett pump servicing at the wells. The log also contains the water depths and total well depths measured at wells when equipment was removed. The disposition of the purge water from well activities is also provided.

Pantex has identified, through the well videos, evidence of bacteria in many of the stainless steel wells. This condition is ubiquitous in monitor wells, especially in wells with lower groundwater velocity. This is occurring in both newly installed wells and older wells, in both the perched aquifer and Ogallala Aquifer. The bacteria may be the source of stainless steel corrosion indicators (chromium, manganese, molybdenum, and nickel) that become elevated in wells. Well videos recorded during routine well inspections indicate that a large percentage of wells have some biofouling. Pantex continues to evaluate rehabilitation methods for the biofouling.

Pantex has redeveloped wells, including brushing, bailing, and pumping, as necessary, when screens were impacted by biofouling or sedimentation or elevated chromium levels were observed (e.g., PTX06-1068). Based on well videos and total depth measurements, some wells were observed to have sediment in the sump, with a few wells having sediment built up into the bottom of the screen. None of the wells had more than 20% of the effective screen (saturated screen) silted in. Efforts were focused on cleaning or redeveloping wells to ensure that representative samples can be collected from the wells and to address wells that exhibited some loss of screen due to silting.

Table 2-7. 2013 Well Maintenance Activities

Location	Work date	Activity	Water Level (ft btoc)	Total Depth (ft btoc)	Sample Intake Depth (ft btoc)	Aquifer	Purge Water Disposal	Volume (gals)	Comments
OW-WR-19	7/10/2013	Redevelopment		244		P			
OW-WR-19	11/7/2013	Plugging and Abandonment		243		P			
PTX06-1005	8/28/2013	Well video and Bennett pump service	277.2	297	286	P	SEPTS	5	
PTX06-1008	4/5/2013	Bennett pump service	268.79	281	273	P			Preparation for redevelopment
PTX06-1008	4/9/2013	Well video	268.79	281		P			
PTX06-1008	4/12/2013	Re-development	268.79	281		P	SEPTS	25	
PTX06-1008	4/15/2013	Re-development	269	281		P	SEPTS	75	
PTX06-1008	4/19/2013	Well video	269	281		P			
PTX06-1008	5/3/2013	Bennett pump service	269	281	273	P	SEPTS	4	Installed tubing bundle and pump
PTX06-1011	7/11/2013	Bennett pump service	273.98	296		P			
PTX06-1011	10/22/2013	Redevelopment	274.4	296		P	SEPTS	400	
PTX06-1011	10/28/2013	Well Video	274.6	296		P			
PTX06-1013	3/13/2013	Bennett pump service	248.7	262	254	P			Pulled pump for re-development
PTX06-1013	3/15/2013	Re-development	248.7	262		P	SEPTS	150	
PTX06-1013	3/19/2013	Re-development	248.7	262		P	SEPTS	70	
PTX06-1013	3/21/2013	Well video	248.3	262		P			
PTX06-1013	3/28/2013	Re-development	248.3	262		P	SEPTS	110	
PTX06-1013	4/1/2013	Well video	248.6	262		P			
PTX06-1013	4/1/2013	Bennett pump service	248.6	262	254	P			Installed tubing bundle and pump
PTX06-1013	4/4/2013	Bennett pump service	248.6	262	254	P	SEPTS	5	Installed new pump
PTX06-1033	3/11/2013	Well video	446.9	551		O			
PTX06-1033	3/14/2013	Re-development	446.9	551		O	Ditch	200	
PTX06-1033	4/1/2013	Bennett pump service		551	457	O	Ditch	5	Installed tubing bundle and pump
PTX06-1038	6/11/2013	Bennett pump service	264.76	285	273	P	SEPTS	5	Added 6' drop tube to lower sample intake

Location	Work date	Activity	Water Level (ft btoc)	Total Depth (ft btoc)	Sample Intake Depth (ft btoc)	Aquifer	Purge Water Disposal	Volume (gals)	Comments
PTX06-1039A	2/8/2013	Bennett pump service	270.31	282	278	P	SEPTS	5	Added 7" drop tube to sample intake
PTX06-1040	5/28/2013	Bennett pump service	274.8	287	281	P			Added 10' drop tube to sample intake
PTX06-1040	5/28/2013	Bennett pump service	274.8	287	283	P	SEPTS	5	Installed new tubing bundle and pump
PTX06-1041	6/11/2013	Bennett pump service	275.48	301	286	P	SEPTS	5	Added 7' drop tube to lower sample intake
PTX06-1042	5/28/2013	Bennett pump service	275.78	285	285	P	SEPTS	5	Added 8' drop tube to sample intake
PTX06-1048A	9/12/2013	Bennett pump service and Well video	237	245	239.5	P	SEPTS	5	Well inspection
PTX06-1061	4/16/2013	Bennett pump service	500.11	844	511	O			Installed 15' drop tube to sample intake
PTX06-1061	4/17/2013	Bennett pump service	500.11	844	511	O	Ditch	10	Installed new pump
PTX06-1068	2/18/2013	Bennett pump service and Pre-sample purge	517.81	801	534	O	Ditch	85	Pump inspection
PTX06-1068	2/19/2013	Pre-sample purge	518.09	801	534	O	Ditch	115	
PTX06-1095A	8/22/2013	Bennett pump service	275.3	288	275	P			
PTX06-1095A	8/23/2013	Well video and Bennett pump service	275.3	288	280	P	SEPTS	5	Installed 15' drop tube to sample intake
PTX06-1098	3/7/2013	Bennett pump service	277.13	306	283	P	SEPTS	3	Installed dedicated tubing bundle and pump
PTX06-1120	5/20/2013	Bennett pump service	278.56	285	282	P	SEPTS	1	Installed new tubing bundle and pump
PTX06-1121	5/20/2013	Bennett pump service	278.7	280	279	P			Installed new tubing bundle and pump
PTX06-1121	5/28/2013	Bennett pump service			279	P			Removed pump and tubing bundle

Location	Work date	Activity	Water Level (ft btoc)	Total Depth (ft btoc)	Sample Intake Depth (ft btoc)	Aquifer	Purge Water Disposal	Volume (gals)	Comments
PTX06-1126	4/26/2013	Bennett pump service	270.4	289.5		P			Removed pump and tubing bundle for pump test
PTX06-1126	5/22/2013	Bennett pump service	269.45	289	277	P	SEPTS	5	Installed tubing bundle and pump
PTX06-1133A	5/20/2013	Bennett pump service	277.28	280	279	P	SEPTS	1	Installed new tubing bundle and pump
PTX06-1136	6/13/2013	Bennett pump service	273.43	284	282	P	SEPTS	5	Added 10' drop tube to lower sample intake
PTX06-1146	6/13/2013	Bennett pump service	272.96	284	275	P			
PTX06-1146	7/9/2013	Redevelopment				P	SEPTS	350	
PTX06-1146	7/23/2013	Well video and Bennett pump service	272.55	294	283	P	SEPTS	5	
PTX06-1149	7/23/2013	Bennett pump service and Well video				P			
PTX06-1149	9/9/2013	Well video	258.5			P			Replacement well video
PTX06-1149	9/23/2013	Well video	258.6			P			Post-redevelopment
PTX06-1149	9/30/2013	Well Video	258.8	272		P			Post-redevelopment
PTX06-1149	10/10/2013	Bennett pump service	258.9	272	264	P	SEPTS	5	Installed new pump
PTX06-1151	4/26/2013	Bennett pump service	274.5	296.5		P			Removed pump and tubing bundle for pump test
PTX06-1151	5/23/2013	Bennett pump service	274.5	296	281	P	SEPTS	5	Installed tubing bundle and pump
PTX06-1159	1/24/2013	Bennett pump service	270.79	289.5	276	P	SEPTS	10	Installed new pump and tubing bundle
PTX06-1160	1/24/2013	Bennett pump service	275.2	302	280	P	SEPTS	10	Installed new pump and tubing bundle
PTX06-1162	3/26/2013	Water level measurement and total depth	272.37	291		P			
PTX06-1163	3/26/2013	Water level measurement and total depth	274.25	295		P			

Location	Work date	Activity	Water Level (ft btoc)	Total Depth (ft btoc)	Sample Intake Depth (ft btoc)	Aquifer	Purge Water Disposal	Volume (gals)	Comments
PTX06-1166	1/22/2013	Bennett pump service	280.02	290	285	P	SEPTS	10	Installed new pump and tubing bundle
PTX06-1167	8/8/2013	Well video		282		P			
PTX06-EW-10	1/17/2013	Extraction well service				P			Installed new pump
PTX06-EW-12	10/1/2013	Extraction well service				P			Pulled tubing bundle and pump for redevelopment
PTX06-EW-12	10/2/2013	Extraction well service	270.6	282		P			Well video
PTX06-EW-12	10/3/2013	Extraction well service	270.7	282		P	SEPTS	60	Redevelopment
PTX06-EW-12	10/7/2013	Extraction well service				P			Installed tubing bundle and pump
PTX06-EW-24	6/4/2013	Installed new pump		299		P			Installed new pump
PTX06-EW-35	10/1/2013	Extraction well service				P			
PTX06-EW-35	10/2/2013	Extraction well service	270.7	286		P			Well video
PTX06-EW-35	10/3/2013	Extraction well service	270.8	286		P	SEPTS	70	Redevelopment
PTX06-EW-35	10/16/2013	Extraction well service				P			Installed tubing bundle and pump
PTX06-EW-45	12/2/2013	Extraction well service	271.8	282		P			
PTX06-EW-45	12/3/2013	Extraction well service	271.8	282		P			Well video
PTX06-EW-45	12/13/2013	Extraction well service	271.8	282		P			Installed tubing bundle and pump
PTX06-EW-46	12/2/2013	Extraction well service	272.1	290		P			
PTX06-EW-46	12/3/2013	Extraction well service	272.1	290		P			Well video
PTX06-EW-46	12/13/2013	Extraction well service	272.1	290		P			Installed tubing bundle and pump
PTX06-EW-53	11/21/2013	Extraction well service	271.9	280		P			
PTX06-EW-53	12/2/2013	Extraction well service	272			P			Well video
PTX06-EW-53	12/16/2013	Extraction well service	271.9	281.5		P	SEPTS	75	Redevelopment
PTX06-EW-53	12/17/2013					P			Well video
PTX06-EW-53	12/18/2013					P			Installed tubing bundle and pump
PTX06-EW-54	11/21/2013	Extraction well service	265.9	280		P			
PTX06-EW-54	12/3/2013	Extraction well service	266.3	280		P			Well video

Location	Work date	Activity	Water Level (ft btoc)	Total Depth (ft btoc)	Sample Intake Depth (ft btoc)	Aquifer	Purge Water Disposal	Volume (gals)	Comments
PTX06-EW-54	12/13/2013	Extraction well service	265.9	280		P			Installed tubing bundle and pump
PTX06-EW-58	9/30/2013	Extraction well service		283		P			Pump service
PTX06-EW-58	10/1/2013	Extraction well service		283		P			
PTX06-EW-66	4/30/2013	Extraction well service		291		P			Installed new pump
PTX06-EW-68	10/2/2013	Extraction well service	272.3	295		P			
PTX06-EW-68	10/3/2013	Extraction well service	272.1	293		P			Well video
PTX06-EW-68	10/4/2013	Extraction well service	272.3	293		P	SEPTS	40	Redevelopment
PTX06-EW-68	10/7/2013	Extraction well service				P			Installed tubing bundle and pump
PTX06-EW-71	5/9/2013	Extraction well service				P			Pulled pump for re-development
PTX06-EW-71	5/13/2013	Extraction well service	229.68	264		P	SEPTS	75	Re-development
PTX06-EW-71	5/16/2013	Extraction well service	229.68	264		P			Installed tubing bundle and pump
PTX06-EW-72	9/25/2013	Extraction well service and Re-development		275		P	SEPTS	225	
PTX06-EW-72	9/27/2013	Well Video	226.4	275		P			
PTX06-EW-72	9/30/2013	Extraction well service		275		P			
PTX06-EW-73	3/14/2013	Extraction well service				P			Changed transducer
PTX06-EW-73	5/9/2013	Extraction well service				P			Redevelopment
PTX06-EW-73	5/10/2013	Extraction well service	225.1	277		P	SEPTS	230	Re-development
PTX06-EW-73	5/17/2013	Extraction well service	225.1	277		P			Installed tubing bundle and pump
PTX06-EW-74	4/30/2013	Extraction well service				P			Removed pump and tubing bundle
PTX06-EW-74	5/1/2013	Extraction well service				P			Well video
PTX06-EW-74	5/8/2013	Extraction well service	225.1	280		P	SEPTS	170	Re-development
PTX06-EW-74	5/9/2013	Extraction well service	225.1	280		P			Installed tubing bundle and pump
PTX06-EW-78A	5/31/2013	Extraction well service				P			Pulled tubing bundle and pump for redevelopment
PTX06-EW-78A	6/3/2013	Extraction well service	228.2	293		P	SEPTS	50	Rehabilitation

Location	Work date	Activity	Water Level (ft btoc)	Total Depth (ft btoc)	Sample Intake Depth (ft btoc)	Aquifer	Purge Water Disposal	Volume (gals)	Comments
PTX06-EW-78A	6/4/2013	Extraction well service	228.2	293		P			Installed new pump
PTX06-EW-78A	10/17/2013	Extraction well service				P			Well maintenance
PTX06-EW-79	4/5/2013	Extraction well service				P			Changed transducer
PTX06-EW-79	4/29/2013	Extraction well service	230.6	279		P			Well maintenance and video
PTX06-EW-79	5/7/2013	Extraction well service	230.6	279		P	SEPTS	270	Re-development
PTX06-EW-79	5/9/2013	Extraction well service	230.6	279		P			Installed tubing bundle and pump
PTX06-EW-80	5/31/2013	Extraction well service				P			
PTX06-EW-80	6/3/2013	Extraction well service	231.38	264		P	SEPTS	50	Rehabilitation
PTX06-EW-80	6/5/2013	Extraction well service	231.38	264		P			Installed new pump
PTX06-EW-81A	10/1/2013	Extraction well service	239.3	295		P			Well video
PTX06-INJ-12A	1/8/2013	Rehabilitation and Well video		262		P			
PTX06-PZ01	9/11/2013	Water level measurement and total depth	258.2	276		P			
PTX06-PZ02	9/11/2013	Water level measurement and total depth	257.6	267		P			
PTX06-PZ03	9/11/2013	Water level measurement and total depth	259.3	280		P			
PTX06-PZ04	9/11/2013	Water level measurement and total depth		249		P			
PTX06-PZ05	9/11/2013	Water level measurement and total depth	266.2	287		P			
PTX06-PZ06	9/11/2013	Water level measurement and total depth	276.1	283		P			
PTX07-1O03	7/24/2013	Bennett pump service	252.44	261	257	P	SEPTS	5	Added 15' drop tube to lower sample intake
PTX08-1001	8/6/2013	Bennett pump service				P			Left bundle and pump in place due to collapse of well during drilling of replacement well
PTX08-1001	9/30/2013	Well Video	229.7	279		P			Post development of new well

Location	Work date	Activity	Water Level (ft btoc)	Total Depth (ft btoc)	Sample Intake Depth (ft btoc)	Aquifer	Purge Water Disposal	Volume (gals)	Comments
PTX08-1001	10/3/2013	Well Video	229.7	279		P			
PTX08-1001	10/21/2013	Bennett pump service	230.7	279	240	P	SEPTS	5	Installed new pump
PTX08-1002	8/6/2013	Bennett pump service	229.6	232	229	P			Pulled tubing bundle and pump to prepare for P&A
PTX08-1002	10/1/2013	Well Video	233.3	263		P			Post development of new well
PTX08-1002	10/10/2013	Bennett pump service	233.3	263	238	P	SEPTS	5	Installed new pump
PTX08-1005	4/26/2013	Bennett pump service	272.98	291.5		P			Removed pump and tubing bundle for pump test
PTX08-1005	5/23/2013	Bennett pump service	272.98	291	285	P	SEPTS	5	Installed tubing bundle and pump
PTX08-1005	10/23/2013	Bennett pump service	273	291	283	P	SEPTS	3	Installed new pump
PTX-BEG3	8/6/2013	Bennett pump service	253.4	285		P			Pulled tubing bundle and pump to prepare for P&A
PTX-BEG3	11/14/2013	Well Video				P			
PTX-BEG3	11/15/2013	Well Video	233.2			P			

btoc – below top of casing

Water level and total depth measurements are required only once during a well maintenance event, although daily measurements were collected during some maintenance activities. Total well depths are only required when all equipment is removed from the well.

Pump intake depth measurements are necessary only when the depths are reset.

2.4.2 Well Casing Elevations

In accordance with CP-50284, Pantex periodically surveys top of casing elevations at wells. This must be performed every 10 years, at a minimum, for wells included in the monitoring network. Pantex also maintains wells not included in the monitoring network to evaluate water levels. These additional wells are also surveyed to ensure that water table maps developed from water level readings will be correct.

Pantex resurveyed all wells in 2010 using Pantex's real-time kinetic GPS system that is calibrated to the National Geodetic Survey. This system will be consistently used for surveying wells in the future. Those well elevations were included in the *2010 Annual Progress Report* (B&W Pantex, 2011a).

Four perched monitoring wells were replaced and one monitoring well and extraction well was installed during 2013. Initial well surveys are completed by a licensed surveyor and those new elevations are included in Table 2-8. Additionally, Pantex resurveyed top of casing (TOC) elevations at wells on the western end of the Southeast ISB during 2013 as part of the continuing evaluation of water flow and treatment on the western of the ISB. The TOCs were similar to those previously surveyed at the wells.

Table 2-8. Well Elevations

Well	Northing	Easting	Ground Surface Elevation (amsl)	TOC Elevation (amsl)
Wells Installed in 2013				
PTX06-1149	3754717.64	635864.13	3529.28	3531.45
PTX06-1167	3752653.00	640913.72	3527.72	3529.82
PTX06-EW-81A	3762095.77	639773.41	3499.00	3525.79
PTX08-1001	3762976.26	638941.45	3516.63	3518.86
PTX08-1002	3763003.22	640859.00	3514.71	3517.01
Resurveyed Wells				
PTX06-ISB033	3752376.96	641369.86	3527.67	3529.79
PTX06-ISB034	3752406.32	641467.42	3527.38	3529.48
PTX06-ISB035	3752433.78	641563.24	3527.02	3529.13
PTX06-ISB015	3752477.10	641282.52	3528.12	3530.25
PTX06-ISB014	3752450.20	641187.89	3528.30	3530.43
PTX06-ISB013	3752438.52	641095.22	3528.29	3530.41
PTX06-ISB012	3752391.65	640997.06	3529.05	3531.17
PTX06-ISB011	3752362.89	640900.99	3528.69	3530.75
PTX06-ISB010	3752334.09	640805.09	3529.17	3531.32
PTX06-ISB032	3752350.04	641277.03	3528.16	3530.31
PTX06-ISB031	3752311.97	641176.00	3527.61	3529.67

Well	Northing	Easting	Ground Surface Elevation (amsl)	TOC Elevation (amsl)
PTX06-ISB030	3752284.96	641094.14	3528.45	3530.63
PTX06-ISB029	3752252.26	640994.41	3528.34	3530.46
PTX06-1153	3752089.30	641184.19	3527.17	3529.29
PTX06-1037	3752191.94	641548.69	3525.94	3528.44

amsl – above mean sea level TOC - top of casing

2.4.3 Water Level Elevations and Total Depths

In accordance with requirements in Article VI.C.4 and Table VIII of the CP-50284, Pantex is to measure water level elevations at each well during each sampling event and total well depths when dedicated pumps are removed or when the well is sampled if no dedicated pump is installed. Pantex also measures water level at all wells twice per year to provide consistent measurements for mapping of the water table. Water level measurements are also taken during any well maintenance activities. In accordance with Table VIII of CP-50284, Table 2-9 provides the measurements and corresponding water elevations and total depth elevations. Some sampling measurements were determined to be unusable based on comparison to past data and measurements were repeated. Those data determined to be unusable are not included in Table 2-9.

Table 2-9. Depth to Water, Total Depth Measurements, and Groundwater Elevations

Location	Aquifer	Measurement Date	Depth to Water ft btoc	Total Well Depth ft btoc	GW Elevation ft amsl	Total Depth Elevation ft amsl
1114-MW4	P	5/14/2013	273.09		3277.64	
1114-MW4	P	6/18/2013	273.2		3277.53	
1114-MW4	P	11/5/2013	273.3		3277.43	
1114-MW4	P	11/5/2013	273.3		3277.43	
1114-MW4	P	12/11/2013	273.57		3277.16	
OW-WR-19	P	6/18/2013	Dry			
OW-WR-19	P	7/10/2013		244		3299.16
OW-WR-19	P	11/7/2013		243		3300.16
OW-WR-38	P	5/13/2013	223.29		3298.65	
OW-WR-38	P	6/18/2013	223.18		3298.76	
OW-WR-38	P	12/10/2013	223.4		3298.54	
OW-WR-45	P	6/21/2013	263.82		3283.28	
OW-WR-45	P	12/12/2013	264.43		3282.67	
PTX01-1001	P	5/2/2013	289.04		3280.12	
PTX01-1001	P	6/18/2013	288.83		3280.33	
PTX01-1001	P	10/30/2013	288.7		3280.46	

Location	Aquifer	Measurement Date	Depth to Water ft btoc	Total Well Depth ft btoc	GW Elevation ft amsl	Total Depth Elevation ft amsl
PTX01-1001	P	12/10/2013	288.75		3280.41	
PTX01-1002	P	4/23/2013	265.43		3297.84	
PTX01-1002	P	6/24/2013	265.18		3298.09	
PTX01-1002	P	12/10/2013	265.26		3298.01	
PTX01-1004	P	6/18/2013	Dry			
PTX01-1004	P	12/10/2013	Dry			
PTX01-1006	P	6/18/2013	Dry			
PTX01-1006	P	12/10/2013	Dry			
PTX01-1007	P	6/18/2013	Dry			
PTX01-1007	P	12/10/2013	Dry			
PTX01-1008	P	2/4/2013	276.38		3294.39	
PTX01-1008	P	5/2/2013	276.13		3294.65	
PTX01-1008	P	6/18/2013	276.54		3294.24	
PTX01-1008	P	10/30/2013	276.6		3294.18	
PTX01-1008	P	12/10/2013	276.74		3294.04	
PTX01-1009	P	6/18/2013	Dry			
PTX01-1009	P	12/11/2013	Dry			
PTX01-1010	O	1/23/2013	495.9		3080.25	
PTX01-1010	O	6/18/2013	499.6		3076.55	
PTX01-1010	O	8/1/2013	503.65		3072.5	
PTX01-1010	O	12/10/2013	499.12		3077.03	
PTX01-1011	O	1/23/2013	492.81		3082.26	
PTX01-1011	O	6/18/2013	494.68		3080.39	
PTX01-1011	O	8/1/2013	496.71		3078.36	
PTX01-1011	O	12/10/2013	495.69		3079.38	
PTX01-1012	O	2/11/2013	506.69		3068.07	
PTX01-1012	O	6/24/2013	509.6		3065.16	
PTX01-1012	O	7/22/2013	518.66		3056.09	
PTX01-1012	O	12/10/2013	510.6		3064.16	
PTX01-1013	O	2/11/2013	503.56		3080.74	
PTX01-1013	O	6/24/2013	505.7		3078.60	
PTX01-1013	O	7/22/2013	512.74		3071.56	
PTX01-1013	O	12/10/2013	507.2		3077.10	
PTX01-1014A	P	6/24/2013	Dry			
PTX01-1014A	P	12/10/2013	Dry			
PTX04-1001	P	6/18/2013	221.13		3306.65	
PTX04-1001	P	12/10/2013	221.2		3306.58	
PTX04-1002	P	6/18/2013	224.72		3306.53	

Location	Aquifer	Measurement Date	Depth to Water ft btoc	Total Well Depth ft btoc	GW Elevation ft amsl	Total Depth Elevation ft amsl
PTX04-1002	P	7/23/2013	224.76		3306.49	
PTX04-1002	P	12/10/2013	224.8		3306.45	
PTX06-1001A	P	6/18/2013	256.95		3284.91	
PTX06-1001A	P	12/10/2013	256.7		3285.16	
PTX06-1002A	P	2/18/2013	259.03		3282.35	
PTX06-1002A	P	6/18/2013	259.45		3281.93	
PTX06-1002A	P	8/26/2013	259.8		3281.58	
PTX06-1002A	P	12/10/2013	260.1		3281.28	
PTX06-1003	P	6/18/2013	263.95		3275.87	
PTX06-1003	P	8/26/2013	264.2		3275.62	
PTX06-1003	P	12/10/2013	264.5		3275.32	
PTX06-1005	P	2/6/2013	275.93		3261.98	
PTX06-1005	P	6/18/2013	276.7		3261.21	
PTX06-1005	P	8/28/2013	277.2	297	3260.71	3240.91
PTX06-1005	P	9/3/2013	277.4		3260.51	
PTX06-1005	P	12/10/2013	278.2		3259.71	
PTX06-1006	P	6/21/2013	268.33		3276.59	
PTX06-1006	P	9/3/2013	268.5		3276.42	
PTX06-1006	P	12/12/2013	268.5		3276.42	
PTX06-1007	P	5/16/2013	268.23		3278.47	
PTX06-1007	P	6/18/2013	268.31		3278.39	
PTX06-1007	P	12/12/2013	268.6		3278.09	
PTX06-1008	P	4/5/2013	268.79	281	3280.39	3268.18
PTX06-1008	P	4/9/2013	268.79	281	3280.39	3268.18
PTX06-1008	P	4/12/2013	268.79	281	3280.39	3268.18
PTX06-1008	P	4/15/2013	269	281	3280.18	3268.18
PTX06-1008	P	4/19/2013	269	281	3280.18	3268.18
PTX06-1008	P	5/3/2013	269	281	3280.18	3268.18
PTX06-1008	P	5/16/2013	268.83		3280.35	
PTX06-1008	P	6/18/2013	268.92		3280.26	
PTX06-1008	P	6/18/2013	268.96		3280.22	
PTX06-1008	P	12/12/2013	269.3		3279.88	
PTX06-1009	P	6/21/2013	265.72		3280.89	
PTX06-1009	P	12/12/2013	265.77		3280.84	
PTX06-1010	P	5/20/2013	259.5		3286.66	
PTX06-1010	P	6/21/2013	259.53		3286.63	
PTX06-1010	P	11/5/2013	259.7		3286.46	
PTX06-1010	P	12/12/2013	259.8		3286.36	

Location	Aquifer	Measurement Date	Depth to Water ft btoc	Total Well Depth ft btoc	GW Elevation ft amsl	Total Depth Elevation ft amsl
PTX06-1011	P	5/20/2013	273.97		3271.39	
PTX06-1011	P	6/21/2013	274.08		3271.29	
PTX06-1011	P	7/11/2013	273.98	296	3271.39	3249.37
PTX06-1011	P	10/22/2013	274.4	296	3270.97	3249.37
PTX06-1011	P	10/28/2013	274.6	296	3270.77	3249.37
PTX06-1011	P	12/12/2013	274.5		3270.87	
PTX06-1012	P	1/29/2013	269.67		3271.19	
PTX06-1012	P	4/22/2013	269.72		3271.14	
PTX06-1012	P	6/17/2013	269.58		3271.28	
PTX06-1012	P	7/22/2013	269.55		3271.31	
PTX06-1012	P	10/28/2013	269.69		3271.17	
PTX06-1012	P	12/12/2013	269.85		3271.01	
PTX06-1013	P	3/13/2013	248.7	262	3295.54	3282.24
PTX06-1013	P	3/15/2013	248.7	262	3295.54	3282.24
PTX06-1013	P	3/19/2013	248.7	262	3295.54	3282.24
PTX06-1013	P	3/21/2013	248.3	262	3295.94	3282.24
PTX06-1013	P	3/28/2013	248.3	262	3295.94	3282.24
PTX06-1013	P	4/1/2013	248.6	262	3295.64	3282.24
PTX06-1013	P	4/1/2013	248.6	262	3295.64	3282.24
PTX06-1013	P	4/4/2013	248.6	262	3295.64	3282.24
PTX06-1013	P	5/13/2013	248.56		3295.68	
PTX06-1013	P	6/18/2013	248.48		3295.76	
PTX06-1013	P	10/30/2013	248.6		3295.64	
PTX06-1013	P	12/10/2013	248.6		3295.64	
PTX06-1014	P	6/18/2013	273.1		3260.04	
PTX06-1014	P	7/24/2013	276.31		3256.83	
PTX06-1014	P	12/10/2013	276.9		3256.24	
PTX06-1015	P	2/5/2013	282.71		3247.39	
PTX06-1015	P	6/18/2013	282.84		3247.26	
PTX06-1015	P	6/18/2013	282.84		3247.26	
PTX06-1015	P	8/12/2013	282.9		3247.20	
PTX06-1015	P	12/11/2013	283.1		3247.0	
PTX06-1017	P	6/18/2013	277.17		3256.49	
PTX06-1017	P	12/10/2013	276.5		3257.16	
PTX06-1023	P	2/4/2013	245.77		3298.66	
PTX06-1023	P	2/4/2013	245.77		3298.66	
PTX06-1023	P	6/18/2013	245.8		3298.63	
PTX06-1023	P	8/20/2013	245.9		3298.53	

Location	Aquifer	Measurement Date	Depth to Water ft btoc	Total Well Depth ft btoc	GW Elevation ft amsl	Total Depth Elevation ft amsl
PTX06-1023	P	12/10/2013	246		3298.43	
PTX06-1030	P	4/29/2013	280.95		3251.47	
PTX06-1030	P	6/18/2013	281.07		3251.35	
PTX06-1030	P	6/18/2013	281.07		3251.35	
PTX06-1030	P	11/14/2013	281.3		3251.12	
PTX06-1030	P	12/10/2013	281.4		3251.02	
PTX06-1031	P	4/29/2013	280.67		3247.86	
PTX06-1031	P	6/24/2013	280.8		3247.73	
PTX06-1031	P	11/14/2013	280.9		3247.63	
PTX06-1031	P	12/10/2013	280.9		3247.63	
PTX06-1033	O	3/11/2013	446.9	551	3094.38	2990.28
PTX06-1033	O	3/14/2013	446.9	551	3094.38	2990.28
PTX06-1033	O	4/1/2013		551		2990.28
PTX06-1033	O	4/18/2013	446.97		3094.31	
PTX06-1033	O	6/18/2013	447.04		3094.24	
PTX06-1033	O	10/29/2013	447.5		3093.78	
PTX06-1033	O	12/10/2013	446.8		3094.48	
PTX06-1034	P	2/19/2013	282.01		3242.91	
PTX06-1034	P	6/24/2013	282.03		3242.89	
PTX06-1034	P	8/7/2013	282		3242.92	
PTX06-1034	P	8/27/2013	282.1		3242.82	
PTX06-1034	P	12/10/2013	282		3242.92	
PTX06-1035	P	2/18/2013	272.01		3269.68	
PTX06-1035	P	6/18/2013	271.4		3270.29	
PTX06-1035	P	8/14/2013	271.8		3269.89	
PTX06-1035	P	12/10/2013	271.5		3270.19	
PTX06-1036	P	6/21/2013	282.4		3252.21	
PTX06-1036	P	7/24/2013	283.51		3251.1	
PTX06-1036	P	12/11/2013	282.6		3252.01	
PTX06-1037	P	2/5/2013	278.71		3249.64	
PTX06-1037	P	4/23/2013	278.86		3249.49	
PTX06-1037	P	6/20/2013	278.79		3249.56	
PTX06-1037	P	7/23/2013	278.82		3249.53	
PTX06-1037	P	10/24/2013	278.68		3249.67	
PTX06-1037	P	12/16/2013	278.69		3249.66	
PTX06-1038	P	1/31/2013	264.61		3277.68	
PTX06-1038	P	6/11/2013	264.76	285	3277.53	3257.29
PTX06-1038	P	6/18/2013	264.66		3277.63	

Location	Aquifer	Measurement Date	Depth to Water ft btoc	Total Well Depth ft btoc	GW Elevation ft amsl	Total Depth Elevation ft amsl
PTX06-1038	P	8/7/2013	264.8		3277.49	
PTX06-1038	P	8/27/2013	264.8		3277.49	
PTX06-1038	P	12/10/2013	264.9		3277.39	
PTX06-1039A	P	2/8/2013	270.31	282	3270.39	3258.71
PTX06-1039A	P	2/18/2013	270.61		3270.1	
PTX06-1039A	P	2/18/2013	270.61		3270.1	
PTX06-1039A	P	6/18/2013	270.9		3269.81	
PTX06-1039A	P	8/7/2013	271.1		3269.61	
PTX06-1039A	P	8/27/2013	271.2		3269.51	
PTX06-1039A	P	12/10/2013	271.3		3269.41	
PTX06-1040	P	2/7/2013	274.39		3265.27	
PTX06-1040	P	2/7/2013	274.39		3265.27	
PTX06-1040	P	5/28/2013	274.8	287	3264.86	3252.66
PTX06-1040	P	5/28/2013	274.8	287	3264.86	3252.66
PTX06-1040	P	6/18/2013	274.7		3264.96	
PTX06-1040	P	8/21/2013	275.2		3264.46	
PTX06-1040	P	12/10/2013	276.4		3263.26	
PTX06-1041	P	2/7/2013	274.66		3264.1	
PTX06-1041	P	6/11/2013	275.48	301	3263.28	3237.76
PTX06-1041	P	6/18/2013	275.42		3263.34	
PTX06-1041	P	8/21/2013	275.7		3263.06	
PTX06-1041	P	12/10/2013	276.5		3262.26	
PTX06-1042	P	1/31/2013	275.54		3259.83	
PTX06-1042	P	1/31/2013	275.54		3259.83	
PTX06-1042	P	5/28/2013	275.78	285	3259.59	3250.37
PTX06-1042	P	6/18/2013	275.75		3259.62	
PTX06-1042	P	6/18/2013	275.74		3259.63	
PTX06-1042	P	8/21/2013	276		3259.37	
PTX06-1042	P	12/10/2013	276.5		3258.87	
PTX06-1043	O	1/22/2013	444.23		3080.41	
PTX06-1043	O	6/18/2013	444.76		3079.88	
PTX06-1043	O	8/5/2013	445.1		3079.54	
PTX06-1043	O	12/10/2013	445.6		3079.04	
PTX06-1044	O	4/17/2013	487.18		3057.34	
PTX06-1044	O	6/18/2013	488.39		3056.12	
PTX06-1044	O	10/29/2013	491.1		3053.41	
PTX06-1044	O	12/10/2013	491.6		3052.91	
PTX06-1045	P	6/20/2013	Dry			

Location	Aquifer	Measurement Date	Depth to Water ft btoc	Total Well Depth ft btoc	GW Elevation ft amsl	Total Depth Elevation ft amsl
PTX06-1045	P	7/23/2013	Dry			
PTX06-1045	P	10/24/2013		284		3244.2
PTX06-1045	P	12/16/2013	Dry			
PTX06-1046	P	1/28/2013	279.87		3246.66	
PTX06-1046	P	1/28/2013	279.87		3246.66	
PTX06-1046	P	6/21/2013	280.09		3246.44	
PTX06-1046	P	8/12/2013	280.2		3246.33	
PTX06-1046	P	12/11/2013	280.5		3246.03	
PTX06-1047A	P	1/28/2013	278.35		3246.61	
PTX06-1047A	P	1/28/2013	278.35		3246.61	
PTX06-1047A	P	6/21/2013	278.37		3246.59	
PTX06-1047A	P	8/12/2013	278.5		3246.46	
PTX06-1047A	P	12/11/2013	278.6		3246.36	
PTX06-1048A	P	4/23/2013	236.87		3303.67	
PTX06-1048A	P	6/18/2013	236.69		3303.85	
PTX06-1048A	P	9/12/2013	237	245	3303.54	3295.54
PTX06-1048A	P	12/10/2013	236.9		3303.64	
PTX06-1049	P	5/15/2013	274.05		3282.53	
PTX06-1049	P	6/24/2013	274.24		3282.34	
PTX06-1049	P	11/21/2013	274.4		3282.18	
PTX06-1049	P	12/11/2013	274.69		3281.89	
PTX06-1050	P	4/22/2013	258.39		3295.991	
PTX06-1050	P	6/24/2013	258.71		3295.67	
PTX06-1050	P	11/21/2013	259.2		3295.18	
PTX06-1050	P	12/11/2013	259.67		3294.71	
PTX06-1051	P	6/21/2013	Dry			
PTX06-1051	P	12/11/2013	Dry			
PTX06-1052	P	2/5/2013	276.36		3260.64	
PTX06-1052	P	6/24/2013	276.52		3260.48	
PTX06-1052	P	8/8/2013	276.6		3260.4	
PTX06-1052	P	12/11/2013	277.1		3259.9	
PTX06-1053	P	4/30/2013	249.36		3270.48	
PTX06-1053	P	6/21/2013	249.45		3270.39	
PTX06-1053	P	11/18/2013	249.8		3270.04	
PTX06-1053	P	12/11/2013	249.8		3270.04	
PTX06-1055	P	6/24/2013	Dry			
PTX06-1055	P	12/11/2013	Dry			
PTX06-1056	O	4/17/2013	396.74		3136.22	

Location	Aquifer	Measurement Date	Depth to Water ft btoc	Total Well Depth ft btoc	GW Elevation ft amsl	Total Depth Elevation ft amsl
PTX06-1056	O	6/18/2013	397.02		3135.94	
PTX06-1056	O	6/18/2013	397.02		3135.94	
PTX06-1056	O	10/28/2013	397.1		3135.86	
PTX06-1056	O	12/11/2013	397.4		3135.56	
PTX06-1057A	O	4/18/2013	465.56		3101.54	
PTX06-1057A	O	6/18/2013	465.95		3101.15	
PTX06-1057A	O	12/11/2013	467.05		3100.05	
PTX06-1058	O	6/18/2013	401.51		3167.04	
PTX06-1058	O	7/31/2013	401.97		3166.58	
PTX06-1058	O	12/11/2013	402.28		3166.27	
PTX06-1059	O	6/18/2013	414.23		3133.8	
PTX06-1059	O	7/31/2013	414.39		3133.64	
PTX06-1059	O	12/11/2013	415.08		3132.95	
PTX06-1060	O	4/15/2013	359.45		3213.31	
PTX06-1060	O	6/24/2013	359.45		3213.31	
PTX06-1060	O	12/12/2013	359.9		3212.86	
PTX06-1061	O	4/16/2013	500.11	844	3092.41	2748.52
PTX06-1061	O	4/17/2013	500.11	844	3092.4	2748.52
PTX06-1061	O	4/18/2013	500.53		3091.9	
PTX06-1061	O	6/24/2013	501.18		3091.34	
PTX06-1061	O	12/10/2013	502.4		3090.12	
PTX06-1062A	O	1/23/2013	501.12		3072.84	
PTX06-1062A	O	6/24/2013	502.65		3071.31	
PTX06-1062A	O	8/1/2013	505.23		3068.73	
PTX06-1062A	O	12/10/2013	503.85		3070.11	
PTX06-1064	O	2/11/2013	508.12		3056.51	
PTX06-1064	O	6/24/2013	509.05		3055.58	
PTX06-1064	O	10/30/2013	510.3		3054.33	
PTX06-1064	O	12/10/2013	510.1		3054.53	
PTX06-1068	O	2/18/2013	517.81	801	3020.9	2737.71
PTX06-1068	O	2/19/2013	518.09	801	3020.62	2737.71
PTX06-1068	O	2/20/2013	517.81		3020.9	
PTX06-1068	O	4/15/2013	517.43		3021.28	
PTX06-1068	O	6/18/2013	518.64		3020.07	
PTX06-1068	O	11/12/2013	520.4		3018.31	
PTX06-1068	O	12/10/2013	519.8		3018.91	
PTX06-1069	P	6/24/2013	Dry			
PTX06-1069	P	7/24/2013	253.26		3279.75	

Location	Aquifer	Measurement Date	Depth to Water ft btoc	Total Well Depth ft btoc	GW Elevation ft amsl	Total Depth Elevation ft amsl
PTX06-1069	P	12/11/2013	253.6		3279.41	
PTX06-1071	P	6/18/2013	224.12		3307.1	
PTX06-1071	P	12/10/2013	224.2		3307.02	
PTX06-1072	O	1/24/2013	415.83		3135.97	
PTX06-1072	O	6/18/2013	416		3135.8	
PTX06-1072	O	8/6/2013	415.9		3135.9	
PTX06-1072	O	12/11/2013	416.73		3135.7	
PTX06-1073A	P	6/18/2013	273.05		3277.5	
PTX06-1073A	P	12/11/2013	273.53		3277.02	
PTX06-1073A	P	12/18/2013	273.5	279	3277.05	3271.55
PTX06-1074	O	4/15/2013	423.69		3154.74	
PTX06-1074	O	6/24/2013	424		3154.43	
PTX06-1074	O	12/10/2013	424.7		3153.73	
PTX06-1075	O	6/24/2013	352.58		3195.88	
PTX06-1075	O	7/31/2013	352.92		3195.54	
PTX06-1075	O	12/10/2013	352.8		3195.66	
PTX06-1076	O	4/17/2013	347.36		3183.0	
PTX06-1076	O	6/18/2013	347.66		3182.7	
PTX06-1076	O	6/18/2013	347.66		3182.7	
PTX06-1076	O	10/28/2013	347.3		3183.06	
PTX06-1076	O	12/11/2013	347.9		3182.46	
PTX06-1077A	P	6/18/2013	268.65		3280.8	
PTX06-1077A	P	7/30/2013	268.69		3280.76	
PTX06-1077A	P	12/12/2013	268.95		3280.5	
PTX06-1078	P	6/18/2013	Dry			
PTX06-1078	P	12/10/2013	Dry			
PTX06-1079	P	6/18/2013	Dry			
PTX06-1079	P	12/10/2013	Dry			
PTX06-1080	P	6/18/2013	270.1		3266.14	
PTX06-1080	P	12/10/2013	270.4		3265.84	
PTX06-1081	P	6/18/2013	229.45		3304.0	
PTX06-1081	P	7/23/2013	229.47		3303.98	
PTX06-1081	P	12/10/2013	229.5		3303.95	
PTX06-1082	P	6/25/2013	177.8		3291.11	
PTX06-1082	P	12/11/2013	176		3292.91	
PTX06-1083	P	6/25/2013	179.11		3289.08	
PTX06-1083	P	12/11/2013	179.6		3288.59	
PTX06-1084	P	1/2/2013	213.9		3265.77	

Location	Aquifer	Measurement Date	Depth to Water ft btoc	Total Well Depth ft btoc	GW Elevation ft amsl	Total Depth Elevation ft amsl
PTX06-1084	P	6/25/2013	212.78		3266.89	
PTX06-1084	P	12/10/2013	214		3265.67	
PTX06-1085	P	4/22/2013	262.16		3271.64	
PTX06-1085	P	6/18/2013	262.37		3271.43	
PTX06-1085	P	12/11/2013	262.78		3271.02	
PTX06-1086	P	4/22/2013	252.68		3273.28	
PTX06-1086	P	6/18/2013	252.86		3273.1	
PTX06-1086	P	12/11/2013	253.27		3272.69	
PTX06-1087	P	6/18/2013	258.3		3275.76	
PTX06-1087	P	12/11/2013	258.89		3275.17	
PTX06-1088	P	5/20/2013	274		3269.91	
PTX06-1088	P	6/21/2013	274.18		3269.73	
PTX06-1088	P	11/5/2013	275.1		3268.81	
PTX06-1088	P	12/12/2013	275.2		3268.71	
PTX06-1089	P	6/24/2013	272.27		3263.19	
PTX06-1089	P	12/11/2013	272.3		3263.16	
PTX06-1090	P	6/24/2013	Dry			
PTX06-1090	P	12/11/2013	Dry			
PTX06-1091	P	6/24/2013	Dry			
PTX06-1091	P	12/11/2013	Dry			
PTX06-1093	P	6/24/2013	Dry			
PTX06-1093	P	12/11/2013	Dry			
PTX06-1094	P	6/24/2013	Dry			
PTX06-1094	P	12/11/2013	Dry			
PTX06-1095A	P	2/5/2013	274.01		3261.72	
PTX06-1095A	P	6/18/2013	274.7		3261.03	
PTX06-1095A	P	8/22/2013	275.3	288	3260.43	3247.73
PTX06-1095A	P	8/23/2013	275.3	288	3260.43	3247.73
PTX06-1095A	P	8/26/2013	275.3		3260.43	
PTX06-1095A	P	12/10/2013	276		3259.73	
PTX06-1096A	P	6/18/2013	Dry			
PTX06-1096A	P	12/10/2013	Dry			
PTX06-1097	P	6/24/2013	Dry			
PTX06-1097	P	12/11/2013	Dry			
PTX06-1098	P	3/7/2013	277.13	306	3257.26	3228.39
PTX06-1098	P	4/29/2013	277.13		3257.26	
PTX06-1098	P	6/20/2013	277.25		3257.14	
PTX06-1098	P	10/10/2013	277.42		3256.97	

Location	Aquifer	Measurement Date	Depth to Water ft btoc	Total Well Depth ft btoc	GW Elevation ft amsl	Total Depth Elevation ft amsl
PTX06-1098	P	12/16/2013	277.5		3256.89	
PTX06-1100	P	5/15/2013	277.74	286.5	3256.89	3248.13
PTX06-1100	P	6/20/2013	277.12		3257.51	
PTX06-1100	P	12/16/2013	278.14		3256.49	
PTX06-1101	P	5/15/2013	277.07	289	3256.48	3244.55
PTX06-1101	P	6/20/2013	277.23		3256.32	
PTX06-1101	P	12/16/2013	277.42		3256.13	
PTX06-1102	P	1/2/2013	286.91		3248.01	
PTX06-1102	P	6/24/2013	286.81		3248.11	
PTX06-1102	P	8/8/2013	286.9		3248.02	
PTX06-1102	P	12/11/2013	286.9		3248.02	
PTX06-1103	P	6/24/2013	Dry			
PTX06-1103	P	8/8/2013	Dry			
PTX06-1103	P	12/11/2013	Dry			
PTX06-1104	P	6/20/2013	279.48		3253.23	
PTX06-1104	P	12/16/2013	279.8		3252.909	
PTX06-1105	P	6/20/2013	279.49		3253.46	
PTX06-1105	P	12/16/2013	279.79		3253.16	
PTX06-1106	P	6/20/2013	279.41		3253.17	
PTX06-1106	P	12/16/2013	279.9		3252.68	
PTX06-1107	P	6/20/2013	279.49		3253.14	
PTX06-1107	P	12/16/2013	279.8		3252.83	
PTX06-1108	P	6/24/2013	292.82		3240.11	
PTX06-1108	P	12/11/2013	292.9		3240.03	
PTX06-1109	P	6/18/2013	233.16		3286.16	
PTX06-1109	P	12/10/2013	234.6		3284.72	
PTX06-1110	P	6/18/2013	236.86		3284.67	
PTX06-1110	P	12/10/2013	237.5		3284.03	
PTX06-1112	P	6/18/2013	250.33		3293.14	
PTX06-1112	P	12/10/2013	251.3		3292.17	
PTX06-1113	P	6/18/2013	253.15		3292.32	
PTX06-1113	P	12/10/2013	253.9		3291.57	
PTX06-1115	P	6/18/2013	236.63		3292.55	
PTX06-1115	P	12/10/2013	237.7		3291.48	
PTX06-1116	P	6/18/2013	238.1		3292.06	
PTX06-1116	P	12/10/2013	239.2		3290.96	
PTX06-1117	P	6/18/2013	238.4		3292.63	
PTX06-1117	P	12/10/2013	239.5		3291.53	

Location	Aquifer	Measurement Date	Depth to Water ft btoc	Total Well Depth ft btoc	GW Elevation ft amsl	Total Depth Elevation ft amsl
PTX06-1118	P	2/5/2013	280.32	281	3249.13	3248.5
PTX06-1118	P	4/29/2013	280.4	281	3249.05	3248.5
PTX06-1118	P	6/20/2013	280.38		3249.07	
PTX06-1118	P	7/23/2013	280.42		3249.03	
PTX06-1118	P	10/24/2013	280.4	281	3249.05	3248.5
PTX06-1118	P	12/16/2013	280.44		3249.01	
PTX06-1119	P	6/24/2013	Dry			
PTX06-1119	P	12/11/2013	Dry			
PTX06-1120	P	5/20/2013	278.56	285	3249.02	3242.58
PTX06-1120	P	5/22/2013	278.53		3249.05	
PTX06-1120	P	6/24/2013	278.45		3249.13	
PTX06-1120	P	11/20/2013	278.7		3248.88	
PTX06-1120	P	12/11/2013	278.7		3248.88	
PTX06-1121	P	5/20/2013	278.7	280	3247.83	3246.53
PTX06-1121	P	5/22/2013	278.68		3247.85	
PTX06-1121	P	6/24/2013	278.52		3248.01	
PTX06-1121	P	11/20/2013	278.6		3247.93	
PTX06-1121	P	12/11/2013	278.7		3247.83	
PTX06-1122	P	6/24/2013	Dry			
PTX06-1122	P	12/11/2013	Dry			
PTX06-1123	P	2/5/2013	278.1		3250.93	
PTX06-1123	P	4/29/2013	278.17		3250.86	
PTX06-1123	P	6/20/2013	278.23		3250.80	
PTX06-1123	P	7/23/2013	278.31		3250.72	
PTX06-1123	P	10/24/2013	278.05		3250.98	
PTX06-1123	P	12/16/2013	278.1		3250.93	
PTX06-1124	P	6/24/2013	Dry			
PTX06-1124	P	12/11/2013	Dry			
PTX06-1125	P	6/24/2013	Dry			
PTX06-1125	P	12/11/2013	Dry			
PTX06-1126	P	4/26/2013	270.4	289.5	3272.05	3252.95
PTX06-1126	P	5/22/2013	269.45	289	3273.00	3253.45
PTX06-1126	P	5/23/2013	269.31		3273.14	
PTX06-1126	P	6/24/2013	264.41		3278.041	
PTX06-1126	P	10/16/2013	269.4		3273.05	
PTX06-1126	P	11/6/2013	269.5		3272.95	
PTX06-1126	P	11/6/2013	269.5		3272.95	
PTX06-1126	P	11/11/2013	269.5		3272.95	

Location	Aquifer	Measurement Date	Depth to Water ft btoc	Total Well Depth ft btoc	GW Elevation ft amsl	Total Depth Elevation ft amsl
PTX06-1126	P	12/11/2013	266.8		3275.65	
PTX06-1126	P	12/16/2013	269.52		3272.93	
PTX06-1127	P	5/14/2013	265.05		3273.55	
PTX06-1127	P	6/24/2013	264.88		3273.72	
PTX06-1127	P	11/6/2013	265.4		3273.19	
PTX06-1127	P	11/6/2013	265.4		3273.19	
PTX06-1127	P	12/11/2013	265.4		3273.19	
PTX06-1128	P	6/18/2013	227.82		3294.14	
PTX06-1128	P	12/10/2013	228.2		3293.76	
PTX06-1129	P	6/18/2013	231.96		3290.58	
PTX06-1129	P	12/10/2013	232.3		3290.24	
PTX06-1130	P	2/19/2013	268.14		3271.65	
PTX06-1130	P	2/19/2013	268.14		3271.65	
PTX06-1130	P	6/24/2013	268.74		3271.05	
PTX06-1130	P	8/22/2013	269		3270.79	
PTX06-1130	P	12/11/2013	269.5		3270.29	
PTX06-1131	P	1/29/2013	281.78		3267.59	
PTX06-1131	P	6/24/2013	281.8		3267.57	
PTX06-1131	P	8/14/2013	281.9		3267.47	
PTX06-1131	P	12/11/2013	281.9		3267.47	
PTX06-1133A	P	5/20/2013	277.28	280	3243.37	3240.65
PTX06-1133A	P	5/22/2013	277.31		3243.34	
PTX06-1133A	P	6/24/2013	277.37		3243.28	
PTX06-1133A	P	11/20/2013	279.5		3241.15	
PTX06-1133A	P	12/10/2013	279.4		3241.25	
PTX06-1134	P	4/30/2013	267.41		3270.78	
PTX06-1134	P	6/24/2013	267.37		3270.82	
PTX06-1134	P	11/18/2013	267.7		3270.49	
PTX06-1134	P	11/18/2013	267.6		3270.59	
PTX06-1134	P	12/11/2013	267.5		3270.69	
PTX06-1135	P	4/30/2013	272.35		3263.18	
PTX06-1135	P	6/21/2013	272.35		3263.18	
PTX06-1135	P	11/19/2013	272.6		3262.93	
PTX06-1135	P	12/11/2013	272.6		3262.93	
PTX06-1136	P	5/15/2013	271.57		3287.85	
PTX06-1136	P	6/13/2013	273.43	284	3285.99	3275.42
PTX06-1136	P	6/24/2013	273.21		3286.21	
PTX06-1136	P	11/21/2013	275.8		3283.62	

Location	Aquifer	Measurement Date	Depth to Water ft btoc	Total Well Depth ft btoc	GW Elevation ft amsl	Total Depth Elevation ft amsl
PTX06-1136	P	12/11/2013	277.51		3281.91	
PTX06-1137A	O	4/24/2013	466.88		3062.73	
PTX06-1137A	O	6/18/2013	467.07		3062.54	
PTX06-1137A	O	6/18/2013	467.07		3062.54	
PTX06-1137A	O	10/24/2013	467.9		3061.71	
PTX06-1137A	O	12/11/2013	468.3		3061.31	
PTX06-1138	O	4/24/2013	460.6		3076.1	
PTX06-1138	O	6/18/2013	460.68		3076.02	
PTX06-1138	O	6/18/2013	460.68		3076.02	
PTX06-1138	O	10/24/2013	461.2		3075.50	
PTX06-1138	O	12/11/2013	461.7		3075.00	
PTX06-1139	O	1/22/2013	435.71		3096.02	
PTX06-1139	O	6/24/2013	435.93		3095.79	
PTX06-1139	O	8/5/2013	436.2		3095.53	
PTX06-1139	O	12/11/2013	436.8		3094.93	
PTX06-1140	O	4/24/2013	479.27		3050.12	
PTX06-1140	O	6/18/2013	479.72		3049.67	
PTX06-1140	O	6/18/2013	479.72		3049.67	
PTX06-1140	O	10/28/2013	482		3047.39	
PTX06-1140	O	12/11/2013	482.5		3046.89	
PTX06-1141	O	1/24/2013	474.3		3088.43	
PTX06-1141	O	6/24/2013	474.75		3087.98	
PTX06-1141	O	8/6/2013	475.5		3087.23	
PTX06-1141	O	12/11/2013	475.75		3086.98	
PTX06-1143	O	4/25/2013	491.78		3056.8	
PTX06-1143	O	6/18/2013	491.86		3056.08	
PTX06-1143	O	10/29/2013	492.2		3055.74	
PTX06-1143	O	12/10/2013	492.3		3055.64	
PTX06-1144	O	4/25/2013	490.64		3037.94	
PTX06-1144	O	11/12/2013	491.2		3037.38	
PTX06-1144	O	12/10/2013	490.6		3037.98	
PTX06-1146	P	2/4/2013	272.44		3263.65	
PTX06-1146	P	6/13/2013	272.96	284	3263.13	3252.09
PTX06-1146	P	6/24/2013	272.7		3263.39	
PTX06-1146	P	7/23/2013	272.55	294	3263.54	3242.09
PTX06-1146	P	8/22/2013	273		3263.09	
PTX06-1146	P	12/11/2013	273.5		3262.59	
PTX06-1147	P	4/29/2013	281.69		3248.06	

Location	Aquifer	Measurement Date	Depth to Water ft btoc	Total Well Depth ft btoc	GW Elevation ft amsl	Total Depth Elevation ft amsl
PTX06-1147	P	6/24/2013	281.88		3247.87	
PTX06-1147	P	11/14/2013	281.8		3247.95	
PTX06-1147	P	12/10/2013	282		3247.75	
PTX06-1148	P	5/1/2013	254.42		3271.70	
PTX06-1148	P	5/1/2013	254.42		3271.70	
PTX06-1148	P	6/24/2013	254.2		3271.92	
PTX06-1148	P	11/19/2013	254.4		3271.72	
PTX06-1148	P	11/19/2013	254.4		3271.72	
PTX06-1148	P	12/11/2013	254.6		3271.52	
PTX06-1149	P	5/1/2013	259.5		3271.95	
PTX06-1149	P	5/1/2013	259.5		3271.95	
PTX06-1149	P	6/24/2013	Dry			
PTX06-1149	P	7/23/2013	Dry			
PTX06-1149	P	9/9/2013	258.5		3272.95	
PTX06-1149	P	9/23/2013	258.6		3272.85	
PTX06-1149	P	9/30/2013	258.8	272	3272.65	3259.45
PTX06-1149	P	10/10/2013	258.9	272	3272.55	3259.45
PTX06-1149	P	11/18/2013	259.4		3272.05	
PTX06-1149	P	12/11/2013	259.4		3272.05	
PTX06-1150	P	5/1/2013	261.98		3272.01	
PTX06-1150	P	5/1/2013	261.98		3272.01	
PTX06-1150	P	6/24/2013	261.6		3272.39	
PTX06-1150	P	11/19/2013	261.8		3272.19	
PTX06-1150	P	12/11/2013	262		3271.99	
PTX06-1151	P	1/21/2013	274.89		3271.79	
PTX06-1151	P	4/26/2013	274.5	296.5	3272.18	3250.18
PTX06-1151	P	5/23/2013	274.5	296	3272.18	3250.68
PTX06-1151	P	6/18/2013	274.65		3272.03	
PTX06-1151	P	8/20/2013	274.6		3272.08	
PTX06-1151	P	12/11/2013	274.88		3271.80	
PTX06-1153	P	2/5/2013	279.32		3249.97	
PTX06-1153	P	4/23/2013	279.52		3249.77	
PTX06-1153	P	6/20/2013	279.41		3249.88	
PTX06-1153	P	7/23/2013	279.4		3249.89	
PTX06-1153	P	10/24/2013	279.4		3249.89	
PTX06-1153	P	12/16/2013	279.38		3249.91	
PTX06-1154	P	2/5/2013	277.78		3250.36	
PTX06-1154	P	4/23/2013	277.92		3250.22	

Location	Aquifer	Measurement Date	Depth to Water ft btoc	Total Well Depth ft btoc	GW Elevation ft amsl	Total Depth Elevation ft amsl
PTX06-1154	P	6/20/2013	277.88		3250.26	
PTX06-1154	P	7/23/2013	277.93		3250.21	
PTX06-1154	P	10/24/2013	277.73		3250.41	
PTX06-1154	P	12/16/2013	277.74		3250.4	
PTX06-1155	P	1/29/2013	269.49		3270.59	
PTX06-1155	P	4/22/2013	269.6		3270.48	
PTX06-1155	P	6/17/2013	269.38		3270.69	
PTX06-1155	P	7/22/2013	269.45		3270.63	
PTX06-1155	P	10/28/2013	269.57		3270.51	
PTX06-1155	P	12/12/2013	269.64		3270.44	
PTX06-1156	P	1/29/2013	256.16		3271.38	
PTX06-1156	P	4/22/2013	256.35		3271.19	
PTX06-1156	P	6/17/2013	256.34		3271.20	
PTX06-1156	P	7/22/2013	256.13		3271.41	
PTX06-1156	P	10/28/2013	256.49		3271.05	
PTX06-1156	P	12/12/2013	256.64		3270.90	
PTX06-1157	O	1/22/2013	397.65		3128.29	
PTX06-1157	O	6/24/2013	397.57		3128.38	
PTX06-1157	O	8/5/2013	397.7		3128.25	
PTX06-1157	O	12/10/2013	397.8		3128.15	
PTX06-1158	P	6/24/2013	Dry			
PTX06-1158	P	11/20/2013	Dry			
PTX06-1158	P	12/10/2013	Dry			
PTX06-1159	P	1/24/2013	270.79	289.5	3271.08	3252.367
PTX06-1159	P	1/29/2013	270.65		3271.21	
PTX06-1159	P	6/18/2013	270.55		3271.32	
PTX06-1159	P	8/22/2013	270.6		3271.27	
PTX06-1159	P	12/10/2013	270.5		3271.37	
PTX06-1160	P	1/24/2013	275.2	302	3271.39	3244.59
PTX06-1160	P	1/29/2013	275.03		3271.56	
PTX06-1160	P	6/18/2013	275		3271.59	
PTX06-1160	P	8/14/2013	275.1		3271.49	
PTX06-1160	P	12/11/2013	275.3		3271.29	
PTX06-1162	P	3/26/2013	272.37	291	3274.0	3255.37
PTX06-1162	P	3/26/2013	272.37	291	3274.0	3255.37
PTX06-1163	P	3/26/2013	274.25	295		
PTX06-1166	P	1/22/2013	280.02	290	3253.44	3243.46
PTX06-1166	P	1/28/2013	279.99		3253.47	

Location	Aquifer	Measurement Date	Depth to Water ft btoc	Total Well Depth ft btoc	GW Elevation ft amsl	Total Depth Elevation ft amsl
PTX06-1166	P	6/24/2013	280.2		3253.26	
PTX06-1166	P	8/8/2013	280.4		3253.06	
PTX06-1166	P	12/11/2013	280.5		3252.96	
PTX06-1167	P	8/8/2013		282		3247.82
PTX06-1167	P	12/13/2013	Dry			
PTX06-EW-12	P	10/2/2013	270.6	282	3259.29	3247.89
PTX06-EW-12	P	10/3/2013	270.7	282	3259.19	3247.89
PTX06-EW-24	P	6/4/2013		299		3235.08
PTX06-EW-35	P	10/2/2013	270.7	286	3260.26	3244.96
PTX06-EW-35	P	10/3/2013	270.8	286	3260.16	3244.96
PTX06-EW-45	P	12/2/2013	271.8	282	3257.28	3247.08
PTX06-EW-45	P	12/3/2013	271.8	282	3257.28	3247.08
PTX06-EW-45	P	12/13/2013	271.8	282	3257.28	3247.08
PTX06-EW-46	P	12/2/2013	272.1	290	3257.11	3239.21
PTX06-EW-46	P	12/3/2013	272.1	290	3257.11	3239.21
PTX06-EW-46	P	12/13/2013	272.1	290	3257.11	3239.21
PTX06-EW-53	P	11/21/2013	271.9	280	3257.69	3249.59
PTX06-EW-53	P	12/2/2013	272		3257.59	
PTX06-EW-53	P	12/16/2013	271.9	281.5	3257.69	3248.09
PTX06-EW-54	P	11/21/2013	265.9	280	3268.73	3254.63
PTX06-EW-54	P	12/3/2013	266.3	280	3268.33	3254.63
PTX06-EW-54	P	12/13/2013	265.9	280	3268.73	3254.63
PTX06-EW-58	P	9/30/2013		283		3252.63
PTX06-EW-58	P	10/1/2013		283		3252.63
PTX06-EW-66	P	4/30/2013		291		3240.41
PTX06-EW-68	P	10/2/2013	272.3	295	3259.0	3236.3
PTX06-EW-68	P	10/3/2013	272.1	293	3259.2	3238.3
PTX06-EW-68	P	10/4/2013	272.3	293	3259.0	3238.3
PTX06-EW-71	P	5/13/2013	229.68	264	3292.25	3257.93
PTX06-EW-71	P	5/16/2013	229.68	264	3292.25	3257.93
PTX06-EW-72	P	9/25/2013		275		3237.62
PTX06-EW-72	P	9/27/2013	226.4	275	3286.22	3237.62
PTX06-EW-72	P	9/30/2013		275		3237.62
PTX06-EW-73	P	5/10/2013	225.1	277	3286.56	3234.66
PTX06-EW-73	P	5/17/2013	225.1	277	3286.56	3234.66
PTX06-EW-74	P	5/8/2013	225.1	280	3287.12	3232.22
PTX06-EW-74	P	5/9/2013	225.1	280	3287.12	3232.22
PTX06-EW-78A	P	6/3/2013	228.2	293	3285.95	3221.15

Location	Aquifer	Measurement Date	Depth to Water ft btoc	Total Well Depth ft btoc	GW Elevation ft amsl	Total Depth Elevation ft amsl
PTX06-EW-78A	P	6/4/2013	228.2	293	3285.95	3221.15
PTX06-EW-79	P	4/29/2013	230.6	279	3285.22	3236.82
PTX06-EW-79	P	5/7/2013	230.6	279	3285.22	3236.82
PTX06-EW-79	P	5/9/2013	230.6	279	3285.22	3236.82
PTX06-EW-80	P	6/3/2013	231.38	264	3284.41	3251.79
PTX06-EW-80	P	6/5/2013	231.38	264	3284.41	3251.79
PTX06-EW-81A	P	10/1/2013	239.3	295		
PTX06-INJ-12A	P	1/8/2013		262		3274.48
PTX06-ISB011	P	2/7/2013	280.88		3249.83	
PTX06-ISB012	P	2/7/2013	281.37		3249.82	
PTX06-ISB012	P	4/9/2013	281.1	287	3250.09	3244.19
PTX06-ISB013	P	2/7/2013	Dry			
PTX06-ISB014	P	3/20/2013	284.59	288	3245.96	3242.55
PTX06-ISB014	P	6/3/2013	282.8	288	3247.75	3242.55
PTX06-ISB014	P	6/20/2013	283.21		3247.34	
PTX06-ISB014	P	11/19/2013	283.15	288	3247.4	3242.55
PTX06-ISB014	P	12/16/2013	283.19		3247.36	
PTX06-ISB015	P	2/7/2013	280.45		3249.75	
PTX06-ISB016	P	2/7/2013	281.38		3248.54	
PTX06-ISB019	P	3/12/2013	278.7	290	3250.97	3239.67
PTX06-ISB019	P	6/3/2013	278.64	290	3251.03	3239.67
PTX06-ISB019	P	6/20/2013	278.89		3250.78	
PTX06-ISB019	P	11/20/2013	278.82	290	3250.85	3239.67
PTX06-ISB019	P	12/16/2013	278.82		3250.85	
PTX06-ISB024	P	3/12/2013	277.2	283	3251.74	3245.94
PTX06-ISB024	P	6/4/2013	277.15	283	3251.79	3245.94
PTX06-ISB024	P	6/20/2013	277.35		3251.59	
PTX06-ISB024	P	12/3/2013	277.53	282.5	3251.41	3246.44
PTX06-ISB024	P	12/16/2013	277.5		3251.44	
PTX06-ISB030B	P	3/13/2013	283.1	291	3247.68	3239.78
PTX06-ISB030B	P	6/4/2013	283.45	291	3247.33	3239.78
PTX06-ISB030B	P	6/20/2013	286.54		3244.24	
PTX06-ISB030B	P	12/4/2013	283.8	291	3246.98	3239.78
PTX06-ISB030B	P	12/16/2013	283.84		3246.94	
PTX06-ISB038	P	3/13/2013	277.65	288	3251.18	3240.83
PTX06-ISB038	P	6/6/2013	277.73	288	3251.1	3240.83
PTX06-ISB038	P	6/20/2013	277.8		3251.03	
PTX06-ISB038	P	12/10/2013	277.8	288	3251.03	3240.83

Location	Aquifer	Measurement Date	Depth to Water ft btoc	Total Well Depth ft btoc	GW Elevation ft amsl	Total Depth Elevation ft amsl
PTX06-ISB038	P	12/11/2013	277.4	288	3251.43	3240.83
PTX06-ISB038	P	12/11/2013	277.8		3251.03	
PTX06-ISB042	P	3/19/2013	277.72	286	3251.09	3242.81
PTX06-ISB042	P	6/6/2013	277.85	286	3250.96	3242.81
PTX06-ISB042	P	6/20/2013	278		3250.81	
PTX06-ISB042	P	12/16/2013	277.9	286	3250.91	3242.81
PTX06-ISB042	P	12/16/2013	277.9		3250.91	
PTX06-ISB046	P	3/20/2013	277.7	289	3250.78	3239.48
PTX06-ISB046	P	6/10/2013	277.63	289	3250.85	3239.48
PTX06-ISB046	P	6/20/2013	277.77		3250.71	
PTX06-ISB046	P	12/16/2013	278.1		3250.38	
PTX06-ISB046	P	12/16/2013	278.1	289	3250.38	3239.48
PTX06-ISB048	P	3/19/2013	278.18	285	3250.35	3243.53
PTX06-ISB048	P	6/10/2013	278.05	285	3250.48	3243.53
PTX06-ISB048	P	6/20/2013	278.17		3250.36	
PTX06-ISB048	P	12/16/2013	283.77		3244.76	
PTX06-ISB048	P	12/18/2013	283.61	285	3244.92	3243.53
PTX06-ISB055	P	2/6/2013	260.41	285	3273.607	3249.02
PTX06-ISB055	P	6/17/2013	260.55		3273.47	
PTX06-ISB055	P	7/29/2013	260	285	3274.02	3249.02
PTX06-ISB055	P	10/29/2013	260	285	3274.02	3249.02
PTX06-ISB055	P	12/12/2013	Dry			
PTX06-ISB059	P	2/11/2013	260.25	283	3273.42	3250.67
PTX06-ISB059	P	6/17/2013	260.33		3273.34	
PTX06-ISB059	P	7/30/2013	259.7	282	3273.97	3251.67
PTX06-ISB059	P	10/30/2013	260.2	282	3273.47	3251.67
PTX06-ISB059	P	12/12/2013	260.6		3273.07	
PTX06-ISB063	P	2/11/2013	262.6	281	3273.29	3254.89
PTX06-ISB063	P	6/17/2013	262.55		3273.34	
PTX06-ISB063	P	7/31/2013	262	280	3273.89	3255.89
PTX06-ISB063	P	11/4/2013	262.55	280	3273.34	3255.89
PTX06-ISB063	P	12/12/2013	262.78		3273.11	
PTX06-ISB069A	P	2/19/2013	265.25	283	3272.87	3255.12
PTX06-ISB069A	P	6/17/2013	264.71		3273.41	
PTX06-ISB069A	P	8/1/2013	264.69	282	3273.43	3256.12
PTX06-ISB069A	P	11/5/2013	265.11	282	3273.01	3256.12
PTX06-ISB069A	P	12/12/2013	265.22		3272.9	
PTX06-ISB071	P	2/19/2013	267.67		3273.02	

Location	Aquifer	Measurement Date	Depth to Water ft btoc	Total Well Depth ft btoc	GW Elevation ft amsl	Total Depth Elevation ft amsl
PTX06-ISB071	P	6/17/2013	267.43		3273.26	
PTX06-ISB071	P	8/5/2013	267		3273.69	
PTX06-ISB071	P	11/6/2013	267.8	288	3272.89	3252.69
PTX06-ISB071	P	12/12/2013	268		3272.69	
PTX06-ISB073	P	2/20/2013	269.3	291	3273.32	3251.62
PTX06-ISB073	P	6/17/2013	Dry			
PTX06-ISB073	P	8/6/2013	269.4	291	3273.22	3251.62
PTX06-ISB073	P	11/7/2013	269.59	291	3273.03	3251.62
PTX06-ISB073	P	12/12/2013	269.55		3273.07	
PTX06-ISB075	P	3/6/2013	269.23	283	3272.82	3259.05
PTX06-ISB075	P	6/17/2013	268.57		3273.48	
PTX06-ISB075	P	8/7/2013	268.95	283	3273.1	3259.05
PTX06-ISB075	P	11/11/2013	269.29	283	3272.76	3259.05
PTX06-ISB075	P	12/12/2013	269.32		3272.73	
PTX06-ISB077	P	6/17/2013	267.25		3272.74	
PTX06-ISB077	P	8/8/2013	261.65	286	3278.34	3253.99
PTX06-ISB077	P	11/12/2013	267.85	286	3272.14	3253.99
PTX06-ISB077	P	12/12/2013	270.91		3269.08	
PTX06-ISB081	P	3/7/2013	257.91	281	3273.01	3249.92
PTX06-ISB081	P	6/17/2013	257.51		3273.41	
PTX06-ISB081	P	8/14/2013	257.85	279	3273.07	3251.92
PTX06-ISB081	P	11/18/2013	258.33	279	3272.59	3251.92
PTX06-ISB081	P	12/12/2013	258.45		3272.47	
PTX06-ISB082	P	3/11/2013	254.94	280	3275.46	3250.4
PTX06-ISB082	P	6/17/2013	257.52		3272.88	
PTX06-ISB082	P	8/15/2013	0	280	3530.39	3250.4
PTX06-ISB082	P	11/18/2013	258.15	280	3272.25	3250.4
PTX06-ISB082	P	12/12/2013	257.16		3273.24	
PTX06-ISB085A	P	3/11/2013	270.77	285	3272.38	3258.15
PTX06-ISB085A	P	6/17/2013	Dry			
PTX06-ISB085A	P	8/12/2013	270.5	285	3272.65	3258.15
PTX06-ISB085A	P	11/14/2013	270.49	285	3272.66	3258.15
PTX06-ISB085A	P	12/12/2013	270.81		3272.34	
PTX06-PZ01	P	6/18/2013	258.03		3284.0	
PTX06-PZ01	P	9/11/2013	258.2	276	3283.83	3266.03
PTX06-PZ01	P	12/10/2013	258.5		3283.53	
PTX06-PZ02	P	6/18/2013	257.42		3284.77	
PTX06-PZ02	P	9/11/2013	257.6	267	3284.59	3275.19

Location	Aquifer	Measurement Date	Depth to Water ft btoc	Total Well Depth ft btoc	GW Elevation ft amsl	Total Depth Elevation ft amsl
PTX06-PZ02	P	12/10/2013	257.8		3284.39	
PTX06-PZ03	P	6/18/2013	258.97		3283.33	
PTX06-PZ03	P	9/11/2013	259.3	280	3282.99	3262.29
PTX06-PZ03	P	12/10/2013	259.6		3282.69	
PTX06-PZ04	P	6/18/2013	Dry			
PTX06-PZ04	P	9/11/2013		249		3279.19
PTX06-PZ04	P	12/10/2013	Dry			
PTX06-PZ05	P	6/18/2013	266.78		3274.89	
PTX06-PZ05	P	9/11/2013	266.2	287	3275.47	3254.67
PTX06-PZ05	P	12/10/2013	265.8		3275.87	
PTX06-PZ06	P	6/18/2013	275.5		3261.52	
PTX06-PZ06	P	9/11/2013	276.1	283	3260.92	3254.02
PTX06-PZ06	P	12/10/2013	276.7		3260.32	
PTX07-1O01	P	2/6/2013	255.88		3296.57	
PTX07-1O01	P	6/18/2013	256.2		3296.25	
PTX07-1O01	P	8/19/2013	256.5		3295.95	
PTX07-1O01	P	12/10/2013	256.8		3295.65	
PTX07-1O02	P	2/6/2013	252.01		3299.32	
PTX07-1O02	P	6/18/2013	252.1		3299.23	
PTX07-1O02	P	8/19/2013	252.3		3299.03	
PTX07-1O02	P	12/10/2013	252.4		3298.93	
PTX07-1O03	P	6/18/2013	252.13		3298.38	
PTX07-1O03	P	7/24/2013	252.44	261	3298.07	3289.51
PTX07-1O03	P	8/19/2013	252.4		3298.11	
PTX07-1O03	P	12/10/2013	252.7		3297.81	
PTX07-1O04	P	6/18/2013	256.3		3296.21	
PTX07-1O04	P	12/10/2013	256.7		3295.81	
PTX07-1O05	P	6/18/2013	256.65		3295.65	
PTX07-1O05	P	12/10/2013	256.6		3295.7	
PTX07-1O06	P	6/18/2013	263.42		3288.29	
PTX07-1O06	P	7/23/2013	263.54		3288.17	
PTX07-1O06	P	12/10/2013	263.8		3287.91	
PTX07-1P01	P	6/18/2013	248.25		3295.6	
PTX07-1P01	P	12/10/2013	248.4		3295.45	
PTX07-1P02	P	5/14/2013	241.33		3293.56	
PTX07-1P02	P	6/18/2013	241.4		3293.49	
PTX07-1P02	P	11/4/2013	242.3		3292.59	
PTX07-1P02	P	12/10/2013	242.3		3292.59	

Location	Aquifer	Measurement Date	Depth to Water ft btoc	Total Well Depth ft btoc	GW Elevation ft amsl	Total Depth Elevation ft amsl
PTX07-1P03	P	6/18/2013	253.59		3293.21	
PTX07-1P03	P	12/12/2013	253.84		3292.96	
PTX07-1P04	P	6/18/2013	Dry			
PTX07-1P04	P	12/10/2013	Dry			
PTX07-1P05	P	5/13/2013	250.24		3295.08	
PTX07-1P05	P	6/18/2013	250.27		3295.05	
PTX07-1P05	P	12/10/2013	250.8		3294.52	
PTX07-1P06	P	6/18/2013	253.9		3291.60	
PTX07-1P06	P	12/10/2013	254.2		3291.30	
PTX07-1Q01	P	6/24/2013	278.92		3268.63	
PTX07-1Q01	P	7/29/2013	278.85		3268.69	
PTX07-1Q01	P	12/11/2013	279.2		3268.35	
PTX07-1Q02	P	6/24/2013	283.6		3268.47	
PTX07-1Q02	P	7/29/2013	283.56		3268.51	
PTX07-1Q02	P	12/11/2013	282.9		3269.17	
PTX07-1Q03	P	6/24/2013	266.6		3270.51	
PTX07-1Q03	P	7/29/2013	266.57		3270.54	
PTX07-1Q03	P	12/11/2013	266.9		3270.21	
PTX07-1R01	O	4/25/2013	451.35		3120.52	
PTX07-1R01	O	6/24/2013	451.55		3120.32	
PTX07-1R01	O	10/24/2013	452.2		3119.67	
PTX07-1R01	O	12/10/2013	452.62		3119.25	
PTX07-1R03	P	6/24/2013	255.34		3318.16	
PTX07-1R03	P	12/10/2013	255.61		3317.89	
PTX08-1001	P	5/14/2013	230.13		3288.73	
PTX08-1001	P	6/18/2013	229.64		3289.22	
PTX08-1001	P	9/30/2013	229.7	279	3289.16	3239.86
PTX08-1001	P	10/3/2013	229.7	279	3289.16	3239.86
PTX08-1001	P	10/21/2013	230.7	279	3288.16	3239.86
PTX08-1001	P	12/10/2013	231.3		3287.56	
PTX08-1002	P	5/14/2013	229.74		3287.27	
PTX08-1002	P	6/18/2013	229.65		3287.36	
PTX08-1002	P	8/6/2013	229.6	232	3287.41	3285.01
PTX08-1002	P	10/1/2013	233.3	263	3283.71	3254.01
PTX08-1002	P	10/10/2013	233.3	263	3283.71	3254.01
PTX08-1002	P	11/4/2013	234		3283.01	
PTX08-1002	P	12/10/2013	232.9		3284.11	
PTX08-1003	P	6/18/2013	275.56		3277.93	

Location	Aquifer	Measurement Date	Depth to Water ft btoc	Total Well Depth ft btoc	GW Elevation ft amsl	Total Depth Elevation ft amsl
PTX08-1003	P	7/30/2013	275.7		3277.79	
PTX08-1003	P	12/11/2013	275.97		3277.52	
PTX08-1005	P	1/21/2013	273.09		3273.64	
PTX08-1005	P	4/26/2013	272.98	291.5	3273.75	3255.23
PTX08-1005	P	5/23/2013	272.98	291	3273.75	3255.73
PTX08-1005	P	6/18/2013	273.04		3273.69	
PTX08-1005	P	8/20/2013	273		3273.73	
PTX08-1005	P	10/23/2013	273	291	3273.73	3255.73
PTX08-1005	P	12/11/2013	273.32		3273.41	
PTX08-1006	P	1/21/2013	271.16		3274.59	
PTX08-1006	P	6/18/2013	271.26		3274.49	
PTX08-1006	P	7/30/2013	271.28		3274.48	
PTX08-1006	P	12/11/2013	271.61		3274.15	
PTX08-1007	P	5/20/2013	270.25		3278.56	
PTX08-1007	P	6/21/2013	270.37		3278.44	
PTX08-1007	P	12/12/2013	270.7		3278.11	
PTX08-1008	P	5/15/2013	267.74		3270.73	
PTX08-1008	P	6/18/2013	267.82		3270.65	
PTX08-1008	P	11/6/2013	268.4		3270.07	
PTX08-1008	P	11/6/2013	268.4		3270.07	
PTX08-1008	P	11/11/2013	267.8		3270.67	
PTX08-1008	P	12/11/2013	267.4		3271.07	
PTX08-1009	P	5/23/2013	273.21		3265.99	
PTX08-1009	P	5/23/2013	273.21		3265.99	
PTX08-1009	P	6/18/2013	273.2		3265.99	
PTX08-1009	P	11/4/2013	273.8		3265.39	
PTX08-1009	P	12/11/2013	274		3265.2	
PTX08-1010	P	6/18/2013	217.7		3307.02	
PTX08-1010	P	12/10/2013	217.9		3306.82	
PTX08-1011A	O	6/18/2013	405.83		3170.75	
PTX08-1011A	O	12/11/2013	406.4		3170.18	
PTX10-1008	P	6/21/2013	267.76		3276.32	
PTX10-1008	P	12/12/2013	267.94		3276.14	
PTX10-1014	P	5/16/2013	259.15		3285.04	
PTX10-1014	P	6/18/2013	259.3		3284.89	
PTX10-1014	P	6/18/2013	259.3		3284.89	
PTX10-1014	P	12/12/2013	259.96		3284.23	
PTX-BEG2	O	1/24/2013	389.93		3154.42	

Location	Aquifer	Measurement Date	Depth to Water ft btoc	Total Well Depth ft btoc	GW Elevation ft amsl	Total Depth Elevation ft amsl
PTX-BEG2	O	6/24/2013	389.82		3154.53	
PTX-BEG2	O	8/6/2013	390.1		3154.25	
PTX-BEG2	O	12/11/2013	388.7		3155.65	
PTX-BEG3	P	6/18/2013	253.55		3284.78	
PTX-BEG3	P	8/6/2013	253.4	285	3284.93	3253.33
PTX-BEG3	P	11/15/2013	233.2		3305.13	

btoc – below top of casing amsl – above mean sea level

2.5 Management of Recovered/Purged Groundwater

All 2013 purged contaminated groundwater exceeding GWPS from sampling events and maintenance activities was containerized and treated through the pump and treat systems in accordance with Provision II.H of the CP-50284, with a few exceptions. Due to high chromium values potentially making the water characteristically hazardous, the purge water from one designated monitor well along with purge water from the ISB systems was containerized and disposed of by the Pantex Plant Waste Operations Department. Purge water that is collected through sampling is tabulated in sampling logs along with the disposal method for the water. The purge volume from maintenance activities is also included in the maintenance logs and that information was included in Table 2-7. Ogallala Aquifer wells are unaffected and are not required to be managed or volumes tabulated so the water is released to nearby ditches.

In accordance with Provision II.H of CP-50284, all recovered perched groundwater from extraction wells is treated through the P1PTS or SEPTS. All treated water from the P1PTS and the majority of the SEPTS treated water is sent through subsurface lines to the WWTF storage lagoon. The lagoon water is then sent through the WWTF filter building and subsequently released to the Plant's subsurface irrigation system, as needed. Pantex Plant has been authorized by permit (TLAP #04397, issued October 6, 2003) to release treated wastewater for irrigation of crops. The TLAP was reissued in April 2012 and includes an additional 100-acre tract for irrigation. Additionally, provisions allowing treated water to be used in other ways, such as for construction projects, as long as the treated water meets GWPS and criteria specified by the State of Texas, were included in the newly issued TLAP.

As authorized by the Underground Injection Control, Authorization No. 5X2600215, Pantex injects treated water into select wells at Pantex. Portions of the SEPTS treated water is injected through injection wells PTX06-INJ-10, PTX06-INJ-11, and PTX06-INJ-12A. Portions of the SEPTS treated water are used for the Southeast ISB and Zone 11 ISB amendment injections. Treated water is mixed with the amendment and injected into the treatment zone. The volumes of treated water injected, sent to the WWTF, or sent to the ISB system is provided in

Section 2.2. Pantex is evaluating methods for delivery of treated water for other beneficial uses, so no water was used for other beneficial purposes in 2013.

3.0 Groundwater Remedial Action Effectiveness

In this section, the groundwater remedial action is evaluated for overall effectiveness during 2013 operations. This evaluation focuses on the following four aspects of monitoring associated with the remedy for perched groundwater:

1. Plume stability
2. Remedial Action effectiveness
3. Uncertainty management/early detection
4. Natural attenuation

In addition, POC and POE wells are evaluated against GWPS to determine compliance with CP-50284.

3.1 Plume Stability

Plume stability is evaluated through examination of water level and concentration data. Water levels are used to generate hydrographs and trends for individual wells and maps of water elevations and contours. Data from dry wells (e.g., continuing dry conditions or influx of water) also support this analysis.

Concentration data are used to perform concentration trend analysis. Concentration trend data are mapped for the four major COCs to identify trends in the spatial distribution of COCs. The concentration data are used to generate plume maps for each COC. The maps and trends together will form the basis for an evaluation of overall plume stability.

In order to satisfy the objectives of the LTM design, expected conditions and trends were developed for each LTM network well in the *Long Term Monitoring System Design Report* (B&W Pantex, 2009a). Therefore, a comparison of observed versus expected conditions was conducted as part of the evaluation process. Appendix D includes the LTM expected conditions as well as current conditions based on 2013 analytical and water level data.

3.1.1 COC Concentration Trending

COC concentration trends were calculated using both the non-parametric Mann-Kendall statistical and parametric linear regression methods adapted from the AFCEE Monitoring and Remediation Optimization System (MAROS) Software. Trends were calculated for the entire dataset for each LTM network well (long-term), data from the four most recent sampling events (short-term), and data collected since the start of remedial actions in 2009. The results of these analyses can be found on the concentration trend graphs located in Appendix D. In addition, the Mann-Kendall trending results since the remedial actions began for RDX, TCE, perchlorate, and hexavalent chromium are depicted in Figure 3-1, Figure 3-2, Figure

3-3, and Figure 3-4, respectively, to illustrate the effectiveness of the groundwater remedial actions.

It should be noted that this is the first progress report to depict the COC trending figures in this manner. In previous reports, trends calculated using the last four measurements had been used to illustrate the short-term effectiveness of the remedial actions. However, the dataset collected since July 2009 is now large enough to realistically reflect effects of the system operations. Short-term or long-term trends may also be discussed when appropriate.

Linear regression is a parametric statistical procedure that is typically used for analyzing trends in data over time. However, with the usual approach of interpreting the log slope of the regression line, concentration trends may often be obscured by data scatter arising from non-ideal hydrogeologic or sampling and analysis conditions. The Mann-Kendall test is a non-parametric statistical procedure that is well suited for analyzing trends in data over time (Gilbert, 1987). The Mann-Kendall test can be viewed as a nonparametric test for zero slope of the first-order regression of time-ordered concentration data versus time. The Mann-Kendall test does not require any assumptions as to the statistical distribution of the data (e.g. normal, lognormal, etc.) and can be used with data sets which include irregular sampling intervals and missing data (i.e., non-detects). More information on these statistical methods can be found in the LTM Design Report (B&W Pantex 2009a).

3.1.1.1 RDX Trends

Evaluation of concentration trends for RDX indicates that RDX is decreasing, stable, or does not demonstrate a trend at all monitoring points near source areas (Playa 1 and the ditch along the eastern side of Zone 12). This condition is expected as the source areas are predicted to continue contributing to the perched aquifer for up to 20 years, but at much lower concentrations than in the past. The SEPTS has had some effect on the plume as the majority of COC concentrations are declining or stable within the boundaries of the well field. The Southeast ISB has had some effect on wells to the south on TTU property as concentrations in downgradient wells are stable or declining, with the exception of PTX06-1153. This is a key area for declining concentrations because portions of that area are potentially more sensitive to vertical migration to the deeper drinking water aquifer. The trends are depicted in Figure 3-1.

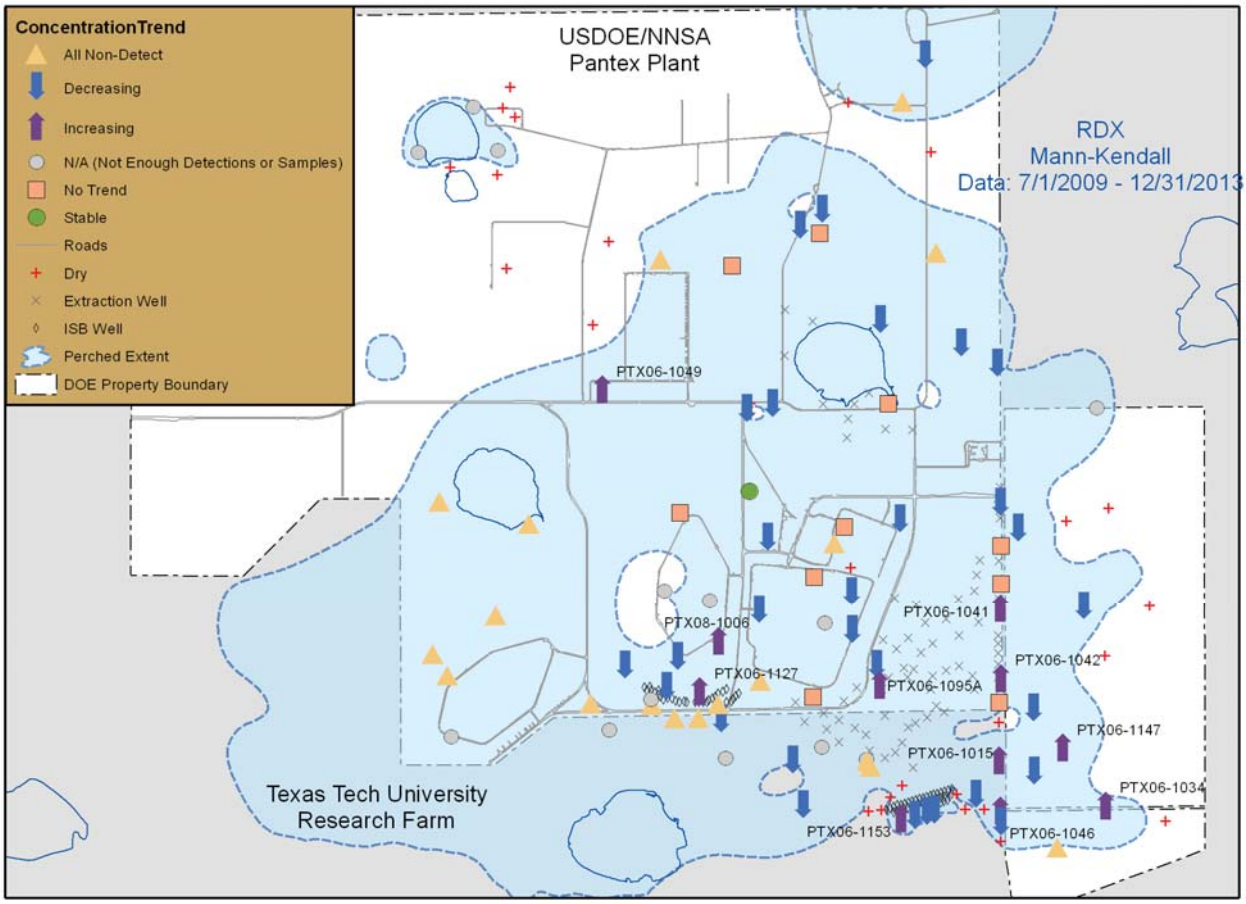

Figure 3-1. RDX Trends in the Perched Aquifer

Overall, eleven monitoring wells exhibited increasing trends in RDX using data since the start of remedial actions, as depicted in Figure 3-1:

- RDX was first observed at low concentrations in PTX06-1049 in 2011 and have steadily increased. However this well is located in the far western side of the perched aquifer which is outside the influence of a remedial action and these trends are likely due to radial groundwater flow from Playa 1.

- PTX06-1127, located south of Zone 11 outside the effects of a remedial action, is exhibiting a slight increasing RDX trend at concentrations below the GWPS. PTX08-1006 is also located south of Zone 11, and while RDX concentrations currently exceed GWPS, short-term trends indicate decreasing concentrations. These wells are located upgradient of the Zone 11 ISB system, and based on the data collected in the Southeast ISB system, RDX will be effectively treated in the system.

- Several wells located in the far southeast lobe of perched groundwater (PTX06-1015, PTX06-1034, PTX06-1046, and PTX06-1147) are exhibiting increasing trends in RDX, likely due to plume movement into these wells. This area has been identified as a

region that is not currently under the effect of a remedial action. Short-term trends in these wells indicate either decreasing or no trends, suggesting possible plume stabilization in the region.

- Two wells installed along the eastern edge of the extraction well field (PTX06-1041 and PTX06-1042) are exhibiting increasing trends in RDX, but are under the direct influence of nearby extraction wells. Both long-term and short-term trends do not indicate increasing concentrations and these variable trends may be due to affected water from the east being pulled back into the well field or other unknown effects of pumping.
- PTX06-1095A is within the influence of the SEPTS well field, but is also located within 50 feet downgradient of the PRB pilot study wells PTX06- PRB01A and PTX06-PRB02. The increasing trend is likely due to the PRB losing treatment effectiveness and concentrations returning to baseline conditions.
- PTX06-1153, which is a downgradient ISPM well for the Southeast ISB system, is exhibiting an increasing trend in RDX. This well is discussed in detail in Section 3.1.2.

A comparison of current trends to expected conditions for specific wells in the LTM network is included in Section 3.1.2.

3.1.1.2 TCE Trends

Evaluation of concentration trends for TCE indicates that TCE is decreasing, stable, or does not demonstrate a trend at the source areas (Zone 11 and multiple areas in Zone 12 including SWMU 122b, and Waste Management Group [WMG] 10). Figure 3-2 presents the TCE trends across the perched aquifer.

As depicted in Figure 3-2, 10 monitoring wells are exhibiting increasing trends in TCE concentration since the start of remedial actions:

- PTX06-1034 and PTX06-1046 are exhibiting increasing trends in TCE concentration since remedial actions began in 2009. These wells are in the southeast lobe of perched groundwater, which is not under the effect of a remedial action. Additionally, the TCE concentrations are well below the GWPS of 5 ug/L and both long and short-term trends (as defined in Section 3.1.1) do not indicate increasing concentrations.

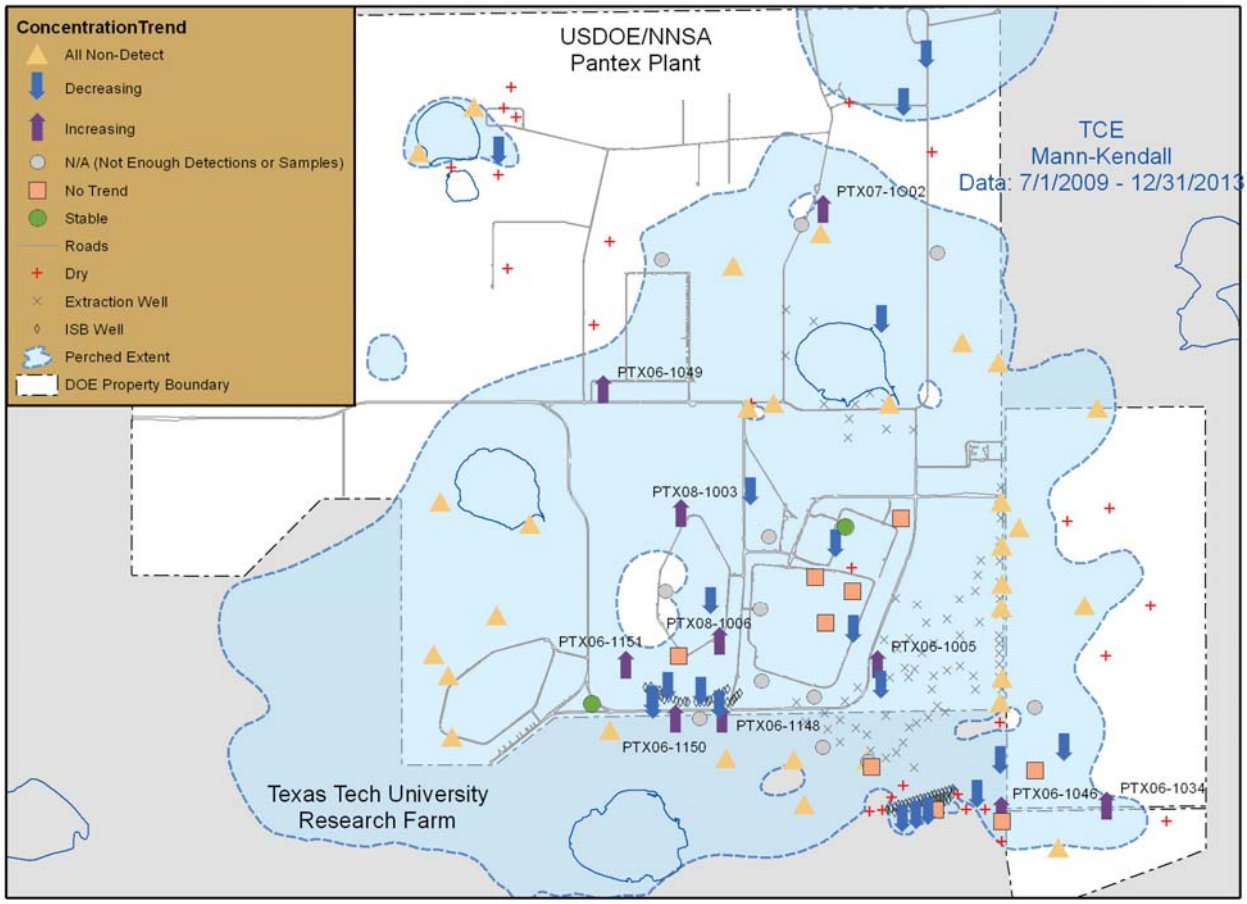

Figure 3-2. TCE Trends in the Perched Aquifer

PTX06-1148 and PTX06-1150, which are downgradient of the Zone 11 ISB, are exhibiting increasing trends in TCE concentration due to general plume movement downgradient. However, the ISB system conceptual site model predicted treated water would not reach these wells for many years (Aquifer Solutions 2011). To address this inconsistency, the expected conditions for these wells were redefined in the Update to the LTM System Design (B&W Pantex 2014) and these changes will be reflected in the 2014 Annual Progress Report.

- TCE is exhibiting an increasing trend in PTX06-1049, located west of Playa 1 which is not under the effect of a remedial action. TCE was first detected in this well in 2006 and has been slowly increasing. This trend is likely due to radial groundwater flow from Playa 1. All TCE detections to date in PTX06-1049 have been less than the GWPS.

- PTX07-1O02, located north of Playa 1, has had variable low-level TCE concentrations since 1996. However, no concentrations have exceeded GWPS.

- TCE is exhibiting an increasing trend below GWPS in PTX08-1003, which is located on the north edge of Zone 11. This trend appears to be due to general plume movement from the former Fire Training Area to the southwest. TCE was first detected in 2010 and is slowly increasing. PTX06-1151 is also exhibiting an increasing TCE trend due to general plume movement in the Zone 11 area. Neither of these wells is under the effect of a remedial action.

- The apparent increasing TCE trend in PTX06-1005 is likely caused by injecting treated water at SEPTS injection well PTX06-INJ-12A, which is located approximately 200-feet to the east. Almost 70 million gallons of treated water have been injected into the perched aquifer at PTX06-INJ-12A since it was installed in 2008. However, since Pantex has taken actions over the past few years to limit injection, injection volumes into this well have decreased dramatically (no water injected in 2013). Therefore, the observed trend is likely the effect of TCE concentrations in the area returning to unaffected conditions.

- The increasing trend in PTX08-1006, which is located downgradient from the identified sources in Zone 11, is likely due to general plume movement.

3.1.1.3 Perchlorate Trends

As depicted in Figure 3-3, five monitoring wells are exhibiting increasing trends in perchlorate concentration:

- PTX06-1035, which is located southwest of the Zone 11 ISB system, is demonstrating an increasing trend in perchlorate concentrations likely due to general plume movement downgradient. Perchlorate concentrations are currently well below GWPS at this well.

- PTX06-1148 and PTX06-1150, which are downgradient of the Zone 11 ISB, are exhibiting increasing trends in perchlorate concentration due to general plume movement. However, the ISB system conceptual site model predicted treated water would not reach these wells for many years (Aquifer Solutions, 2011). To address this inconsistency, the expected conditions for these wells were redefined in the Update to the LTM System Design (B&W Pantex 2014) and these changes will be reflected in the 2014 Annual Progress Report.

- PTX06-1007 was exhibiting a decreasing trend in perchlorate from the time it was installed in 2000 until 2007, then began exhibiting increasing trends. This could be caused by changes in flux and plume movement from the SWMU 5-13A ditch. Another possible cause of these shifting trends could be injection effects. As discussed in several prior Annual Progress Reports, historic injection at SEPTS injection well

PTX06-INJ-02 (1996 – 2006) affected COC concentrations and trends in wells installed east of PTX06-1007.

- 1114-MW4 is exhibiting an increasing trend in perchlorate concentrations since the start of remedial actions in 2009. This well had concentrations in the range of 300 ug/L when installed in 2002, which steadily declined until 2010 then exhibited a slow increasing trend. These shifting trends could be due to changes in mass flux at the source areas or general plume movement downgradient. Regardless, 1114-MW4 is installed upgradient of the Zone 11 ISB system and the perchlorate will be treated as it flows through the system.

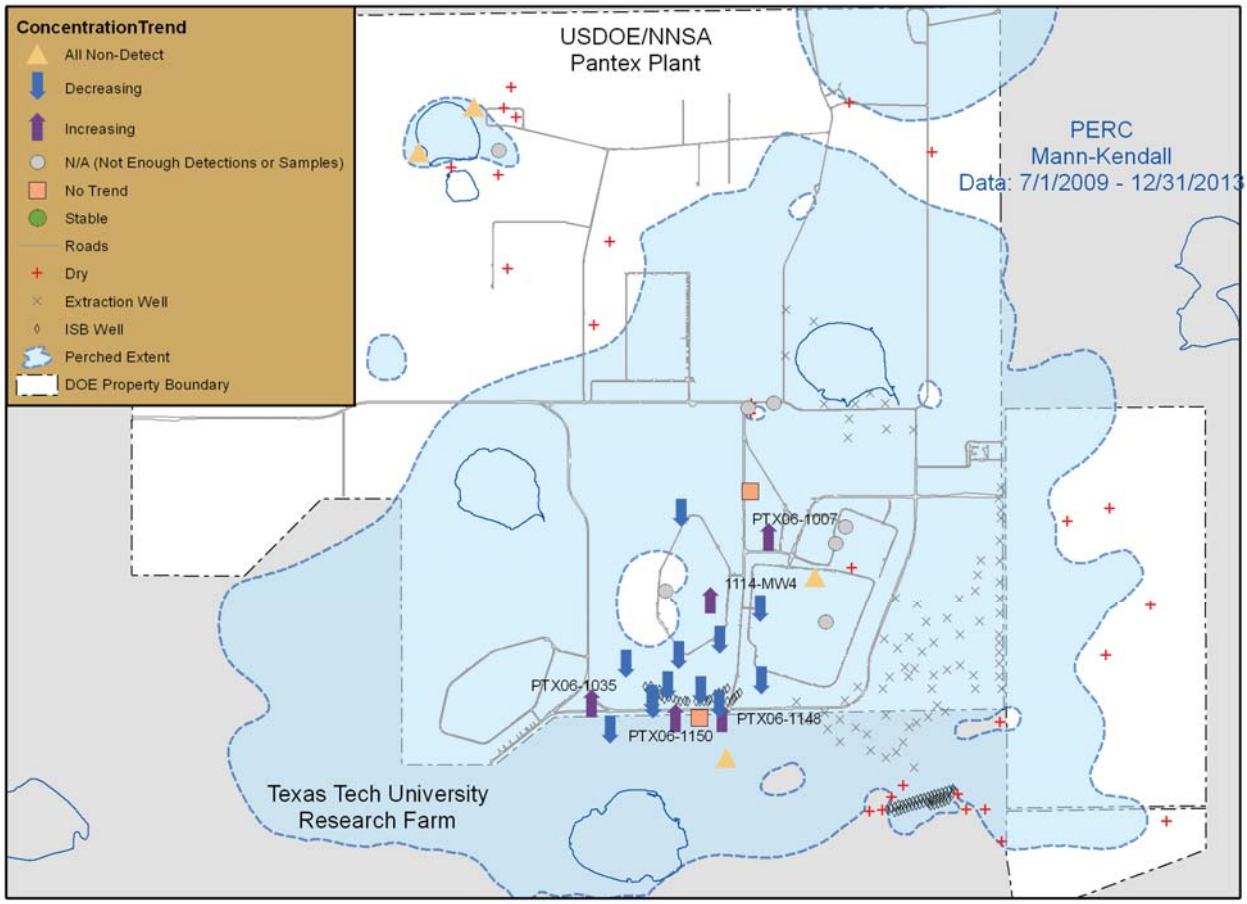

Figure 3-3. Perchlorate Trends in the Perched Aquifer

3.1.1.4 Hexavalent Chromium Trends

As depicted in Figure 3-4, four perched aquifer wells are exhibiting increasing trends in hexavalent chromium since remedial actions began:

- PTX06-1146 has had sporadic low-level hexavalent chromium detections ranging from approximately 5 – 10 ug/L since it was installed in 2008. However, these

detections are attributed to stainless steel screen corrosion rather than a source of hexavalent chromium in this area.

- As described in the 2010 Annual Progress Report, the increasing trend in hexavalent chromium at PTX06-1010 is likely related to effects of injection at PTX06-INJ-02. Concentrations have continued to increase at this well since 2010 and appear to be stabilizing (no short-term trend).
- The increasing hexavalent chromium trend in PTX06-1005 is likely due to effects of injection in PTX06-INJ-12A, as described in Section 3.1.1.2.
- PTX06-1153, which is a downgradient ISPM well for the Southeast ISB system, is exhibiting an increasing trend in hexavalent chromium. This well is discussed in detail in Section 3.2.3.2.

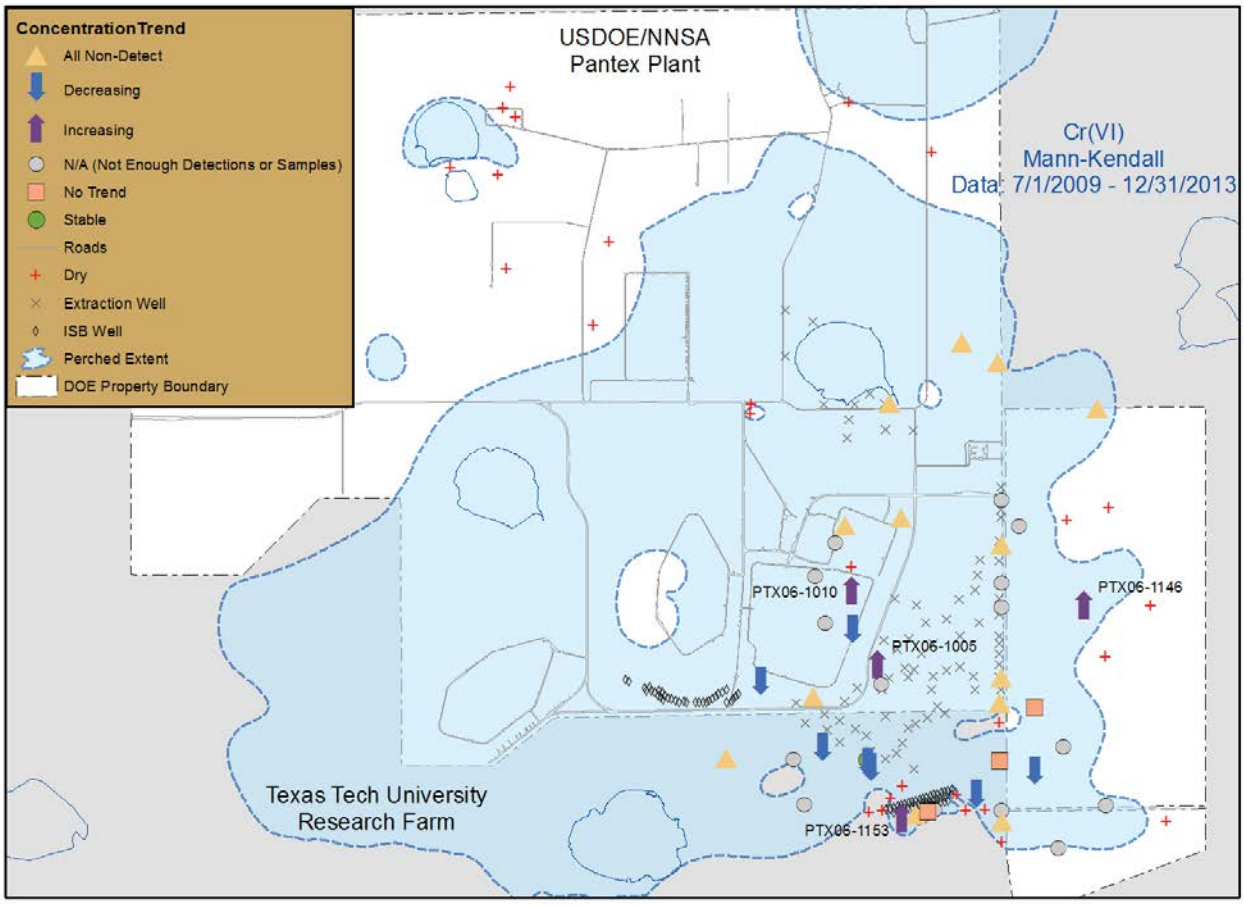

Figure 3-4. Hexavalent Chromium Trends in the Perched Aquifer

3.1.2 Concentration Trends Compared To Expected Conditions

Of the 103 monitor wells with expected COC concentration conditions defined in the LTM Design Report, 19 wells did not exhibit trends (since the start of remedial actions) consistent with the expected conditions. Four wells, including 1114-MW4, PTX06-1127, PTX07-1O02, and PTX06-1014, had an expected condition of long-term decreasing trends in concentration, but indicated increasing or stable trends since the start of remedial actions. However, their long-term trends were decreasing, so the expected conditions are met and the wells are not discussed below. Currently, the smaller size of the comparative dataset (covering approximately 4 ½ years since remedial actions began) limits its effectiveness to represent long-term trends. It is expected that, as remedial actions continue to operate and the dataset continues to grow, these trends will become more representative of long-term conditions in the perched aquifer.

The following monitoring wells (depicted in Figure 3-5) exhibited trends that were not consistent with the expected conditions:

- PTX06-1005 is exhibiting increasing trends in TCE and hexavalent chromium while the expected condition is a long-term stabilization of concentrations. As discussed in Sections 3.1.1.2 and 3.1.1.4, these trends are likely caused by injection well PTX06-INJ-12A.
- PTX06-1007 is exhibiting an increasing trend in perchlorate while the expected condition is a long-term decreasing trend. As discussed in Section 3.1.1.3, this trend could be caused by changes in mass flux from the perchlorate source area or possible effects of injection.
- PTX06-1010 is exhibiting an increasing trend in hexavalent chromium while the expected condition is a long-term decreasing trend. As discussed in Section 3.1.1.4, these trends are likely caused by injection at PTX06-INJ-02.
- PTX06-1015 is exhibiting an increasing trend in RDX concentration and PTX06-1034 is exhibiting increasing trends in RDX and TCE while the expected condition is long term stabilization of concentrations in this well. These wells are located in the southeast portion of perched groundwater which is currently not under the effect of a remedial action.
- PTX06-1035 is exhibiting an increasing trend in perchlorate while the expected condition is a stable or decreasing trend below the GWPS. This well is not currently under the influence of a remedial action and the increasing trend is likely due to general plume movement downgradient.
- PTX06-1041 and PTX06-1042 are exhibiting increasing trends in RDX while the expected condition is long-term stabilization of concentrations. As discussed in

Section 3.1.1.1 the trends in these wells are likely due to pumping effects and do not represent general plume movement in the area.

- PTX06-1046 is exhibiting increasing trends in RDX and TCE while the expected condition is long-term stabilization of concentrations. This well is located in the southeastern portion of the perched aquifer, which is not likely currently affected by the SEPTS.
- PTX06-1049 is exhibiting increasing trends in RDX and TCE while the expected condition is long-term stabilization of concentrations. As discussed in Sections 3.1.1.1 and 3.1.1.2, this well is not under the effect of a remedial action and these increasing trends are likely due to radial groundwater flow away from Playa 1.
- PTX06-1095A is exhibiting an increasing trend in RDX while the expected condition is long-term stabilization of concentrations. This well is located within the influence of the SEPTS well field, but is also downgradient from the PRB Pilot Study and the increasing RDX trend likely due to the PRB losing treatment effectiveness and concentrations returning to baseline conditions due to plume movement.
- PTX06-1146 is exhibiting an increasing trend in hexavalent chromium while the expected condition is a long-term decreasing trend. However, this trend is attributed to corrosion of the stainless steel well screen.
- PTX06-1147 is exhibiting an increasing trend in RDX while the expected condition is a long-term decreasing trend. This well is located in the southeast zone of perched groundwater and is not currently under the effect of a remedial action.
- PTX06-1148 and PTX06-1150, which are downgradient of the Zone ISB, are exhibiting increasing trends in TCE and perchlorate concentration while the expected condition is to be below GWPS in 2 – 5 years. However, the conceptual site model predicted treated water would not reach this well for many years (Aquifer Solutions, 2011). To address this inconsistency, the expected conditions for these wells were redefined in the Update to the LTM System Design (B&W Pantex 2014) and these changes will be reflected in the 2014 Annual Progress Report.
- PTX06-1151 is exhibiting an increasing trend in TCE concentration while the expected condition is a long-term decreasing trend. This well is not currently under the effect of a remedial action and this trend is likely due to continued plume movement downgradient.
- PTX06-1153, which is a downgradient ISPM well for the Southeast ISB system, is exhibiting increasing trends in hexavalent chromium and RDX concentrations exceeding GWPS while the expected condition is to be below GWPS in 2 – 5 years.

Pantex is actively investigating the cause of this unexpected condition as described in Section 3.1.1.4.

- PTX08-1003 is exhibiting an increasing trend in TCE below GWPS while the expected condition is a stable or decreasing trend below GWPS. As discussed in Section 3.1.1.2, this trend is likely due to general plume movement downgradient of the former Fire Training Area.
- PTX08-1006, located upgradient of the Zone 11 ISB system, is exhibiting increasing trends in RDX and TCE while the expected condition is a long-term decreasing trend. These trends are likely due to general plume movement downgradient. Additionally, recent RDX data indicates a decreasing trend in this well.

Additional detail on all LTM wells is located in Table D-1 in Appendix D.

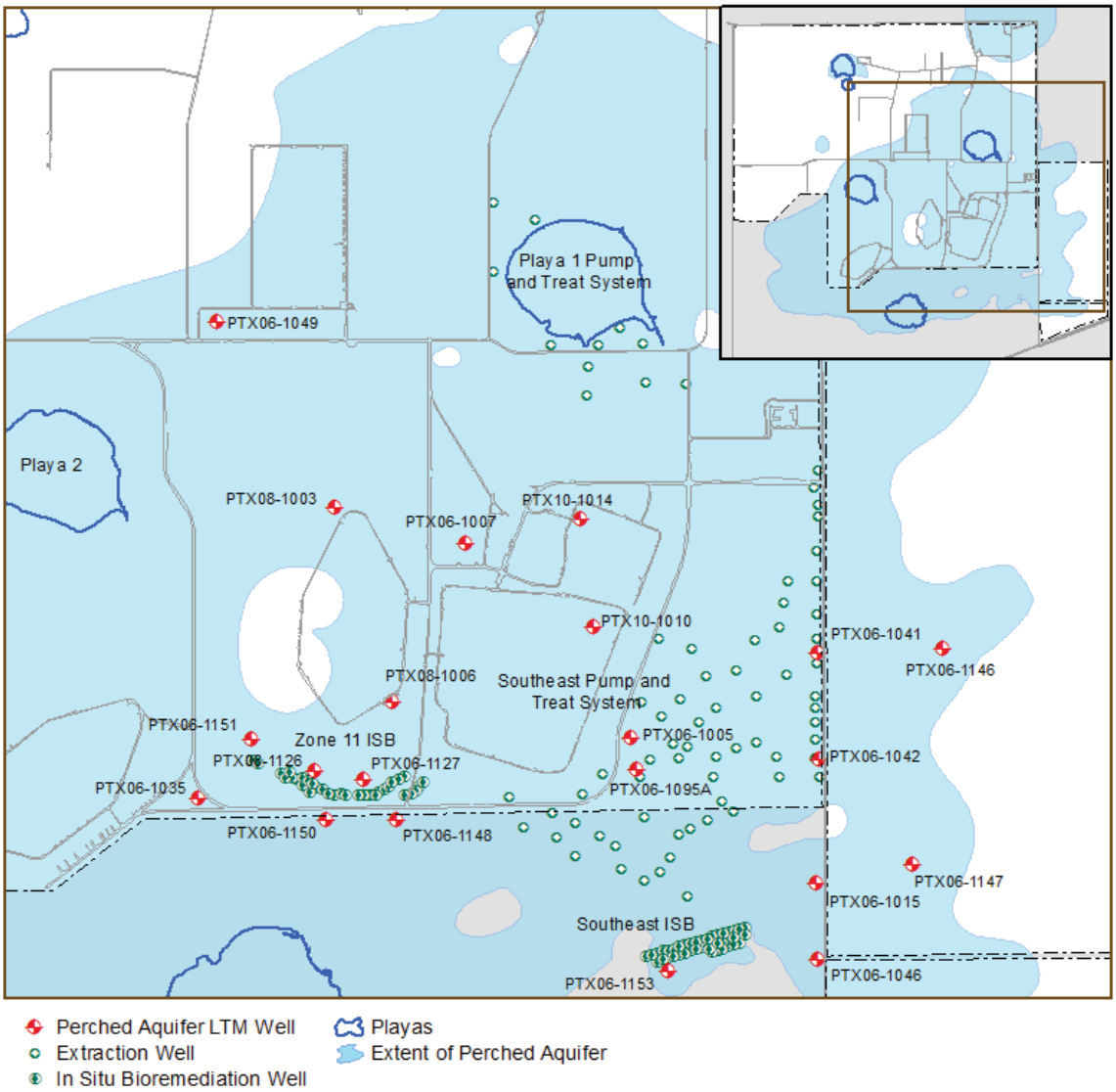

Figure 3-5. Perched Wells with Unexpected COC Trends

3.1.3 Water Level Trending

MAROS linear regression methodology outlined in the LTM Design Report was used to trend water levels at each well. Trends were calculated for the entire dataset of water levels for each well as well as the most recent two years of data at each well. The recent trends are expected to give a more accurate measurement of the effectiveness of the two pump and treat systems as the P1PTS began operating in late 2008 and the SEPTS began operating near full capacity by April 2009. Figure 3-6 depicts the water level trends in all LTM perched aquifer wells. Well hydrographs are included in Appendix E.

Trending results are showing positive effects of the remedial actions as all wells currently recognized to be under the influence of the pump and treat systems are exhibiting short-term decreasing trends in water levels. Additionally, if the short-term and long-term trends are compared for wells located in Zone 11 and Zone 12, many wells in this region have begun to exhibit short-term decreasing trends in water level. These trends could be an indication of expansion of the zone of influence of the pump and treat systems as the perched aquifer saturated thickness below Playa 1 continues to be reduced.

A discussion of the remedial action effectiveness is included in a later section.

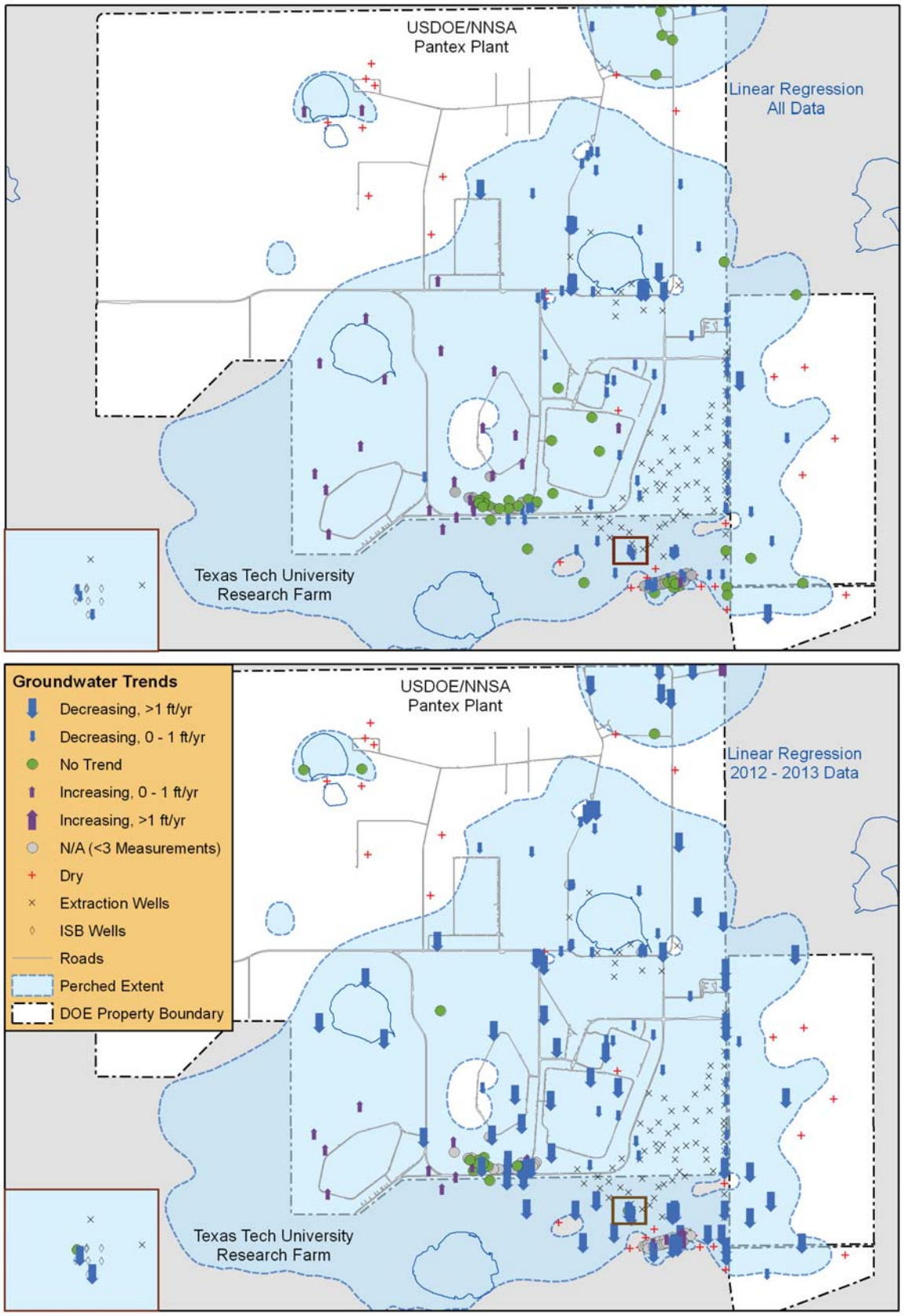

Figure 3-6. Water Level Trends in the Perched Aquifer

3.1.4 Water Level Trends Compared To Expected Conditions

Overall, calculated groundwater level trends are consistent with expected conditions defined in the LTM Design Report summarized in Appendix D. Of the 43 monitor wells with expected decreasing water level trends defined in the LTM Design Report, only three wells did not exhibit trends (last two years) consistent with the expected conditions. However, all of these wells are installed in areas of limited saturated thickness at the fringe of the perched groundwater extent. Due to the variability in water levels observed in these areas, the expected conditions for these wells were redefined in the *Update to the LTM System Design Report* (B&W Pantex 2014a) and these changes will be reflected in the 2014 Annual Progress Report.

Considering the remedial action has been in place for less than five years, these data are very encouraging and it is expected that these trends will continue as the perched aquifer saturated thickness is reduced in the zone of influence of the two pump and treat systems.

The following wells (depicted in Figure 3-7) exhibited trends that were not consistent with the current expected conditions:

- Water continued to be measured (saturated thickness of 0 – 1 foot) in PTX06-1133A in 2013 while the expected condition was for this well to remain dry. This well, which is in the southeast lobe of the perched aquifer, was installed in November 2008 and remained dry through 2009 and 2010. Recent water level data indicate decreasing trends and the December water level measurement suggested the water was near the bottom of the screen.

- Water was measured in the sump at PTX06-1089 in 2013. This well had been historically dry until 2011, when water was first measured in the sump. Water was measured at the bottom of the screen during 2013, but no discernable trend could be calculated at this location. The perched extent could be slightly expanding as identified in PTX06-1133A. However, PTX06-1093, which is located between the current estimated perched extent and PTX06-1089, has remained dry. Water levels will continue to be monitored at this well to determine if a trend emerges.

- Water was measured throughout 2013 in PTX06-1073A, which is located on the edge of perched saturation in western Zone 11. This well was dry from installation until 2007, when approximately 2 feet of water was measured. The well maintained 1- 2 feet of water until 2009, when the water level dropped into the sump. The well had been dry for one year before the December 2012 measurement event, when the highest historic water level was observed (~5 feet saturated thickness). Recent data indicate decreasing water levels in this well.

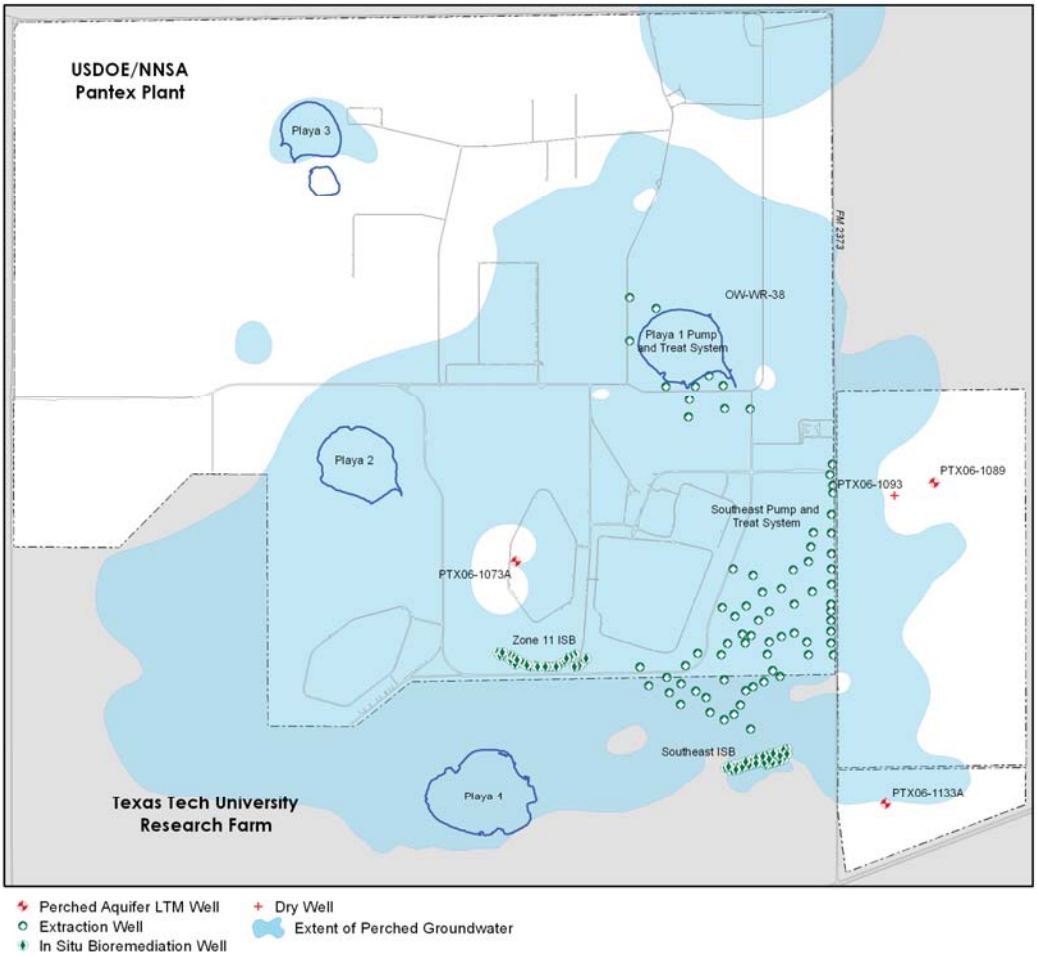

Figure 3-7. Perched Wells with Unexpected Water Level Trends

3.1.5 Water Level Mapping

Groundwater beneath the Pantex Plant and vicinity occurs in two stratigraphic horizons within the Ogallala Formation. The most significant quantities of groundwater in the vicinity of the Plant are found in the Ogallala Aquifer system. Considerably less water occurs in the upper Ogallala Formation, as perched groundwater overlying a FGZ.

Presented in this section are water table maps of the Ogallala Aquifer and the primary perched aquifer underlying Pantex Plant. Water level measurements used to create these maps were collected primarily during December 2013 from Pantex Ogallala and perched aquifer investigative wells. These data were supplemented with water level measurements in the Ogallala Aquifer collected during December 2013 and January 2014 by other agencies and published by the Texas Water Development Board (TWDB). Figure 3-8 presents the Ogallala Aquifer water levels. Figure 3-9 and Figure 3-10 present perched aquifer water levels.

3.1.5.1 Ogallala Aquifer

As shown in Figure 3-8, flow in the Ogallala Aquifer underlying Pantex Plant is to the northeast. The northeast hydraulic gradient results from agricultural pumping as well as from the City of Amarillo well field to the north and from the Pantex water supply wells in the northeastern part of the Plant. The Amarillo well field produces approximately 12.7 million gallons per day from the Ogallala Aquifer, based on 2013 City of Amarillo data. The hydraulic gradient in the Ogallala Aquifer underlying the northern part of Pantex Plant is approximately 0.007 ft/ft.

3.1.5.2 Perched Aquifer

As shown in Figure 3-9 and Figure 3-10, perched groundwater occurs as a number of separate flow systems beneath Pantex Plant. Each of these flow systems is associated with an area of focused recharge, usually a playa lake. The main perched aquifer is associated with natural recharge from Playas 1, 2, and 4, past treated wastewater discharge to Playa 1, and historical wastewater releases to the ditches draining Zones 11 and 12. Small areas of perched groundwater occur in the vicinity of Playa 3, the Old Sewage Treatment Plant (OSTP) area, and Zone 6. Because of the limited extent and saturated thickness of these separate areas, water table contours for these areas are omitted from the perched aquifer contour map. The extents of saturation for the main perched aquifer and perched groundwater beneath the OSTP area show that these two bodies of groundwater are separated by only a short distance. However, observed water levels in both areas indicate that hydraulic interaction between these two areas is limited, even if the extents of saturation overlap. Perched groundwater has also been observed beneath the southern side of Pantex Lake, located about 2.5 miles northeast of the Plant property boundary, but this body of groundwater is not hydraulically connected to the perched aquifer underlying the Pantex Plant.

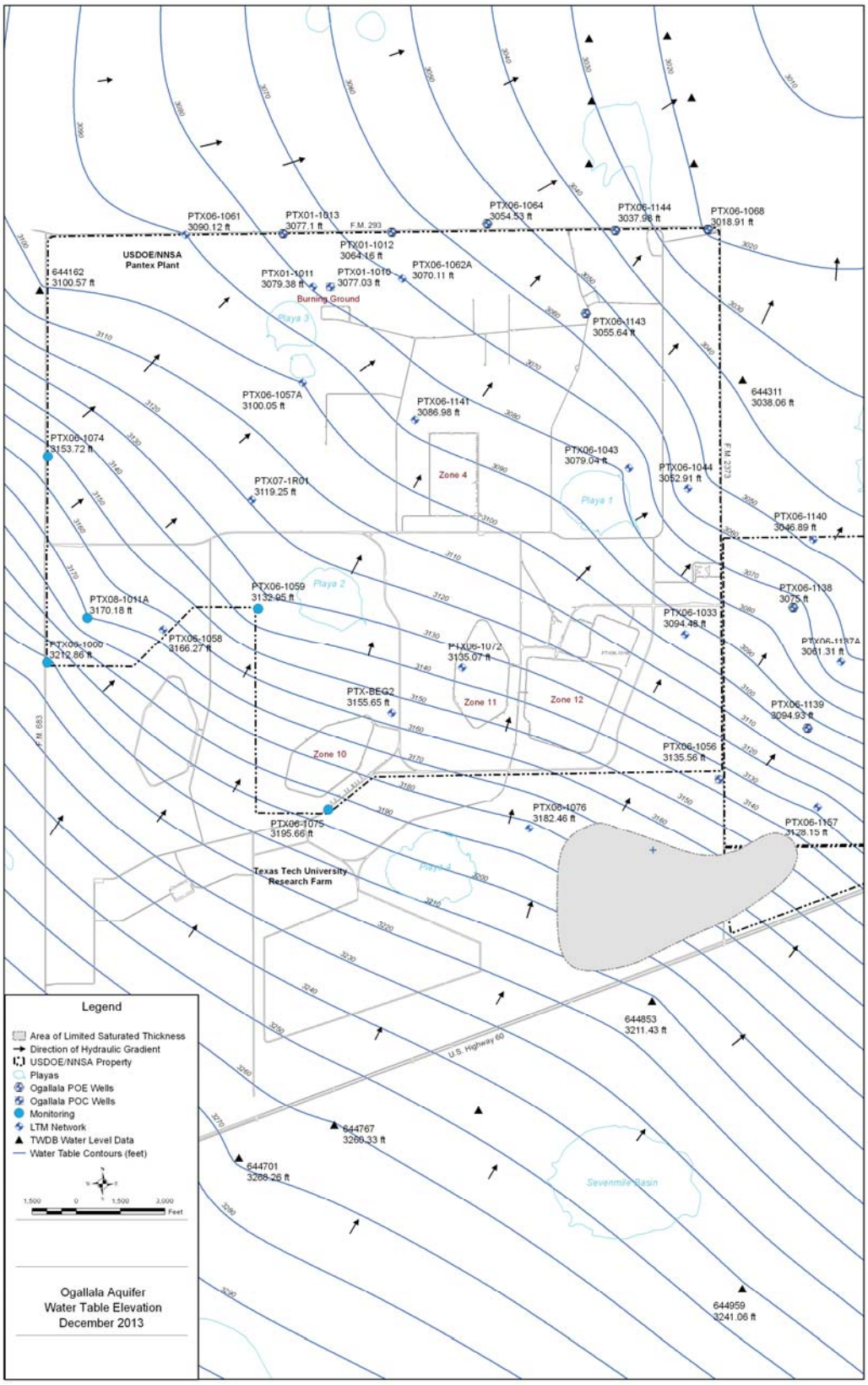

Figure 3-8. Ogallala Aquifer Water Levels

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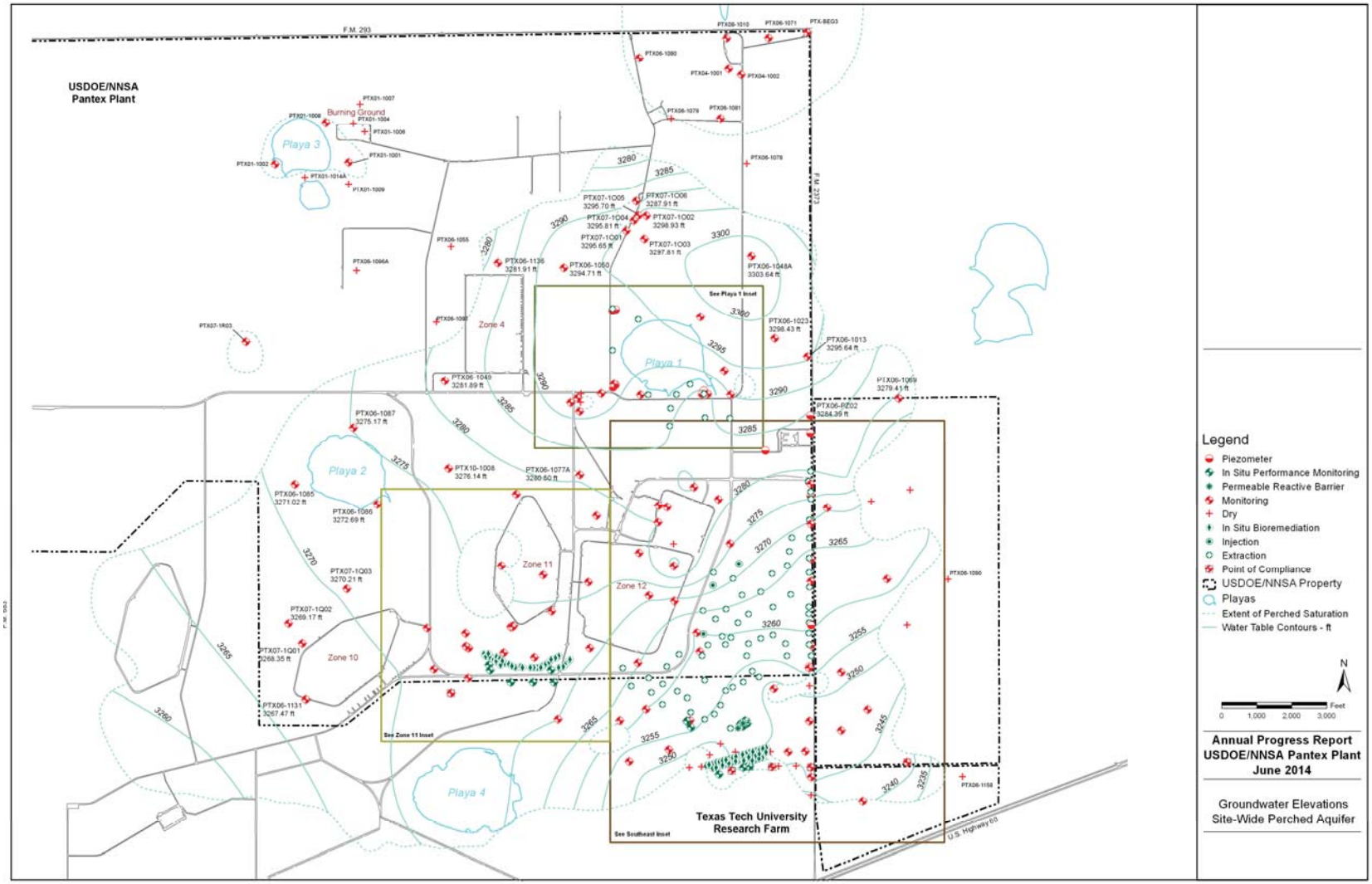

Figure 3-9. Perched Aquifer Water Levels

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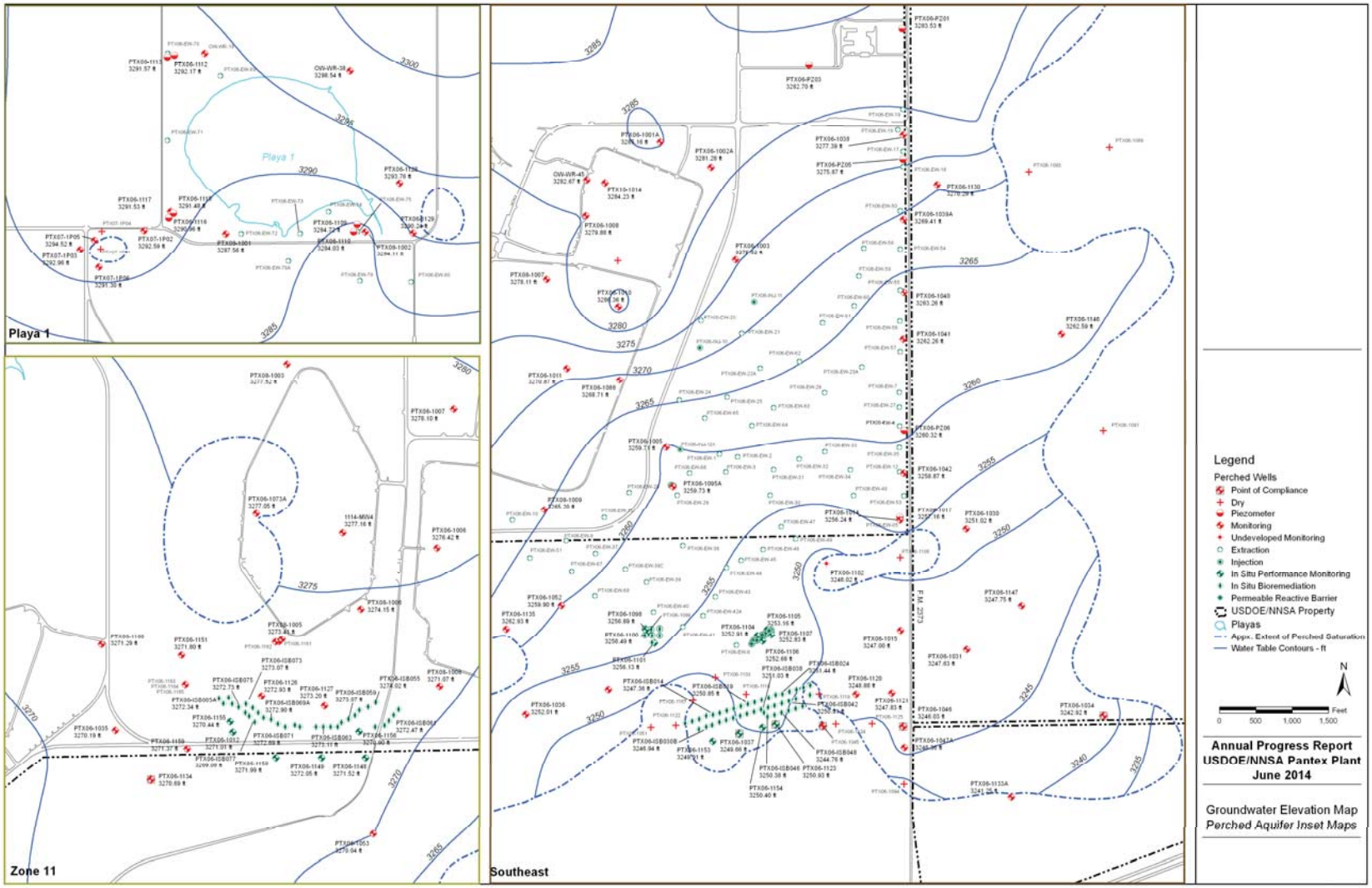

Figure 3-10. Perched Aquifer Water Levels, Inset Maps

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Groundwater in the perched aquifer tends to flow radially away from Playa 1. Flow to the north and directly east of Playa 1 is limited by the structure of the FGZ. Flow to the south and southwest has extended several miles from Playa 1 and has been enhanced by recharge through Playas 2 and 4. Additionally, the large area of contaminated groundwater in the southeast corner of the USDOE/NNSA property occurred as a result of historical discharges of treated and untreated process waters from Zone 12. Two perched groundwater pump and treatment systems are currently removing water and contaminants from the perched aquifer thus limiting the further migration of contaminated groundwater to the east and south.

The horizontal hydraulic gradient of the perched aquifer varies spatially across the Plant. The hydraulic gradient is 0.005 ft/ft near Playa 1, 0.001 ft/ft near Playa 2, 0.005 ft/ft downgradient of Zone 12, and 0.004 ft/ft south of Zone 11.

3.1.6 Plume Mapping

Isoconcentration maps of indicator constituents (COCs and breakdown products of RDX and TCE) in the perched aquifer are presented in this section. Perched aquifer indicator parameters were proposed in the SAP. Isoconcentration maps for this annual report were produced from groundwater data collected in 2013. Each isoconcentration map presents the highest detected concentration for each constituent using validated analytical data from January to December 2013. For each constituent, extent is defined in the perched aquifer by the extent of saturation, detected concentrations below the GWPS or PQL, or non-detects from an LTM well.

The COC plumes were delineated to the approved PQL, GWPS, or site-specific backgrounds proposed in the SAP. In some cases, where the PQL and GWPS were not significantly different and the plume shape would not be significantly affected, the GWPS was used for delineation. For example, the RDX GWPS is 2 ug/L and the PQL is 1 ug/L. In this case, the RDX plume was delineated to 2 ug/L. The GWPS isoconcentration contour is highlighted by a yellow line outlined in black.

Constituent concentrations for samples from the extraction wells located within the two extraction well fields were used in generating the isoconcentration contours, but the analytical concentration data from these wells may differ from investigative wells because of the different sampling techniques used for the extraction wells. The extraction wells are clearly identified on the figures with an "EW" in the well identification label and a distinct symbol. Pump and treat system injection wells are identified on the figures with an "INJ" and ISB injection wells are identified with an "ISB" in their respective well identification labels.

Figure 3-39 and Figure 3-40 present total chromium isoconcentrations for the perched aquifer. Well locations shown surrounded by a green pentagon were constructed with a stainless steel well screen and casing. Extraction wells, ISB injection wells, and dry wells were

not depicted with these symbols. Several of these wells have been shown by video observation to be corroded and/or have bacterial growth present, and statistical analysis of the concentrations of chromium and other components of stainless steel (manganese, molybdenum, and nickel) shows strong correlations among the concentrations of these metals in samples obtained from these wells. This evidence indicates some degree of corrosion occurring in all perched aquifer stainless steel wells at Pantex. Therefore, the chromium concentrations for these wells were not included in the kriging of the isoconcentration lines unless the well is associated with the hexavalent chromium plume. The maximum observed concentration for the year is posted on the map for each of these wells.

Constituent concentrations for samples from the Southeast ISB injection wells were generally used in generating the isoconcentration contours; however, for some constituents, including metals and HEs, these data were not used because the concentrations were indicative of the ISB treatment zone rather than the surrounding formation. Additionally, most downgradient ISPM wells are now indicating treatment effects of the ISB treatment zone, as well as effects of expansion of the treatment zone. When these effects resulted in concentrations that were not believed to be representative of the surrounding formation and the overall plume shape, these results were not included in the contouring process. The estimated downgradient areas under the influence of the ISB systems are now depicted on plume maps, when appropriate. COC data obtained from the wells immediately downgradient from the three in situ remediation pilot project areas were not used in generating the isoconcentration contours. Concentrations observed at these wells are typically much lower than surrounding plume concentrations and represent the localized influence of the pilot-scale remediation projects.

Table 3-1 identifies all indicator constituents for the perched aquifer. Figure 3-11 through Figure 3-50 are isoconcentration maps for RDX, DNX, TNX, HMX, MNX, TNT, 2-amino-4,6-dinitrotoluene, 4-amino-2,6-dinitrotoluene, 2,4-dinitrotoluene, 2,6-dinitrotoluene, 1,3,5-trinitrobenzene, boron, chromium, hexavalent chromium, perchlorate, 1,2-dichloroethane, *cis*-1,2-dichloroethene, 1,4-dioxane, PCE, TCE, vinyl chloride, and chloroform.

Table 3-1. Perched Aquifer Indicator Parameters

HEs	Metals	Inorganics	Volatile Organics
RDX	Boron	Perchlorate	1,2-Dichloroethane
HMX	Chromium		1,4-Dioxane
MNX	Hexavalent Chromium		*cis*-1,2-Dichloroethene
DNX			*trans*-1,2-Dichloroethene
TNX			PCE
TNT			TCE
1,3-Dinitrobenzene			Chloroform
2-Amino-4,6-dinitrotoluene			Vinyl Chloride
4-Amino-2,6-dinitrotoluene			
2,4-Dinitrotoluene			
2,6-Dinitrotoluene			
1,3,5-Trinitrobenzene			

Isoconcentration maps for the other indicator constituents (trans-1,2-dichloroethene and 1,3-dinitrobenzene) were not prepared because none of the measured concentrations exceeded the background or PQL or detections were isolated to only a few wells and could not be used to map a distinct plume. The following sections provide specific information detailing the reasons maps were not prepared for these constituents.

Trans-1,2-Dichloroethene

Trans-1,2-dichloroethene was detected in 3 of the 103 perched aquifer wells (PTX06-ISB075 replacement well, PTX06-1155, and PTX06-1012) sampled in 2013. PTX06-1155 and PTX06-1012 are downgradient ISPM wells for the Zone 11 ISB system, where breakdown products of TCE are expected. The reported values were less than the GWPS of 100 ug/L. Therefore, an isoconcentration map was not prepared for this compound.

1,3-Dinitrobenzene

1,3-Dinitrobenzene was not detected in any perched aquifer wells sampled in 2013. Therefore, an isoconcentration map was not prepared for this compound.

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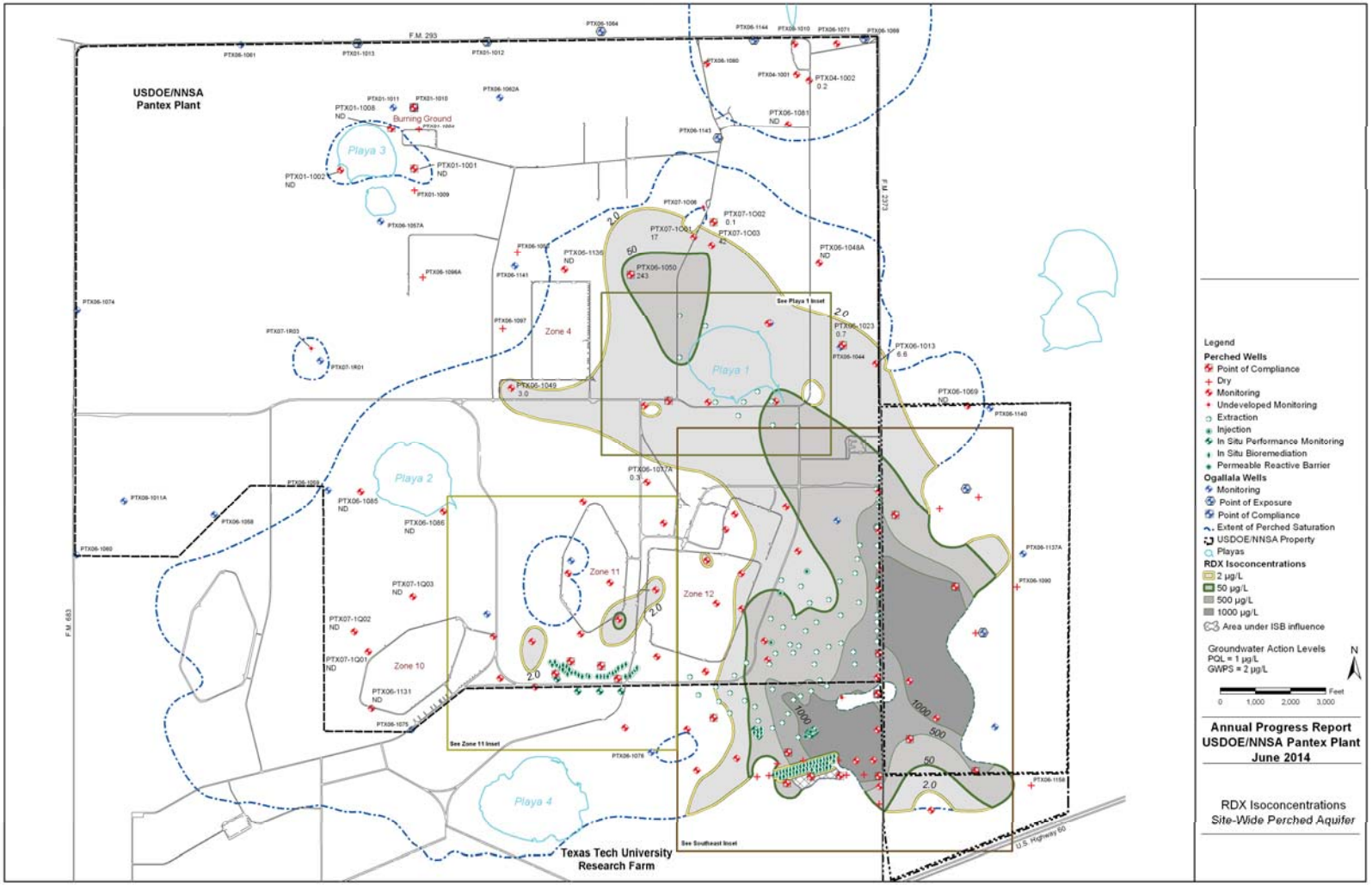

Figure 3-11. RDX Isoconcentration Map

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Figure 3-12. RDX Isoconcentration Inset Map

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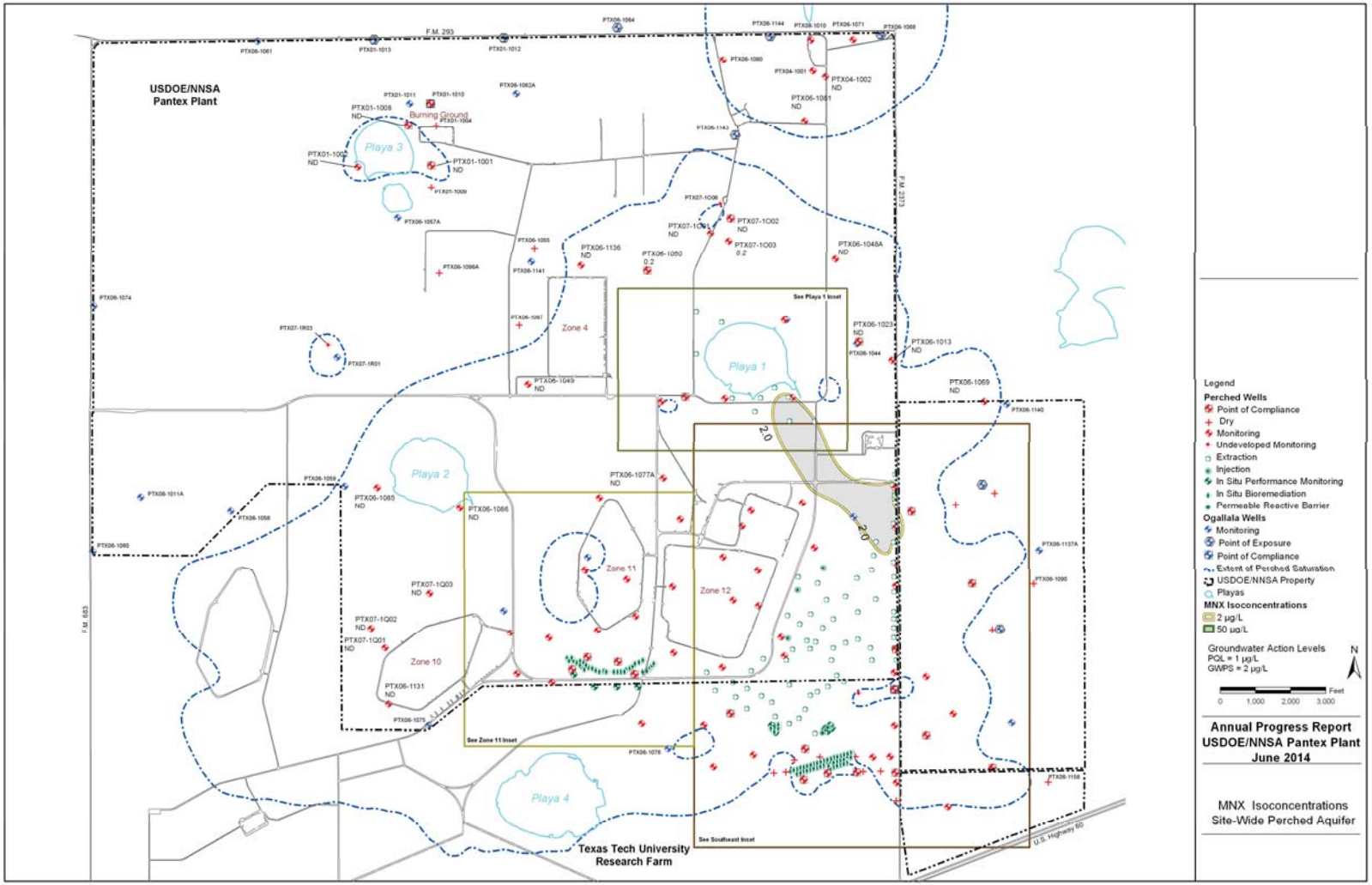

Figure 3-13. MNX Isoconcentration Map

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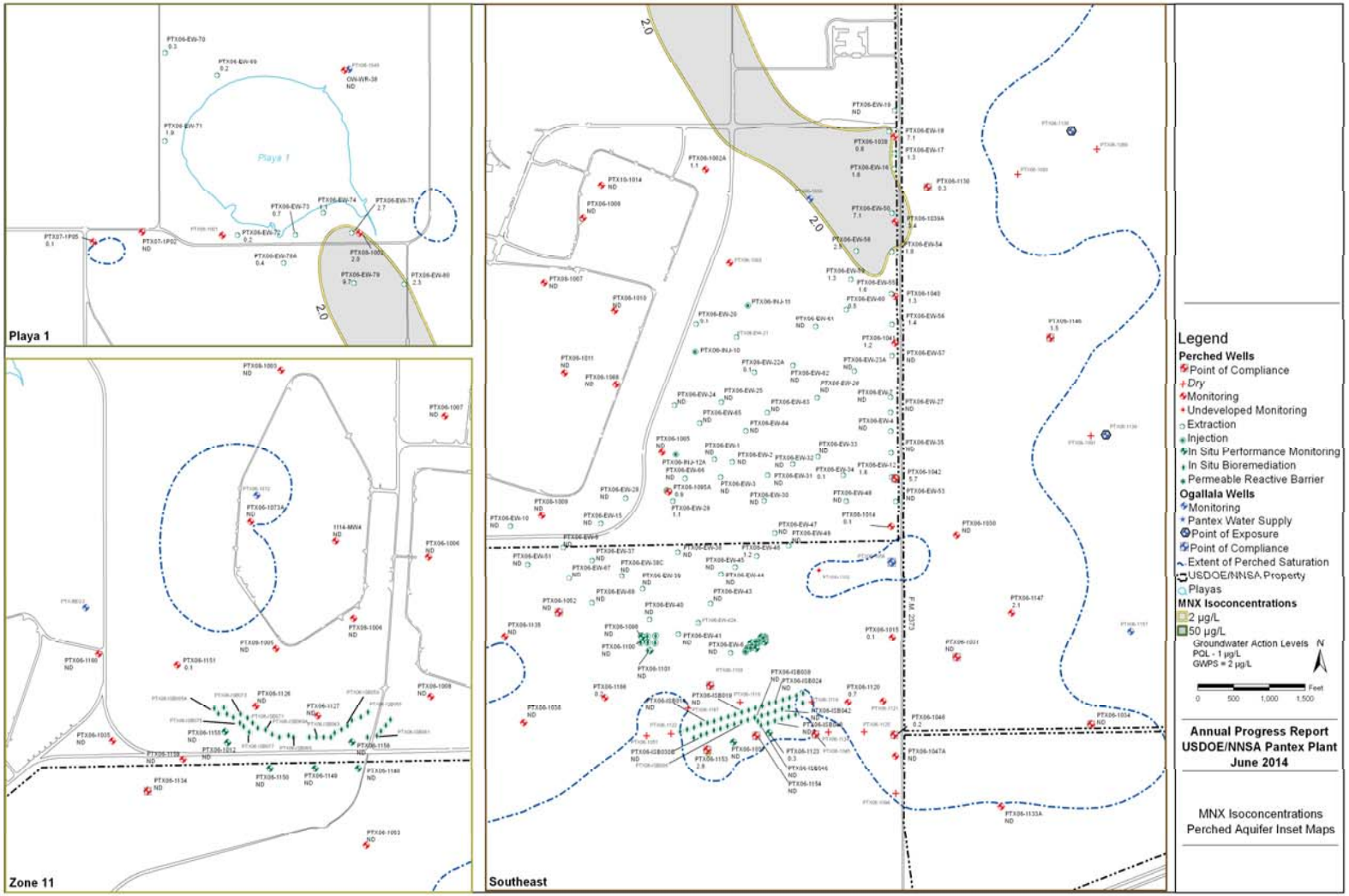

Figure 3-14. MNX Isoconcentration Inset Map

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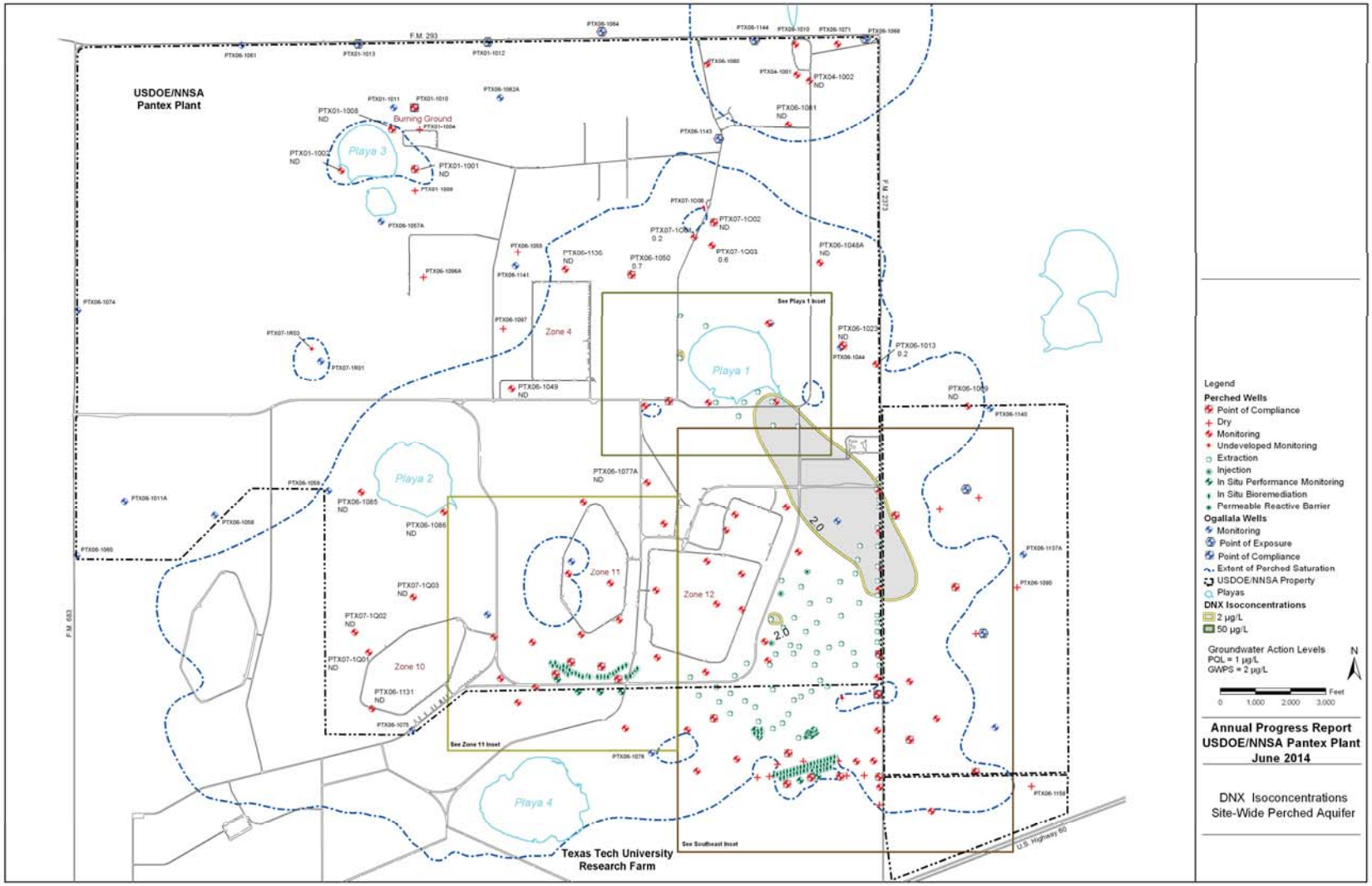

Figure 3-15. DNX Isoconcentration Map

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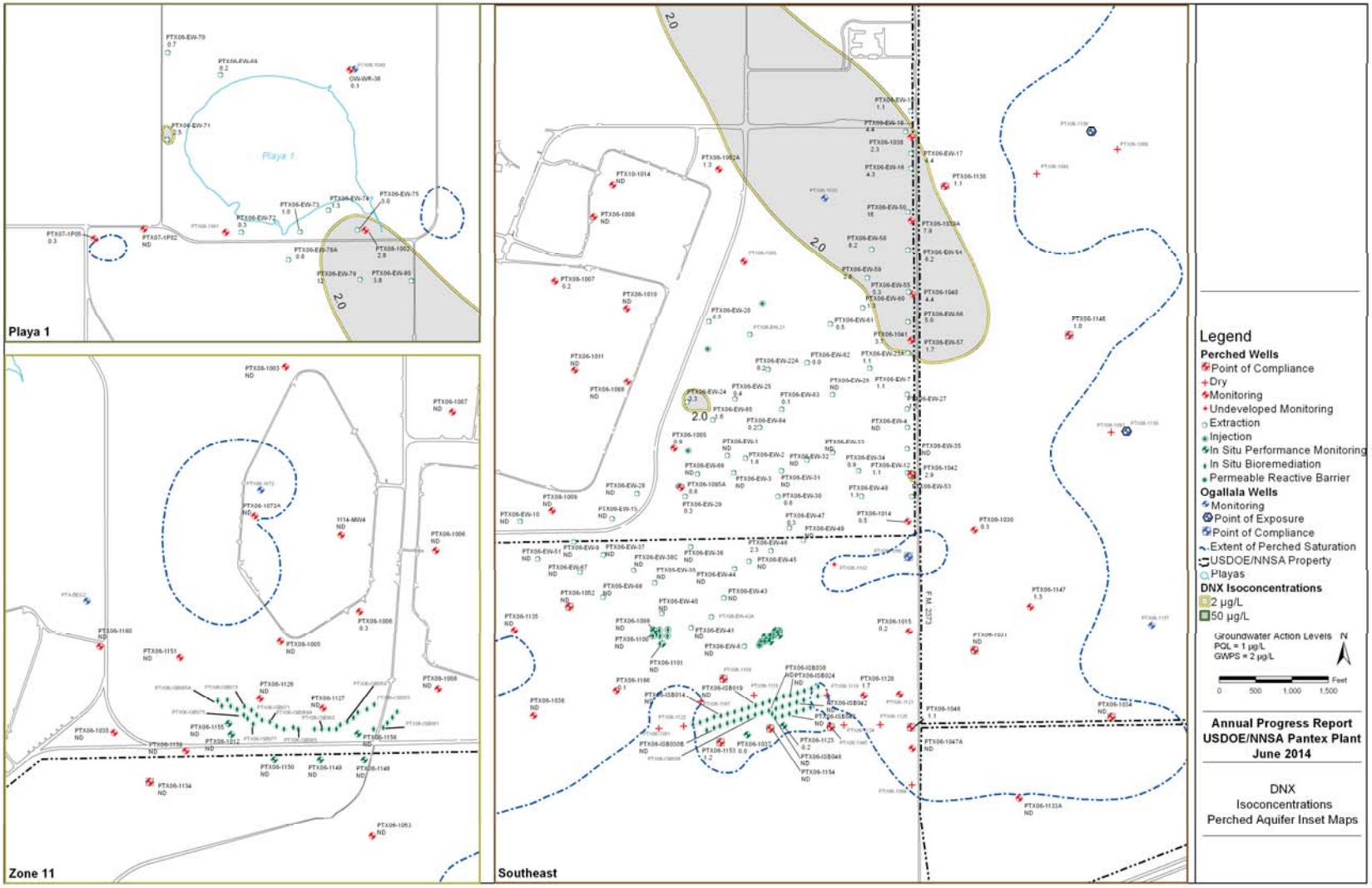

Figure 3-16. DNX Isoconcentration Inset Map

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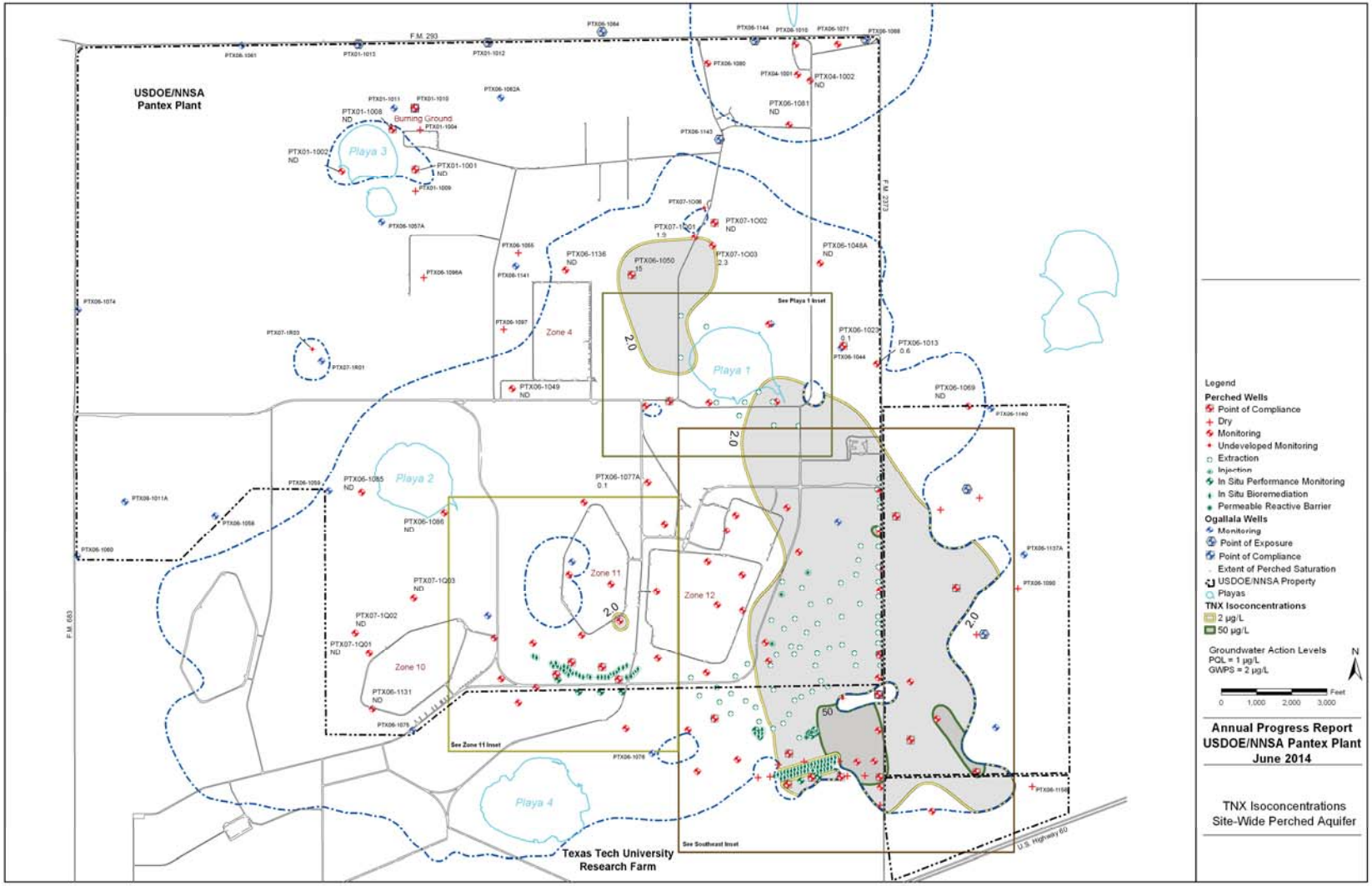

Figure 3-17. TNX Isoconcentration Map

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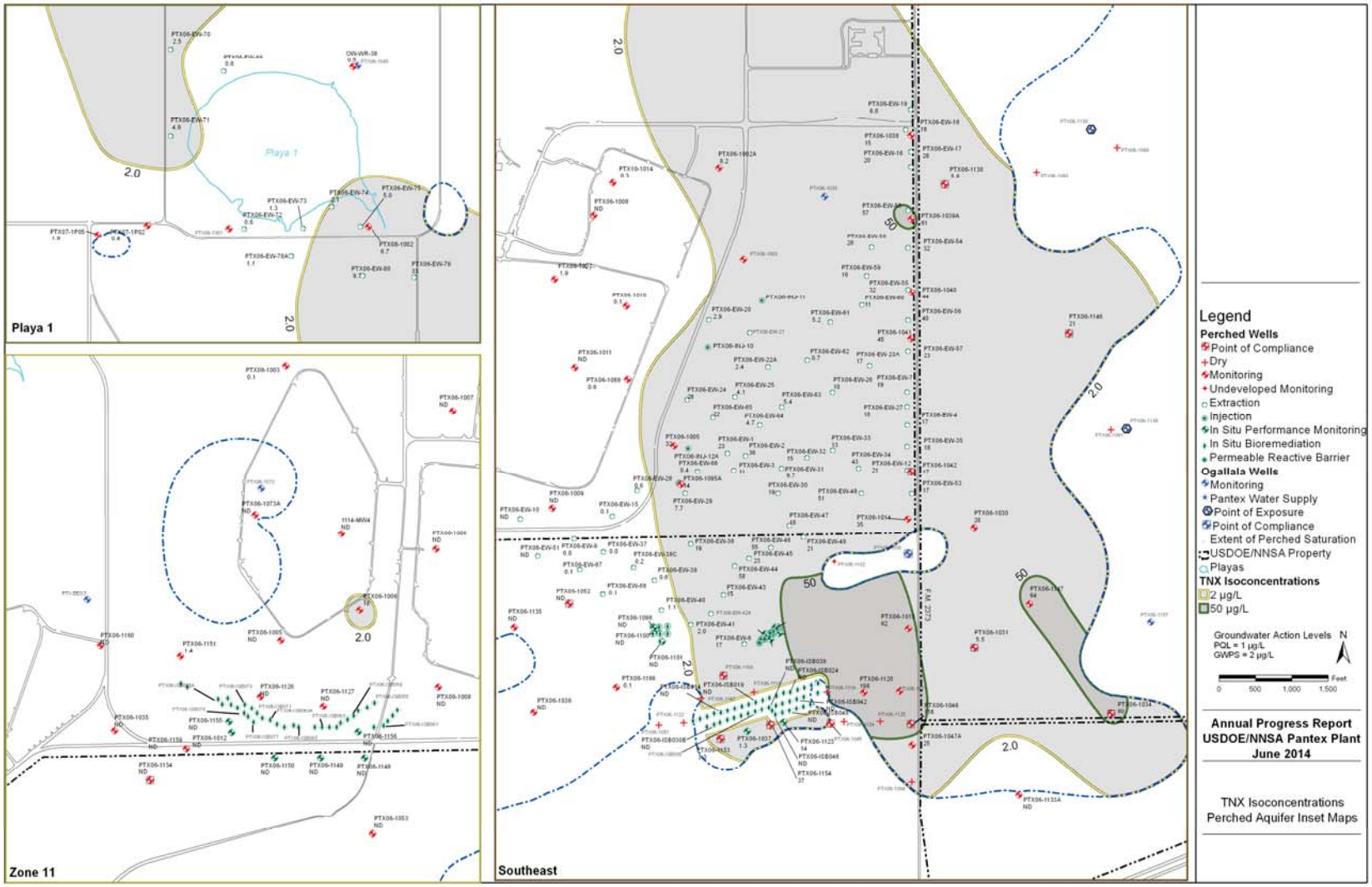

Figure 3-18. TNX Isoconcentration Inset Map

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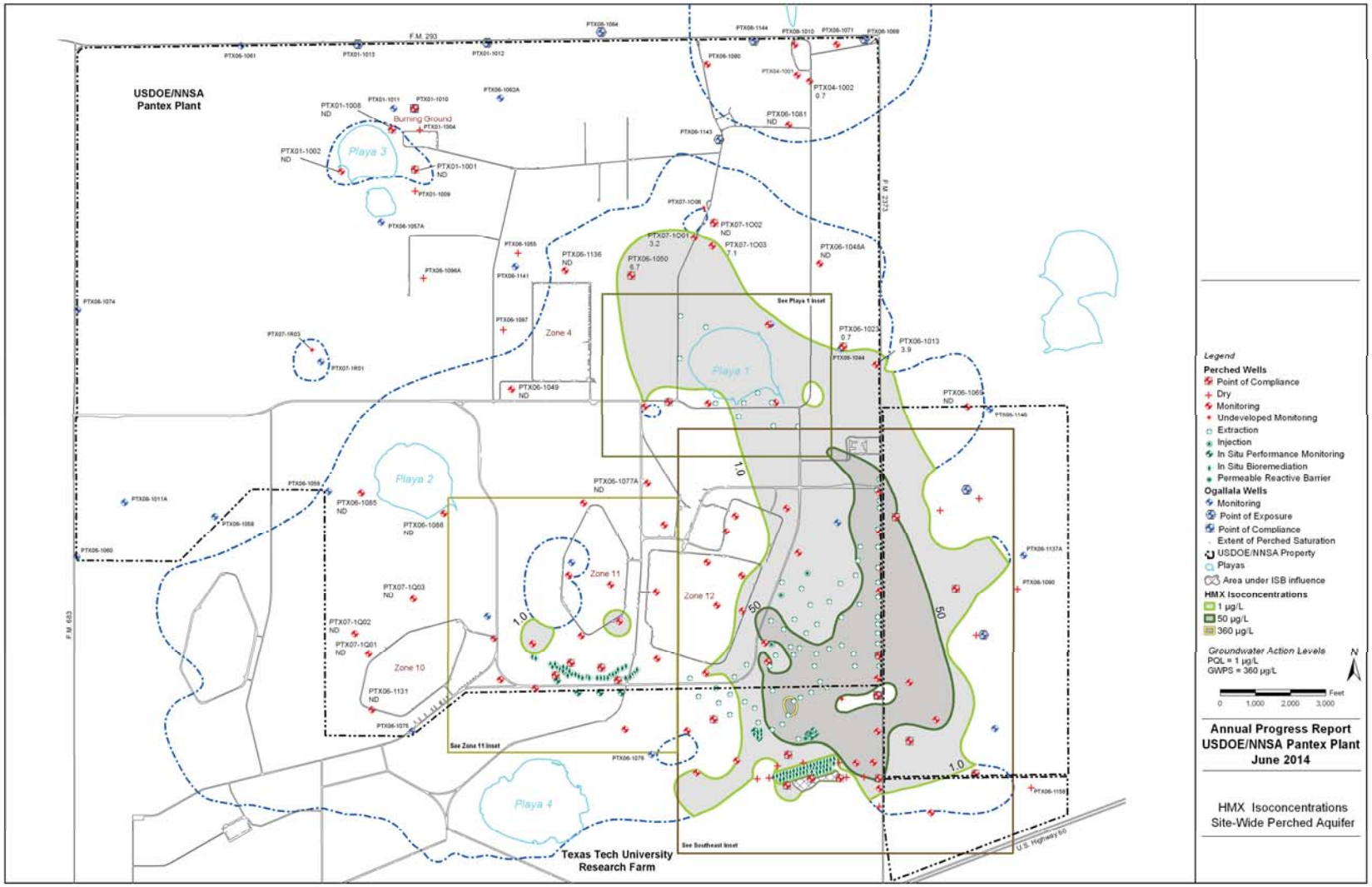

Figure 3-19. HMX Isoconcentration Map

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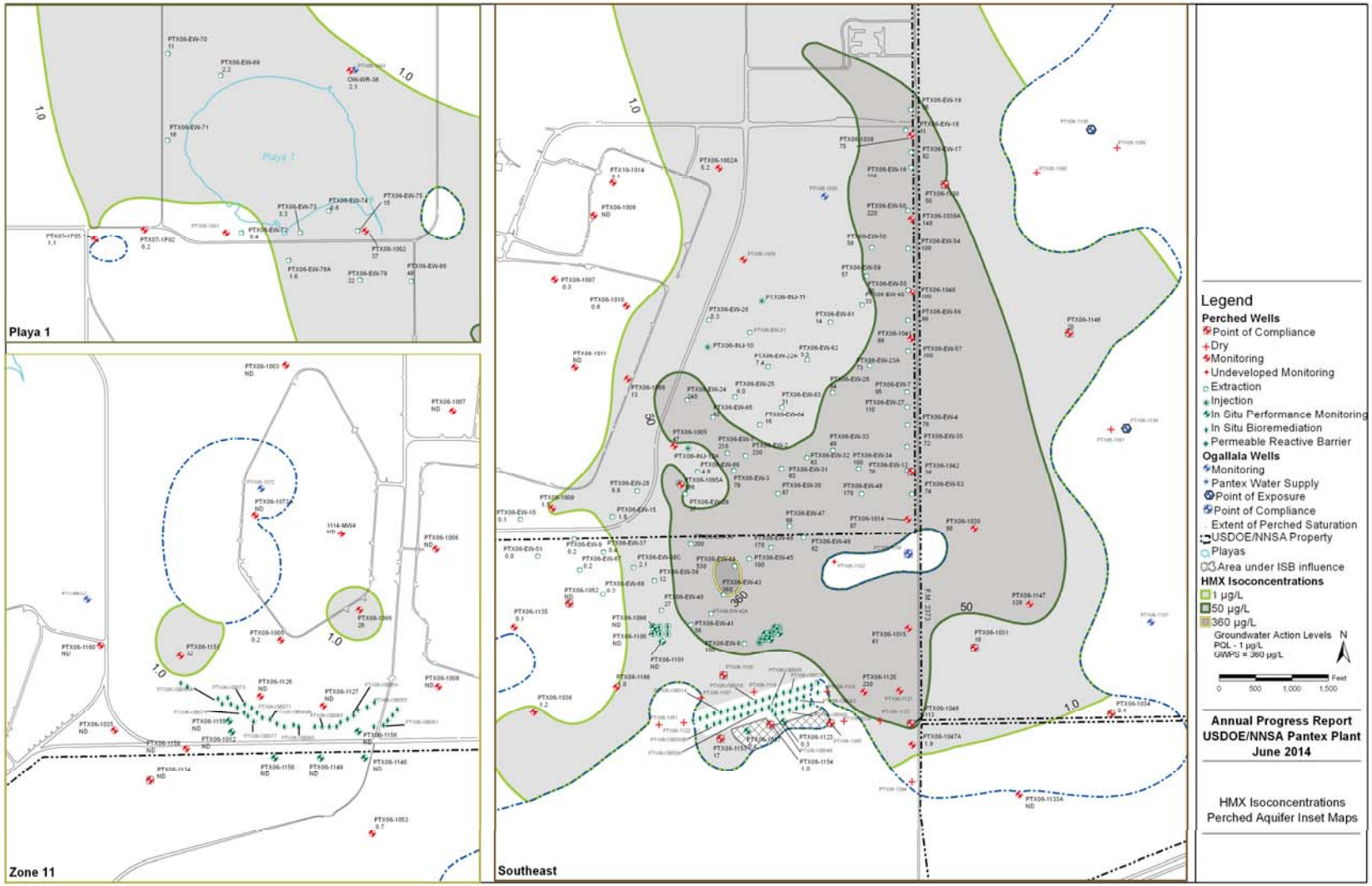

Figure 3-20. HMX Isoconcentration Inset Map

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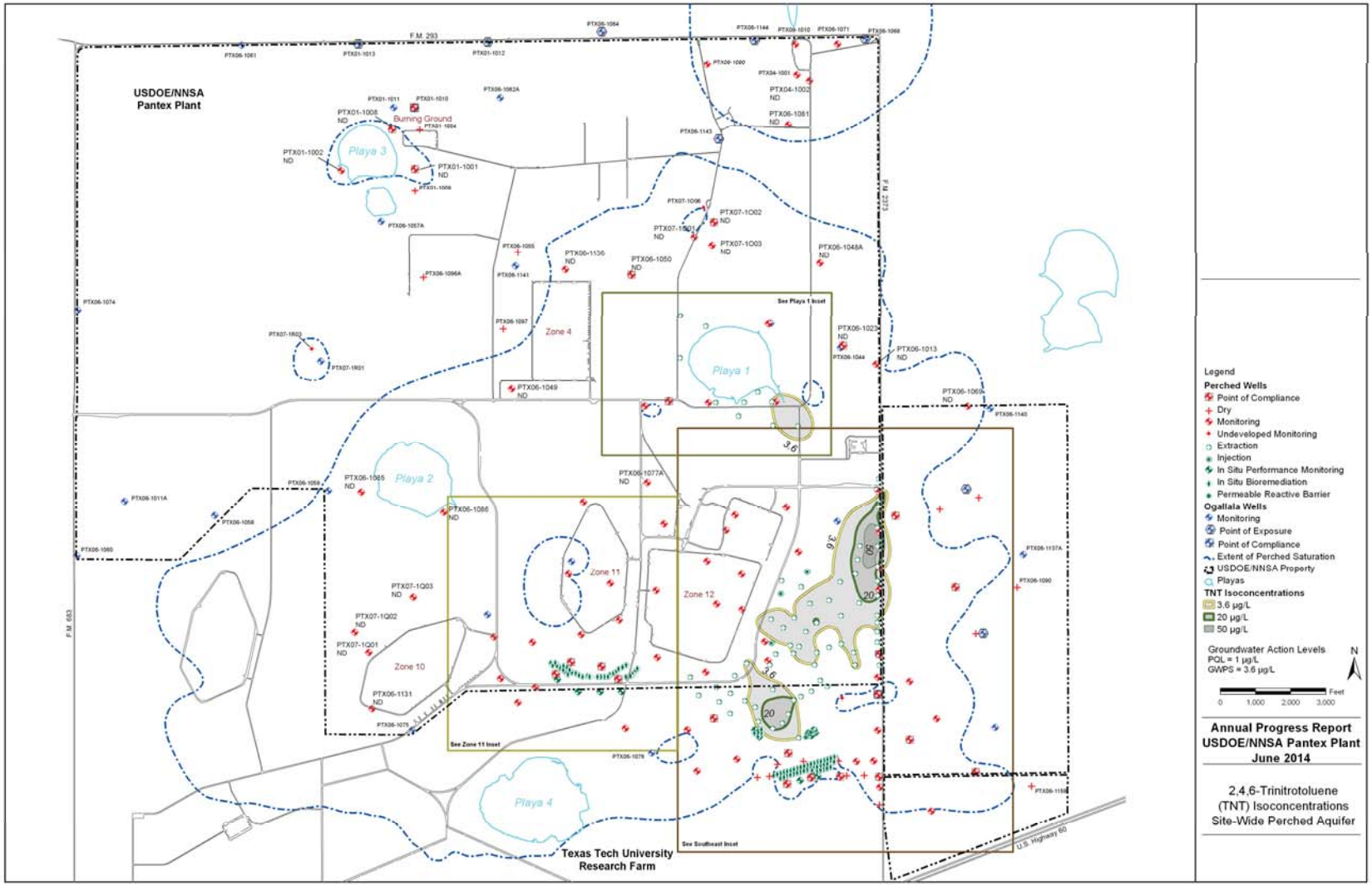

Figure 3-21. TNT Isoconcentration Map

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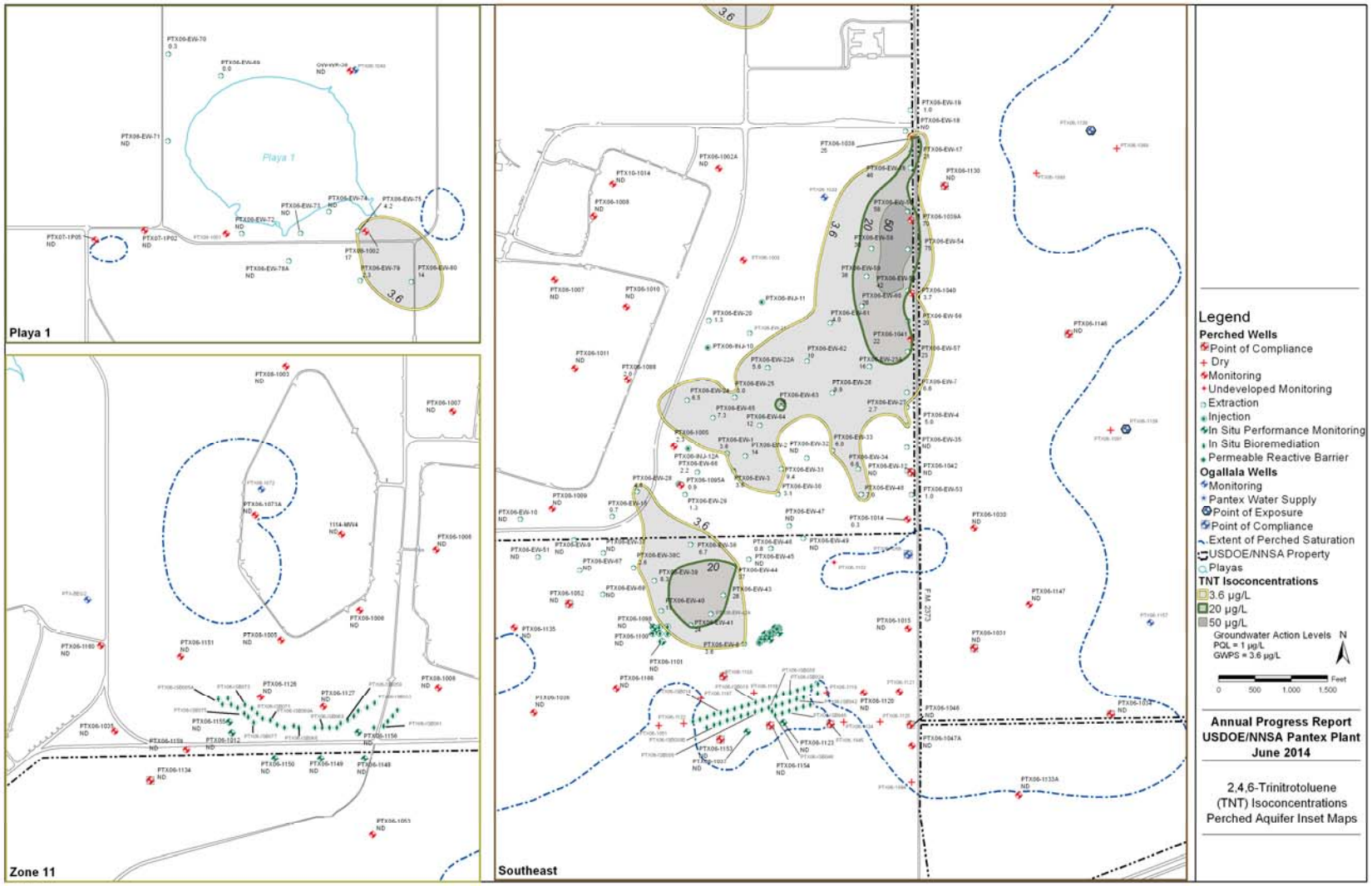

Figure 3-22. TNT Isoconcentration Inset Map

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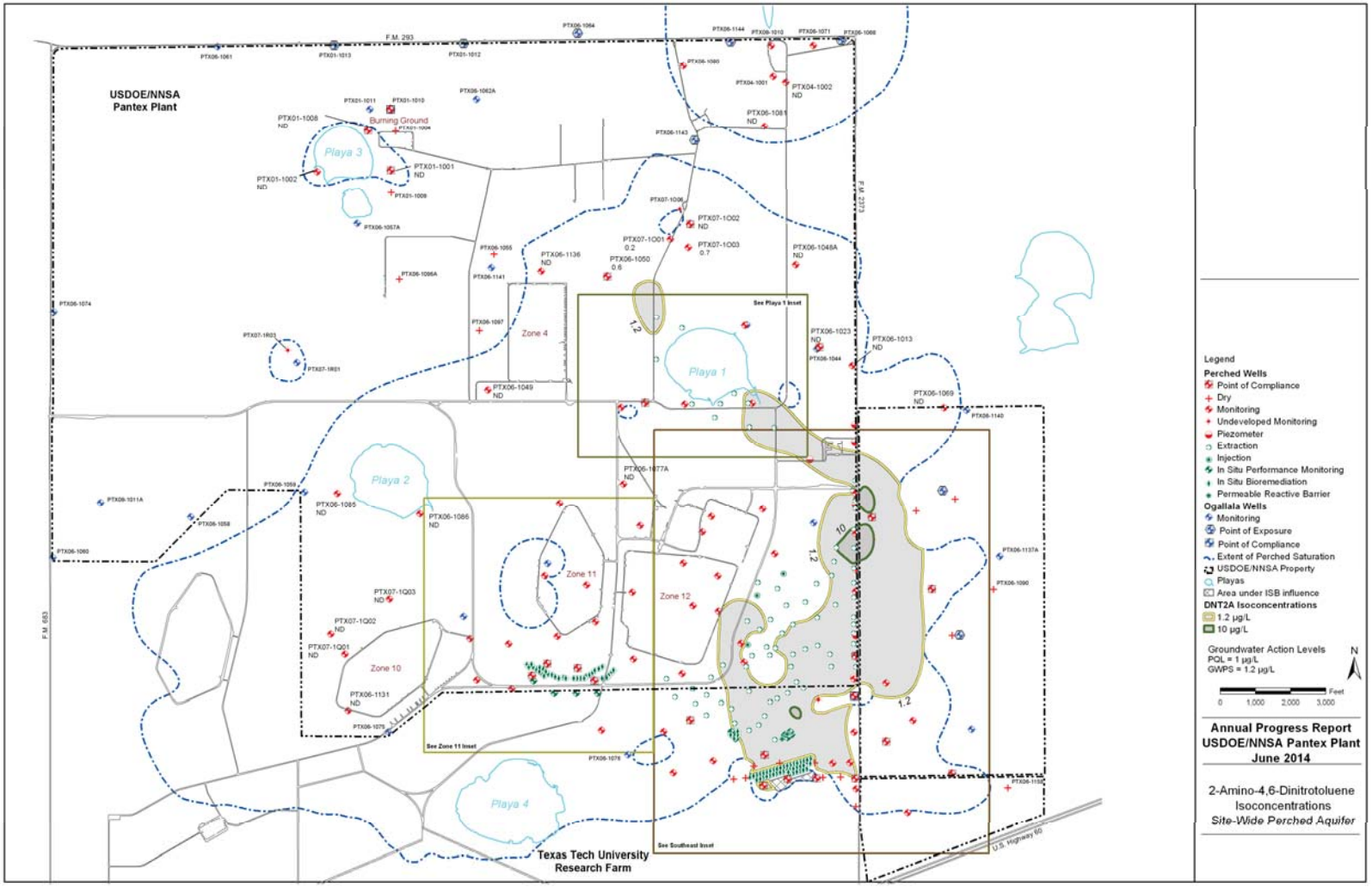

Figure 3-23. DNT-2A Isoconcentration Map

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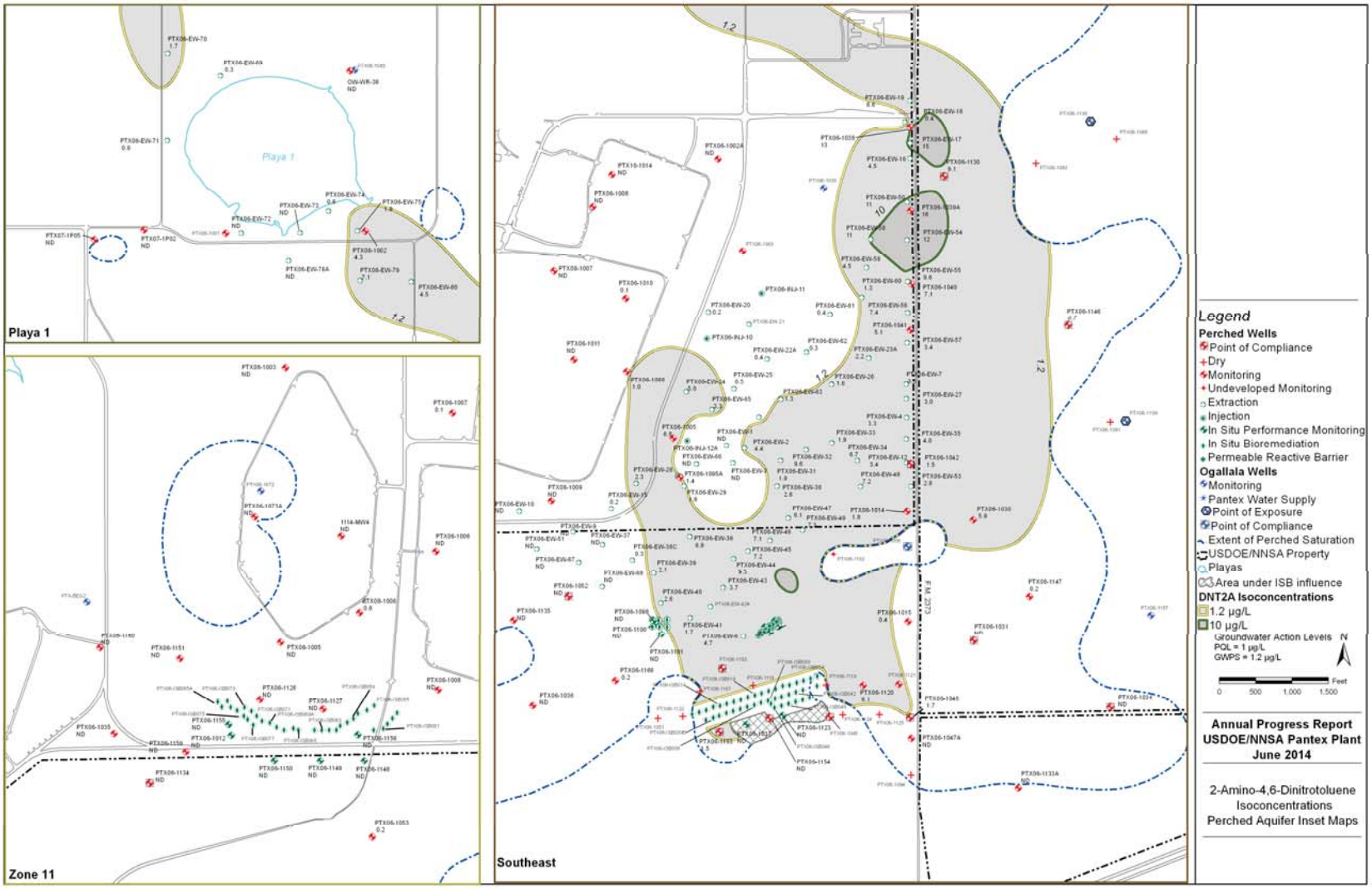

Figure 3-24. DNT-2A Isoconcentration Inset Map

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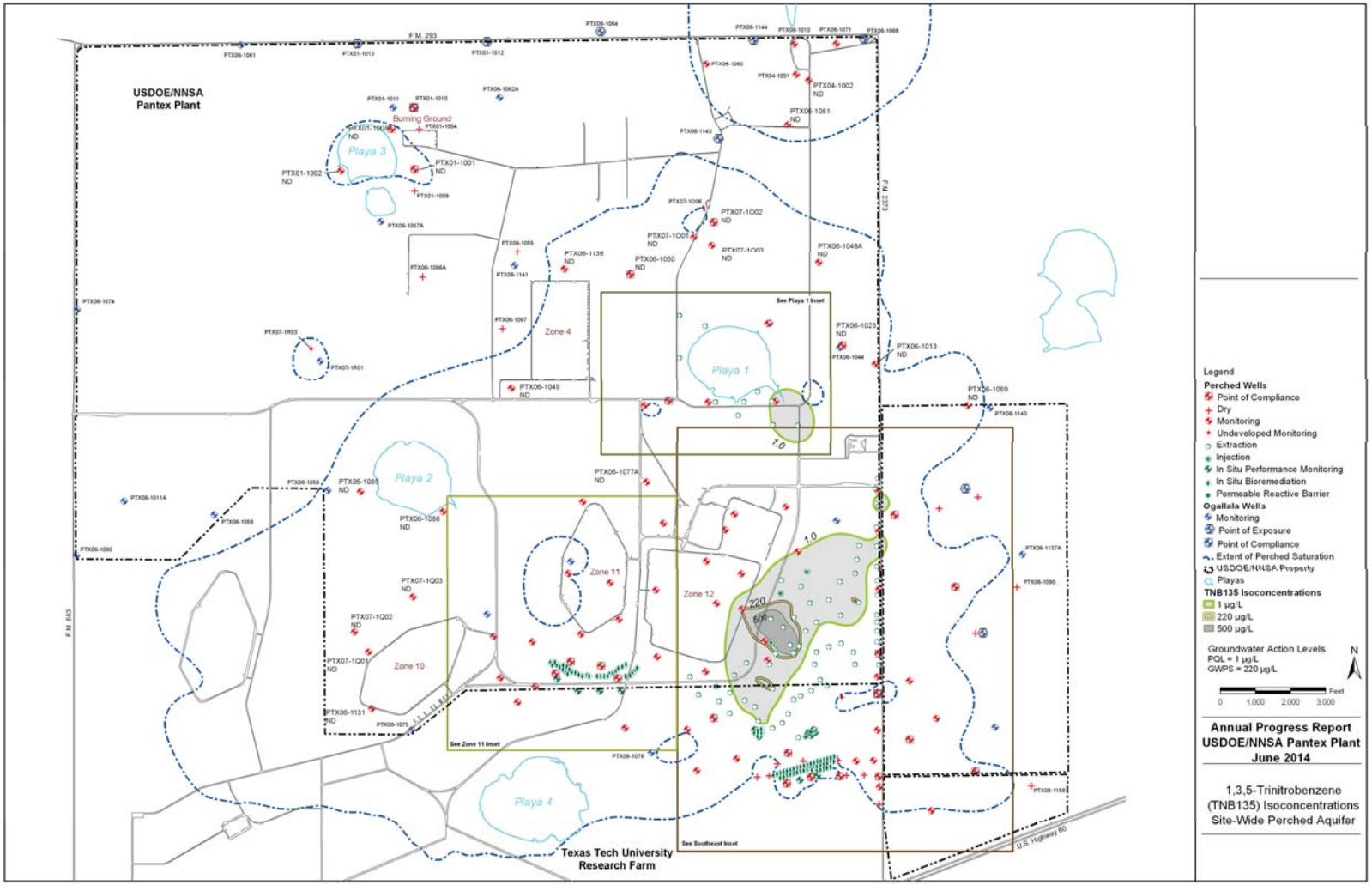

Figure 3-25. 1,3,5 - Trinitrobenzene Isoconcentration Map

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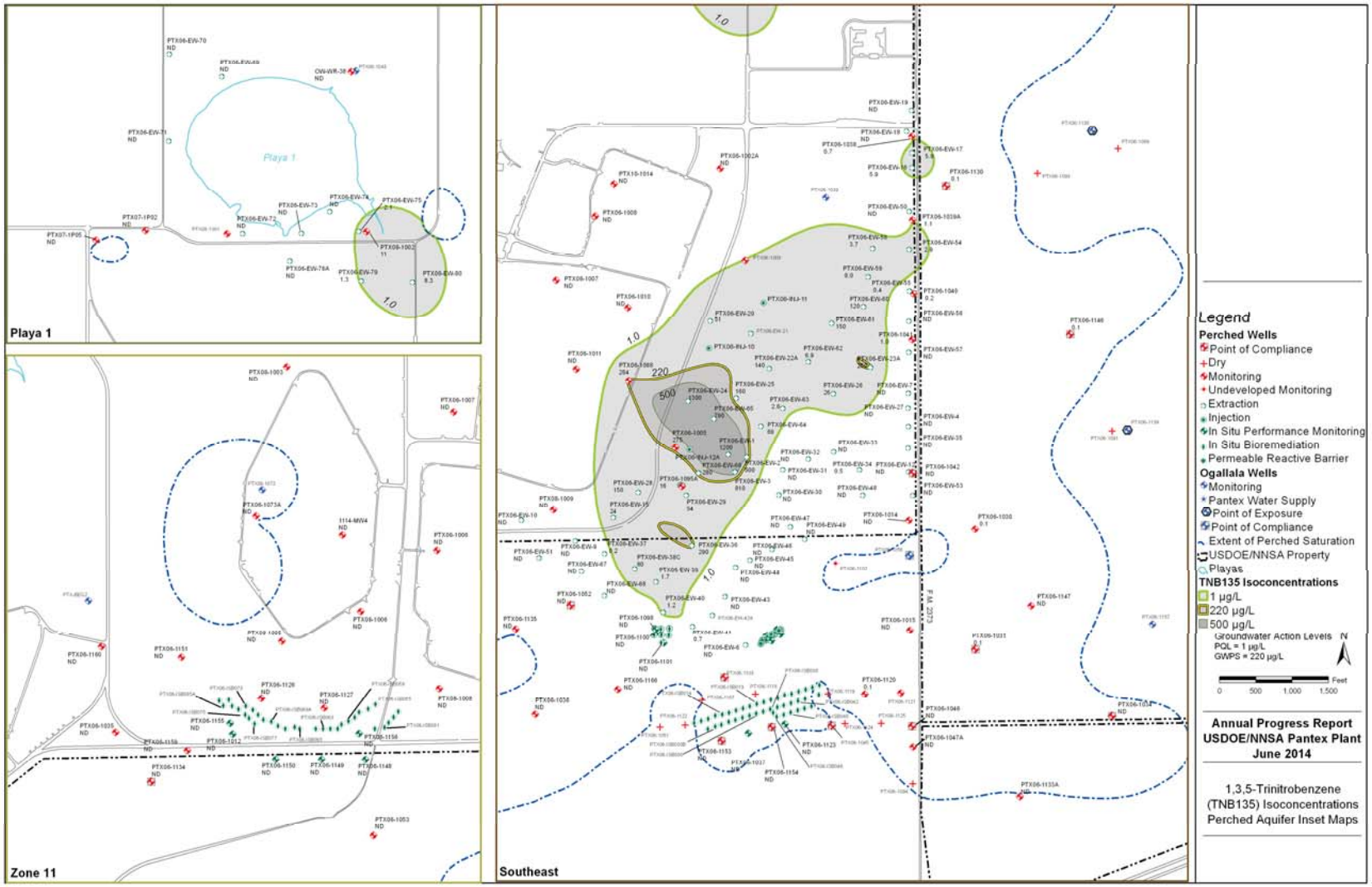

Figure 3-26. 1,3,5 - Trinitrobenzene Isoconcentration Inset Map

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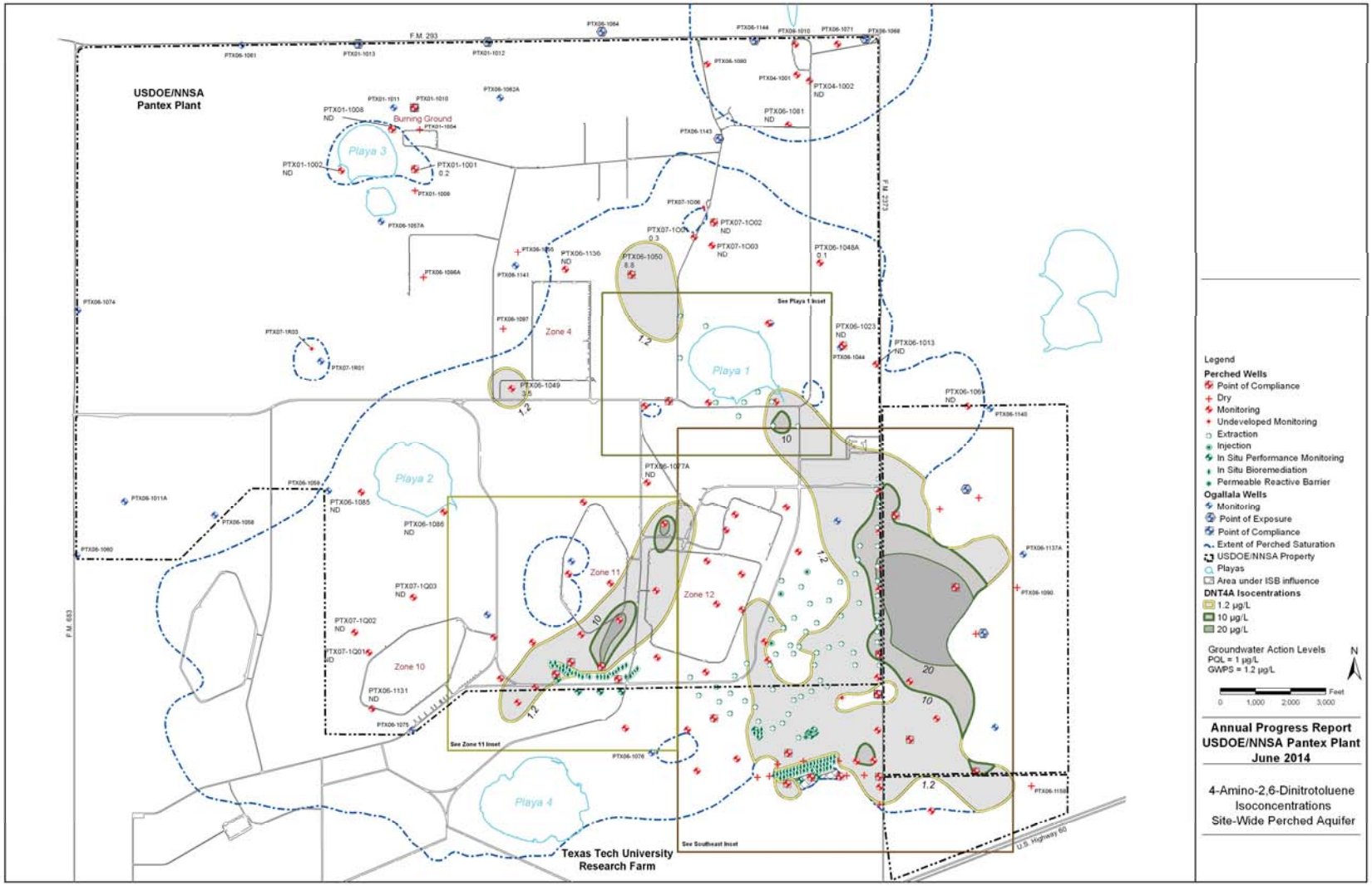

Figure 3-27. DNT-4A Isoconcentration Map

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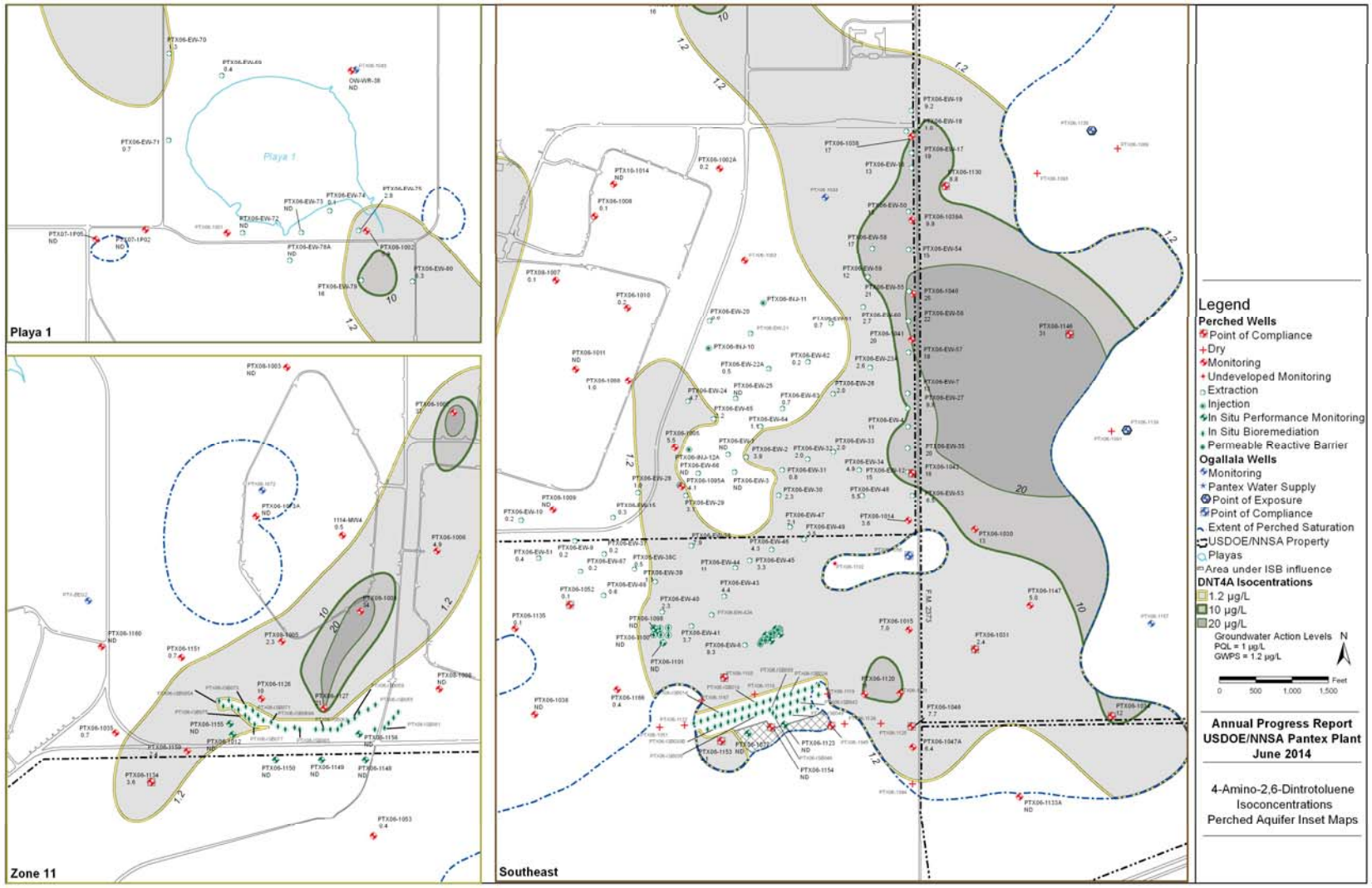

Figure 3-28. DNT-4A Isoconcentration Inset Map

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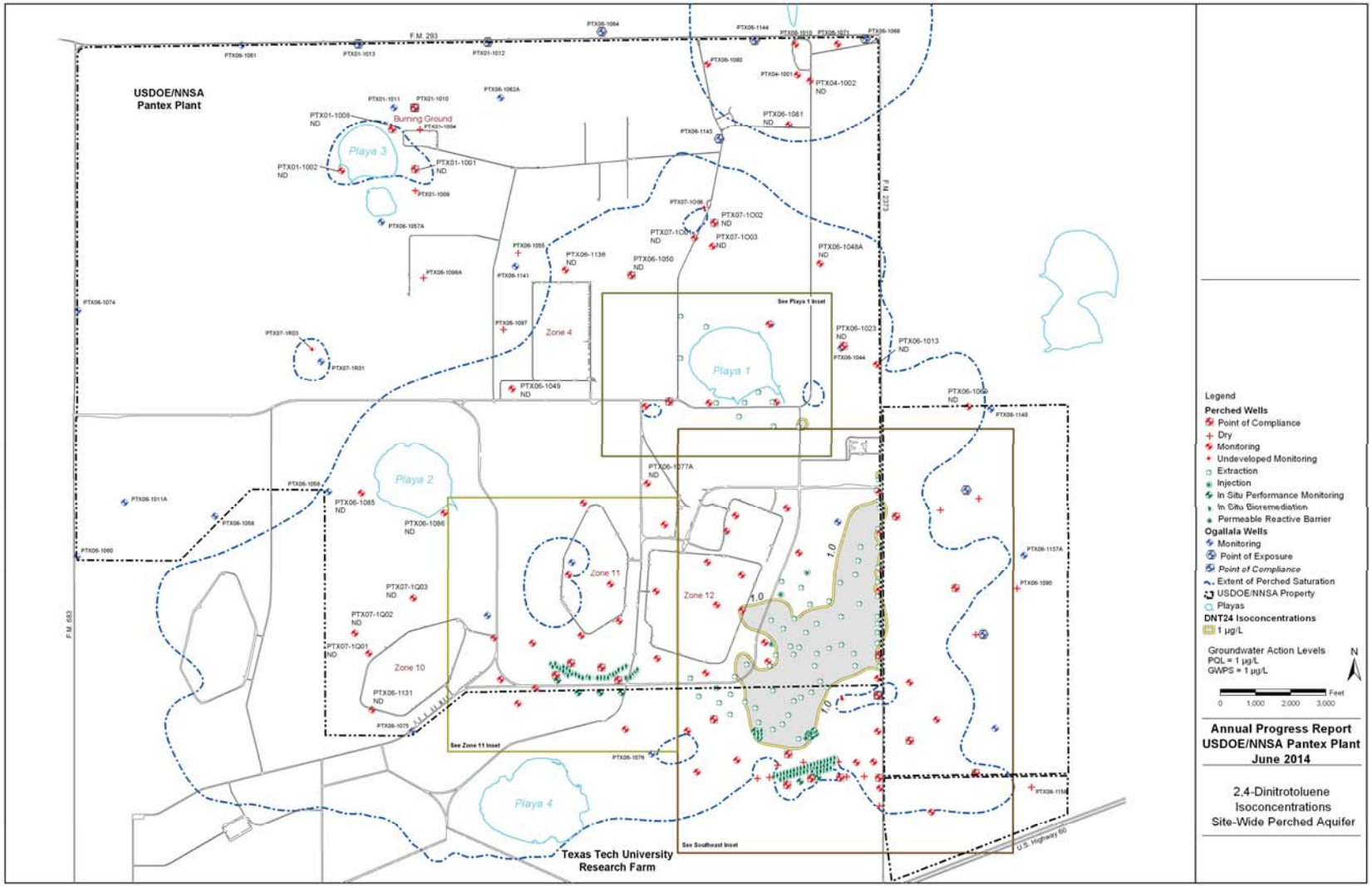

Figure 3-29. 2,4-DNT Isoconcentration Map

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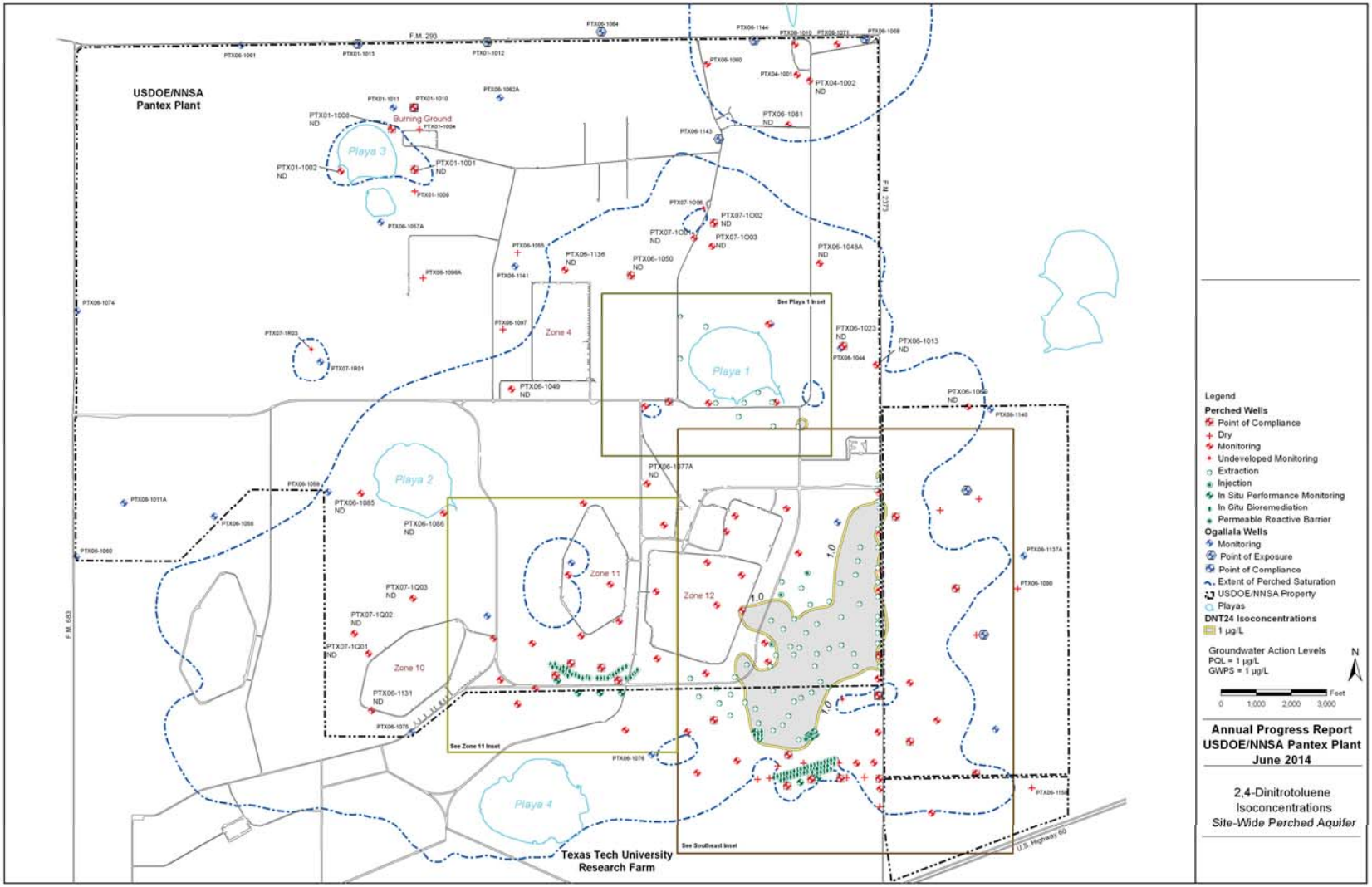

Figure 3-30. 2,4-DNT Isoconcentration Inset Map

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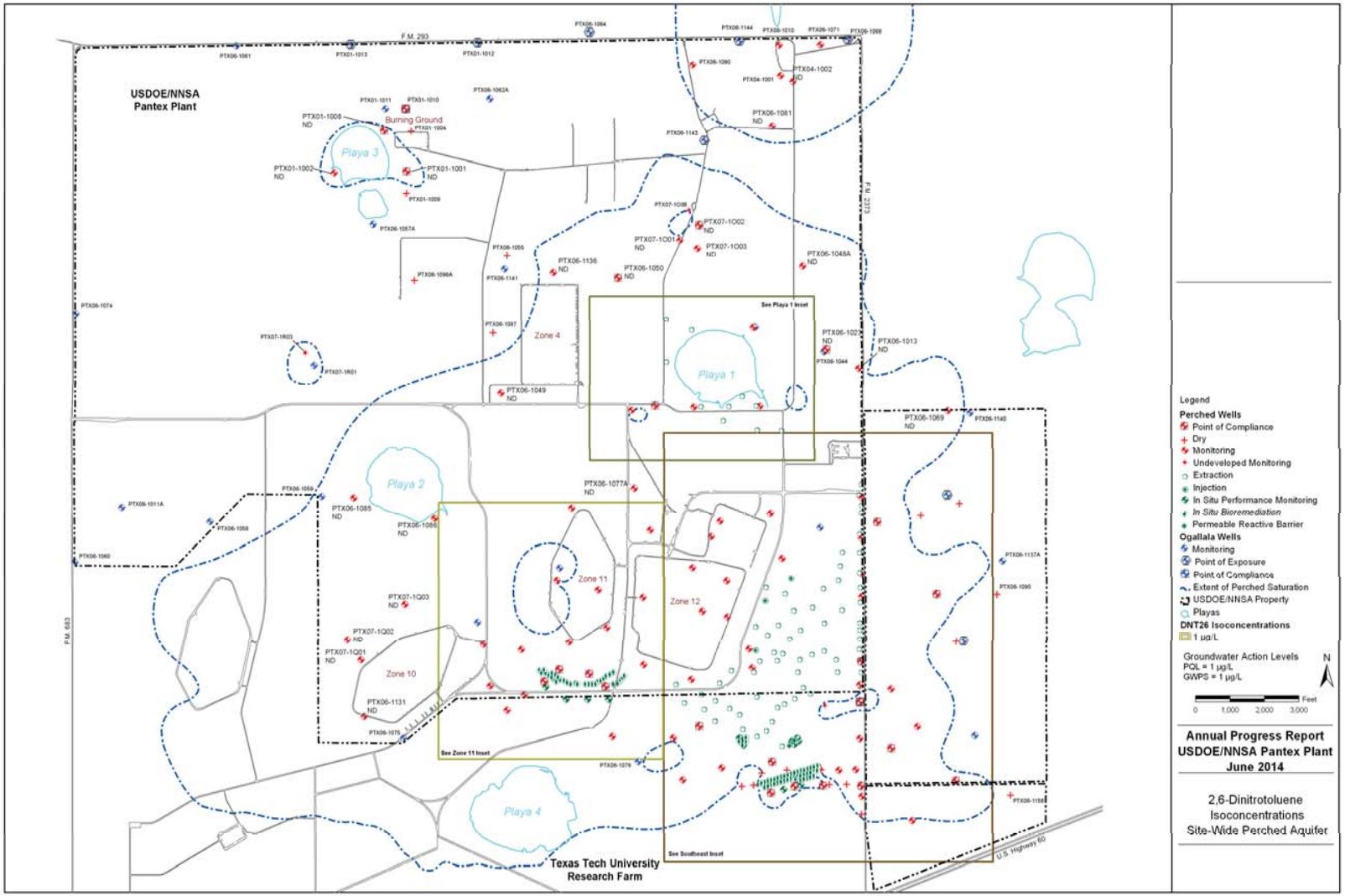

Figure 3-31. 2,6-DNT Isoconcentration Map

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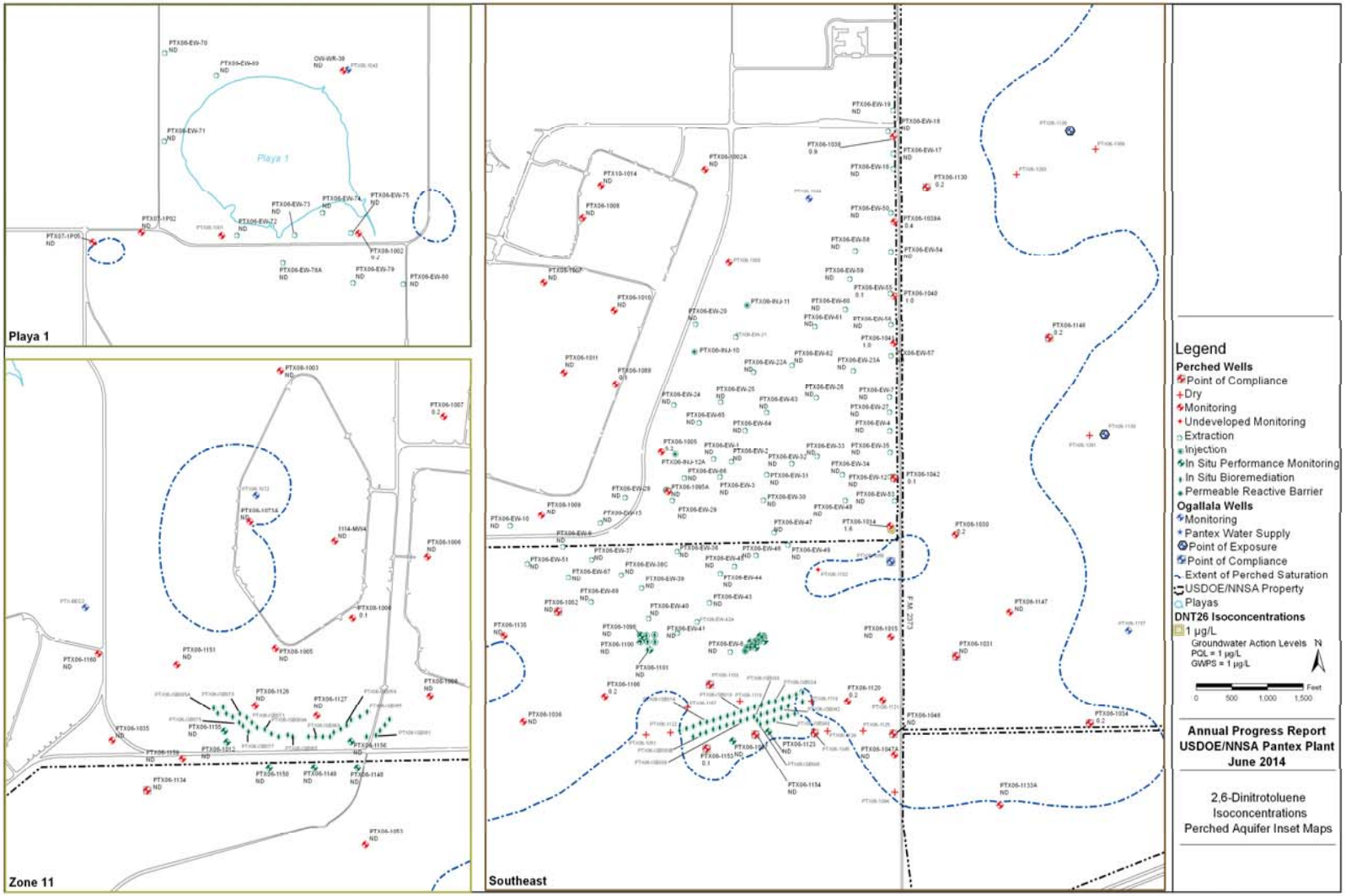

Figure 3-32. 2,6-DNT Isoconcentration Inset Map

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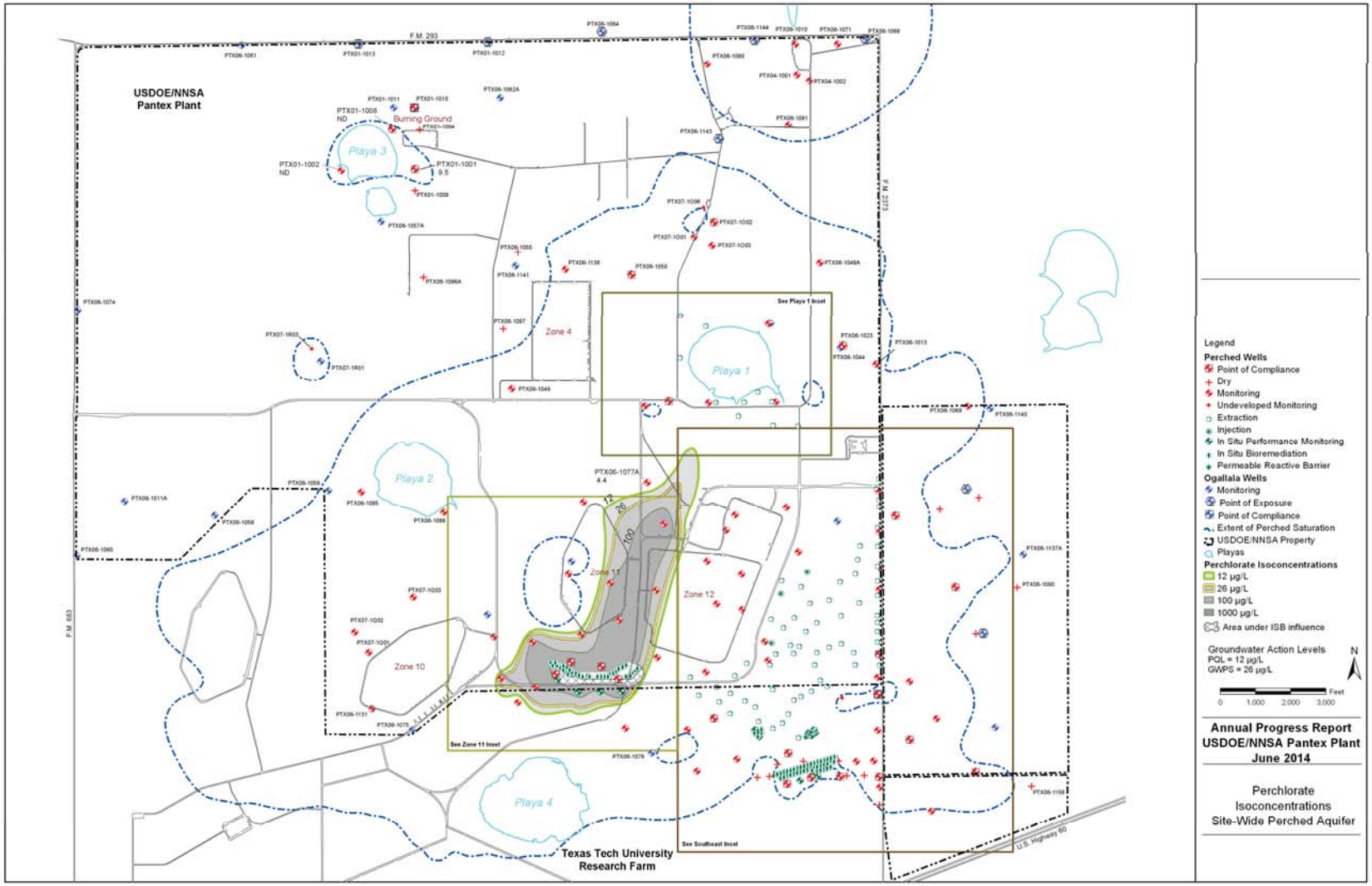

Figure 3-33. Perchlorate Isoconcentration Map

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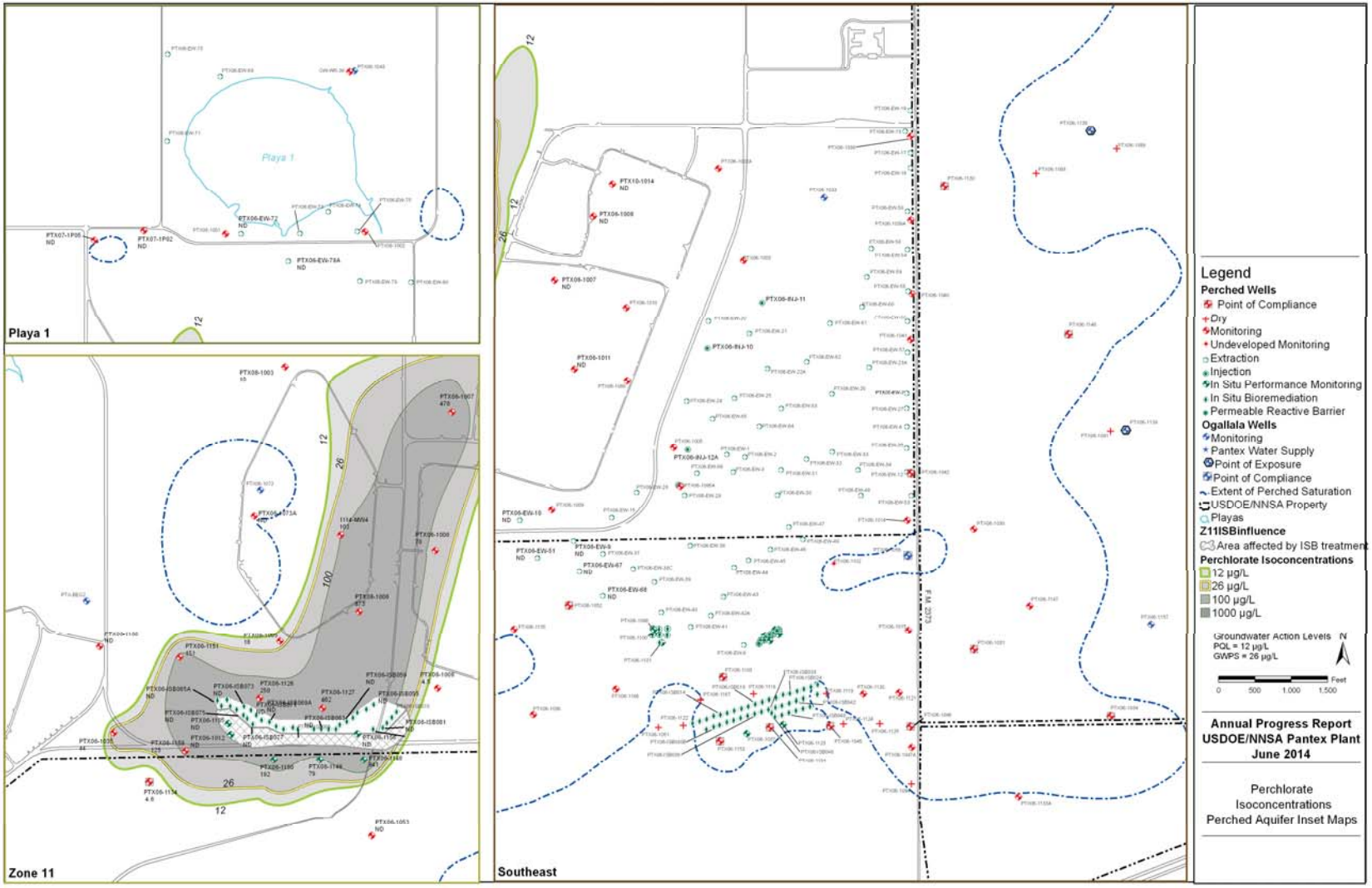

Figure 3-34. Perchlorate Isoconcentration Inset Map

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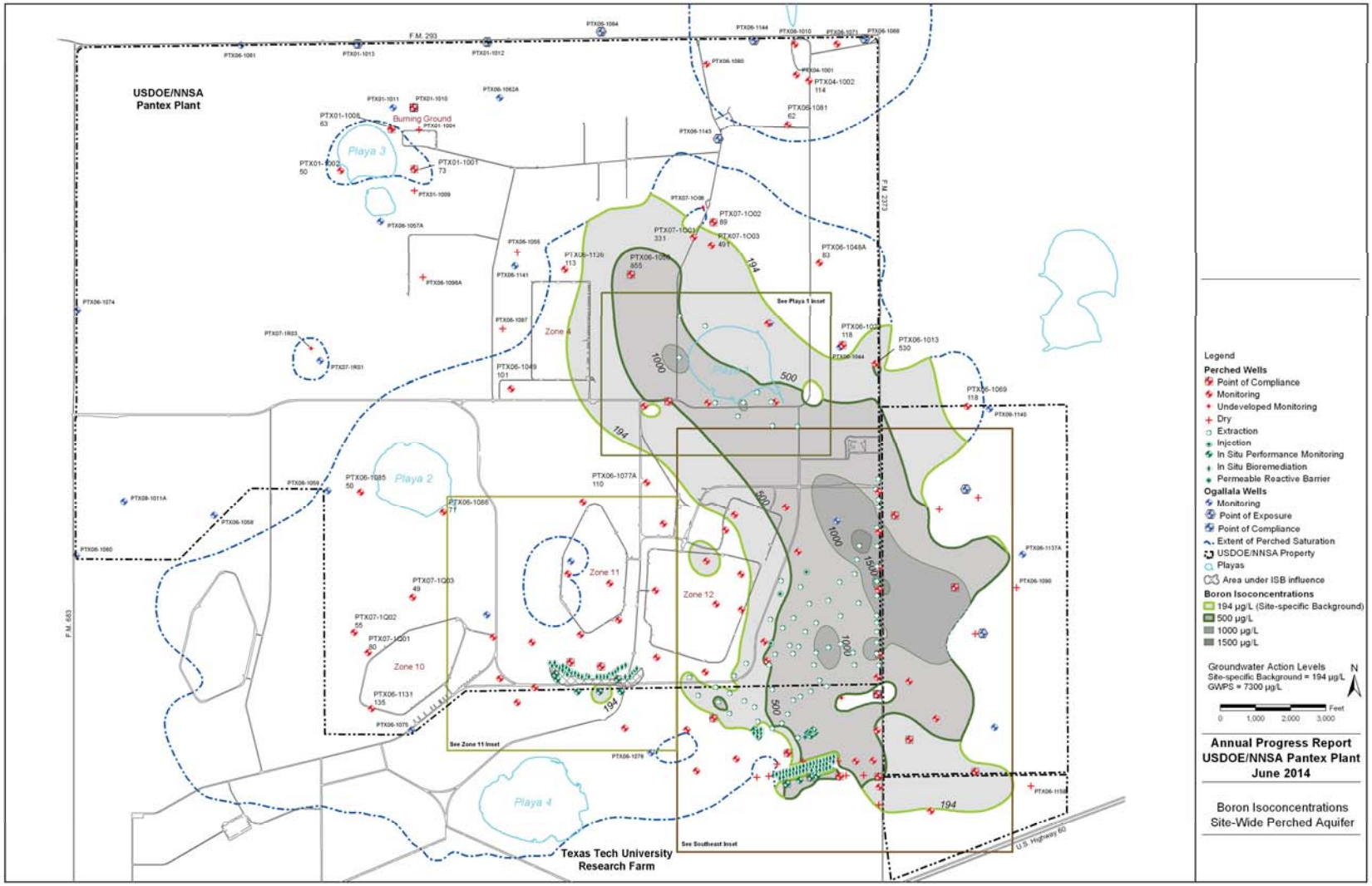

Figure 3-35. Boron Isoconcentration Map

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Figure 3-36. Boron Isoconcentration Inset Map

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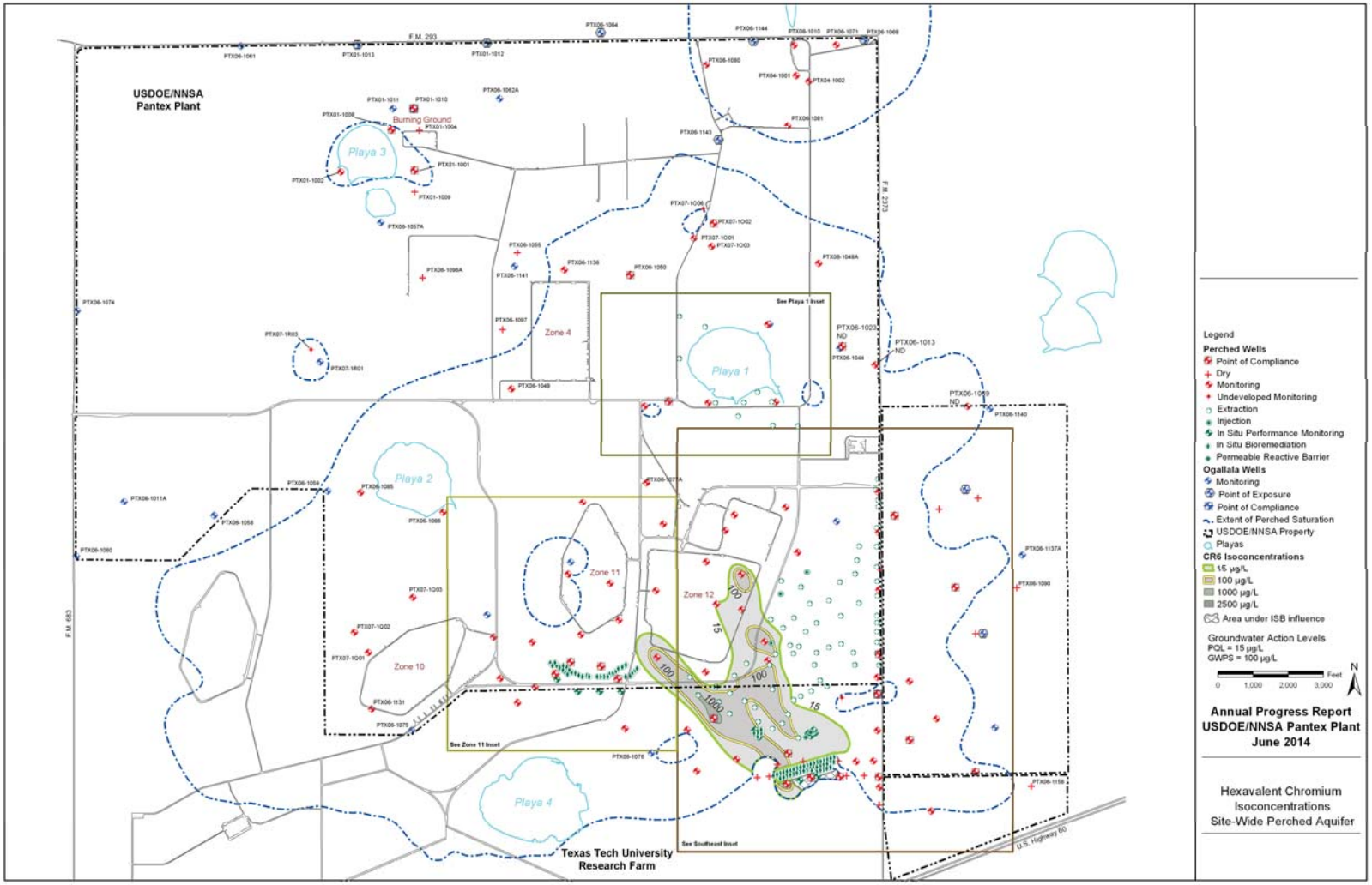

Figure 3-37. Hexavalent Chromium Isoconcentration Map

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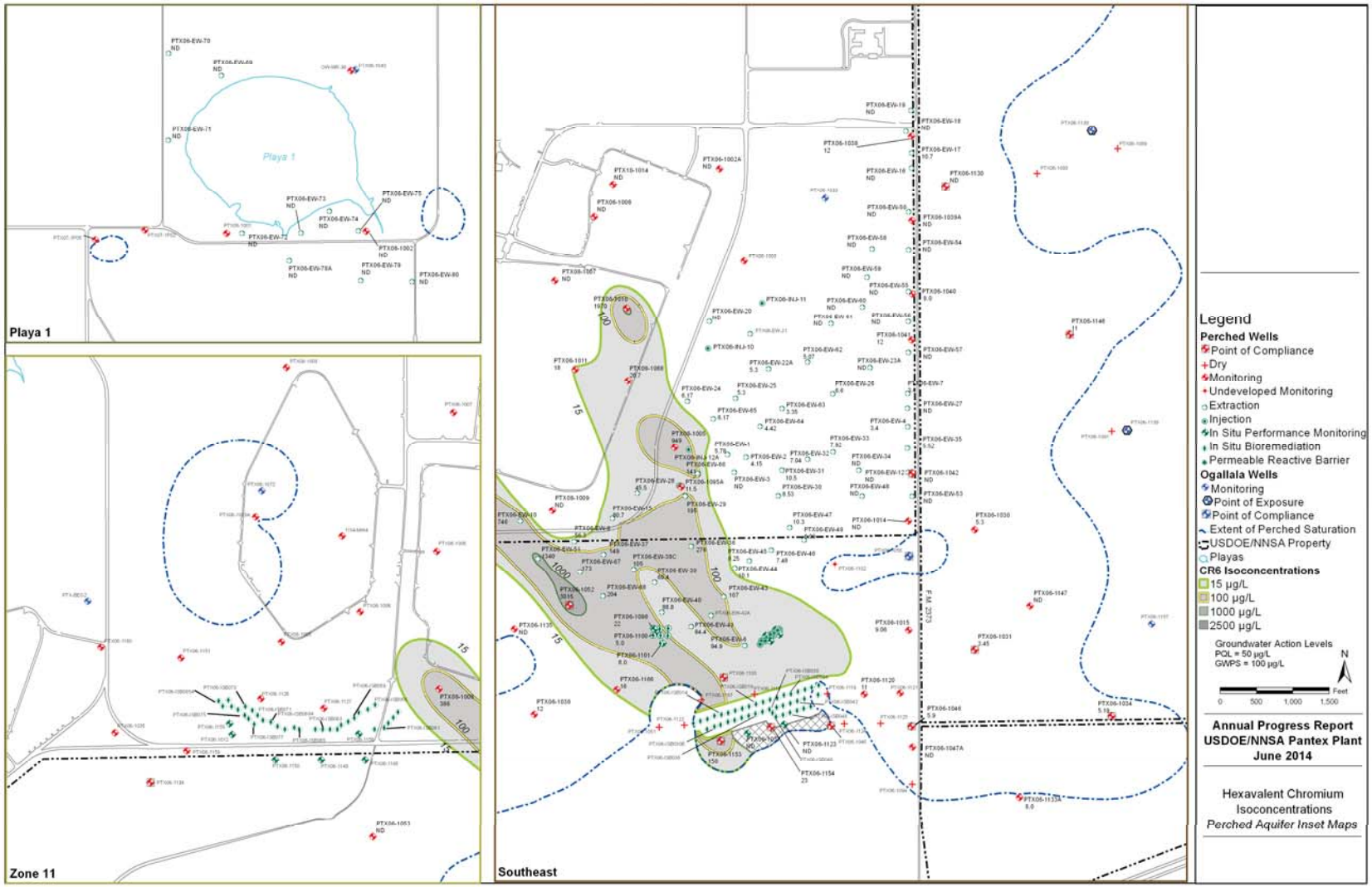

Figure 3-38. Hexavalent Chromium Isoconcentration Inset Map

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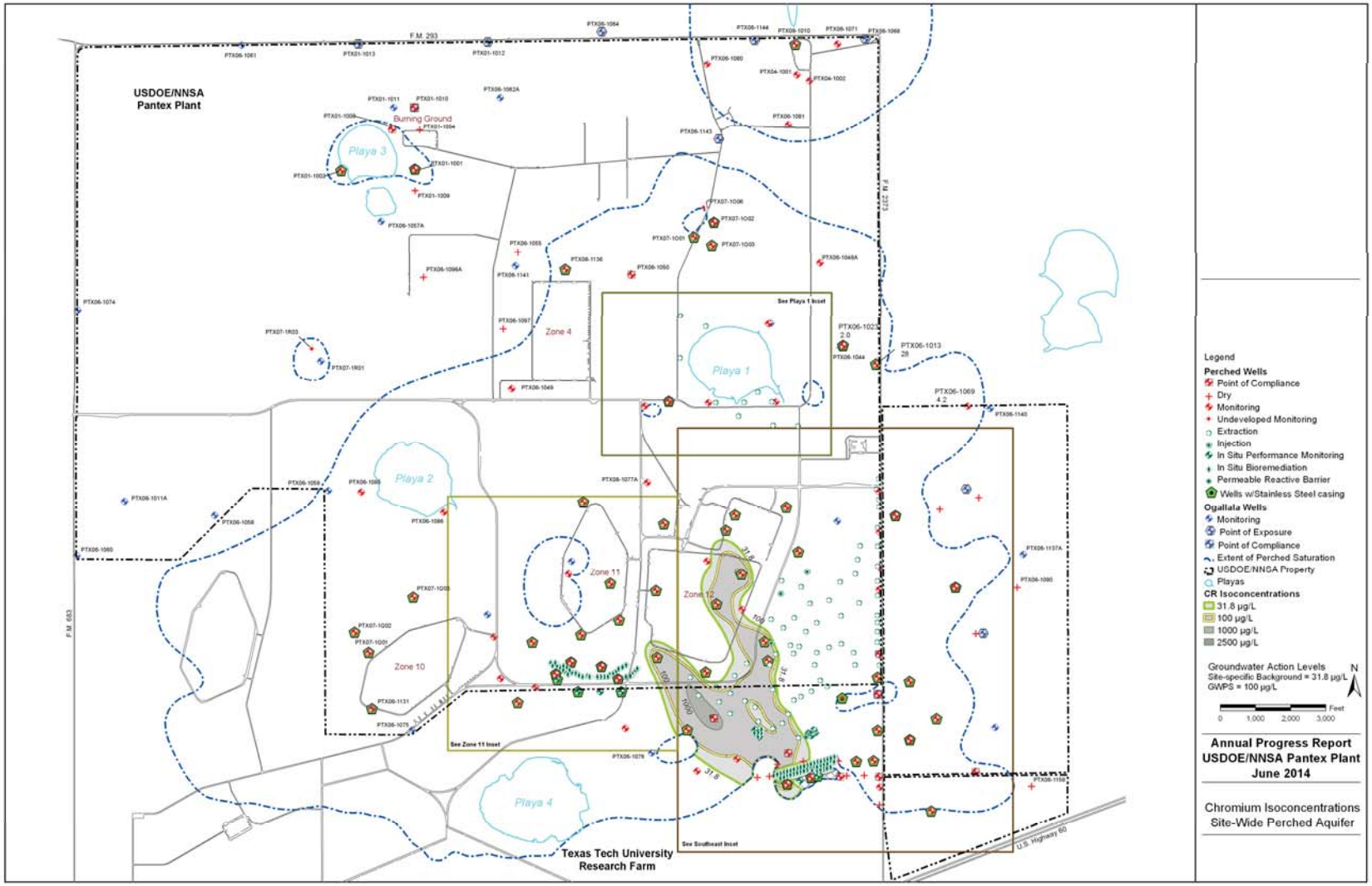

Figure 3-39. Chromium Isoconcentration Map

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Figure 3-40. Chromium Isoconcentration Inset Map

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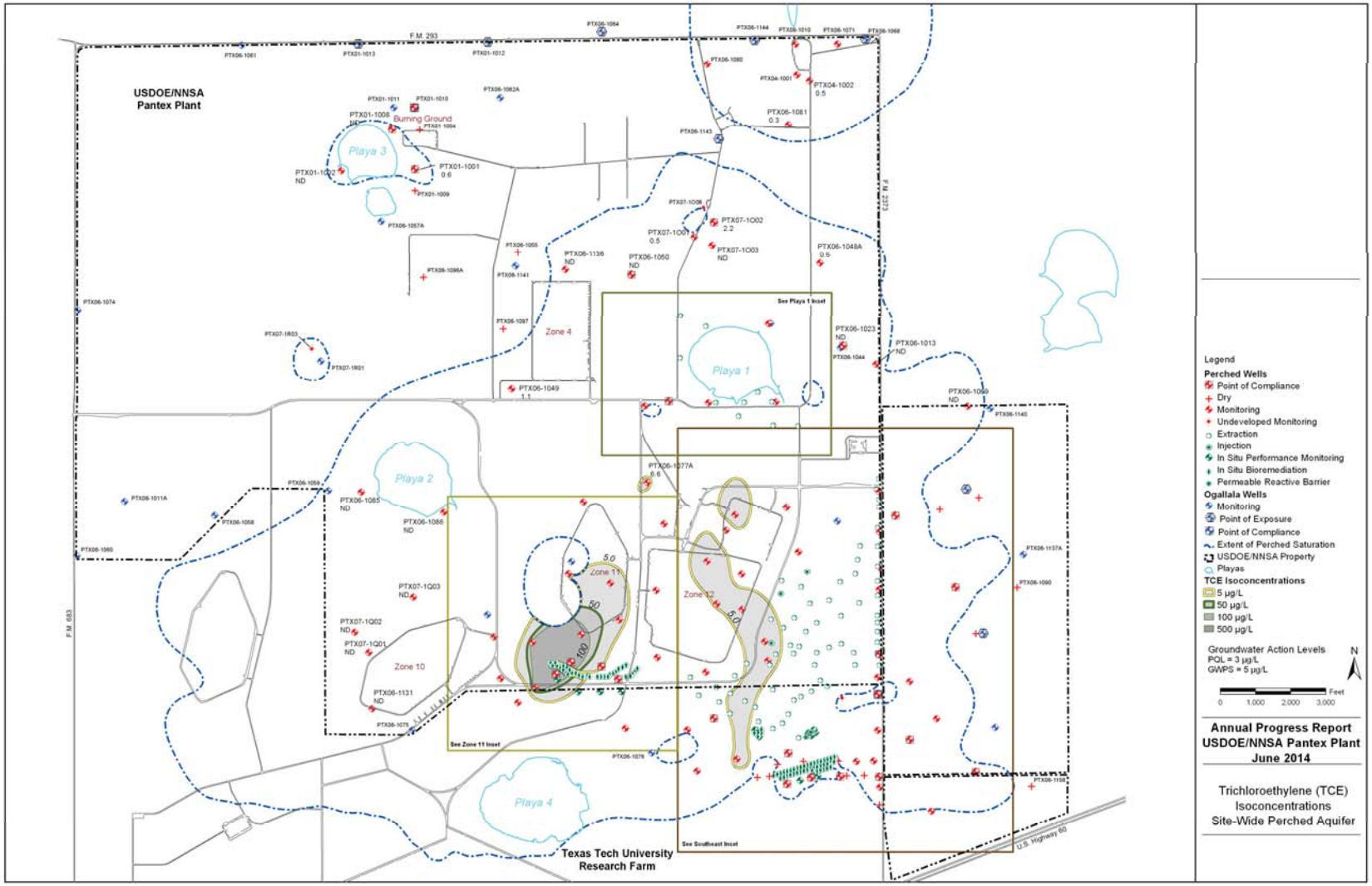

Figure 3-41. TCE Isoconcentration Map

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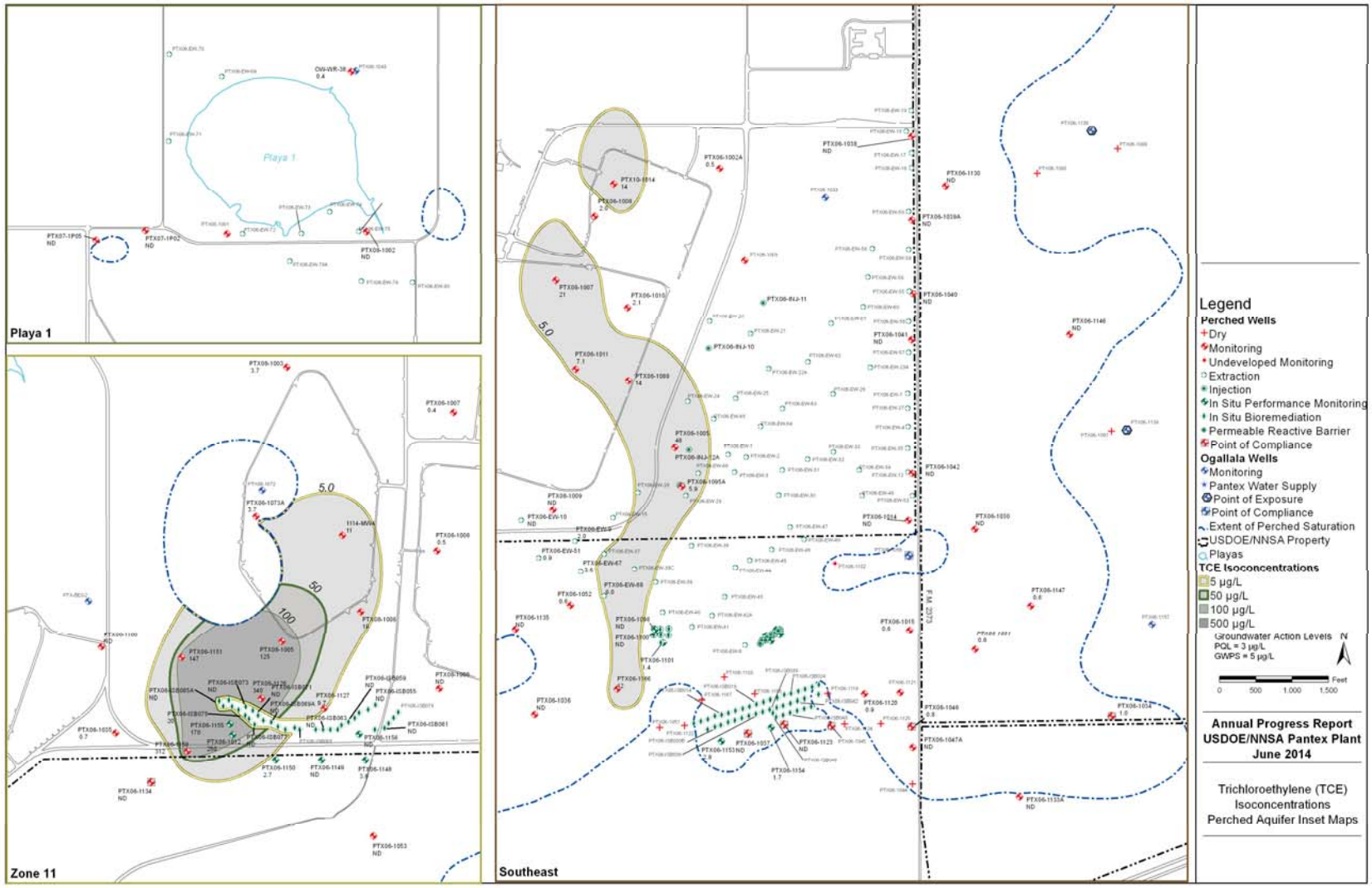

Figure 3-42. TCE Isoconcentration Inset Map

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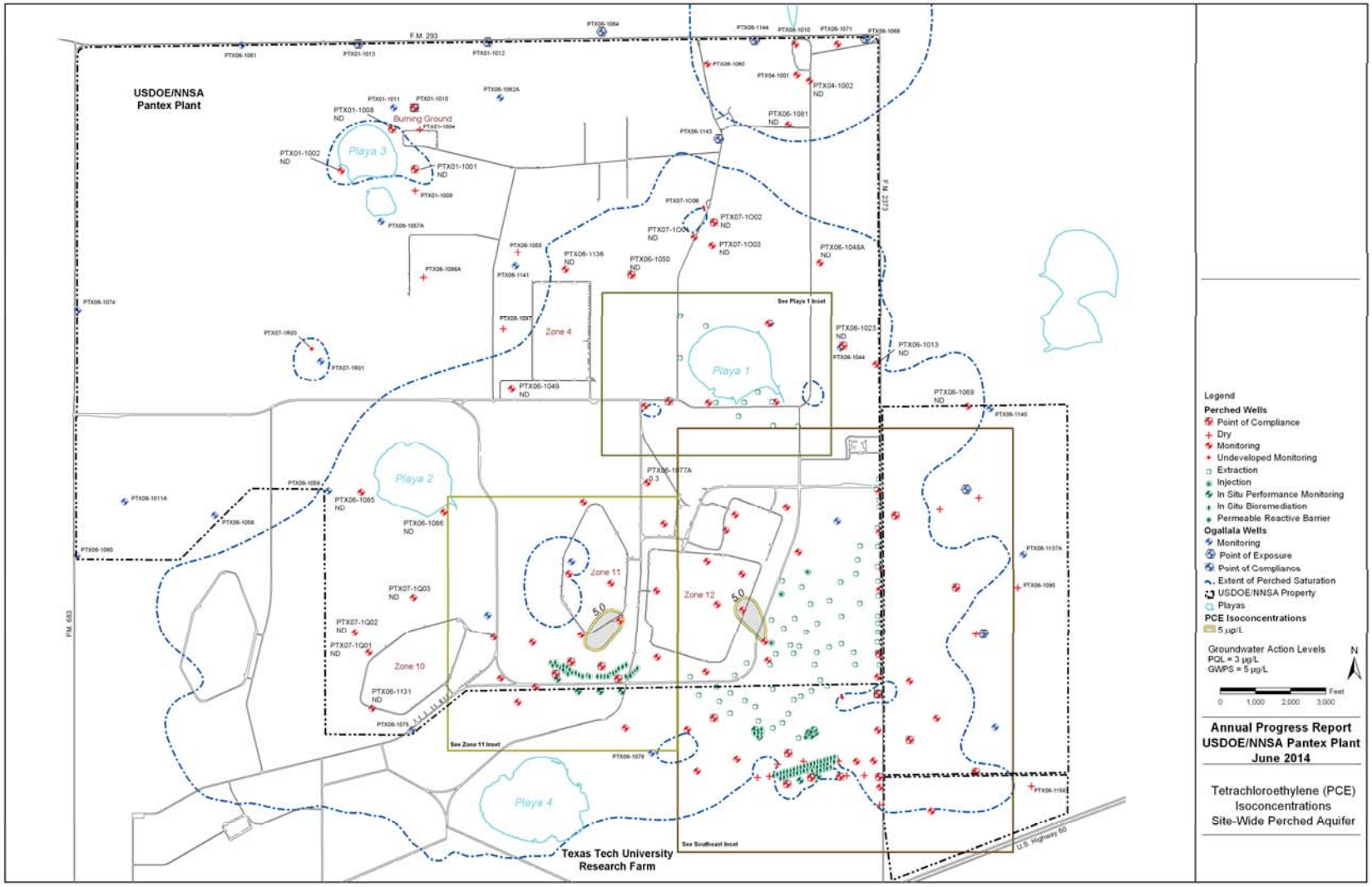

Figure 3-43. PCE Isoconcentration Map

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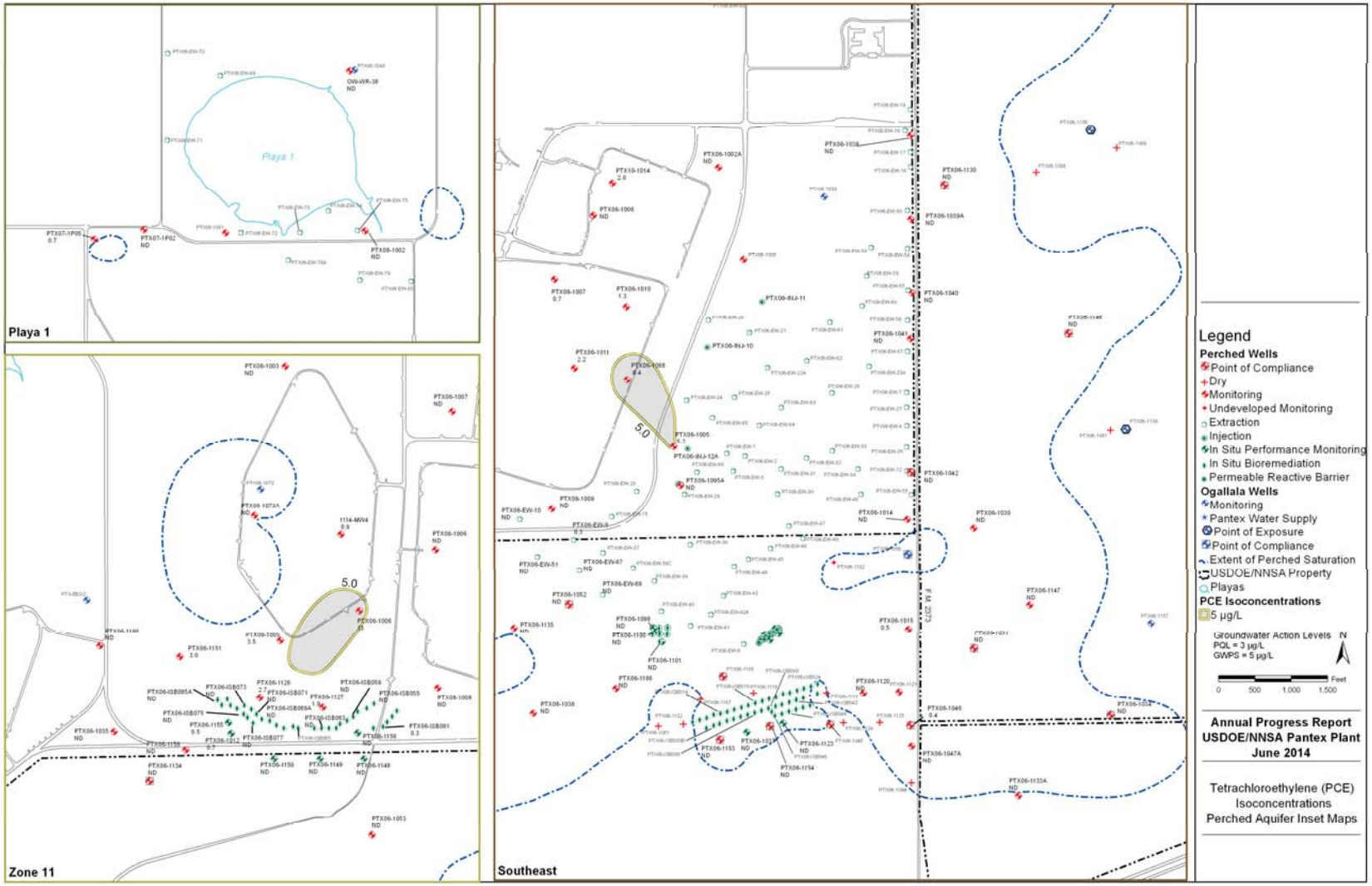

Figure 3-44. PCE Isoconcentration Inset Map

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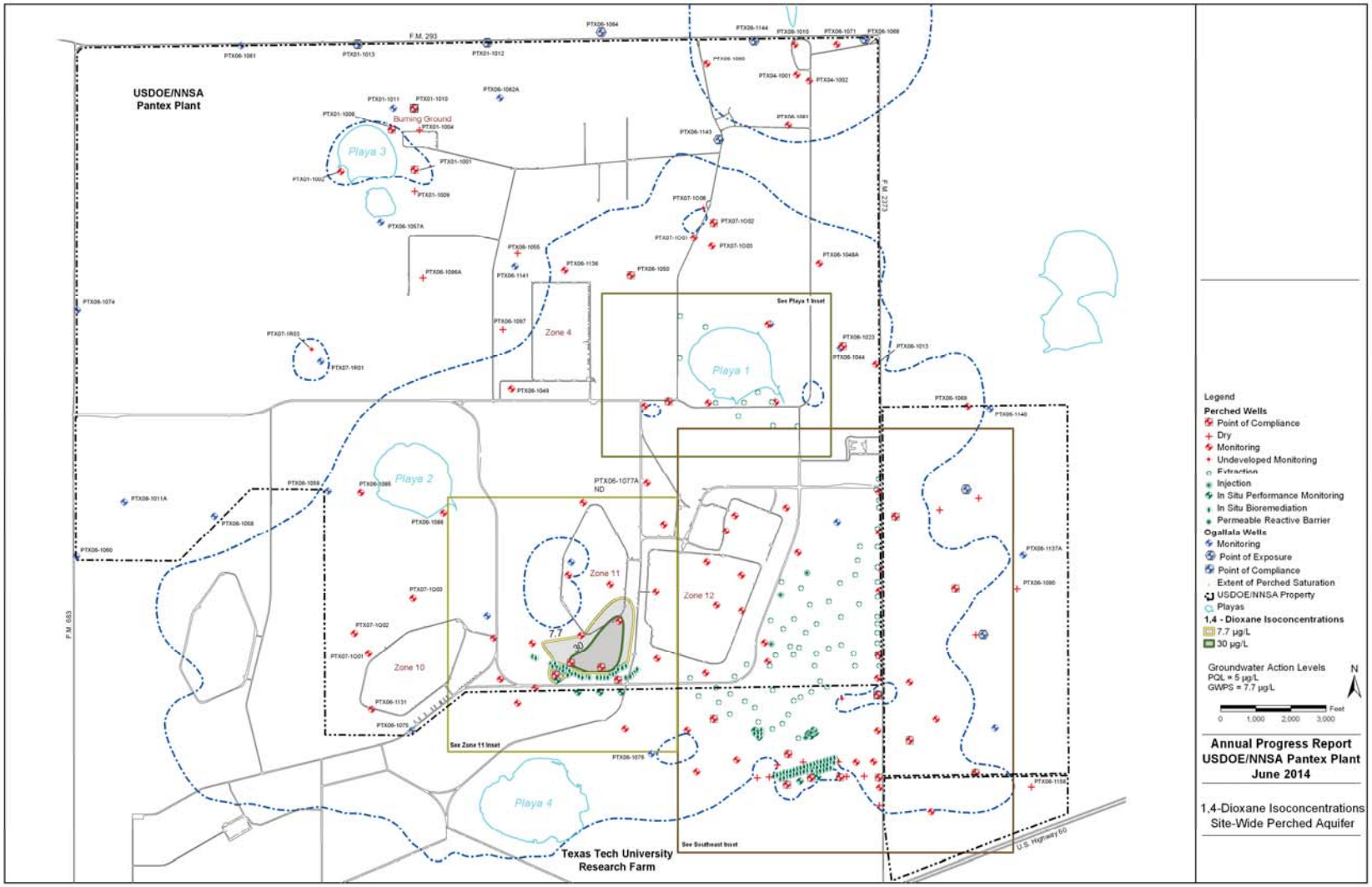

Figure 3-45. 1,4-Dioxane Isoconcentration Map

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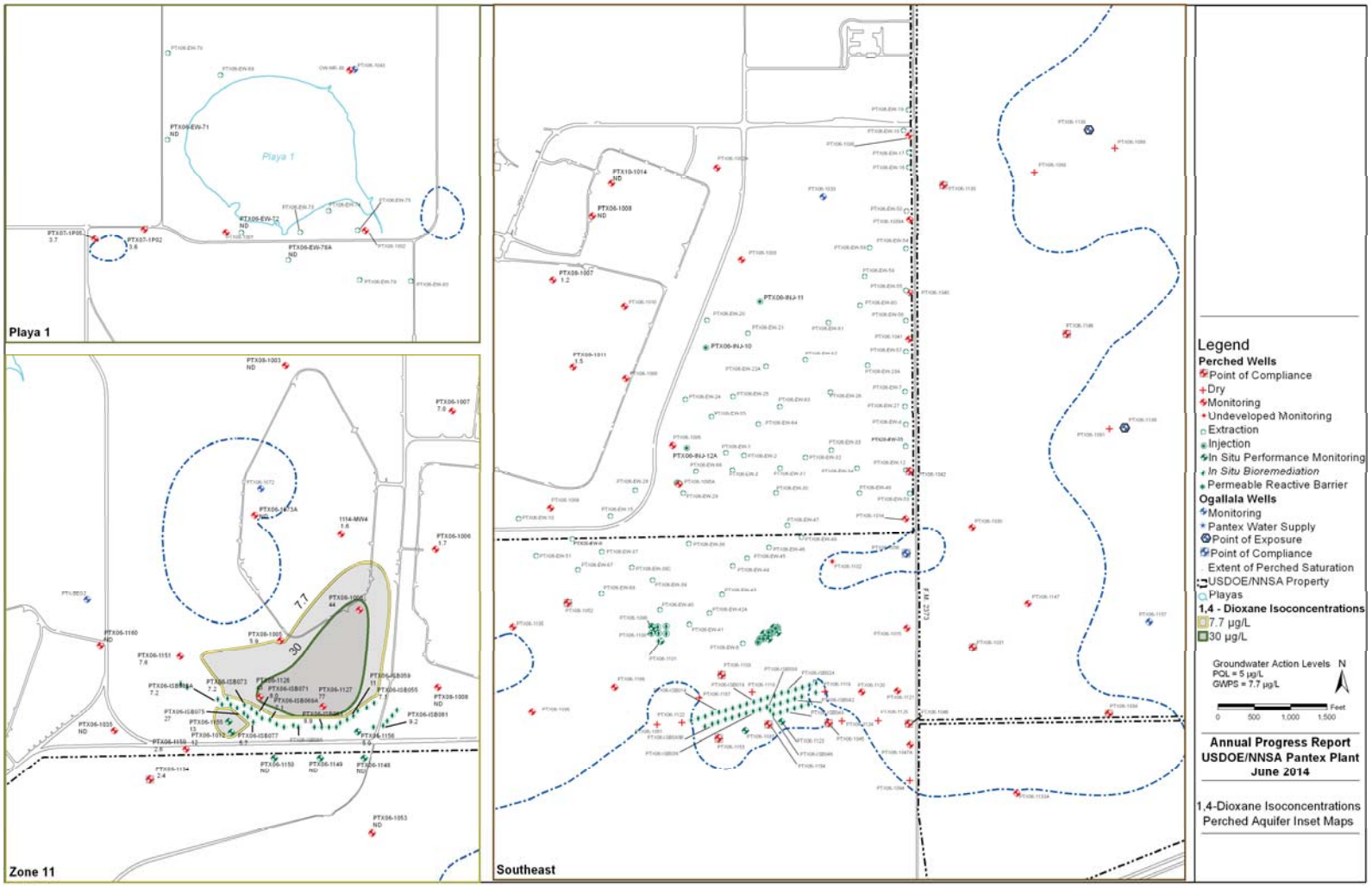

Figure 3-46. 1,4-Dioxane Isoconcentration Inset Map

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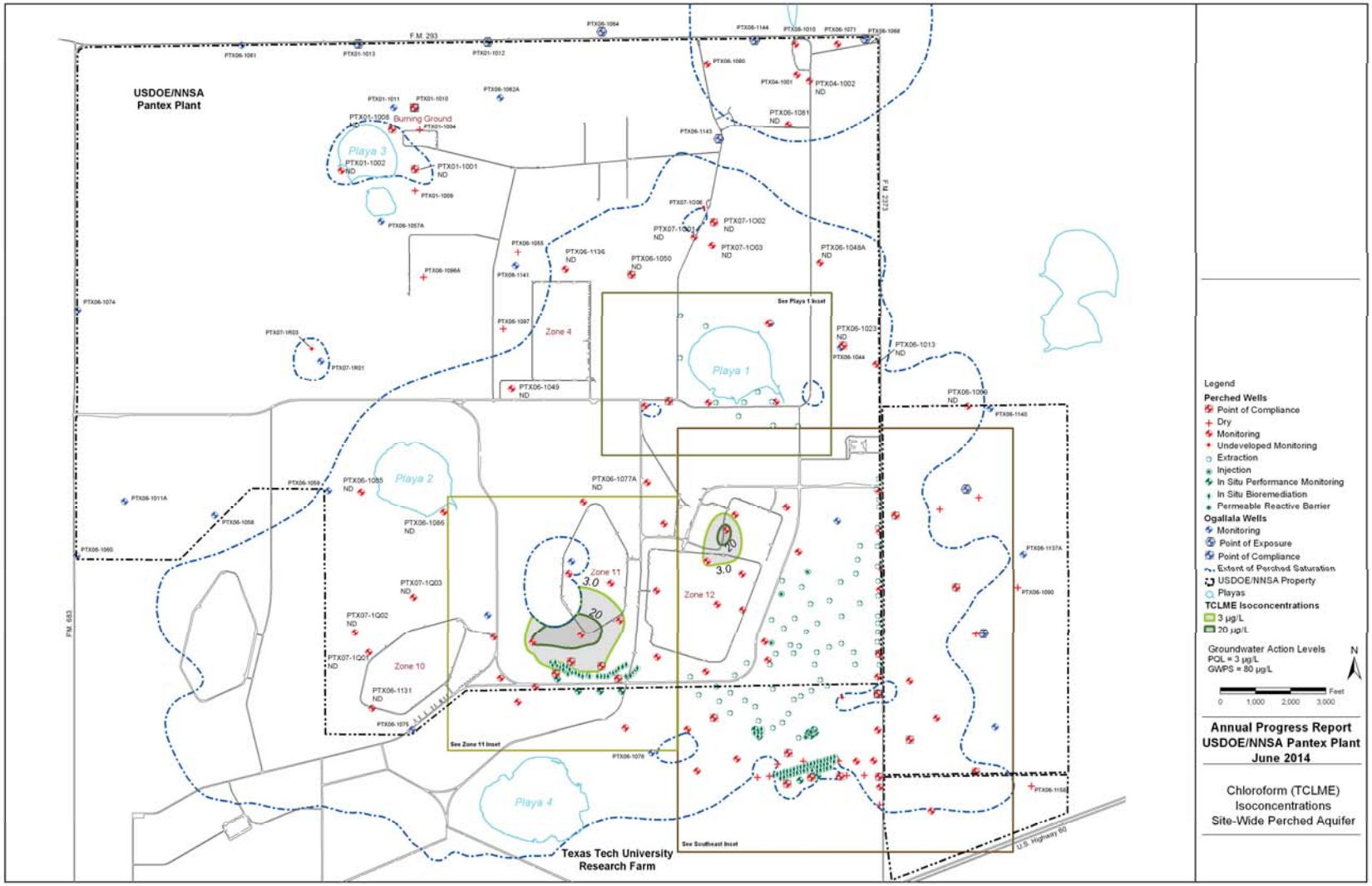

Figure 3-47. Chloroform Isoconcentration Map

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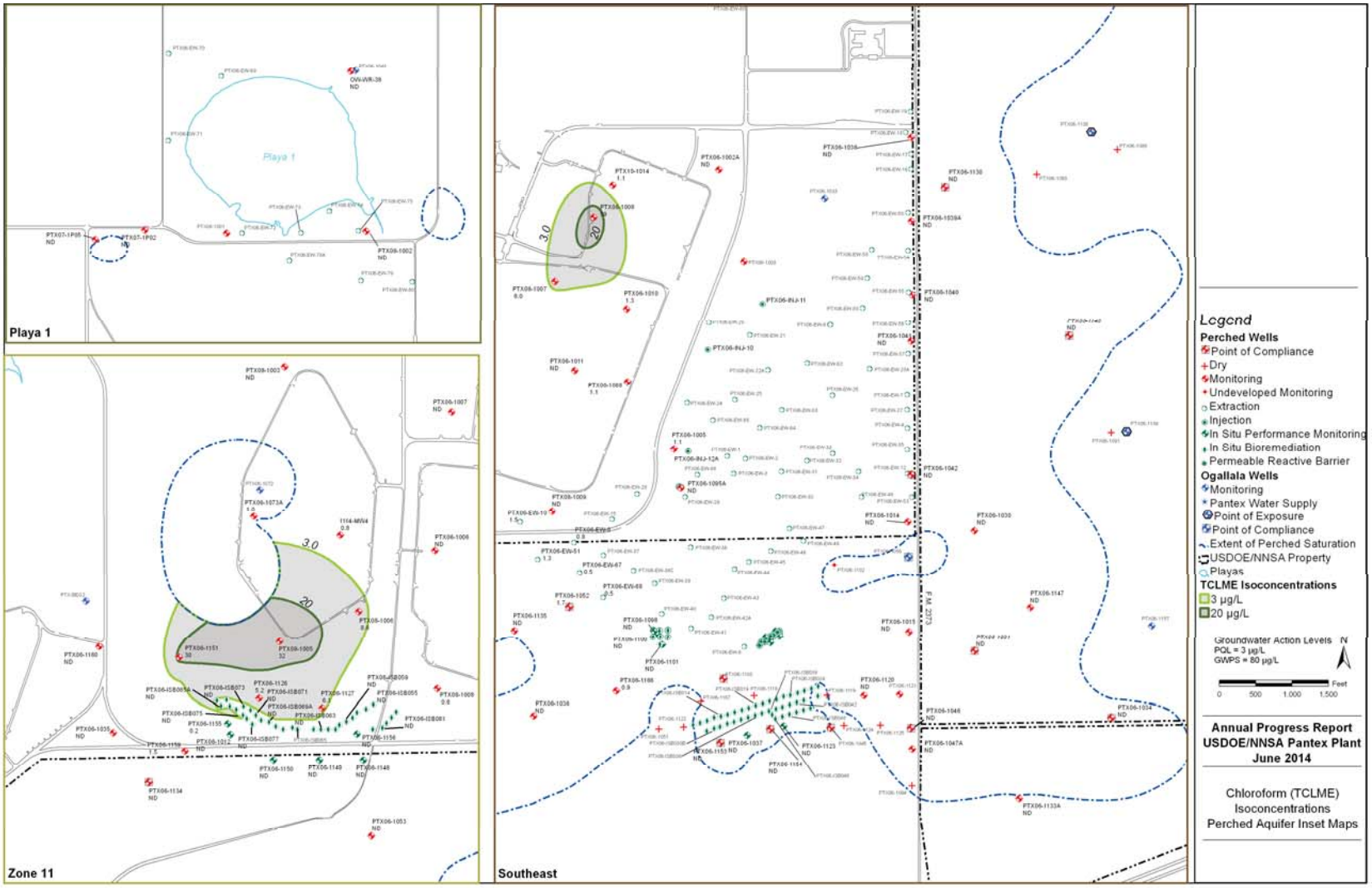

Figure 3-48. Chloroform Isoconcentration Inset Map

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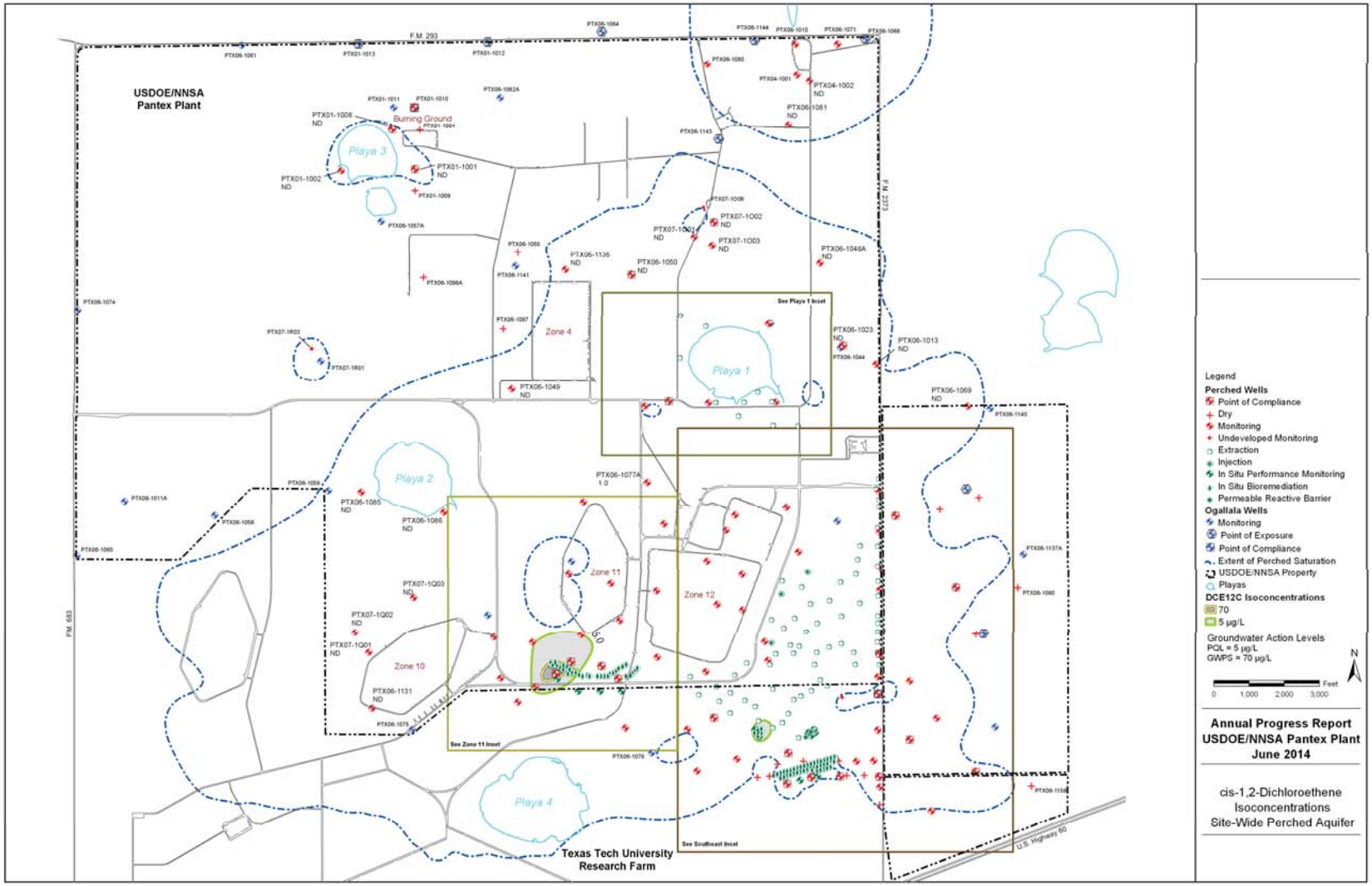

Figure 3-49. cis-1,2-DCE Isoconcentration Map

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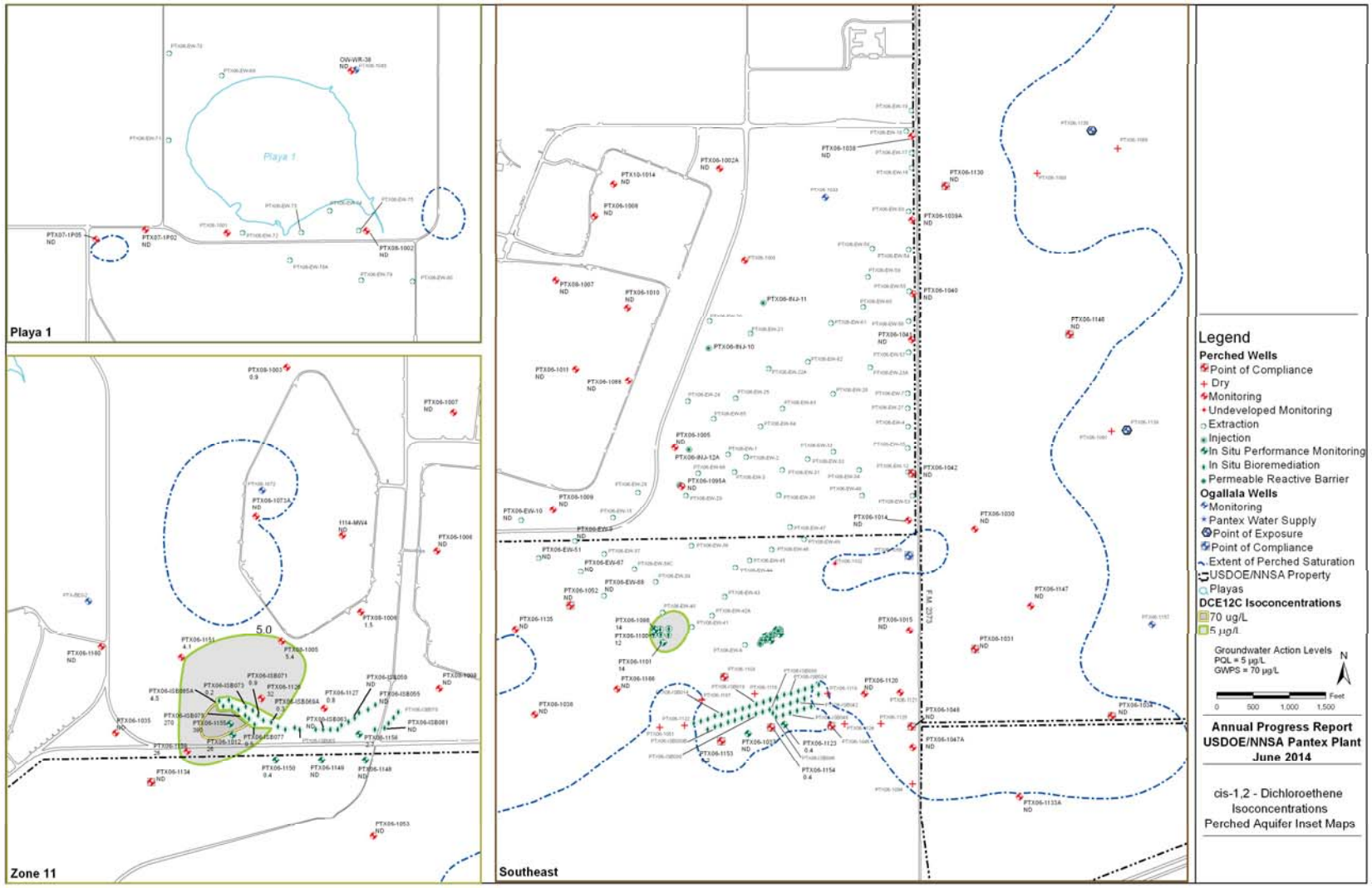

Figure 3-50. cis-1,2-DCE Isoconcentration Inset Map

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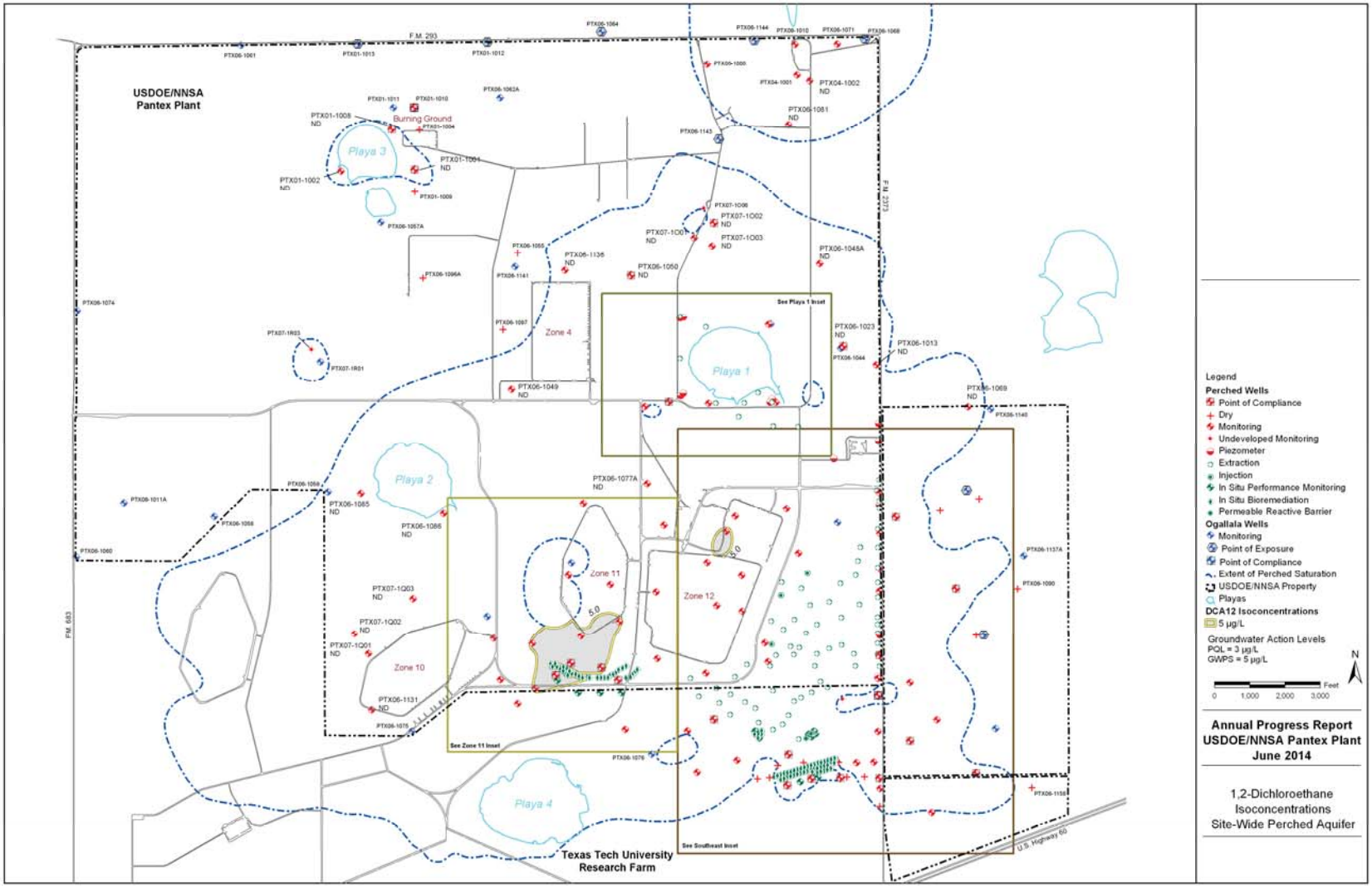

Figure 3-51. 1,2 - DCA Isoconcentration Map

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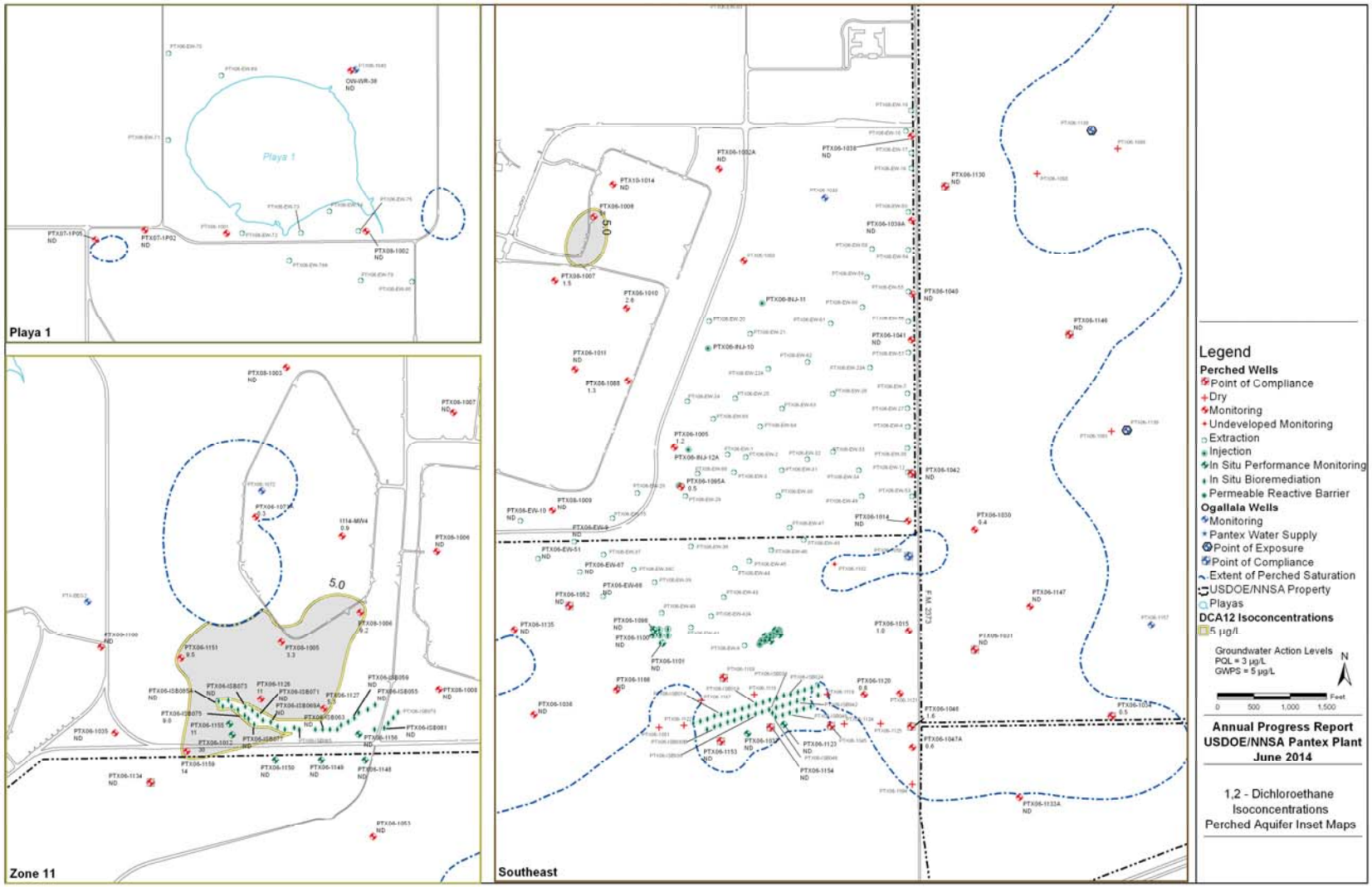

Figure 3-52. 1,2 - DCA Isoconcentration Inset Map

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Figure 3-53. Vinyl Chloride Isoconcentration Map

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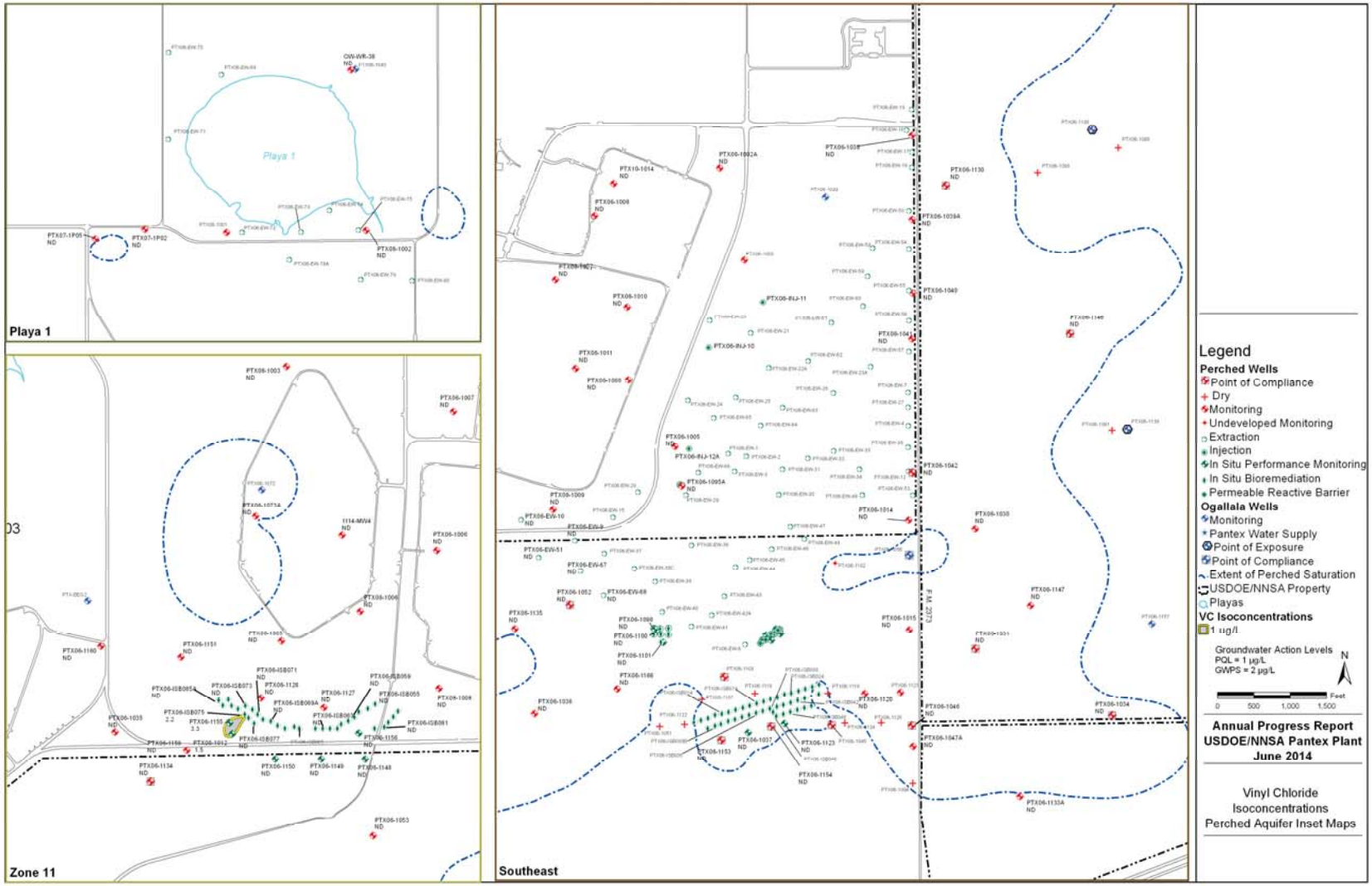

Figure 3-54. Vinyl Chloride Isoconcentration Inset Map

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3.1.7 Estimate of Plume Movement

The unique characteristics of the perched aquifer, including the limited areal extent of the aquifer, cause difficulty for estimating the rate of migration of groundwater contaminants. Unlike a typical contaminant plume in a regional aquifer, the HE plume associated with Pantex (Figure 3-11) extends to the edge of aquifer saturation, because this part of the aquifer was largely created by the infiltration of industrial wastewater discharges from legacy activities at Pantex. Furthermore, movement of contaminants within the plume is difficult to assess because of the impacts of the groundwater treatment systems. COC concentration trends for individual wells are located in Appendix D.

The approved LTM network has been in place since 2009, making it possible to compare the size and shape of plumes from year-to-year. However, since only four datasets are available using the same monitoring network and delineation levels, only a qualitative discussion of plume movement from 2012–2013 is included in the following sections. 2013 plume boundaries and/or select contours were compared with the 2012 isocontour maps available. As additional data are collected, quantification of plume movement, possibly by calculating centroids of individual plumes or portions of plumes, will be attempted.

Groundwater contamination in the perched aquifer occurs as several overlapping plumes associated with historical release areas. Each of the principal plumes is discussed below.

3.1.7.1 High Explosive Plumes

Several HE plumes are present in the perched aquifer as shown in Figure 3-11 through Figure 3-32. These plumes are primarily composed of RDX, HMX, and TNT, but also include TNT breakdown products and other HE constituents. The largest plume having the highest concentrations, referred to as the Southeast Plume, is located east and southeast of Zone 12 and Playa 1, and extends offsite to the south and east to the extent of perched saturation. A second HE plume occurs beneath the southeast portion of Zone 11. Other HE plumes are present in the areas surrounding Playa 1.

The Southeast Plume was formed as a result of the discharge of HE-contaminated process waters into unlined ditches in Zone 12. The contaminated wastewater flowed through the ditches to Playa 1, but significant volumes of the water infiltrated through the ditches. The HE plume maps presented show that the highest concentrations of HEs in groundwater occur away from the ditches indicating that contaminated perched groundwater has moved to the southeast away from the source areas and that concentrations of contaminated recharge water have declined over time. Trending of historic analytical data for this plume indicates source areas along the ditches continue to leach HEs (RDX and HMX) into perched groundwater, but at much lower concentrations than occurred historically. This plume is being actively remediated by the SEPTS that limits further migration of contaminants to the

east. In addition, the P1PTS is actively treating the HE plume in the vicinity of Playa 1, as well as reducing the head driving the southeast plume movement. The Southeast ISB system is also actively treating the HE plume before reaching the area beneath TTU property where the FGZ becomes less resistant to vertical migration.

The Zone 11 plume was formed as a result of the discharge of HE-contaminated process waters into unlined ditches and ponds in Zone 11. Groundwater contaminant concentrations in wells located along the southeast perimeter of Zone 11 are increasing, while concentrations at the south end of Zone 11 are decreasing. It is likely increasing concentrations indicate movement of the plume away from upgradient source areas rather than increasing concentrations related to a source near the well.

HE plumes surrounding Playa 1 may be associated with water infiltrating from the playa. Wells installed near Landfills 1 and 2 exhibit decreasing, stable, or no trends and PTX06-1050 is exhibiting no trend in RDX concentration.

When compared to the 2012 HE plume estimates, the shapes are generally similar, with some small differences that are primarily due to slight variations in the data and low values defining the boundaries. Breakdown product plumes are variable and will likely continue to be variable as natural attenuation and remedial actions continue in the perched aquifer.

In order to attempt to evaluate HE plume movement from 2012–2013, the RDX plume was chosen due to its size and distribution near the remedial actions. Considering the size and complexity of the RDX plume and the fact the plume is defined by the perched aquifer extent in many areas, the 1000 ug/L contours were included in the evaluation. These two contours represent the “hearts” of the two original plume sources (Playa 1 and Zone 12 ditches) that have since commingled in the southeast portion of the perched aquifer and are under the effects of the remedial actions. As depicted in Figure 3-55, the 1000 ug/L plume outlines have slightly shifted in the SEPTS well field and the eastern edge of the perched aquifer extent. This is likely due to a combination of SEPTS operations and general plume movement in areas that are not under the SEPTS influence, as well as the number and location of extraction wells sampled.

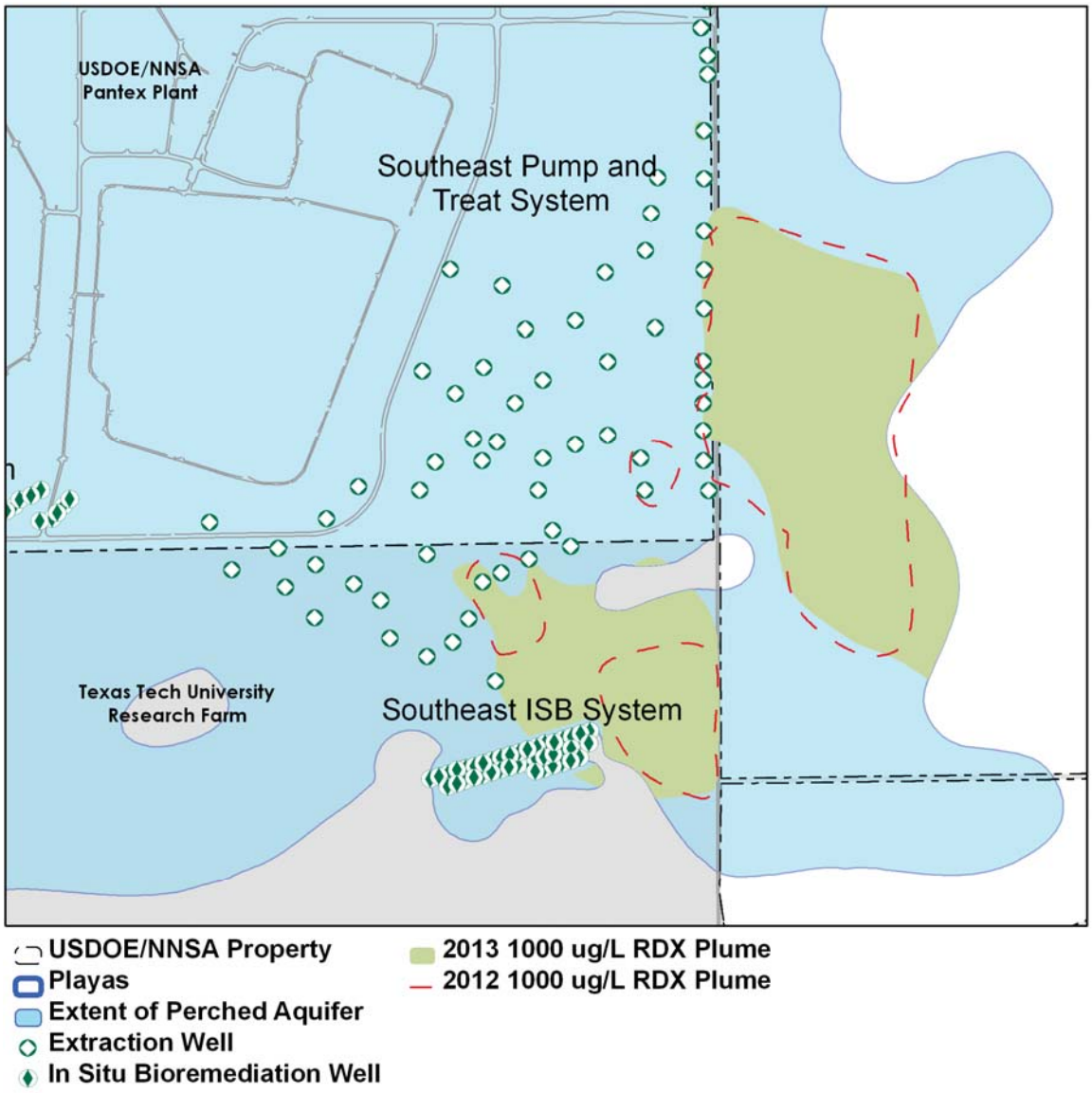

Figure 3-55. RDX Plume Movement, 2012-2013

3.1.7.2 Hexavalent Chromium Plumes

Hexavalent chromium is present in the perched aquifer in two commingled plumes originating in Zone 12 as shown in Figure 3-37 and Figure 3-38. Both of these plumes are being actively remediated by the SEPTS. The highest concentrations are associated with a source in WMG 5 in the southwestern corner of Zone 12. Concentrations near the source area are decreasing indicating the source is declining. However, concentrations within the plume and in the far downgradient wells are variable, and the plume continues to move offsite to the southeast and extends to the limit of perched aquifer saturation on TTU property and Southeast ISB system.

A smaller plume of hexavalent chromium emanates from the area of the Former Cooling Tower on the east side of Zone 12. Concentrations in this plume have decreased, but it is likely the source area continues to leach contamination to the perched groundwater.

When compared with the 2012 hexavalent chromium maps (Figure 3-56), the shapes are similar, with the following exceptions:

- The lobe that was believed to be caused by injection at PTX06-INJ-02 has continued to contract and shift back towards the east as concentrations in the area have decreased.
- The southern portion of the plume has apparently shifted to the east, primarily due to data collected at newly installed monitoring well PTX06-1166, which has better defined the plume boundary in this area. The shift was also affected by the non-detect hexavalent chromium results in PTX06-1135 in 2013. This well has historically defined the southwestern plume boundary and had a first-time detection in 2012.

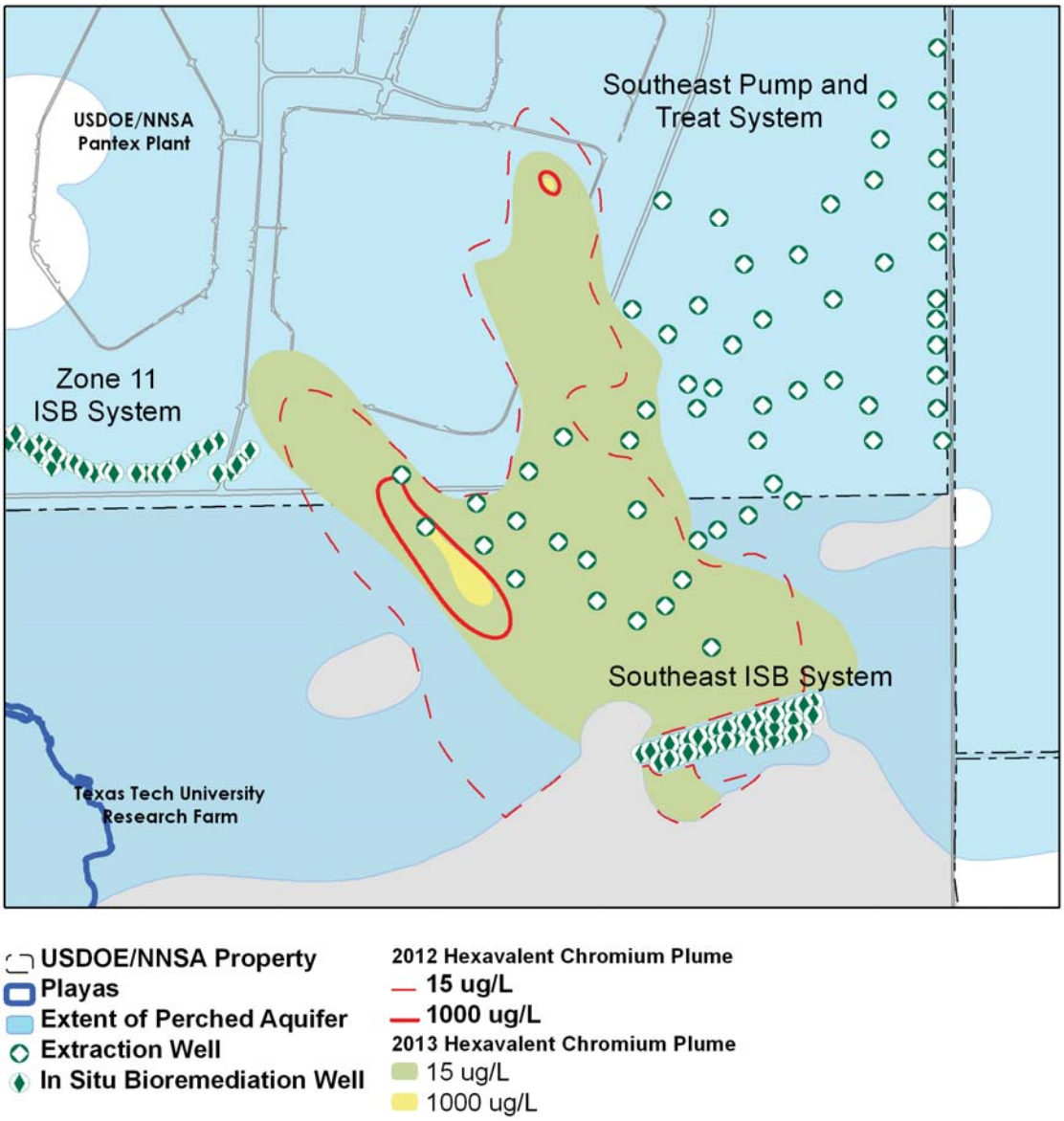

Figure 3-56. Hexavalent Chromium Plume Movement, 2012–2013

3.1.7.3 Trichloroethene Plumes

Several TCE plumes are present in the perched aquifer as shown in Figure 3-41 and Figure 3-42. The largest plume originates in the north and east sides of Zone 12 (SWMU 122b and WMG 10) and extends to the southeast. Another TCE plume originates beneath Zone 11 and extends to the south off-site. TCE in the perched aquifer occurs from partitioning of TCE in soil gas into perched groundwater and leaching of TCE-contaminated process water associated with legacy discharges to unlined ditches and former ponds.

Groundwater concentrations of TCE near SWMU 122b are stable or exhibiting no trend, but indicate a continuing source of TCE to the groundwater. This plume is being actively remediated by the SEPTS. PTX10-1014, which is near WMG 10, is exhibiting an increasing trend in TCE, but this trend is most likely due to effects of injection rather than increased sourcing. Concentrations in the small plume of TCE originating from the Fire Training Area are slightly decreasing indicating TCE in soil gas continues to impact perched groundwater at this location.

The TCE plume underlying Zone 11 is associated with legacy HE operations which resulted in industrial wastewater that infiltrated into the subsurface and TCE in soil gas originating from several areas within the zone. Concentrations in this plume are stable or slightly increasing beneath Zone 11 indicating continuing migration of TCE into perched groundwater. This plume is migrating southward, and observed concentrations at the TTU property boundary are increasing. This plume is being actively remediated by the Zone 11 ISB System.

As depicted in Figure 3-57, the 2012 and 2013 TCE plume shapes are similar, with the following notable exceptions.

- The plume originating from Zone 12 has contracted near the Zone 12 source areas, likely due to decreasing TCE concentrations in nearby monitoring wells. However, the plume has expanded significantly to the south due to data collected in newly installed monitoring well PTX06-1166.
- The plume originating from Zone 11 has slightly shifted to the north due to data collected in newly installed monitoring wells PTX06-1159 and PTX06-1160.

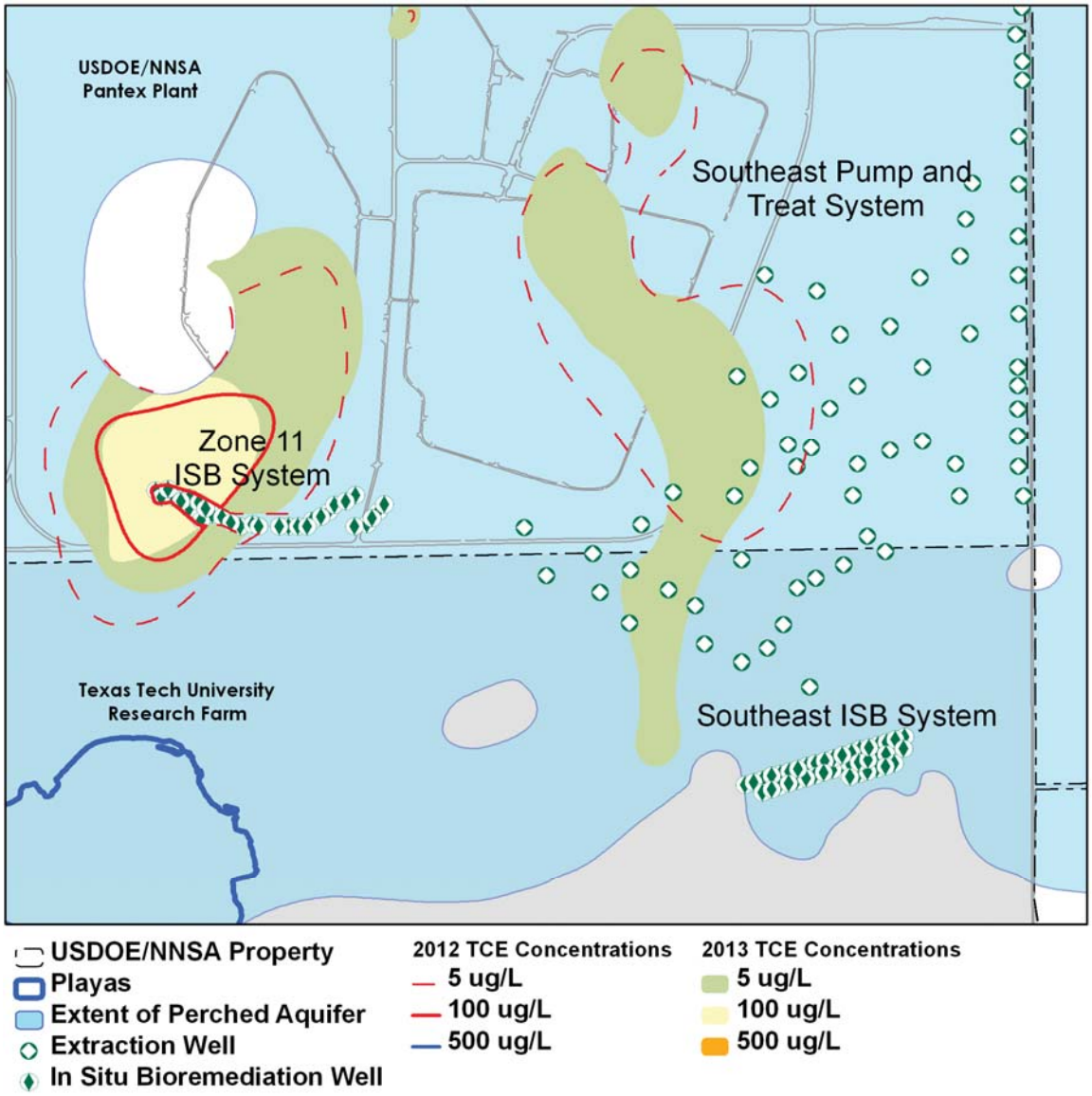

Figure 3-57. TCE Plume Movement, 2012-2013

3.1.7.4 Perchlorate Plume

A single plume of perchlorate occurs in the perched aquifer underlying Zone 11. This plume extends northeast to Playa 1 and Southwest beneath TTU property as shown in Figure 3-33 and Figure 3-34. This plume is associated with the historical release of perchlorate from processes in Zone 11 to unlined ditches that carried the material to the playa.

Concentrations of perchlorate in areas underlying the potential source areas in Zone 11 are decreasing, but remain steady or are increasing (PTX06-1007) near the ditch to Playa 1. Perchlorate concentrations near the southern boundary of Pantex Plant continue to generally increase. This plume is being actively remediated by the Zone 11 ISB System.

As depicted in Figure 3-58, the perchlorate plume shape is similar to the 2009 plume map, with the following notable exceptions.

- The northwestern plume boundary has shifted to the north due to the low-level perchlorate detection at PTX06-1077A, which was non-detect in 2012. Since PTX08-1001 went dry in 2013, a sample was not collected, causing the northeastern lobe to shift to the south. Perchlorate concentrations in PTX08-1001 and resulting northern plume boundaries have been variable since 2010.
- The eastern plume boundary has shifted to the west due to decreasing perchlorate concentrations in wells defining the plume extent in this area, including PTX06-1006, PTX06-1011, and PTX10-1014.
- The southwestern plume boundary shifted to the east due to data collected at newly installed well PTX06-1160 (non-detect).

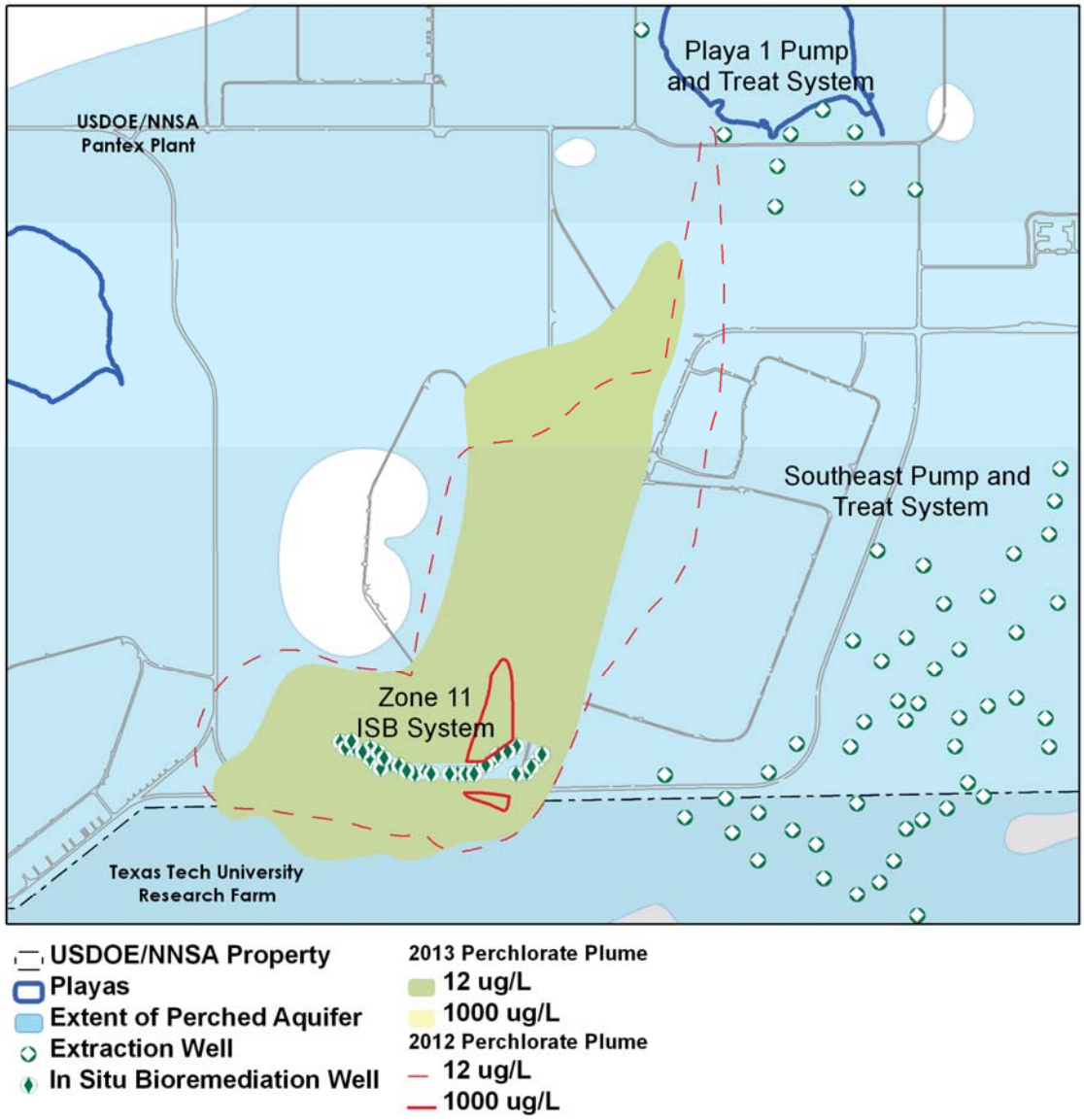

Figure 3-58. Perchlorate Plume Movement, 2012-2013

3.2 Remedial Action Effectiveness

3.2.1 Southeast Pump and Treat System

The objective of the SEPTS (Figure 3-59) is to remove contaminated perched groundwater and treat it for industrial and/or irrigation use. While the capability is being maintained for injection of treated water back into the perched zone, the intent is to permanently remove perched groundwater to gradually reduce the saturated thickness in this zone. This will achieve two important goals:

- A gradual reduction of the volume of perched groundwater (and contamination) moving downgradient toward the extent of saturation, and

- A reduction in the head (driving force) for vertical migration of perched groundwater into the FGZ and toward the drinking water aquifer.

The SEPTS has altered the groundwater flow direction and gradient at localized areas near the extraction wells in the perched aquifer. Although P1PTS has been in operation for approximately five years, it appears to be influencing local water levels and hydraulic gradient in the Playa 1 south area. Figure 3-60 illustrates the influence of these two systems. Water levels measured at extraction wells were not used in the interpretation of water table contours so that cones of depression would not be overestimated. Localized cones of depression are present surrounding several extraction wells, but formation of an extensive cone of depression throughout the system is limited by the thin saturated thickness of the aquifer.

The water table map indicates groundwater is still flowing southward across the USDOE/NNSA property boundary onto TTU property. However, extraction wells located on this property limit the further migration of perched groundwater contaminants to the south.

Water table contours along FM 2373 indicate groundwater is flowing to the south and southeast along the USDOE/NNSA property boundary, thus limiting the transport of perched aquifer contaminants eastward.

The hydraulic gradient varies greatly in this area because of the influence of the SEPTS. Very steep gradients occur locally near many of the extraction wells, and the southerly flow direction is reversed in some areas.

3.2.1.1 System Operations in 2013

The SEPTS operated 349 days in 2013 with an average operational rate of 91% based on total hours operated versus total possible operation time, exceeding the operational goal of 90%. The SEPTS extracted an average of 286 gpm from the well field while operating, exceeding the operational goal during 2013. However, monthly operational goals were not consistently met, primarily March and December when flow to the WWTF was reduced to limit injection to the perched aquifer. The system treated a total of approximately 138 million gallons of extracted water during 2013. This system released 96% of the treated water to the WWTF for use in the irrigation system, 2% was injected into the perched aquifer and the remainder was used for amendment injection in both ISB systems. Injection of treated water back into the perched zone was utilized only to maintain minimum flow requirements in the SEPTS. Since P1PTS can only discharge effluent to the WWTF, operation of SEPTS under injection/minimum flow conditions allows for continued P1PTS operations and removal of the

mound of water beneath Playa 1, thereby reducing the head that causes vertical migration of perched groundwater and contamination.

The system removed about 120 lbs of hexavalent chromium, 408 lbs of RDX, and 263 lbs of all other HEs during 2013. The average removal rate of hexavalent chromium was 0.9 lbs/Mgal of water, and the average removal rate for HEs was 4.9 lbs/Mgal of water. This system has treated approximately 9,894 lbs of HEs and 1,266 lbs of hexavalent chromium since beginning operation. Evaluation of effluent data indicates the system continues to treat the recovered groundwater to concentrations below the PQL and the GWPS.

3.2.1.2 Hydrodynamic Control

Hydrodynamic control limits the horizontal migration of contaminants by using extraction wells to alter the hydraulic gradient. Because of the limited saturated thickness of the perched aquifer, complete hydraulic containment of the contaminant plume is not possible. However, the SEPTS has been effective at altering the hydraulic gradient to limit the movement of contaminants. Analysis of groundwater flow directions as indicated by water table contours shows that the SEPTS has reduced the eastward movement of perched groundwater across FM 2373 and limited expansion of the plume south of the extraction wells on TTU property. The approximate radius of influence of the groundwater treatment systems and the directions of perched groundwater flow gradients outside the radius of influence are shown on Figure 3-60. Capture zones, shown in Figure 3-60 for the extraction wells, were calculated using a single-layer groundwater flow model of the perched aquifer. Average 2013 extraction flow rates for each well were used in the calculations.

3.2.1.3 System Effectiveness

Considering the primary goal of both pump and treat systems is to affect plume movement and reduce saturated thickness in the perched aquifer, the plume stability discussion included in Section 3.1 can be used to determine the effectiveness of these systems. To this end, the pump and treat systems have been very effective in 2013. When comparing the 2013 conditions to LTM Design expected conditions, the majority of monitor wells are meeting expected conditions in the fourth year of the remedial action. The three LTM wells that are not yet meeting expected conditions (PTX06-1133A, PTX06-1089, and PTX06-1073A) are on the periphery of the perched aquifer extent and are not under the influence of a pump and treat system.

As a part of the SEPTS secondary goal of mass removal, the system continued to remove both HEs and hexavalent chromium and treated 143 million gallons of extracted water to concentrations below the PQL and the GWPS. The SEPTS did not consistently meet all goals for treatment volumes established in the *Remedial Design/Remedial Action Work Plan* (B&W Pantex, 2009c), primarily to limit injection of treated water into the perched aquifer in early 2013. Pantex continues to optimize the system operation.

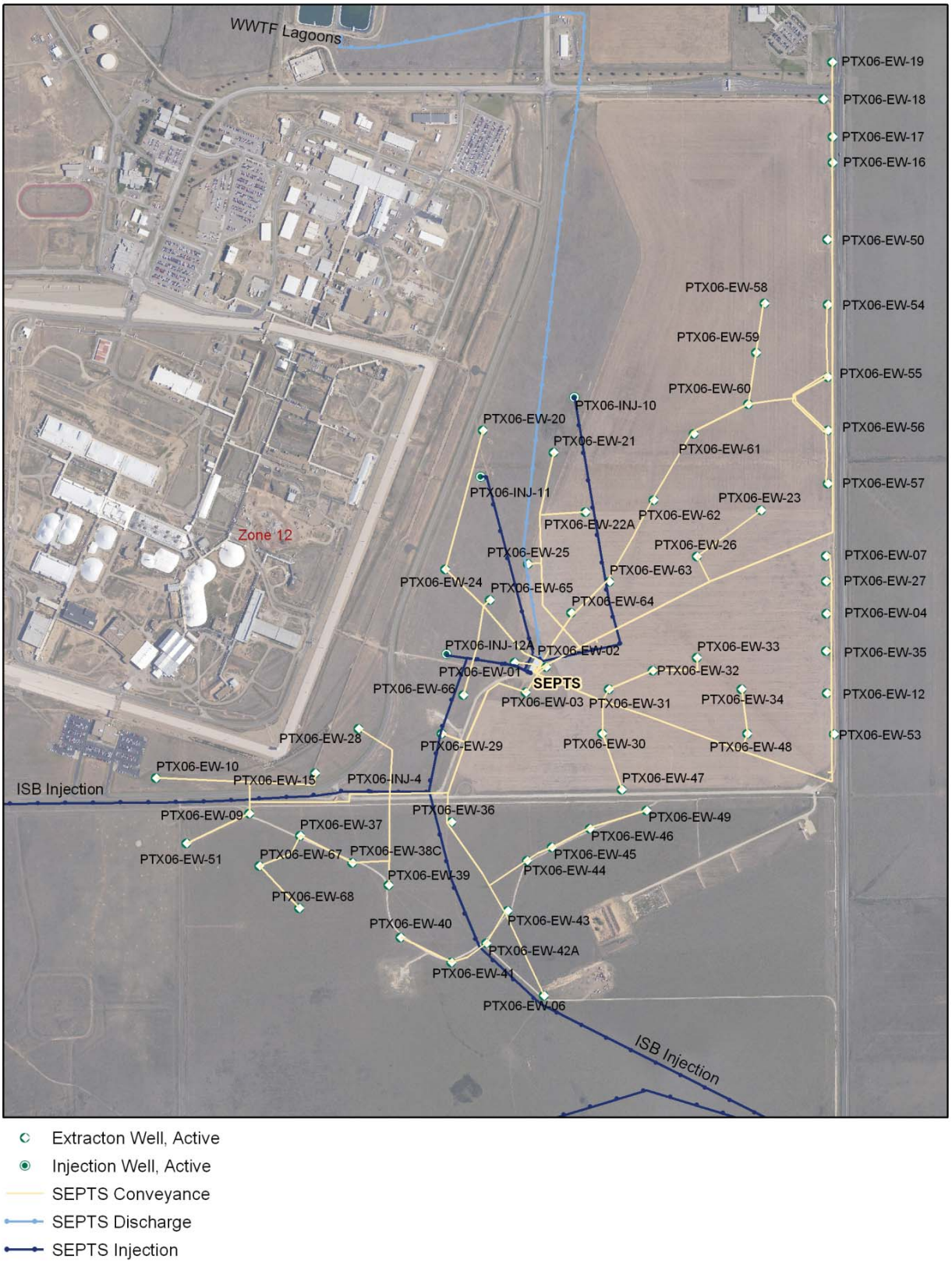

Figure 3-59. SEPTS Extraction Wells and Conveyance Lines

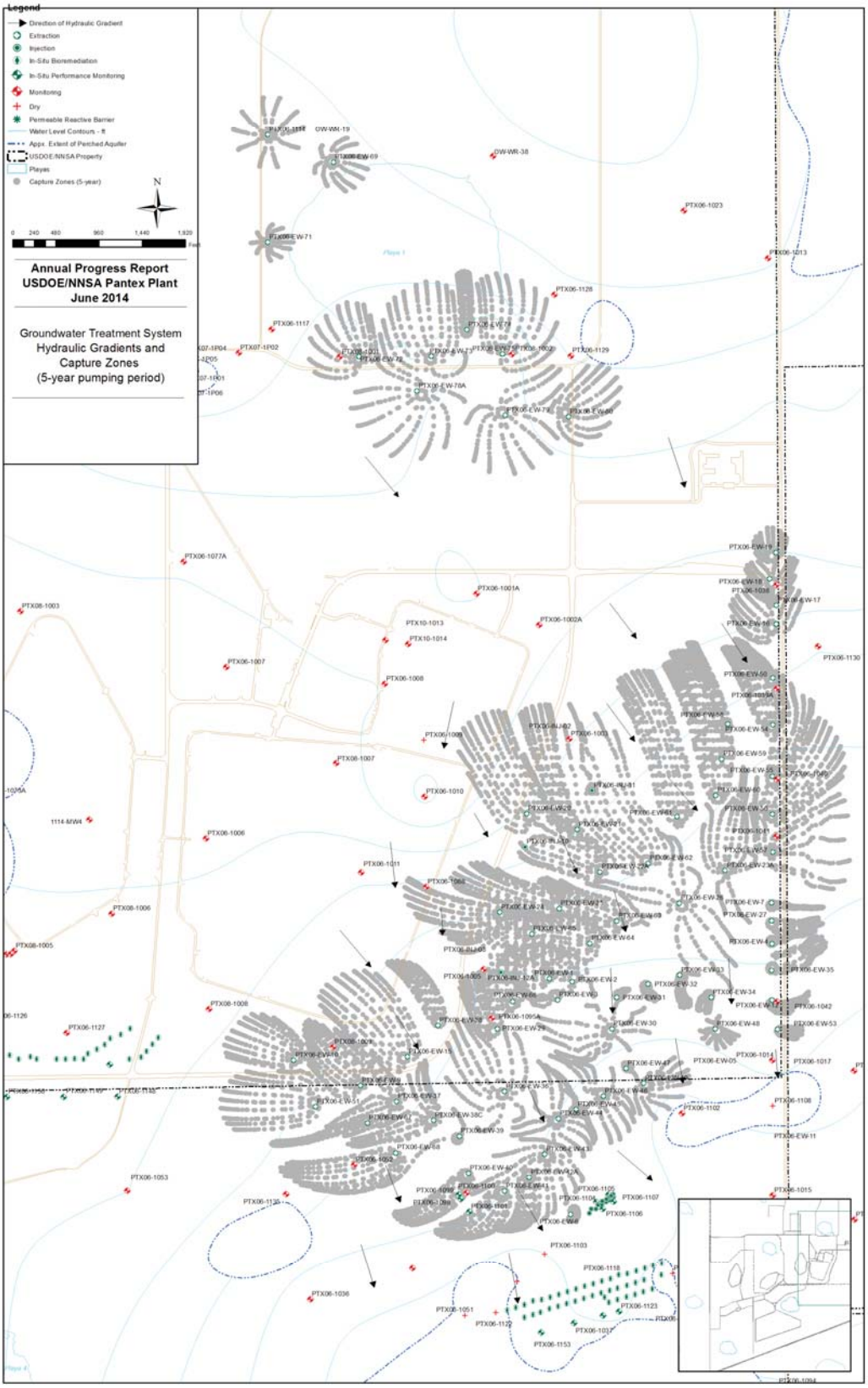

Figure 3-60. Pump and Treat System Capture Zones

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3.2.2 Playa 1 Pump and Treat System

The P1PTS was completed during 2008 with operations starting in September 2008. This system extracts water from 10 wells near Playa 1 (see Figure 3-61) and treats the water through a series of GAC beds and ion exchange process units to reduce HEs and metals below the GWPS established in CP-50284 and the ROD. The objective of this system is to reduce the mound of perched groundwater associated with Playa 1, affecting the movement of the southeast plume by reducing the hydraulic head, as well as achieving mass removal.

Although P1PTS has been in operation for only five years, it appears to be influencing local water levels and hydraulic gradient in the Playa 1 area. Figure 3-60 illustrates the influence of both groundwater pump and treat systems. Water levels measured at extraction wells were not used in the interpretation of water table contours so that cones of depression would not be overestimated. Due to the thicker saturated interval near Playa 1 and more consistent pump operation, cones of depression are established around the extraction wells. Table 3-2 summarizes the estimated drawdown at the running extraction wells and influence on the local gradient is depicted in Figure 3-60.

Table 3-2. P1PTS Average Flow and Drawdown

EW	Average Flow (gpm)	Average Drawdown (ft)
EW-69	13.8	--
EW-70	21.9	17.7
EW-71	8.6	11.8
EW-72	21.9	13.2
EW-73	25.0	26.6
EW-74	26.7	--
EW-75	33.0	31.8
EW-78A	43.2	--
EW-79	29.1	--
EW-80	6.4	9.1

EW-69, EW-74, EW-78A, and EW-79 had transducer problems throughout 2013, so drawdown is unknown

The water table map indicates the mound of groundwater beneath Playa 1 has been reduced as the groundwater high in the perched aquifer is now to the northeast. Groundwater is still generally flowing away from Playa 1, then to the south/southeast across the USDOE/NNSA property boundary onto TTU property. As the perched aquifer saturated thickness continues to be reduced in this region, this flow should decrease and the driving head will be reduced.

In addition, SEPTS extraction wells limit the further migration of perched groundwater contaminants to the south.

The hydraulic gradient has begun to be affected by pumping at the P1PTS well field and is difficult to estimate. Very steep gradients occur locally near most of the extraction wells, and the general flow patterns are reversed in some areas.

3.2.2.1 System Operations in 2013

The P1PTS operated 354 days in 2013 with an average operational rate of 95% based on total hours operated versus total possible operation time. The P1PTS has a maximum design treatment capacity of 250 gpm. The goal for this system is to operate at 90% efficiency or higher (225 gpm or 324,000 gpd). The system extracted an average of 199 gpm from the well field while operating and treated an average of 272,000 gpd during 2013.

The system treated approximately 99 million gallons during 2013. Overall, the system has not consistently met the 90% of design throughput goal established in the *Remedial Design/Remedial Action Work Plan* (B&W Pantex, 2009c), although the system performance improved after June. Treatment volumes were primarily affected by operational issues with individual extraction wells and restricted flow to the WWTF in December.

During 2013, the system removed a total of 55 lbs of RDX and 23 lbs of all other HEs. The average removal rate of HEs was 0.8 lbs per million gallons (lbs/Mgal) of treated water. Evaluation of effluent data indicates the system treated the recovered groundwater to concentrations below the PQL and the GWPS.

3.2.2.2 System Effectiveness

Considering the primary goal of both pump and treat systems is to affect plume movement and reduce saturated thickness in the perched aquifer, the plume stability discussion included in Section 3.1 can be used to determine the effectiveness of these systems. To this end, the pump and treat systems have been very effective in 2013. When comparing the 2013 conditions to LTM Design expected conditions, the majority of monitor wells are meeting expected conditions in the fifth year of the remedial action. The three LTM wells that are not yet meeting expected conditions (PTX06-1133A, PTX06-1089, and PTX06-1073A) are on the periphery of the perched aquifer extent and are not under the influence of a pump and treat system.

To satisfy the P1PTS secondary goal of mass removal, the system removed 78 lbs of HEs and treated 99 million gallons of extracted water to concentrations below the PQL and the GWPS. The P1PTS has not consistently met all operational goals established in the *Remedial Design/Remedial Action Work Plan* (B&W Pantex, 2009c). Pantex continues to optimize the system operation and operational goals are expected to be met when the various issues are resolved with the extraction wells. As recommended in the Five-year Review Report (B&W

Pantex 2013), Pantex has installed one additional P1PTS extraction well (PTX06-EW81A) to ensure operational goals can be consistently met regardless of individual well repair issues. That well will be connected to the system during upgrades that will be complete in 2015.

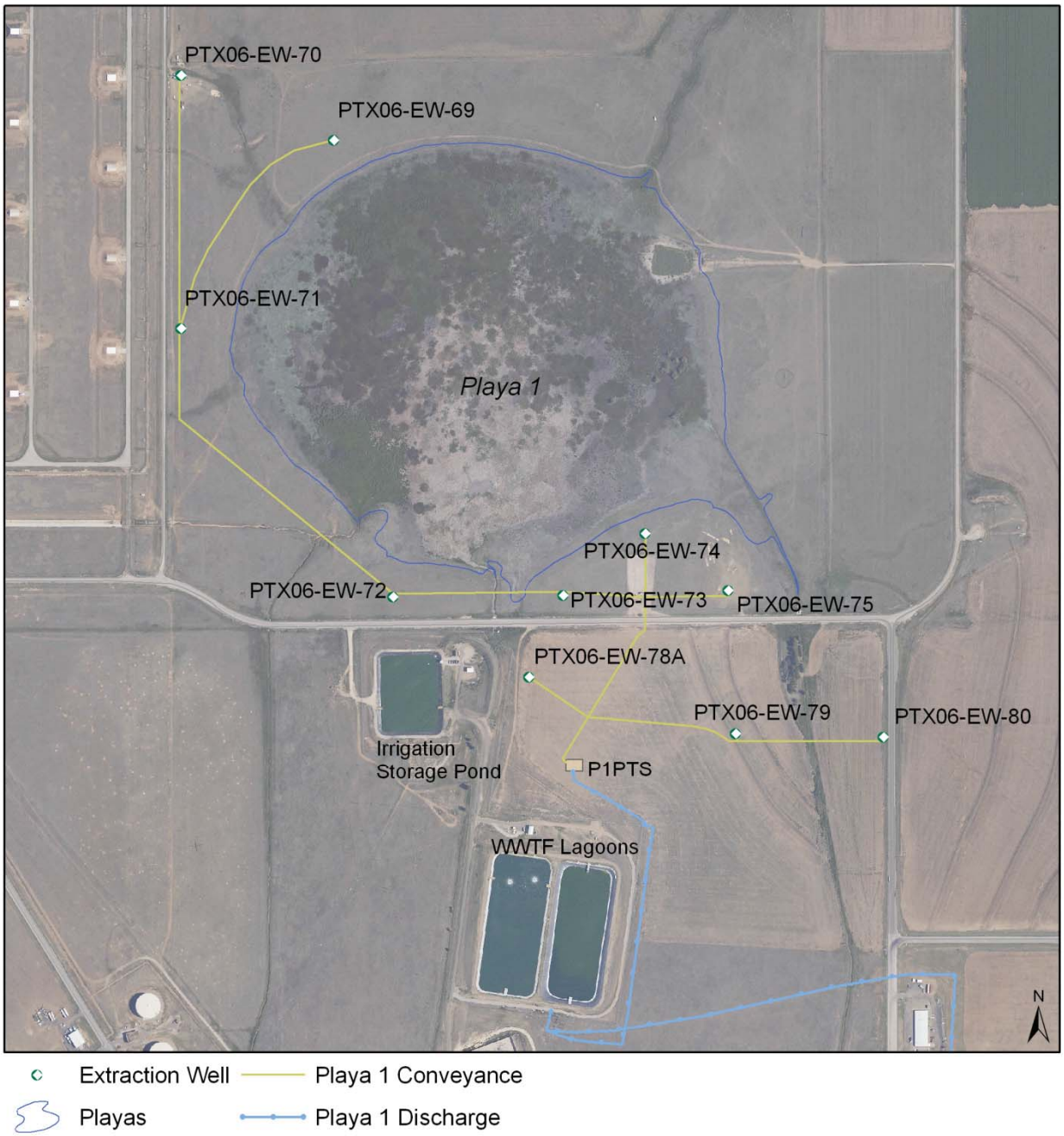


Figure 3-61. P1PTS Extraction Wells and Conveyance Lines

3.2.3 ISB Systems

Pantex has installed and operates two ISB systems. One system is southeast of Pantex Plant on TTU property and one is south of Zone 11. The ISB systems consist of 74 treatment zone wells and 9 ISPM wells.

The objective of the ISB systems is to establish an anaerobic biodegradation treatment zone capable of reducing COCs to the GWPS by injecting the necessary amendments and nutrients to stimulate resident bacteria. The microbial growth first consumes oxygen and then in turn consumes other electron acceptors, creating reducing geochemical conditions. Under reducing conditions, biotic and abiotic treatment mechanisms are carried out. The following sections provide an understanding of the expected conditions at the ISB systems and downgradient concentrations of COCs. This information is used to determine whether further injections are required for continued treatment of COCs and to ensure that COC concentrations are being reduced downgradient of the treatment zone.

To monitor the effectiveness of the treatment zones, indicators of geochemical conditions and amendment longevity are used to determine if conditions are within an acceptable range for oxidation-reduction (redox) potential, electron acceptor concentrations (i.e., dissolved oxygen [DO], nitrate, and sulfate), and nutrient supply (total organic carbon and prevalent volatile fatty acids [VFAs]). These parameters are important because reducing conditions and adequate nutrients must be present to treat the COCs.

The bioremediation amendment, or carbon source, selected for the ISB systems is an emulsion of sodium lactate and soybean oil called Newman Zone™. The formulation provides both a rapidly-utilized electron donor (sodium lactate) and a slow-release long-term electron donor (soybean oil). As illustrated in Figure 3-62, the complex carbon source slowly ferments releasing lighter weight organic compounds, such as VFAs, which are further used for microbial energy and growth. Many steps of the fermentation process produce hydrogen, which is utilized by some microbes to directly metabolize COCs. As long as optimal subsurface reducing conditions and VFAs are available, a diverse microbial community can be sustained which leads to in situ treatment of COCs. Total VFAs are evaluated at the ISBs and serve as a good indicator that fermentation is occurring. TOC was selected as an indicator that an adequate carbon source remains available for continued ISB treatment. Pantex monitors for a wide range of VFAs and the results of that monitoring are included in Appendix D.

In addition, geochemical conditions can be evaluated to determine if adequate reducing conditions exist to achieve reduction. Figure 3-63 presents the redox ranges for reduction of various COCs. TCE and perchlorate are the primary COCs in the Zone 11 area, while HEs (primarily RDX) and hexavalent chromium are the primary COCs in the southeast area. Perchlorate degradation does not require as strongly reduced conditions as RDX or TCE.

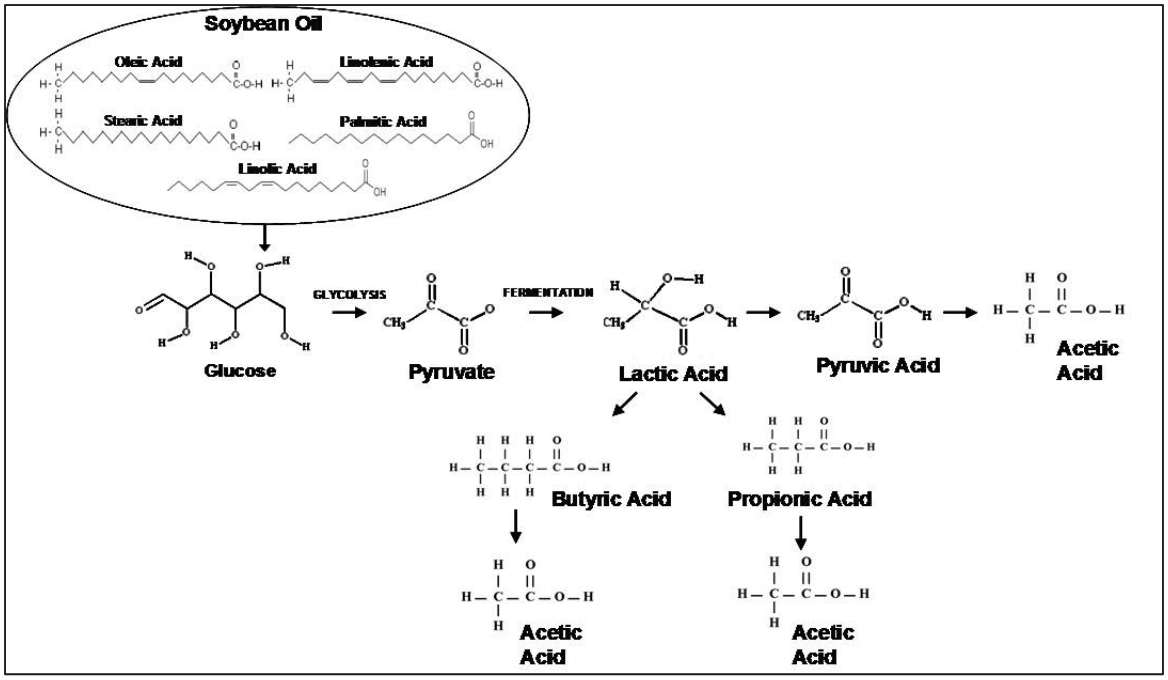


Figure 3-62. Soybean Oil Fermentation Pathways

To document the effectiveness of COC removal, downgradient wells are monitored for specific target indicators chosen for each ISB system. Target indicators include COCs that are the most widespread and that have the potential to affect human health if the water were to be used for residential purposes, even though perched groundwater use is controlled to prevent any potential for exposure. In addition, breakdown products are monitored to determine if complete degradation is occurring. Specific indicators are discussed separately for each system below.

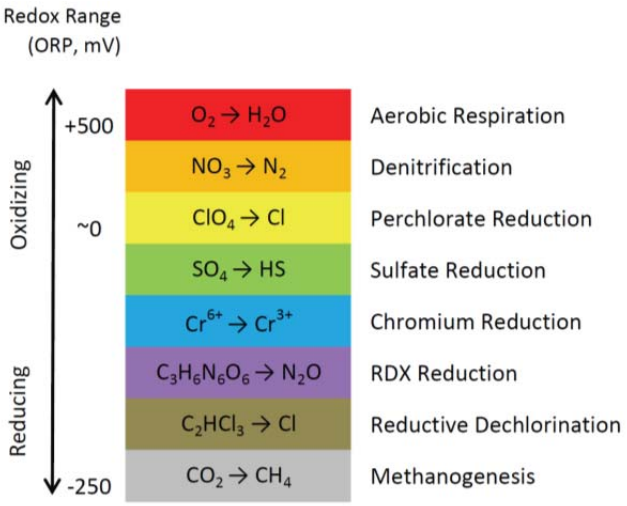


Figure 3-63. Typical Geochemical Redox Ranges

In addition to specific indicators to help determine if additional injections are required, Pantex monitors for a wide range of VFAs, metals, and general chemistry parameters. The VFAs help determine if fermentation is occurring and also help determine the fermentation pathways. Specific metals are monitored in downstream performance monitoring wells to ensure that metals are returning to background conditions after leaving the treatment zone. Specific metals are expected to increase in the treatment zone because

of reducing conditions that release the naturally occurring metals in the formation soils. However, as the water moves away from the reducing conditions, the metals are expected to precipitate out into the soil matrix. The general chemistry parameters are also monitored to determine if the water is returning to baseline conditions.

3.2.3.1 Zone 11 ISB

The Zone 11 ISB system is on Pantex Property, south of Zone 11 (see Figure 3-64). The current system consists of 32 injection wells and 3 downgradient performance monitoring wells installed in a zone of saturated thickness of approximately 15-20 ft. The Zone 11 ISB was installed by early 2009 with injection completed in the original 23 wells by June 2009. As summarized in Table 3-3, a fifth injection event, described in Section 2.2.1, was completed in July 2013.

Table 3-3. Zone 11 ISB Injection Dates

Injection Event	Completion Date
1	June 2009 (original 23 wells) November 2009 (9 new wells)
2	September 2010
3	October 2011
4	September 2012
5	July 2013

Eleven treatment zone wells and three downgradient performance monitoring wells are used to evaluate the Zone 11 ISB (see Figure 3-64). The injection wells were drilled in a line perpendicular to the hydraulic gradient so water flowing through this zone will be treated before it reaches the area beneath TTU property near Playa 4. Based on the current rate of perched groundwater flow, estimated amendment longevity, and data collected in the treatment zone, injections will be necessary about every 12 months.

COCs targeted for treatment by this system are perchlorate and TCE. Indicator constituents evaluated for trends at downgradient performance monitoring wells include TCE and its degradation products (*cis*-1,2-DCE and vinyl chloride) and perchlorate. Expected conditions are that the indicator constituent concentrations will begin to decline at downgradient monitoring wells at their estimated travel times from the treatment zones, which are discussed later in this section.

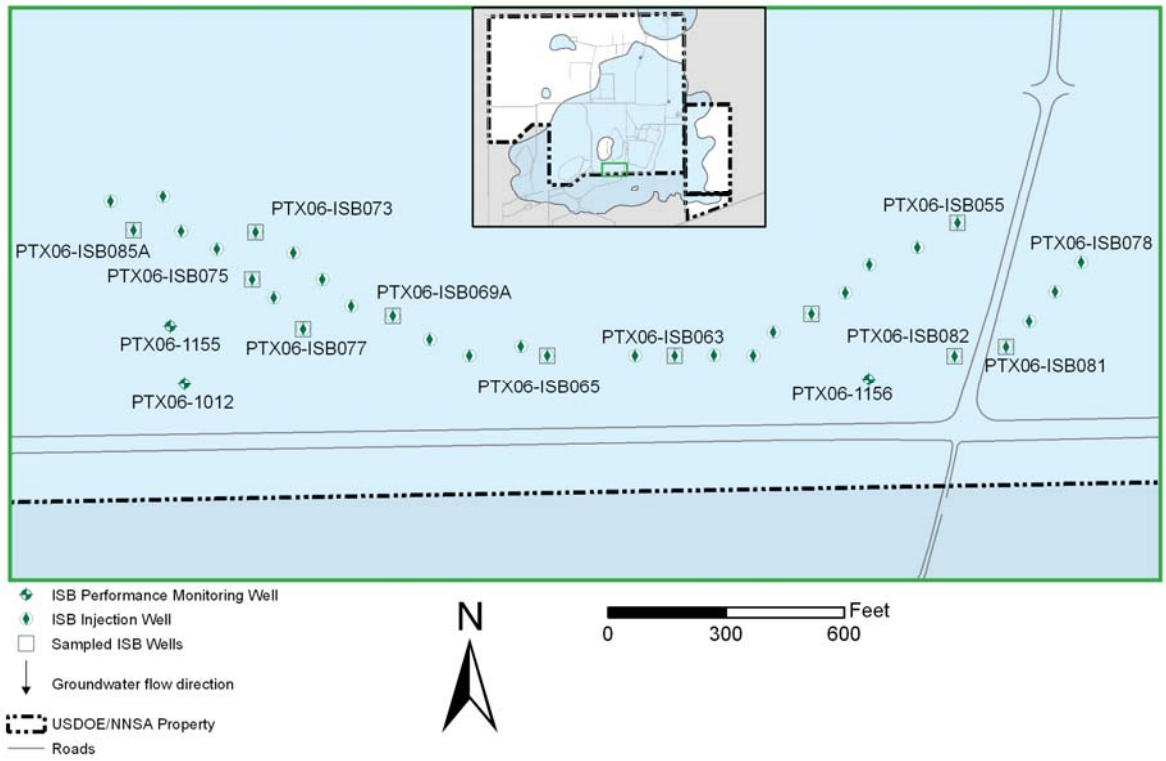


Figure 3-64. Zone 11 ISB System Wells and Sampling Locations

Dissolved oxygen, redox potential, nitrate, sulfate, total organic carbon, and total VFAs in the ISB treatment zone performance wells are evaluated to determine if the treatment zone is rebounding to baseline conditions, thus requiring amendment injection. The expected conditions for the treatment zone wells are that redox potential and electron acceptor (DO, nitrate, and sulfate) concentrations will decline after injection. As shown in Figure 3-63, strongly reducing conditions must be achieved for reductive dechlorination of TCE to occur. The redox potential should decline from baseline and be below 0 mV for the reduction of TCE and near 0 mV for the reduction of perchlorate. Concentrations of total organic carbon and acetic acid should increase after injection, but decline over time as the amendment is consumed.

Table 3-4 summarizes the post-injection and recent trends in the ISB treatment zone performance wells.

Table 3-4. Zone 11 ISB Treatment Zone Conditions

Well	DO		ORP		Nitrate		Sulfate		TOC		Total VFAs	
	PI	R	PI	R	PI	R	PI	R	PI	R	PI	R
PTX06-ISB055	↑	↓	↑	↓	→	**	*	↑	↑	↓	↑	↓
PTX06-ISB059	→	→	↑	↓	→	**	↑	↓	↑	↓	↑	↓
PTX06-ISB063	→	→	→	→	→	**	*	→	↑	↓	↑	↓
PTX06-ISB069A	→	→	→	→	→	**	→	↓	↓	↑	↑	↓
PTX06-ISB071	→	→	↑	↓	→	**	*	→	↑	↓	↑	↓
PTX06-ISB073	→	→	→	→	→	**	→	→	↑	→	↑	↓
PTX06-ISB075	→	→	→	↑	→	→	→	→	↑	↓	↑	↓
PTX06-ISB077	→	→	→	→	→	→	↓	↑	↑	↓	↑	↓
PTX06-ISB081	→	→	→	→	→	→	→	↓	→	↓	↑	↓
PTX06-ISB082	NDA		NDA		NDA		NDA		NDA		NDA	
PTX06-ISB085A	↑	→	↑	↓	→	→	→	→	↑	↓	↑	↓

Legend:
- ↓ Decline
- ↑ Increase
- ↳ Decline, then stabilized
- → Stable
- Rebounding near or at baseline conditions or food source depleting
- Mild conditions established or starting to rebound
- Expected condition

PI = Post-injection trend R = Recent trend NDA = No data available

*Sulfate was non-detect in this well in the 3rd quarter sampling event; however, detection limits were high relative to previous data so no conclusions could be drawn from the data. 4th quarter data were compared to pre-injection conditions to determine recent trends.

** Nitrate was non-detect in this well; however, detection limits were high relative to previous data so no conclusions could be drawn from the data.

Prior to the 2nd quarter injection, the TOC and VFAs had decreased in the majority of the injection wells. After injection, the TOC and VFA concentrations responded variably across the treatment zone wells, with most indicating increased TOC and VFAs. The variable results may be linked to the magnitude of biological activity or groundwater flux at the wells. This data indicates that a fair to good food source is available at the wells to allow continued biological activity and remediation of the COCs.

Adequate reducing conditions have been established in the treatment zone for both perchlorate and TCE. Conditions favorable for reductive dechlorination are present in that area as available nitrate and sulfate concentrations are relatively stable at low concentrations. Evaluation of TCE data collected in the treatment zone indicate that, with one exception of one well (discussed below), TCE concentrations are non-detect, cis-1,2-dichloroethene (DCE) was detected at low concentrations below its GWPS and PQL, and vinyl chloride was non-detect. Cis-1,2-DCE and vinyl chloride are both breakdown products of TCE. Perchlorate has been reduced to concentrations below the GWPS and the PQL at all monitored injection wells.

Due to a damaged well casing at PTX06-ISB075, a replacement well was installed approximately 20 feet southeast (cross/downgradient) of the original well after injection in September 2012. As reported in the 2012 Annual Progress Report, the replacement well was monitored throughout 2013 while the original well received amendment injection in the fifth injection event. As shown in Table 3-5, TCE concentration exceeded GWPS in 1st quarter but steadily decreased during 2013 and was non-detect in 4th quarter. In addition, 1,2-dichloroethane, cis-1,2- DCE and vinyl chloride were detected at concentrations exceeding their respective GWPS. Trans-1,2-DCE was detected at concentrations below its GWPS. ORP data collected in the field as well as nitrate and sulfate results indicate that a mild reducing environment is present. Total VFAs did increase after the 2013 injection event, but not as strongly as most of the other injection wells. Organic carbon (both TOC and DOC) continued to be detected at lower concentrations than all other Zone 11 ISB injection well values, including historic values in all wells since the first injection event. These unusually low carbon levels may indicate an inadequate food source is available to maintain the microbial community required for treatment at this location.

Downgradient ISPM wells are exhibiting effects from the treatment zone. TOC and total VFAs have been detected in all three downgradient wells. Additionally, nitrate and sulfate concentrations have declined and ORP is negative in all three downgradient wells suggesting arrival of ISB-affected water or expansion of the treatment zone.

Table 3-5 summarizes the current and maximum COC concentrations in each ISPM well. PTX06-1012 and PTX06-1155 are on the western side of the ISB where TCE is the primary COC, although baseline concentrations of perchlorate also exceeded the GWPS in that area. PTX06-1156 is on the eastern side of the Zone 11 ISB where perchlorate is the primary COC. Perchlorate concentrations were non-detect in all downgradient ISPM wells during 2013. TCE concentrations were either non-detect or below GWPS in PTX06-1156 during 2013. PTX06-1012 and PTX06-1155 are exhibiting decreasing trends in TCE in 2013, and TCE was below GWPS for the first time in PTX06-1155 in the 4th quarter. If these trends continue, TCE will be below GWPS in all downgradient wells in 1 – 2 years.

Table 3-5. Summary of Zone 11 ISB Monitoring Well Data for TCE and Perchlorate

Well ID	PERC Baseline[a]	PERC 1Q2013	PERC 2Q2013	PERC 3Q2013	PERC 4Q2013	TCE Base-line[a]	TCE 1Q2013	TCE 2Q2013	TCE 3Q2013	TCE 4Q2013
In Situ Bioremediation Wells										
PTX06-ISB055	3000	<12	--	<12	<12	16	<3	--	<3	<3
PTX06-ISB059	970	<12	--	<12	<12	<5	<3	--	<3	<3
PTX06-ISB063	39	<12	--	<12	<12	<5	0.47	--	<3	<3
PTX06-ISB069A	880	<12	--	<12	<12	62	0.44	--	<3	<3
PTX06-ISB071	400	<12	--	<12	<12	1500	--	--	<3	<3
PTX06-ISB073	380	<12	--	<12	<12	560	0.5	--	<3	<3
PTX06-ISB075[b]	97	<12	--	<12	<12	440	20	--	2.9	<3
PTX06-ISB077	840	<12	--	<12	<12	310	0.81	--	<3	<3
PTX06-ISB081	153	<12	--	<12	<12	<5	0.57	--	<3	<3
PTX06-ISB082[a]	3090	<12	--	<12	<12	9.6	0.3	--	<3	<3
PTX06-ISB085A	558	<12	--	<12	<12	89	<3	--	<3	<3
In Situ Performance Monitoring Wells										
PTX06-1012	341	<12	<12	<12	<12	580	250	210	200	170
PTX06-1155	487	<12	<12	<12	<12	660	170	27	18	4.8
PTX06-1156	2140	<12	<12	<12	<12	7.4	0.5	0.39	<3	<3

Concentrations provided in ug/L.
PERC – IRPIM code for perchlorate.
Highlighted cells indicate concentrations less than the GWPS.
The "--" symbol indicates no samples were collected.
When COC was not detected, a "less than" with the detection limit is provided.
[a]Baseline values for ISB injection wells are represented by data collected prior to initial injection in 2008. Because some ISPM wells were installed after start of the remedial action, baseline values for ISPM wells are represented by the maximum values reported in that well, regardless of the date in which it was collected.
[b]Due to well damage, PTX06-ISB075 was replaced in September 2012 and the replacement well was sampled during 2013.

TCE breakdown products cis-1,2-DCE and vinyl chloride continue to be detected in downgradient wells. Cis-1,2-dichloroethane is exhibiting an increasing trend above the GWPS of 70 ug/L in PTX06-1155, increasing from 100 ug/L to 390 ug/L in 2013. Cis-1,2-DCE concentrations have been relatively stable below GWPS in PTX06-1012 and PTX06-1156. Vinyl chloride also exhibited an increasing trend in PTX06-1155, with the 2nd and 3rd quarter results exceeding the GWPS of 2 ug/L. As first discussed in the 3rd Quarter Progress Report, the breakdown product detections in the PTX06-ISB075 replacement well and downgradient monitoring wells indicate that the treatment zone may be affected by a lack of *Dehalococcoides sp.* (DHC) that are necessary for complete dechlorination of TCE. As a result, the following actions were proposed to address this uncertainty:

- Conduct additional sampling in the Zone 11 ISB treatment zone and surrounding monitoring wells, which should include:
    - Quantitative Polymerase Chain Reaction (qPCR) analysis to identify Dehalococcoides sp., as well as functional genes for complete dechlorination

  - Compound-specific isotope analysis (CSIA) to determine the isotopic composition of TCE, cis-DCE, and vinyl chloride, which can assist in determining whether microbial degradation is occurring in and around the treatment zone

- If the qPCR and CSIA sampling do not strongly indicate the proper bacterial population at the proper density for complete reductive dechlorination in the treatment zone, Pantex will evaluate the potential for bioaugmentation, which is the introduction of a laboratory-cultured population of microorganisms (DHC) into the treatment zone.

Five wells, including the PTX06-ISB075 replacement, PTX06-1151, PTX06-1126, PTX06-1155, and PTX06-1012 were sampled in January – February 2014 for qPCR in order to gather data from within the treatment zone, as well as upgradient and downgradient. The wells were sampled using two methods. First the wells were sampled using the current modified low-flow sampling method and shipped to Microbial Insights for analysis. Next, Bio-Traps®, which are passive sampling devices that provide the surface area for microbial growth, were deployed in the same wells for 40 days, removed, and shipped to Microbial Insights for analysis. As summarized in Table 3-6, results using both sampling methods yielded non-detect results for all wells sampled. Microbial Insights reviewed the qPCR data, as well as field and analytical data collected in these wells and the following conclusions were drawn:

- Since DHC was not detected in the upgradient wells or inside the treatment zone, it is likely that the indigenous DHC population was too small or non-existent to be noticeably stimulated by the treatment (amendment injection).

- The TCE concentration in the treatment zone compared to the upgradient wells indicates the TCE had been degraded to cis-1,2-dichloroethene. The treatment may have stimulated other dehalorespiring microorganisms such as *Dehalobacter*, *Desulfuromonas*, and *Desulfitobacterium*, all of which are capable of dechlorinating TCE and PCE to cis-1,2-dichloroethene.

- The treatment appeared to have stimulated TCE degradation at downgradient wells. But without DHC, complete reductive dechlorination is likely to remain limited at these wells.

Table 3-6. qPCR Analysis Results

Well	Water Sample DHC[1] (cells/mL)	Bio-Trap® DHC (cells/L
PTX06-1126	<5.0E-01	<5.0E-01
PTX06-1151	<5.0E-01	<5.0E-01
PTX06-ISB075	<5.0E-01	<5.0E-01
PTX06-1155	<5.0E-01	<5.0E-01
PTX06-1012	<5.0E-01	<5.0E-01

[1]Typical target for DHC population in a treatment zone is 10^3-10^4 cells/mL

Water samples collected in January 2014 were also analyzed for CSIA. The basic principle behind using CSIA for determining degradation of TCE is that, during biodegradation, the microbes preferentially consume lighter isotopes before heavier ones. So, if a compound is being degraded, the ratio of heavy isotopes to light isotopes increases, also called fractionation. In the case of degradation of TCE in the Zone 11 ISB treatment zone, the TCE molecules with the lighter carbon isotopes (^{12}C) will be degraded before the TCE molecules with heavier carbon isotopes (^{13}C), resulting in a heavier (less negative) ratio of $^{13}C/^{12}C$. . The complicating factor in this case is that there are potentially multiple degradation reactions occurring simultaneously as depicted in Figure 3-65 and both cis-1,2-dichloroethane and vinyl chloride are being both created and consumed, if complete dechlorination is occurring. However, two key points should be considered when evaluating the data:

- If a daughter product does not degrade, it still gets heavier (less negative isotopic ratio of carbon δ^{13C}) as the parent gets heavier.
- The undegraded daughter product can get no heavier than the original, undegraded parent product.

These two key points are illustrated in Figure 3-66, which compares typical graphs of isotopic ratios of parent and daughter products over time when daughter products are degrading and with no daughter product degradation.

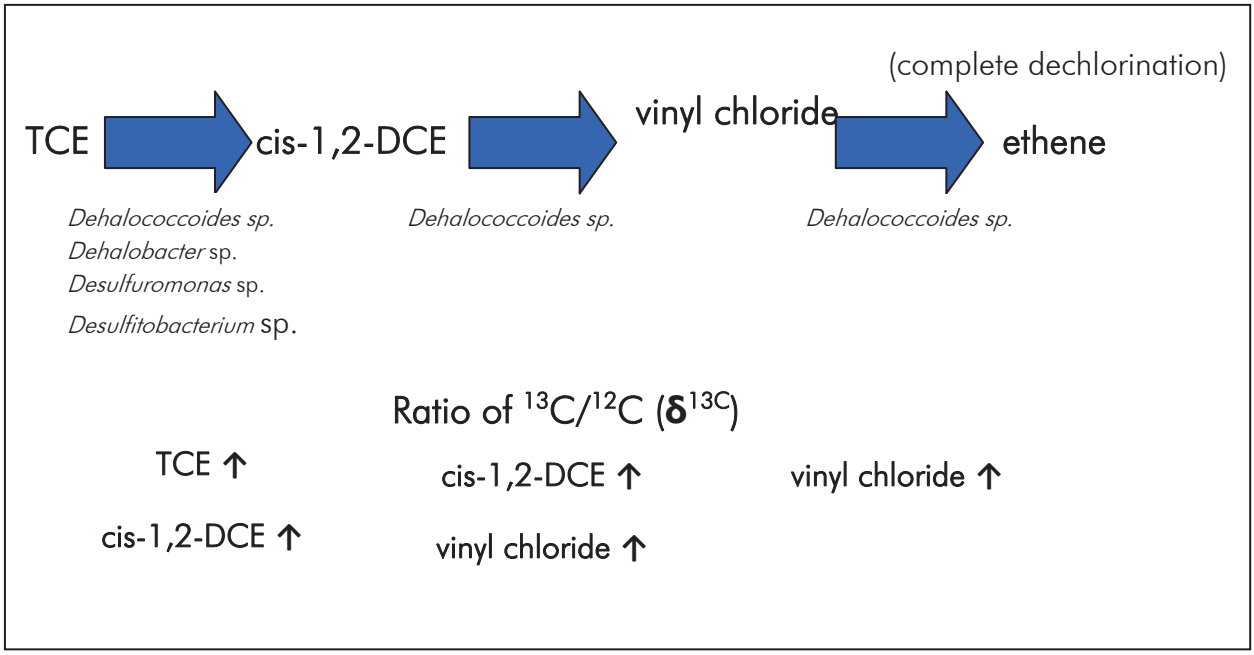


Figure 3-65. TCE Degradation and Its Effect on Isotopic Ratios

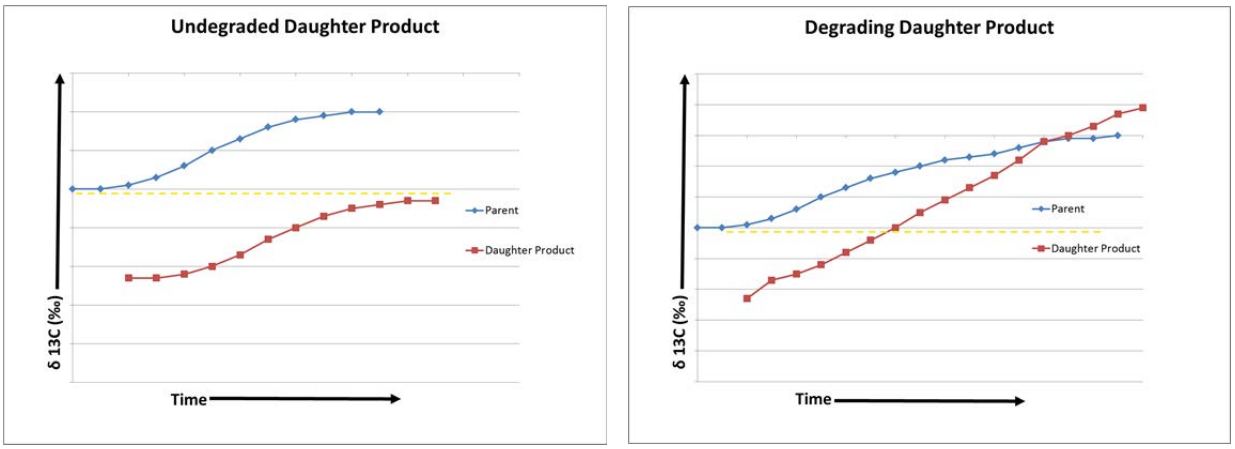


Figure 3-66. Comparison of Daughter Product Formation and Degradation

Table 3-7 summarizes the CSIA data collected from wells in January 2014. Since the typical range of isotopic ratios for manufactured ethenes is approximately -25 to -35‰, the results for upgradient wells PTX06-1126 and PTX06-1151 indicate there is little to no degradation occurring in the perched aquifer. These results also represent baseline results to which treatment zone and downgradient wells can be compared. Additionally, the line of wells from PTX06-1126 to the PTX06-ISB075 replacement well to PTX06-1155 represents a general groundwater flow path through the ISB treatment zone. The following key conclusions can be drawn from the CSIA data:

- TCE isotopic ratios downgradient slightly increase from baseline ratios, indicating a degree of TCE treatment. However, the non-detect TCE result in the PTX06-ISB075 replacement well limits the comparative dataset.
- Cis-1,2-DCE isotopic ratios were variable, but there is some indication of treatment as the isotopic ratios in PTX06-1155 and the PTX06-ISB075 replacement well are slightly heavier than baseline TCE concentrations.
- Vinyl chloride isotopic ratios do not suggest complete dechlorination as they are significantly lighter than the baseline parent compound (TCE and cis-1,2-DCE) ratios.

Table 3-7. CSIA Results, Zone 11 ISB

Well	Ratio of $^{13}C/^{12}C$ ($\delta^{13}C$), ‰		
	TCE	cis-1,2-DCE	Vinyl chloride
PTX06-1126	-27.67	-27.75	ND
PTX06-1151	-27.21	-33.32	ND
PTX06-ISB075	ND	-24.41	-36.68
PTX06-1155	-23.73	-24.32	-39.78
PTX06-1012	-20.05	-28.0	-32.17

The qPCR and CSIA data discussed above, combined with the historical dataset from the Zone 11 ISB area, indicate that complete dechlorination is either not occurring or occurring at a limited extent due to a lack of proper DHC population. Therefore, bioaugmentation will likely be necessary for complete dechlorination in the treatment zone. As a result, Pantex commissioned the production of a Bioaugmentation Plan, which was completed in March 2014. The Plan indicated the most efficient, cost effective way to introduce the culture would be during an amendment injection event. However, since the current ISB O&M contract does not include bioaugmentation and the contractor is already in the field preparing for the sixth injection event, implementation of this plan will not occur until the 2015 injection event.

Metals concentrations are increasing in all downgradient performance monitoring wells since the start of remedial actions and some are exceeding GWPS. For example, arsenic concentrations in PTX06-1155 and PTX06-1156 and barium concentrations in PTX06-1156 exceeded GWPS in 2013. However, these concentrations are expected to decrease as the treated water moves downgradient, the water returns to more oxidized conditions, and the metals precipitate onto the soil matrix as discussed in Section 3.2.3. This can be seen in recent metals trends in the downgradient wells as only arsenic in PTX06-1156 and

molybdenum (no established GWPS) in PTX06-1156 and PTX06-1012 are exhibiting increasing trends.

3.2.3.2 Southeast ISB

The Southeast ISB System is on TTU property south of Pantex. The system was installed in 2007 as an early action and consists of 42 injection wells within the treatment zone and six performance monitoring wells (see Figure 3-67). The injection wells were drilled in a line perpendicular to the hydraulic gradient so the water flowing through the treatment zone will be treated before reaching the area beneath TTU property where the FGZ becomes less resistant to vertical migration. Based on the current rate of perched groundwater flow and estimated amendment longevity, injections will be necessary about every 18 months. Table 3-8 summarizes the four injection events completed to date at the Southeast ISB system.

Table 3-8. Southeast ISB Injection Dates

Injection Event	Completion Date
1	March 2008
2	April 2010
3	May 2012
4	September 2013

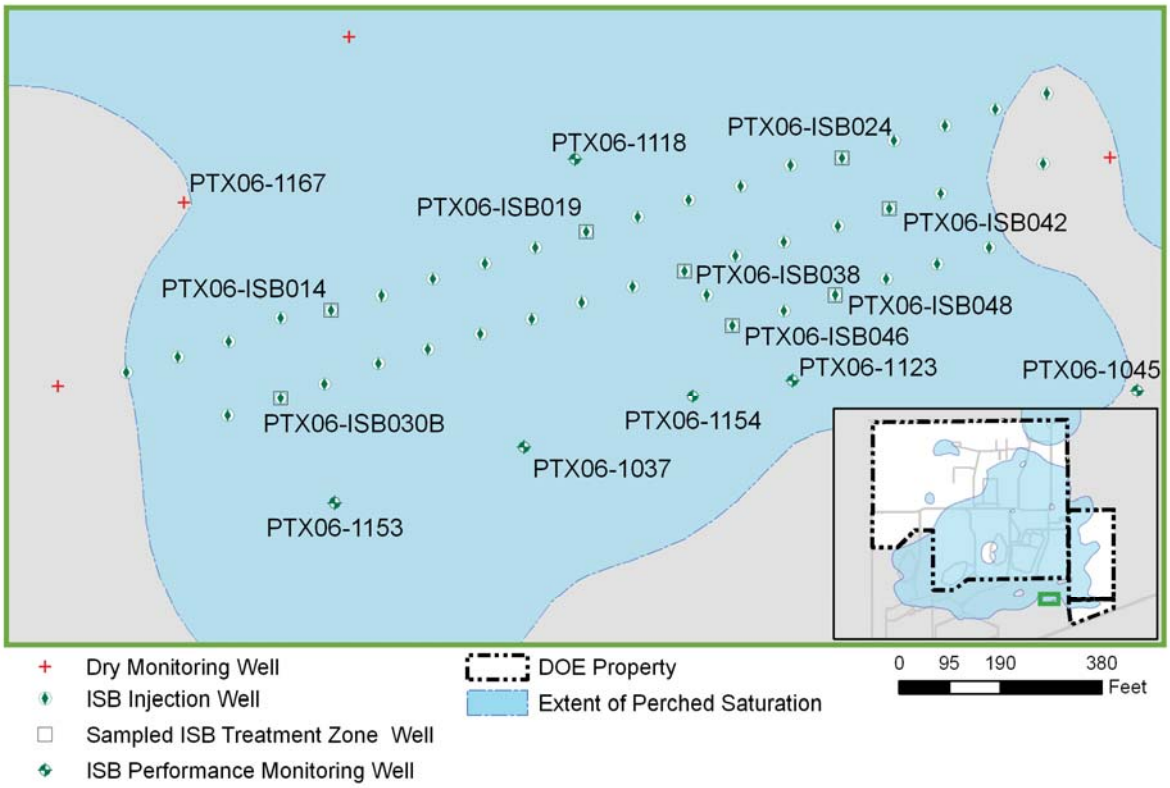


Figure 3-67. Southeast ISB System Wells and Sampling Locations

Constituents targeted for treatment by this system are RDX, other HE constituents of concern (DNTs and 1,3,5-TNB), and hexavalent chromium. Indicator constituents evaluated for trends at downgradient performance monitoring wells include RDX and its degradation products (DNX, MNX, and TNX) and total and hexavalent chromium. Expected conditions at downgradient performance monitoring wells are that concentrations of indicator constituents will decline over time and that all degradation products of RDX will not be detected or will be present in low concentrations indicating complete breakdown is occurring. Dissolved oxygen, redox potential, nitrate, sulfate, total organic carbon, and volatile fatty acids are also evaluated at the ISB treatment zone performance wells.

The expected conditions for the treatment zone wells are that redox potential and electron acceptor (dissolved oxygen, nitrate, and sulfate) concentrations will decline after injection. Redox potential should be less than 0 mV for reduction of RDX and hexavalent chromium. Dissolved oxygen may continue to be observed because oxygen is replenished from the atmosphere when equipment is introduced into the well during sampling, injection, or well rehabilitation or development and the saturated thickness in the treatment zone is very thin. Concentrations of total organic carbon and total VFAs should increase after injection but decline over time as the amendment is consumed.

Graphs of the amendment indicators and COCs for the eight ISB injection wells sampled, as well as concentrations for target indicators at the six performance monitoring wells for this system are included in Appendix D and summarized in Table 3-9. The conditions represent the only data collected following injection in 3rd quarter 2013. Five of the performance monitoring wells are downgradient of the system, one (PTX06-1118) is upgradient of the system. The conditions in the treatment and performance monitoring wells are discussed below.

Recent data indicate that reducing conditions have been maintained in the treatment zone. With the exception of one well (PTX06-ISB014), ORP measurements indicated mild to deep reducing conditions for treatment of HEs and chromium. Nitrate, sulfate, and dissolved oxygen levels remained low as expected, with the exception of PTX06-ISB014 (discussed below). VFA concentrations did not increase as expected in a few wells while organic carbon concentrations did increase in all wells, when collected.

Table 3-9. Southeast ISB Treatment Zone Conditions

Well	DO PI	ORP PI	Nitrate PI	Sulfate PI	TOC PI	Total VFAs PI
PTX06-ISB014	↓	→	↑	↑	↑	↑
PTX06-ISB019	→	→	→	↓	↑	→
PTX06-ISB024	→	↑	→	→	NDA	↑
PTX06-ISB030B	→	↓	→	↓	NDA	↓
PTX06-ISB038	→	→	↓	↓	↑	↑
PTX06-ISB042	→	↓	→	↓	↑	→
PTX06-ISB046	→	→	→	→	↑	→
PTX06-ISB048	NDA	NDA	NDA	NDA	NDA	NDA

Legend

↓ Decline

↑ Increase

↳ Decline, then stabilized

→ Stable

Rebounding near or at baseline conditions or food source depleting

Mild conditions established

Expected condition

PI = Post-injection NDA = No data available (well was dry or went dry during sampling)

One injection well, PTX06-ISB014, exhibited oxidizing conditions during the 2nd quarter and 4th quarter sampling events (pre- and post-injection). Additionally, the nitrate and sulfate concentrations increased to near baseline conditions in the 4th quarter sampling event, suggesting untreated water may be affecting the analytical results in this well. As a result, sampling for field parameters only was attempted in adjacent injection wells to investigate whether these conditions were widespread or limited to PTX06-ISB014 only. However, limited water did not allow for sampling in these wells. Regardless, dissolved oxygen, ORP, nitrate, and sulfate data collected in the 1st quarter 2014 sampling event indicate a return to reducing conditions in this well.

As demonstrated in Table 3-10, the ISB system has been effective in treating HEs and hexavalent chromium at three of the closest downgradient ISPM wells (PTX06-1037, 1123, and 1154) for the SE ISB. RDX concentrations in all three of these wells are below the GWPS of 2 ug/L. Hexavalent chromium is either non-detect or detected at levels below the GWPS in these wells. These wells indicate that the reducing zone has extended beyond the treatment zone as TOC and total VFAs are present, nitrate and sulfate concentrations are reduced. ORP is negative in two wells (PTX06-1154 and PTX06-1123).

RDX concentrations in PTX06-1153 are much lower than initial concentrations in the upgradient treatment zone, but still remain around 250 ug/L. Concentrations have ranged from approximately 100 – 300 ug/L since the well was installed in 2009 and are currently exhibiting an increasing trend. The concentrations of the degradation products (MNX, DNX, and TNX, in sequence) are either near or below the cleanup value of 2 ug/L or significantly lower than pre-injection RDX concentrations. Hexavalent chromium concentrations in this well have been stable at concentrations above GWPS (100 ug/L) for the last 3 sampling events in 2013. As discussed in the 2011 Annual Progress Report, this well had responded similar to the other three wells discussed above for indications of TOC, DOC, and VFAs in early stages of the remedial action. PTX06-1153 initially indicated similar conditions for nitrate, sulfate, and ORP; but, nitrate and sulfate elevated during 2011 and stabilized in 2012 - 2013. ORP did decline in PTX06-1153 during 2012, but increased throughout 2013 and conditions were mildly oxidizing by the 4th quarter sampling event. These unexpected conditions were also identified as an issue in the Five-Year Review Report (B&W Pantex 2013a).

Pantex is actively investigating the cause of the unexpected results in PTX06-1153. Activities conducted in 2013 included the installation of a monitoring well north of the western side of the treatment zone (PTX06-1167). This well was dry when installed and dry conditions continued through 2013. As has been demonstrated in several other wells installed in areas of perched groundwater with limited saturated thickness, air-rotary drilling methods can displace the thin layer of groundwater, resulting in temporary dry conditions that may take several months to recover. However, these dry conditions are consistent with several other wells in the area, including PTX06-1103 (dry since the original well was plugged, abandoned, and replaced in 2010), PTX06-1051 (dry since installation in 2003), PTX06-1122 (dry since installation in 2008), and PTX06-1118 (dry or water level below the screen since late 2010).

Table 3-10. Summary of Southeast ISB Monitoring Well Data for RDX and Hexavalent Chromium

Well ID	CR+6 Baseline*	CR+6 1Q 2013	CR+6 2Q 2013	CR+6 3Q 2013	CR+6 4Q 2013	RDX Baseline[a]	RDX 1Q 2013	RDX 2Q 2013	RDX 3Q 2013[b]	RDX 4Q 2013
In Situ Bioremediation Wells										
PTX06-ISB014	NE	NE	NE	NE	NE	217	<0.99	<2	--	<1.7
PTX06-ISB019	NE	NE	NE	NE	NE	143	<2	<2	--	<2
PTX06-ISB024	NE	NE	NE	NE	NE	3860	<2	<2	--	<2.9
PTX06-ISB030B	NE	NE	NE	NE	NE	2.7	<2	<2	--	<2.5
PTX06-ISB038	NE	NE	NE	NE	NE	421	<2	<2	--	<0.89
PTX06-ISB042	NE	NE	NE	NE	NE	2920	<0.99	<2	--	<2
PTX06-ISB046	NE	NE	NE	NE	NE	4350	<0.98	<4	--	<2
PTX06-ISB048[c]	NE	NE	NE	NE	NE	--	<2	<4	--	--
In Situ Performance Monitoring Wells										
PTX06-1037	108.5	<15	<15	<10	<10	2800	0.53	0.37	<1	0.27
PTX06-1123	10	<15	<15	<10	<10	4300	1.1	0.33	<0.99	0.73
PTX06-1153	146	11	118	150	133	320	290	240	210	250
PTX06-1154	13	<15	23	8.53	<10	630	<0.39	<0.4	<1	<1

Concentrations provided in ug/L.

[a] Baseline values for ISB injection wells are represented by data collected prior to initial injection in 2008. Because some ISPM wells were installed after start of the remedial action, baseline values for ISPM wells are represented by the maximum values reported in that well, regardless of the date in which it was collected.

[b] The Southeast ISB injection wells were not sampled in 3Q 2013 based on the approved Field Sampling Plan, which allows for the suspension of sampling during injection activities

[c] PTX06-ISB048 went dry in 4Q and was not sampled.

[*] NE – Hexavalent chromium was not evaluated in the ISB treatment zone

Highlighted cells indicate non-detect or concentrations less than the GWPS.

Data from ISPM Wells PTX06-1045 and PTX06-1118 were not included in this table. PTX06-1045 is the furthest downgradient ISPM well that may have little to no hydraulic connection to the Southeast ISB treatment zone. In addition, this well went dry in the second half of 2011. PTX06-1118 is upgradient to the ISB system and is used to monitor the influent COC concentrations and was dry throughout 2013. This well may not demonstrate decreasing concentrations unless it is affected by the treatment zone inadvertently.

The "--" symbol indicates that no data are available.

Hydrologic data, including the dry well data north of the treatment zone and groundwater elevations were evaluated in February 2014. Several scenarios were suggested that could be causing the unexpected conditions at PTX06-1153, including:

- A pocket of stagnant groundwater with no apparent direction of groundwater flow
- A shift in groundwater direction, which has been suggested by historic water level measurements in PTX06-1153, which contradicted the presumed north-south groundwater flow direction.

- Continued movement of groundwater from north to south, but at a much lower velocity than that calculated for the Southeast ISB conceptual model.
- Some other unknown hydrologic condition.

Any of the conditions described above could result in the unexpected conditions observed at PTX06-1153 and it may be difficult to prove (or disprove) any of these are occurring. Several confounding issues complicate the investigation efforts in the area, including significant heterogeneity in the fine-grained zone, potential changes in formation properties due to biologic growth or other injection effects, and potential reduction of saturated thickness upgradient due to pump and treat operations. Additionally, amendment was injected into historically dry ISB injection wells PTX06-ISB033 and PTX06-ISB034 during the 2013 injection event in an attempt to ensure adequate amendment dosage across the area upgradient of PTX06-1153.

Based on the above discussion, it is not prudent to conduct additional investigation, i.e. drill additional monitoring wells, at this time. The best course of action is to:

1. Continue to closely monitor water levels in the western side of the ISB system to better discern flow patterns in the area, especially considering the changes that have occurred since the original conceptual model was developed.
2. Continue to closely monitor the analytical results in PTX06-1153 to determine if the changes made in the 2013 injection event had any effect, or if the groundwater flow velocity is significantly slower than originally predicted.
3. If the dry conditions persist northwest of the treatment zone through 2014, consider installing an additional well further to the east to aid in defining the extent of the dry area, as well as monitoring the COC concentrations/mass flux entering the ISB treatment zone.
4. Consider revising the conceptual model of the Southeast ISB system based on the newly acquired data.

Metals concentrations have increased in all downgradient performance monitoring wells and some are exceeding GWPS. Arsenic and barium detections exceeded the GWPS in PTX06-1154 and PTX06-1123 during 2013. VFA and organic carbon data suggest the treatment zone has expanded into these wells and the reduced conditions continue to mobilize the naturally occurring metals. However, these concentrations are expected to decrease as the treated water moves out of the treatment zone and returns to more oxidized conditions.

Pantex also monitors for degradation products of RDX to evaluate whether complete breakdown is occurring. Monitoring results for the system indicate that RDX and breakdown products (MNX, DNX, and TNX) are present in downgradient performance monitoring wells. TNX, the final degradation product, is the best indicator of degradation because the other intermediate products (MNX, DNX) degrade rapidly and do not accumulate in the environment. As shown in Figure 3-68, the ratio of TNX to RDX is quite variable in the downgradient wells. Both RDX and TNX have been reduced to concentrations below the GWPS at PTX06-1037. High RDX concentrations and low TNX concentrations at PTX06-1153 indicate little to no treatment at this location. Both PTX06-1123 and PTX06-1154 have high TNX concentrations compared to RDX, indicating possible incomplete treatment of RDX. However, the TNX concentrations are low compared to baseline concentrations and may reduce more with time. RDX concentrations have been reduced from historic high values exceeding 500 ug/L to concentrations near or below the GWPS of 2 ug/L in three downgradient ISPM wells. These trends are expected to continue as biodegradation continues.

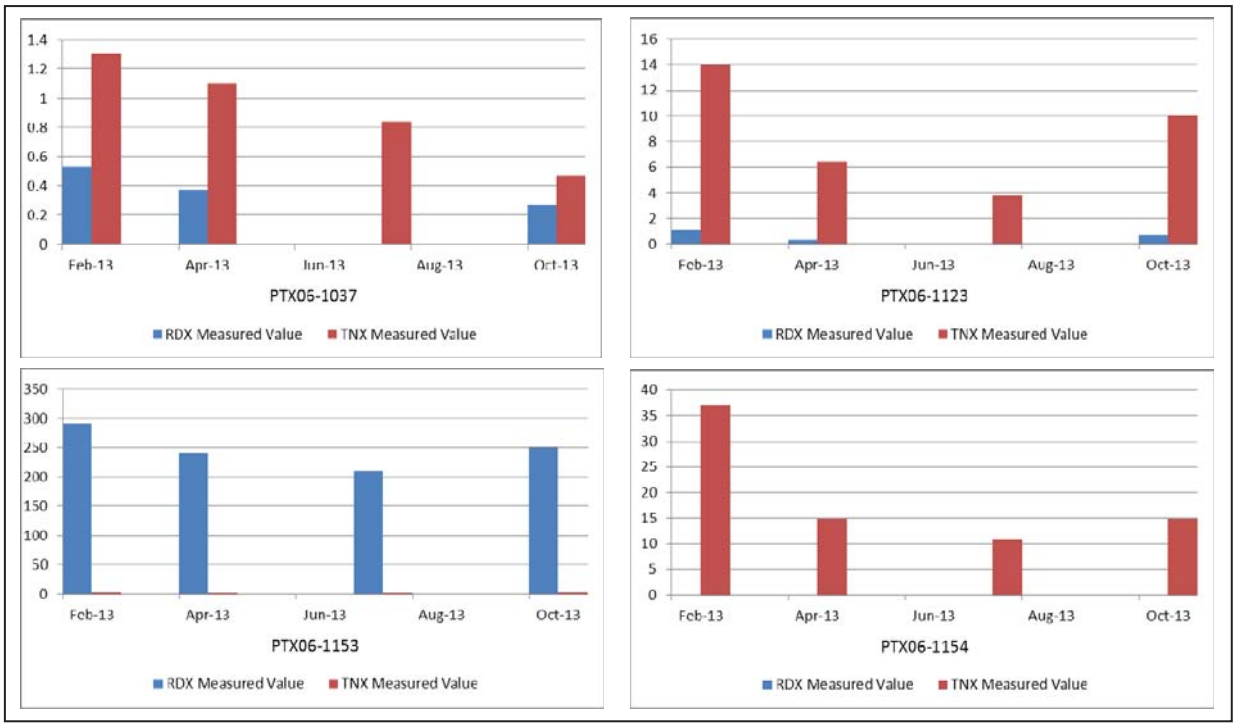


Figure 3-68. RDX and TNX Concentrations (ug/L) from Southeast ISB Performance Monitoring Wells

3.3 Natural Attenuation

Natural attenuation is the result of processes that naturally lower concentrations of contaminants over time. This process is monitored at Pantex to help determine where natural attenuation is occurring, under what conditions it is occurring, and to eventually determine a rate of attenuation. This is an important process for RDX, the primary risk driver in perched groundwater, because it is widespread and extends beyond the reach of the groundwater remediation systems in some areas. Because the right microbes for biodegradation are present in the perched sediments, Pantex is interested in monitoring for breakdown products of RDX. Pantex started monitoring for degradation products of RDX in all monitoring wells by July 2009, after testing analytical methods to ensure they can reliably detect and quantify those products. Since analytical methods are readily available, Pantex has monitored for degradation products of TNT and TCE in the past and continues to monitor for those in key areas.

Natural Attenuation Processes

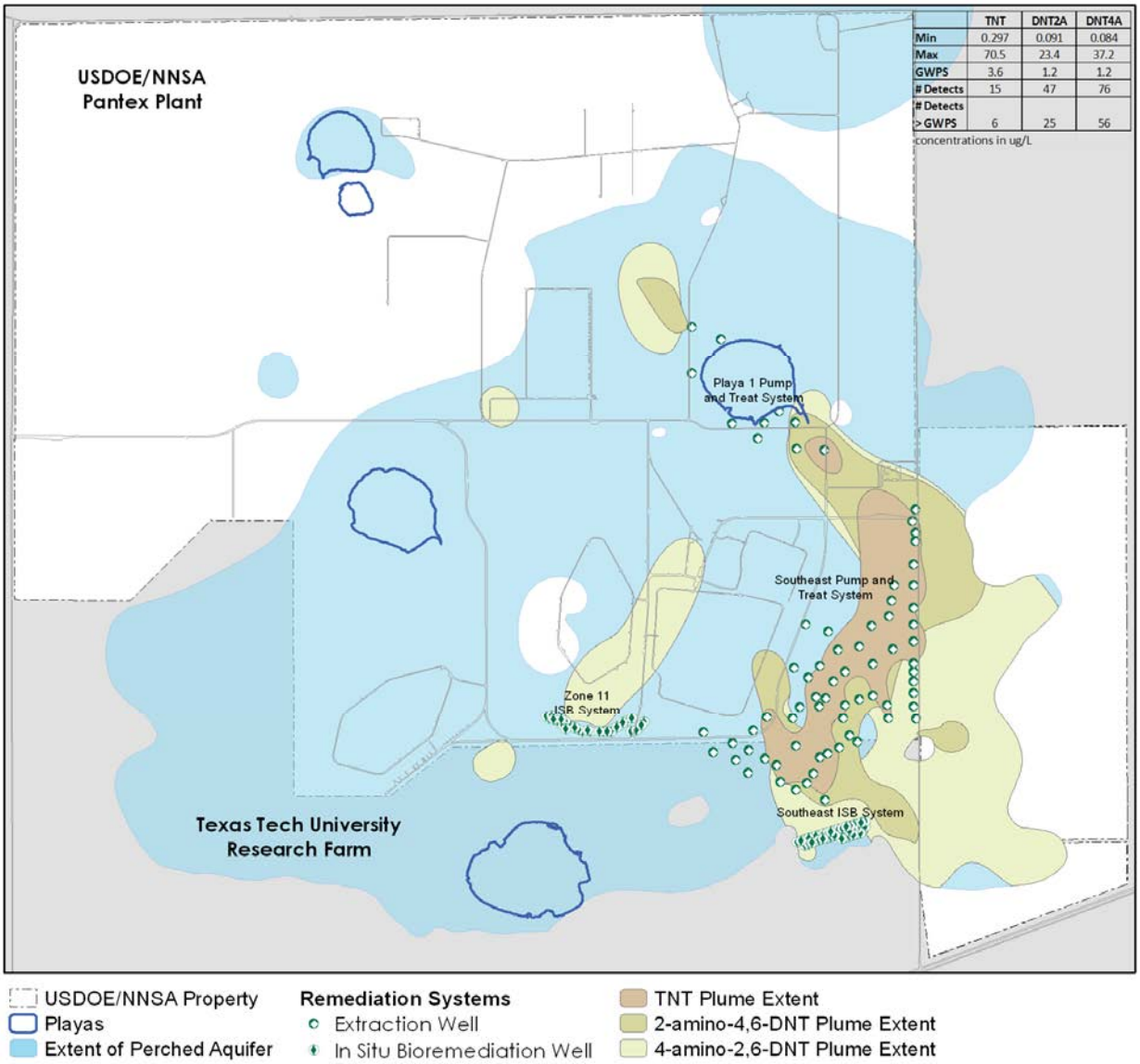
- Biodegradation – soil microbes can cause the contaminants to break down to less harmful products
- Sorption – the contaminants are bound to soil particles so that movement through groundwater is stopped or is slower allowing time for other processes to work
- Dispersion – the contaminants are dispersed through the groundwater as they move away from the source so that concentrations are diluted

Other groundwater conditions that may impact attenuation, such as dissolved oxygen and redox potential, are also monitored in each well. The concentration data, as well as dissolved oxygen and redox potential are detailed in electronic form in Appendix C.

RDX can degrade under aerobic and anaerobic conditions, but achieves best reduction under anaerobic conditions. As more data are collected, trending and statistical analysis can be used to evaluate the degradation of RDX. Trending of concentrations is also performed at each well to determine if concentrations are declining as expected.

Based on monitoring results for TNT and its breakdown products (2-amino-4,6-DNT and 4-amino-2,6-DNT), TNT has naturally attenuated over time (see Figure 3-69). TNT has been manufactured at Pantex since the 1950s, yet is only present in the central portion of the overall southeastern plume - within the SEPTS well field and near Playa 1. Its first breakdown product, 2-amino-4,6-DNT, occurs near the TNT plume and extends slightly beyond. The final monitored breakdown product, 4-amino-2,6-DNT, extends out to the edges of the perched aquifer saturation at low concentrations. Only TNT breakdown products are present in perched groundwater beneath Zone 11 and north of Playa 1. Concentrations of the breakdown products are still above GWPS, but most wells with detections are recently

showing a decreasing or stable trend. A table of concentration ranges for wells outside the influence of the ISB systems is included in Figure 3-69.



	TNT	DNT2A	DNT4A
Min	0.297	0.091	0.084
Max	70.5	23.4	37.2
GWPS	3.6	1.2	1.2
# Detects	15	47	76
# Detects > GWPS	6	25	56

concentrations in ug/L

Figure 3-69. TNT and Degradation Product Plumes

Perched aquifer sampling results for RDX and breakdown products (MNX, DNX, and TNX) indicate that the breakdown products are present throughout most of the RDX plume, with TNX being the most widespread. TNX, the final degradation product, is a better indicator of degradation because the other intermediate products (MNX, DNX) degrade rapidly and do not accumulate in the environment (SERDP, 2004). If complete biodegradation of RDX is occurring, RDX and all breakdown products would be expected to decrease over time. Figure 3-70 depicts the overall RDX and TNX plume. A table of concentrations ranges for wells

outside the influence of the ISB systems is included in the figure. More data will be required over time to determine trends and rates of attenuation.

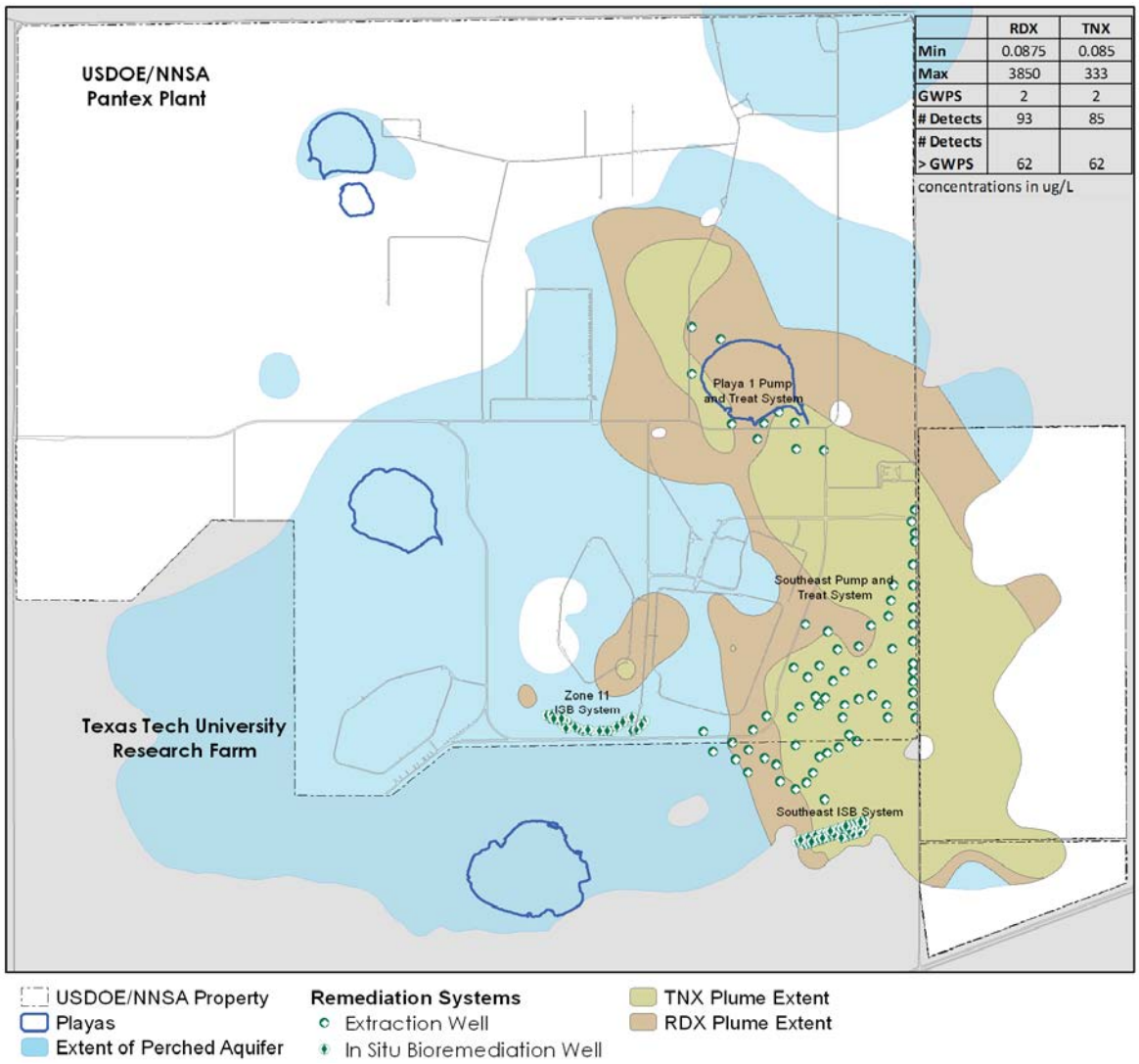


Figure 3-70. RDX and Degradation Product Plumes

Pantex has monitored for breakdown products of TCE for many years and a strong indication of natural attenuation of TCE has not been observed in the perched aquifer. Recent qPCR data collected upgradient of the Zone 11 ISB system does not indicate that indigenous microbes are able to completely degrade TCE. However, the TCE plumes at Pantex are being actively treated by the SEPTS and the ISB treatment zones.

3.4 Uncertainty Management/Early Detection

The purpose of uncertainty management wells in perched and Ogallala groundwater is to confirm expected conditions identified in the RCRA Facility Investigations and ensure there are not any deviations, fill potential data gaps, and fulfill long-term monitoring requirements for soil units evaluated in a baseline risk assessment. The purpose of early detection wells is to monitor for breakthrough of constituents to the Ogallala Aquifer from the overlying perched aquifer, if present, or from potential source areas in the unsaturated zone before potential points of exposure have been impacted. These wells were proposed in the LTM design for purposes of evaluating the effectiveness of the soil and groundwater remedial actions. Additionally, the perched aquifer data were evaluated with respect to field observations. In 2013, no evidence of NAPL was observed in sampled perched aquifer wells.

Uncertainty Management/Early Detection Wells

- 37 Group 1 wells installed in locations where contamination has not been detected or confirmed, or in previous plume locations where concentrations have fallen below GWPS, background, or PQL.
- 24 Group 2 wells installed near source areas.

This report focuses on subsets of the uncertainty management/early detection wells as depicted in Figure 3-71. The wells are evaluated with respect to:

1. Locations where contamination has not been detected or confirmed, or in previous plume locations where concentrations have fallen below GWPS, background, or PQL (e.g., Burning Ground and Old Sewage Treatment Plant areas). These are typically Ogallala Aquifer wells, although some perched aquifer wells are located in areas where there are no active groundwater remedial actions. These wells were evaluated in the quarterly reports.

2. Uncertainty management wells near groundwater contamination source areas. This is to confirm that source strength and mass flux are decreasing over time. Every five years these wells are also evaluated for new COCs from source areas.

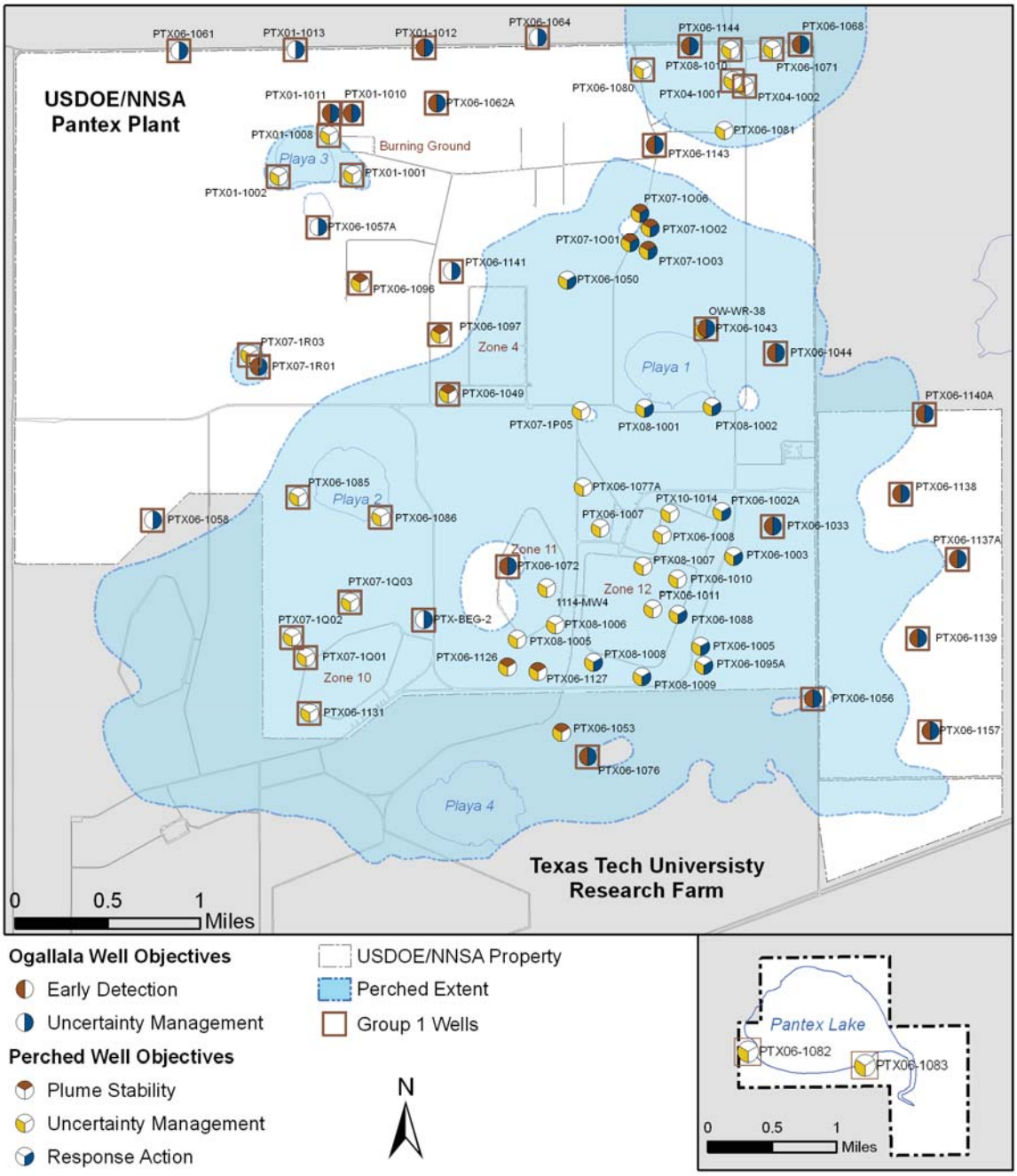


Figure 3-71. Uncertainty Management and Early Detection Wells

3.4.1 Group 1 Wells

Table 3-11 provides a summary of all 2013 Group 1 perched aquifer well indicator COC detections and comparisons of the detections to naturally occurring background concentrations, the laboratory PQL, and the GWPS provided in the approved SAP (B&W Pantex, 2009b). Explanations are also provided in the table. The wells with unexpected conditions are discussed below.

3.4.1.1 Perched Aquifer Wells

As depicted in Table 3-11, no Group 1 perched aquifer wells had unexpected conditions in 2013. As presented in the 2012 Annual Progress Report, the 2012 unexpected conditions in the wells installed in the perched aquifer in the Burning Ground/Playa 3 area may have been caused by the 2010 flood event as concentrations have now decreased to concentrations consistent with pre-2012 conditions. COC concentrations continue to increase in PTX06-1049, most likely due to radial movement of groundwater away from Playa 1 and RDX is now exceeding GWPS.

3.4.1.2 Ogallala Aquifer Wells

As depicted in Table 3-12, five Ogallala wells had detected results (above background for those metals with site-specific background concentrations). This table does not include boron detections as these data are summarized in Table 3-13. PTX06-1033 had a low-level detection of hexavalent chromium and a detection of nickel exceeding site-specific background. This well has had confirmed screen corrosion as documented by increasing concentrations of metals. This well was rehabilitated in February 2012 and metals concentrations subsequently decreased to values below their respective site-specific backgrounds. The increasing nickel concentration is likely due to continued well screen corrosion. This well was assigned a maintenance frequency of two years in the Well Maintenance Plan, so it will be rehabilitated again in 2014.

Hexavalent chromium was detected in five wells (PTX06-1033, PTX06-1043, PTX06-1056, PTX06-1138, and PTX06-1140) in 2013 below the laboratory PQL of 10 ug/L and well below the GWPS of 100 ug/L. These detections are likely a result of one or more of the following:

- Low-level background of hexavalent chromium in the Ogallala aquifer as suggested in a recent Texas Tech study. As presented in the 3rd quarter Progress Report, Pantex worked with the Texas Tech University Water Resources Center to investigate the occurrence, distribution, and speciation of chromium in the Ogallala Aquifer system in the Texas Panhandle. In this study, 19 wells distributed across the Texas Panhandle were sampled and analyzed for total chromium and hexavalent chromium using an ultra-high resolution method (PQL = 0.015 ug/L). Low-level hexavalent chromium (approximately 0.5 – 5 ug/L) was detected in all 19 wells sampled. Furthermore,

when both total and hexavalent chromium were detected in the same sample (total chromium was analyzed using a standard resolution method with a PQL of 10 ug/L), the ratio of hexavalent to total chromium ranged from approximately 0.5 to 1, with an average of 0.74. These results suggest that the oxidized conditions in the Ogallala Aquifer are converting the naturally occurring chromium to the hexavalent oxidation state, creating a possible low-level hexavalent chromium background in the aquifer.

- Lower detection limits for Method SW-7196 based on improvements to the method. MDLs dropped from 5 ug/L to 3.3 ug/L and the PQL dropped from 15 ug/L to 10 ug/L in June 2013. The new detection limits allow low-level background concentrations to be estimated above the new MDL and below the PQL.
- Corrosion of stainless steel screen/casing. Specific wells at Pantex have documented evidence of corrosion and conversion of total chromium to hexavalent chromium is possible due to oxidized conditions in the Ogallala Aquifer.
- False positive detections near the MDL due to the colorimetric analytical method. Typically, these detections are not confirmed by total chromium results.

It is likely that most of these sporadic detections are related to the lower detection limits and the ability to quantify low-level background detections as all hexavalent chromium detections in 2013 occurred after lower detection limits were achieved in June. PTX06-1033 has documented evidence of corrosion. No evidence of screen corrosion was discernable from data collected from the other wells.

As presented in Table 3-13, several Ogallala wells, including PTX06-1043, PTX06-1056, PTX06-1137A, PTX06-1139, PTX06-1140, PTX06-1144, and PTX07-1R01 had boron detections slightly above the background value of 194 ug/L. Because the boron concentrations at these wells are very close to background and observed boron concentrations tend to be considerably variable, it appears that these concentrations also represent background for these wells. Evaluation of historic boron data in these wells results in variable trends. The two measured boron concentrations in PTX06-1137A illustrate this variability as the first boron concentration was relatively high in the first sampling event (230 ug/L) and then dropped to near background levels (196 ug/L) for the second. The measured concentrations are well below the GWPS of 7,300 ug/L. Pantex will continue to monitor these wells according to the *SAP*. Boron detections were higher in PTX06-1056, but this well is installed in deeper segments of the Ogallala formation, and is believed to be influenced by the lower Dockum formation. The Dockum formation influence is supported by the fact that boron concentrations increased with depth in several multi-level well sampling events.

Table 3-11. Detected Results in Group 1 Perched Aquifer Uncertainty Management/Early Detection Wells

Well ID	Sample ID	Sample Date	Sample Type	Analyte	Measured Value (ug/L)	Detection Limit (ug/L)	Lab Qualifier	PTX Qualifier	Background (ug/L)	>Background?	PQL (ug/L)	>PQL?	GWPS (ug/L)	>GWPS ?	Expected Condition?	Explanation
PTX01-1001	20130502M00120	5/2/13	N	Perchlorate	9.48	12	J			NA	12	N	26	N	Y	Previously affected by perchlorate, but had been <GWPS from 2003 - 2011. Perchlorate was detected in 2012 and exceeded the GWPS in one sample. Concentrations decreased in 2013 and were non-detect in the second sampling event.
PTX01-1001	20130502M00120	5/2/13	N	Trichloroethene	0.58	1	J			NA	1	N	5	N	Y	This well was previously affected by TCE. However, the concentrations have declined below the GWPS and PQL.
PTX01-1001	20130502M00120	5/2/13	N	4-Amino-2,6-Dinitrotoluene	0.236	0.258	J			NA	.236	N	1.2	N	Y	This well has had sporadic detections of DNT4A at similar concentrations.
PTX01-1001	20131030M00273	10/30/13	N	Trichloroethene	0.6	1	J			NA	1	N	5	N	Y	This well was previously affected by TCE. However, the concentrations have declined below the GWPS and PQL.
PTX04-1002	20130723M00176	7/23/13	N	HMX	0.684	0.266				NA	0.266	Y	360	N	Y	This well has historic low-level intermittent HE and TCE detections. This well will continue to be monitored and trended for HE and TCE.
PTX04-1002	20130723M00176	7/23/13	N	RDX	0.151	0.266	J			NA	0.266	N	2	N	Y	This well has historic low-level intermittent HE and TCE detections. This well will continue to be monitored and trended for HE and TCE.
PTX04-1002	20130723M00176	7/23/13	N	Trichloroethene	0.46	1	J			NA	1	N	5	N	Y	This well has historic low-level intermittent HE and TCE detections. This well will continue to be monitored and trended for HE and TCE.
PTX06-1049	20130515M00136	5/15/13	N	4-Amino-2,6-Dinitrotoluene	3.34	0.258				NA	0.258	Y	1.2	Y	Y	DNT4A was detected in this well at levels > GWPS in 2011. This may indicate that the contamination is slowly moving into this well from Playa 1 or the contributing ditches. This well will continue to be monitored and trended over time.
PTX06-1049	20130515M00136	5/15/13	N	RDX	2.53	0.258				NA	0.258	Y	2	Y	Y	RDX was first detected in this well in 2011. This may indicate that the contamination is slowly moving into this well from Playa 1 or the contributing ditches. This well will continue to be monitored and trended over time.

Well ID	Sample ID	Sample Date	Sample Type	Analyte	Measured Value (ug/L)	Detection Limit (ug/L)	Lab Qualifier	PTX Qualifier	Background (ug/L)	>Background?	PQL (ug/L)	>PQL?	GWPS (ug/L)	>GWPS ?	Expected Condition?	Explanation
PTX06-1049	20130515M00136	5/15/13	N	Trichloroethene	1.04	1				NA	1	Y	5	N	Y	TCE has been detected in this well since 2009. This may indicate that the contamination is slowly moving into this well from Playa 1 or the contributing ditches. This well will continue to be monitored and trended over time.
PTX06-1049	20131121M00331	11/21/13	N	4-Amino-2,6-Dinitrotoluene	3.47	0.269				NA	0.269	Y	1.2	Y	Y	DNT4A was detected in this well at levels > GWPS in 2011. This may indicate that the contamination is slowly moving into this well from Playa 1 or the contributing ditches. This well will continue to be monitored and trended over time.
PTX06-1049	20131121M00331	11/21/13	N	RDX	3.02	0.269				NA	0.269	Y	2	Y	Y	RDX was first detected in this well in 2011. This may indicate that the contamination is slowly moving into this well from Playa 1 or the contributing ditches. This well will continue to be monitored and trended over time.
PTX06-1049	20131121M00331	11/21/13	N	Trichloroethene	1.12	1				NA	1	Y	5	N	Y	TCE has been detected in this well since 2009. This may indicate that the contamination is slowly moving into this well from Playa 1 or the contributing ditches. This well will continue to be monitored and trended over time.
PTX06-1081	20130723M00177	7/23/13	N	Trichloroethene	0.3	1	J			NA	1	N	5	N	Y	This well has continuously exhibited low-level concentrations of TCE below the GWPS. Trending indicates a stable trend (linear regression) or no trend (Mann-Kendall). Because concentrations are low, this well will continue to be monitored and trended over time.

Table 3-12. Detected Results in Group 1 Ogallala Aquifer Uncertainty Management/Early Detection Wells

Well ID	Sample ID	Sample Date	Sample Type	Analyte	Measured Value (ug/L)	Detection Limit (ug/L)	Lab Qualifier	PTX Qualifier	Background (ug/L)	>Background?	PQL (ug/L)	>PQL?	GWPS (ug/L)	>GWPS?	Expected Condition?	Explanation
PTX06-1033	20131029M00268	10/29/13	N	Chromium, Hexavalent	4.64	10	J			NA	10	NA	100	N	Y	Corrosion or possible low-level background.
PTX06-1033	20131029M00268	10/29/13	N	Nickel	17.8	2			15	Y	2	Y	730	N	Y	Likely corrosion.
PTX06-1043	20130805M00205	8/5/13		Chromium, Hexavalent	4.07					NA	10	N	100	N	**N**	Unexpected condition
PTX06-1056	20130618M00163	6/18/13	N	Chromium, Hexavalent	4.46	10				NA	10	N	100	N	**N**	Unexpected condition
PTX06-1056	20131028M00265	10/28/13	N	Chromium, Hexavalent	4.64	10				NA	10	N	100	N	**N**	Unexpected condition
PTX06-1138	20131024M00262	10/24/13	N	Chromium, Hexavalent	5.56	10				NA	10	N	100	N	**N**	Unexpected condition
PTX06-1140	20130618M00165	6/18/13	N	Chromium, Hexavalent	3.62	10				NA	10	N	100	N	**N**	Unexpected condition
PTX06-1140	20131028M00266	10/28/13	N	Chromium, Hexavalent	4.64	10				NA	20	Y	100	N	**N**	Unexpected condition

Table 3-13. Detected Boron Results in Group 1 Ogallala Aquifer Wells

Well ID	Sample ID	Sample Date	Sample Type	Measured Value (ug/L)	Detection Limit (ug/L)	Lab Qualifier	PTX Qualifier	>Background? (193.9 ug/L)	PQL (ug/L)	>PQL?	GWPS (ug/L)	>GWPS?	Expected Condition?	Mann-Kendall Trends		Explanation
														LT	ST	
PTX06-1043	20130122M00009	1/22/13	N	195	15		J	Y	15	NA	7300	N		Increasing	No Trend	This concentration likely represents natural variability in background.
PTX06-1043	20130805M00205	8/5/13	N	197	30			Y	30	NA	7300	N		Increasing	No Trend	This concentration likely represents natural variability in background.
PTX06-1056	20130417M00078	4/17/13	N	225	75			Y	75	NA	7300	N		No Trend	Decreasing	May be under the influence of a deeper formation.
PTX06-1056	20131028M00265	10/28/13	N	223	75			Y	75	NA	7300	N	Y	No Trend	Decreasing	May be under the influence of a deeper formation.
PTX06-1137A	20130424M00092	4/24/13	N	232	30			Y	30	NA	7300	N		Increasing	No Trend	This concentration likely represents natural variability in background.
PTX06-1137A	20131024M00261	10/24/13	N	196	15			Y	15	NA	7300	N		Increasing	No Trend	This concentration likely represents natural variability in background.
PTX06-1139	20130122M00008	1/22/13	N	200	15		J	Y	15	NA	7300	N		No Trend	No Trend	This concentration likely represents natural variability in background.
PTX06-1139	20130805M00204	8/5/13	N	200	30			Y	30	NA	7300	N	Y	No Trend	No Trend	This concentration likely represents natural variability in background.
PTX06-1140	20130424M00094	4/24/13	N	206	75			Y	75	NA	7300	N	Y	Probably Increasing	Stable	This concentration likely represents natural variability in background.
PTX06-1140	20131028M00266	10/28/13	N	198	15			Y	15	NA	7300	N		Probably Increasing	Stable	This concentration likely represents natural variability in background.
PTX06-1144	20130425M00096	4/25/13	N	201	75			Y	75	NA	7300	N		Decreasing	No Trend	This concentration likely represents natural variability in background.
PTX07-1R01	20130425M00100	4/25/13	N	198	30			Y	30	NA	7300	N	Y	No Trend	No Trend	This concentration likely represents natural variability in background.

LT – Long-Term Trend (all data)
ST – Short-Term Trend last 4 samples)

In addition to comparison of measured concentrations to GWPS, all Ogallala Aquifer wells were evaluated to determine if specific constituents that are detected are trending upward (see Appendix D). For the trending analysis, a small list of HEs (RDX and the DNTs), boron, chromium, and hexavalent chromium were evaluated. The HEs have been sporadically detected in the past at a few wells and the metals, except for hexavalent chromium, are naturally occurring.

The Mann-Kendall trending results, summarized in Table 3-14, indicate that across all data, nine wells are indicating increasing or probably increasing trends.

Six wells indicate an increasing or probably increasing trend in chromium. However, in five of these wells the 2013 detections were either non-detect or below the laboratory PQL of 10 ug/L and the remaining detection (30.27 ug/L in PTX06-1058) was below the chromium background of 31.8 ug/L. These chromium trends may also be related to the stainless steel casings and the confirmed presence of bacterial growth that has been found in many wells (perched and Ogallala Aquifers) at Pantex. Typically, chromium levels drop in these wells after brushing and bailing of the well.

PTX06-1068 exhibited an increasing trend in hexavalent chromium, but the 2013 result was non-detect. As discussed in the 2012 Annual Progress Report, the increasing trend is likely due to several 2012 detections associated with the corrosion of the stainless steel sampling pump.

Mann-Kendall trending across all data also indicates that boron is increasing or probably increasing in three Ogallala Aquifer wells. However, all boron detections are well below the GWPS of 7,300 ug/L and likely represent background variability as all detections were within approximately 5% of the background value of 193.9 ug/L/

Table 3-14. Increasing Trends in Group 1 Ogallala Aquifer Wells

Well	COC	Concentration Trend
PTX06-1043	B	Increasing
PTX06-1043	Cr	Increasing
PTX06-1056	Cr	Increasing
PTX06-1058	Cr	Increasing
PTX06-1068	Cr	Increasing
PTX06-1068	Cr(VI)	Increasing
PTX06-1076	Cr	Increasing
PTX06-1137A	B	Increasing
PTX06-1140	B	Probably Increasing
PTX06-1140	Cr	Increasing

3.4.2 Group 2 Wells

These wells are near source areas and generally have contamination at levels above the GWPS. The purpose of this evaluation is to determine if source strength is declining. It is an expected condition that the ditches and playas would continue to contribute contamination to the perched aquifer for a long period of time (20 years or more), but at much lower concentrations than in the past. For many of these wells, it is expected that concentrations will stabilize with an eventual long-term decreasing trend below the GWPS. Table 3-15 presents the evaluation of Group 2 wells COC trends (since the start of remedial actions) against expected conditions that were developed in the LTM Design Report. A full reporting of all trends versus expected conditions is included in Appendix D.

The following indicator parameters were not included in Table 3-15:

- HE breakdown products (MNX; TNX; DNX; 1,3,5-TNB; 1,3-DNB; 2-amino-4,6-DNT; and 4-amino-2,6-DNT) were not included since increasing trends are not an indicator of continued sourcing.
- TCE breakdown products (cis-1,2-DCE; trans-1,2-DCE; and vinyl chloride) were not included since increasing trends are not an indicator of continued sourcing.
- Total Chromium was not included in lieu of hexavalent chromium.

Many wells that have detections of COCs already meet expected conditions at the well. Several wells have increasing or probably increasing historical COC trends. PTX06-1095A and PTX06-1005 are exhibiting increasing trends in multiple COCs, but these two wells are under the influence of remedial actions and these trends are not likely due to increased mass

flux from the source areas. PTX06-1126 and PTX06-1127, while classified as Group 2 wells, are far away from the source areas, so these trends are not representative of the current mass flux near the source areas. The increasing hexavalent chromium trend in PTX06-1002A is an artifact of the statistical method since this well has been non-detect for hexavalent chromium since 2008.

The remaining 10 wells that are exhibiting increasing trends when the expected condition is a decreasing or stable trend are discussed below.

- 1114-MW4, located in central Zone 11, is exhibiting increasing trends in TCE, PCE, and chloroform, possibly due to increased mass flux and plume movement downgradient away from the source (Hypalon pond).
- PTX06-1007 is exhibiting an increasing trend in perchlorate while the expected condition is a long-term decreasing trend. As discussed in Section 3.1.1.3, this trend could be caused by changes in mass flux from the perchlorate source area or possible effects of injection.
- PTX06-1008 and PTX06-1010 are exhibiting increasing trends in chloroform while the expected condition is a long-term decreasing trend. These trends may be due to increased mass flux at the source area (WMG 10) or possible down gradient plume movement from the source.
- PTX06-1077A is exhibiting an increasing trend in RDX while the expected condition is a stable or decreasing trend below GWPS. The detections are well below the GWPS, near the method detection limits and recent trends indicate decreasing concentrations at this well.
- PTX06-1088 is exhibiting increasing concentrations in 2,4-DNT, 2,6-DNT, and PCE since the start of remedial actions. However, short-term trends for the DNTs indicate decreasing trends.
- PTX07-1P05 is probably exhibiting an increasing historic trend in RDX. However, more recent data indicate decreasing trends.
- PTX08-1005 is exhibiting increasing trends in chloroform and TCE while the expected condition is a long-term decreasing trend. This well is located on the south end of Zone 11, further away from the Zone 11 VOC source areas. Therefore, these trends may be due to general plume movement downgradient rather than a current increase in mass flux at the source.
- PTX08-1006 is exhibiting increasing trends in RDX, perchlorate, TCE, PCE, and chloroform while the expected condition is a long-term decreasing trend. This well is

located in southeast Zone 11 and the trends are likely due to plume movement away from upgradient sources.

- PTX08-1007 is exhibiting an increasing trend in RDX while expected condition is a long-term decreasing trend. This trend could be due to increased mass flux at the source or possible injection effects.

Many other wells show stabilization of concentrations or no trend, rather than a decreasing trend. However, the expected condition is that most of these wells will have a long-term decreasing trend. These wells should start indicating a decreasing trend over the next few years.

Table 3-16 summarizes all detections of analytes above the laboratory PQL and site-specific background, if calculated, that are not considered to be indicator parameters. All of the detections above background were nickel or manganese, which are components of stainless steel and are likely due to corrosion of stainless steel screens. Specific exceedences are discussed below:

- PTX06-1010 had a detection of nickel exceeding site-specific background in May 2013. Nickel concentrations in this well have been variable in this well, likely due to stainless steel screen corrosion. The nickel result from the second sampling event had returned to a value less than background and all values were well below the GWPS of 730 ug/L.

- PTX06-1095A had manganese and nickel detections exceeding site-specific background in 2013. These detections are likely due to stainless steel screen corrosion. All detections were well below their respective GWPS.

- PTX08-1002 had a manganese detection exceeding background. This well went dry and was replaced with a well constructed entirely of PVC in August 2013, so this detection is not likely due to well screen corrosion. However, this detection may be due to manganese in drilling fluids in a similar fashion to OW-WR-38 as discussed in the 2012 Annual Progress Report.

- PTX10-1014 had manganese and nickel detections exceeding site-specific background in 2013. These detections are likely due to stainless steel screen corrosion as indicated by increasing trends in several components of stainless steel. Since the nickel concentration exceeded the GWPS, this well will be scheduled for rehabilitation prior to the 2014 sampling event.

Table 3-15. COC Trends vs. Expected Conditions, Group 2 Wells

Well ID	COC Expected Condition - LTM Design	COC >GWPS	Historic Mann-Kendall Trends									
			RDX	TNT	DNT24	DNT26	PERC	TCE	PCE	CR+6	1,4-Dioxane	TCLME
1114-MW4	Long-term decreasing trend	PERC, TCE	N/A	ND	ND	ND	Decreasing	**Increasing**	**Probably Increasing**	NT	Decreasing	**Increasing**
OW-WR-38	Long-term stabilization of concentrations	NONE	Decreasing	ND	ND	ND	NT	Decreasing	ND	NT	NT	ND
PTX06-1002A	Long-term stabilization of concentrations	RDX, TNX	No Trend	ND	ND	N/A	NT	Decreasing	N/A	**Increasing**	NT	ND
PTX06-1003[1]	Long-term stabilization of concentrations	RDX, TNX	NT	ND	NT	NT	NT	NT	NT	NT	NT	NT
PTX06-1005	Long-term stabilization of concentrations	DNT24, DNT2A, DNT4A, RDX, TNB135, TNX, TCE, CR, CR+6	Decreasing	Decreasing	Decreasing	Decreasing	NT	**Increasing**	**Increasing**	**Increasing**	NT	**Probably Increasing**
PTX06-1007	Long-term decreasing trend	PERC, DNT4A	Decreasing	ND	ND	N/A	**Increasing**	Decreasing	ND	NT	Decreasing	ND
PTX06-1008	Long-term decreasing trend	DCA12, CR	ND	ND	ND	ND	N/A	Decreasing	ND	N/A	ND	**Increasing**
PTX06-1010	Long-term decreasing trend	CR, CR+6, RDX	Decreasing	Decreasing	N/A	N/A	NT	Decreasing	Decreasing	Decreasing	NT	**Increasing**
PTX06-1011	Stable or decreasing trend below GWPS	RDX, TNX,CR, TCE	Decreasing	N/A	Decreasing	ND	N/A	Decreasing	Decreasing	Decreasing	Decreasing	N/A
PTX06-1050	Long-term stabilization of concentrations	RDX, TNX, DNT2A, DNT4A	Decreasing	ND	ND	ND	NT	ND	ND	NT	NT	ND
PTX06-1053	Stable or decreasing trend below GWPS	NONE	N/A	ND	ND	N/A	Probably Increasing	ND	ND	N/A	ND	ND
PTX06-1077A	Stable or decreasing trend below GWPS	TCE	**Increasing**	ND	ND	ND	Decreasing	Decreasing	Decreasing	NT	N/A	ND
PTX06-1088	Long-term stabilization of concentrations	TNT, TCE, CR, CR+6, RDX, DNT24, DNT2A, DNT4A, TNB135, PCE	Decreasing	Decreasing	**Increasing**	**Increasing**	NT	Decreasing	**Increasing**	Decreasing	NT	Decreasing
PTX06-1095A	Long-term stabilization of concentrations	RDX, TNX, DNT4A	**Increasing**	**Increasing**	N/A	ND	NT	**Increasing**	N/A	N/A	NT	N/A
PTX06-1126	Long-term decreasing trend	RDX, TNX, DNT4A	Decreasing	ND	ND	ND	Decreasing	No Trend	**Increasing**	NT	**Increasing**	**Increasing**
PTX06-1127	Long-term decreasing trend	TCE, PERC, DIOXANE14, DNT4A, DCA12	Decreasing	ND	ND	ND	Decreasing	Decreasing	**Increasing**	NT	**Increasing**	**Increasing**
PTX07-1O01	Long-term decreasing trend	RDX, TNX	Decreasing	N/A	ND	N/A	NT	N/A	ND	NT	NT	ND
PTX07-1O02	Long-term decreasing trend	NONE	Decreasing	ND	ND	ND	NT	Decreasing	ND	NT	NT	N/A
PTX07-1O03	Long-term decreasing trend	RDX, TNX	Decreasing	ND	ND	ND	NT	ND	ND	NT	NT	ND

Well ID	COC Expected Condition - LTM Design	COC >GWPS	Historic Mann-Kendall Trends									
			RDX	TNT	DNT24	DNT26	PERC	TCE	PCE	CR+6	1,4-Dioxane	TCLME
PTX07-1O06[1]	Stable or decreasing trend below GWPS	NONE	Decreasing	NT	NT	NT	NT	NT	NT	NT	NT	NT
PTX07-1P02	Stable or decreasing trend below GWPS	RDX	Decreasing	ND	ND	ND	N/A	ND	ND	NT	Decreasing	ND
PTX07-1P05	Stable or decreasing trend below GWPS	RDX, TNX	**Probably Increasing**	ND	ND	ND	N/A	ND	Decreasing	NT	Decreasing	ND
PTX08-1001[2]	Long-term stabilization of concentrations	RDX, DNX, TNX	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
PTX08-1002	Long-term stabilization of concentrations	RDX, MNX, DNX, TNX, DNT2A, DNT4A	Decreasing	Decreasing	Decreasing	N/A	NT	ND	ND	N/A	NT	ND
PTX08-1005	Long-term decreasing trend	TCE, DNT4A	Decreasing	N/A	ND	ND	Decreasing	**Increasing**	Decreasing	NT	No Trend	**Increasing**
PTX08-1006	Long-term decreasing trend	RDX, TNX, PERC, DNT4A, TCE, PCE, DIOXANE14, DCA12	**Increasing**	N/A	ND	Decreasing	**Increasing**	**Increasing**	**Increasing**	NT	Decreasing	**Increasing**
PTX08-1007	Long-term decreasing trend	TCE, RDX, TNX	**Increasing**	ND	ND	ND	N/A	No Trend	Decreasing	No Trend	N/A	Decreasing
PTX08-1008	Long-term stabilization of concentrations	CR, CR+6	N/A	ND	ND	N/A	Decreasing	Decreasing	ND	Decreasing	N/A	Decreasing
PTX08-1009	Long-term stabilization of concentrations	NONE	Decreasing	N/A	ND	ND	NT	Decreasing	ND	Decreasing	NT	Decreasing
PTX10-1014	Long-term decreasing trend	TCE, RDX	No Trend	ND	ND	ND	Decreasing	Decreasing	No Trend	N/A	ND	Decreasing

CR = Chromium, total
CR+6 = Chromium, hexavalent
DCA12 = 1,2-dichloroethane
TCLME = chloroform
DNT2A = 2-amino-4,6-dinitrotoluene
DNT4A = 4-amino-2,6-dinitrotoluene
DNT24 = 2,4-dinitroluene
N/A = not enough detections
DIOXANE14 = 1,4-dioxane
PCE = tetrachloroethene
PERC = perchlorate
TCE = trichloroethene
ND = non-detect
NT = not tested

[1] – PTX06-1003 and PTX07-1O06 were not able to be sampled in 2013 due to either dry conditions or insufficient water to sample .

[2] – PTX08-1001 went dry during 2012 and was replaced with a deeper well in late 2013, but was not sampled. The new well will be sampled in 2014.

Table 3-16. Group 2 Well Detections of non-Indicator Parameters

Well ID	Sample ID	Sample Date	Sample Type	Analyte	Measured Value (ug/L)	Detection Limit (ug/L)	Lab Qualifier	PTX Qualifier	Background (ug/L)	>Background?	PQL (ug/L)	>PQL?	GWPS (mg/L)	>GWPS ?	Expected Condition?	Explanation
PTX06-1010	20130520M00147	5/20/2013	N	Nickel	41.1	2			15	Y	2	Y	730	N	Y	Likely Screen Corrosion
PTX06-1095A	20130205M00044	2/5/2013	N	Manganese	147	5			16	Y	5	Y	1715.5	N	Y	Likely Screen Corrosion
PTX06-1095A	20130205M00044	2/5/2013	N	Nickel	27	2			15	Y	2	Y	730	N	Y	Likely Screen Corrosion
PTX06-1095A	20130826M00250	8/26/2013	N	Manganese	163	25			16	Y	25	Y	1715.5	N	Y	Likely Screen Corrosion
PTX06-1095A	20130826M00250	8/26/2013	N	Nickel	17	2			15	Y	2	Y	730	N	Y	Likely Screen Corrosion or variability in background
PTX08-1002	20131104M00280	11/4/2013	N	Manganese	91.7	5			16	Y	5	Y	1715.5	N	Y	Likely Screen Corrosion
PTX10-1014	20130516M00143	5/16/2013	N	Manganese	115	5			16	Y	5	Y	1715.5	N	Y	Likely Screen Corrosion
PTX10-1014	20130516M00143	5/16/2013	N	Nickel	866	2			15	Y	2	Y	730	Y	Y	Likely Screen Corrosion

N – Normal sample D-Duplicate sample

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3.5 POC/POE Well Evaluation

As part of the approved changes to CP-50284, Pantex has designated POC and POE wells. As defined by CP-50284, the purpose of these wells is:

1. POC wells demonstrate compliance with the GWPS.

2. POE wells demonstrate compliance with the GWPS and are used to evaluate the effectiveness of the remediation program.

POC/POE Wells

- 21 perched aquifer POC wells, with 14 exceeding GWPS
- 2 Ogallala Aquifer POC wells, with no GWPS exceedences.
- 8 Ogallala Aquifer POE wells, with no GWPS exceedences.

The remediation program must continue until the POC and POE wells are compliant with the GWPS. The POC/POE wells approved in CP-50284 are depicted in Figure 3-72. All but one POC well is in the perched aquifer. All POE wells are in the Ogallala Aquifer and are not expected to exhibit detections of COCs.

All POC/POE wells were evaluated against the established GWPS. Evaluation of the data indicates that only four perched aquifer POC wells had concentrations below GWPS. This is an expected condition at these wells as the full remedial actions were started during 2009. The COC concentrations above the GWPS are provided in Table 3-17. The Ogallala Aquifer wells were evaluated in the uncertainty management/early detection section to determine if any COCs were detected above background or PQL. All well data, along with comparison to the laboratory PQL, background, and GWPS are provided in Appendix C.

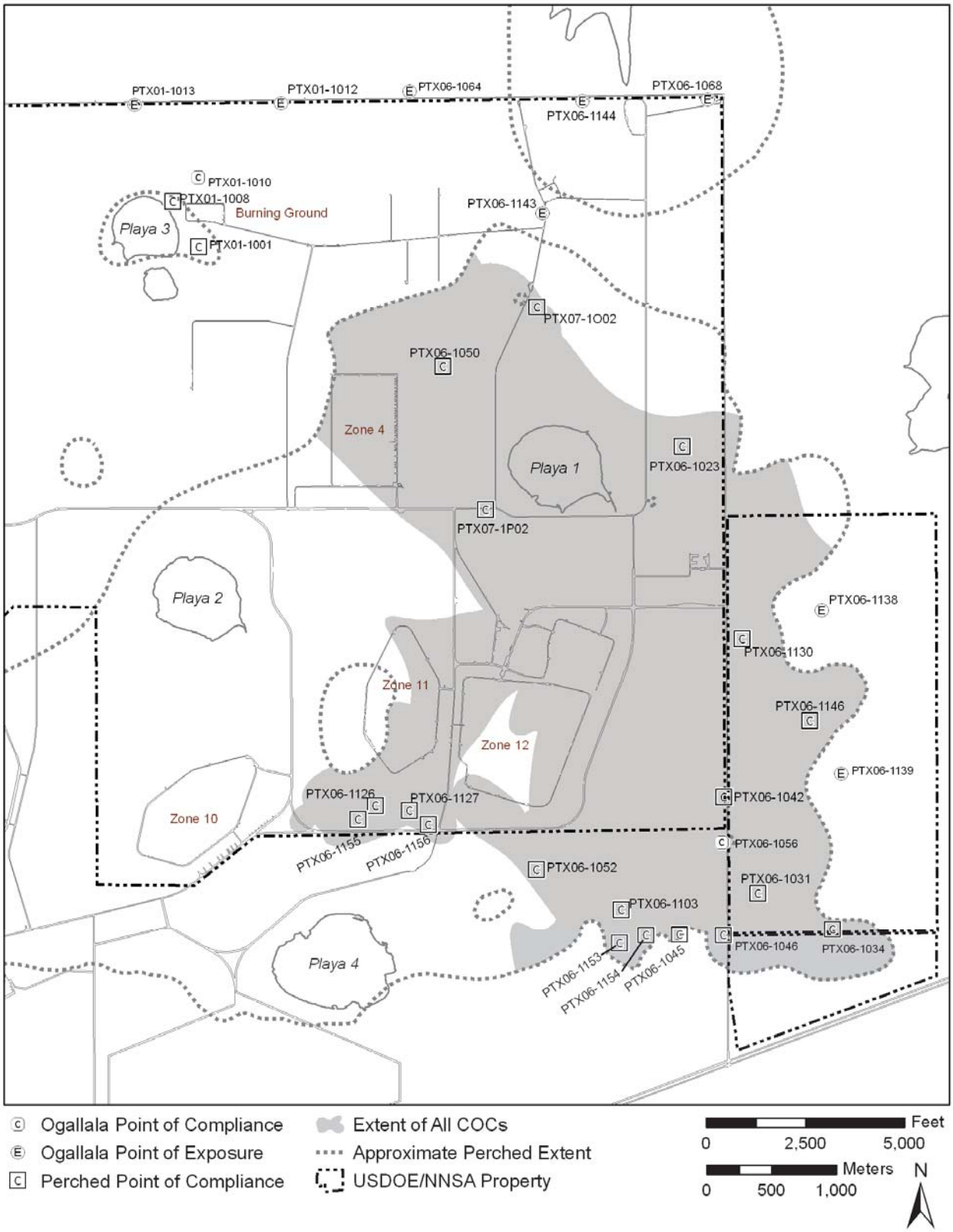

Figure 3-72. POC and POE Wells

Table 3-17. POC Well Detections Above GWPS

Well ID	Sample ID	Analyte	2013 Average Value (ug/L)	Measured Value (ug/L)	Detection Limit (ug/L)	Lab Qualifier	PTX Qualifier	GWPS (ug/L)
PTX06-1031	20130429M00104	4-Amino-2,6-Dinitrotoluene	2.2	2.35	0.259			1.2
PTX06-1031	20130429M00104	RDX	517	453	13			2
PTX06-1031	20130429M00104	TNX	5.3	4.7	0.259			2
PTX06-1031	20131114M00307	4-Amino-2,6-Dinitrotoluene	2.2	2.12	0.279		J	1.2
PTX06-1031	20131114M00307	RDX	517	485	14		J	2
PTX06-1031	20131114M00307	TNX	5.3	5.53	0.279		J	2
PTX06-1034	20130219M00064	4-Amino-2,6-Dinitrotoluene	2.2	12.3	3.24			1.2
PTX06-1034	20130219M00064	RDX	413	734	32.4		J	2
PTX06-1034	20130219M00064	TNX	46.8	80.1	3.24		J	2
PTX06-1034	20130807M00211	4-Amino-2,6-Dinitrotoluene	9.2	11.9	0.518			1.2
PTX06-1034	20130807M00211	RDX	413	647	25.9			2
PTX06-1034	20130807M00211	TNX	47	69.4	25.9		J+	2
PTX06-1042	20130131M00031	2-Amino-4,6-Dinitrotoluene	1.9	1.54	0.259			1.2
PTX06-1042	20130131M00033	2-Amino-4,6-Dinitrotoluene	1.9	1.64	0.256			1.2
PTX06-1042	20130131M00031	4-Amino-2,6-Dinitrotoluene	14.3	15.6	1.3			1.2
PTX06-1042	20130131M00033	4-Amino-2,6-Dinitrotoluene	14.3	15.4	1.28			1.2
PTX06-1042	20130131M00031	DNX	2.5	2.48	0.259			2
PTX06-1042	20130131M00033	DNX	2.5	2.36	0.256			2
PTX06-1042	20130131M00031	MNX	3.6	5.04	0.259			2
PTX06-1042	20130131M00033	MNX	3.6	4.86	0.256			2
PTX06-1042	20130131M00031	RDX	884	793	64.8			2
PTX06-1042	20130131M00033	RDX	884	726	64.1			2
PTX06-1042	20130131M00031	TNX	22.7	16.5	1.3			2
PTX06-1042	20130131M00033	TNX	22.7	16.4	1.28			2
PTX06-1042	20130821M00240	4-Amino-2,6-Dinitrotoluene	1.3	13.3	1.32			1.2
PTX06-1042	20130821M0024	DNX	2.5	2.88	0.263			2

Well ID	Sample ID	Analyte	2013 Average Value (ug/L)	Measured Value (ug/L)	Detection Limit (ug/L)	Lab Qualifier	PTX Qualifier	GWPS (ug/L)
	0							
PTX06-1042	20130821M00240	MNX	3.6	5.69	0.263			2
PTX06-1042	20130821M00240	RDX	884	850	65.8			2
PTX06-1042	20130821M00240	TNX	22.7	15.9	1.32			2
PTX06-1046	20130128M00020	4-Amino-2,6-Dinitrotoluene	7.4	7.56	0.255		J	1.2
PTX06-1046	20130128M00020	RDX	1535	1280	63.8		J	2
PTX06-1046	20130128M00020	TNX	124	101	6.38			2
PTX06-1046	20130812M00221	2-Amino-4,6-Dinitrotoluene	1.3	1.65	0.26			1.2
PTX06-1046	20130812M00221	4-Amino-2,6-Dinitrotoluene	9.8	7.67	0.26			1.2
PTX06-1046	20130812M00221	RDX	1535	1650	65.1		J	2
PTX06-1046	20130812M00221	TNX	124	116	13		J	2
PTX06-1050	20130422M00085	4-Amino-2,6-Dinitrotoluene	9.8	8.78	0.526		J	1.2
PTX06-1050	20130422M00085	RDX	159	224	13.2		J	2
PTX06-1050	20130422M00085	TNX	7.8	10.9	0.526		J	2
PTX06-1050	20131121M00327	4-Amino-2,6-Dinitrotoluene	9.8	8.72	0.273		J	1.2
PTX06-1050	20131121M00328	4-Amino-2,6-Dinitrotoluene	9.8	9.05	0.272		J	1.2
PTX06-1050	20131121M00327	RDX	159	243	13.7		J	2
PTX06-1050	20131121M00328	RDX	159	291	13.6		J	2
PTX06-1050	20131121M00327	TNX	7.8	14.5	0.683		J	2
PTX06-1050	20131121M00328	TNX	7.8	14.5	0.679		J	2
PTX06-1052	20130205M00041	Chromium, Total	5475	3260	500		J	100
PTX06-1052	20130205M00041	Chromium, Hexavalent	4935	3015	300	I		100
PTX06-1052	20130808M00216	Chromium, Total	5475	3100	1000			100
PTX06-1052	20130808M00216	Chromium, Hexavalent	4935	2980	500			100
PTX06-1126	20130523M00160	4-Amino-2,6-Dinitrotoluene	7.6	6.97	0.255			1.2
PTX06-1126	20130523M00160	Perchlorate	238	221	60		J	26
PTX06-1126	20130523M00160	1,2-Dichloroethane	8.2	8.21	1			5

Well ID	Sample ID	Analyte	2013 Average Value (ug/L)	Measured Value (ug/L)	Detection Limit (ug/L)	Lab Qualifier	PTX Qualifier	GWPS (ug/L)
PTX06-1126	20130523M0016 0	1,4-Dioxane	23	39	1			7.7
PTX06-1126	20130523M0016 0	Trichloroethene	227	187	5			5
PTX06-1126	20131106M0029 6	4-Amino-2,6-Dinitrotoluene	7.6	9.75	0.521			1.2
PTX06-1126	20131106M0029 6	Perchlorate	238	226	60			26
PTX06-1126	20131106M0029 6	1,2-Dichloroethane	8.2	8.69	1			5
PTX06-1126	20131106M0029 6	1,4-Dioxane	23	33	1			7.7
PTX06-1126	20131106M0029 7	1,4-Dioxane	23	31.3	5		J-	7.7
PTX06-1126	20131106M0029 6	Trichloroethene	227	231	5			5
PTX06-1126	20131111M0030 1	4-Amino-2,6-Dinitrotoluene	7.6	9.99	0.518			1.2
PTX06-1126	20131111M0030 1	Perchlorate	238	250	60			26
PTX06-1126	20131111M0030 1	1,2-Dichloroethane	8.2	10.7	1			5
PTX06-1126	20131111M0030 1	1,4-Dioxane	23	43	1			7.7
PTX06-1126	20131111M0030 1	Trichloroethene	227	340	4		J+	5
PTX06-1127	20130514M0013 0	4-Amino-2,6-Dinitrotoluene	17.2	21.3	1.28			1.2
PTX06-1127	20130514M0013 0	Perchlorate	501	419	120			26
PTX06-1127	20130514M0013 0	1,2-Dichloroethane	10.2	5.32	1			5
PTX06-1127	20130514M0013 0	1,4-Dioxane	44	77	2.2	D	J+	7.7
PTX06-1127	20130514M0013 0	Trichloroethene	9.4	9.72	1			5
PTX06-1127	20131106M0029 2	4-Amino-2,6-Dinitrotoluene	17.2	18.2	1.32			1.2
PTX06-1127	20131106M0029 4	4-Amino-2,6-Dinitrotoluene	17.2	18.2	1.32			1.2
PTX06-1127	20131106M0029 2	Perchlorate	501	462	120			26
PTX06-1127	20131106M0029 4	Perchlorate	501	455	120			26
PTX06-1127	20131106M0029 2	1,4-Dioxane	44	35	1			7.7
PTX06-1127	20131106M0029 3	1,4-Dioxane	44	35.4	5		J-	7.7
PTX06-1127	20131106M0029 4	1,4-Dioxane	44	42	1			7.7
PTX06-1127	20131106M0029 2	Trichloroethene	9.4	6.64	1			5
PTX06-1127	20131106M0029	Trichloroethene	9.4	6.6	1			5

Well ID	Sample ID	Analyte	2013 Average Value (ug/L)	Measured Value (ug/L)	Detection Limit (ug/L)	Lab Qualifier	PTX Qualifier	GWPS (ug/L)
	4							
PTX06-1130	20130219M00065	2-Amino-4,6-Dinitrotoluene	12.6	9.1	0.26			1.2
PTX06-1130	20130219M00065	4-Amino-2,6-Dinitrotoluene	8.6	8.59	0.26			1.2
PTX06-1130	20130219M00065	RDX	119.6	108	6.51		J	2
PTX06-1130	20130219M00065	TNX	5.9	5.46	0.26		J	2
PTX06-1130	20130822M00247	2-Amino-4,6-Dinitrotoluene	12.6	9.1	0.267			1.2
PTX06-1130	20130822M00247	4-Amino-2,6-Dinitrotoluene	8.6	8.76	0.267			1.2
PTX06-1130	20130822M00247	RDX	119.6	125	6.68			2
PTX06-1130	20130822M00247	TNX	5.9	5.55	0.267			2
PTX06-1146	20130204M00036	4-Amino-2,6-Dinitrotoluene	27	31.2	1.32		J	1.2
PTX06-1146	20130204M00036	RDX	1145	1020	66.1		J	2
PTX06-1146	20130204M00036	TNX	17	12.1	1.32		J-	2
PTX06-1146	20130204M00036	Chromium, Total	12	250	50			100
PTX06-1146	20130822M00246	4-Amino-2,6-Dinitrotoluene	27	24.1	1.34			1.2
PTX06-1146	20130822M00246	RDX	1145	1190	67.2			2
PTX06-1146	20130822M00246	TNX	17	21.1	1.34			2
PTX06-1153	20130205ISB004	4-Amino-2,6-Dinitrotoluene	2.6	2.8	2		J	1.2
PTX06-1153	20130205ISB004	RDX	237.5	290	40		J-	2
PTX06-1153	20130205ISB004	TNX	2.5	3.3	5	J		2
PTX06-1153	20130423ISB022	4-Amino-2,6-Dinitrotoluene	2.6	3	1			1.2
PTX06-1153	20130423ISB022	RDX	237.5	240	40		J	2
PTX06-1153	20130423ISB022	TNX	2.5	2.3	2.5	J		2
PTX06-1153	20130423ISB022	Chromium, Total	163.5	140	10			100
PTX06-1153	20130423ISB022	Chromium, Hexavalent	137.8	118	15			100
PTX06-1153	20130723ISB045	2-Amino-4,6-Dinitrotoluene	1.4	1.5	1			1.2
PTX06-1153	20130723ISB045	4-Amino-2,6-Dinitrotoluene	2.6	2.7	1			1.2
PTX06-1153	20130723ISB045	RDX	237.5	210	10		J	2
PTX06-1153	20130723ISB045	TNX	2.5	2.1	2.5	J		2

Well ID	Sample ID	Analyte	2013 Average Value (ug/L)	Measured Value (ug/L)	Detection Limit (ug/L)	Lab Qualifier	PTX Qualifier	GWPS (ug/L)
PTX06-1153	20130723ISB045	Chromium, Total	163.5	180	10			100
PTX06-1153	20130723ISB045	Chromium, Hexavalent	137.8	150	20			100
PTX06-1153	20131024ISB062	2-Amino-4,6-Dinitrotoluene	1.4	1.5	0.2		J	1.2
PTX06-1153	20131024ISB062	4-Amino-2,6-Dinitrotoluene	2.6	3.1	0.2			1.2
PTX06-1153	20131024ISB062	MNX	1.5	2.8	5	J		2
PTX06-1153	20131024ISB062	RDX	237.5	250	20			2
PTX06-1153	20131024ISB062	TNX	2.5	3.1	0.5		J	2
PTX06-1153	20131024ISB062	Chromium, Total	163.5	190	50			100
PTX06-1153	20131024ISB062	Chromium, Hexavalent	137.8	133	20			100
PTX06-1154	20130205ISB002	TNX	100	37	9.9			2
PTX06-1154	20130205ISB002	Arsenic	47.1	51	5			12
PTX06-1154	20130205ISB002	Barium	7573	11000	10		J	2000
PTX06-1154	20130423ISB020	TNX	100	15	2.5			2
PTX06-1154	20130423ISB020	Arsenic	47.1	51	5			12
PTX06-1154	20130423ISB020	Barium	7573	10000	10			2000
PTX06-1154	20130723ISB043	TNX	100	11	2.5			2
PTX06-1154	20130723ISB043	Arsenic	47.1	55	5			12
PTX06-1154	20130723ISB043	Barium	7573	9800	20		J	2000
PTX06-1154	20131024ISB060	TNX	100	15	2.5		J	2
PTX06-1154	20131024ISB060	Arsenic	47.1	71	25			12
PTX06-1154	20131024ISB060	Barium	7573	9200	10			2000
PTX06-1154	20131024ISB060	Manganese	1948	2000	10			1716
PTX06-1155	20130129ZSB006	Arsenic	38.9	31	5			12
PTX06-1155	20130129ZSB006	1,2-Dichloroethane	12.8	6.9	3			5
PTX06-1155	20130129ZSB006	cis-1,2-Dichloroethene	70	100	5			70
PTX06-1155	20130129ZSB006	1,4-Dioxane	8.9	11	5	B	J	7.7
PTX06-1155	20130129ZSB006	Trichloroethene	353	170	3			5
PTX06-1155	20130422ZSB044	Arsenic	38.9	29	5			12
PTX06-1155	20130422ZSB044	1,2-Dichloroethane	12.8	8.4	3			5
PTX06-1155	20130422ZSB044	cis-1,2-Dichloroethene	70	220	10		J	70
PTX06-1155	20130422ZSB044	1,4-Dioxane	8.9	10	5			7.7
PTX06-1155	20130422ZSB044	Trichloroethene	353	27	3			5

Well ID	Sample ID	Analyte	2013 Average Value (ug/L)	Measured Value (ug/L)	Detection Limit (ug/L)	Lab Qualifier	PTX Qualifier	GWPS (ug/L)
PTX06-1155	20130722ZSB050	Arsenic	38.9	31	5			12
PTX06-1155	20130722ZSB050	1,2-Dichloroethane	12.8	11	3			5
PTX06-1155	20130722ZSB050	cis-1,2-Dichloroethene	70	310	25	H	J-	70
PTX06-1155	20130722ZSB050	1,4-Dioxane	8.9	13	5		J-	7.7
PTX06-1155	20130722ZSB050	Trichloroethene	353	18	3		J	5
PTX06-1155	20130722ZSB050	Vinyl Chloride	2.9	2.5	1			2
PTX06-1155	20131028ZSB100	Arsenic	38.2	57	25			12
PTX06-1155	20131028ZSB100	1,2-Dichloroethane	12.8	11	3			5
PTX06-1155	20131028ZSB100	cis-1,2-Dichloroethene	70	390	13			70
PTX06-1155	20131028ZSB100	1,4-Dioxane	8.9	8.6	5			7.7
PTX06-1155	20131028ZSB100	Vinyl Chloride	2.9	3.3	1			2
PTX06-1156	20130129ZSB005	Arsenic	38	31	5			12
PTX06-1156	20130129ZSB005	Barium	3340	2100	2			2000
PTX06-1156	20130422ZSB045	Arsenic	38	32	5			12
PTX06-1156	20130722ZSB051	Arsenic	38	42	5			12
PTX06-1156	20131028ZSB101	Arsenic	38	52	25			12
PTX06-1156	20131028ZSB101	Barium	3340	2300	10			2000

Note: A description of all qualifiers can be found in Appendix C ("Information" tab in the 2013 electronic data file).

4.0 Soil Remedial Action Effectiveness

Three soil remedial actions were implemented to prevent cross-contamination of soils to groundwater. Those actions include soil covers on landfills, a ditch liner in Zone 12, and the Burning Ground SVE. This evaluation focuses on the following two aspects of effectiveness:

1. Remedial action effectiveness of the SVE
2. Uncertainty Management

4.1 SVE Remedial Action Effectiveness

The small-scale Burning Ground SVE operated intermittently during 2013. The small catalytic oxidizer (CatOx)/wet scrubber system installed in 2012 continues to focus on treating residual NAPL and soil gas at a single soil gas well (SVE-S-20), where soil gas concentrations continue to remain high. The system was down for power outages, freezing weather, and maintenance or repairs. The system removed approximately 529 lbs of VOCs during 2013.

Influent and effluent PID readings are taken at the SVE system (prior to the oxidizer and at the scrubber stack) at least weekly to ensure compliance with the permit by rule. Pantex also collects quarterly influent samples that are sent to a laboratory for analysis. The analytical samples are used to estimate the mass removal for the SVE system.

Table 4-1 presents a summary of detected 2013 data and the average concentrations from 2007-2008. The 2013 data represent the current small-scale SVE system. Samples were collected in April, June, August, and November.

The 2013 measured values are typically lower than the 2007-2008 data collected at the system. Maximum and average values are lower than the baseline concentrations, with about half of the COC maximum concentrations still within the same order of magnitude. This change in concentration will continue to be tracked to determine if a long-term trend emerges. Methylene chloride was detected in 2013 although it was not detected in baseline data. This COC has been detected prior to 2007 at low concentrations at the large-scale system or in individual soil gas wells. Other low-level COCs may be detected in the future because detection limits are expected to improve as the major COC concentrations decrease.

Table 4-1. Burning Ground SVE Data Summary

Analyte	2013 Measured Value			2007-2008 Measured Value		
	Avg	Max	Min	Avg	Max	Min
Acetone	34,000	49,000	23,000	82,666	140,000	38,000
Toluene	183,333	190,000	180,000	477,307	990,000	45,000
Methylene chloride	1,867	5,500	1,200	ND	ND	ND
PCA	1,833	2,100	1,600	3,356	6,300	760
TCE	7,900	8,300	7,700	26,714	41,000	13,000
Tetrahydrofuran (THF)	6,900	10,000	5,300	20,107	26,000	9,500

Measured concentrations in parts per billion by volume (ppbv).
Indicates values greater than the baseline 2007-2008 concentration.

To verify whether concentrations of VOCs are decreasing, a Mann-Kendall test was performed on all available SVE analytical data collected since the small-scale CatOx system was installed in early 2012. Trends were calculated based on all data and recent data (last 4 measurements). Since the analytical results can be affected by multiple factors including extraction equipment, sample port location, or other system conditions, no effort was made to trend the new results with analytical data associated with the old system. Generally, the concentrations appear to be lower than those collected in the previous GAC system, but it is unknown whether these lower concentrations reflect a true source reduction or are due to one of the factors listed above.

The results of the statistical testing indicate that of the four main COCs (acetone, toluene, TCE, and tetrahydrofuran [THF]) one COC exhibited a decreasing trend considering all data and one COC exhibited a decreasing trend considering the last 4 measurements. All other soil gas COCs exhibited no trend. Table 4-2 provides a summary of the statistical trending. The average monthly PID measurements collected at the system influent, summarized in Figure 4.2, are showing some variability but linear regression results for the dataset, represented by the trend line on the graph, indicate a relatively stable trend.

In the Five-Year Review Report, Pantex recognized the conflicting data and uncertainty concerning the reduction of soil gas VOCs and mass of NAPL remaining in the soil near SVE-S-20. However, no expected conditions or path toward closure were defined for the SVE system, other than "significant reduction in soil gas VOCs". Therefore, Pantex recommended the development of a Burning Ground SVE Performance Monitoring Plan, which will define expected conditions of the system performance as well as a clear path towards an end point of active SVE operations and potential transition to a passive system. In anticipation of this plan, a rebound test was performed in conjunction with an unplanned shutdown due to freeze issues in January 2014. The data collected during the rebound test may be used for future comparison in the Performance Monitoring Plan. An additional rebound test is scheduled for May – June 2014. The proposed submittal date for this plan is December 2014.

Table 4-2. Mann-Kendall Results for Soil Gas COCs

COC	Trend-All Data	Recent Trend
Toluene	No Trend	Decreasing
TCE	Decreasing	No Trend
Tetrahydrofuran (THF)	No Trend	No Trend
Acetone	No Trend	No Trend

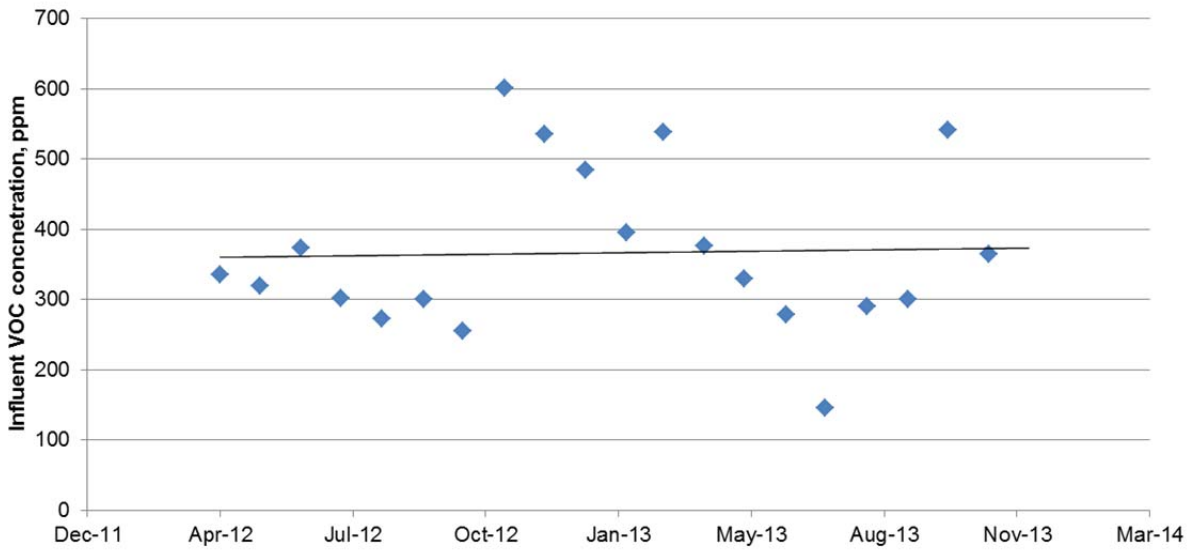

Figure 4-1. Influent Average PID VOC Concentrations vs. Time

4.2 Uncertainty Management

One of purposes of the uncertainty management wells is to confirm expected conditions from the soil units. The expected conditions are:

1. Declining source contributions from soil units that have historically contributed to groundwater.
2. No new source contributions to the current impacted groundwater.
3. Areas that have no historical contamination in the uppermost groundwater will not exhibit signs of sourcing to groundwater.

Pantex analyzes for indicator constituents at all wells according to the SAP. This list of constituents helps determine possible impact at areas that were previously unaffected or to ensure that source area strength is declining in impacted areas. This evaluation is presented in Section 3.4.

No Group 1 perched aquifer wells had unexpected conditions in 2013. As discussed in Section 3.4.2, 10 Group 2 wells exhibited increasing long-term trends in COC concentration while the expected condition was decreasing or stable trends below the GWPS. Several of these wells are indicating decreasing recent trends and it may take some time for the long-term trends to reflect these shifts. The increasing trends in the remaining wells may indicate changes in mass flux or possible plume movement from the source areas. These wells will continue to be monitored and evaluated over time to determine if the source strength declines as expected.

Five Ogallala aquifer wells had unexpected conditions in 2013. All five wells had estimated hexavalent chromium detections. As discussed in Section 3.4.1.2, these detections are likely the result of lower detection limits, low-level background, stainless steel screen corrosion, or combination of these factors. Additionally, PTX06-1033 had a detection of nickel exceeding site-specific background, but this well has documented screen corrosion.

5.0 Conclusions and Recommendations

5.1 Conclusions from the 2013 Annual Report

Overall, the groundwater remedial actions have been effective in 2013. In particular, the groundwater pump and treat systems are affecting groundwater levels and COC concentrations in nearby wells. The influence of both pump and treat systems will continue to expand as the saturated thickness is reduced in the perched aquifer. There has been no evidence of migration of perched groundwater COCs to the Ogallala Aquifer. Several Ogallala Aquifer wells had unexpected low-level detections of hexavalent chromium, but these detections are attributed to a combination of lower detection limits and either screen corrosion or background levels rather than breakthrough of perched groundwater.

The pump and treat system throughput performance objectives outlined in the Remedial Design/Remedial Action Work Plan (B&W Pantex 2009c) were not consistently achieved throughout the year. P1PTS was primarily affected by inoperable extraction wells and reduced flow to the WWTF due to freezing temperatures and SEPTS was primarily affected by reduced flow to the WWTF.

Downgradient Zone 11 ISPM wells are exhibiting effects from the treatment zone. TOC and total VFAs have been detected, nitrate and sulfate concentrations have declined, and ORP is negative in all three downgradient wells suggesting expansion of the treatment zone. Perchlorate concentrations were non-detect in all downgradient ISPM wells during 2013. TCE concentrations were non-detect in PTX06-1156 during 2013. PTX06-1012 and PTX06-1155 are exhibiting decreasing trends in TCE in 2013 and TCE was below GWPS by 4th quarter. If these trends continue, TCE will be below GWPS in PTX06-1012 in 1 – 2 years. However, recent data suggest that TCE treatment may be limited by a lack of the proper bacterial strains necessary for complete TCE dechlorination and bioaugmentation will likely be necessary.

The Southeast ISB system has been effective in treating HEs and hexavalent chromium at three downgradient ISPM wells (PTX06-1037, 1123, and 1154) for the SE ISB. RDX concentrations in all three of these wells are below the GWPS of 2 ug/L. Hexavalent chromium is either non-detect or detected at levels below the GWPS in these wells. These wells indicate that the reducing zone has extended beyond the treatment zone as TOC and total VFAs are present, and nitrate and sulfate concentrations are reduced. ORP is negative in two wells (PTX06-1154 and PTX06-1123). Data collected in 2013 to determine why COC concentrations did not respond in downgradient ISPM well PTX06-1153 revealed inconsistent flow patterns in the

western end of the ISB system. Pantex will continue to evaluate data collected and develop a path forward for this area as needed.

Soil remedies have been effective at Pantex as workers and the public are protected from exposure to contaminated soils and data do not indicate that new contamination is migrating to the underlying groundwater from soil source areas. The landfill covers are operating as designed, although drought conditions have caused vegetation loss on some covers that could impact future protectiveness if not addressed. The ditch liner is maintained and prevents the infiltration of water that would cause migration of HEs in soils to the perched aquifer. The SVE system is actively removing soil gas and residual NAPL in soils at the Burning Ground thereby mitigating vertical movement of VOCs to the Ogallala Aquifer.

The institutional controls are in place for soils and groundwater providing short-term protection of human health and the environment while active remedies continue to operate. Pantex will continue to evaluate areas that are not under the influence of the active remedies to determine if the remedies will actively affect the areas to provide permanent long-term protection.

In order to address the identified issue of HE plumes expanding east of FM 2373 and in the southeast lobe of the perched aquifer, Pantex completed a hydrologic evaluation of these areas in 2012. This evaluation is to be updated annually as part of the annual progress reporting process. The 2013 update included the addition of groundwater data collected during 2013. Overall, the conclusions drawn were similar to those in the original report. Key findings from the new dataset include:

- RDX data suggest possible plume stabilization in the far southeast area of perched groundwater.
- Groundwater elevations are suggesting the dry zone located directly downgradient of the SEPTS well field is expanding, resulting in reduced mass flux to the southeast.

Aquifer testing and activities at PTX06-1146 and PTX06-1147 began in May 2014. Testing results, conclusions, and implications for possible remedial actions in the area will be presented in a future Progress Report.

5.2 Conclusions from the Five-Year Review

The Five-Year Review Report was submitted in December 2012 and final approval was received in August 2013. While the recommended changes outlined in the 2012 Annual Report did not change, this section will remain in the Annual Progress Reports in order to track the recommendations and subsequent actions taken to address them.

The conclusions of the Five-Year Review indicate that the overall soil and groundwater remedies are performing as designed and expected. The institutional controls and soil remedies are actively preventing contact with contaminated soil and groundwater while active remedies decrease concentrations of contaminants in soil and groundwater to provide long-term protection of human health and the environment. The groundwater pump and treat systems continue to decrease perched aquifer saturated thickness to reduce the driving force (head) that may cause migration of impacted water to the Ogallala Aquifer.

Some issues were noted that require Pantex to gather additional information to assess the active remedies and the areas that are outside the influence of the remedies and to develop and implement plans to correct noted issues. Deficiencies were also noted in the active remedies so Pantex recommended further actions to optimize remedies or monitoring to ensure continued protection of human health and the environment. Corrective actions, remedy and monitoring optimization, and completion dates are included in Tables 5-1 and 5-2. The majority of the identified issues and recommendations have been resolved or are ongoing.

Table 5-1. Issues Identified through the Five Year Review

Issue	Corrective Action/Path Forward	Completion Date
Vegetation on protective landfill covers have been impacted by drought conditions and could lead to erosion of the covers.	Phase I – Reseeding of landfills identified in the Five Year Review.	October 2013
	Phase II – Assess the effectiveness of Landfill reseeding.	Annually through 2016*
	Phase III – Additional reseeding of targeted areas.	September 2017*
Ecological risk assessment for Firing Site 5 was performed before the TCEQ guidance was issued. This guidance requires the depression east of Firing Site 5 to be incorporated into the assessment.	Completed Tier 1 Ecological Exclusion Criteria Checklist.	March 2014
Plumes of high explosives (primarily RDX) are expanding east of FM 2373 and in the southeast lobe of the perched aquifer.	Aquifer testing in PTX06-1146 and PTX06-1147.	May 2014
	Collect and evaluate natural attenuation data to estimate the site-specific rate of natural attenuation for risk driving contaminants like RDX and TNT.	Ongoing
Plumes of TCE and perchlorate extend north and west of the Zone 11 ISB treatment zone.	Expansion of Zone 11 ISB System to the west.	June – September 2014 (proposed)
Incomplete treatment of contaminants (HEs and hexavalent chromium) downgradient of the west end of the Southeast ISB (at PTX06-1153).	Installation of PTX06-1167.	July 2013
	Continued monitoring and evaluation of wells in the western edge of the system.	Ongoing
Cadmium concentrations exceeded the MCL in 2011 beneath Zone 12 South (WMG 6/7) at PTX06-1010, indicating a new COC in that area.	Added cadmium sampling to schedule for PTX06-1010 and PTX06-1088, modified the Sampling and Analysis Plan to reflect changes.	January 2014
Detections of 1,4-dioxane in Zone 11 ISB may not be treated and could result in residual risk.	Added 1,4-dioxane to northwest indicator list for Ogallala Aquifer sampling in the SAP.	January 2014
Detections of hexavalent chromium in Zone 11 (PTX08-1005) near the GWPS that indicate a potential new contaminant in that area.	Added chromium sampling to schedule for PTX08-1005, PTX06-1126, and PTX06-1127, modified the Sampling and Analysis Plan to reflect changes.	January 2014
Other metals (arsenic, barium, manganese) solubilized as a result of ISB treatment could result in residual risk downgradient of the Southeast ISB.	Added sampling of barium, arsenic, and manganese to the sampling schedule for PTX06-1056.	January 2014

*These are proposed dates revised from the Final Five-Year Review Report (B&W Pantex, 2014). See discussion of the landfill covers in Section 2.3.2.1 and the schedule in Section 1.5.

Grey shading indicates tasks that have been completed.

Table 5-2. Recommendations for Remedy Optimization and Monitoring Identified through the Five Year Review

Recommendation	Corrective Action	Completion Date
Worker protection values used for the SWMU interference process to protect workers need to be updated.	SWMU interference worker protection values to be updated.	August 2014
There are no criteria established for ceasing SVE system operations.	Completion of an SVE Performance Monitoring Plan.	December 2014
Pump and treat system operational priorities should be focused on reducing reliance on injection of treated water back into the perched aquifer.	Proposed changes to the P&T system operational goals and priorities are presented in this report.	June 2014
If more than one extraction well is not operational for an extended period of time at P1PTS, the system cannot meet throughput goals.	Two potential locations identified. EW-81A installed.	June 2013 September 2013
	Design/construction of vault, controls, and connection to the distribution system.	May 2015
Shorten time between amendment injection for the Southeast ISB; monitoring data indicate two years may be too long.	An 18-month schedule has been incorporated into future costs, schedule, and contract.	January 2013
Improvement to the early detection monitoring of Ogallala wells should be considered to ensure continued protection of the Ogallala Aquifer.	Developed Ogallala Aquifer Sampling Improvement Plan.	June 2013
	Development and implementation of Well Maintenance Plan.	January 2014
	Installation of Diverters.	December 2014
	Transition to micropurge sampling method – pilot study in progress.	January 2015
New monitoring well locations and changes in analytes need to be addressed in the LTM Design Report and the SAP.	Changes reflected in LTM Design and SAP.	Submitted in January 2014 and approved in March 2014
A formal well maintenance plan should be finalized to ensure the wells are inspected, maintained, and repaired as necessary.	Well Maintenance Plan completed and implemented.	January 2014
Implement measures to better inform Pantex neighbors of the remedial action.	Updated Community Involvement Plan. Updated neighbor mailing lists. Provided newsletter to Pantex neighbors.	November 2013 December 2013 April 2014

Grey shading indicates tasks that have been completed.

5.3 Recommendations

Pantex recommends continuing operation of the current remedial actions. The groundwater remedies are considered protective for the short-term as untreated perched groundwater use is controlled to prevent human contact and Ogallala Aquifer data continue to indicate no contamination. The pump and treat systems continue to reduce saturated thickness of the perched aquifer and the ISB systems are reducing COC concentrations and are expected to

meet GWPS in the near future. Soil remedies are functioning as designed and performing as expected.

Five Ogallala Aquifer wells had unexpected hexavalent chromium detections in 2013. In all cases, the detections were below the laboratory PQL of 10 ug/L and well below the GWPS of 100 ug/L. It is likely that most of these sporadic detections are related to the lower detection limits and the ability to quantify low-level background detections as all hexavalent chromium detections in 2013 occurred after lower detection limits were achieved in June. Recent data collected by Texas Tech University support the possibility of a low-level hexavalent chromium background in the Ogallala Aquifer in the Texas Panhandle. Therefore, Pantex is pursuing the calculation of a site-specific background for hexavalent chromium. Pantex is currently testing several analytical methods for low-level total chromium and hexavalent chromium and developing a Background Plan, which will be ready for review by August 2014.

Based on issues identified in the Five-Year Review and during completion of this report, several changes are recommended to enhance the effectiveness of the remedies in some areas and to better monitor the effectiveness of the actions. Those recommendations are provided in the following sections.

5.3.1 Recommended Changes to the Pump and Treat Systems

As discussed in the Five Year Review and 2012 Annual Progress Report, injection of treated groundwater into the perched aquifer conflicts with the goal of reducing the saturated thickness of the aquifer and has likely affected nearby COC plumes. Because of these impacts, the pump and treat system operational goals (currently 90% operational time and 90% treatment system design flow) should be revised to emphasize beneficial use of treated water and eventual elimination of injection. Additionally, Pantex recognizes that, over time, the reduction of saturation in the perched aquifer will lead to reduced production of the extraction well field and the inability to meet design flow at the treatment systems.

Based on these constraints, the following prioritized goals were developed for both systems:

Priority 1: 90% plant operational time

Priority 2: No injection at SEPTS, as long as minimum system flow rates (125 gpm to prevent channeling in the GAC vessels) can be maintained in both systems without injection. Since P1PTS can only discharge to the WWTF, injection will be required when flow has been restricted to values less than 250 gpm. When flow to the WWTF is greater than 250 gpm, injection will be suspended and flow will be split between the two systems.

Priority 3: 90% of system capacity, defined as either treatment system or well field, whichever is lower.

5.3.2 Recommended Changes to the ISB Systems

5.3.2.1 Southeast ISB

Since no clear reason for the unexpected conditions in PTX06-1153 has been identified, it is recommended to continue monitoring the water level and analytical data collected in and around the Southeast ISB to continue to attempt to discern groundwater flow patterns. If the line of dry wells north and west of the treatment zone continue to exhibit dry conditions throughout 2014, the installation of a well further to the east may be necessary to both define the extent of the perched groundwater in the area and estimate COC mass flux into the treatment system. If these dry conditions upgradient of the system continue, it may also be necessary to revise the conceptual model and design basis for the system.

5.3.2.2 Zone 11 ISB

In order to address the identified issue of plumes extending north and west of the current treatment zone (Table 5-1), Pantex has secured funding and is planning to expand the Zone 11 ISB system to the northwest. The expansion includes the following components:

- Installation of up to 18 additional injection wells
- Installation of three downgradient ISPM wells
- Installation of four ISPM wells located within the treatment zone (two in the current treatment zone and two in the expansion treatment zone)
- Installation of two upgradient monitoring wells
- Design/construction of a new equipment pad and water line to service the expanded system

The injection well placement will follow the original Design Basis Document for the Zone 11 ISB System (Aquifer Solutions 2008) as well as incorporate two of the wells installed in the area in 2012 for pump testing purposes. Initial amendment injection into the expanded treatment zone will occur in 2015.

As discussed in Section 5.1, it also appears that complete dechlorination may not be occurring due to a lack of the proper bacterial strains in the treatment zone and bioaugmentation is recommended. A bioaugmentation plan was completed in March 2014 and bioaugmentation will be included in the new ISB O&M contract, which is expected to be in place by September 2014. Bioaugmentation for the current treatment zone will most likely take place during the 2015 injection event, depending on availability of funding. However, bioaugmentation for the expanded treatment zone cannot occur until at least 2016 in order to establish the reducing conditions required for DHC.

5.3.3 Recommended Changes to the Monitoring Network

As summarized in Tables 5-1 and 5-2, several changes were recommended to the LTM network in the Five-Year Review or subsequent reports. Most of the changes have been implemented with the exception of two recommendations from the Ogallala Aquifer Sampling Improvement Plan:

- The transition to micropurge sampling for Ogallala Aquifer monitoring wells has not yet occurred. A micropurge pilot study is currently in progress, and if the resulting data evaluation indicates that micropurge sampling improves the detection monitoring program, it is anticipated this change will be implemented starting in CY 2015.
- Planning is currently underway for installing diverters in the three Ogallala Aquifer wells identified in the Plan. Diverters are expected to be in place by December 2014.

5.3.4 Recommended Changes to Soil Remedies

Vegetative loss on landfill covers was identified as an issue in the Draft Final Five-Year Review Report, primarily due to the recent drought conditions in the Texas panhandle. Therefore, Pantex proposed to develop and implement a phased plan to revegetate the landfill covers as outlined in Section 2.3.2. Pantex completed reseeding in 2013 and is now evaluating its effectiveness. Evaluation will continue for several years as the areas were over seeded and the seeds will remain viable for three years. Additional reseeding, if necessary, is scheduled for 2017. See schedule in Section 1.5 and Table 5-1 for details.

The small-scale SVE system continues to remove VOCs from SVE-S-20 and the VOC source area may be slowly decreasing. As discussed in the Five-Year Review and 2012 Annual Progress Report, no expected conditions or path toward closure were defined for the SVE system, other than “significant reduction in soil gas VOCs”. Therefore, Pantex recommended the development of a Burning Ground SVE Performance Monitoring Plan, which will define expected conditions of the system performance as well as a clear path towards an end point of active SVE operations and potential transition to a passive system. The SVE Performance Monitoring Plan is in progress and scheduled for completion in December 2014.

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