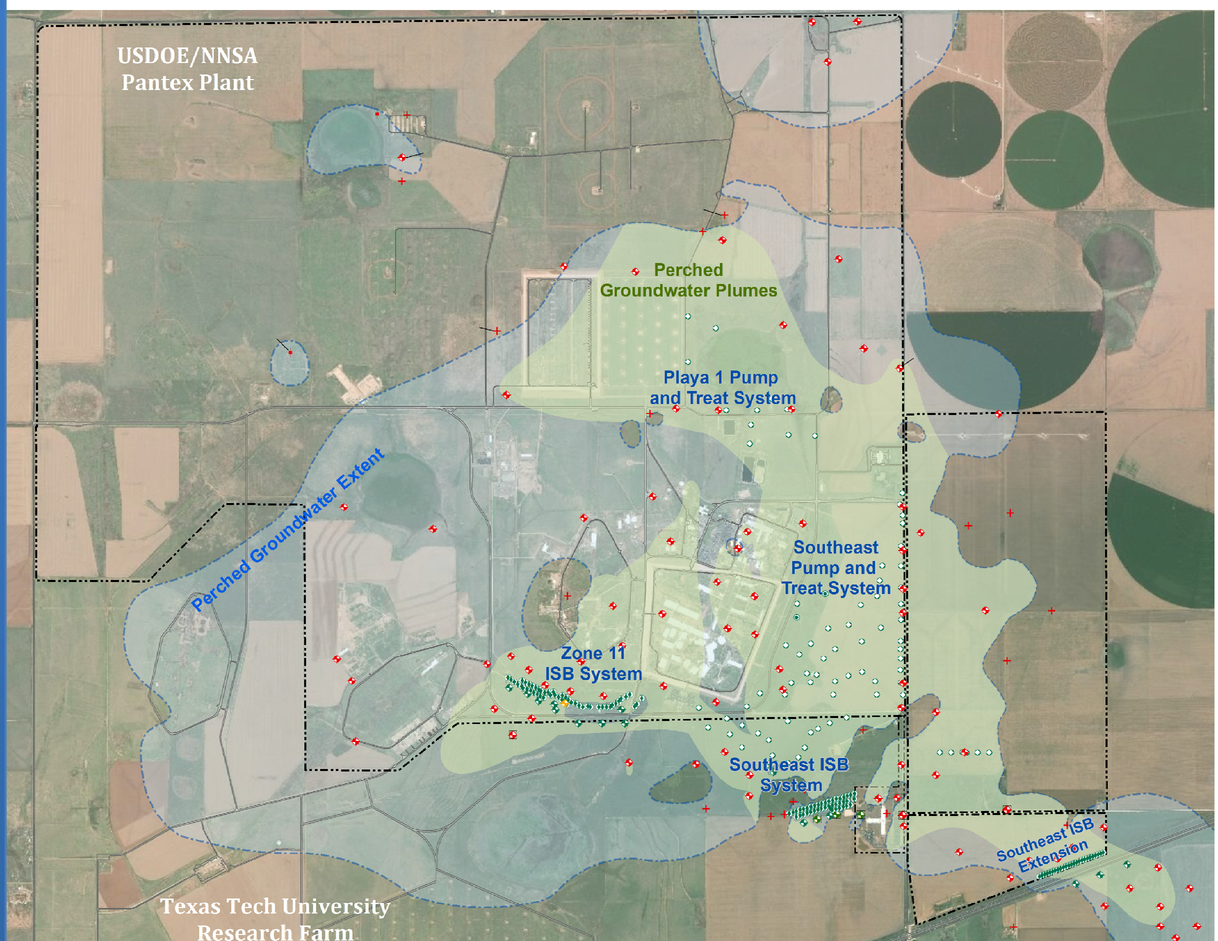
Update to the Long-Term Monitoring System Design Report

For USDOE/NNSA Pantex Plant
Groundwater Remedial Action Progress

Pantex Plant



August 2019

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Update to the Long-Term Monitoring System Design Report
for the U.S. Department of Energy/
National Nuclear Security Administration
Pantex Plant, Amarillo, Texas

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ACRONYMS

B&W Pantex	Babcock & Wilcox Technical Services Pantex, LLC
CERCLA	Comprehensive Environmental Response Compensation and Liability Act
CNS	Consolidated Nuclear Security, LLC
COC	Contaminants of concern
COV	Coefficient of variation
EPA	United States Environmental Protection Agency
GWPS	Groundwater Protection Standard
HGL	HydroGeoLogic, Inc.
IAG	Inter-Agency Agreement
ISB	In Situ Bioremediation
ISPM	In Situ Performance Monitoring
LTM	Long-term monitoring
LTMO	Long-term monitoring optimization
MAROS	Monitoring and Remediation Optimization System
NNSA	National Nuclear Security Administration
POC	Point of Compliance
PQL	Practical quantitation limit
RAO	Remedial Action Objective
RCRA	Resource Conservation and Recovery Act
RDX	Research Development Explosive (cyclo-trimethylene trinitramine)
RFI	RCRA Facility Investigation
ROD	Record of Decision
RRS	Risk Reduction Standard
SEPTS	Southeast Pump and Treat System
TCE	Trichloroethene
TCEQ	Texas Commission on Environmental Quality
USDOE	U.S. Department of Energy
WMG	Waste management group

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1. INTRODUCTION

This report presents proposed modifications to the long-term groundwater monitoring well network that was originally developed in 2009 (Appendix A) and updated in 2014 (Appendix B). The original network was developed using statistical methods, fate and transport modeling, and site-specific knowledge for the evaluation of response actions (corrective/remedial actions) for Pantex Plant and monitoring uncertainties near source areas. The 2014 update was based on an evaluation of the perched aquifer monitoring system and data collected during the first Five-Year Review, as well as updated expected conditions based on changing aquifer conditions. Similarly, this update proposes modifications based on an evaluation of the perched aquifer monitoring system during the second Five-Year Review along with updated expected conditions based on changing aquifer conditions. Contingency actions for unexpected conditions are provided in the *Pantex Plant Ogallala Aquifer and Perched Groundwater Contingency Plan* (CNS, 2019).

Pantex Plant is located on the plains of the Texas Panhandle, 17 miles northeast of Amarillo as shown in Figure 1-1. The Ogallala Aquifer, part of the High Plains aquifer system, is the principal water-bearing unit and provides a primary source of water for the region. Additionally, bodies of perched groundwater above the Ogallala Aquifer occur beneath much of Pantex Plant. Areas of this perched groundwater zone have been contaminated as a result of past wastewater discharges from legacy operations at the facility. Contaminated sites at the surface are separated from groundwater in either the perched zone or the Ogallala Aquifer by a 200- to 500-ft (61- to 153-m) thick unsaturated zone. In areas where perched groundwater is present, a second vadose zone occurs above the Ogallala Aquifer. A full description of the hydrogeology for Pantex is provided in Appendix A.

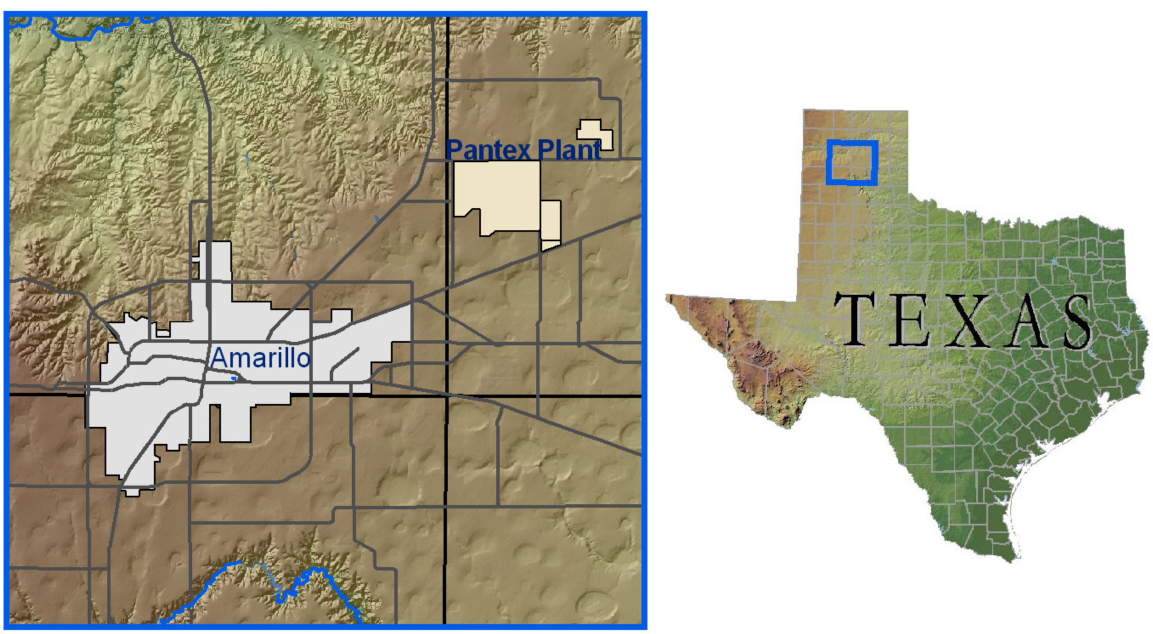

Figure 1-1. Pantex Plant Location Map

The primary purpose of the Long-Term Monitoring (LTM) network is to provide data to determine if Remedial Action Objectives (RAOs) are being achieved. The data collected from the LTM network is evaluated in annual progress reports with a full evaluation of the effectiveness of the response actions in a five-year review. The LTM network is also reevaluated during each Five-Year Review to determine if changes are required to the network or the remedies to meet remedial action objectives presented in the Record of Decision (ROD) (B&W Pantex and Sapere Consulting, 2008).

The perched groundwater monitoring network is designed to monitor plume stability, response action effectiveness, and uncertainty management. The many components of the selected remedy for perched groundwater are intended to work together to create conditions that both stabilize the extent of the plume and remove contaminants. The pump and treat systems in the southeast perched groundwater and the Playa 1 area focus on affecting the hydraulics of the groundwater system, that is groundwater removal as a means of reducing the potential for both vertical and lateral migration of contaminants. With this understanding, the primary metric for success of the pump and treat systems is reduction in perched groundwater thickness, as determined through periodic water level measurements. Routine monitoring for this parameter will provide the basis for determining flow directions, gradients, and saturated thickness. These determinations aid in prediction of plume movement and rate, as well as vertical flux of contaminants. A secondary benefit of the pump and treat systems is contaminant mass removal. Therefore, chemical analytical data are also important in evaluating remedial response effectiveness and the risk posed by the contaminant plumes.

The southeast and Zone 11 in situ treatment systems target contaminant mass removal as a means of cleaning up the perched groundwater and protecting the underlying Ogallala Aquifer from future degradation that could affect its use as a drinking water source. These systems are downgradient of the perched groundwater plumes in the areas that pose the greatest potential for vertical migration to the Ogallala Aquifer. Chemical analyses and parameters associated with redox conditions in perched groundwater provide the most important information for determining the effectiveness of these systems. Evaluation of groundwater chemistry in downgradient wells is used as the metric for the effectiveness of the treatment on the perched groundwater.

1.1. REGULATORY REQUIREMENTS

Long-term monitoring is required to confirm expected future conditions within perched groundwater and the Ogallala Aquifer at Pantex Plant. This plan is being provided in accordance with Article 8.5 of the Interagency Agreement, as part of the Remedial Design Submittal Package, and Provision XI of Hazardous Waste Permit No. 50284. The original was included as part of the Corrective Measures Implementation Work Plan and as part of the Compliance Plan Application for CP-50284 and HW-50284.

Uncertainty management objectives are included in the development of the plan to fulfill conditions of approval for the Resource Conservation and Recovery Act (RCRA) Facility Investigation Reports presented by Texas Commission on Environmental Quality (TCEQ) and United States Environmental Protection Agency (EPA). Long-term monitoring of perched groundwater and the Ogallala Aquifer will result in obtaining data to identify any unknown contaminant migration pathways. Should data be acquired that confirms an unexpected condition, the conceptual site model assumptions would be evaluated to determine the cause and mitigation measures would be assessed and implemented, as necessary, to maintain protection of human health and the environment. Contingency actions for unexpected conditions are presented in the *Pantex Plant Ogallala Aquifer and Perched Groundwater Contingency Plan* (CNS, 2019).

1.2. LONG-TERM MONITORING NETWORK OBJECTIVES

1.2.1 Perched Groundwater

Three objectives were identified for monitoring wells in perched groundwater: Plume Stability, Response Action Effectiveness, and Uncertainty Management. Some of the Response Action Effectiveness wells will be used to satisfy requirements under HW-50284 for Point of Compliance (POC) with the Groundwater Protection Standards (GWPS). Some of the Uncertainty Management Wells will be used to satisfy requirements in the HW-50284 for periodic evaluation of the closest water bearing unit near sources of contamination.

Plume Stability

The purpose of plume stability wells is to determine if impacted areas (plumes) of perched groundwater are expanding and affecting clean perched groundwater and to monitor the changes occurring within the perched plumes. Plume stability wells are located along the edges of the perched plumes where GWPSs are currently being met (note that some areas of perched groundwater are currently impacted above GWPSs to the extent of perched saturation and should show a decline in concentrations over time) and within perched plumes in areas where plumes may be expanding. The focus of monitoring in plume stability wells will be on constituents specific to the plume, Zone, waste management group (WMG), or unit where the well is located. The expected conditions for the plume stability wells are that changes in concentrations of constituents can be identified over time at various locations within and around the plumes.

Response Action Effectiveness

The purpose of response action effectiveness wells is to determine the effectiveness of response measures, indicate when RAOs for perched groundwater have been achieved, and validate modeling results or provide data that can be used to refine modeling. The focus of monitoring in response action effectiveness wells will be on constituents specific to the plume, Zone, WMG, or unit where the well is located. The expected conditions for the response action effectiveness wells are that, over time, indicators of the reduction in volume, toxicity and mobility of constituents will be observed. These indicators may include stable or decreasing concentrations of constituents or declining water levels in areas where response measures have been implemented.

Uncertainty Management

The purpose of uncertainty management wells in perched groundwater is to confirm expected conditions identified in the RCRA Facility Investigations (RFIs) and ensure there are not any deviations, fill potential data gaps, and fulfill LTM requirements for soil units evaluated in a baseline risk assessment.

Uncertainty management wells are located downgradient of risk assessment units, using a Zone or WMG approach, in areas where perched groundwater is the underlying groundwater or downgradient of known source areas, such as the ditches and playas that contributed much of the constituent mass currently found in perched groundwater. Uncertainty management wells will be used to confirm expected conditions for each Zone, WMG, or unit through monitoring.

Some of the Uncertainty Management Wells will also be used to satisfy requirements in the Compliance Plan for periodic evaluation of wells near sources of contamination to ensure that new contamination is not found over time. Pantex recommends this sampling be conducted every 5 years to correspond to the 5-year review and will focus on wells near the source areas.

1.2.2 Ogallala Aquifer

Two objectives were identified for monitoring wells in the Ogallala Aquifer: Early Detection and Uncertainty Management. Specific wells in the Ogallala Aquifer serve as Point of Exposure wells to also satisfy requirements in HW-50284. Some of the Uncertainty Management Wells were used to satisfy requirements in HW-50284 for periodic evaluation of the closest water bearing unit near sources of contamination.

Early Detection

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. Early detection wells are located downgradient of potential source areas, such as impacted areas of perched groundwater, along the edge of the known extent of impacted perched groundwater, and upgradient of potential points of exposure (i.e., the Pantex property boundary). Wells downgradient of potential source areas are located as close to the source area as possible; in some cases these wells must be moved further downgradient because of the risk of creating a migration pathway to the Ogallala Aquifer by drilling through impacted perched groundwater. The focus of monitoring in early detection wells will be on indicator constituents, defined as contaminants of concern (COCs) and degradation products in overlying or upgradient perched groundwater that will most likely be detected following breakthrough to the aquifer. Because of the cleanup actions that have been implemented to protect the Ogallala Aquifer, the expected conditions for the early detection wells are that constituents are not detected above background, the practical quantitation limit (PQL), or GWPSs and that constituents do not reach potential points of exposure above GWPSs.

Uncertainty Management

The purpose of uncertainty management wells in the Ogallala Aquifer is to confirm expected conditions identified in the RFIs and ensure there are not any deviations, fill potential data gaps, and fulfill LTM requirements for soil units closed to Risk Reduction Standard (RRS) 3. Uncertainty management wells will be located downgradient of RRS 3 units, using a Zone or WMG approach, in areas where perched groundwater is not present, or downgradient of potential source areas, such as impacted areas of perched groundwater and along the edge of the known extent of impacted perched groundwater.

Some of the Uncertainty Management Wells were also used to satisfy requirements in the Compliance Plan for periodic evaluation of wells near sources of contamination to ensure that new contamination is not found over time. Pantex recommends this sampling be conducted every 5 years to correspond to the 5-year review and will focus on wells near the source areas.

1.3. CURRENT LONG-TERM MONITORING NETWORK

For the original LTM Network Design (Appendix A) a step-wise approach was developed by the Pantex Core Team:

- Develop monitoring objectives for each water bearing unit,
- Evaluate the existing well networks, and
- Design the final proposed monitoring network.

As outlined in the final 2009 LTM Network Design, monitoring objectives of plume stability, uncertainty management, and response action effectiveness were established for the perched aquifer and uncertainty management and early detection were assigned for the Ogallala Aquifer. Based on these objectives, the final monitoring network was proposed, approved, and implemented by September 2009.

The 2014 LTM Network Update (Appendix B) did not result in changes to the monitoring objectives, monitoring of soil release units, or methods for evaluation of the response actions. The update did result in the following changes to the long-term groundwater monitoring well network:

- Addition of five perched aquifer LTM wells;
- Plugging, abandonment, and replacement of one Ogallala Aquifer LTM Well;
- Conversion of three LTM wells installed downgradient of the Zone 11 In Situ Bioremediation (ISB) system to In Situ Performance Monitoring (ISPM) wells; and
- Adjustment of expected conditions of several perched aquifer monitoring wells based on the effects of remedial actions, as well as changes in water level along the fringes of perched groundwater.

The previous 2014 LTM network consisted of 129 perched aquifer wells and 24 Ogallala wells. A total of 25 new perched aquifer wells have been proposed for addition to the LTM network since 2014, 14 perched aquifer wells have been proposed for removal, including two wells previously plugged and abandoned, and 2 Ogallala aquifer wells that were previously plugged and abandoned have been removed. Table 1-1 summarizes monitoring frequency for wells in the 2014 LTM network and the recommendations in this 2019 LTM System Design Update. The basis and rationale for the proposed changes are provided in Sections 2 and 3 of this update for the perched groundwater and Ogallala Aquifer, respectively.

Table 1-1 Monitoring Frequency and Number of Wells in LTM Network in 2014 and 2019

Monitoring Frequency	2014 LTM Network (Number of Wells)	Recommended 2019 LTM Network (Number of Wells)
Perched Aquifer		
Quarterly	7	0
Semi-Annual	54	54
Annual	33	43
5 Year	7	10
Water Level Only	17	22
Total Perched Aquifer Wells	**118**	**129**
Ogallala Aquifer		
Semi-Annual	22	16
Annual	4	8
Total Ogallala Aquifer Wells	**26**	**24**

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2. PERCHED GROUNDWATER

The primary goal of the LTM network in the perched aquifer is to confirm progress toward RAOs. Data collected from the monitoring network are used to evaluate the performance and efficacy of the remedies and are used to compare actual site conditions to expected conditions. The three primary monitoring objectives for the perched groundwater network are to manage uncertainty, evaluate plume stability, and evaluate remedial efficacy. All monitoring wells are assigned one or more of these monitoring objectives.

This section summarizes the proposed changes to the LTM network for perched groundwater beneath Pantex Plant. The strategy used to develop the original monitoring network has not changed. A quantitative statistical evaluation of the site was conducted using the Monitoring and Remediation Optimization System (MAROS) software. The MAROS results were qualitatively reviewed for consistency with the goals and objectives of the monitoring program and the conceptual site model. Final recommendations for the monitoring network are a combination of the quantitative analysis and qualitative review.

Groundwater plumes in the perched aquifer for the four major COCs, RDX, hexavalent chromium, perchlorate, and TCE, are shown in Figures 2-1 through 2-4, respectively. The site wide LTM network is shown in Figures 2-5 through 2-7.

2.1. EVALUATION OF PERCHED AQUIFER LONG-TERM MONITORING NETWORK

The current groundwater monitoring network and groundwater concentration data were quantitatively evaluated for RAO progress using statistical tools found in the MAROS software by Dr. Mindy Vanderford of HydroGeoLogic, Inc. (HGL) as described in the *Optimization Review Report, Long-Term Monitoring Optimization, Perched Groundwater Unit, July 2017* (Appendix C). MAROS is a decision-support software developed for the Air Force Center for Engineering and the Environment to assist in formulating cost-effective long-term groundwater monitoring plans. MAROS optimizes an existing ground water monitoring program using both temporal and spatial data analyses to determine the locations and frequency of sampling for future compliance monitoring at the site.

Recommendations for perched groundwater sampling frequency and location are based on current hydrogeologic conditions and defined LTM goals for the system. These recommendations have been developed based on the technical review, balancing both the statistical results from MAROS with goals of the monitoring system and anticipated site management decisions.

2.1.1 Perched Aquifer Long-Term Monitoring Goals and Objectives

The goal of the long-term monitoring optimization (LTMO) process is to review the current groundwater monitoring program and provide recommendations for improving the efficiency and accuracy of the network in supporting monitoring objectives. Specifically, the LTMO process provides information on site characterization, plume stability, sufficiency and redundancy of monitoring locations, and the appropriate frequency of network sampling. The end product of the LTMO process at Pantex Plant is a recommendation for specific sampling locations and frequencies that best address site monitoring goals and objectives while minimizing time and expense associated with collecting and interpreting analytical data.

2.1.2 Results

The monitoring system for perched groundwater was evaluated using analytical and hydrogeologic data collected between 2012 and 2016; analytical data from the previous LTM investigations (2000 through 2011) were used to supplement analyses of long-term trends. For the MAROS analysis, perched groundwater was divided into three sectors based on the direction of groundwater flow, source areas, and major constituents associated with each sector. Investigation wells were grouped into networks according to the defined sectors.

The Southeast Sector monitoring network consists of wells in perched groundwater extending south from Playa 1 to the eastern and southern extent of perched groundwater including Zone 12. The Southwest Sector monitoring network includes and extends west and south of Zone 11. Investigation wells south of Zone 12 were included in both the Southwest and Southeast Sector spatial analyses to account for possible variability in groundwater flow. The North Sector includes groundwater north of Zones 11 and 12 in the vicinity of Playa 1.

Pantex Plant perched groundwater levels and analytical data were evaluated to produce the following general recommendations for monitoring:

- At least one additional monitoring well in the far southeastern area of the perched unit with additional wells to define the extent of the plume and the saturated zone. (Note that Pantex has installed 16 wells in this area since 2017 to define and track the movement of the RDX plume in the far southeast extent of perched groundwater).
- At least one additional monitoring well for the area downgradient from PTX06-1035 and downgradient and west of PTX06-1134 to delineate the leading edge of the TCE and perchlorate plumes.
- Overall, rates of concentration change are low for most locations and reduction in monitoring frequency from annual to biennial (every two years) monitoring is recommended based on the MAROS analysis. However, early warning of changing conditions and collection of a statistically significant dataset are high priorities for the site so an overall annual sampling frequency is recommended for most locations. Semi-annual sampling is recommended at wells used to evaluate the ISB and Southeast Pump and Treat System (SEPTS) remedies and potential plume migration along the east and southeast edges of the perched unit. Perched groundwater in the Burning Ground and northern boundary are recommended for 5-year sampling frequency except for POC wells that are recommended for annual sampling.

The proposed implementation of the MAROS recommendations in the perched groundwater LTM network is discussed in detail by indicator area in the following sections. The proposed changes meet or exceed all sampling frequencies recommended in the MAROS evaluation.

2.2. MONITORING RECOMMENDATIONS FOR INDICATOR AREAS

The proposed LTM network is shown in Table 2-1 and Figure 2-8. The indicator areas described in the following sections are shown on Figure 2-9. The recommended sampling frequencies for all perched aquifer wells are shown on Figure 2-10. Proposed changes to the LTM network include:

- Twenty-three new wells installed since the 2014 update are recommended for addition to the LTM network. Seventeen of these wells were installed to define and track the movement of the RDX plume in the far southeast extent of perched groundwater. Five wells were installed to monitor plumes emanating from Zone 11, and one well was installed to monitor hexavalent chromium in the southeast area.

- Two additional new wells (PTX060-1207 and PTX06-1208) are proposed for this 2019 Update.
- Reduced monitoring frequency in 41 LTM wells.
- Water level (WL) monitoring only for nine wells in which water levels have declined as expected and are below the bottom of the screen.
- Removal of 14 wells from the LTM network. Two wells (PTX01-1002 and PTX06-1124) were previously plugged and abandoned with regulatory approval, and the remaining 12 wells are dry, do not provide useful data, or are redundant with other wells.

2.2.1 Southeast Indicator Area

The Southeast indicator area extends from Playa 1 to the south and southeast including most of Zone 12 (Figure 2-9). The Southeast indicator area encompasses the SEPTS, the Southeast ISB System, and the Southeast ISB Extension. A total of 77 perched aquifer LTM wells are located in this indicator area. Along the eastern edge of the Southeast indicator area are five wells that generally establish the extent of the perched zone. These wells are either dry or have water levels below the screened interval and are monitored for water level only.

The central section of the Southeast indicator area includes 21wells that monitor the mid-plume area (Figures 2-8 and 2-9). These wells have gradually declining water levels and COCs (RDX and breakdown products) above the GWPS. The long-term RDX trend since the start of remedial action is decreasing in these wells. The monitoring frequency in most of these mid-plume wells is semi-annual.

The southern portion of the Southeast indicator area includes a grouping of LTM wells associated with the Southeast ISB (Figure 2-12). These wells are on the fringe of the perched saturated zone. The water levels in most of these wells are just above or just below the bottom of the screened interval; COCs are present in concentrations greater than the GWPS except in downgradient wells demonstrating treatment. Figure 2-13 shows the wells associated with the Southeast ISB Extension in the far southeast area of perched groundwater.

Recommended changes in LTM monitoring for the Southeast indicator area include:

- Addition of 17 monitoring wells installed since 2016 in the far southeast extent of perched groundwater. Eleven of these wells (PTX06-1182, PTX06-1185, PTX06-1190, PTX06-1192, PTX06-1197, PTX06-1199, PTX06-1200, PTX06-1201, PTX06-1202, PTX06-1203, and PTX06-1204) are recommended for semi-annual monitoring for at least the next five years to develop a solid baseline of information for this area. Three wells, PTX06-1191, PTX06-1194, and PTX06-1196, have been designated as ISB performance monitoring wells for the Southeast ISB Extension and are proposed for semi-annual monitoring. One well, PTX06-1195, is proposed for annual monitoring because it is located outside the extent of COCs and is not downgradient of the plume. The remaining wells, PTX06-1184 and PTX06-1193, are dry[1] and are recommended for water level monitoring only.

[1] PTX06-1184 has consistently had less than about one foot of water above the bottom of the screen; however, the measured water level is below the top of FGZ at this location. Therefore, the well is considered to be dry.

- Addition of PTX06-1183, located within the hexavalent chromium plume south of Zone 12. This well is proposed for semi-annual monitoring.

- Monitoring frequency reduced from semi-annual to annual in 18 wells (PTX06-1002A, PTX06-1010, PTX06-1015, PTX06-1023, PTX06-1030, PTX06-1038, PTX06-1039A, PTX06-1045, PTX06-1053, PTX06-1098, PTX06-1103, PTX06-1120, PTX06-1130, PTX06-1166, PTX06-1193, PTX06-1195, PTX08-1002, and PTX08-1009). This reduction in frequency is recommended because the COC concentration trends in these wells can be adequately assessed on an annual basis.

- Monitoring frequency reduced from quarterly to semi-annual in two wells (PTX06-1153 and PTX06-1154). This reduction in frequency is recommended because the COC concentration trends in these wells can be adequately assessed on a semi-annual basis.

- Water level monitoring only in five wells (PTX06-1036, PTX06-1102, PTX06-1121, PTX06-1135, PTX06-1167). This change is recommended because four of these wells have been dry for 5 years or longer. The remaining well, PTX06-1135, exhibited steadily declining water levels since 2009 and has been dry since 2018.

- Removal of six wells from the LTM system (PTX06-1003, PTX06-1094, PTX06-1100, PTX06-1118, PTX06-1119, PTX06-1124). Four of these wells have been dry for several years and are redundant with other wells for verifying the presence or absence of perched groundwater. One well, PTX06-1124, was plugged and abandoned in 2016 with regulatory approval. The remaining well, PTX06-1100, was installed as part of the ISB Pilot System and is redundant with PTX06-1098 and PTX06-1101.

- Installation of one new well, PTX06-1207, proposed to monitor hexavalent chromium and perchlorate downgradient of PTX06-1183 near the extent of perched saturation.

2.2.2 Zone 11 Indicator Area

The Zone 11 indicator area is centered on the Pantex Zone 11 operational area and extends northeast along the ditches to Playa 1 and to the southeast and southwest in the directions of groundwater flow from the southern part of Zone 11. The Zone 11 indicator area has been expanded to the east and southeast from previous TLM design reports based on the westward shift in the perched groundwater flow divide. The flow divide represents the change in perched groundwater flow direction from generally southeast to generally southwest. Historically, this flow divide was generally located between Zones 11 and 12, but in recent years the divide has shifted westward in response to declining water levels in the areas east and southeast of Zone 12 resulting from operation of the SEPTS. The indicator area includes 34 existing LTM wells and one proposed new monitor well (Figure 2-9). ISB injection and monitoring wells are located south of Zone 11 (Figure 2-11).

The northern portion of the Zone 11 indicator area is influenced by Playa 1. Two wells near the playa (PTX07-1P02 and PTX08-1001) have exhibited increasing water levels over the past 2 years. The recent water level rise is attributed to above normal precipitation during the spring and summer of 2016 and again in the summers of 2017 and 2018 that filled the playas. In addition, a break at the irrigation system filter bank caused all of the water from the wastewater treatment facility to be routed to Playa 1 after June 2017 in accordance with TCEQ Permit #WQ00002296000. The irrigation system break also affected operation and throughput of both pump and treat systems because of restricted flow to the wastewater treatment facility.

Recommended changes in LTM monitoring for the Zone 11 indicator area are:

- Addition of five monitoring wells installed since 2014 in the downgradient area southwest of Zone 11. Three wells, PTX06-1173, PTX06-1174, and PTX06-1175, have been designated as ISB performance monitoring wells for the Zone 11 ISB and are proposed for semi-annual monitoring. One well, PTX06-1171, is located upgradient of the Zone 11 ISB system and is proposed for annual monitoring. One well, PTX06-1180, is located near the downgradient western extent of the TCE plume and is proposed for semi-annual monitoring.

- Monitoring frequency reduced from quarterly to semi-annual in five ISB performance monitoring wells (PTX06-1148, PTX06-1149, PTX06-1150, PTX06-1155, PTX06-1156). This reduction in frequency is recommended because the ISB remedy in now well-established, and a semi-annual frequency provides sufficient data to monitor changing conditions downgradient of the ISB treatment zone and inform remedial decision making.

- Monitoring frequency reduced from semi-annual to annual in three monitoring wells (1114-MW4, PTX07-1P02, PTX08-1005). This reduction in frequency is recommended because the COC concentration trends in these wells can be adequately assessed on an annual basis.

- Water level monitoring only in one well, PTX07-1P05, because this well has been dry for more than five years.

- Remove the uncertainty management monitoring objective from two wells, PTX06-1126 and PTX06-1127, because these wells are not immediately downgradient of or near to soil source areas.

- Installation of one new well, PTX06-1208, proposed to define the extent of perchlorate and TCE in the area southwest of Zone 11. This well is proposed for semi-annual monitoring.

2.2.3 North Indicator Area

The North indicator area is generally the area north of Playa 1 and includes seven LTM wells. Recommended changes in LTM monitoring in the North indicator area are:

- Reduce monitoring frequency from semi-annual to annual in two wells (PTX06-1050 and PTX07-1O02). This change is recommended because the COC concentration trends in these wells can be adequately assessed on an annual basis.
- Water level monitoring only for two wells (PTX06-1136, PTX07-1O01) that have been dry for the past four years.
- Removal of one well, PTX07-1O06, from the LTM network. This well has been dry for more than five years and adequate monitoring of any localized changes to the perched zone is provided by the three other LTM wells in this area.

2.2.4 Burning Ground

A small body of perched groundwater is present beneath the Burning Ground; four LTM wells are used to monitor this area. Recommended changes in LTM monitoring in the Burning Ground area are:

- Reduce monitoring frequency from semi-annual to annual in two wells (PTX01-1001 and PTX01-1008). This change is recommended because COC concentrations in these wells have been below GWPS or non-detect for 15 years.

- Removal of one well, PTX01-1002, from the LTM network. This well was plugged and abandoned in 2017 with regulatory approval.

2.2.5 Miscellaneous Areas

The Miscellaneous area includes wells near Zone 10, Playa 2, Pantex Lake, and the Old Sewage Treatment Plant and includes 13 LTM wells. Recommended changes in LTM monitoring in the Miscellaneous area are:

- Reduce monitoring frequency from annual to five years in five wells (PTX04-1002, PTX06-1085, PTX06-1086, PTX07-1Q01, and PTX07-1Q02). This change is recommended because COC concentrations have been non-detect or below GWPS in all samples for at least ten years in each of these wells.

- Reduce monitoring frequency from semi-annual to annual in two wells (PTX06-1049 and PTX06-1131). This change is recommended because the COC concentration trends in these wells can be adequately assessed on an annual basis.

- Remove the uncertainty management monitoring objective from two wells, PTX06-1049 and PTX06-1097, because these wells are not immediately downgradient of or near soil source areas. In addition, PTX06-1097 has been dry since it was installed in 2005.

- Removal of six wells from the LTM system (PTX04-1001, PTX06-1055, PTX06-1080, PTX06-1081, PTX06-1096A, PTX07-1Q03).

    - Three of these wells, PTX04-1001, PTX06-1080, and PTX06-1081, are located in the northeast corner of the Plant at the Old Sewage Treatment Plant area. No COCs have ever been detected above GWPS in these wells based on data collected since 1998, 2002, and 2002, respectively. Three wells (PTX04-1002, PTX06-1071, and PTX08-1010), located near the source areas, have been retained in the LTM network.

    - PTX07-1Q03 is located north of Zone 10 upgradient of LTM wells PTX07-1Q01 and PTX07-1Q02. COC concentrations have been non-detect or below GWPS for at least ten years in this well. This well is proposed for removal because it is redundant with the other wells in this area.

    - PTX06-1055 and PTX06-1096A are both dry wells; adequate monitoring of any changes to the perched zone in this area is provided by PTX06-1097.

Table 2-1. Proposed Long-Term Monitoring Network for Perched Groundwater

Indicator Area[1]	Well ID	LTM Objectives	Progress Report Metrics	Expected Condition	Indicator List[2] Monitoring Frequency	Modified Appendix IX Monitoring (5-Year Frequency)[3]
Zone 11	1114-MW4	Uncertainty Management	Trend/Compare to GWPS	Long-term decreasing trend	Annual	Y
North	OW-WR-38	Uncertainty Management, Response Action Effectiveness	Water Level, Trend/Compare to GWPS	Decreasing water levels, Long-term stabilization of concentrations	Annual	Y
Burning Ground	PTX01-1001	Uncertainty Management	Trend/Compare to GWPS	Stable or decreasing trend below GWPS	Annual	Y
Burning Ground	PTX01-1004	Plume Stability	Dry	Remain dry	WL[4]	N
Burning Ground	PTX01-1008	Uncertainty Management	Compare to GWPS	Below background/PQL and GWPS	Annual	Y
Burning Ground	PTX01-1009	Plume Stability	Dry	Remain dry	WL	N
Miscellaneous	PTX04-1002	Uncertainty Management	Trend/Compare to GWPS	Stable or decreasing trend below GWPS	5 Yrs	Y
Southeast	PTX06-1002A	Uncertainty Management, Response Action Effectiveness	Water Level, Trend/Compare to GWPS	Decreasing water levels, Long-term stabilization of concentrations	Annual	Y
Southeast	PTX06-1005	Uncertainty Management, Response Action Effectiveness	Water Level, Trend/Compare to GWPS	Decreasing water levels, Long-term stabilization of concentrations	Semi-Annual	Y
Zone 11	PTX06-1006	Plume Stability	Trend/Compare to GWPS	Long-term decreasing trend	Annual	N
Zone 11	PTX06-1007	Uncertainty Management	Trend/Compare to GWPS	Long-term decreasing trend	Annual	Y
Southeast, Zone 11	PTX06-1008	Uncertainty Management	Trend/Compare to GWPS	Long-term decreasing trend	Annual	Y
Southeast	PTX06-1010	Uncertainty Management	Trend/Compare to GWPS	Long-term decreasing trend	Annual	Y
Southeast, Zone 11	PTX06-1011	Uncertainty Management	Trend/Compare to GWPS	Stable or decreasing trend below GWPS	Annual	Y
Zone 11	PTX06-1012	Plume Stability, Response Action Effectiveness	Trend/Compare to GWPS	Below GWPS in 2–5 years	Semi-Annual	N
Southeast	PTX06-1013	Response Action Effectiveness	Water Level, Trend/Compare to GWPS	Decreasing water levels, Long-term stabilization of concentrations	Annual	N
Southeast	PTX06-1014	Response Action Effectiveness	Water Level, Trend/Compare to GWPS	Decreasing water levels, Long-term stabilization of concentrations	Annual	N
Southeast	PTX06-1015	Response Action Effectiveness	Water Level, Trend/Compare to GWPS	Decreasing water levels, Long-term stabilization of concentrations	Annual	N
Southeast	PTX06-1023	Response Action Effectiveness	Water Level, Trend/Compare to GWPS	Decreasing water levels, Long-term stabilization of concentrations	Annual	N
Southeast	PTX06-1030	Response Action Effectiveness	Trend/Compare to GWPS	Long-term stabilization of concentrations	Annual	N
Southeast	PTX06-1031	Response Action Effectiveness	Trend/Compare to GWPS	Long-term stabilization of concentrations	Semi-Annual	N
Southeast	PTX06-1034	Plume Stability, Response Action Effectiveness	Trend/Compare to GWPS	Long-term stabilization of concentrations	Semi-Annual	N
Zone 11	PTX06-1035	Plume Stability	Trend/Compare to GWPS	Stable or decreasing trend below GWPS	Semi-Annual	N
Southeast	PTX06-1036	Plume Stability	Trend/Compare to GWPS	Stable or decreasing trend below GWPS	WL	N
Southeast	PTX06-1037	Response Action Effectiveness	Trend/Compare to GWPS	Below GWPS in 2–5 years	Semi-Annual	N
Southeast	PTX06-1038	Response Action Effectiveness	Water Level, Trend/Compare to GWPS	Decreasing water levels, Long-term stabilization of concentrations	Annual	N
Southeast	PTX06-1039A	Response Action Effectiveness	Water Level, Trend/Compare to GWPS	Decreasing water levels, Long-term stabilization of concentrations	Annual	N
Southeast	PTX06-1040	Response Action Effectiveness	Water Level, Trend/Compare to GWPS	Decreasing water levels, Long-term stabilization of concentrations	Semi-Annual	N
Southeast	PTX06-1041	Response Action Effectiveness	Water Level, Trend/Compare to GWPS	Decreasing water levels, Long-term stabilization of concentrations	Semi-Annual	N
Southeast	PTX06-1042	Response Action Effectiveness	Water Level, Trend/Compare to GWPS	Decreasing water levels, Long-term stabilization of concentrations	Semi-Annual	N
Southeast	PTX06-1045	Response Action Effectiveness	Water level, Trend/Compare to GWPS	Limited water, Below GWPS in 2–5 years	Annual	N
Southeast	PTX06-1046	Response Action Effectiveness	Water Level, Trend/Compare to GWPS	Decreasing water levels, Long-term stabilization of concentrations	Semi-Annual	N

Indicator Area[1]	Well ID	LTM Objectives	Progress Report Metrics	Expected Condition	Indicator List[2] Monitoring Frequency	Modified Appendix IX Monitoring (5-Year Frequency)[3]
Southeast	PTX06-1047A	Response Action Effectiveness	Water Level, Trend/Compare to GWPS	Decreasing water levels, Long-term stabilization of concentrations	Semi-Annual	N
North	PTX06-1048A	Plume Stability, Response Action Effectiveness	Trend/Compare to GWPS	Stable or decreasing trend below GWPS	Annual	N
Miscellaneous	PTX06-1049	Plume Stability	Trend/Compare to GWPS	Long-term stabilization of concentrations	Annual	N
North	PTX06-1050	Uncertainty Management, Response Action Effectiveness	Water Level, Trend/Compare to GWPS	Decreasing water levels, Long-term stabilization of concentrations	Annual	N
Southeast	PTX06-1051	Plume Stability	Dry	Remain dry	WL	N
Southeast	PTX06-1052	Response Action Effectiveness	Water Level, Trend/Compare to GWPS	Decreasing water levels, Long-term stabilization of concentrations	Semi-Annual	N
Southeast, Zone 11	PTX06-1053	Plume Stability, Uncertainty Management	Trend/Compare to GWPS	Stable or decreasing trend below GWPS	Annual	N
Southeast	PTX06-1069	Plume Stability	Trend/Compare to GWPS	Stable or decreasing trend below GWPS	Annual	N
Miscellaneous	PTX06-1071	Uncertainty Management	Compare to GWPS	Below background/PQL and GWPS	5 Yrs	Y
Zone 11	PTX06-1073A	Uncertainty Management	Water Level, Trend/Compare to GWPS	Limited water, Long-term stabilization of concentrations	WL	N
Zone 11	PTX06-1077A	Uncertainty Management	Trend/Compare to GWPS	Stable or decreasing trend below GWPS	Annual	Y
Miscellaneous	PTX06-1082	Uncertainty Management	Compare to GWPS	Below background/PQL and GWPS	5 Yrs	Y
Miscellaneous	PTX06-1083	Uncertainty Management	Trend/Compare to GWPS	Stable or decreasing trend below GWPS	5 Yrs	Y
Miscellaneous	PTX06-1085	Uncertainty Management	Compare to GWPS	Below background/PQL and GWPS	5 Yrs	Y
Miscellaneous	PTX06-1086	Uncertainty Management	Compare to GWPS	Below background/PQL and GWPS	5 Yrs	Y
Southeast	PTX06-1088	Uncertainty Management, Response Action Effectiveness	Water Level, Trend/Compare to GWPS	Decreasing water levels, Long-term stabilization of concentrations	Semi-Annual	Y
Southeast	PTX06-1089	Plume Stability	Dry	Remain dry	WL	N
Southeast	PTX06-1090	Plume Stability	Dry	Remain dry	WL	N
Southeast	PTX06-1091	Plume Stability	Dry	Remain dry	WL	N
Southeast	PTX06-1093	Plume Stability	Dry	Remain dry	WL	N
Southeast	PTX06-1095A	Uncertainty Management, Response Action Effectiveness	Water Level, Trend/Compare to GWPS	Decreasing water levels, Long-term stabilization of concentrations	Semi-Annual	N
Miscellaneous	PTX06-1097	Plume Stability	Dry	Remain dry	WL	N
Southeast	PTX06-1098	Response Action Effectiveness	Water Level, Trend/Compare to GWPS	Long-term stabilization of concentrations	Annual	N
Southeast	PTX06-1101	Response Action Effectiveness	Water Level, Trend/Compare to GWPS	Long-term stabilization of concentrations	Annual	N
Southeast	PTX06-1102	Response Action Effectiveness	Water Level, Trend/Compare to GWPS	Decreasing water levels, Long-term stabilization of concentrations	WL	N
Southeast	PTX06-1103	Response Action Effectiveness	Water Level, Trend/Compare to GWPS	Limited water, Long-term stabilization of concentrations	Annual	N
Southeast	PTX06-1120	Plume Stability	Water Level, Trend/Compare to GWPS	Limited water, Long-term stabilization of concentrations	Annual	N
Southeast	PTX06-1121	Plume Stability	Dry	Remain dry	WL	N
Southeast	PTX06-1122	Plume Stability	Dry	Remain dry	WL	N
Southeast	PTX06-1123	Response Action Effectiveness	Trend/Compare to GWPS	Below GWPS in 2–5 years	Semi-Annual	N
Southeast	PTX06-1125	Plume Stability	Dry	Remain dry	WL	N
Zone 11	PTX06-1126	Plume Stability	Trend/Compare to GWPS	Long-term decreasing trend	Semi-Annual	N
Zone 11	PTX06-1127	Plume Stability	Trend/Compare to GWPS	Long-term decreasing trend	Semi-Annual	N

Indicator Area[1]	Well ID	LTM Objectives	Progress Report Metrics	Expected Condition	Indicator List[2] Monitoring Frequency	Modified Appendix IX Monitoring (5-Year Frequency)[3]
Southeast	PTX06-1130	Response Action Effectiveness	Water Level, Trend/Compare to GWPS	Decreasing water levels, Long-term stabilization of concentrations	Annual	N
Miscellaneous	PTX06-1131	Uncertainty Management	Compare to GWPS	Below background/PQL and GWPS	Annual	Y
Southeast	PTX06-1133A	Plume Stability	Water Level, Trend/Compare to GWPS	Limited water, Long-term stabilization of concentrations	Semi-Annual	N
Zone 11	PTX06-1134	Plume Stability	Trend/Compare to GWPS	Long-term decreasing trend	Semi-Annual	N
Southeast	PTX06-1135	Plume Stability	Trend/Compare to GWPS	Long-term decreasing trend	WL	N
North	PTX06-1136	Plume Stability	Trend/Compare to GWPS	Long-term decreasing trend	WL	N
Southeast	PTX06-1146	Plume Stability	Trend/Compare to GWPS	Long-term decreasing trend	Semi-Annual	N
Southeast	PTX06-1147	Plume Stability	Trend/Compare to GWPS	Long-term decreasing trend	Semi-Annual	N
Zone 11	PTX06-1148	Response Action Effectiveness	Trend/Compare to GWPS	Below GWPS in 5 -10 years	Semi-Annual	N
Zone 11	PTX06-1149	Response Action Effectiveness	Trend/Compare to GWPS	Below GWPS in 5 -10 years	Semi-Annual	N
Zone 11	PTX06-1150	Response Action Effectiveness	Trend/Compare to GWPS	Below GWPS in 5 -10 years	Semi-Annual	N
Zone 11	PTX06-1151	Plume Stability	Trend/Compare to GWPS	Long-term decreasing trend	Semi-Annual	N
Southeast	PTX06-1153	Response Action Effectiveness	Trend/Compare to GWPS	Below GWPS in 2–5 years	Semi-Annual	N
Southeast	PTX06-1154	Response Action Effectiveness	Trend/Compare to GWPS	Below GWPS in 2–5 years	Semi-Annual	N
Zone 11	PTX06-1155	Response Action Effectiveness	Trend/Compare to GWPS	Below GWPS in 2–5 years	Semi-Annual	N
Zone 11	PTX06-1156	Response Action Effectiveness	Trend/Compare to GWPS	Below GWPS in 2–5 years	Semi-Annual	N
Southeast	PTX06-1158	Plume Stability	Water Level, Trend/Compare to GWPS	Limited water, Long-term stabilization of concentrations	WL	N
Zone 11	PTX06-1159	Plume Stability	Trend/Compare to GWPS	Long-term decreasing trend	Semi-Annual	N
Zone 11	PTX06-1160	Plume Stability	Trend/Compare to GWPS	Long-term decreasing trend	Semi-Annual	N
Southeast	PTX06-1166	Plume Stability	Trend/Compare to GWPS	Long-term stabilization of concentrations	Annual	N
Southeast	PTX06-1167	Response Action Effectiveness	Trend/Compare to GWPS	Long-term stabilization of concentrations	WL	N
Zone 11	PTX06-1171	Plume Stability	Trend/Compare to GWPS	Long-term decreasing trend	Annual	N
Zone 11	PTX06-1173	Response Action Effectiveness	Trend/Compare to GWPS	Below GWPS in 2 – 5 years	Semi-Annual	N
Zone 11	PTX06-1174	Response Action Effectiveness	Trend/Compare to GWPS	Below GWPS in 2 – 5 years	Semi-Annual	N
Zone 11	PTX06-1175	Response Action Effectiveness	Trend/Compare to GWPS	Below GWPS in 2- 5 years	Semi-Annual	N
Zone 11	PTX06-1180	Plume Stability	Trend/Compare to GWPS	Long-term decreasing trend	Semi-Annual	N
Southeast	PTX06-1182	Plume Stability	Trend/Compare to GWPS	Long-term decreasing trend	Semi-Annual	N
Southeast	PTX06-1183	Plume Stability	Trend/Compare to GWPS	Long-term decreasing trend	Semi-Annual	N
Southeast	PTX06-1184	Plume Stability	Dry	Remain dry	WL	N
Southeast	PTX06-1185	Plume Stability	Trend/Compare to GWPS	Long-term decreasing trend	Semi-Annual	N
Southeast	PTX06-1190	Plume Stability	Trend/Compare to GWPS	Long-term decreasing trend	Semi-Annual	N
Southeast	PTX06-1191	Response Action Effectiveness, Plume Stability	Trend/Compare to GWPS	Below GWPS in 2 – 5 years	Semi-Annual	N
Southeast	PTX06-1192	Plume Stability	Trend/Compare to GWPS	Below background/PQL and GWPS	Semi-Annual	N

Indicator Area[1]	Well ID	LTM Objectives	Progress Report Metrics	Expected Condition	Indicator List[2] Monitoring Frequency	Modified Appendix IX Monitoring (5-Year Frequency)[3]
Southeast	PTX06-1193	Plume Stability	Dry	Remain dry	WL	N
Southeast	PTX06-1194	Response Action Effectiveness, Plume Stability	Trend/Compare to GWPS	Below GWPS in 2 – 5 years	Semi-Annual	N
Southeast	PTX06-1195	Plume Stability	Trend/Compare to GWPS	Below background/PQL and GWPS	Annual	N
Southeast	PTX06-1196	Response Action Effectiveness, Plume Stability	Trend/Compare to GWPS	Below GWPS in 2 – 5 years	Semi-Annual	N
Southeast	PTX06-1197	Plume Stability	Trend/Compare to GWPS	Long-term decreasing trend	Semi-Annual	N
Southeast	PTX06-1199	Plume Stability	Trend/Compare to GWPS	Long-term decreasing trend	Semi-Annual	N
Southeast	PTX06-1200	Plume Stability	Trend/Compare to GWPS	Below background/PQL and GWPS	Semi-Annual	N
Southeast	PTX06-1201	Plume Stability	Trend/Compare to GWPS	Long-term decreasing trend	Semi-Annual	N
Southeast	PTX06-1202	Plume Stability	Trend/Compare to GWPS	Long-term decreasing trend	Semi-Annual	N
Southeast	PTX06-1203	Plume Stability	Trend/Compare to GWPS	Long-term decreasing trend	Semi-Annual	N
Southeast	PTX06-1204	Plume Stability	Trend/Compare to GWPS	Below background/PQL and GWPS	Semi-Annual	N
Southeast	PTX06-1207	Plume Stability	Trend/Compare to GWPS	Long-term decreasing trend	Semi-Annual	N
Zone 11	PTX06-1208	Plume Stability	Trend/Compare to GWPS	Long-term decreasing trend	Semi-Annual	N
North	PTX07-1O01	Plume Stability, Uncertainty Management, Response Action Effectiveness	Trend/Compare to GWPS	Long-term decreasing trend	WL	N
North	PTX07-1O02	Plume Stability, Uncertainty Management, Response Action Effectiveness	Trend/Compare to GWPS	Long-term decreasing trend	Annual	Y
North	PTX07-1O03	Plume Stability, Uncertainty Management, Response Action Effectiveness	Trend/Compare to GWPS	Long-term decreasing trend	Annual	Y
Zone 11	PTX07-1P02	Uncertainty Management	Trend/Compare to GWPS	Stable or decreasing trend below GWPS	Annual	Y
Zone 11	PTX07-1P05	Uncertainty Management	Trend/Compare to GWPS	Stable or decreasing trend below GWPS	WL	N
Miscellaneous	PTX07-1Q01	Uncertainty Management	Compare to GWPS	Below background/PQL and GWPS	5 Yrs	Y
Miscellaneous	PTX07-1Q02	Uncertainty Management	Compare to GWPS	Below background/PQL and GWPS	5 Yrs	Y
Miscellaneous	PTX07-1R03	Uncertainty Management	Compare to GWPS	Below background/PQL and GWPS	5 Yrs	Y
Zone 11	PTX08-1001	Uncertainty Management, Response Action Effectiveness	Water Level, Trend/Compare to GWPS	Decreasing water levels, Long-term stabilization of concentrations	Annual	Y
Southeast	PTX08-1002	Uncertainty Management, Response Action Effectiveness	Water Level, Trend/Compare to GWPS	Decreasing water levels, Long-term stabilization of concentrations	Annual	Y
Zone 11	PTX08-1003	Plume Stability	Trend/Compare to GWPS	Stable or decreasing trend below GWPS	Annual	N
Zone 11	PTX08-1005	Uncertainty Management	Trend/Compare to GWPS	Long-term decreasing trend	Annual	Y
Zone 11	PTX08-1006	Uncertainty Management	Trend/Compare to GWPS	Long-term decreasing trend	Semi-Annual	Y
Southeast, Zone 11	PTX08-1007	Uncertainty Management	Trend/Compare to GWPS	Long-term decreasing trend	Annual	Y
Southeast, Zone 11	PTX08-1008	Uncertainty Management, Response Action Effectiveness	Water Level, Trend/Compare to GWPS	Decreasing water levels, Long-term stabilization of concentrations	Semi-Annual	Y
Southeast	PTX08-1009	Uncertainty Management, Response Action Effectiveness	Water Level, Trend/Compare to GWPS	Decreasing water levels, Long-term stabilization of concentrations	Annual	Y
Miscellaneous	PTX08-1010	Uncertainty Management	Trend/Compare to GWPS	Stable or decreasing trend below GWPS	5 Yrs	Y
Southeast, Zone 11	PTX10-1014	Uncertainty Management	Trend/Compare to GWPS	Long-term decreasing trend	Annual	Y

1 The indicator monitoring lists are set according to the monitoring areas. The indicator monitoring lists can be found in the *Sampling and Analysis Plan*, Table IIIA of the Corrective Action Compliance Plan; indicator areas are shown on Figure 2-9.
2 Refer to the latest approved Pantex Sampling and Analysis Plan or the Corrective Action Compliance Plan Table IIIA for the indicator monitoring lists.
3 A full list of constituents to be monitored is required for uncertainty management. A modified Appendix IX has been recommended for the Corrective Action Compliance Plan Application (Table III) and in the *Sampling and Analysis Plan*.
4 WL-Water Level monitoring only.

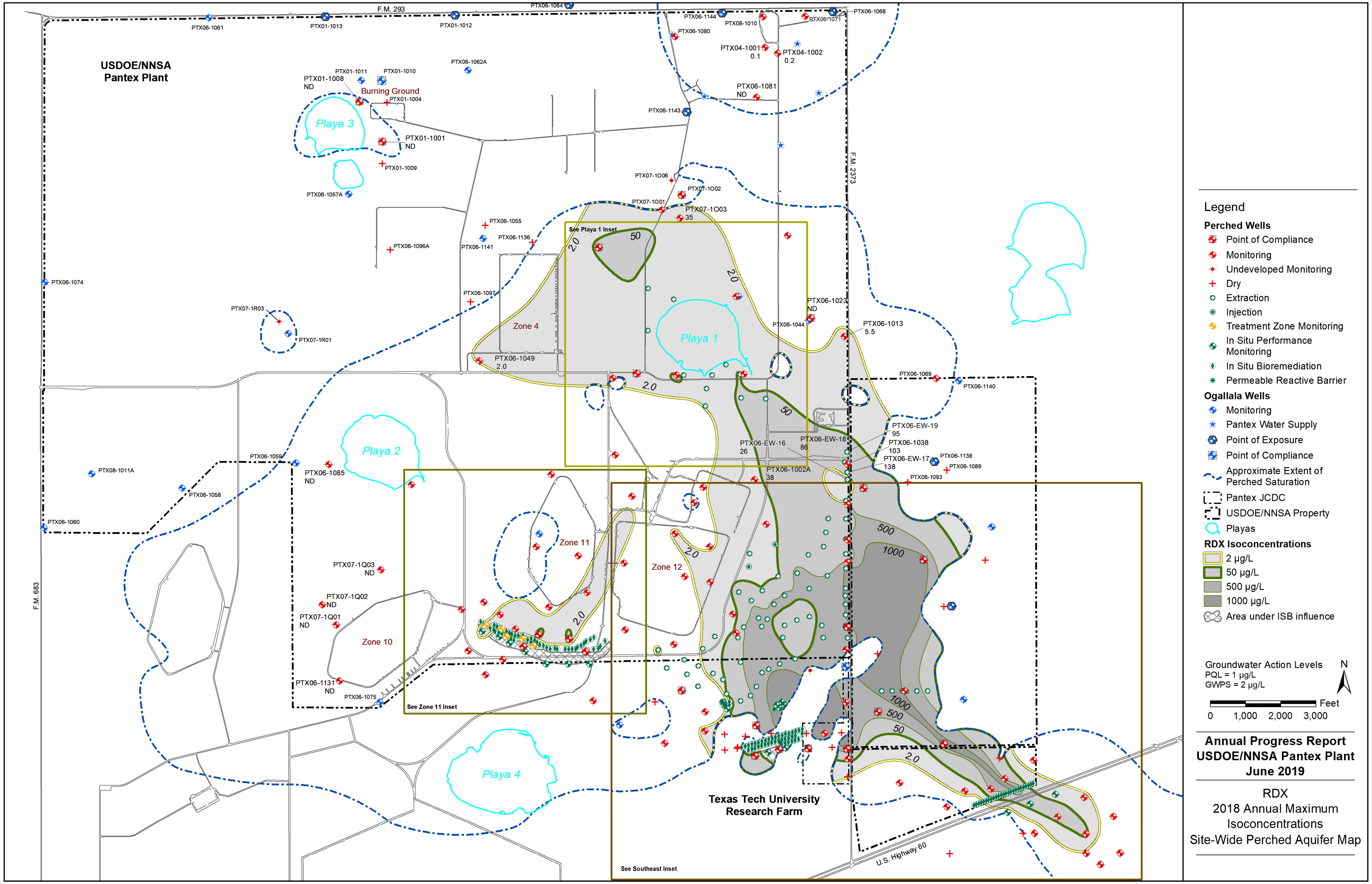

Figure 2-1. Perched Groundwater RDX Isoconcentrations

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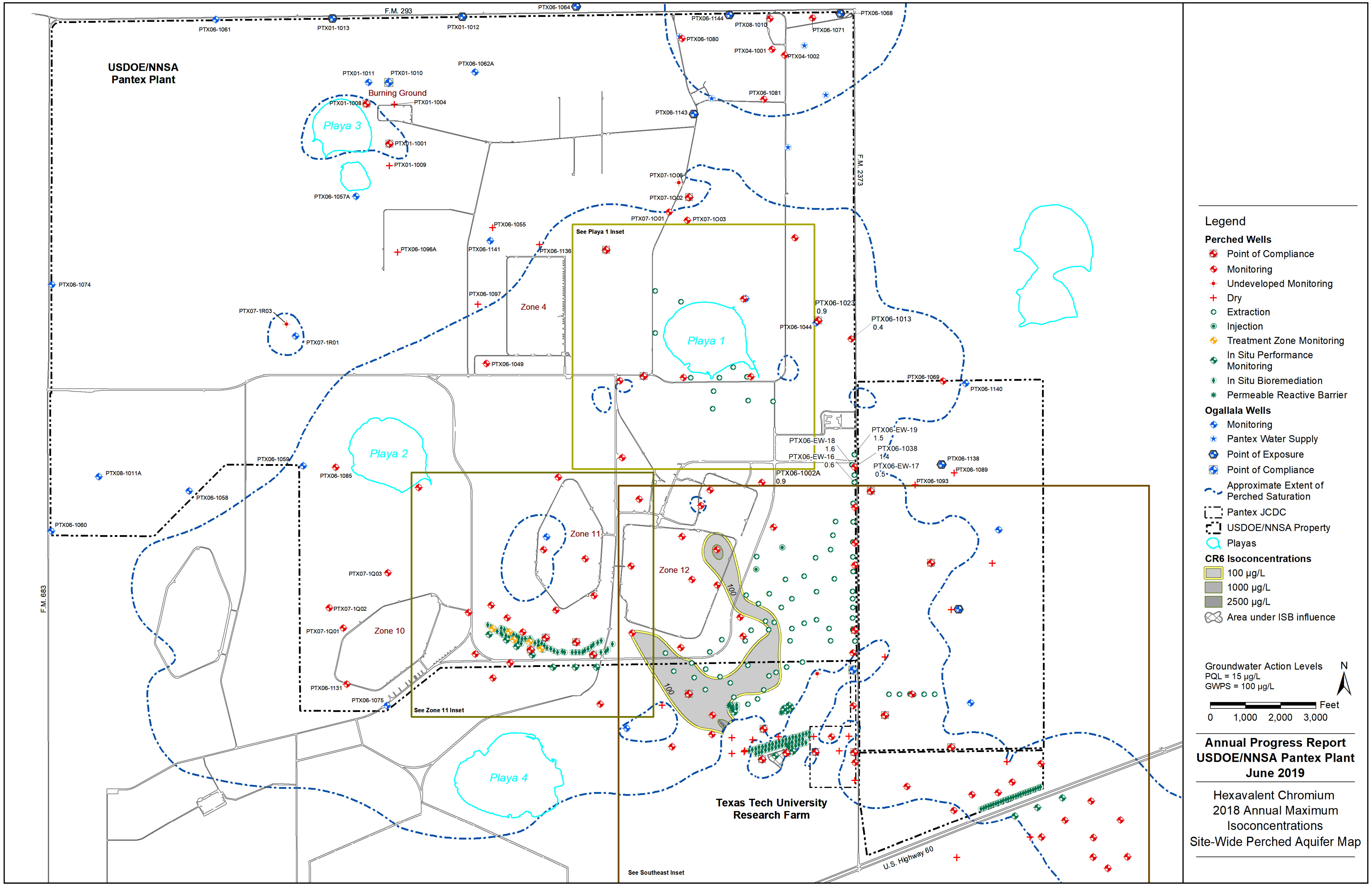

Figure 2-2. Perched Groundwater Hexavalent Chromium Isoconcentrations

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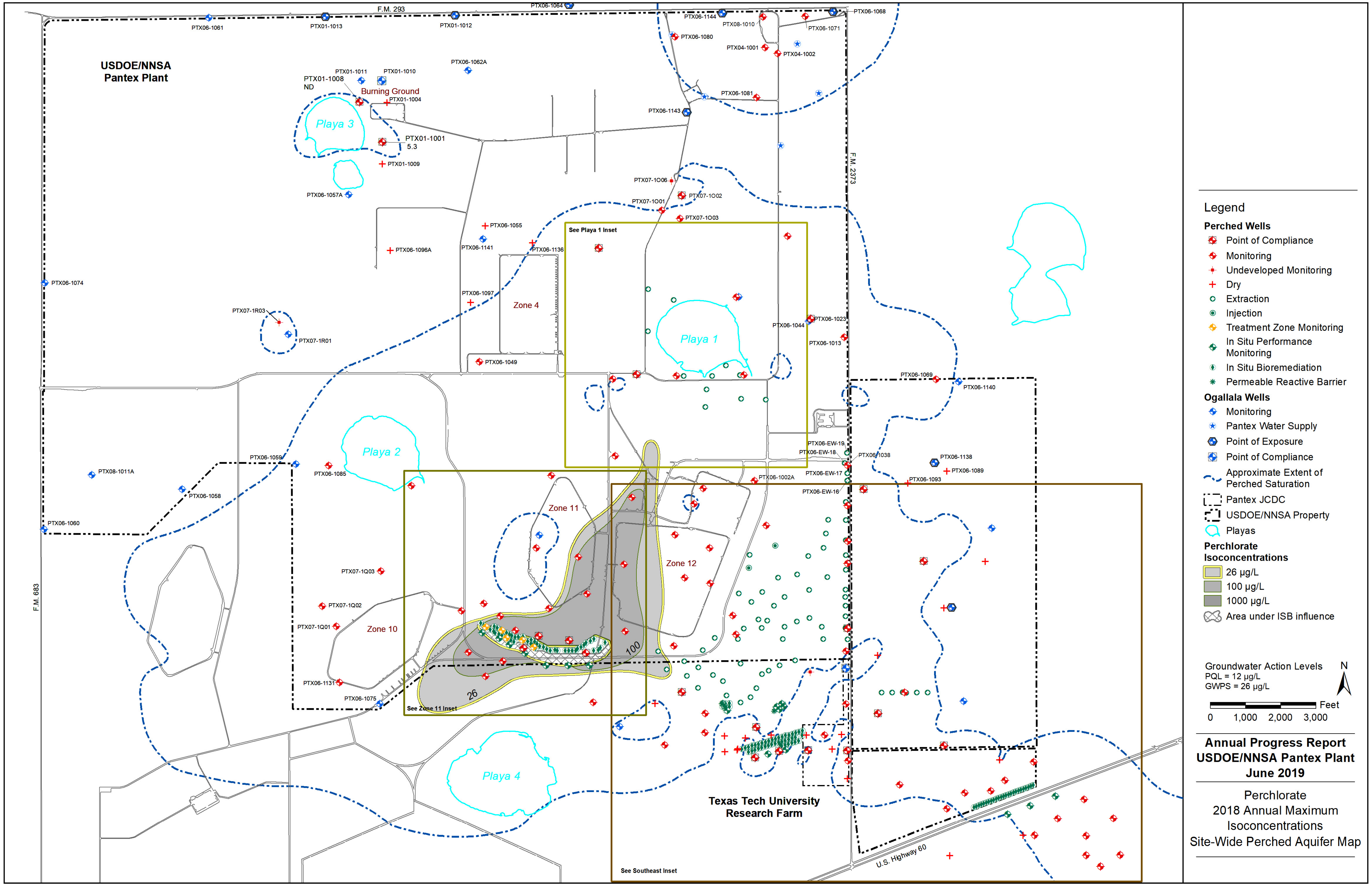

Figure 2-3. Perched Groundwater Perchlorate Isoconcentrations

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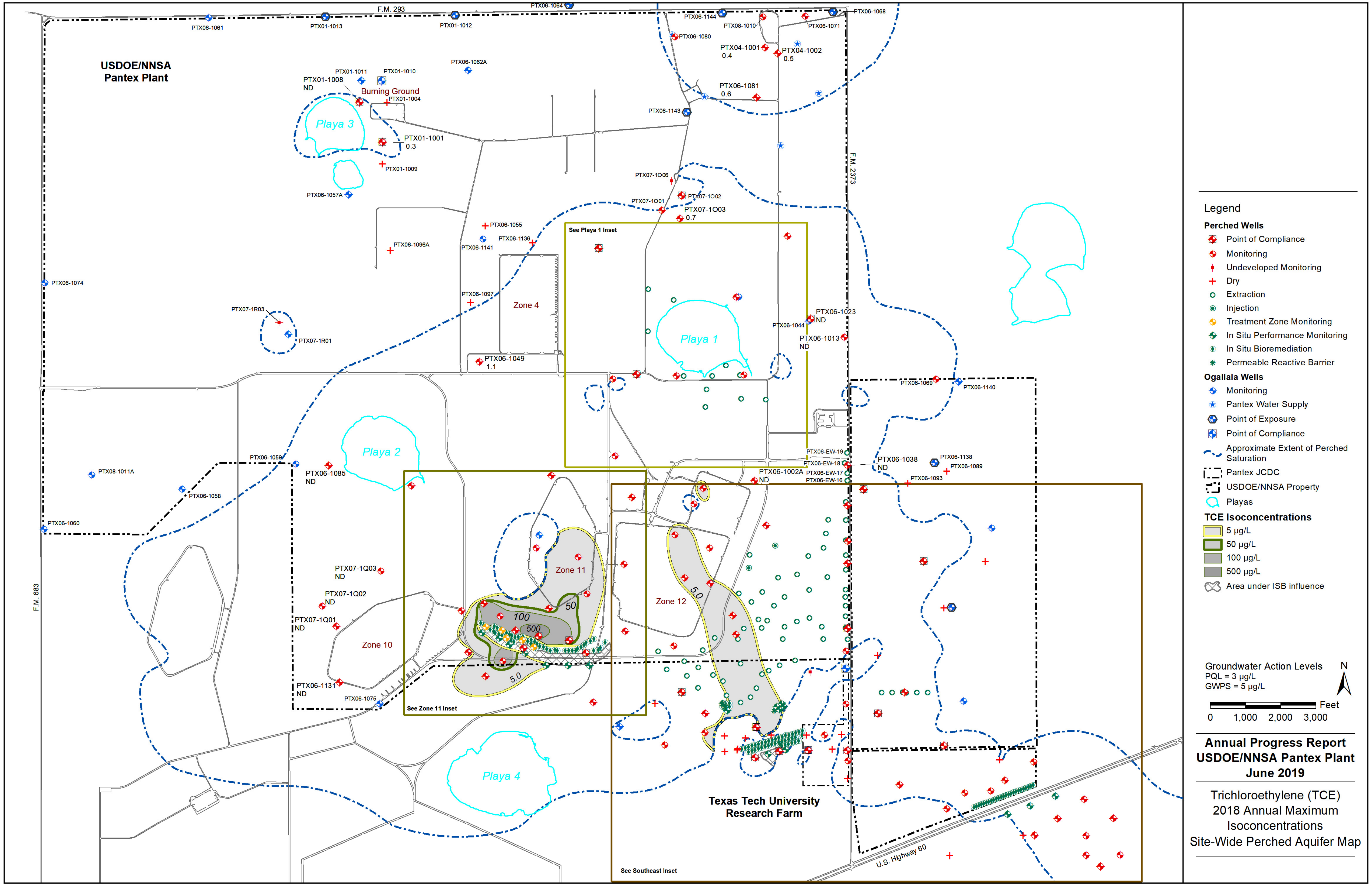

Figure 2-4. Perched Groundwater TCE Isoconcentrations

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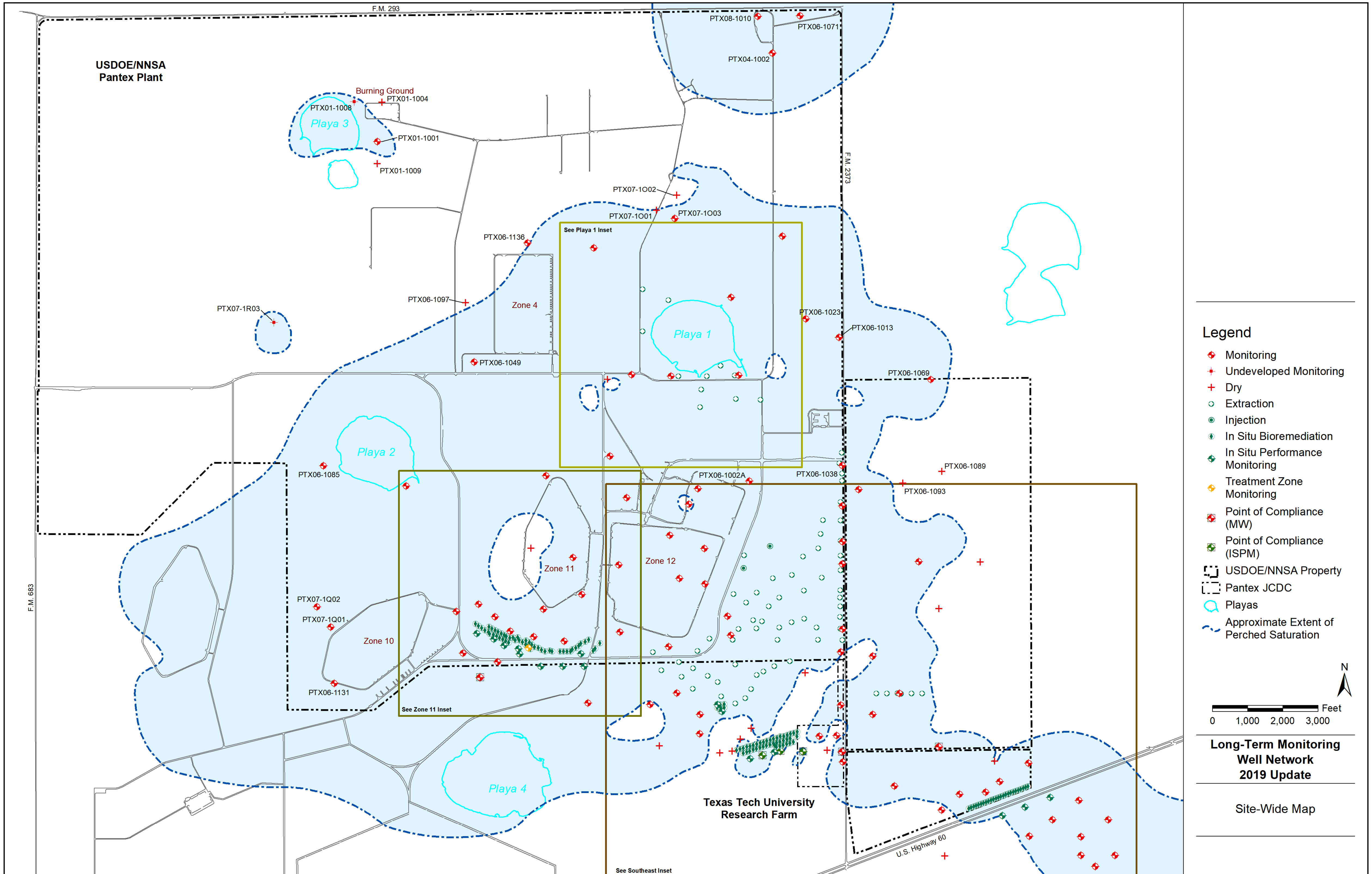

Figure 2-5. Site-Wide LTM Well Location Map

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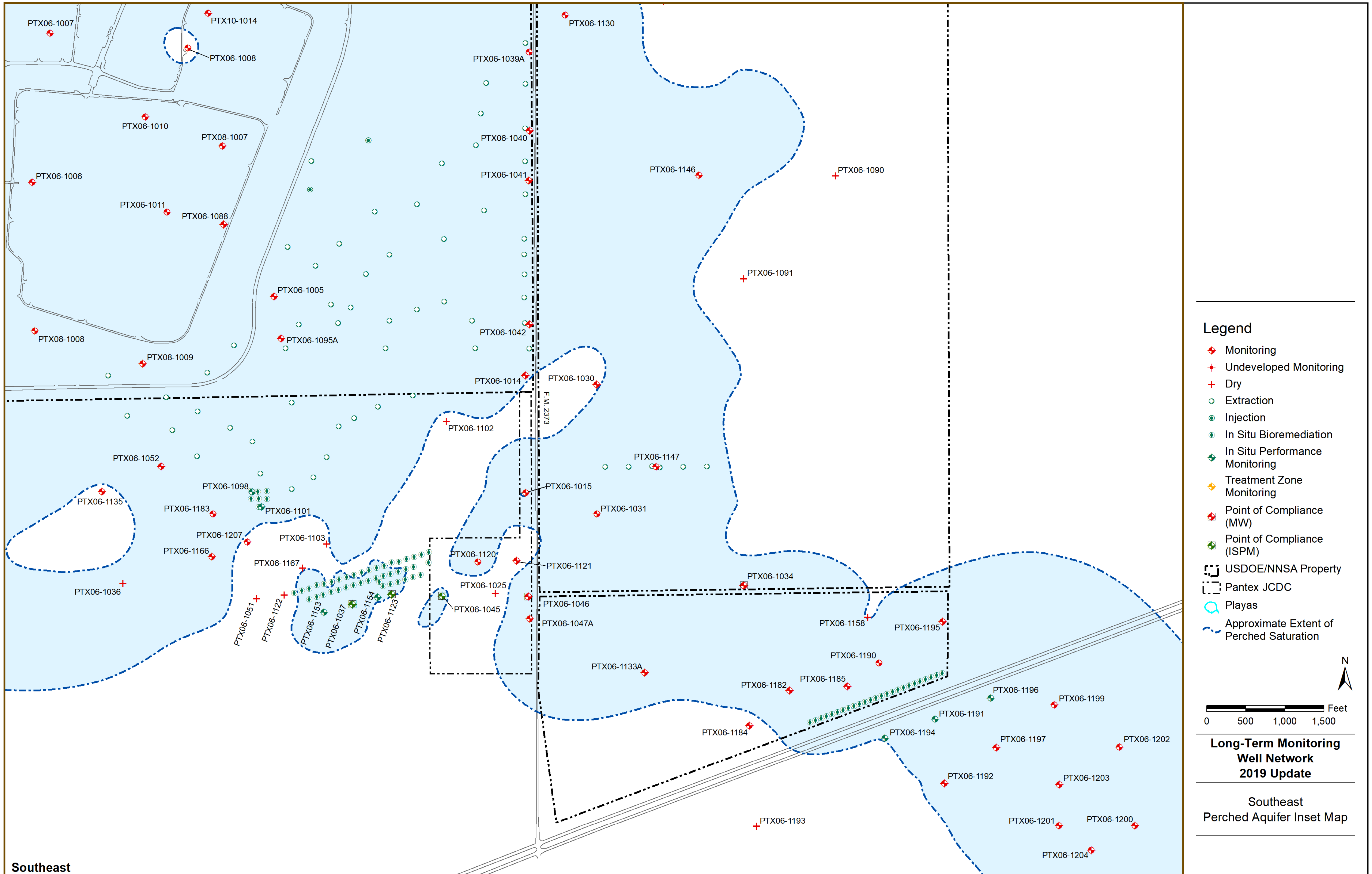

Figure 2-6. Southeast Inset LTM Well Location Map

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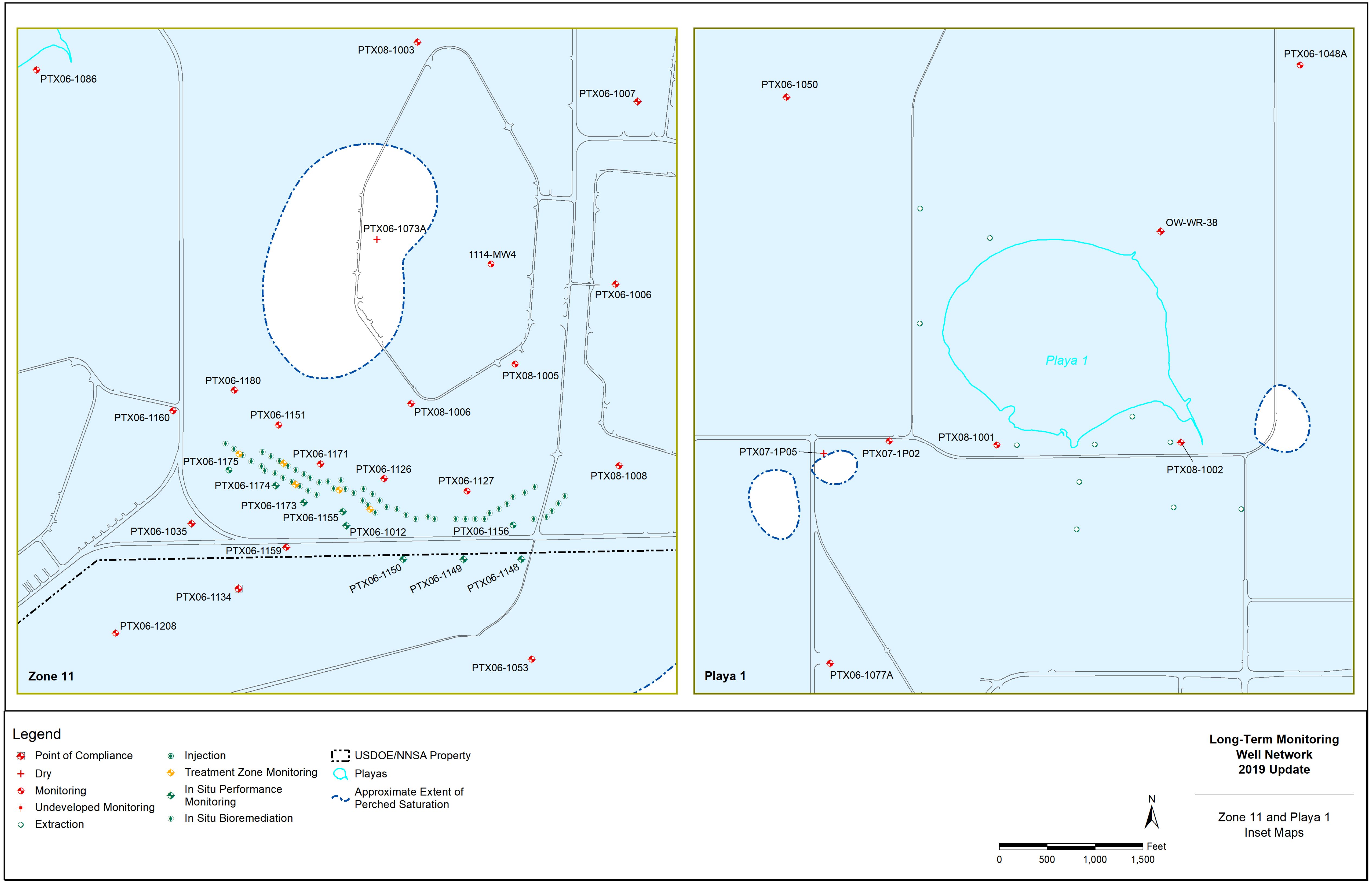

Figure 2-7. Zone 11 and Playa 1 Inset LTM Well Location Maps

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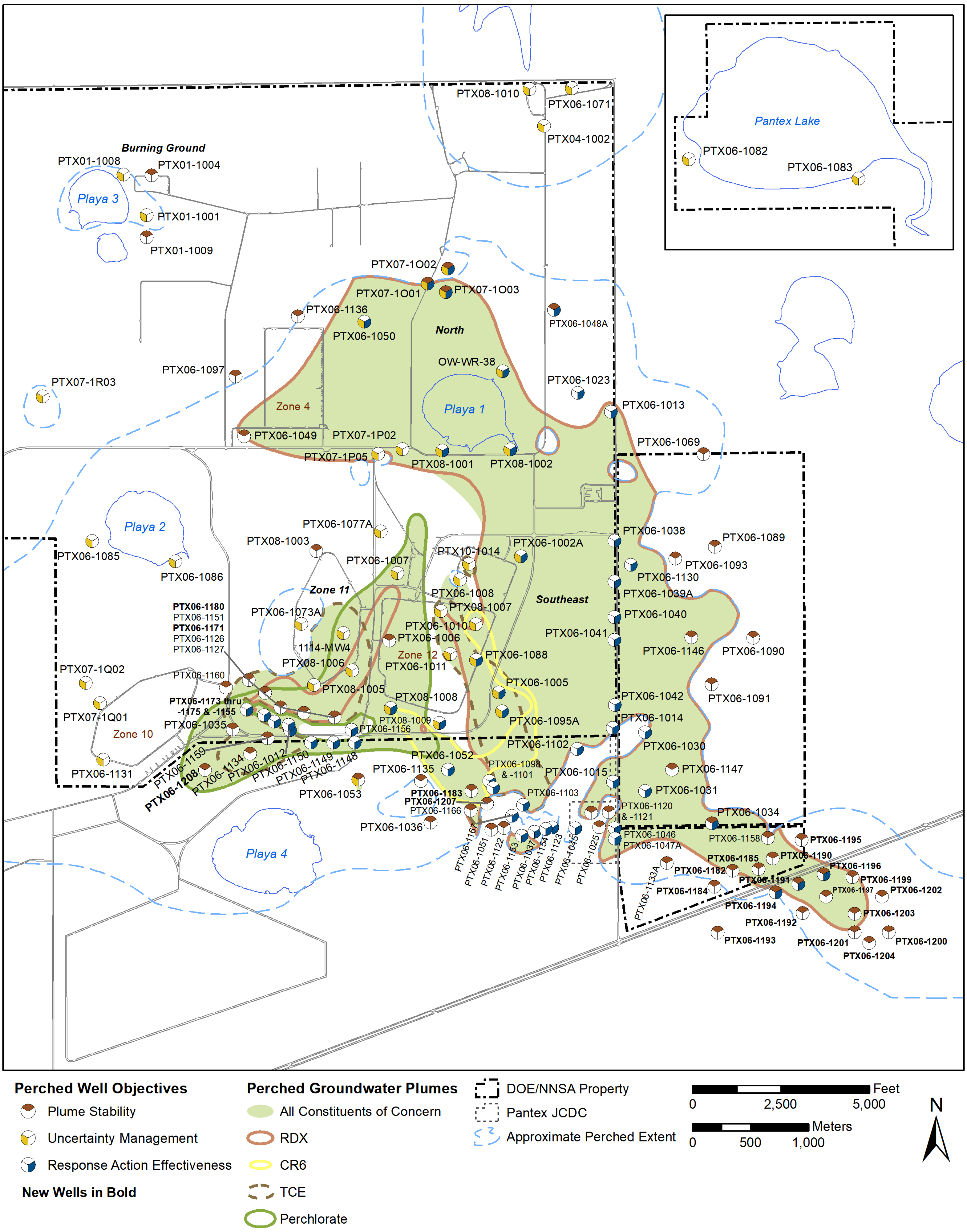

Figure 2-8. Perched Groundwater Long-Term Monitoring Network

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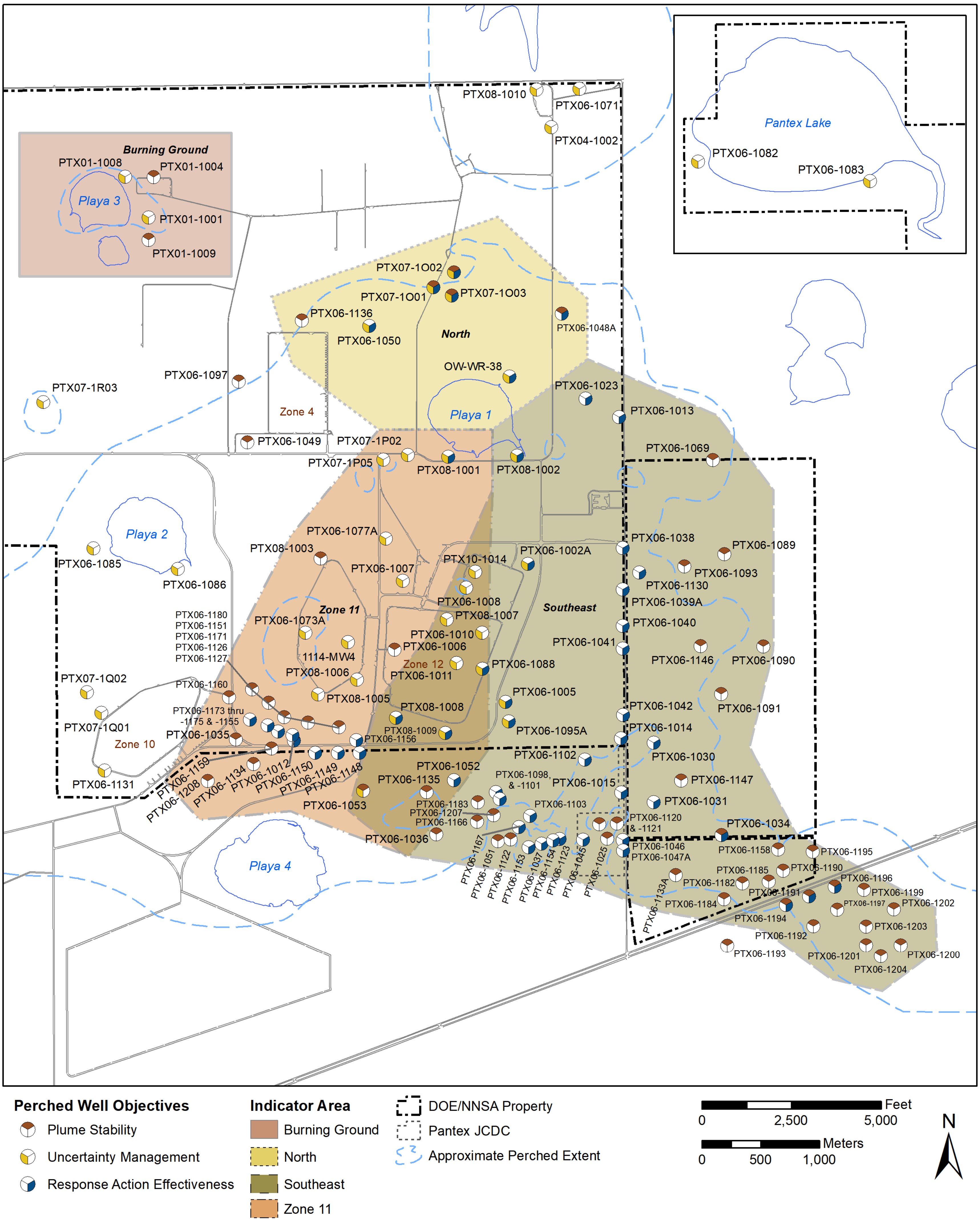

Indicator Constituents	Indicator Area				
	Burning Ground	Miscellaneous	North	Southeast	Zone 11
Primary List (Explosives, VOCs, Boron)	x	x	x	x	x
Chromium (Total & Hexavalent)				x	
1,4-Dioxane					x
Perchlorate	x				x

Primary Indicator Constituent List

High Explosives (12)

RDX	2-Amino-4,6-dinitrotoluene
MNX	4-Amino-2,6-dinitrotoluene
DNX	1,3-Dinitrobenzene
TNX	2,4-Dinitrotoluene
HMX	2,6-Dinitrotoluene
TNT	1,3,5-Trinitrobenzene

VOCs (7)

1,2-Dichloroethane
Chloroform
Tetrachloroethene (PCE)
Trichloroethene (TCE)
cis-1,2-Dichloroethene
trans-1,2-Dichloroethene
Vinyl Chloride

Metals (1)

Boron

Figure 2-9. Indicator Constituent Areas for Perched Groundwater

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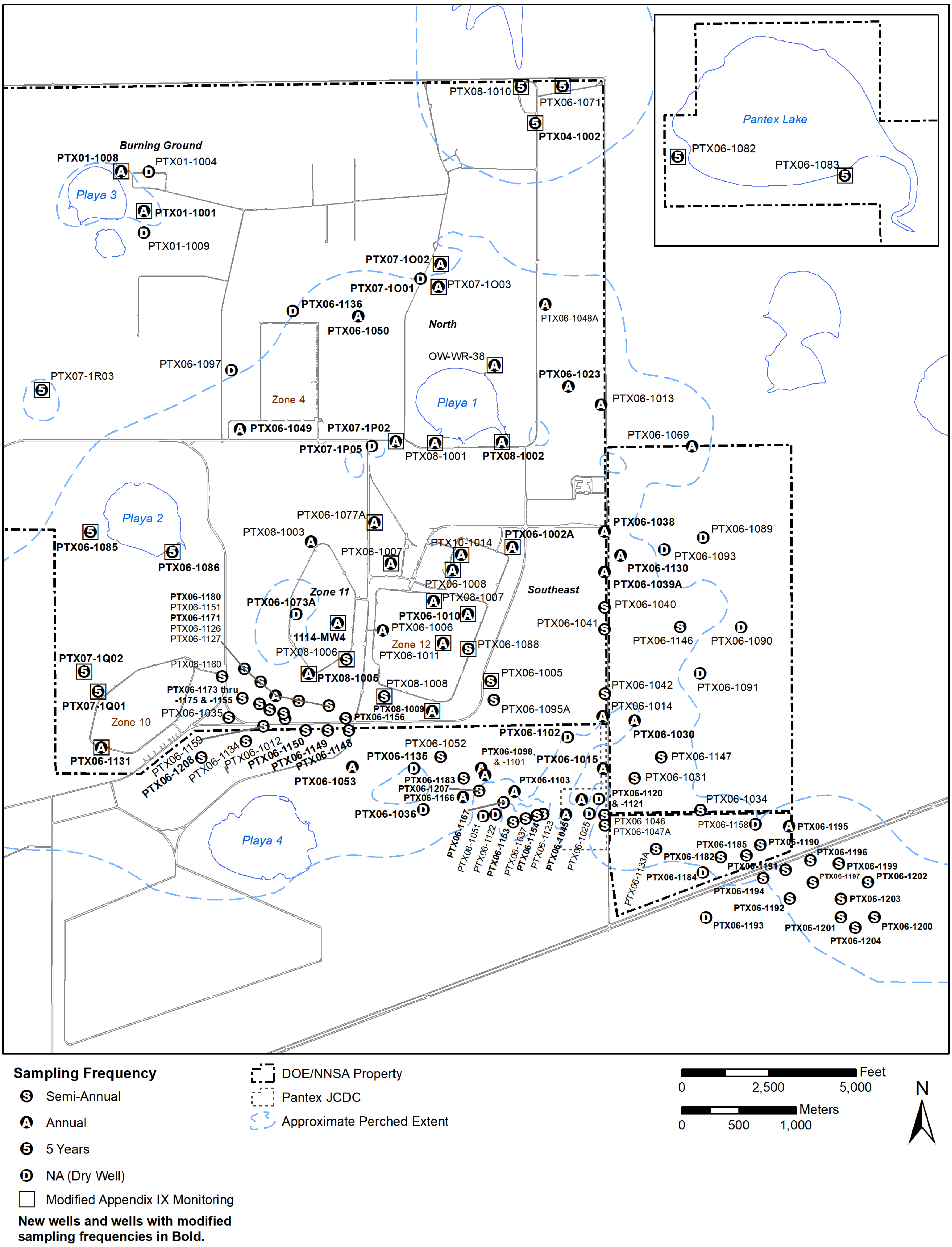

Figure 2-10. Sampling Frequency for Perched Groundwater

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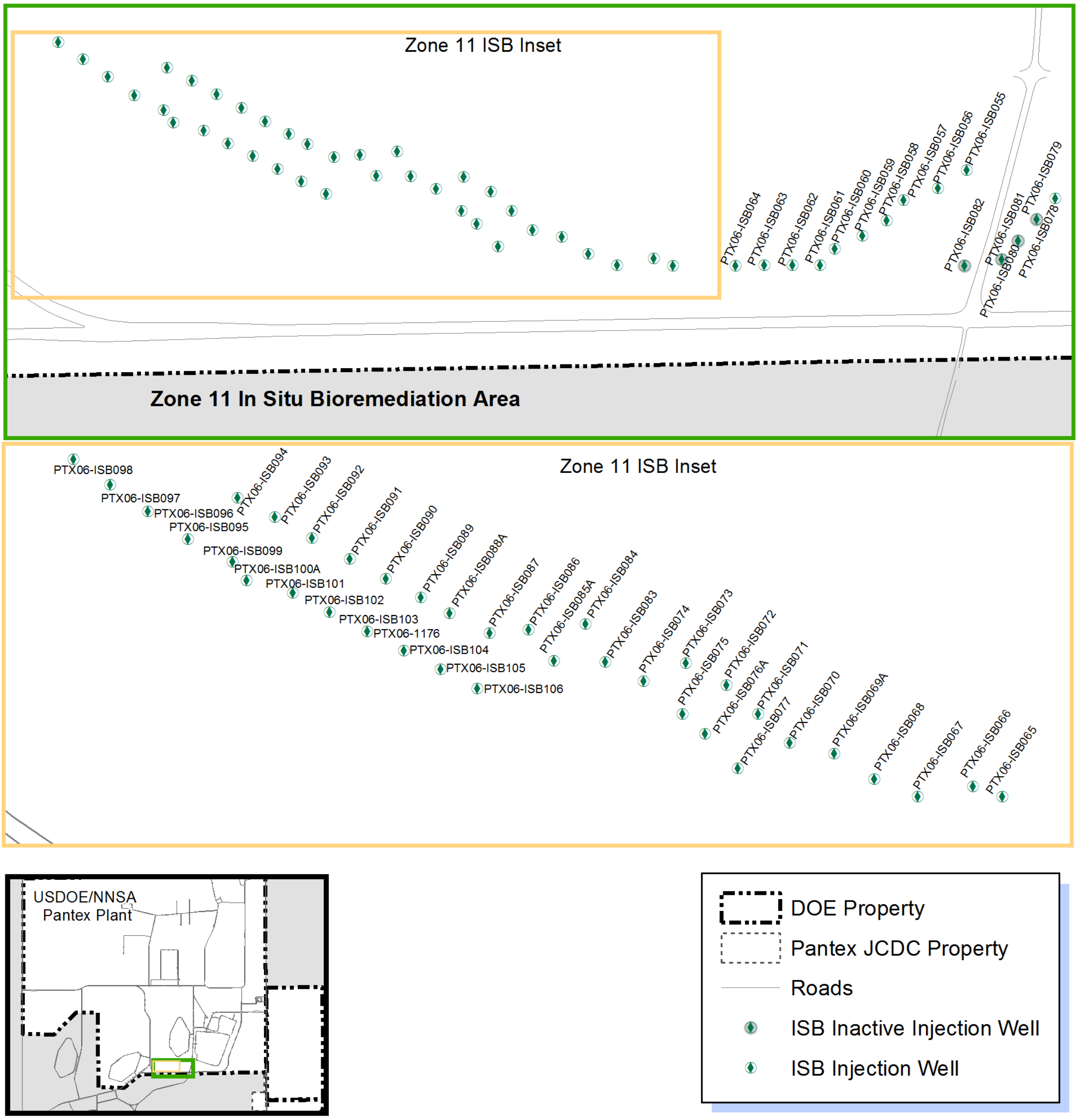

Figure 2-11. Zone 11 ISB Wells

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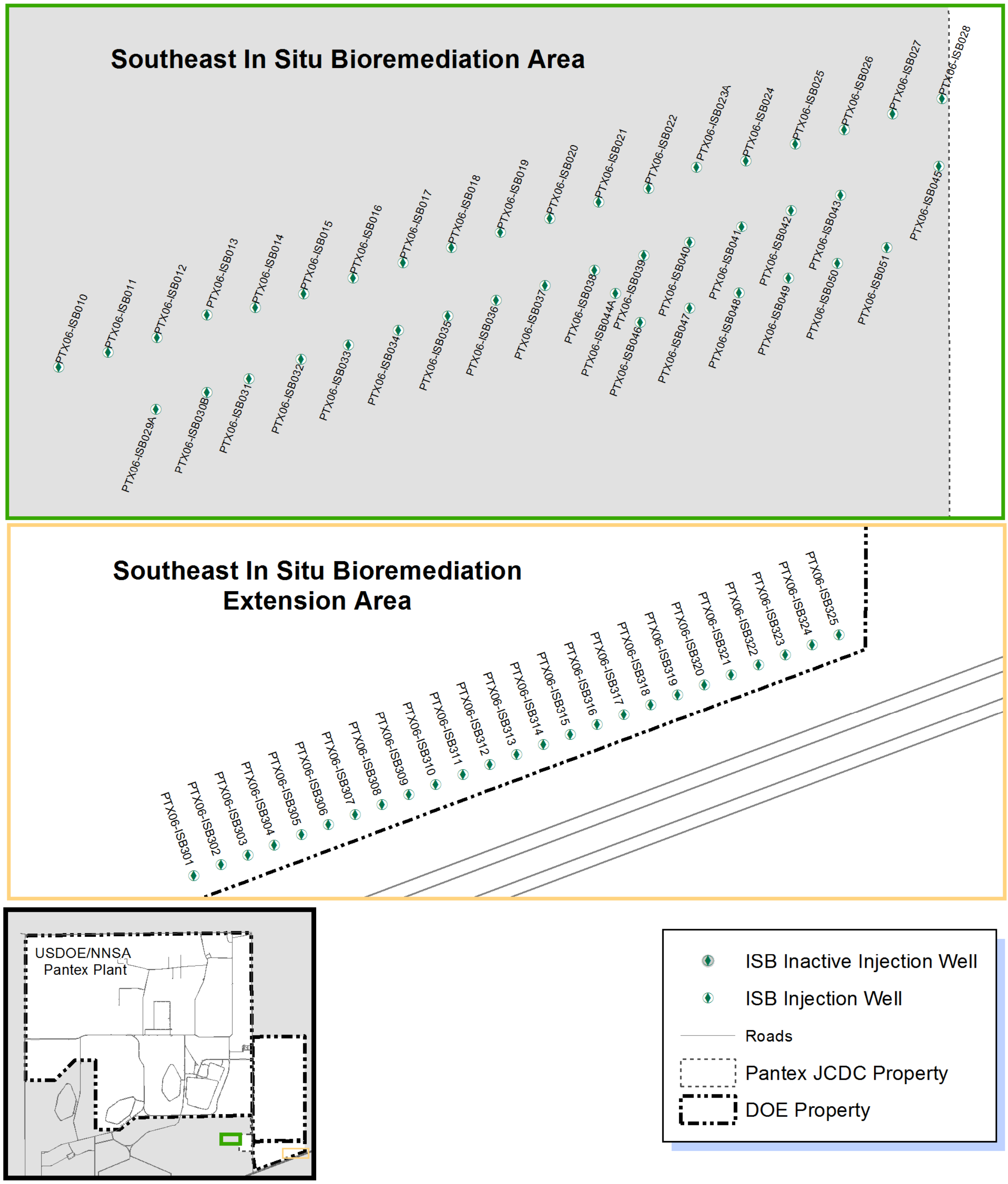

Figure 2-12. Southeast ISB and Extension Wells

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3. OGALLALA AQUIFER

The Ogallala Aquifer Monitoring Network was evaluated as part of the first and second Five-Year Reviews, and no changes to the monitoring network locations or sampling frequency were recommended. Recommendations for LTM improvements from the First FYR were incorporated into an *Ogallala Aquifer Sampling Improvement Plan* (B&W Pantex, 2013) and have been addressed by development of a Pantex well maintenance plan, use of diverters at a select group of wells, and implementation of a micropurge sampling method. These changes are described in Section 4 along with other changes to sampling methods and materials.

The Ogallala LTM network was evaluated qualitatively using the process described in Section 2.1. The recommendations for updating the Ogallala Aquifer LTM network are:

- Monitoring frequency reduced from semi-annual to annual in four wells, PTX01-1012, PTX01-1013, PTX06-1064, and PTX07-1R01. Three of these wells are located along the northern boundary of Pantex Plant away from potential source areas, and other wells monitored semi-annually are located immediately downgradient of potential source areas. The remaining well, PTX07-1R01, is located in an area overlain by perched groundwater.
- Remove the 5-year Appendix IX sampling from four wells, PTX06-1057A, PTX06-1064, PTX06-1068, and PTX07-1R01. This change is recommended because these wells are not located near potential soil source areas or are overlain by perched groundwater so the Ogallala is not the uppermost aquifer.
- Removal of two wells, PTX06-1033 and PTX-BEG2, from the LTM network. Both of these wells were previously plugged and abandoned in 2018 with regulatory approval.

The Ogallala Aquifer LTM network, with the recommendations incorporated, is depicted in Figure 3-1 and summarized in Table 3-1. Ogallala Aquifer indicator areas and sampling frequencies are depicted in Figures 3-2 and 3-3, respectively.

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Table 3-1. Proposed Long-Term Monitoring Network for the Ogallala Aquifer

Indicator Area[1]	Well ID	LTM Objectives	Progress Report Metrics	Expected Condition	Indicator List[2] Monitoring Frequency	Multiple Sampling Depth Frequency[3]	Modified Appendix IX Monitoring[4] (5-Year Frequency)[5]
Northwest	PTX01-1010	Early Detection, Uncertainty Management	Compare to GWPS	Below background/PQL and GWPS	Semi-Annual	NA	Y
Northwest	PTX01-1011	Early Detection, Uncertainty Management	Compare to GWPS	Below background/PQL and GWPS	Semi-Annual	NA	Y
Northwest	PTX01-1012	Early Detection, Uncertainty Management	Compare to GWPS	Below background/PQL and GWPS	Annual	NA	N
Northwest	PTX01-1013	Uncertainty Management	Compare to GWPS	Below background/PQL and GWPS	Annual	NA	N
Northwest	PTX06-1057A	Uncertainty Management	Compare to GWPS	Below background/PQL and GWPS	Annual	NA	N
Northwest	PTX06-1058	Uncertainty Management	Compare to GWPS	Below background/PQL and GWPS	Annual	NA	Y
Northwest	PTX06-1061	Uncertainty Management	Compare to GWPS	Below background/PQL and GWPS	Annual	NA	N
Northwest	PTX06-1062A	Early Detection, Uncertainty Management	Compare to GWPS	Below background/PQL and GWPS	Semi-Annual	NA	Y
Northwest	PTX06-1064	Uncertainty Management	Compare to GWPS	Below background/PQL and GWPS	Annual	NA	N
Northwest	PTX06-1068	Early Detection, Uncertainty Management	Compare to GWPS	Below background/PQL and GWPS	Semi-Annual	NA	N
Northwest	PTX06-1072	Early Detection, Uncertainty Management	Compare to GWPS	Below background/PQL and GWPS	Semi-Annual	NA	Y
Northwest	PTX06-1141	Uncertainty Management	Compare to GWPS	Below background/PQL and GWPS	Annual	5-Yr	Y
Northwest	PTX06-1143	Early Detection, Uncertainty Management	Compare to GWPS	Below background/PQL and GWPS	Semi-Annual	5-Yr	Y
Northwest	PTX06-1144	Early Detection, Uncertainty Management	Compare to GWPS	Below background/PQL and GWPS	Semi-Annual	5-Yr	N
Northwest	PTX07-1R01	Early Detection, Uncertainty Management	Compare to GWPS	Below background/PQL and GWPS	Annual	NA	N
Southeast	PTX06-1056	Early Detection, Uncertainty Management	Compare to GWPS	Below background/PQL and GWPS	Semi-Annual	NA	N
Southeast	PTX06-1137A	Early Detection, Uncertainty Management	Compare to GWPS	Below background/PQL and GWPS	Semi-Annual	5-Yr	N
Southeast	PTX06-1138	Early Detection, Uncertainty Management	Compare to GWPS	Below background/PQL and GWPS	Semi-Annual	5-Yr	N
Southeast	PTX06-1139	Early Detection, Uncertainty Management	Compare to GWPS	Below background/PQL and GWPS	Semi-Annual	5-Yr	N
Southeast	PTX06-1140	Early Detection, Uncertainty Management	Compare to GWPS	Below background/PQL and GWPS	Semi-Annual	5-Yr	N
Southeast	PTX06-1157	Early Detection, Uncertainty Management	Compare to GWPS	Below background/PQL and GWPS	Semi-Annual	5-Yr	N
Southeast/Northwest	PTX06-1043	Early Detection, Uncertainty Management	Compare to GWPS	Below background/PQL and GWPS	Semi-Annual	NA	N
Southeast/Northwest	PTX06-1044	Early Detection, Uncertainty Management	Compare to GWPS	Below background/PQL and GWPS	Semi-Annual	NA	N
Southeast/Northwest	PTX06-1076	Early Detection, Uncertainty Management	Compare to GWPS	Below background/PQL and GWPS	Semi-Annual	NA	N

1 The indicator monitoring lists are set according to the monitoring areas.
2 Refer to the current Pantex Sampling and Analysis Plan or the Compliance Plan Table IIIA for the indicator monitoring lists.
3 The wells that were completed with blanks between the screened intervals were selected for this sampling because the intervals could be isolated during sampling. Dedicated pumps used for standard sampling will be removed and sampling will be conducted to correspond to the 5-year sampling event for the Five-Year Review under CERCLA and the Compliance Plan. These samples will be analyzed for the indicator list of constituents.
4 A full list of constituents to be monitored is required for uncertainty management. A modified Appendix IX has been included in Corrective Action Compliance Plan 50284 Table III and in the current Pantex Sampling and Analysis Plan.
5 The modified Appendix IX monitoring list and 5-year frequency are applied to wells near source areas where the uppermost aquifer may be affected (outside the perched groundwater).

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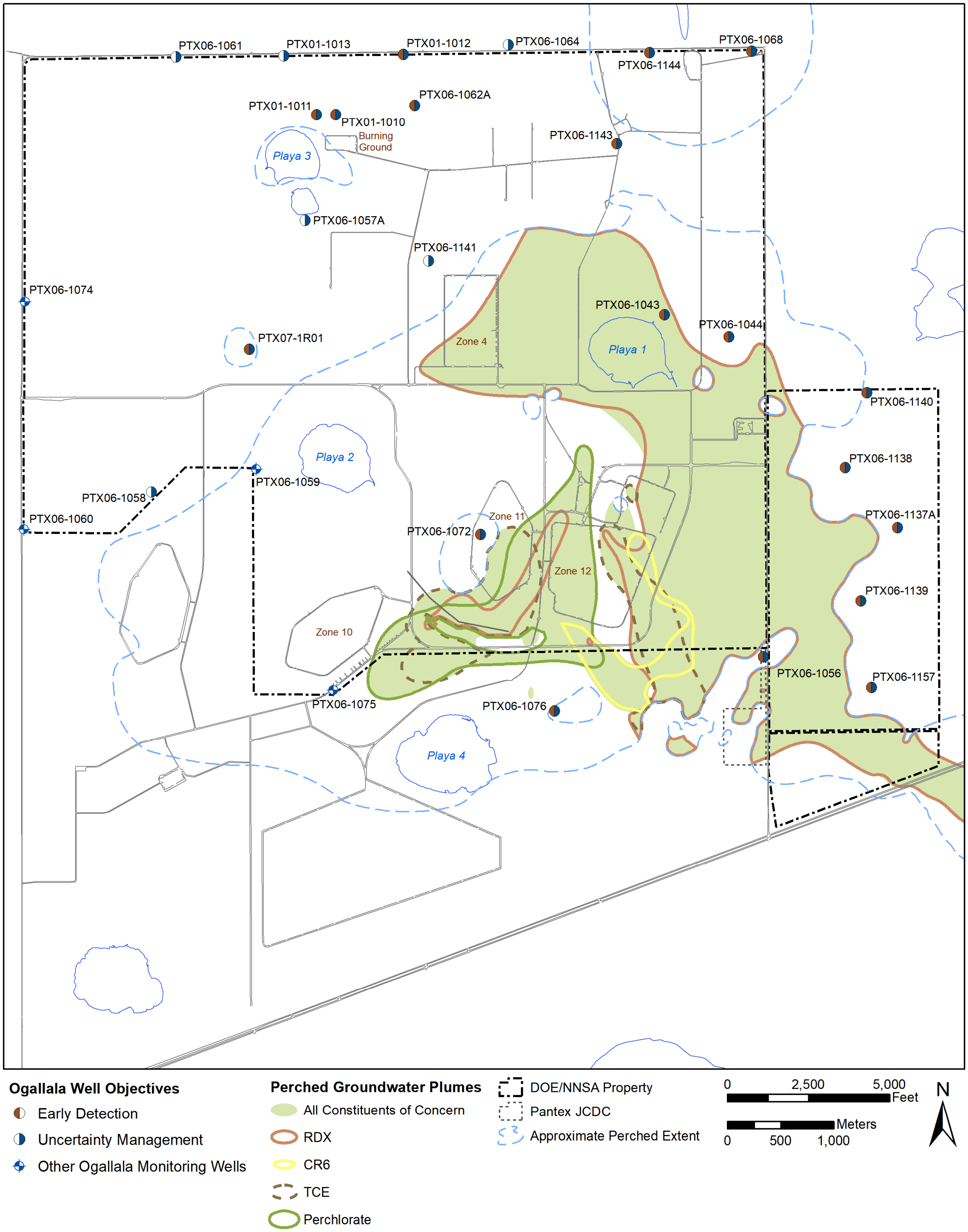

Figure 3-1. Ogallala Aquifer Long-Term Monitoring Network

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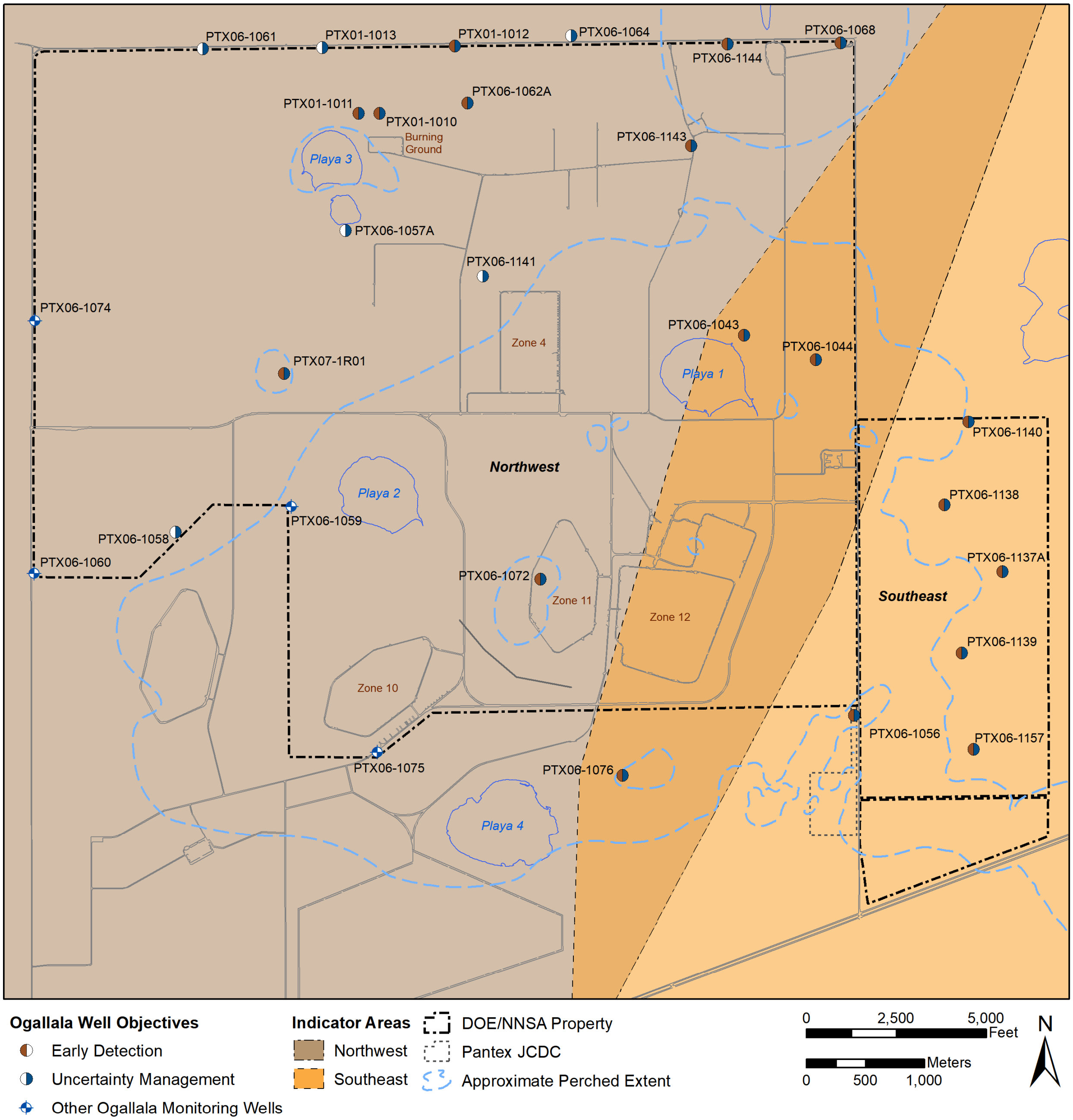

Indicator Constituents	Indicator Area	
	Southeast	Northwest
Primary List (Explosives, VOCs, Boron)	x	x
Chromium (Total & Hexavalent)	x	
Perchlorate		x

Figure 3-2. Indicator Constituent Areas for the Ogallala Aquifer

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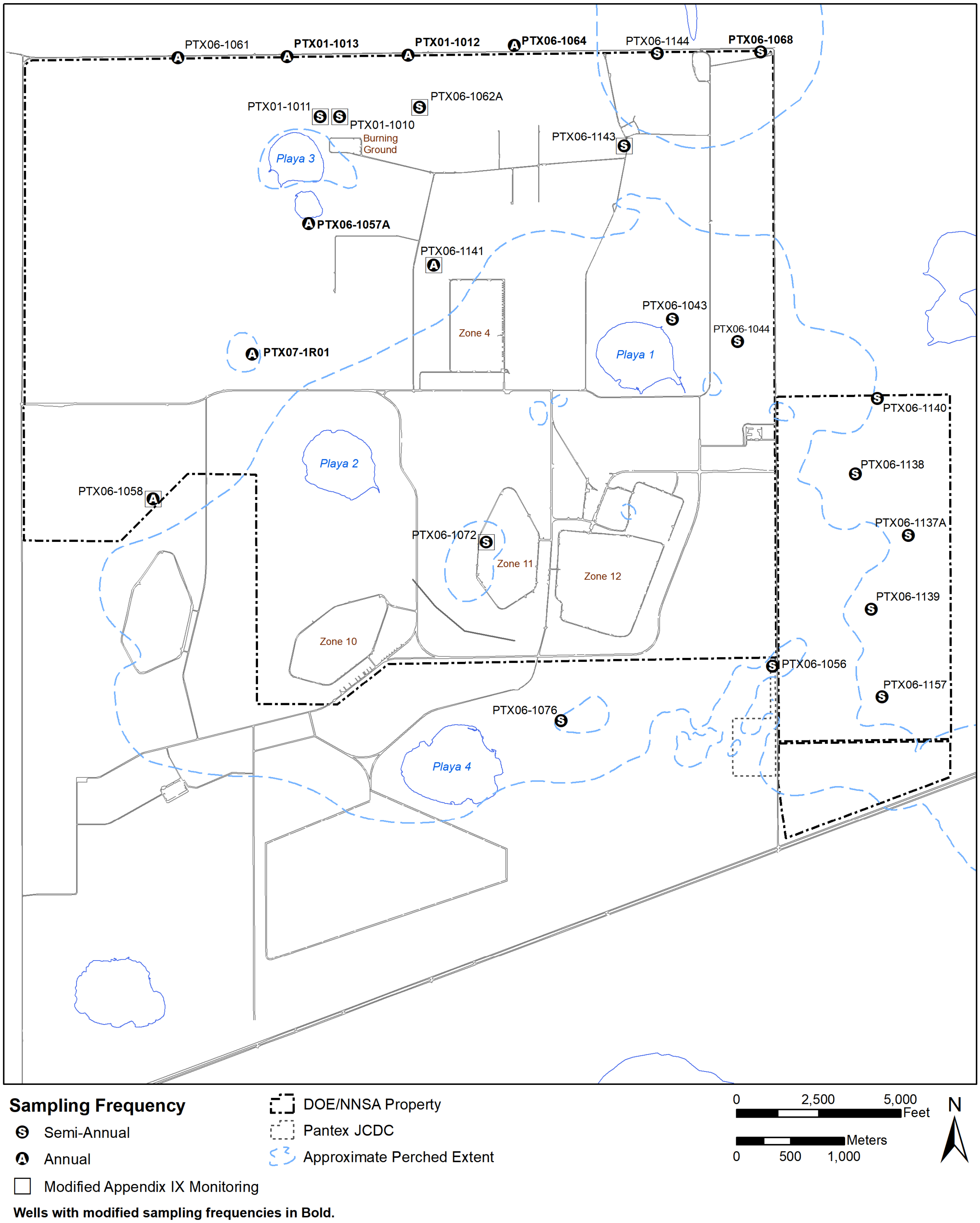

Figure 3-3. Ogallala LTM Network Sampling Frequency

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4. MONITORING WELL CONSTRUCTION

This section describes the screened intervals and the sample intake placement for each LTM Network well. The well construction information is presented for perched and Ogallala wells that will be part of the LTM Network.

4.1. PERCHED WELL CONSTRUCTION AND SCREENED INTERVALS

New perched monitoring wells will be constructed in accordance with the standard HW-50284 Attachment C Well Specifications with one exception. In cases where the perched aquifer saturated thickness exceeds 10 feet and the well is to be constructed in an area under the influence of a groundwater pump and treat system, the wells will be screened across the entire perched saturated interval, thus exceeding the design specification. This construction extends the effective well lifetime and allows for continued monitoring of declining perched groundwater in these areas. Any deviations from the Attachment C Specifications other than that described above will be requested via electronic mail from the TCEQ and EPA Project Managers prior to installation.

4.2. PERCHED WELL SAMPLE INTAKE PLACEMENT

Table 4-1 provides the current sample intake placement for perched monitoring wells. Because many sample intakes were installed in the upper saturated thickness of the groundwater, as water levels decline, the sample intake levels will require adjustment to maintain the ability to sample from the upper 5-10 feet of saturated thickness.

Table 4-1. Perched Aquifer Well Pump Intake Placement

Well ID	Status	Groundwater Elevation[1] (ft amsl)	Sample Intake Elevation (ft amsl)	Sample Intake Depth (ft below top of GW)	Screened Saturated Thickness[2] (ft)	Bottom of Screen Elevation (ft amsl)
1114-MW4	Active	3276.33	3270.73	5.6	16.01	3260.32
OW-WR-38	Active	3305.14	3294.94	10.2	9.28	3295.86
PTX01-1001	Active	3282.56	3271.66	10.9	10.58	3271.98
PTX01-1004	Dry	Dry	No Dedicated Pump[3]	NA	0	3300.23
PTX01-1008	Undeveloped	3297.58	3289.78	7.8	7.82	3289.76
PTX01-1009	Dry	3280.80	No Dedicated Pump	NA	0.12	3280.68
PTX04-1002	Active	3307.35	3302.25	5.1	18.52	3288.83
PTX06-1002A	Active	3280.38	3273.38	7.0	9.72	3270.66
PTX06-1005	Active	3258.21	3251.91	6.3	13.4	3244.8
PTX06-1006	Active	3274.92	3268.92	6.0	22.38	3252.54
PTX06-1007	Active	3276.30	3270.7	5.6	19.77	3256.53
PTX06-1008	Active	3279.88	3273.18	6.7	7.27	3272.61
PTX06-1010	Active	3286.86	3275.16	11.7	22.83	3264.03
PTX06-1011	Active	3269.37	3265.37	4.0	16.78	3252.59
PTX06-1012	Active	3271.72	3258.86	12.9	15.53	3256.19
PTX06-1013	Active	3295.04	3289.24	5.8	8.79	3286.25
PTX06-1014	Active	3254.34	3250.14	4.2	2.74	3251.6
PTX06-1015	Active	3242.40	3242.1	0.3	-0.55	3242.95
PTX06-1023	Active	3297.43	3296.1	1.3	5.49	3291.94
PTX06-1030	Dry	Dry	3247.42	NA	0	3247.15
PTX06-1031	Active	3245.51	3242.71	2.8	3.34	3242.17
PTX06-1034	Active	3242.12	3236.92	5.2	5.99	3236.13
PTX06-1035	Active	3271.19	3264.69	6.5	13.7	3256.18
PTX06-1036	Active	3249.91	3248.01	1.9	-2.21	3252.12
PTX06-1037	Undeveloped	3247.69	3246.85	0.8	-0.18	3247.87
PTX06-1038	Active	3275.49	3269.29	6.2	14.76	3260.73
PTX06-1039A	Active	3266.41	3262.71	3.7	4.35	3262.06
PTX06-1040	Active	3259.56	3258.66	0.9	5.04	3254.52
PTX06-1041	Active	3259.26	3256.76	2.5	19.65	3239.61
PTX06-1042	Active	3256.47	3253.37	3.1	4.37	3252.1
PTX06-1045	Dry	3247.60	3245.2	2.4	2.76	3244.84
PTX06-1046	Active	3244.79	3238.79	6.0	11.75	3233.04
PTX06-1047A	Active	3245.46	3238.96	6.5	5.8	3239.66
PTX06-1048A	Active	3303.34	3297.04	6.3	6.33	3297.01
PTX06-1049	Active	3281.58	3276.58	5.0	37	3243.39
PTX06-1050	Active	3295.08	3283.38	11.7	30	3264.96
PTX06-1051	Dry	3239.19	No Dedicated Pump	NA	-0.05	3239.24
PTX06-1052	Active	3258.50	3254.6	3.9	12.04	3246.46
PTX06-1053	Active	3269.74	3264.84	4.9	7.53	3262.21
PTX06-1069	Active	3280.01	3275.01	5.0	4.98	3275.03
PTX06-1071	Active	3307.65	3302.05	5.6	10	3279.16
PTX06-1073A	Active	Dry	3273.04	NA	0	3273.73

Well ID	Status	Groundwater Elevation[1] (ft amsl)	Sample Intake Elevation (ft amsl)	Sample Intake Depth (ft below top of GW)	Screened Saturated Thickness[2] (ft)	Bottom of Screen Elevation (ft amsl)
PTX06-1077A	Active	3278.85	3272.95	5.9	6.41	3272.44
PTX06-1082	Active	3293.61	3287.91	5.7	6.67	3286.94
PTX06-1083	Active	3288.49	3277.9	10.6	18.59	3269.9
PTX06-1085	Active	3275.70	3254.8	20.9	25	3246.52
PTX06-1086	Active	3276.26	3232.5	43.8	45	3225.72
PTX06-1088	Active	3267.40	3259.09	8.3	19.87	3247.53
PTX06-1089	Dry	3263.26	No Dedicated Pump	NA	-0.02	3263.28
PTX06-1090	Dry	Dry	No Dedicated Pump	NA	0	3254.83
PTX06-1091	Dry	Dry	No Dedicated Pump	NA	0	3261.3
PTX06-1093	Dry	Dry	No Dedicated Pump	NA	0	3274.59
PTX06-1095A	Active	3257.73	3250.73	7.0	10	3246.22
PTX06-1097	Dry	Dry	No Dedicated Pump	NA	0	3268.73
PTX06-1098	Active	3255.35	3251.39	4.0	13.61	3241.74
PTX06-1101	Active	3254.60	No Dedicated Pump	NA	10.05	3243.8
PTX06-1102	Dry	Dry	3249.7	NA	0	3248.3
PTX06-1103	Dry	Dry	3234.83	NA	0	3249.74
PTX06-1120	Active	3246.48	3245.58	0.9	1.95	3244.53
PTX06-1121	Dry	Dry	3247.53	NA	0	3246.49
PTX06-1122	Dry	Dry	No Dedicated Pump	NA	0	3251.5
PTX06-1123	Active	3250.98	3249.03	2.0	2.15	3248.83
PTX06-1125	Dry	Dry	No Dedicated Pump	NA	0	3245.34
PTX06-1126	Active	3273.75	3265.45	8.3	21.2	3252.55
PTX06-1127	Active	3273.50	3266.6	6.9	23.9	3248.58
PTX06-1130	Dry	Dry	3261.29	NA	0	3258.74
PTX06-1131	Active	3269.67	3260.37	9.3	10.87	3258.8
PTX06-1133A	Active	3243.85	3241.65	2.2	2.23	3241.62
PTX06-1134	Active	3271.59	3264.19	7.4	10.53	3261.06
PTX06-1135	Dry	Dry	3261.03	NA	0	3261.38
PTX06-1136	Dry	Dry	3277.42	NA	0	3277.21
PTX06-1146	Active	3258.79	3253.09	5.7	14.83	3243.96
PTX06-1147	Active	3244.55	3239.75	4.8	12.93	3231.62
PTX06-1148	Active	3271.22	3267.12	4.1	15.16	3256.06
PTX06-1149	Active	3272.15	3267.45	4.7	12.7	3259.28
PTX06-1150	Active	3272.49	3266.99	5.5	11.59	3260.9
PTX06-1151	Active	3273.58	3265.68	7.9	15	3254.55
PTX06-1153	Active	3247.97	3245.29	2.7	3.59	3244.38
PTX06-1154	Active	3248.42	3248.14	0.3	0.88	3247.54
PTX06-1155	Active	3272.95	3263.67	9.3	15	3256.89
PTX06-1156	Active	3272.37	3261.42	11.0	22.1	3250.27
PTX06-1158	Dry	Dry	No Dedicated Pump	NA	0	3235.24
PTX06-1159	Active	3272.17	3265.87	6.3	18.24	3253.93
PTX06-1160	Active	3273.19	3266.59	6.6	25	3246.51
PTX06-1166	Active	3251.46	3248.46	3.0	7.1	3244.36
PTX06-1167	Dry	Dry	No Dedicated Pump	NA	0	3248.22

Well ID	Status	Groundwater Elevation[1] (ft amsl)	Sample Intake Elevation (ft amsl)	Sample Intake Depth (ft below top of GW)	Screened Saturated Thickness[2] (ft)	Bottom of Screen Elevation (ft amsl)
PTX06-1171	Active	3273.44	3266.54	6.9	10	3257.42
PTX06-1173	Active	3272.50	3265.97	6.5	10	3255.86
PTX06-1174	Active	3272.98	3266.29	6.7	10	3256.12
PTX06-1175	Active	3272.44	3265.29	7.2	10	3258.15
PTX06-1180	Active	3273.27	3266.37	6.9	10	3258.29
PTX06-1182	Active	3240.22	3234.32	5.9	6.92	3233.3
PTX06-1183	Active	3253.92	3249.32	4.6	7.56	3246.36
PTX06-1184	Dry	3242.27	No Dedicated Pump	NA	0.16	3242.11
PTX06-1185	Active	3237.87	3232.87	5.0	4.58	3233.29
PTX06-1190	Active	3236.69	3231.59	5.1	6.18	3230.51
PTX06-1191	Active	3233.80	3228.08	5.7	11.78	3222.02
PTX06-1192	Active	3231.32	3226.32	5.0	13.09	3218.23
PTX06-1193	Dry	3240.37	No Dedicated Pump	NA	-0.91	3241.28
PTX06-1194	Active	3235.38	3234.25	1.1	0.7	3234.68
PTX06-1195	Active	3234.98	3228.88	6.1	7.15	3227.83
PTX06-1196	Active	3232.89	3227.95	4.9	10.22	3222.67
PTX06-1197	Active	3231.57	3226.07	5.5	5.19	3226.38
PTX06-1199	Active	3231.10	3225.9	5.2	10.36	3220.74
PTX06-1200	Active	3227.44	3222.24	5.2	10.16	3217.28
PTX06-1201	Active	3228.02	3223.02	5.0	10.99	3217.03
PTX06-1202	Active	3229.41	3223.11	6.3	6.25	3223.16
PTX06-1203	Active	3228.65	3223.05	5.6	9.62	3219.03
PTX06-1204	Active	3227.72	3222.92	4.8	15.82	3211.9
PTX07-1O01	Active	3294.85	3294.45	0.4	0.17	3294.68
PTX07-1O02	Active	3290.53	3291.83	-1.3*	-2.73	3293.26
PTX07-1O03	Active	3297.91	3293.51	4.4	4.69	3293.22
PTX07-1P02	Active	3294.29	3285.89	8.4	10.84	3283.45
PTX07-1P05	Active	3294.32	3294.6	-0.3*	-0.46	3294.78
PTX07-1Q01	Active	3270.75	3262.55	8.2	20.89	3249.86
PTX07-1Q02	Active	3270.67	3249.07	21.6	30	3237.94
PTX07-1R03	Undeveloped	3320.60	3314.5	6.1	5.7	3314.9
PTX08-1001	Active	3293.56	3278.86	14.7	45	3241.63
PTX08-1002	Active	3289.51	3276.01	13.5	34.8	3254.71
PTX08-1003	Active	3276.99	3273.49	3.5	22.61	3254.38
PTX08-1005	Active	3275.12	3263.72	11.4	15.51	3259.6
PTX08-1006	Active	3273.66	3269.76	3.9	32.7	3240.96
PTX08-1007	Active	3276.51	3274.81	1.7	30.96	3245.55
PTX08-1008	Active	3269.37	3261.47	7.9	22.33	3247.04
PTX08-1009	Active	3264.00	3262.2	1.8	13.91	3250.09
PTX08-1010	Active	3308.02	3302.92	5.1	21.8	3286.22
PTX10-1014	Active	3283.58	3277.18	6.4	11.74	3271.84

1 Based on December 2018 or June 2019 water level measurements.
2 Saturated thickness above the bottom of the well screen, negative numbers likely due to water measured in the sump.
3 No dedicated pumps have been installed in these wells because the wells have low yield or limited saturated thickness.
* Water level has dropped below the bottom of the well screen and is below the sample intake.

4.3. OGALLALA WELL CONSTRUCTION, SCREENED INTERVALS, AND DIVERTERS

The 2009 LTM Network Design Report (Appendix A) recommended that all new Ogallala Aquifer monitoring wells be installed with screens that provide flexibility to sample from both the uppermost part of the aquifer and the deeper part of the aquifer. The *Sampling Evaluation for High Plains Aquifer Monitoring Wells* (RPS Espey, 2012) found that this well construction design provides flexibility for sampling from multiple intervals, allows isolation of individual screen intervals, and extends the life span of wells in relation to the declining water table of the aquifer. However, recent experience at Pantex indicates that monitoring wells installed in the deeper portions of the Ogallala Aquifer in the northern part of Pantex Plant are susceptible to excessive silting within the screen. In some existing wells, this silting has been observed to almost completely fill the lower screened intervals of the wells.

Based on these recent observations in existing Ogallala Aquifer wells, new Ogallala Aquifer monitoring wells will be installed with screens that provide flexibility to sample from the uppermost part of the aquifer near the water table and deeper parts of the aquifer, but new wells will not be completed and screened to the bottom of the aquifer unless needed to meet specific sampling objectives. Screen placement for each well will be determined by the observed lithology of the borehole with more transmissive zones of the saturated sediments screened and blank casing installed across finer silt and/or clay intervals. Well completions will generally intercept the upper 30 to 100 feet of saturation using multiple screened intervals (no greater than 40 ft each) separated by blank casing. The anticipated decline of the water table may also affect selection of the length of the upper screened intervals for each well. The blank casing sections will enable placement of diverters to isolate the upper screened interval. The diverters and dedicated pumps will be adjusted as necessary to account for the declining Ogallala Aquifer water table.

Additionally, several older wells were identified in the *Ogallala Aquifer Sampling Improvement Plan* (B&W Pantex, 2013) that are not sampled as multi-level wells, but have multiple screen segments. Of these wells, four were identified that have relatively short saturated screen intervals (i.e. < 100 ft) that could potentially yield more representative samples with diverters installed. Table 4-2 summarizes the diverter placement in these wells.

Table 4-2. Diverter Placement

Well ID	Year Installed	Thickness of Upper Screened Interval (ft)	Diverter Depth (ft bgs)
PTX01-1010	2000	~70	570
PTX01-1011	2000	~95	604
PTX01-1013	2000	~85	590
PTX06-1072	2001	~85	505

4.4. OGALLALA INTAKE PLACEMENT

Table 4-3 provides the current sample intake placement for Ogallala Aquifer monitoring wells. Figure 4-1 presents the Ogallala Aquifer wells and their sample intake placements and approximate saturated thickness (some wells are not completed to the base of the aquifer, so only the in-well saturated thickness can be calculated). As discussed in the 2009 LTM Network Design Report, initial sampling in newly installed Ogallala Aquifer wells will be conducted at multiple depths using procedures described in the *Sampling and Analysis Plan*.

Dedicated sample pumps are installed in the wells at the stated sample intake depth. As illustrated in Table 4-3, sample pump intake depths are typically set in the upper 20-feet of the uppermost screened interval. Routine samples at the proposed frequency for indicator constituents will be obtained from this depth.

At the five-year sampling event, the dedicated sample pumps will be removed after collecting the sample. Samples at the remaining screened intervals will be collected using the equipment described in the 2009 LTM Design Report (Appendix A). As summarized in Table 4-4, the sampling equipment is currently designed for the intake to be set 10 feet below the bottom of the upper blank in every screened interval where the dedicated pump is not installed. However, this length may need to be re-evaluated as water levels continue to drop in the Ogallala Aquifer.

Table 4-3. Dedicated Sample Intake Information for Ogallala Aquifer Wells

Well ID	Status	Groundwater Elevation[1] (ft amsl)	Sample Intake Elevation (ft amsl)	Sample Intake Depth (ft below top of GW)	Screened Saturated Thickness[2] (ft)	Bottom of Screen Elevation (ft amsl)
PTX01-1010	Active	3070.25	3061.15	9.1	341.24	2729.01
PTX01-1011	Active	3072.07	3019.07	53.0	289.26	2782.81
PTX01-1012	Active	3057.56	3038.76	18.8	380.07	2677.49
PTX01-1013	Active	3070.80	3016.3	54.5	353.64	2717.16
PTX06-1043	Active	3071.74	2912.64	159.1	175.65	2896.09
PTX06-1044	Active	3044.61	2998.51	46.1	115.92	2928.69
PTX06-1056	Active	3132.56	3124.96	7.6	71.79	3060.77
PTX06-1057A	Active	3093.20	3085.1	8.1	281.68	2811.52
PTX06-1058	Active	3164.05	3157.55	6.5	125.60	3038.45
PTX06-1061	Active	3083.44	3065.94	17.5	353.79	2729.65
PTX06-1062A	Active	3063.26	3053.96	9.3	379.38	2683.88
PTX06-1064	Active	3046.73	3033.63	13.1	274.74	2771.99
PTX06-1068	Active	3011.51	3004.71	6.8	274.96	2736.55
PTX06-1072	Active	3131.50	3128.8	2.7	125.19	3006.31
PTX06-1076	Active	3183.56	3170.3	13.3	15.92	3167.64
PTX06-1137A	Active	3053.71	3042.61	11.1	101.21	2952.5
PTX06-1138	Active	3067.50	3029.7	37.8	118.04	2949.46
PTX06-1139	Active	3089.43	3071.73	17.7	110.01	2979.42
PTX06-1140	Active	3034.59	3007.39*	27.2	187.26	2847.33
PTX06-1141	Active	3079.43	3070.73	8.7	193.86	2885.57
PTX06-1143	Active	3048.44	3005.94	42.5	282.44	2766
PTX06-1144	Active	3030.98	2886.58	144.4	304.64	2726.34
PTX06-1157	Active	3127.35	3112.95	14.4	128.76	2998.59
PTX07-1R01	Active	3113.17	3107.87	5.3	138.70	2974.47

1 Based on June 2019 measurements for most wells.
2 Saturated thickness above the bottom of the well screen.
* Proposed sample intake elevation based on water level recently declining below the existing intake.

Table 4-4. Pump Intake depths for Multi-level Wells

Well ID	Approximate pump intake depths (ft bgs) Screened Interval 1	2	3	4	5	Comments
PTX06-1137A	--	**DP**	--	--	--	no water in first interval
PTX06-1138	**DP**	507	--	--	--	
PTX06-1139	--	**DP**	--	--	--	no water in first interval
PTX06-1140	**--**	**DP**	572	647	--	water level at bottom of first interval in 2019
PTX06-1141	**DP**	532	587	--	--	
PTX06-1143	**DP**	542	597	697	772	
PTX06-1144	497	552	**DP**	672	792	pump set in third screened interval
PTX06-1157	**DP**	467	517	--	--	

-- No water in/well not constructed with this interval
DP – dedicated pump

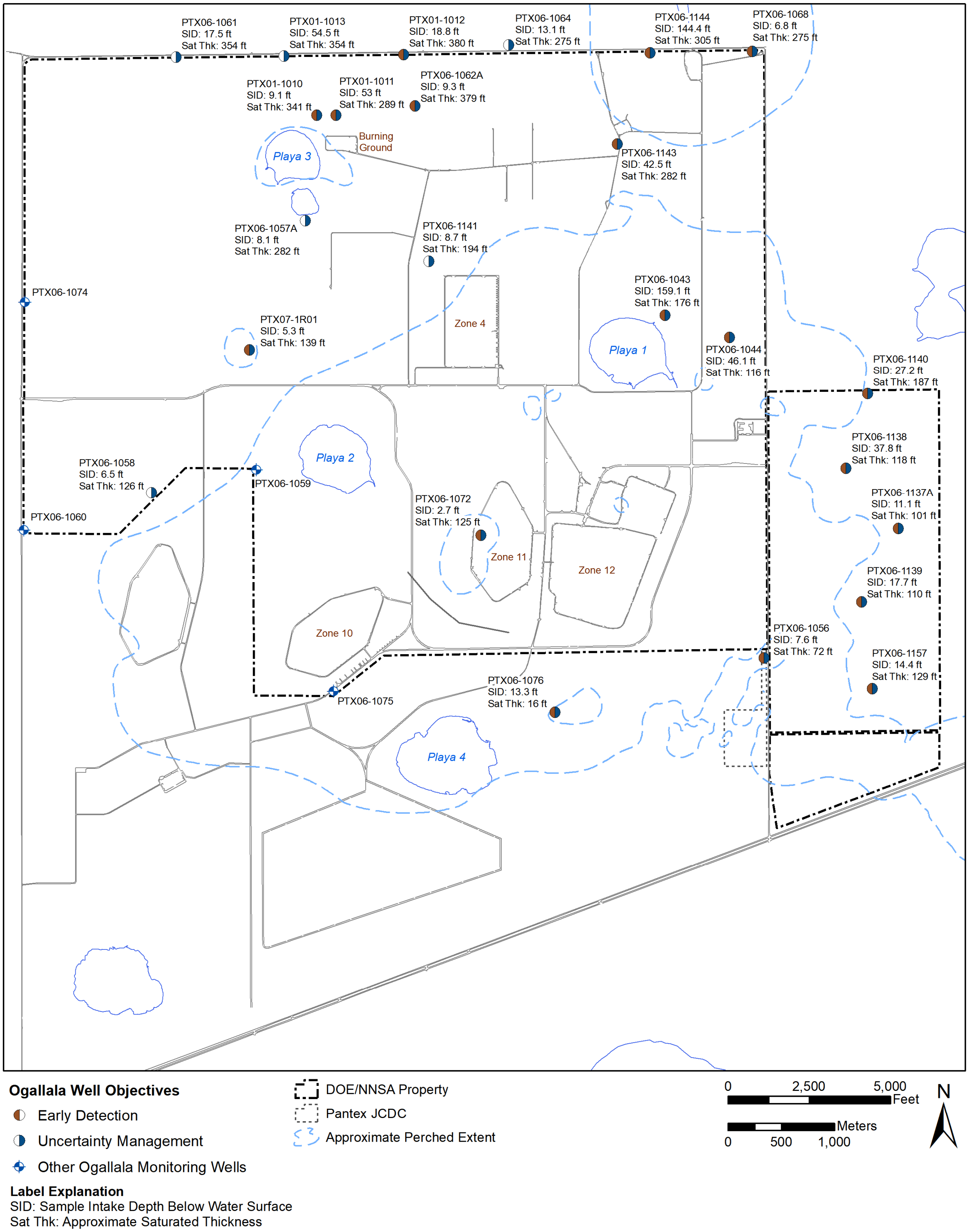

Figure 4-1. Sample Intake Depths for Ogallala Aquifer Wells

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5. EVALUATION OF MONITORING DATA

This section discusses methods that will be used to evaluate monitoring data with respect to the various objectives identified in this report. Monitoring data are collected at various frequencies including semi-annually, annually, and every 5 years. All data are reviewed as received from the laboratories as part of the data validation process. The data also undergo an automated review process as received to identify anomalies such as first time detections, all-time high detections, or off-trend values. Monitoring data are further reviewed at various frequencies according to the purpose for collection of the data. For example, semi-annual data collected from ISB treatment zones are reviewed after validation to evaluate redox conditions within the barrier and determine the need for amendment injection. A comprehensive review and evaluation is conducted annually with findings documented in an annual progress report. Quarterly progress reports supplement the annual reports by providing snapshots of monitoring data, evaluation of redox conditions, charts of pump and treat system performance, and evaluation of key uncertainty management well data. The data also support the Five-Year Review required under the Inter-Agency Agreement (IAG) and HW-50284.

5.1. ANNUAL PROGRESS REPORT EVALUATION

For the annual progress report, data are compared to the GWPS and evaluated with respect to the remedial action objectives in the ROD and the response actions installed for Pantex. The following are evaluated:

- Plume stability
- Response Action Effectiveness: performance of individual response actions and the combination of response actions as a total remedy, achievement of cleanup standards
- Uncertainty Management: evaluation of data relative to expected conditions
- Early Detection: COC concentrations in the Ogallala Aquifer
- Natural attenuation of COCs

The expected conditions identified for each well in Tables 2-2 and 3-1 are used in data evaluations.

5.1.1 <u>Plume Stability</u>

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

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

5.1.2 Response Action Effectiveness

In Situ Bioremediation Systems

Data collected at wells within and downgradient of the in situ bioremediation systems are used to evaluate system performance and to determine when subsequent injections of bioremediation amendment are needed as described in the bioremediation system O&M plans. Within the treatment zone, data are evaluated to demonstrate that appropriate reducing conditions have been achieved and are being maintained, that amendment degradation products are available to support microbial growth, and that concentrations of primary COCs and degradation products are decreasing. Separate from the evaluation for the annual report, these data are also used to determine when additional injections of bioremediation amendment are needed to ensure that reducing conditions are maintained and that amendment availability is not a limiting factor in overall ISB treatment performance. Downgradient of the treatment zone, the data evaluation must demonstrate that objectives of the response action have been achieved; specifically, concentrations of COCs and degradation products must be below GWPS within an appropriate timeframe after initial injection, generally 3 to 5 years, although a longer time period is required for wells located further downgradient from the injection wells. Data collected from ISB performance monitoring wells are used in trend analyses of concentrations of COCs and degradation products, geochemical parameters, and amendment performance indicators to support evaluation of ISB effectiveness. Estimates of groundwater velocities and plume migration rates also support determination of amendment injection frequency.

Pump and Treat Systems

Because the primary metric for success of the pump and treat systems is decreasing perched groundwater thickness, well hydrographs and water level trends are used to demonstrate pump and treat system effectiveness. The water level data are also used to determine the effects of the extraction systems on flow direction, hydraulic gradient, and saturated thickness. Although hydraulic containment is not a primary objective of either system, extraction well capture zones are determined through available data and modeling. Concentration data collected at extraction wells also benefit the plume stability analysis.

Comparison of process monitoring data to GWPS demonstrate that the treatment processes are achieving cleanup standards.

Overall Response Action Effectiveness

The derived data outputs described previously, including plume maps, concentration and water level trends, potentiometric surface maps, and capture zone analysis, together provide the basis for analysis of overall response action effectiveness. Over time, these data evaluations must demonstrate overall declines in perched saturated thickness, decreases in perched hydraulic gradients and rates of COC plume migration, and effective treatment of COC plumes downgradient of the in situ bioremediation systems.

5.1.3 Uncertainty Management

Uncertainty management monitoring is designed to obtain data to identify any unknown contaminant migration pathways. Indicator parameter data collected from uncertainty management wells are compared to the GWPS. For wells located near known groundwater contaminant source areas, trend analyses are used to confirm the expected conditions that source strength and mass flux are decreasing over time. Data for the broader suite of constituents collected every 5 years are reviewed to identify new groundwater constituents, if any.

5.1.4 Early Detection

Data for indicator constituents collected in Ogallala Aquifer wells are compared to background levels or PQLs and GWPS. Trend analyses are also used for naturally-occurring constituents and for low-level detections of site-related constituents to help identify impacts to the Ogallala Aquifer.

5.1.5 Natural Attenuation

In addition to regular monitoring of COC and daughter product concentrations, natural attenuation parameters are collected from all perched wells on a two-year interval to permit screening and evaluation of natural degradation processes. These data are compared to screening values that may indicate favorable conditions for natural attenuation to occur. The results of these comparisons are combined with COC trend analysis results and estimates of plume migration and variability to determine if natural attenuation is occurring and to possibly estimate degradation rates. Because of the observed slow attenuation rates for most COCs, quantitative analysis of natural attenuation based solely on monitoring data is not feasible.

5.2. QUARTERLY PROGRESS REPORTS

The quarterly progress reports are intended to provide intermediate data summaries for response action systems throughout the year without requiring time-intensive, comprehensive data analyses. The quarterly progress reports address three of the five evaluations included in the annual progress report: response action effectiveness, uncertainty management, and early detection. Analyses of plume stability are not provided quarterly because the analyses require more data than what is collected each quarter. Because natural attenuation data are collected only every two years, no analyses of natural attenuation are included in the quarterly reports. Analytical data reports and comparison of data to GWPS are provided in the annual progress reports and are not provided quarterly.

The evaluation of response action effectiveness for the ISB systems includes a statement of treatment zone status (e.g., maintenance of reducing conditions and need for amendment injection) and trend charts of target COCs and degradation products at downgradient performance monitoring locations. For the pump and treat systems, the evaluation includes a summary of operational efficiency for the quarter (such as a chart of monthly flow rate compared to a target flow rate) and graphs of treatment volumes and contaminant mass removed.

For uncertainty management and early detection objectives, the quarterly progress reports provide summaries of any unexpected conditions or a statement that no unexpected conditions were observed.

5.3. FIVE-YEAR REVIEW

A five-year review is required under the IAG in accordance with CERCLA §121(c) and the National Oil and Hazardous Substances Pollution Contingency Plan (40 CFR Part 300.430(f)(4)(ii)). Data collected for the LTM system also support the five-year review. The evaluations performed for the annual report are reviewed collectively to determine the performance of the response actions across a five-year time period to determine if the response actions need to be adjusted to better meet the RAOs. In addition, the LTM system design will be reevaluated using similar methods to those used for this report. Adjustments that need to be made to the network will be documented in an updated design report and submitted for approval.

5.4. EVALUATION METRICS

Most methods for the evaluation are based on simple comparisons to established values, such as the PQL, background, or GWPS. Statistical analyses of concentration trends in each well are conducted using the methods described in the following sections. Well hydrographs are provided for all monitoring wells, and a linear regression trend analysis is used to determine if water levels are declining as stated in the cleanup objectives for the perched groundwater.

5.4.1 Statistical Concentration Trend Analysis

The general change in concentration, or trend, of a particular constituent in a well can be quantified using a statistical trend analysis method. The methods used, including a nonparametric Mann-Kendall analysis and a parametric linear regression, were adapted from the MAROS Software. The following descriptions of the statistical trend analysis methods were adapted from the MAROS Version 2.2 User's Guide (AFCEE, 2007).

With actual site measurements, apparent concentration trends may often be obscured by data scatter arising from non-ideal hydrogeologic or sampling and analysis conditions. However, even though the scatter may be of such magnitude as to yield a poor fit (typically characterized by a low correlation coefficient, e.g., $R^2 << 1$) for the first-order relationship, parametric and nonparametric methods can be utilized to obtain confidence intervals on the estimated first-order coefficient, i.e., the slope of the log-transformed data. Nonparametric tests such as the Mann-Kendall test for trend are suitable for analyzing data that do not follow a normal distribution. Nonparametric methods focus on the location of the probability distribution of the sampled population, rather than specific parameters of the population. The outcome of the test is not determined by the overall magnitude of the data points, but depends on the ranking of individual data points. Assumptions on the distribution of the data are not necessary for nonparametric tests. The Mann-Kendall test for trend is a nonparametric test which has no distributional assumptions and irregularly spaced measurement periods are permitted. The advantage gained by this approach involves the cases where outliers in the data would produce biased estimates of the least squares estimated slope.

Parametric tests such as first-order regression analysis make assumptions on the normality of the data distribution, allowing results to be affected by outliers in the data in some cases. However, more accurate trend assessments using parametric methods result from data where there is a normal distribution of the residuals. Therefore, when the data are normally distributed, the nonparametric Mann-Kendall test is not as efficient.

Mann-Kendall Analysis

General

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 MAROS tool includes this test to assist in the analysis of groundwater plume stability. 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. The Mann-Kendall test is designed for analyzing a single groundwater constituent, multiple constituents are analyzed separately. For this evaluation, a decision matrix was used to determine the "Concentration Trend" category for each well, as presented in Table 5-1.

Mann-Kendall Statistic (S)

The Mann-Kendall statistic (S) measures the trend in the data. Positive values indicate an increase in constituent concentrations over time, whereas negative values indicate a decrease in constituent concentrations over time. The strength of the trend is proportional to the magnitude of the Mann-Kendall statistic (i.e., large magnitudes indicate a strong trend). Data for performing the Mann-Kendall Analysis must be in time sequential order. The first step is to determine the sign of the difference between consecutive sample results. Sign(x_j–x_k) is an indicator function that results in the values 1, 0, or –1 according to the sign of (x_j–x_k), where j > k. The function is calculated as follows:

$$\operatorname{sgn}(x_j - x_k) = 1 \qquad \text{if } x_j - x_k > 0$$

$$\operatorname{sgn}(x_j - x_k) = 0 \qquad \text{if } x_j - x_k = 0$$

$$\operatorname{sgn}(x_j - x_k) = -1 \qquad \text{if } x_j - x_k < 0$$

The Mann-Kendall statistic is defined as the sum of the number of positive differences minus the number of negative differences or

$$S = \sum_{k=1}^{n-1} \sum_{j=k+1}^{n} \operatorname{sgn}\left(x_j - x_k\right).$$

The ***confidence in the trend*** for the Mann-Kendall statistic is calculated using a Kendall probability table (e.g. Hollander, M. and Wolfe, D.A., 1973). By assessing the S result along with the number of samples, n, the Kendall table provides the probability of rejecting the null hypothesis (H_0 = no trend) for a given level of significance. MAROS calculates a “confidence level” percentage by subtracting the probability (*p*) from 1 (Confidence = 1-*p* %). Confidence of 90% represents a significance level of $\alpha = 0.1$, and 95% confidence corresponds to $\alpha = 0.05$. The resulting confidence in the trend is applied in the Mann Kendall trend analysis.

Average

The arithmetic mean of a sample of n values of a variable is the average of all the sample values written as

$$\bar{x} = \frac{\sum_{i=1}^{n} x_i}{n}$$

Standard Deviation

The standard deviation is the square root of the average of the square of the deviations from the sample mean written as

$$s = \sqrt{\frac{\sum_{i=1}^{n} (x_i - \bar{x})^2}{n-1}}\ .$$

The standard deviation is a measure of how the value fluctuates about the arithmetic mean of the data.

Coefficient of Variation (COV)

The Coefficient of Variation (COV) is a statistical measure of how the individual data points vary about the mean value. The coefficient of variation, defined as the standard deviation divided by the average or

$$C.O.V. = \frac{s}{\bar{x}}$$

Values less than or near 1.00 indicate that the data form a relatively close group about the mean value. Values larger than 1.00 indicate that the data show a greater degree of scatter about the mean.

Results and Interpretation of Results: Mann-Kendall Analysis

The concentration data are used to calculate COV and S for each well with at least four sampling events. A “Concentration Trend” and “Confidence in Trend” are reported for each well with at least four sampling events. If data are insufficient, the well trend analysis is not conducted.

The COV is a statistical measure of how the individual data points vary about the mean value. Values less than or near 1.0 indicate that the data form a relatively close group about the mean value. Values larger than 1.0 indicate that the data show a greater degree of scatter about the mean. The Mann-Kendall statistic (S) measures the trend in the data. Positive values indicate an increase in constituent concentrations over time, whereas negative values indicate a decrease in constituent concentrations over time. The strength of the trend is proportional to the magnitude of S (i.e., larger magnitudes indicate a stronger trend). The “Confidence in Trend” ($1-p$) is the statistical probability that the constituent concentration is increasing ($S>0$) or decreasing ($S<0$). The null hypothesis (no trend) is rejected for confidence above 90%.

The “Concentration Trend” for each well is determined according to the rules in the decision matrix (Table 5-1), where COV is the coefficient of variation. The MAROS Mann-Kendall Analysis Decision Matrix was developed by Groundwater Services Inc. for AFCEE. Strongly increasing or decreasing trends indicate a higher level of statistical significance. The confidence can be used as a qualitative measure of the statistical strength of the trend when evaluating the overall stability of the plume.

Linear Regression Analysis

General

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. Even though the scatter may be of such magnitude as to yield a poor goodness of fit (typically characterized by a low correlation coefficient, e.g., $R^2 << 1$) for the first-order relationship, confidence intervals can nonetheless be constructed on the estimated first-order coefficient, i.e., the slope of the log-transformed data. Using this type of analysis, a higher degree of scatter simply corresponds to a wider confidence interval about the average log slope. Assuming the sign (i.e., positive or negative) of the estimated log slope is correct, a level of confidence that the slope is not zero can be easily determined. Thus, despite a poor fit, the overall trend in the data may still be ascertained, where low levels of confidence correspond to “Stable” or “No Trend” conditions (depending on the degree of scatter) and higher levels of confidence indicate the stronger likelihood of a trend. The coefficient of variation, defined as the standard deviation divided by the average, is used as a secondary measure of scatter to distinguish between "Stable" or "No Trend" conditions for negative slopes. The linear regression analysis is designed for analyzing a single groundwater constituent, multiple constituents are analyzed separately. For this evaluation, a decision matrix was used to determine the "Concentration Trend" category for each well, as presented in Table 5-1.

Linear Regression

The objective of linear regression analysis is to find the trend in the data through the estimation of the log slope as well as placing confidence limits on the log slope of the trend. Regression begins with the specification of a model to be fitted. A linear relationship is one expressed by a linear equation. The linear regression analysis is performed on log(concentration) versus time. The regression model assumes that for a fixed value of x (sample date) the expected value of y (log concentration) is some function. For a particular value, x_i or sample date the predicted value for y (log concentration) is given by

$$\hat{y}_i = a + bx_i$$

The fit of the predicted values to the observed values (x_i, y_i) are summarized by the difference between the observed value y_i and the predicted value $\hat{y}_i$ (the residual value). A reasonable fit to the line is found by making the residual values as small as possible. The method of least squares is used to obtain estimates of the model parameters (a, b) that minimize the sum of the squared residuals, S^2 or the measure of the distance between the estimate and the values we want to predict (the y's).

$$S^2 = \sum_{i=1}^{n} (y_i - \hat{y}_i)^2$$

The values for the intercept (a) and the slope (b) of the line that minimize the sum of the squared residuals (S^2), are given by

$$b = \frac{\sum_{i=1}^{n} (x_i - \bar{x})(y_i - \bar{y})}{\sum_{i=1}^{n} (x_i - \bar{x})^2} \qquad \text{and} \qquad a = \bar{y} - b\bar{x}$$

where $\bar{x}$ and $\bar{y}$ are the mean x and y (log concentration) values in the dataset.

In order to test the confidence on the regression trend, there is a need to place confidence limits on the slope of the regression line. In this stage of the trend analysis, it is assumed that for each x value, the y-distribution is normal. A t-test may be used to test that the true slope is different from zero. This t-test is preferentially used on data that is not serially correlated or seasonally cyclic or skewed.

The variance of y_i (σ^2) is estimated by the quantity $S^2_{y|x}$ where this quantity is defined as

$$S^2_{y|x} = \frac{\sum_{i-1}^{n} (y_i - \hat{y}_i)^2}{n-2}$$

where n is the number of samples.

The estimation of the standard deviation or standard error of the slope (s.e.b.) is defined as

$$s.e.b. = \sqrt{\frac{S_{y|x}^2}{\sum_{i-1}^{n}(x_i - \overline{x}_i)^2}}$$

To test significance of the slope calculated, the following t-test result can be used to find the confidence interval for the slope.

$$t = \frac{b}{s.e.b.}$$

The t result along with the degrees of freedom (n–2) are used to find the confidence in the trend by utilizing a t-distribution table found in most statistical textbooks (e.g. Fisher, L.D. and van Belle, G., 1993). The resulting confidence in the trend is utilized in the linear regression trend analysis.

Results and Interpretation of Results: Linear Regression Analysis

The concentration data are used to calculate the COV and the first-order coefficient (log slope) for each well with at least four sampling events. A "Concentration Trend" and "Confidence in Trend" are reported for each well with at least four sampling events. If data are insufficient, the well trend analysis is not conducted.

The COV is a statistical measure of how the individual data points vary about the mean value. Values less than or near 1.0 indicate that the data form a relatively close group about the mean value. Values larger than 1.0 indicate that the data show a greater degree of scatter about the mean.

The Log Slope measures the trend in the data. Positive values indicate an increase in constituent concentrations over time, whereas negative values indicate a decrease in constituent concentrations over time.

The "Confidence in Trend" is the statistical probability that the constituent concentration is increasing (log slope > 0) or decreasing (log slope < 0).

The "Concentration Trend" for each well is determined according to the rules in the decision matrix (Table 5-2), where COV is the coefficient of variation. The MAROS Linear Regression Analysis Decision Matrix was developed in-house by Groundwater Services Inc. for AFCEE.

5.4.2 Water Level Trend Analysis

A similar linear regression trend analysis is used with water level measurements to determine if water levels are declining as stated in the cleanup objectives for the perched groundwater. For water level trend analysis, the measured water levels are the y values. These values are not log-transformed before applying the regression analysis.

5.4.3 Comparison to GWPS

Data collected at each well are directly compared to the GWPS for each constituent to determine if concentrations exceed the GWPS. Wells that exceed the GWPS are highlighted.

5.4.4 Dry

Dry wells are checked semi-annually for water. If sufficient water is found to allow sample collection, the well will be sampled according to the appropriate indicator list, and the data collected will be evaluated accordingly.

5.5. EXPECTED CONDITIONS

The expected condition designated for each well provides a context for evaluating the monitoring data from the well based on the monitoring history, knowledge of plume movement and source area conditions, and expected impacts of remedial action systems. The range of expected conditions were classified into seven categories presented below.

Below background/PQL and GWPS: Concentrations are not expected to exceed background/PQL or the GWPS. This conditions applies to wells that are located outside the extent of a plume or that have not produced exceedances of RRS1 in historical sampling data.

Stable or decreasing trend below GWPS: Concentrations are below the GWPS and are expected to remain stable or decrease over time. This condition applies to wells that have exhibited a decline of concentrations to below the GWPS or that have a history of detections below the GWPS.

Decreasing water levels, Long-term stabilization of concentrations: These wells are within the influence of the groundwater extraction systems, so water levels are expected to decline over time. Concentrations are expected to stabilize as the pump and treat systems continue to remove contaminant mass from the perched groundwater.

Below GWPS in 2–5 years: These wells are downgradient of the ISB systems, so concentrations are expected to decrease as groundwater passing through the treatment zone migrates to the wells. The decrease in concentrations may not be evident until sufficient time has passed to allow treated groundwater to travel the distance from the treatment zone to the well at the pore water velocity.

Below GWPS in 5-10 years: These wells are also downgradient of the ISB systems, so concentrations are expected to decrease as groundwater passing through the treatment zone migrates to the wells. However, these wells are installed further away from the treatment zone so it will take longer for treated water to reach these locations.

Long-term decreasing trend: These wells are outside the zone of influence of the groundwater extraction systems and are not downgradient of an ISB system. Concentrations in these wells are expected to slowly decrease through natural attenuation processes including dispersion, dilution, and degradation.

Limited water: These wells are either installed in areas of limited perched groundwater thickness or along the fringes of the extent of perched groundwater in areas that are not likely under the effects of remedial actions. These wells have been observed to have variable low water levels, likely due to slight perched aquifer expansion or other hydrogeologic conditions in these areas, but are not expected to have measured water over 5 feet in the screened interval. These wells have been assigned a sampling frequency and expected condition in Table 2-1 and will be attempted to be sampled each event, but if there is not enough water in the screened interval for sampling, the well is dry, or a slight increasing water level trend is calculated, these will not be considered to be unexpected conditions.

Remain dry: These wells are well beyond the extent of perched saturation in areas likely affected by remedial actions and serve as plume stability wells. These wells are monitored for perched groundwater and contaminant plume expansion in these areas. The expected condition for these wells is that water will not be observed in the screen.

Table 5-1. MAROS Mann-Kendall Analysis Decision Matrix

Mann-Kendall Statistic	Confidence in Trend	Concentration Trend
S > 0	> 95%	Increasing
S > 0	90–95%	Probably Increasing
S > 0	< 90%	No Trend
S ≤ 0	< 90% and COV ≥ 1	No Trend
S ≤ 0	< 90% and COV < 1	Stable
S < 0	90–95%	Probably Decreasing
S < 0	> 95%	Decreasing

Table 5-2. MAROS Linear Regression Analysis Decision Matrix

Log Slope	Confidence in Trend	Concentration Trend
Positive	> 95%	Increasing
Positive	90–95%	Probably Increasing
Positive	< 90%	No Trend
Negative	< 90% and COV ≥ 1	No Trend
Negative	< 90% and COV < 1	Stable
Negative	90–95%	Probably Decreasing
Negative	> 95%	Decreasing

6. SUMMARY AND CONCLUSIONS

This report documents recommended updates to the long-term groundwater monitoring well network based on quantitative and qualitative analyses of hydrogeologic and analytical data. The changes include:

- Addition of 23 new wells to the perched LTM network installed since the 2014 update. Seventeen of these wells were installed to define and track the movement of the RDX plume in the far southeast extent of perched groundwater. Five wells were installed to monitor plumes emanating from Zone 11, and one well was installed to monitor hexavalent chromium in the southeast area.

- Proposed installation of two additional new wells in the Southeast indicator area.

- Monitoring of water levels only for nine perched groundwater wells in which water levels have declined as expected and are below the bottom of the screen.

- Removal of 14 wells from the perched LTM network, including two wells that were previously plugged and abandoned with regulatory approval, and 12 wells that are either dry, do not provide useful data, or are redundant with other LTM wells.

- Reduced monitoring frequency in 41 perched and four Ogallala LTM wells based on well location, evaluation of historical trends, and groundwater flow conditions.

- Removal of the 5-year modified Appendix IX sampling from four Ogallala LTM wells that are not located near potential soil source areas or are overlain by perched groundwater so the Ogallala is not the uppermost aquifer.

- Removal of two previously plugged and abandoned wells from the Ogallala LTM network.

No changes to the monitoring objectives, monitoring of soil release units, or methods for evaluation of the response actions are recommended at this time.

The LTM network will be evaluated and this document will be updated as necessary as part of the next Five-Year Review, scheduled for completion in 2023.

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Appendix A

2009 LTM Network Design Report

Appendix B

2014 Update to the Long-Term Monitoring System Design Report

Appendix C

Optimization Review Report Long-Term Monitoring Optimization Perched Groundwater Unit 2017 (HGL, 2017)

Optimization Review Report
Long-Term Monitoring Optimization

Perched Groundwater Unit

Pantex Plant
Carson County, Texas

FINAL
Issued: 25 July 2017

Prepared for:
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HGL
HydroGeoLogic, Inc

LONG-TERM MONITORING OPTIMIZATION REVIEW

PERCHED GROUNDWATER
PANTEX PLANT

FINAL REPORT
July 2017

EXECUTIVE SUMMARY

SITE-SPECIFIC BACKGROUND

The Pantex Plant Site (site) is located approximately 17 miles northeast of Amarillo, Texas in Carson County in U.S. Environmental Protection Agency (EPA) Region VI. The site covers roughly 10,000 acres with additional property consisting of a 1,000-acre tract at Pantex Lake. The primary mission of the Pantex Plant is to assemble, disassemble, and evaluate nuclear weapons from the U.S. stockpile, to develop, fabricate, and test explosives and explosive components, and to provide secure storage for material from the above activities. Historical Plant waste management activities have resulted in impacts to soil and perched groundwater above risk-based, human health standards.

The site was added to the National Priorities List (NPL) under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) in 1994. A corrective action program has been developed to address unacceptable risks for a perched groundwater unit at the facility. The purpose of the following study is to review the current groundwater monitoring network for the perched unit relative to the stated monitoring objectives and provide recommendations for improving the efficiency and accuracy of the network for supporting site management decisions.

SUMMARY OF CONCEPTUAL SITE MODEL AND KEY FINDINGS

The Pantex Plant lies on the High Plains portion of the Great Plains Physiographic Province in the Texas Panhandle. The area is a flat plateau with topographic elevation across the site ranging between 3,501 feet above mean sea level (ft amsl) to 3,595 ft amsl. A distinguishing feature of the surface of the plain is the presence of numerous shallow circular basins called *playas*. Playas are ephemerally moist depressions that are the location of much of the recharge to groundwater in the region. The hydrostratigraphy below the Pantex Plant consists of the Blackwater Draw (BWD) underlain by the Ogallala Formation. Within the Ogallala Formation are an upper perched saturated unit and a lower groundwater unit. Permeable units within the Ogallala are composed of coarse-grained fluvial sequences including channel sands and gravels overlain by finer overbank deposits.

The perched groundwater unit is present between about 215 and 280 feet below ground surface (bgs) and is underlain by a Fine-Grained Zone (FGZ). The FGZ is composed of silts and clays and separates the upper perched zone from the lower Ogallala Formation. Below the FGZ is an unsaturated zone of variable thickness. The lower Ogallala Aquifer is present between about 400 to 500 feet bgs, and is the primary source of drinking water for the city of Amarillo, Texas.

Because of mounding in the main perched unit near Playa 1 and the topography of the FGZ, groundwater flow tends to be radial, with the surface sloping to the southeast, south and east. The thickness of the perched unit varies between a maximum of about 70 feet under Playa 1 to trace levels of saturation at the edges. Smaller, isolated areas of perched groundwater are present under other playa formations at the Plant.

The primary sources of constituents of concern (COCs) to groundwater at the Pantex Plant arose from infiltration of historic wastewater discharges through areas of focused recharge to the vadose zone and perched groundwater unit. Historically, effluent from industrial processes, sanitary wastewater, cooling water discharge and storm water runoff were released to unlined ditches and directed to playas.

Primary COCs affecting the perched unit include trichloroethene (TCE), perchlorate, hexavalent chromium [Cr (VI)] and the high explosives (HE) RDX (hexahydro-1,3,5-trinitro-1,3,5-triazine) and trinitrotoluene (TNT) as well as degradation products such as 4-amino-2,6-dinitrotoluene (4ADNT).

Remedies selected in the 2008 Record of Decision (ROD) include groundwater extraction and treatment and injection of amendments to enhance anaerobic degradation of COCs. Two groundwater pump and treat (P&T) systems are currently operational. The Southeast Pump and Treat System (SEPTS) consists of 61 groundwater extraction wells and a 300 gallon per minute (gpm) treatment plant. The Playa 1 Pump and Treat System (P1PTS) consists of 10 extraction wells and a 250 gpm treatment plant. Treated groundwater is discharged through a crop irrigation system. An in-situ bioremediation system (ISB) has been installed along the southeast edge of the perched unit to treat RDX and other COCs in an area where the FGZ thins. A second ISB system is located southwest of industrial Zone 11 to treat TCE and perchlorate. Groundwater monitoring is part of the selected remedy for the site.

The primary goal of the monitoring network is to confirm progress toward Remedial Action Objectives (RAOs). Data collected from the monitoring network are used to evaluate the performance and efficacy of the remedies and are used to compare actual conditions to expected site conditions. The three primary monitoring objectives for the perched groundwater network are to manage uncertainty, evaluate plume stability and evaluate remedial efficacy. All monitoring wells are assigned monitoring objectives.

Evaluation of the groundwater monitoring network for the Pantex Plant consisted of both quantitative and qualitative methods. A quantitative statistical evaluation of the site was conducted using tools in the Monitoring and Remediation Optimization System (MAROS) software. All results returned by the MAROS software were reviewed for consistency with the goals and objectives of the monitoring program and the conceptual site model (CSM). Final recommendations for the monitoring network are a combination of quantitative and qualitative review.

Groundwater analytical data collected between 2012 and 2016 from the Pantex Plant long-term monitoring (LTM) network were supplied in a site database. Received data include geographic coordinates of the wells, sample dates, analytical results, detection limits, and data flags. Analytical data from the previous LTM investigations (2000 through 2011) were used to supplement analyses of long-term trends.

For the current report, analytical data from 214 different sampling locations were received including data from investigation monitoring wells (IW), extraction wells (EW) and ISB wells. Only data from the 112 active IWs were used in the statistical analyses. The database contained data for 24 different COC analytes. As in the previous analyses, IWs were grouped by sector of dominant groundwater flow direction. IWs were grouped into North, Southeast and Southwest Sectors. Statistical findings for each sector are summarized below.

SOUTHEAST SECTOR FINDINGS

- RDX was identified as the priority COC at 29 of the 50 monitoring locations in the Southeast Sector based on the magnitude of the exceedance of remedial goals. Perchlorate and Cr (VI) were prioritized in the area south of industrial Zones 11 and 12. 4ADNT was selected as a priority COC for optimizing the monitoring network due to its wide distribution in the Southeast Sector. Other monitoring locations show priority exceedances for 1,2-dichloroethane, TCE, RDX degradation products, and barium
- Individual well concentrations for priority COCs showed largely *stable* to *decreasing* statistical trends. Overall RDX trend results from 2012 through 2016 include many more *decreasing* statistical trend results for the Southeast Sector than the 2012 analysis.
- Source area wells showed largely *stable* to *decreasing* trends indicating a reduction in mass export from primary release areas. Tools in the MAROS software estimated that about 2 to 3 percent of total plume contaminant mass remains in the Zone 12 source area.
- None of the SEPTS monitoring wells show an *increasing* trend for RDX or 4ADNT. Data indicate that the SEPTS has stabilized plume migration downgradient from primary sources.
- The far southeastern area of the perched unit shows *probably increasing* individual well trends for RDX and increasing trends for 4ADNT at wells PTX06-1030 and PTX06-1031. High concentrations and a strongly *increasing* trend for RDX were found at PTX06-1034, the well defining the extent of the perched unit to the east. While there were insufficient data to evaluate a statistical trend at PTX06-1182 (installed July 2016), concentrations exceeded remedial goals for both RDX and 4ADNT at this location.
- Monitoring wells immediately downgradient from the Southeast ISB remedy show strongly *decreasing* trends for RDX as well as RDX degradation products TNX, DNX and MNX, indicating that the ISB remedy is successfully removing contaminant mass. However, well PTX06-1153, the westernmost ISB monitoring well has a *probably increasing* trend for RDX with persistent high concentrations.
- Total dissolved mass of RDX showed no trend 2012 through 2016 while 4ADNT showed a *stable* statistical trend. These results indicate stabilization of plumes since the 2008 through 2012-time frame. Centers of plume mass remained in the area of the SEPTS, with some migration of the center of the RDX plume to the southeast.
- The results of the MAROS spatial analyses indicate overall low concentration uncertainty and low variability between monitoring locations in the Southeast Sector. Evenly spaced monitoring locations, low concentration uncertainty and relatively low variability, along with the *stable* individual well trend and moment analysis results indicate that the network is well designed to address priority monitoring goals of plume stability and uncertainty assessment.
- The MAROS software recommended an overall Biennial (every two years) monitoring frequency based on the rate of concentration change for most wells and mass within the network as a whole.

SOUTHWEST SECTOR FINDINGS

- TCE is the priority COC at 21 of 53 sampling locations, and perchlorate is the priority at 6 of the 40 wells sampled for perchlorate in the Southwest Sector. Priority COCs at individual wells other than TCE and perchlorate include 4ADNT, RDX, Cr (VI) and degradation products of TCE and RDX. 1,4-Dioxane was detected above remedial goals at 10 sampling locations in the Southwest Sector.
- The Southwest Sector monitoring well network has several wells that have been installed since 2013, many in the western ISB area for remedial action monitoring. New wells and uncertainty management wells that are sampled infrequently do not have a sufficiently large dataset for statistical trend analysis. For remedial action monitoring wells, about 50 percent of TCE and 42 percent of perchlorate trend analyses have either insufficient or variable data showing no distinct statistical trends.
- For TCE, some *stable* concentration trends are found in the western ISB area at older wells and *decreasing* statistical trends were found in the central and eastern ISB areas. Other ISB wells have variable concentration results. These results indicate that the efficacy of the ISB remedy is likely improving with time.
- Two remedial action and plume stability monitoring wells with *increasing* TCE trends (PTX06-1150 and PTX06-1159) are found south of the ISB remedy. PTX06-1159 also shows an *increasing* trend for perchlorate and cis-1,2-dichloroethene. MAROS estimates the percentage of total plume contaminant mass monitored by each well in the network. Results indicate that well PTX06-1159 monitors about 27 percent of the total TCE mass in the network, due to the large area it monitors.
- Wells PTX06-1035 and PTX06-1134, near PTX06-1150 and PTX06-1159, also show *increasing* and *probably increasing* trends for TCE and perchlorate.
- Results for the moment analyses for both TCE and perchlorate plumes indicate statistically *stable* overall trends within the network. While individual wells within the network may show strong trends, the plumes are not migrating or significantly changing distribution on a larger landscape level. Centers of mass for TCE and perchlorate had no trend and *stable* results, respectively.
- Unlike the Southeast Sector, more contaminant mass is present in the Zone 11 source area. The MAROS tool estimated that 28 percent of TCE and 69 percent of residual perchlorate remain in the source area.
- In the spatial analysis, uncertainty and variability between sampling locations was found to be low and no areas within the plume were identified as requiring additional monitoring locations.
- The software identified the area outside of the monitoring network south of the ISB as potentially requiring additional monitoring. *Increasing* concentration trends at leading edge wells PTX06-1035, PTX06-1134 and PTX06-1159 indicate that at least one additional monitoring well is required downgradient to monitor the leading edge of the plume.

- The MAROS well redundancy analysis identified well PTX06-1162 for TCE and perchlorate as redundant. Removal of PTX06-1162 well data from the network spatial analysis did not increase uncertainty between adjacent wells, change estimates of the mass or distribution of TCE and perchlorate in the plume.
- Most wells in the program were recommended by the software for Biennial sampling for both TCE (37 of 53 wells) and perchlorate (28 of 43 wells). The Biennial recommendation is consistent with the finding that concentrations are not changing rapidly and plumes are largely stable.

NORTH SECTOR MONITORING NETWORK

- RDX is the only priority COC on a sector-wide basis in the north. Constituents that exceed remedial goals at individual wells are RDX, boron, and 4ADNT. Many wells north of Zones 11 and 12 are uncertainty management wells and have low to no detections of site COCs.
- North of Playa 1, PTX06-1050 monitors groundwater with historical high concentrations of RDX, boron and 4ADNT, but has shown *decreasing* and *probably decreasing* trends since 2008. Well PTX06-1136, downgradient from PTX06-1050 is non-detect for RDX, indicating the plume in the northwest is not expanding and is well delineated
- Total dissolved mass for RDX was found to be *increasing* within the network, but the plume does not appear to be migrating. The P1PTS may be mobilizing RDX from below Playa 1, but the groundwater extraction system is controlling migration of the center of mass of the plume. Metrics were *stable* to *no trend* for 4ADNT.
- The North Sector show significant spatial uncertainty between monitoring locations, which is consistent with the finding that the North Sector has variable groundwater flow and source locations, as well as disconnected saturated zones.
- As with Southeast and Southwest Sectors, concentration trends in the North Sector are not changing rapidly. Overall, most wells in the North Sector were recommended for Biennial sampling by the MAROS algorithm

RECOMMENDATIONS

SOUTHEAST SECTOR RECOMMENDATIONS

- At least one additional monitoring well is recommended for the far southeastern area of the perched unit. The area around PTX06-1182 and upgradient of Highway 60 requires delineation of the plume and the extent of the saturated zone.
- Identifying the extent of the perched unit and evaluating elevations of the FGZ in the Southeast Sector is challenging as the formation can be intermittently saturated and the FGZ tilts upward in this area. Intermittently dry wells in the southeast are checked semi-annually for saturation. This effort should continue going forward to enhance CSM development
- Continued investigation of the area around in situ performance monitoring well PTX06-

1153 is recommended to address uncertainty related to RDX concentration trends in this area. Additional monitoring wells are not recommended, but periodic sampling of previously dry wells is recommended along with data review to update the CSM in this area.

- No wells are recommended for removal from the Southeast Sector routine monitoring program, at this time. Monitoring locations with very low spatial uncertainty (e.g. where the nearest neighboring wells can predict concentrations at a well node) were considered for reduced sampling frequency.
- While the MAROS results indicate that a Biennial sampling frequency would be sufficient to evaluate the rate of concentration change in the network and at most wells, an overall Annual sampling frequency is recommended for most locations in the Southeast Sector. Semi-annual sampling is recommended at wells used to evaluate the ISB and SEPTS remedies and potential plume migration along the east and southeast edges of the perched unit.

SOUTHWEST SECTOR RECOMMENDATIONS

- At least one additional monitoring well is recommended for the area downgradient from the ISB to manage uncertainty about migration of the TCE and perchlorate plumes. If concentration trends at PTX06-1134 do not stabilize in the near future, as expected, then an additional well may be required downgradient from PTX06-1134 to delineate the TCE plume.
- Site data indicate high and increasing concentrations of perchlorate at PTX08-1008, cross gradient from the ISB remedy. While an additional well is not recommended downgradient of PTX08-1008 at this time, the recommendation is to monitor perchlorate at PTX08-1009 and wells to the southeast of PTX08-1008 for potential migration of the perchlorate plume around the end of the ISB remedy.
- Overall, there is very low spatial uncertainty within the network, and no wells in the routine sampling network are recommended for elimination. One well, PTX06-1162 was found to be redundant in the network. This wells is not currently sampled routinely, and continued limited sampling is recommended.
- Monitoring wells in the Zone 11 and Zone 12 source areas show largely *stable* to *decreasing* trends resulting in recommendations for Annual sampling. ISB area wells are recommended for a Semi-annual sampling frequency. Wells outside of the main plumes to the west are minimally affected by site COCs and are recommended for sampling once before each Five-Year Review (or as regulatory permitting requires).

NORTH SECTOR RECOMMENDATIONS

- No additional wells are recommended in the North Sector. No additional wells are recommended for the isolated perched water units at the Burning Ground or along the northern Plant boundary.
- Well PTX-BEG3 is recommended for elimination from routine monitoring.
- For the northern perched unit, a largely Annual sampling frequency is recommended for

the Playa 1 area based on the rate of concentration change and the outstanding remedy management questions. Perched groundwater in the Burning Ground and northern boundary are recommended for 5-year sampling frequency except for POC wells that are recommended for Annual sampling.

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LIST OF ACRONYMS AND ABBREVIATIONS

2ADNT	2-Amino, 4,6-dinitrotoluene
24DNT	2,4-Ditinitrotoluene
26DNT	2,6-Dinitrotoluene
4ADNT	4-Amino, 2,6-dinitrotoluene
AEC	Atomic Energy Commission
amsl	above mean sea level
AOC	Area of Concern
bgs	below ground surface
BWD	Blackwater Draw
C	Carcinogenic
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CMS	Corrective Measure Study
CNS	Consolidated Nuclear Security, L.L.C.
COC	Constituent of Concern
COV	Coefficient of Variation
Cr III	Trivalent chromium
Cr VI	Hexavalent chromium
CSM	Conceptual Site Model
DOE	United States Department of Energy
DNX	Hexahydro-1,3-Dinitroso-5-Nitro-1,3,5-Triazine
EM	Department of Energy Environmental Management
EPA	U.S. Environmental Protection Agency
EW	Extraction Well
FGZ	Fine Grained Zone
FS	Feasibility Study
FYR	Five-Year Review
GAC	Granular activated carbon
GW	Groundwater
GW-Res	TCEQ Standard No. 2 Groundwater MSC for Residential Use

HA	Hazard Assessment
HE	High explosive
HMX	High melting explosive (Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine)
HSU	Hydrostratigraphic Unit
IAG	Interagency Agreement
IC	Institutional Control
ICM	Interim Corrective Measures
ISB	*In Situ* Bioremediation
ISM	Interim Stabilization Measure
IW	Investigation Well
LTM	Long-Term Monitoring
LTMO	Long-Term Monitoring Optimization
MAROS	Monitoring and Remediation Optimization Software
MCL	Maximum Contaminant Level
MNX	Hexahydro-1-Nitroso-3,5-Dinitro-1,3,5-Triazine
MK	Mann-Kendall Trend
MOA	Memorandum of Agreement
MSC	Medium Specific Concentration
N/A	Not Analyzed/Not Applicable
NC	Non-carcinogenic
NNSA	National Nuclear Security Administration
NPL	National Priorities List
P1PTS	Playa 1 Pump and Treat System
POC	Point of Compliance
POE	Point of Exposure
PQL	Practical Quantitation Limit
PRG	Preliminary Remediation Goal
PS	Plume Stability Monitoring
R^2	Coefficient of Determination
RA	Response Action Monitoring
RAO	Remedial Action Objectives
RCRA	Resource Conservation and Recovery Act
RDX	Research Department Explosive (Hexahydro-1,3,5-trinitro-1,3,5-triazine)

RFI	Resource Conservation and Recovery Act Facility Investigation
ROD	Record of Decision
RRR	Risk Reduction Rules
SEPTS	Southeast Pump and Treat System
SF	Slope Factor
SVE	Soil Vapor Extraction
SWMU	Solid Waste Management Unit
TCE	Trichloroethene
TCEQ	Texas Commission on Environmental Quality
TNT	Trinitrotoluene
TNX	Hexahydro-1,3,5-Trinitroso-1,3,5-Triazine
TTU	Texas Tech University
UM	Uncertainty Management Monitoring
VOC	Volatile Organic Compound
WMG	Waste Management Group
WWTF	Waste Water Treatment Facility

Statistical Trends

D	*decreasing*
PD	*probably decreasing*
S	*stable*
PI	*probably increasing*
I	*increasing*
ND	non-detect
NT	*no trend*

Units

µg/L	micrograms per liter
mg/L	milligrams per liter
gpd	gallons per day
gpm	gallons per minute
ft	feet

1.0 OBJECTIVES OF THE OPTIMIZATION REVIEW

The Pantex Plant Site (site) is located approximately 17 miles northeast of Amarillo, Texas in Carson County in U.S. Environmental Protection Agency (EPA) Region VI. The site covers roughly 10,000 acres with additional property consisting of a 1,000-acre tract at Pantex Lake. Over 5,000 acres are owned by Texas Tech University (TTU) as a buffer around the site. Industrial operations occur on approximately 2,000 acres of the Plant (**Figure 1**).

The Pantex Plant is currently managed as a government-owned, contractor-operated facility, overseen by the Department of Energy/National Nuclear Security Administration (DOE/NNSA) and operated by Consolidated Nuclear Security, L.L.C. (CNS). As the prime contractor, CNS also directs environmental activities including investigation, construction and operation and maintenance of remedial systems.

Historical Plant waste management activities have resulted in impacts to soil and perched groundwater above risk-based, human health standards. A corrective action program has been developed to address unacceptable risks for soil and perched groundwater at the facility. Corrective measures for perched groundwater have been implemented to stabilize and control contaminant migration while reducing the contaminant mass.

The following report focuses on optimization strategies for long-term monitoring of remedial response actions for the perched groundwater unit at the Pantex Plant. Groundwater monitoring plays a critical role in long-term environmental restoration of the Pantex Plant site. Long-term monitoring optimization (LTMO) is part of overall remediation optimization for affected groundwater. The perched groundwater network was the subject of LTMO reviews in 2007 and 2012 with results published in reports (GSI 2008, GSI 2012).

The purpose of the following study is to review the current groundwater monitoring network relative to the stated monitoring objectives and provide recommendations for improving the efficiency and accuracy of the network for supporting site management decisions. The evaluation includes new groundwater data collected from 2012 to 2016 as well as historical site characterization and monitoring data collected 2007 through 2012. Documents and data sources used in the analysis are listed in Appendix A.

2.0 SITE BACKGROUND

2.1 SITE BACKGROUND

The primary mission of the Pantex Plant is to assemble, disassemble, and evaluate nuclear weapons from the U.S. stockpile, to develop, fabricate, and test explosives and explosive components, and to provide secure storage for material from the above activities. Pantex Plant operations began in 1942 under the Army Ordnance Corps, manufacturing conventional munitions and high explosives (HE) such as trinitrotoluene (TNT). The Plant was briefly deactivated at the end of the World War II, and the property sold to TTU. In 1951, the site was reclaimed for use by the Atomic Energy Commission (AEC) to produce both nuclear weapons and HE compounds. Radioactive materials have not been manufactured at the facility but components containing radioactive materials are managed at the site. Compounds such as TNT, High Melting Explosive (HMX, octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine) and Research Department Explosive (RDX, hexahydro-1,3,5-trinitro-1,3,5-triazine) have been manufactured, tested and disposed of at the site.

In 1988, the EPA conducted a *Resource Conservation and Recovery Act (RCRA) Facility Assessment* of the Pantex Plant, identifying Solid Waste Management Units (SWMUs) and Areas of Concern (AOC) containing environmental media possibly subject to interim corrective measures (ICMs). The RCRA Facility Investigation (RFI) identified operational areas at the site and groupings of corrective action units in common watersheds termed waste management groups (WMGs). The Pantex Plant was proposed for addition to the National Priorities List (NPL) under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) in 1991 and formally listed in 1994. The Pantex Plant is, therefore, subject to the provisions of CERCLA in addition to RCRA and State of Texas requirements.

In 2008, an Interagency Agreement (IAG) went into effect between EPA, USDOE/NNSA and Texas Commission on Environmental Quality (TCEQ), setting forth the roles and responsibilities of each of the agencies for performance and oversight of remedial activities. The IAG is a binding agreement between the parties outlining procedures to ensure that remediation is accomplished pursuant to requirements under CERCLA and related statutes. The DOE/NNSA is the lead federal agency to investigate, assess, plan and remediate affected media at the Pantex Plant. The TCEQ and EPA share oversight of remedial requirements under a 1994 Memorandum of Agreement (MOA) and the IAG. All non-radiological environmental restoration activities under both state and federally-authorized programs at the Pantex Plant are conducted under the State of Texas Risk Reduction Rules (RRR) (30 TAC §335 Subchapter S, 1993).

A Corrective Measure Study/Feasibility Study (CMS/FS) was completed in 2007 and conditionally approved by TCEQ and EPA in 2008 with the Pantex Site-Wide Record of Decision (ROD) finalized in the same year. The CM/FS and ROD outline the interim corrective and stabilization measures (ICMs and ISMs respectively) for the perched groundwater unit. A comprehensive long-term groundwater monitoring strategy (LTM Report) supporting assessment of the proposed remedies was developed and finalized in 2009 (B&WPantex 2009a) and updated in 2014 (B&WPantex 2014). The perched groundwater monitoring network described in the 2014 document is the subject of the following report. **Figure 2** illustrates the location of investigation monitoring wells in the program and the approximate location of the Southeast, Southwest and North Sectors of the perched groundwater unit used in the following analysis.

A chronology of key site events is presented in **Table 1**.

TABLE 1. Pantex Plant Site Chronology

Date	Action
1942	Army Ordnance Corps Pantex Plant begins operations
1951	Plant Site transferred to AEC
1980s	DOE Environmental Management (EM) initiated Environmental Restoration Project
1988	RCRA facility investigation
1991	EPA and TCEQ issue RCRA Hazardous Waste Permit to Pantex Plant, Pantex Plant proposed to NPL
1994	Pantex Plant final listing on NPL
1999-2005	RI/FS approvals
2000	USDOE/NNSA succeeds DOE EM as lead federal agency
2004	Pantex Plant Groundwater Modeling Report
2007-2008	CMS/FS completed
2008	ROD signed (benchmark for Five-Year Review [FYR]schedule); IAG executed; Southeast in situ remedy installed
2009	LTM Plan; Playa 1 groundwater extraction system installed
2010	All remedial design and construction approved
2013	First FYR, LTMO Review
2014	Updated LTM Plan
2017	LTMO Review
2018	Second FYR scheduled

2.2 REGULATORY BACKGROUND

The Pantex Plant is permitted as a hazardous waste facility under RCRA and regulated under CERCLA as well as the state of Texas RRR.

Remedial response actions for all inactive areas at the Pantex Plant and perched groundwater unit were selected in the 2008 ROD. Many interim remedial actions were implemented before 2008 and were included as selected remedies in the ROD. The schedule for FYRs was, therefore, initiated by the ROD signature.

Remedial Action Objectives (RAOs) articulated in the ROD have the primary goals of restoring perched groundwater to drinking water standards and protecting the deeper Ogallala Aquifer. Specific RAOs include:

- Reduce the risk of exposure to perched groundwater through prevention of human or ecological contact;
- Achieve cleanup standards for all constituents of concern (COCs);

- Prevent growth of the perched groundwater contaminant plumes;
- Prevent contaminants from exceeding cleanup standards in the lower Ogallala Aquifer.

The remedy selected for perched groundwater in the ROD is:

- Operation of the existing Southeast Pump and Treat System (SEPTS) to stabilize migration of the plume and treat groundwater in the perched unit;
- Construction and operation of the Playa 1 Pump and Treat System (P1PTS) to reduce mounding of perched groundwater under Playa 1;
- Continued operation of the in-situ bioremediation system (ISB) to treat HE southeast of Zone 12 and downgradient of Zone 11 to treat trichloroethene (TCE) and perchlorate;
- Institutional controls (IC) to prevent exposure to contaminants in the soils and perched groundwater/ cross-contamination to the regional Ogallala Aquifer.

Effectiveness of the selected remedies for the Pantex Plant Site perched groundwater is determined through groundwater monitoring implemented through the Long-Term Groundwater Monitoring Plan. The groundwater monitoring plan was developed in 2009 and updated in 2014. Results of groundwater monitoring are summarized in annual reports and used to support analyses in FYRs.

Additional remedies selected for other site media include soil vapor extraction (SVE) in the area of the Burning Ground, lining drainage ditches, capping landfills and institutional controls (ICs). The efficacy of these remedies are not specifically considered in this report, but may be assessed indirectly by data from the perched groundwater monitoring program.

3.0 CONCEPTUAL SITE MODEL

3.1 GEOLOGY AND HYDROGEOLOGY

The Pantex Plant lies on the High Plains portion of the Great Plains Physiographic Province in the Texas Panhandle. The area, known as the Llano Estacado is a broad, flat, plateau with topographic elevation across the site ranging between 3,501 feet above mean sea level (ft amsl) to 3,595 ft amsl. A distinguishing feature of the area is the presence of numerous shallow circular basins called *playas* (**Figure 1**). Playas are ephemerally moist depressions that are the location of much of the recharge to groundwater in the region. When inundated the playas form shallow lakes and wetlands, contributing to animal and plant diversity in the region. The average topographic slope across the Plant area is approximately 0.006 feet (ft), and most Plant surface water tends to drain to the onsite playas.

The hydrostratigraphy below the Pantex Plant is summarized in **Table 2**. The uppermost hydrostratigraphic unit (HSU) at the Pantex Plant is the Blackwater Draw (BWD). The BWD extends up to 90 ft below ground surface (bgs) at the site, and is largely unsaturated. The unit consists of silts and sands and an approximately 20-foot thick lower unit composed of silty sand and caliche. The playas are depressions in the BWD.

TABLE 2. Pantex Hydrostratigraphic Units

Name	Location/Elevation	Description
Blackwater Draw (BWD)	Surface at 3550 ft amsl to 3460 ft amsl (~ 90 ft bgs)	Unsaturated silts and sands, lower 20 ft interval of silty sand and caliche
Ogallala		
• Caprock Caliche	~3460 to 3450 ft amsl (0 to 30 ft thickness)	Hard, dense and finely crystalline caliche
• Perched Groundwater Unit	Groundwater between 3305 and 3245 ft amsl (215 and 275 ft bgs, 0 to 60 ft saturated thickness)	Fine to medium sand, saturated sands with clays and gravel
• Fine-Grained Zone (FGZ)	3300 to 3200 ft amsl with variable thickness (10 to 150 ft thick)	Silts and clays, separate upper from lower Ogallala
• Lower Ogallala Unsaturated Zone	3200 to 3100 ft amsl with variable thickness	Coarse-grained fluvial, channel sands and gravels
• Lower Ogallala Saturated Zone (High Plains Aquifer)	3175 to 3100 ft amsl (400 to 500 ft bgs, 30 to 400 ft saturated thickness)	Coarse-grained sands, gravel, drinking water supply for Amarillo, irrigation water supply
• Red Beds / Dockum Group	3100 ft amsl dipping to 3050 ft amsl	Siltstone, confining layer

Elevations are approximate from (B&WPantex 2004) and 2016 Hydrographs

The Ogallala Formation underlies the BWD. A Caprock Caliche layer generally defines the top of the Ogallala Formation, but is not continuous across the entire Pantex Plant. The Caprock, where present, consists of a hard, dense and finely crystalline caliche. Below the Caprock Caliche, the Ogallala Formation consists of upper and lower permeable units separated by a Fine-Grained Zone (FGZ). The permeable units are composed of coarse-grained fluvial sequences including channel sands and gravels overlain by finer overbank deposits.

The upper unit of the Ogallala formation contains discontinuous areas of perched groundwater underlain by the FGZ. Perched groundwater is found in three main areas under the Pantex Plant. The largest area of perched groundwater is associated with recharge from Playas 1, 2 and 4 and drainage ditches associated with industrial Zones 11 and 12 (see **Figure 1**). Groundwater elevation is highest under Playa 1 (about 3305 ft amsl) with radial flow to the north and to the south beneath Zones 11 and 12, pinching out on the TTU property to the south and off-site to the east (3245 ft amsl).

Saturated thickness of perched groundwater varies across the unit and over time with a historical maximum of 70 ft beneath Playa 1 to 0 ft at the extreme edges of the unit. Depth to groundwater varies from about 215 ft near Playa 1 to approximately 280 ft south of the main perched unit under TTU property.

Because of mounding near Playa 1 and the topography of the FGZ, groundwater flow in the main perched unit tends to be radial, with the surface sloping to the southeast, south and east of Zone 12, and sloping to the southwest, west of Zone 11. Groundwater north of Playa 1 tends to flow to the north. Radial flow within the main perched unit is the reason why the monitoring network was divided into sectors for the LTMO analysis (see Sectors identified on **Figure 2** and described under Section 2.1.1). Isolated areas of perched groundwater also occur under the Burning Ground (near Playa 3) and in the northeast corner of the Pantex Plant (near Pratt Playa), which are included in the North Sector.

The perched groundwater unit meets the yield and water quality criteria to be considered a potential drinking water source in the state of Texas. However, no water supply wells are drilled into the unit for either drinking water or industrial water supply on-site. Public drinking water supply wells in the vicinity are drilled into the Ogallala Aquifer, except for one perched groundwater well on offsite property northeast of Pantex near Pratt Playa. The perched groundwater does not discharge to surface water bodies and hydraulic connection with the Ogallala is limited by the FGZ.

The FGZ consists of low-permeability silts and clays and varies in thickness from over 150 ft to less than 10 ft. The FGZ slopes downward, from the center of the Plant toward the southeast corner of the property. The FGZ tends to isolate perched water from deeper strata; however, the FGZ becomes coarser, thinner and more permeable in areas to the south and east of the main Plant.

The Lower Ogallala Saturated Zone or High Plains Aquifer (Ogallala Aquifer) is encountered at depths of 400 to 500 ft bgs beneath the Pantex Plant. An unsaturated zone between 50 and 100 ft in thickness is present between the FGZ and the saturated portion of the Lower Ogallala. The saturated thickness of the Ogallala Aquifer varies from less than 30 ft to over 400 ft. The Ogallala Aquifer is the principal municipal water supply for the city of Amarillo, Texas. The city operates a municipal water supply field north of the Pantex Plant. The Aquifer has, historically, provided potable and industrial water for the Pantex Plant as well as agricultural water for the surrounding properties. Removal of water from the Ogallala Aquifer for municipal, industrial and large-scale agricultural uses has reduced the saturated thickness in many areas of the aquifer. The following report does not consider monitoring of the deeper Ogallala Aquifer.

3.2 CONSTITUENTS AND SOURCES

The primary sources of COCs to groundwater at the Pantex Plant arose from infiltration of historic wastewater discharges through areas of focused recharge to the vadose zone and perched groundwater unit. Major historical industrial operational areas are Zone 10, Zone 11 and Zone 12 (see **Figure 1**) in the central portion of the Pantex Plant. Historically, effluent from industrial processes, sanitary wastewater, cooling water discharge and storm water runoff were released to unlined ditches. Discharges directed to Playas 1, 2 and 4 created linear sources as well as point sources to the subsurface. Subsequent infiltration has resulted in numerous co-mingled plumes and an artificially expanded perched groundwater unit under Playa 1 and areas southwest and southeast of the main industrial zones.

All wastewaters are currently directed to the sanitary sewer system and to the Pantex Plant Waste Water Treatment Facility (WWTF). All treated wastewater, including extracted groundwater is directed to the agricultural irrigation system for surface application.

3.2.1 Zone 12

Historical industrial waste water generated in Zone 12 was discharged to the eastern ditch running to Playa 1. Industrial operations in Zone 12 included development, testing and manufacture of HE components. Wastewater discharge from Zone 12 varied between 200,000 and 300,000 gallons per day (gpd). Discharges originating in Zone 12 infiltrated along the unlined ditch discharging to Playa 1, resulting in groundwater mounding under Playa 1. Groundwater mounding resulted in plumes exceeding drinking water standards migrating north, east and southeast of Zone 12. Contamination is present to the extent of the groundwater unit to the east and southeast. Constituents remaining in the vadose zone may represent a continuing low-level, long-term, source of contamination to the perched unit.

Constituents in wastewater from Zone 12 included RDX, TNT; and other HEs, hexavalent chromium (Cr VI) from cooling waters and some chlorinated volatile organic compounds (VOCs). TNT is photo-reactive, decaying to products like 2-Amino-4,6-Dinitrotoluene (2ADNT) and 4-Amino-2,6-Dinitrotoluene (4ADNT) causing the characteristic colored ‘red water’ discharge in surface water. RDX degrades to TNX, MNX and DNX under anaerobic conditions stimulated by the ISB remedies. These constituents, which are often short-lived, are monitored for remedy effectiveness rather than as priority risk drivers. RDX and degradation products of TNT are the priority constituents of concern (COCs) originating from Zone 12 and define the extent of affected groundwater in the southeast. Cr (VI) is found in limited areas in the Southeast Sector with most of the mass occurring directly south of Zone 12.

3.2.2 Zone 11

Industrial operations in Zone 11 were diverse, consisting of quality assurance testing and machining operations that included cleaning of components with chlorinated solvents. Discharges from Zone 11 also infiltrated along ditches to the north and to Playa 1 resulting in linear sources extending north to Playa 1. Constituents associated with Zone 11 include chlorinated solvents such as TCE, perchlorate, and Cr (VI). The groundwater flow from Zone 11 is predominantly to the southwest where the TCE and perchlorate plumes are located. 1,4-Dioxane is also associated with releases from Zone 11. Zone 10 is located downgradient to the southwest of Zone 11. Zone 10 has limited releases, and constituents in this area are not distinct from plumes emanating from Zone 11.

A groundwater flow divide is located south of Zone 11/ Zone 12 and constituents associated with Zone 11 such as perchlorate and Cr (VI) are migrating southeast in some locations.

3.2.3 Burning Ground and Northern Property

The Burning Ground area is northwest of the main Zone 11 and 12 industrial areas and west of Playa 1. The Burning Ground has a small and, apparently, isolated perched groundwater unit associated with Playa 3. The Burning Ground is an active operation area used for thermal treatment of HE. Historical activities have resulted in some releases to shallow and deep soils. Selected remedies of the Burning Ground include an SVE system to remove VOCs from soil. Perched groundwater below the Burning Ground has limited detections of chlorinated VOCs and some HEs.

Most of the area north of Playa 1 did not have known industrial sources. An isolated perched groundwater unit is present in the northeast corner of the main property. A historical wastewater treatment facility was in the area, but no residual contamination from the facility has been found in perched groundwater. Monitoring wells north of Zones 11 and 12 and north of Playa 1 do not indicate consistent or high concentrations of constituents.

3.2.4 Constituents of Concern

Groundwater analyses indicate that several contaminants are found above EPA Maximum Contaminant Levels (MCLs) or Texas Medium Specific Concentrations (MSCs) in perched groundwater. The 2008 ROD identified MCLs and MSCs as the primary remedial standards for the site constituents. Constituents and standards used for optimization of the monitoring network are listed in **Table 3** along with the maximum concentration results from groundwater analyses between 2012 and 2016 and from 2007 through 2011.

Boron concentrations in the perched unit are below drinking water standards and are protective for human consumption. However, the concentrations of boron present in some areas of the perched aquifer are harmful to crops, posing potential problems for agricultural application of treated wastewater. For this reason, boron is removed in the groundwater extraction treatment systems before application to crops. The standard for boron for the statistical analysis was set to the background value of 192 micrograms per liter (μg/L).

Table 3: Perched Groundwater Remedial Goals

Constituent Name	Standard	Basis of Standard	Maximum Concentration 2012 – 2016	Maximum Concentration 2007 – 2011
1,3,5-Trinitrobenzene	220	$GW\text{-}Res_{NCAdj}$	1,260*	N/A
1,2-Dichloroethane	5	MCL	50.8	190
1,3-Dinitrobenzene	3.7[a]	GWRESc	0.093	N/A
1,4-Dioxane	7.7	GWRESc	77	120
2,4-Dinitrotoluene	1	PQL	18*	99.1
2,6-Dinitrotoluene	1	PQL	1.9	N/A
2-Amino-4,6-Dinitrotoluene (2ADNT)	1.2 (6.1[a])	GW ResNC Adj	23.4	32
4-Amino-2,6-Dinitrotoluene (4ADNT)	1.2 (6.1[a])	GW ResNC Adj	37.3	78.8
Arsenic	12	Background	430**	134
Barium	2000	MCL	21000	20500
Boron	7300* (192)	†GW-ResNC	1900*	2270
Chloroform	80	MCL for Trihalomethanes	46.2	N/A
Chromium, Hexavalent [Cr(VI)]	100	MCL	6031	7148
Chromium, Total	100	MCL	6840	25800
cis-1,2-Dichloroethene	70	MCL	490	89
Hexahydro-1,3-Dinitroso-5-Nitro-1,3,5-Triazine (DNX)	2	EPA Lifetime HA for RDX	24*	100
Octahydro-1,3,5,7-Tetranitro-1,3,5,7-Tetrazocine (HMX)	360	EPA Lifetime HA for HMX	530*	767
Lead	15	MCL	0.644	127
Manganese	1715.5		26000	34100
Hexahydro-1-Nitroso-3,5-Dinitro-1,3,5-Triazine (MNX)	2	EPA Lifetime HA for RDX	145	278
Molybdenum	182.5		43.9	1200
Perchlorate	26	GW ResNC	1290	3090
Hexahydro-1,3,5-Trinitro-1,3,5-Triazine (RDX)	2	EPA Lifetime HA	3850	4300
Selenium	50	MSC	59.2	57.5
Tetrachloroethene (PCE)	5	MCL	20.1	16.9
2,4,6-Trinitrotoluene (TNT)	3.6	GW-RescNC Adj	89*	120
Hexahydro-1,3,5-Trinitroso-1,3,5-Triazine (TNX)	2	EPA Lifetime HA for RDX	333	1000
Trichloroethene (TCE)	5	MCL	500	1500

All concentrations in µg/L—Micrograms per liter
a ROD identified values for these constituents were adjusted below the calculated MSC because they target the same organs from a cumulative risk perspective.
N/A = Data not analyzed; * Sample from extraction well. **Sample from ISB well.
GW-Res—TCEQ Standard No. 2 Groundwater MSC for Residential Use
MCL—EPA Maximum Contaminant Level; PQL—Practical Quantitation Limit C—Carcinogenic; NC—Noncarcinogenic; HA – Hazard Assessment
† Boron exceeds background, posing potential threat to agricultural applications. Remedial goal is background concentration of 192 ug/L.

3.3 REMEDIES

Interim remedies implemented at the Pantex Plant were described in the 2003 *Compliance Plan for Industrial Solid Waste Management Sites* , with final remedies provided in the 2010 update to the *Compliance Plan* (TCEQ 2010). Selected remedies are described in the 2008 ROD. Remedy components are summarized in **Table 4** and are illustrated on **Figure 2**.

Table 4 Perched Groundwater Remedies

Location	Remedy	Goal	Contingency
Playa 1	P1PTS –GW Extraction and Treatment – GAC and boron Ion Exchange; Effluent to industrial supply or irrigation system	Reduce GW elevation and head causing downgradient movement; reduce mass of RDX, other HEs and boron	Additional extraction wells and expanded treatment
Southeast	SEPTS - GW Extraction and Treatment Effluent – GAC, Cr and Boron Ion Exchange; Effluent to industrial supply, irrigation system or re-injection	Reduce GW elevation and mass of RDX and other HE, VOCs and Cr (VI)	Expand P1PTS, improve irrigation system or find alternatives for disposal of treated water; Addition of perchlorate treatment unit; re-grading ditch
Southeast	In-Situ Bioremediation -- Injection of carbon and nutrients to create reducing conditions	Create conditions supporting biological reduction of RDX	Change formulation for amendment, addition of more injection points, maintenance for biofouling
Zone 11	In-Situ Bioremediation -- Injection of carbon and nutrients to create reducing conditions	Create conditions supporting biological reduction of TCE (VOCs), perchlorate	Change formulation for amendment, addition of more injection points, maintenance for biofouling
Site-Wide	Institutional Controls	Prevent human and ecological exposure and potential cross-contamination	None

GAC = Granular Activated Carbon; GW = Groundwater

Performance of the selected remedies is evaluated through groundwater monitoring implemented as described in the *Long-Term Groundwater Monitoring Plan* (B&WPantex 2009a) and *Update to the Long-Term Monitoring System Design Report*, (B&WPantex 2014), developed as part the Remedial Design, in accordance with the IAG. The expected performance of the remedies has been identified based on the Conceptual Site Model (CSM), groundwater modeling and engineering estimates. Results of groundwater monitoring are compared to expected performance in annual reports (CNS 2016). Significant deviation from expected remedy performance may result in modifications to response actions. Contingency plans for remedies are detailed in the *Pantex Plant Ogallala Aquifer and Perched Groundwater Contingency Plan*

(B&WPantex 2009b) and are summarized below.

The overall remedy strategy for the perched unit is to reduce the volume and driving force of groundwater, particularly around Playa 1. Downgradient portions of the plumes are treated using biological and geochemical reduction of contaminants facilitated by in situ amendments. The individual remedy components are designed to work together to stabilize plumes in the perched unit and to reduce contaminant mass and mobility.

Plumes within the perched groundwater unit are somewhat unique relative to most groundwater plumes in that the abiotic, natural attenuation processes of advection, dilution and dispersion are not anticipated to reduce constituent concentrations due to the contained nature of the unit. Therefore, several active remedies were selected in the regulatory decision documents to address contaminant plumes in the perched unit.

3.3.1 Playa 1 Pump and Treat System

A groundwater extraction and treatment system was installed in the Playa 1 area consisting of 10 extraction wells and lines conveying water to a treatment plant. The system became fully operational in 2009. Water treatment consists of granular activated carbon (GAC) and ion exchange units capable of removing contaminants from about 250 gallons per minute (gpm). The goal of the P1PTS is to reduce groundwater mounding under Playa 1 and to remove contaminant mass. Perched groundwater elevations are highest under Playa 1, with gradients radiating from this location. Treated water is discharged to the irrigation system supporting agricultural crops covering much of the Pantex and TTU properties. It is expected that the infiltration of irrigation water will not exceed evapo-transpiration losses, thereby preventing additional water from entering the perched unit.

The P1PTS is anticipated to reduce saturated thickness in perched groundwater beneath Playa 1. Success of the P1PTS is defined as reduction in the groundwater elevation mound in the area, reducing flux of contaminants to the edges of the perched unit.

Monitoring to confirm performance of the P1PTS includes measuring groundwater elevations around Playa 1 and developing potentiometric surface maps and elevation trends for the north-central Pantex Plant. Remedy performance expectations include a reduction in RDX concentrations as well as RDX mass flux to the southeast. Decreases in mass are anticipated to level off after several years of pumping. Should the P1PTS fail to meet performance objectives for head reduction, the proposed contingent remedy includes addition of extraction wells and treatment capacity. Investigation well (IW) monitoring locations for the North Sector along with monitoring objectives are listed in **Table B-15**.

3.3.2 Southeast Pump and Treat System

The SEPTS was piloted in 1995 and has been expanded to full scale in the intervening years. The SEPTS was a part of the ISM in the original Compliance Plan. The system currently consists of 61 groundwater extraction wells and lines conveying extracted water to a 300 gpm treatment plant with GAC, chromium ion exchange and boron ion exchange units. Treated water is used for industrial purposes, discharged to the irrigation system, and, when necessary, re-injected through three wells into the southeast perched unit. Monitoring locations and individual well monitoring objectives for the Southeast Sector are listed in **Table B-3**.

Performance objectives for the SEPTS are to reduce groundwater volume and lateral flux in the southeast portion of the perched unit, reducing transport potential to the edges of the plume and possible vertical migration to the lower Ogallala Aquifer. The SEPTS is also anticipated to reduce total contaminant mass and mass flux of RDX and other HEs in the southeast, stabilizing the plumes. The SEPTS is designed to work in concert with both the P1PTS and the ISB remedy in the southeast.

The function of the monitoring network relative to the SEPTS is to demonstrate reduction in groundwater elevation and to monitor concentrations in the southeast area. Potential concerns for the SEPTS include migration of constituents from the southwest across the groundwater divide (south of Zones 11/12), and redistribution of mass in the plume toward the extraction wells away from the original sources.

Several conditions may result in under performance of the remedy, triggering possible contingency actions. If the P1PTS does not reduce flux to the south, additional extraction wells may be added around Playa 1 and the P1PTS treatment plant expanded. Infiltration from the 5/12a Ditch could be greater than expected, overloading the SEPTS. In this case, the contingent action would involve re-grading or lining portions of the 5/12a Ditch to reduce infiltration. If the irrigation system is unable to handle the treated groundwater, reinjection of treated water may be necessary, undermining the volume reduction function of the SEPTS. For this scenario, expansion of the irrigation system or finding alternative uses for the treated water may be required. If perchlorate or 1,4-dioxane are detected in the groundwater extraction wells at levels that exceed discharge criteria, then the extraction from wells closest to the plume fronts migrating from Zone 11 will need to be modified temporarily until the treatment system can be upgraded to treat these COCs. Data collected from the perched groundwater monitoring network are used to determine if the selected remedies are operating effectively and attaining remedial performance objectives.

3.3.3 Southeast In Situ Bioremediation (ISB) System

The Southeast ISB system is designed to create strongly reducing geochemical conditions on the southeast edge of the perched unit to facilitate reduction of RDX and Cr (VI). The system consists of 42 injection wells where a mixture of bioavailable carbon and nutrients have been injected approximately every 18 to 24 months to stimulate anaerobic conditions. The in-situ amendment consists of an emulsion of sodium lactate and soybean oil. Installation and preliminary injections were completed in March 2008. Injections have continued through 2016. Contaminant concentrations in the treatment zone will determine if the system is achieving its performance objective. RDX (and other HEs) and Cr (VI) approximately 200 ft downgradient of the treatment zone are expected to show strongly decreasing trends. Monitoring wells used to evaluate efficacy of the Southeast ISB remedy are listed in **Table B-3**.

The function of the monitoring network relative to the ISB system is to provide data to demonstrate the efficacy of treatments downgradient from the injection points. One challenge for the monitoring network design is locating wells in areas of adequate saturated thickness along the southeast edge of the perched unit so that representative samples can be collected. Several wells drilled in the area are either dry, intermittently or apparently dry for some time after drilling. Delineating the edge of saturation of the perched unit to the east and southeast is a challenge due to the limited saturated thickness and response of the aquifer to changing recharge conditions.

Should monitoring data indicate the remedy is not performing as expected the contingent remedy includes changing the amendments to respond to specific geochemical needs, bioaugmentation with microorganisms or installation of additional injection wells. Biofouling of the injection wells or formation may require more rigorous maintenance or reconfiguration of the system.

3.3.4 Zone 11 In Situ Bioremediation System

An ISB system has been installed in the southwest portion of the Pantex Plant to create anaerobic conditions conducive to biological break down of TCE and perchlorate. By 2015, the system consisted of 94 injection wells and 12 in situ performance monitoring wells (ISPM). In-situ amendments are the same as those used in the Southeast ISB. Installation of the system was completed in 2009. Monitoring locations and objectives for the Southwest Sector are listed in **Table B-9**.

The function of the ISB monitoring network is to confirm that amendments are stimulating biodegradation of chlorinated compounds (TCE) and perchlorate and reduction of Cr (VI) to trivalent chromium [Cr (III)]. Concentrations of parent compounds should decrease, approaching cleanup goals over the next five-year period.

Contingent remedies for the Zone 11 ISB include installation of upgradient extraction wells to reduce the flow of water through the ISB area. Biofouling of the injection wells or formation may require more rigorous maintenance or reconfiguration of the system. Breakthrough of perchlorate above cleanup goals may require reformulation of the amendments delivered to the subsurface to optimize treatment of this constituent.

3.4 CURRENT MONITORING PROGRAM

The current groundwater monitoring program at Pantex was designed in a formal process that included setting monitoring objectives, evaluating the function of each well relative to the objectives and using statistical, mathematical, modeling and qualitative tools to locate wells spatially.

The primary goal of the monitoring network is to confirm progress toward RAOs. Data collected from the monitoring network are used to evaluate the performance and efficacy of the remedies and are used to compare actual conditions to expected site conditions. Three primary monitoring objectives have been identified for the Pantex perched groundwater network:

- Evaluate plume stability (PS) – identify areas of increasing and decreasing concentrations on the edge of the plumes and identify where the plume may be expanding into clean areas.

- Efficacy of the response action (RA) – the response action will be evaluated based on its ability to reduce the elevation of groundwater in the Playa 1 area, reduce the mass in the Playa 1 area and reduce the mass in the southeast area and reduce the spread of contamination in the southeast and southwest areas.

- Uncertainty management (UM) – confirm expected conditions identified in the RFI exist and identify any deviations; compare results to expected conditions, identify deviations that may alter assumptions about existing conditions.

Each well in the LTM network has been assigned at least one monitoring objective under the LTM Plan – UM, PS, and/or RA. Many wells have also been designated as point of compliance (POC) or Point of Exposure (POE) wells under the Compliance Plan as per Texas RRR. Wells in the current program used for this analysis, along with the monitoring objectives for each well are listed in **Table B-1** and shown on **Figure 2**.

Secondary objectives of the monitoring network include:

- Delineation of groundwater exceeding applicable regulatory standards (and delineation of the extent of saturation in the perched zone);
- Provide sufficient data to evaluate risks (under State of Texas RRR);
- Support calibration and development of site groundwater models;
- Provide early warning for potential impacts to the lower Ogallala Aquifer (lower saturated Ogallala);
- Provide data to optimize remedy performance and efficacy;
- Comply with regulatory requirements.

For the following report, 112 individual LTM program locations were evaluated. Of these wells, several are intermittently dry, and help define the extent of perched groundwater. No active ISB injection or extraction remedy wells were included in the monitoring network analysis. Some well locations not in the LTM program, particularly those that were drilled in dry locations, were included in the spatial analysis to prevent recommending additional wells where decommissioned wells currently exist.

4.0 ANALYTICAL METHOD

Evaluation of the groundwater monitoring network for the Pantex Plant consisted of both quantitative and qualitative methods. A quantitative statistical evaluation of the site was conducted using tools in the Monitoring and Remediation Optimization System (MAROS) software (version 3.0 Beta). The qualitative evaluation reviewed hydrogeologic conditions, well construction and placement as well as contaminant geochemistry in the context of monitoring objectives. Both quantitative statistical and qualitative evaluations were combined using a 'lines of evidence' approach to recommend a final groundwater monitoring strategy to support site monitoring objectives. The analytical method for the current report is similar to that conducted for the 2012 *Perched Groundwater Monitoring Network Optimization* (GSI 2012) (referred to below as the 2011 evaluation).

Details of the MAROS tool, including algorithms used in the analysis are provided in MAROS User and Technical Manuals (AFCEE, 2004, 2012). A summary of the analytical process is provided below.

4.1 INPUT DATA AND REPORTS REVIEWED

Groundwater analytical data collected between 2012 and 2016 from the Pantex Plant LTM network remedial action monitoring locations were supplied by CNS from the site database (CNS, 2017). Received data include geographic coordinates of the wells, sample dates, analytical results, detection limits, and data flags. Analytical data from the previous LTM investigations (2000 through 2011) were used to supplement analyses of long-term trends.

Analytical data from 214 different sampling locations were received including investigation monitoring wells (IW), extraction wells (EW) and ISB wells. Only data from the 112 active IWs were used in the statistical analyses. The database contained data for 24 different COC analytes. Remedial goals for each of the COCs are those specified in site decision documents such as the ROD. Water quality and geochemical parameters were not included in the statistical analyses.

Well construction data including depth, saturated unit, and screened intervals, elevations, installation dates, well monitoring objectives, and other details were provided by CNS. Well construction details were used to identify active monitoring locations in the perched unit and monitoring objectives for each well. Water level trend data, geochemical data, and remedy performance data were received from CNS in various reports, with preliminary data from 2016 included. These data were reviewed qualitatively to support monitoring recommendations.

As in the previous analyses, IWs were grouped by sector of dominant groundwater flow direction, with the elevation maximum under Playa 1. IWs were grouped into North, Southeast and Southwest Sectors. Wells used in the analysis, their monitoring objectives and sector location are shown in **Table B-1**. The spatial sectors defined for the analysis are illustrated on **Figure 2**. Aquifer parameters used in the MAROS analyses are listed on **Table B-2**, and were taken from the previous LTMO analyses and site documents.

For the time frame of 2012 through 2016, 50 monitoring wells were included in the Southeast Sector analysis, 53 wells were included in the Southwest Sector analysis and 33 wells were included in the North Sector analysis. Some wells were considered in two different Sectors to provide more complete spatial coverage. Data from extraction or ISB wells were not considered in the formal analysis, but were reviewed qualitatively to support monitoring recommendations.

Documents reviewed for the report are listed in **Appendix A**.

4.2 MONITORING GOALS AND OBJECTIVES

Pantex site managers have developed three primary objectives for monitoring data collection discussed in Section 3.4: PS, UM and RA. Most wells in the network have been assigned at least one of these objectives. **Table B-1** lists all the wells used in the LTMO and primary monitoring objectives defined by Pantex Plant managers.

For the LTMO analysis, wells were also assigned secondary monitoring objectives. 'Source' wells are those wells closest to initial release areas in Zones 11 and 12 or with high historical concentrations. 'Tail' or plume wells are downgradient from sources. The purpose of identifying source and tail wells is to evaluate the trend for a group of wells. Trends in source wells will indicate if the source discharge is attenuating or remaining stable. Trends in tail wells will indicate if remedies are affecting the downgradient concentrations relative to discharge from the source.

Wells were assigned monitoring objectives for evaluating specific remedies (e.g. SEPTS for the southeast pump and treatment system; ISPM for in situ performance monitoring) and for COCs with limited spatial distribution [e.g. 1,4-dioxane, Cr (VI)]. Wells with secondary monitoring objectives were grouped to evaluate area-wide trends (e.g. source).

A summary of the secondary monitoring objectives by well provided in **Table B-3, Table B-9** and **Table B-15** for each Sector in **Appendix B.**

4.3 INDIVIDUAL WELL ANALYSES

In MAROS, the goal of statistical analysis at individual wells is to assess contaminant concentrations and trends at monitoring locations within the plume. Statistical analysis provides insight into critical questions about point concentrations such as variability and stability over time, increasing or decreasing trends, attainment of remedial goals, magnitude and rate of concentration change and whether expectations about concentration change are being met.

Analytical data from individual wells were analyzed statistically to provide metrics to assess the magnitude, trend and variability in contamination at each monitoring location. One goal of the individual well analyses is to help assess the importance of each well in characterizing the plume and attaining its specific monitoring objectives. The statistical methods and procedures used to evaluate individual well locations at the Pantex Plant are summarized below and described in more detail in the MAROS User and Technical Manuals.

Statistical methods encoded in the MAROS software for individual wells are taken, primarily, from the *Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities Unified Guidance* (USEPA, 2009). MAROS calculates the detection frequency, maximum concentration, date of maximum concentration and whether the maximum is above the remedial goal for each priority constituent and well. The Individual Well Statistics module also includes the following functions:

- *Priority COCs* for each well are determined by identifying the maximum value for the average concentration normalized by the cleanup goal. The priority COC for each well was used to identify the primary plume associated with each well and to select COCs for calculation of summary statistics. Sector-wide priority COCs are also identified in the software based on toxicity (concentrations above remedial goals), prevalence (number of wells exceeding remedial goals) and mobility (partition coefficient).
- *Summary statistics* by Kaplan-Meier method identify the mean, median, percentiles, standard deviation and coefficient of variation (COV) for each dataset. The Kaplan-Meier method provides a more precise way to estimate statistics for datasets that have non-detect (left censored) data
- *Outlier* identification by Dixon's method (USEPA, 2009). High or low outliers are not removed from the dataset, but rather the User can identify outliers and review sampling documentation to determine if the outlier is likely a result of laboratory or sampling artifacts.
- *Distribution* test by Shapiro-Wilk. Identifies datasets that are likely normally or log-normally distributed. Data distribution determination is important to identify an appropriate statistical framework to apply to the analyses.
- *Concentration Trend* determination by Mann-Kendall (MK) method and by Linear Regression. For the following analysis, the non-parametric MK trend as it does not rely on a specific data distribution. (In the text, statistical MK trend results are indicated in *italics.*)
- Identification of locations that have 'attained' cleanup goals by Sequential T-Test (USEPA 1992).

4.4 PLUME LEVEL ANALYSES

The Plume-Level Analysis in MAROS was developed to assess plume-wide and area-level stability by tracking plume migration on a level above that of the individual well. The Moment Analysis module, estimates the total dissolved mass, center of mass and spread of mass plume-wide for each contaminant. Trends for each of the plume-level metrics are found by applying the non-parametric MK trend test. Remedial performance and monitoring needs can be assessed based on whether total dissolved mass and centers of mass are *increasing, decreasing* or *stable*.

MAROS also contains a tool to estimate how much of the plume area and mass each well "represents" relative to other wells in the network using the Delaunay/Voronoi spatial geometry engine described below. A tool that evaluates concentration trends for groups of wells in an area is also included. The Plume Area Trend module automatically groups "source" wells and "tail" wells, and allows selection of two custom groups of related wells (e.g., up vs. downgradient of a remedy). The software weights results of the individual well MK trend analysis to calculate an aggregate trend for the group of wells. The software also estimates the amount of mass each group represents relative to the total mass in the plume. In this way, the software determines if the source wells have an aggregate trend and what percentage of total mass the wells represent (e.g the source wells have a *probably decreasing* trend and represent about 80 percent of the total dissolved mass in the plume). Identifying the amount of mass in the source relative to the tail may help inform decisions on source monitoring or treatment.

Moving from concentration data at individual wells to evaluating concentrations on a plume or area-wide basis requires spatial interpolation of discreet data. The primary tool for spatial analysis in MAROS is a mesh-creation method known as Delaunay Triangulation/Voronoi Diagram spatial geometry (also known as Theissen polygons).

In MAROS, Delaunay triangulation is first used to generate a grid for the site with existing/potential sampling locations as its nodes. The Delaunay triangulation includes triangulation of a point set with the property that no point in the point set falls in the interior of the circumcircle of any triangle in the network. In this application, triangles are drawn such that all wells are located on vertices of triangles and the circumcircle defined by the triangle does not contain more than the three wells defining the triangles' vertices. Voronoi diagrams are polygons generated by bisecting the sides of the Delaunay triangles connecting centers of the circumcircles. In MAROS, Voronoi diagrams are polyhedral regions that correspond to the set of points on a plane closest to one specific well in a network and form the 'monitoring area' for the well. Monitoring volumes are calculated by multiplying the 2- dimensional area by the plume thickness and porosity.

The Delaunay triangles are used in the Moment Analysis to assign concentrations to areas, which are then summed to estimate total mass in the plume (zeroth moment), center of mass (first moment) and spread of mass in the direction of and perpendicular to groundwater flow (second moments). These values are then assessed for MK trends. The Delaunay triangles and Voronoi diagrams are also used in the Spatial Optimization modules to assess concentration uncertainty, prioritize regions for new wells and to identify potentially redundant well locations.

Using the Voronoi polygons, the Plume Mass by Well tool in the Plume-Level analysis estimates a percentage of total plume mass and area represented by each well. In practical application, this tool may indicate that data from one source well constitutes 50 percent of the total estimated plume mass but monitors only 10 percent of plume area. With this information, analysts may prioritize sampling at wells that monitor high percentages of mass or large areas.

4.5 SPATIAL ANALYSES

The Spatial Optimization module in MAROS includes tools to select and prioritize groundwater monitoring locations based on estimates of concentration uncertainty. Two modules are available to select appropriate sampling frequencies.

The quantitative spatial optimization tool relies on calculation of a Slope Factor (SF) to estimate concentration uncertainty between monitoring locations. The SF is calculated by finding the difference between the known concentration at a well and a concentration estimated for the well from the nearest neighbors, then dividing by the maximum of the two. A SF is calculated for each sample event and an average value is returned for the full monitoring time frame. SF values fall between 1 and 0, with low values indicating potentially redundant locations and high values indicating areas with higher concentration uncertainty. Potentially redundant wells with low SF are then removed from the calculation and the network is tested to make sure that the estimate of total plume area or total plume mass does not change significantly when the wells are removed. Wells are then recommended for removal based on SF of priority constituents. Areas within the plume with high spatial uncertainty are recommended for additional wells.

The COV (standard deviation divided by the mean) of SFs is calculated to assess the level of variability of uncertainty over time. COVs over 1 indicate high variability between locations over time, potentially requiring additional monitoring effort to understand and predict the causes of variability.

In addition, the MAROS spatial analysis uses the area of the Voronoi polygon surrounding each well to assess the spatial coverage for each well location. The well monitoring area or area of influence represents all points nearer to the node well than any other well in the network. Large areas of influence may mean there is insufficient spatial density of wells while extremely small areas may indicate that a well is redundant.

MAROS includes an additional decision logic module for spatial optimization. Under the decision logic framework, "good" monitoring networks have sampling locations that are evenly spaced, monitor similar sized areas, reduce concentration uncertainty and thoroughly monitor edges of the network and areas where concentration trends are statistically *increasing*. Redundant locations are those with low SF and monitor relatively small Voronoi polygons and are predictable over time. Areas on the edges of the existing network with *increasing* concentration trends or high uncertainty are recommended for additional well locations.

4.6 Sampling Frequency Analyses

Sampling frequency recommendations in MAROS are based on the rate of concentration change over recent (2012 through 2016) and long-term (2008 through 2016) time intervals (calculated from linear regression of concentration versus time) and on the trends over the time frames for each well. Locations with rapid or high magnitude concentration changes are recommended for more frequent sampling.

An additional sampling frequency module is included to estimate a sampling frequency for the network as a whole. The idea behind the tool is that networks where the estimates of total dissolved mass are predictable, that is with a linear trend with low variability, require less monitoring effort. Networks that display high variability, determined from variability about the linear regression of total dissolved mass (zeroth moment) require more sampling effort.

To this end, MAROS plots the natural log of total dissolved mass for each sample event from the Moment Analysis against time to find the linear regression of mass in the plume as well as the COV for the sample set of mass estimates. The software calculates the slope and coefficient of determination (R^2) for the linear regression of total mass. The software calculates an average network sampling frequency by counting how often each well is sampled each year and taking an average for the network. The software also estimates a groundwater travel time between the source and each monitoring location. The average travel time from the source to network locations is shown for the user's consideration. The software uses decision logic to make a sampling frequency recommendation based on the current sampling frequency and the results of the regression of total mass estimates. A network-level sampling frequency is returned for each priority contaminant.

4.7 Qualitative Review

All results returned by the MAROS software are reviewed for consistency with the goals and objectives of the monitoring program and the CSM. Statistical results are compiled for the priority COCs and compared, on a well-by-well basis, with results for spatial sufficiency and redundancy, and sampling frequency. Final recommendations for the monitoring network are a combination of quantitative and qualitative review.

5.0 RESULTS

5.1 SOUTHEAST SECTOR RESULTS

5.1.1 Priority COCs

Priority constituents evaluated for individual wells in the Southeast Sector are listed on **Table B-3**. Priority COCs are those whose average concentrations exceed the cleanup goals by the highest magnitude. RDX is the priority COC at 29 of the 50 monitoring locations including source area wells PTX06-1002A, PTX06-1088 and PTX06-1005.

Source area wells PTX06-1008, PTX06-1010 and PTX06-1011 monitor areas of higher total Cr [combined Cr (VI) and Cr (III)] and Cr (VI). High concentrations of total Cr are associated with stainless steel well construction. However, Cr (VI) exceedances are likely the result of industrial activities. Other monitoring locations show priority exceedances for 1,2-dichloroethane, TCE, perchlorate, RDX degradation products, and barium. Exceedances for metals such as barium and arsenic are related to oxidation/reduction changes stimulated by the ISB remedy. Boron exceeds standards for irrigation water at three locations.

A Sector-wide evaluation of priority COCs was performed in the MAROS software and the results are indicated in the MAROS COC Assessment for the Southeast Sector (**Appendix C** Reports). Based on toxicity and prevalence metrics, the two priority COCs for the Southeast Sector are RDX and perchlorate. The extent of the perchlorate plume in the Southeast is extremely limited (like Cr (VI)), located in the area of the groundwater divide. Perchlorate was identified as a priority COC due to the magnitude of concentrations relative to the remedial goal over this small area. The majority of perchlorate mass is located in the Southwest Sector, and the perchlorate plume is examined in more depth in the Southwest Sector analysis. Wells affected by perchlorate are included in the Southeast Sector analysis to account for mobility of constituents from the Southwest to the Southeast through the groundwater divide.

4ADNT exceeds remedial goals by a lower magnitude than other COCs, but is much more widely distributed in the Southeast Sector. In addition, 4ADNT may have potential for early migration through the FGZ due to its distribution at the edges of the Southeast Sector plume. It was, therefore, selected as a priority COC for monitoring optimization.

The Southeast Sector-wide monitoring network was optimized for RDX and 4ADNT. However, consideration was also given to COCs indicating remedy performance (e.g. TNX, DNX and MNX), Cr (VI) and COCs potentially untreated by current remedies (e.g. 1,4-dioxane).

5.1.2 Individual Well Statistics

Individual well exploratory statistics for the Southeast Sector are shown in **Tables B-4** and **B-5**. Detection frequencies, maximum and average concentrations indicate locations that consistently exceed cleanup goals or delineate the edges of high concentration plumes with concentrations below remedial goals. COVs provide a measure of the variability in concentration measurements over time.

Individual well concentration trends were determined using the MK non-parametric trend method. General MK trend results for both RDX and 4ADNT are summarized in **Table 5**, with RDX trend results tabulated for each of the primary monitoring objectives (e.g. RA, PS and UM). Results of the trend analysis for individual wells for RDX and 4ADNT for the years 2012 through 2016 are detailed on **Table B-4**. Included in **Table B-4** are trend results from the 2008 through 2011-time frame for comparison. MK trend results and average concentrations normalized by remedial goals for RDX are shown on **Figure 3.** Normalized average concentrations and trend results for 4ADNT are shown on **Figure 4.** Concentrations relative to remedial goals illustrated alongside concentration trends help identify processes of interest in the plumes, supporting decisions on the spatial distribution of monitoring locations. A detailed list of MK trends for all wells is provided in **Appendix C**.

Table 5. Southeast Sector Individual Well Trend Summary

COC	Total Wells	Pantex Plant Southeast Perched Groundwater Mann-Kendall Trend Results by Number of Wells				
		Nondetect	Decreasing or Probably Decreasing	Stable	Increasing or Probably Increasing	No Trend or Insufficient Data
RDX						
All wells	50	2 (4%)	15 (30%)	12 (24%)	8 (16%)	13 (26%)
RA	33	1 (3%)	14 (42%)	6 (18%)	5 (15%)	7 (21%)
PS	13	0	0	5 (38%)	2 (15%)	6 (46%)
UM	13	1 (7%)	5 (38%)	3 (23%)	1 (7%)	3 (23%)
4ADNT						
All wells	50	13 (26%)	16 (32%)	6 (12%)	4 (8%)	11 (22%)

RA = Remedial action; PS = Plume Stability; UM = Uncertainty Management

Overall RDX trend results from 2012 through 2016 include many more *decreasing* trend results than the 2012 analysis. Wells where concentration trends became *decreasing* during the recent five-year period include PTX06-1005, PTX06-1010, PTX06-1013, PTX06-1015, PTX06-1023, PTX06-1038, and PTX06-1047A. Most wells designated to evaluate remedial performance and manage uncertainty show *stable* to *decreasing* trends. Several plume stability wells do not have sufficient data in the recent time frame to evaluate a trend, but continued sampling will resolve trends going forward. None of the PS-designated wells for RDX showed non-detect or *decreasing* trends.

Wells designated to monitor remedy performance of the SEPTS, PTX06-1013, PTX06-1014, PTX06-1038, PTX06-1039A, PTX06-1040, and PTX06-1042, located along the picket of extraction wells (along FM 2373), show residual RDX concentrations significantly above cleanup goals. However, strongly *increasing* RDX trends seen before 2007 have stabilized and have started *decreasing*. PTX06-1015 had an *increasing* RDX trend through 2011 and is now *decreasing*, along with PTX06-1038, PTX06-1042. None of the SEPTS wells show an *increasing* trend for RDX or 4ADNT. PTX06-1040 does show an *increasing* trend for TNT, but this appears to be an isolated area of increase. These results indicate that the extraction wells along FM 2373 are stabilizing the plume in this area.

The wells east of FM 2373 monitor migration of plumes to the edge of the perched unit. These wells include PTX06-1130, PTX06-1031, PTX06-1146, PTX-1039, PTX06-1147, PTX06-1034, PTX06-1133A and PTX06-1082. To the north, PTX06-1130 and PTX06-1146, while showing relatively high concentrations of RDX, show *stable* concentration trends for RDX and *stable* to *decreasing* trends for 4ADNT, indicating that the SEPTS is likely controlling the plume in the northeast extent of the perched unit.

However, the far southeastern area of the perched unit shows *probably increasing* trends for RDX at PTX06-1030 and PTX06-1031 and *increasing* trends for 4ADNT at these locations. These wells have some of the highest concentrations of RDX in the plume, with no statistical outliers. High concentrations and a strongly *increasing* trend for RDX were found at PTX06-1034, the well defining the extent of the perched unit to the east. An *increasing* trend at PTX06-1034 is significant as the well delineates the extent of the perched unit and is outside of the influence of the remedies. Interestingly, this well showed a *decreasing* trend for 4ADNT. Downgradient, well PTX06-1182 was installed in July, 2016 to delineate both the extent of saturation and the RDX plume. While there were insufficient data to evaluate a statistical trend at PTX06-1182, concentrations exceeded remedial goals for both RDX and 4ADNT.

Up and cross-gradient from PTX06-1034, wells PTX06-1020, PTX06-1046, PTX06-1147 show some of the highest concentrations of RDX on site. For locations PTX06-1120 (maximum concentration 3.8 milligrams per liter (mg/L) RDX) and PTX06-1046 (maximum concentration 3.1 mg/L), the plume is likely not intercepted by the SEPTS, indicating potential for migration to the east and south. High concentrations and *increasing* trends in the southeastern area indicate that additional monitoring locations may be required to delineate the extent of contamination in this area.

Monitoring wells immediately downgradient from the Southeast ISB remedy show strongly *decreasing* trends for RDX (PTX06-1037, PTX06-1154 and PTX06-1123) as well as degradation products TNX, DNX and MNX, indicating that the ISB remedy is removing contaminant mass. However, well PTX06-1153 has a *probably increasing* trend for RDX with persistent high concentrations. *Increasing* trends were also found for TNX (*probably increasing*), DNX and MNX at this location, and a *probably increasing* trend was found for Cr (VI). The CSM for the aquifer at PTX06-1153 does not indicate why concentrations of RDX and its metabolites are increasing in this location. A *probably increasing* trend for Cr (VI) was also found at PTX06-1166 located cross and upgradient, above a historically dry area of the perched unit. PTX06-1153 monitors an area with very limited saturated thickness (~5 ft.), and small quantities of affected groundwater may be bypassing the ISB to influence concentrations at this location. Results for PTX06-1153 indicate a data gap in the CSM at this location.

The area of *increasing* RDX concentrations in 2011 located at well PTX08-1002 in the north near Playa 1, now shows *stable* trends for RDX. Likewise, well PTX08-1009 showed an *increasing* trend for RDX in 2011, but concentrations are now *decreasing* with concentrations below remedial goals.

Decreasing and *probably decreasing* RDX trends are found at source area wells PTX06-1002A, PTX06-1005, PTX06-1010 and PTX06-1088. *Decreasing* trends in the source area is a sign of source depletion for RDX and 4ADNT.

Wells PTX06-1053 and PTX06-1135 south of Zone 12 near the groundwater divide show very low but *increasing* trends for RDX. PTX06-1053 had non-detect results for RDX before November 2013, but recent sampling results show a small increase above detection limits.

Chromium (VI) Individual Well Results

The table below includes a list of monitoring wells exceeding remedial goals for Cr (VI) for the Southeast and Southwest Sector divide with maximum concentrations and the MK trends indicated. Wells where high Cr (VI) concentration results are identified as statistical outliers are not included in the table.

Table 6: Trend Results for Chromium Affected Wells

Well Name	Cr(VI) Trend 2008 to 2011	Cr(VI) Trend 2012 to 2016	Maximum Concentration 2012-2016 [mg/L]
PTX06-1052	Stable	Decreasing	6.03
PTX06-1010	Increasing	Stable	3.23
PTX08-1008	Decreasing	Decreasing	1.53
PTX06-1118	No Trend	--	0.325
PTX06-1088	Decreasing	Stable	0.16
PTX06-1153	Increasing	Decreasing	0.159
PTX06-1005	--	Decreasing	0.95
PTX06-1095A	--	No Trend	0.148
PTX06-1183	--	(Insufficient Data)	1.92

Cr (VI) is found in a comingled, U-shaped plume that crosses the groundwater divide between the Southeast and Southwest Sectors. The Cr (VI) plume is contained within the Southeast and Southwest monitoring networks, so does not tend to drive decisions for adding or removing well locations. Well PTX06-1010 is located near one suspected Cr (VI) source and showed an *increasing* trend 2008 through 2011. However, the trend for 2012 through 2016 is *stable*, indicating that mass export from the source may be depleting. Downgradient from PTX06-1010, well PTX06-1088 has a *stable* trend for Cr (VI) while neighboring well PTX06-1011 has concentrations below remedial goals.

Well PTX06-1052 located near another historic source has the highest current Cr (VI) concentration in the network and exhibits a *decreasing* concentration trend. Recently installed well PTX06-1183 is downgradient from PTX06-1052 and exceeds remedial goals, but does not have sufficient data to evaluate a trend. PTX06-1166 downgradient from PTX06-1183 shows a *probably increasing* trend for Cr (VI) with concentrations below remedial goals. Upgradient from PTX06-1052, well PTX06-1009 is the only well in the network to show an *increasing* trend for Cr (VI), but concentrations are also below remedial goals. Concentration data support the conclusion that the Cr (VI) plume is likely spreading and becoming more dilute in most locations.

5.1.2 Plume-Level Analysis

MK trends for total dissolved mass, center of mass and spread of mass within the Southeast Sector monitoring network (zeroth, first and second moments, respectively) were calculated for annually consolidated data 2012 through 2016 and for the 2008 through 2016-time frame. Calculation of these trends is intended to provide a measure of plume stability. Trend estimates of the zeroth, first and second moments for both RDX and 4ADNT for the Southeast Sector are summarized in **Table 7**, and first moments (center of mass) for RDX and 4ADNT are illustrated on **Figure 3** and **Figure 4**, respectively. MAROS reports for zeroth, first and second moments for other COCs are in **Appendix C**.

The number of wells in the annually consolidated dataset varied between 36 to 46 between 2008 and 2016 from the total of 50 wells in the dataset. This reflects variation in the number, identity and analyte list of wells sampled in the time frame of interest.

The zeroth moment analysis (estimate of total dissolved mass) shows *no trend* (variable) for RDX between 2012 and 2016, but resolves as a *probably increasing* trend for the longer time frame. The transition from an *increasing* trend to a more *variable* trend in the recent time frame is consistent with more *stable* individual well trends and reduced source area concentrations. While the centers of mass of RDX show a statistically *increasing* trend (with movement to the southeast), the centers of mass are clustered tightly along the FM 2373 with plume mobility likely influenced by the SEPTS. The *increasing* trend for center of mass is also the result of *increasing* trends in the far southeast, notably at PTX06-1034 and the newly installed PTX06-1183.

Second moments, indicating the spread (dilution) of mass relative to the center of the plume show *stable* to *decreasing* trends in the direction perpendicular to groundwater flow (Y direction). The spread of mass in the X direction is stabilizing, indicating the plume is not spreading downgradient, and is likely staying more concentrated in the core due to the influence of the SEPTS. Results for 4ADNT are *stable* and *no trend* for all metrics indicating high overall stability of this plume relative to the RDX plume.

Table 7 Southeast Sector Moment Analysis Results

Moment Type	RDX Trend		4ADNT Trend	
	2008 - 2016	2012 - 2016	2008 - 2016	2012 - 2016
Zeroth (Total Dissolved Mass)	Probably Increasing	No Trend	Stable	Stable
First (Center of Mass)	Increasing	Increasing	Probably Increasing	No Trend
Second (Spread of Mass X/Y)	Increasing/ Decreasing	No Trend/ Decreasing	Stable/ Probably Decreasing	Stable / Stable

*Result for uniform saturated thickness

For the Cr (VI) plume in the 2012 through 2016-time frame estimates of total dissolved mass are *decreasing*, the center of mass is *increasing* (moving to the southeast) with *no trend* in the spread of mass parallel and perpendicular to the groundwater flow direction. For the longer time frame of 2008 through 2016, the total dissolved mass is *stable*, with the center of mass *probably increasing* and *stable* trends for the spread of mass. The results indicate that the Cr(VI) plume in the Southeast is largely stable with the plume core migrating slowly to the east.

Aggregate trends for areas within the Southeast Sector plumes were evaluated based on grouping of individual well trends. Aggregate trends were found for the Source area (near the original ditch line release from Zone 12 to Playa 1), the Tail (non-source wells), the ISB Southeast remedy area and the area along the picket of extraction wells to the east along FM 2373.

The number of wells in each group is indicated in **Table 8**, and the identity of wells in the group is provided in **Table B-3**. Wells assigned to the southeast source area (Zone 12) are PTX06-1002A, PTX06-1003, PTX06-1005, PTX06-1010, PTX06-1011, and PTX06-1088. A small proportion of the total dissolved contaminant mass, 3 percent for RDX and 2 percent for 4ADNT, remains in Zone 12. The source area shows an overall *probably decreasing* trend for RDX and 4ADNT, consistent with diminishing source strength.

Based on the results of the analysis, most of the residual contaminant mass is in the 'tail' or downgradient plume region. Overall, wells in the tail of the plume show a stable trend, which likely indicates a combination of decreasing trends in the central/north and increasing trends in the southeast. The centers of mass of the RDX and 4ADNT plumes are aligned along the picket of extraction wells near FM 2373 and this is reflected in the estimate of the percentage of plume mass in this area (48 percent of total RDX and 66 percent for 4ADNT). Wells east of the FM 2373 extraction picket show a *probably increasing* trend, in the aggregate.

Monitoring locations around the Southeast ISB remedy show an aggregate *stable* trend and represent approximately 17 percent and 8 percent of plume mass for RDX and 4ADNT, respectively. The overall *stable* trend is a result of some *decreasing* and some variable individual well trends as noted above. The percentage of mass estimates for the extraction and ISB areas show the difference in distribution of 4ADNT and RDX in the plume overall.

Table 8 Aggregate Trends for RDX and 4ADNT in the Southeast Sector

Area	Number of Wells	RDX Aggregate Trend	RDX Aggregate Mass %	4ADNT Aggregate Trend	4ADNT Aggregate Mass %
Source	8	S	3%	S	2%
Tail	42	NT	97%	S	98%
East of FM2373	8	PI	44%	NT	37%
SEPTS	8	NT	48%	NT	66%

S=Stable
NT= No Trend
PI = Probably Increasing

The MAROS Percent of Mass by Well tool uses the Voronoi area and concentration at the well to estimate the percentage of the total plume mass closest to each well. The analysis for COCs in 2016 (annually consolidated data from 45 wells) indicated wells that monitor areas of high mass based on concentration and distance between other monitoring locations. The tool is intended to identify wells that monitor disproportionately high or low amounts of plume mass that may require additional sampling locations or elimination of wells that do not provide significant information about the distribution of mass.

The following wells showed the highest estimated percentage of RDX in the plume: PTX06-1041 (9 percent), PTX06-1147 (9 percent), and PTX06-1146 (15 percent). Other wells representing mass in the range of 5 to 8 percent included PTX06-1095A, PTX06-1030, PTX06-1040, PTX06-1120, PTX06-PRB16, PTX06-1034. Each of the wells monitoring high percentages of mass is near or east of FM 2373. Overall, however, the mass of RDX is evenly distributed in the downgradient tail of the plume. These estimates were made assuming a uniform saturated thickness, so for wells in thinner areas of the perched unit (e.g. PTX06-1034), the mass estimates are likely high.

The well monitoring the most mass of 4ADNT is PTX06-1146 (21 percent), in part due to the large area that it monitors. The 4ADNT plume is distributed more evenly with several wells accounting for about 10 percent of mass. MK concentration trends for the high mass locations are *stable* for PTX06-1030 and *no trend* for PTX06-1038 and PTX06-1146. The combination of mass due to movement under the influence of the extraction wells and the large distance between wells (resulting in large monitoring area for each well) indicate that these wells are very important in characterizing the 4ADNT plume. The *stable* and *no trend* results indicate that the extraction remedy may be stabilizing concentrations in this area. Even though these wells monitor large areas of higher mass, no new wells are recommended north of PTX06-1034 due to the largely *stabl*e trends and low concentration uncertainty between neighboring points.

The MAROS reports for Percentage of Mass by Well are in **Appendix C**.

Relatively few wells account for the majority of Cr (VI) mass in the network. The area around PTX06-1010 contains 51percent of the Cr (VI). Other wells of importance in monitoring Cr (VI) are PTX06-1052 (13 percent of total mass) and PTX06-1183 (17 percent of total mass). These data indicate that the Cr (VI) plume is well contained within the existing monitoring network and additional sampling locations are not required to define the extent of contamination.

5.1.3 Spatial Analysis

The Southeast Sector network was evaluated for spatial sufficiency by calculation of SFs estimating concentrations at wells from the well's nearest neighbors. Average SFs, COVs and monitoring areas for wells in the Southeast Sector for RDX and 4ADNT are shown on **Table B-6**.

Overall, Southeast Sector SFs are low (below 0.5) for both priority COCs, indicating that there is low uncertainty within the current network. COV of SF is likewise low (below 1) for most locations, indicating stable relationships among wells over time. The areas of influence (Voronoi polygons) are fairly uniform in size, relative to the overall extent of the monitoring network, and wells are evenly spaced within the network. Evenly spaced monitoring locations, low concentration uncertainty and relatively low SF variability, along with the individual well trend analysis and moment analyses for plume stability indicate that the network is well designed to address priority monitoring goals of plume stability and uncertainty assessment.

Well Sufficiency

Higher concentration uncertainty is often found along the edges or 'hull' of the monitoring network. Two wells in areas with higher concentration uncertainty (SF >0.8), PTX06-1069 and PTX06-1023, are located on the northern edge of the network. These wells have intermittent detections of COCs with low concentrations and define the northern extent of the plumes. Higher SFs at these locations are due to the edge effect in that the wells have fewer wells around them. In this case, hull wells with low concentrations are compared against the higher concentration interior wells, resulting in higher uncertainty estimates. No additional sampling locations are needed in this area due to the low edge concentrations, limited area of saturation and relatively stable current trends.

Well location PTX06-1052 in the area of the groundwater divide on the western edge of the plumes shows higher uncertainty for RDX, but RDX is not a priority constituent in this area. The higher uncertainty estimate for PTX06-1052 results from the location on the edge of the high concentration RDX plume. The priority COCs at PTX06-1052 are chromium species.

PTX06-1133A is another monitoring network hull location on the southern edge of the RDX plume with high concentration uncertainty (SF = 0.83). PTX06-1133A is the well farthest downgradient to the south on the edge of the saturated extent of the perched unit. The southeastern area is a priority monitoring zone due to the concerns about potential vertical migration and delineation of horizontal impacts. PTX06-1133A shows intermittent detections below remedial goals. PTX06-1133A is the western node of the triangle of wells including PTX06-1183 and PTX06-1034 that define the downgradient edge of the RDX plume.

PTX06-1182 was installed in July 2016, 2,000 ft east of PTX06-1133A to define the edge of the RDX plume. PTX06-1182 shows concentrations above cleanup goals, but does not have sufficient data to evaluate a trend. Well PTX06-1034 defines the eastern edge of the plume front in the southeast. PTX06-1034 has concentrations above remedial goals and shows recent *increasing* concentration trends for RDX. The combination of higher SFs, concentration trends and exceedances of remedial goals suggests that additional monitoring locations are required in this area.

Well Redundancy

While many of the calculated SFs and COVs for RDX and 4ADNT are low (< 0.3), no wells were identified by the software for removal from the network for all COCS. Several wells that are redundant to define the extent and stability of the RDX plume, are important to the 4ADNT, Cr (VI), perchlorate, or other COC plumes.

Wells with low SF such as PTX06-1005 and PT06-1014 are near source areas and provide information on source inputs to the downgradient plume. Sampling locations with low SFs such as PTX06-1015, PTX06-1030 and PTX06-1031 are along the plume migration pathway to the southeast. PTX06-1015 may be a candidate for elimination in the future if concentrations continue to decrease. Wells such as PTX06-1039A, PTX06-1041 and PTX-06-1042 with low SFs are required to evaluate plume stability and remedy effectiveness for the SEPTS.

Monitoring well PTX06-1102, near the ISB pilot test location has already been removed from annual routine monitoring. Remaining wells in the area are monitored to provide information on long-term impacts of ISB treatments. Likewise, PTX06-1121, redundant with PTX06-1120 and PTX06-1046, is sampled on a much-reduced frequency.

All wells with low SF were reviewed for their value in addressing the priority monitoring objectives. Results of the qualitative review are shown on **Table B-6**.

5.1.4 Sampling Frequency Analysis

Sampling frequency analysis included assessment of the rates of concentration change at individual well locations and the trend over both the long term (2008 through 2016) and the recent time period (2012 through 2016). Results of the individual well sampling frequency analysis for RDX are shown on **Table B-7**.

The MAROS recommended sampling frequency for RDX (36 wells out of 50) and 4ADNT (42 wells out of 50) is Biennial (every two years). Monitoring locations with statistically *increasing* trends (PTX06-1030, PTX06-1034, PTX06-1046, PTX06-1153, and PTX06-1101) or with insufficient data in the recent time frame to calculate a trend (PTX06-1102, PTX06-1121, PTX06-1182 and PTX06-PRB16) were recommended for Quarterly monitoring by the software. The software defaults to Quarterly monitoring recommendations for locations that do not have data from at least 4 sample events. A Biennial frequency was recommended by the software for the network-level sampling frequency analysis.

The overall Biennial monitoring frequency recommendation for most wells is consistent with the findings from the plume-level, individual well and spatial analyses indicating stable plumes, low uncertainty and low rates of concentration change.

MAROS recommended sampling frequencies were reviewed qualitatively with respect to the monitoring goals of the network and individual wells. Recommendations included one well for sampling once every five years, five wells for Biennial sampling, 25 wells for Annual sampling and 19 wells for Semi-annual sampling. Semi-annual sampling was recommended for RA monitoring wells and wells in the far southeast corner of the perched unit. No locations are recommended for Quarterly sampling. Final recommendations for sampling frequency for the Southeast Sector are provided on **Table B-8**.

5.2 Southwest Sector Results

5.2.1 Priority COCs

Priority COCs for individual wells in the Southwest Sector are listed on **Table B-9**. TCE is the priority COC at 21 of 53 locations, and perchlorate is the priority at 6 of the 40 wells sampled for perchlorate. Priority COCs at individual wells other than TCE and perchlorate include 4ADNT, RDX, Cr (VI) and degradation products of TCE and RDX. Metals such as arsenic and manganese are produced as byproducts of the ISB remedy, and are elevated in some areas. Boron is a lower priority COC in the Southwest Sector as groundwater is not intercepted for treatment and subsequent surface application from this area.

Sector-wide priority COCs for the Southwest Sector are TCE and perchlorate. The Southwest Sector monitoring network was optimized for TCE and perchlorate as these COCs are more widely distributed at levels exceeding remedial goals. However, lower priority constituents such as 1,4-dioxane, metals, Cr (VI), and TCE degradation products were considered as monitoring priorities at specific locations.

1,4-Dioxane was detected above remedial goals at 10 sampling locations in the Southwest Sector: PTX06-1012, PTX06-1126, PTX06-1127, PTX06-1151, PTX06-1155 PTX06-1162, PTX06-1173, PTX06-1174, PTX08-1005. PTX08-1006. The highest concentration was found at PTX06-1127 upgradient of the eastern ISB remedy. Wells downgradient from PTX06-1127 such as PTX06-1156 and PTX06-1148 show concentrations below the 1,4-dioxane remedial goal of 7.7 μg/L indicating the 1,4-dioxane plume is currently delineated.

COCs such as TCE and perchlorate exceed remedial goals by a greater magnitude at each of these locations, however, the ISB and P&T remedies do not treat 1,4-dioxane. Monitoring of 1,4-dioxane is, therefore, conducted with the goal of assessing mobility through the groundwater divide toward the SEPTS remedy.

Wells in the immediate vicinity of the ISB (PTX06-1170, PTX06-1173, PTX06-1155, PTX06-

1012, and PTX06-1169) show high concentrations of cis-1,2-dichloroethene. While TCE concentrations are much higher relative to remedial goals at these locations, sampling degradation products of TCE is an important aspect of assessing ISB remedy performance. Therefore, monitoring the distribution and trends of TCE degradation product formation in the ISB area is important for remedy performance and efficacy monitoring.

5.2.2 Individual Well Statistics

Individual well exploratory data analysis statistics for the Southwest Sector are shown in **Tables B-10** and **B-11**. General MK trend results for both TCE and perchlorate are summarized in **Table 9**, with TCE and perchlorate statistical trend results tabulated for each of the primary monitoring objectives (e.g. RA, PS and UM). Results of the trend analysis for individual wells for TCE and perchlorate for the years 2012 through 2016 are detailed on **Table B-10**. Included in **Table B-10** are trend results from the 2008 through 2011-time frame for comparison. MK trend results and average concentrations normalized by remedial goals for TCE are shown on **Figure 5.** Normalized average concentrations and trend results for perchlorate are shown on **Figure 6.**

Table 9. Southwest Sector Individual Well Trend Summary

Well Group	Total Wells	Pantex Plant Southeast Perched Groundwater Mann-Kendall Trend Results by Number of Wells				
		Nondetect	Decreasing or Probably Decreasing	Stable	Increasing or Probably Increasing	No Trend or Insufficient Data
TCE						
All Wells	53	10 (19%)	11 (20%)	8 (15%)	7 (13%)	17 (32%)
RA	22	2 (9%)	3 (13%)	4 (18%)	2 (9%)	11 (50%)
PS	17	1 (6%)	4 (24%)	2 (12%)	6 (34%)	4 (24%)
UM	24	10 (42%)	6 (25%)	3 (13%)	2 (8%)	3 (13%)
Perchlorate						
All Wells	53	8 (15%)	6 (11%)	10 (19%)	4 (7%)	15 (28%)
RA	19	3 (16%)	3 (16%)	3 (16%)	2 (10%)	8 (42%)
PS	15	3 (20%)	4 (27%)	3 (20%)	3 (20%)	2 (13%)
UM	17	4 (24%)	1 (6%)	7 (41%)	1 (6%)	4 (24%)

RA = Remedial action; PS = Plume Stability; UM = Uncertainty Management

The Southwest Sector monitoring well network has several wells that have been installed since 2013, most in the area of the western ISB area for RA monitoring. Wells PTX06-1169, PTX06-1171, PTX06-1172, PTX06-1173, PTX06-1174, PTX06-1175, PTX06-1180, PTX06-1181, and PTX06-1183 in the western ISB area have insufficient data to determine a statistical trend (less than 4 sample event results). Other wells in the network are sampled infrequently for long-term uncertainty management, and therefore, do not have a statistically significant dataset for trend estimation in the recent time frame. Thus, the trend values for the Southwest Sector reflect a larger percentage of wells with insufficient data than wells in the Southeast Sector.

For RA monitoring wells, about 50 percent of TCE and 42 percent of perchlorate trend analyses have either insufficient or variable data showing no distinct statistical trends. The remaining RA wells for TCE show *stable*, *decreasing* and *increasing* trends at various locations. For TCE, some *stable* trends are found in the western ISB area and *decreasing* trends in the central and eastern ISB areas. Well PTX06-1012 shows a strongly *decreasing* trend for TCE and an *increasing* trend for cis-1,2-dichloroethene, indicating successful TCE degradation within the ISB area.

Two RA/PS wells with *increasing* TCE trends (PTX06-1150 and PTX06-1159) are found south of the ISB remedy. PTX06-1159 also shows an *increasing* trend for perchlorate and cis-1,2-dichloroethene. The variability in trend results in the RA well group may result from the remedy design where the ISB was installed within the plume core and expanded westward over time. *Increasing* trends may result from migration of residual core mass, present downgradient from the installed remedy. Alternately, the trends may result from variability in the performance or maturity of the ISB remedy or from variability in the groundwater flow regime. The additional wells installed between 2013 and 2016 will provide data in the future to close data gaps in the CSM.

Several PS wells show *increasing* concentration trends. PTX06-1035 and PTX06-1134, PS wells near PTX06-1150 and PTX06-1159, also show *increasing* and *probably increasing* trends for TCE and perchlorate. These monitoring locations are near or below remedial goals for TCE, but exceed goals for perchlorate. As these locations delineate the groundwater plumes to the south of the ISB remedy, it is possible that additional downgradient wells may be required to delineate the extent of affected groundwater going forward.

Among the UM source area wells, PTX08-1006 shows an *increasing* trend for TCE but strongly *decreasing* trends for perchlorate and 1,4-dioxane. Long-term trend results for PTX08-1006 indicate *increasing* trends from 2000 through 2016 for TCE. The trend result for TCE is inconsistent with surrounding wells in the source area that show overall *stable* to *decreasing* trends. These trend results indicate that PTX08-1006 should continue to be monitored, with sampling results integrated into the overall CSM for source strength upgradient of the ISB remedy.

Wells PTX06-1012 and PTX06-1155 show *increasing* trends for 1,4-dioxane in the center of the ISB area, while Zone 12 source area wells PTX08-1007 and PTX08-1009 show *probably increasing* trends. In addition to PTX08-1006, upgradient wells PTX08-1005, PTX06-1P02, and PTX06-1011 show *decreasing* trends for 1,4-dioxane.

5.2.3 Plume-Level Analysis

MK trends for total dissolved mass, center of mass and spread of mass (zeroth, first and second moments, respectively) were calculated for annually consolidated data 2012 through 2016 and for the 2008 through 2016-time frame. Trend estimates of the zeroth, first and second moments for both TCE and perchlorate for the Southwest Sector are summarized in **Table 10**, and first moments (center of mass) for TCE and perchlorate are illustrated on **Figure 5** for TCE and **Figure 6** for perchlorate. MAROS reports for zeroth, first and second moments for other COCs are in **Appendix C**.

Results for the moment analyses for both TCE and perchlorate plumes indicate statistically *stable* overall trends within the network. While individual wells within the network may show strong trends, the plumes are not migrating or significantly changing distribution on a larger landscape level. There is no change in the trends calculated during the longer versus the more recent time frame. Stable conditions for total dissolved mass indicate that additional mass mobilizing into the monitoring network from the source is balanced by degradation and attenuation within the plumes. *Stable* conditions indicate that the interior network is adequate to evaluate the distribution of contamination.

Table 10 Southwest Sector Moment Analysis Results

Moment Type	Constituent			
	TCE Trend 2008 - 2016	TCE Trend 2012 - 2016	Perchlorate Trend 2008 - 2016	Perchlorate Trend 2012 - 2016
Zeroth (Total Dissolved Mass)	Stable	Stable	Stable	Stable
First (Center of Mass)	No Trend	No Trend	Stable	Stable
Second (Spread of Mass X/Y)	Stable/Decreasing	Stable/Stable	Increasing/Stable	Increasing/Stable

*Result for uniform saturated thickness

MAROS estimates the percentage of contaminant mass monitored by each well in the network, based on the Voronoi area and concentrations. Results indicate that well PTX06-1159 monitors about 27 percent of the total TCE mass in the network, due to the large area it monitors. Well PTX06-1151 monitors about 9 percent of the mass, with other wells in the network monitoring smaller areas with lower concentrations. This finding supports prioritization of monitoring in the area of PTX06-1159. For perchlorate, wells monitoring higher percentages of plume mass are PTX08-1008 at 14 percent, PTX08-1006 at 11 percent and PTX06-1007 at 15 percent. PTX06-1007 monitors a large area upgradient in Zone 11. PTX08-1008 and PTX08-1006 are in the southwest corner of Zone 11, with PTX08-1008 showing an increasing trend outside of the ISB remedy.

Table 11 Aggregate trends for TCE and Perchlorate in the Southeast Sector

Area	Number of Wells	TCE Aggregate Trend	TCE Aggregate Mass %	Perchlorate Aggregate Trend	Perchlorate Aggregate Mass %
Source	10	S	28%	S	69%
Tail	43	NT	72%	S	31%
ISPM	9	NT	13%	D	8%
Downgradient ISB	3	I	18%	I	4%

The aggregate trend analyses indicate that the source area has overall stable concentration trends. Individual well trends in the source area are largely *decreasing*, with one *increasing* trend at PTX08-1006, resulting in an overall stable assessment. The analysis indicates that about 28 percent of TCE mass and 69 percent of perchlorate mass remain in the source area. For TCE, most of the contaminant mass is in the downgradient plume, with about 13 percent accounted for by ISPM wells and 18 percent in the three downgradient wells on the leading edge of the plumes (PTX06-1035, PTX06-1134 and PTX06-1159). The relatively large mass accounted for by three edge wells indicates additional monitoring in this area may be warranted.

5.2.4 Spatial Analysis

Results of the spatial sufficiency and redundancy analysis for the Southwest Sector are summarized in **Table B-12**.

Overall, Southwest Sector SFs are low (below 0.5) for priority COCs, indicating that there is low uncertainty within the current network. COV of SF is low (below 1) for most locations, indicating stable relationships among wells over time. Higher variability was found between PTX06-1012 and PTX06-1155, adjacent wells downgradient from the central ISB remedy. Both wells have high concentrations with rapidly decreasing concentrations, which may cause variability in concentrations between the wells over time.

The areas of influence (Voronoi polygons) for the Southwest Sector are variable due to the close spacing of wells around the ISB to assess remedy performance and the larger spacing between wells in the source area and western Zone 10 where concentrations are *decreasing* or not detected. The variability in monitoring areas is consistent with the stated objectives of assessing remedy performance over a short spatial extent and managing uncertainty on the outer edges of the plume.

Well Sufficiency

Increasing concentration trends at leading edge wells PTX06-1035, PTX06-1134 and PTX06-1159 indicate that at least one additional monitoring well is required downgradient to monitor the leading edge of the plume. TCE concentrations at PTX06-1134 are below the remedial goal of 5 μg/L, but have been increasing from non-detect between 2015 and 2016. Perchlorate concentrations at PTX06-1035 are above remedial goals and statistically *increasing*. It is unknown if the ISB remedy is reducing the flux of TCE downgradient or whether the perchlorate plume mobility is now controlled by the ISB.

While an *increasing* concentration trend and high percentage of dissolved mass in the perchlorate plume was found at well PTX08-1008, the SFs and uncertainty are low, so an additional monitoring location is not recommended downgradient from this well. However, the data suggest the area should be prioritized for monitoring going forward and downgradient wells should be evaluated for potential perchlorate plume migration to the southeast.

Well Redundancy

Wells PTX06-1162 and PTX08-1005 are adjacent. SFs and trends for PTX08-1005 indicate the well is important to characterize the plumes in this area. However, SFs for PTX06-1162 for TCE and perchlorate were below 0.3 (0.04 and 0.29, respectively) and removal of this well from the network spatial analysis did not increase uncertainty between adjacent wells, change estimates of the mass or distribution of TCE and perchlorate in the plume. Well PTX06-1162 was found to be redundant with PTX08-1005. The recommendation is to eliminate PTX06-1162 from routine monitoring, but not plug and abandon the well in case additional characterization is required.

Other wells located close together, such as those around the ISB remedy show more spatial concentration variability and are required to evaluate the efficacy and provide data to optimize the ISB injections.

Several wells on the western side of the perched unit in Zone 10 such as PTX07-1Q01, PTX07-1Q02, PTX07-1Q03 and PTX06-1131 show low to non-detect concentrations with no *increasing* trends and low SFs. These UM wells are monitored to confirm low to non-detect conditions on the outer edge of the western perched unit, and are, therefore, not redundant.

5.2.5 Frequency Analysis

Results of the sampling frequency analysis for the Southwest Sector are listed on **Table B-13**. Most wells in the program were recommended by the software for Biennial sampling for both TCE (37 of 53 wells) and perchlorate (28 of 43 wells). The Biennial recommendation is consistent with the finding that concentrations are not changing rapidly and plumes are largely stable. The MAROS software defaults to a recommendation of Quarterly sampling at locations with less than 4 sampling results in the recent (2012 through 2016) time frame. As noted above, several wells in the network have been installed since 2013 and have not been sampled 4 times.

MAROS recommended sampling frequencies were reviewed qualitatively with respect to the monitoring goals of the network and individual wells. For the Southwest Sector, 9 wells are recommended for sampling once every five years, 7 wells are recommended for Biennial sampling, 17 wells for Annual sampling and 19 wells for Semi-annual sampling. Semi-annual sampling frequencies are recommended for wells in the ISB remedy area to monitor remedy performance and to provide data to optimize remedial response.

No wells are recommended for routine Quarterly sampling; however, Quarterly sampling may be performed if short-term data are required to evaluate ISB remedy performance after injections or if the injection protocol is optimized. Final recommendations for sampling frequency are provided on **Table B-14**. Sampling recommendations are illustrated on **Figure 8**.

5.3 NORTH SECTOR RESULTS

5.3.1 Priority COCs

Priority constituents for the 27 individual wells included in the North Sector analysis are listed on **Table B-15**. Four North Sector wells were included in the Southeast Sector analysis, and three wells were included in the Southwest Sector analytical group. The North Sector is characterized by radial groundwater flow, isolated saturated zones, and limited areas of continuous plumes. RDX is the only priority COC on a sector-wide basis. Boron also exceeds the standard for irrigation re-use (192 µg/L) at many locations, which is critical for the P1PTS operation. Many wells north of Zones 11 and 12 are UM wells and have low to no detections of site COCs. Constituents that exceed remedial goals at individual wells are RDX, boron, and 4ADNT.

5.3.2 Individual Well Statistics

Summary statistics for North Sector wells are shown on **Table B-16**. Concentration ratios and trend results for RDX in the North Sector are shown on **Figure 7**. Many monitoring locations in the North Sector either have low or no detections of site COCs. Overall, the magnitude and extent of contamination in the North is less than the Southeast and Southwest Sectors.

Higher concentrations of RDX are centered around Playa 1, which was a source of contamination through historical infiltration of industrial discharge. Monitoring locations with high concentrations of RDX south of Playa 1 include PTX08-1002, considered as a source well for the Southeast Sector, PTX08-1001, PX07-1P05 and PX07-1P02. North of Playa 1, OW-WR-

38 shows concentrations above remedial goals. OW-WR-38 and PTX07-1P02 show *increasing* trends for RDX in the recent time frame, while PTX08-1001 and PTX08-1002 show *stable* trends.

North of Playa 1, PTX06-1050 monitors groundwater with historical high concentrations of RDX, boron and 4ADNT, but has shown *decreasing* and *probably decreasing* trends since 2008. Well PTX06-1136, downgradient from PTX06-1050 is non-detect for RDX, indicating the plume in the northwest is not expanding and is well delineated. Northern wells PTX07-1O03 and PTX07-1O01 exceed remedial goals for RDX and boron. PTX07-1O03 shows an *increasing* concentration trend for RDX, while the RDX and boron trends at PTX07-1O01 are *stable*.

PTX06-1013 is on the eastern edge of the perched unit has shown exceedances of RDX, boron and total Cr. The well shows *probably decreasing* trends for both RDX and boron, and concentrations of total Cr have dropped below remedial goals. Concentrations of COCs downgradient from PTX06-1013 at PTX06-1069 have dropped below remedial goals. Individual well results for these locations indicate the plumes are not expanding to the east.

Concentration trends in the main perched unit of the North Sector may be influenced by varying recharge from rainfall to Playa 1. The site experienced heavy rains in 2010, drought in 2011 and wetter conditions from 2015 through 2016. Changes in recharge may also influence the extent of saturation in some areas over long time scales.

The Burning Ground is located over a perched groundwater unit separate from and west of the main perched unit. Concentrations of COCs in the Burning Ground area are below remedial goals and have shown *stable* or *decreasing* trends or non-detect results in the recent time frame. Perched groundwater along the northern boundary of the Pantex Plant, isolated from the main perched unit, also shows low to non-detect concentrations of COCs.

5.3.3 Plume-Level Analysis

MK trends for total dissolved mass, center of mass and spread of mass (zeroth, first and second moments, respectively) were calculated for annually consolidated data 2012 through 2016 for wells in the main perched unit around Playa 1 (excluding the detached perched units). Total dissolved mass for RDX was *increasing* within the network, but does not appear to be migrating. The P1PTS may be mobilizing RDX from below Playa 1, but the groundwater extraction system is preventing migration of the center of mass of the plume. Metrics were *stable* to *no trend* for 4ADNT.

Table 12 North Sector Moment Analysis Results

Moment Type	Constituent	
	RDX Trend 2012 - 2016	4ADNT Trend 2012 - 2016
Zeroth (Total Dissolved Mass)	Increasing	No Trend
First (Center of Mass)	Stable	No Trend
Second (Spread of Mass X/Y)	No Trend/No Trend	Stable/Stable

*Result for uniform saturated thickness

The MAROS tool that identifies the percentage of total plume mass represented by each well identified wells PTX06-1050 as accounting for 66 percent of RDX and 69 percent of 4ADNT in the North Sector. PTX06-1050 monitors a large area and shows relatively high concentrations of priority COCs. Other North Sector wells that are important in monitoring total plume mass are PTX08-1002 (22 percent of RDX and 11 percent of 4ADNT) and OW-WR-38 (3.5 percent of RDX).

5.3.4 Spatial Analysis

The MAROS quantitative network spatial analyses require monitoring locations in areas of consistent groundwater flow directions relative to source material to evaluate spatial redundancy and sufficiency. The SF analysis indicated significant spatial uncertainty, which is consistent with the finding that the North Sector has variable groundwater flow and sources, as well as disconnected saturated zones. For the North Sector, well redundancy and sufficiency were evaluated using qualitative methods and consideration of site monitoring objectives, as well as findings from previous LTMO efforts.

The primary monitoring objectives for the North Sector are to evaluate uncertainty in the Burning Ground and other isolated groundwater units with limited impacts. UM and RA wells are also located on the edges of the higher concentration areas to delineate impacts around Playa 1 in the main perched unit. Wells that monitor the performance of the P1PTS are located around Playa 1. The North Sector well network has been optimized formally and informally over many years. The current distribution of wells is both sufficient to address monitoring objectives and does not include redundant wells.

Well PTX-BEG3 has been sampled historically for Cr species. Detections of Cr at PTX-BEG3 are likely an artifact of well construction. PTX-BEG3 does not address any priority monitoring objectives, so the recommendation is to remove this well from routine monitoring.

5.3.5 Frequency Analysis

As with Southeast and Southwest Sectors, concentration trends in the North Sector are not changing rapidly. Overall, most wells in the North Sector were recommended for Biennial sampling by the MAROS algorithm. Well OW-WR-38 was recommended for Semi-annual sampling and wells with less than 4 sampling results in the recent time frame were recommended for Annual (no or low detections) or Quarterly (higher concentrations) sampling. The final recommended sampling frequencies, after qualitative review, is listed on **Table B-17**.

Several wells were recommended for reduced sampling frequency. Wells in the Burning Ground and north plant boundary area are recommended for sampling every five years due to low and unchanging historical concentrations. Of the 27 wells considered in the North Sector, 9 are recommended for sampling every five years, 16 are recommended for Annual sampling and one well (PTX-BEG3) is recommended for elimination from routine monitoring. The Annual sampling frequency for North Sector wells around Playa 1 will provide sufficient data in a five-year interval to determine trends to evaluate the performance of the P1PTS.

6.0 RECOMMENDATIONS

6.1 SOUTHEAST SECTOR RECOMMENDATIONS

6.1.1. Southeastern Perched Unit

Based on the monitoring optimization, at least one additional monitoring well is recommended for the far southeastern area of the perched unit. While the spatial uncertainty analysis indicates that concentration uncertainty between the existing wells is low (due to low variability between monitoring locations), high concentrations and statistically *increasing* trends on the edges of the southeastern perched saturated zone indicate that at least one additional well is needed to define the extent of contamination and saturation.

Identifying the extent of the perched unit and evaluating elevations of the FGZ in the Southeast Sector is challenging as the formation can be intermittently saturated and the FGZ tilts upward in this area.

If sampling results indicate significant saturation to the south/southeast of PTX06-1182 and show *increasing* concentration trends, then an additional well or wells may be installed to define the extent of the plume and the saturated zone near abandoned well PTX06-9905 north of Highway 60. PTX06-9905 was installed in this area in 1999, but was plugged after exhibiting dry conditions. The exact extent of saturation and the long-term variability in saturated thickness in the southeast area is a data gap in the site CSM that can be addressed by installation of an additional well or wells.

Well PTX06-1158 was installed east of PTX06-1034 in 2012, but the well was dry. The Pantex Plant region experienced drought conditions in 2011, possibly resulting in drying at the edges of the perched unit. Rainfall and recharge have been higher than average recently, so PTX06-1158 may be intermittently saturated. Intermittently dry wells in the southeast are checked semi-annually for saturation. This effort should continue going forward to enhance CSM development

6.1.2 Southeast Sector ISB

Continued investigation of the area around ISPM well PTX06-1153 is recommended to address uncertainty related to RDX concentration trends in this area. The limited saturated thickness in this area may mean that small migrations of affected groundwater may impact concentrations downgradient of the ISB. Additional monitoring wells are not recommended, but periodic sampling of previously dry wells is recommended. PTX06-1051, PTX06-1188, PTX06-1167 and PTX06-1122 are dry wells located west of the ISB remedy. Monitoring saturation at these locations may indicate if untreated water is circumventing the ISB from the west (PTX06-1166), causing variable concentrations at ISPM well PTX06-1153. The ISB CSM can be strengthened by monitoring water levels and geochemistry in the ISB injection wells and downgradient ISPM wells. The potential effect of injections on the distribution of saturation in the area should be considered and incorporated into the CSM for the remedy.

6.1.3 *Well Redundancy*

The results of the MAROS analysis indicate overall low uncertainty and low variability between monitoring locations in the Southeast Sector. This result is consistent with the Plant history of optimizing the monitoring network over time. No wells are recommended for removal from the Southeast Sector routine monitoring program, now. Low spatial uncertainty results were considered when recommending sampling frequency. Locations with very low uncertainty (e.g. where the nearest neighboring wells can predict concentrations at a well node) were considered for reduced sampling frequency.

6.1.4 Sampling Frequency

While the MAROS results indicate that a Biennial sampling frequency would be sufficient to evaluate the rate of concentration change in the network and at most wells, an overall Annual sampling frequency is recommended for most locations in the Southeast Sector. Semi-annual sampling is recommended at wells used to evaluate the ISB and SEPTS remedies and potential plume migration along the east and southeast edges of the perched unit. Final sampling recommendations are provided on **Table B-18** and shown on **Figure 8**.

6.2 SOUTHWEST SECTOR RECOMMENDATIONS

6.2.1 Additional Well Monitoring Plume Front

At least one additional monitoring well is recommended for the area downgradient from PTX06-1035 and downgradient and west of PTX06-1134. A well in this location will delineate the leading edge of the TCE and perchlorate plumes. If concentration trends at PTX06-1134 do not stabilize in the near future, then an additional well may be required downgradient from PTX06-1134 to delineate the TCE plume. The ISB remedy appears to be controlling the spread of the plume in the center of the ISB curtain, but results on the western edge of the ISB are variable, and it is currently unknown if the remedy will control and shrink the plume in this area.

6.2.2 Perchlorate Plume

Site data indicate high and increasing concentrations of perchlorate at PTX08-1008, cross gradient from the ISB remedy. The perchlorate plume may be migrating from PTX08-1006 southeast around the edge of the eastern ISB remedy. While an additional well is not recommended downgradient of PTX08-1008 at this time, the recommendation is to monitor perchlorate at PTX08-1009 and wells to the southeast of PTX08-1008. The spatial analysis indicates low concentration uncertainty in this area, but monitoring effort should be directed toward quantifying perchlorate flux toward the SEPTS.

6.2.3 Well Redundancy

As in the Southeast Sector, the monitoring network in the Southwest Sector has been optimized several times since initial site characterization. Overall, there is very low spatial uncertainty within the network. One well, PTX06-1162 was found to be redundant in the network. This wells is not currently sampled routinely, and continued limited sampling is recommended.

6.2.4 Sampling Frequency

Monitoring wells in the Zone 11 and Zone 12 source areas show largely *stable* to *decreasing* trends resulting in recommendations for Annual sampling. Wells located within and downgradient from the ISB remedy monitor changing conditions as the remedy is optimized and require more frequent monitoring to inform remedial decision making. ISB area wells are recommended for largely a Semi-annual sampling frequency. Wells outside of the main plumes to the west are minimally affected by site COCs and are recommended for sampling once before each Five-Year Review (or as regulatory permitting requires). Final recommended sampling frequencies are illustrated on **Figure 8**.

6.3 NORTH SECTOR RECOMMENDATIONS

6.1 Well Redundancy and Sufficiency

The North Sector monitoring network has been optimized previously based on the priority monitoring objectives. No additional wells are recommended in the North Sector. In the 2007 analysis, the area west of PTX06-1050 was recommended for a new monitoring location to delineate RDX to the west. The new well PTX06-1136 has delineated the affected area and concentrations at PTX06-1050 are decreasing. No additional monitoring points are recommended downgradient of the *increasing* RDX trends at PTX07-1O03, OW-WR-38 and PTX07-1P05 as wells in the Southwest and Southeast Sectors delineate the extent of contamination and the plumes do not appear to be mobilizing beyond the P1PTS. No additional wells are recommended for the isolated perched water units at the Burning Ground or along the northern Plant boundary.

Well PTX-BEG3 is recommended for elimination from routine monitoring.

6.2 Sampling Frequency

For the northern perched unit, a largely Annual sampling frequency is recommended for the Playa 1 area based on the rate of concentration change and the outstanding remedy management questions. Perched groundwater in the Burning Ground and northern boundary are recommended for 5-year sampling frequency except for POC wells that are recommended for Annual sampling.

APPENDIX A:

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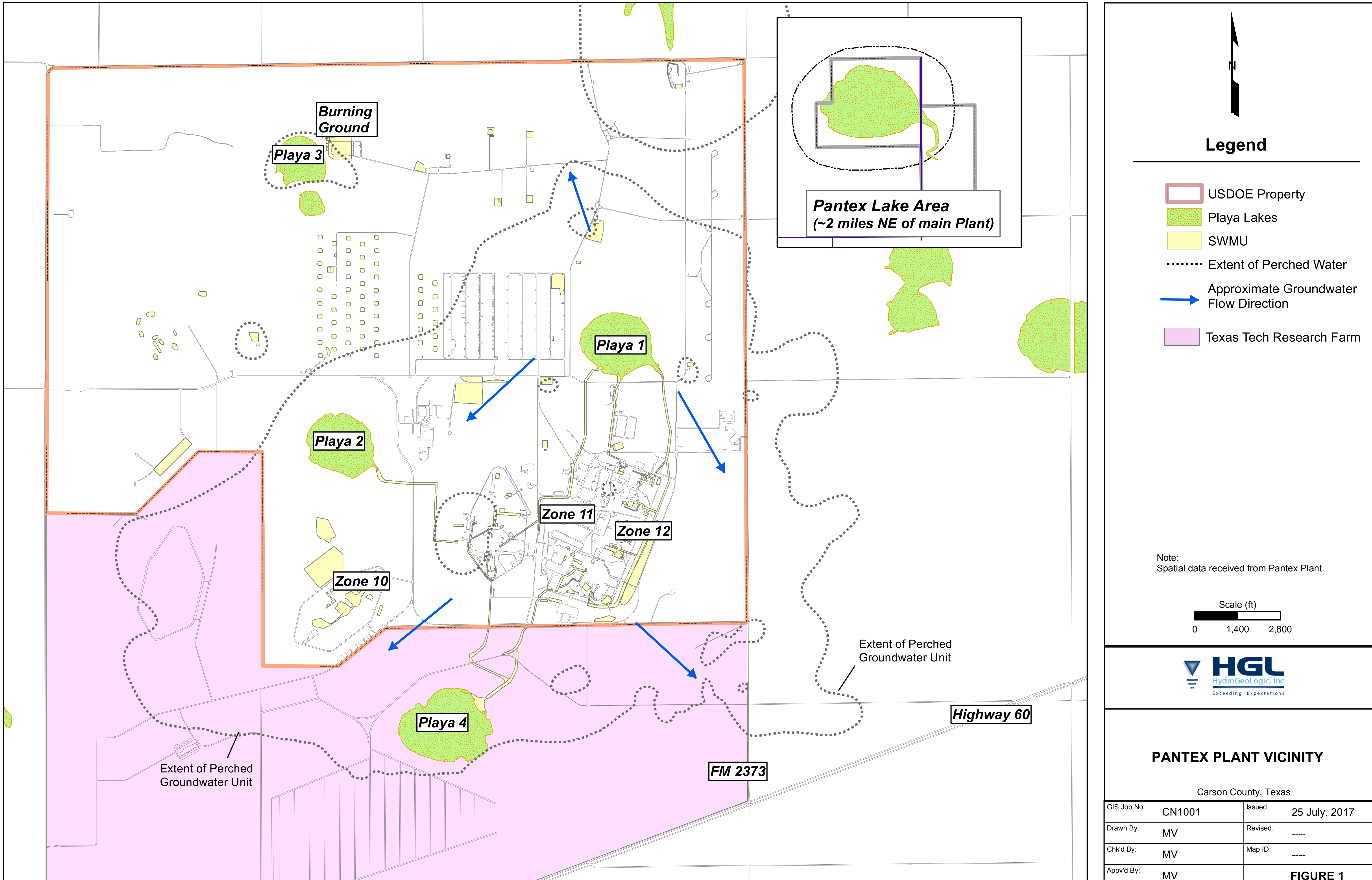
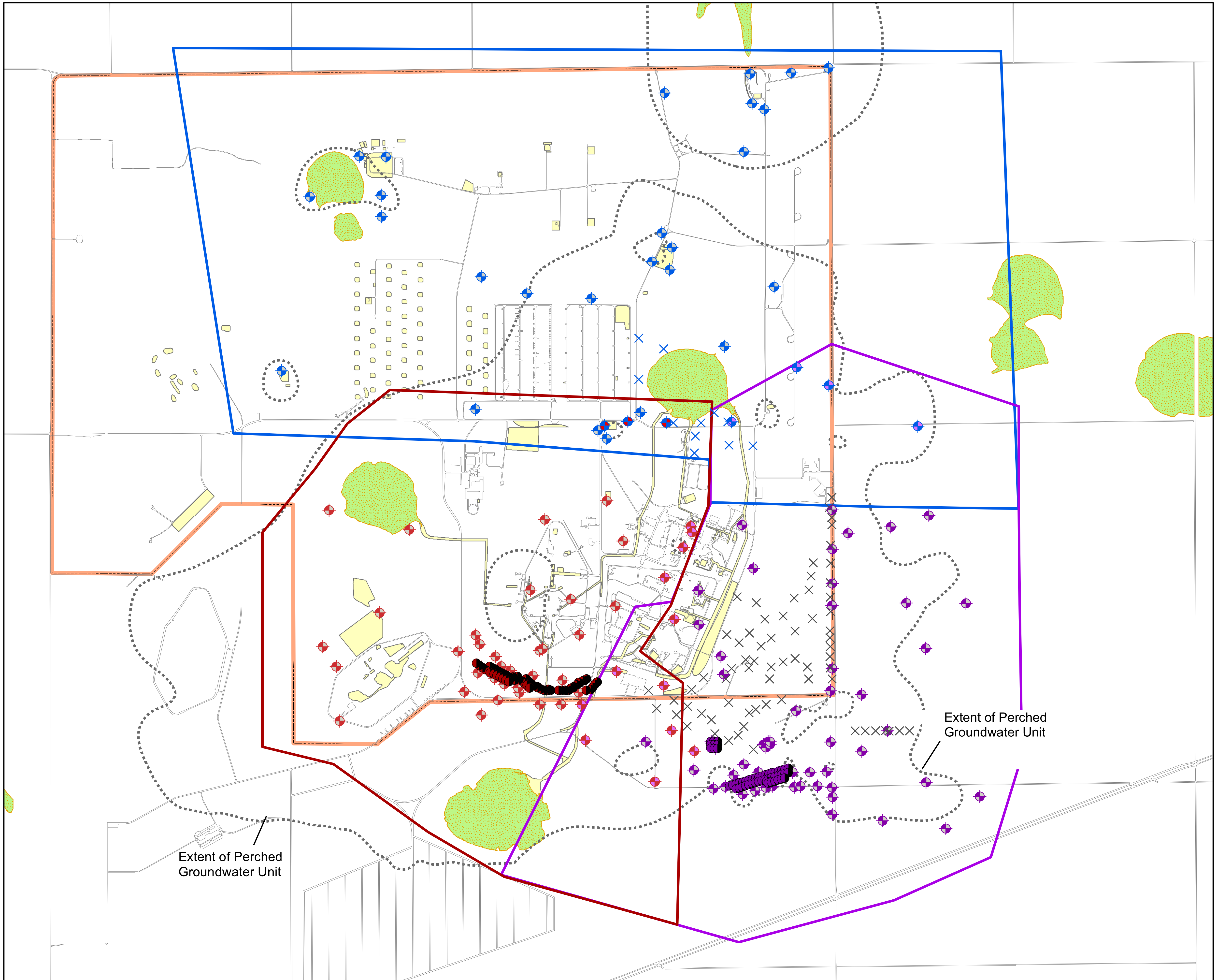
Figures


Burning Ground
Playa 3
Playa 1
Playa 2
Zone 11
Zone 12
Zone 10
Playa 4
FM 2373
Highway 60
Extent of Perched Groundwater Unit
Extent of Perched Groundwater Unit
Pantex Lake Area
(~2 miles NE of main Plant)
N
Legend
USDOE Property
Playa Lakes
SWMU
Extent of Perched Water
Approximate Groundwater Flow Direction
Texas Tech Research Farm
Note:
Spatial data received from Pantex Plant.
Scale (ft)
0
1,400
2,800
HGL
HydroGeoLogic, Inc
Exceeding Expectations
PANTEX PLANT VICINITY
Carson County, Texas
GIS Job No. CN1001
Issued: 25 July, 2017
Drawn By: MV
Revised: ----
Chk'd By: MV
Map ID: ----
Appv'd By: MV
FIGURE 1



Legend

Remedies

- Southeast P&T Extraction Well
- Playa 1 P&T Extraction Well
- ISB Southeast
- ISB Southwest

Investigation Wells

- North Area
- North/Southeast Areas
- North/Southwest Areas
- Southeast Area
- Southwest Area
- Southwest/Southeast Area
- Southwest Area
- Southeast Area
- North Area
- Pantex Plant
- Extent of Perched Unit
- Playas
- SWMU

Scale (ft)

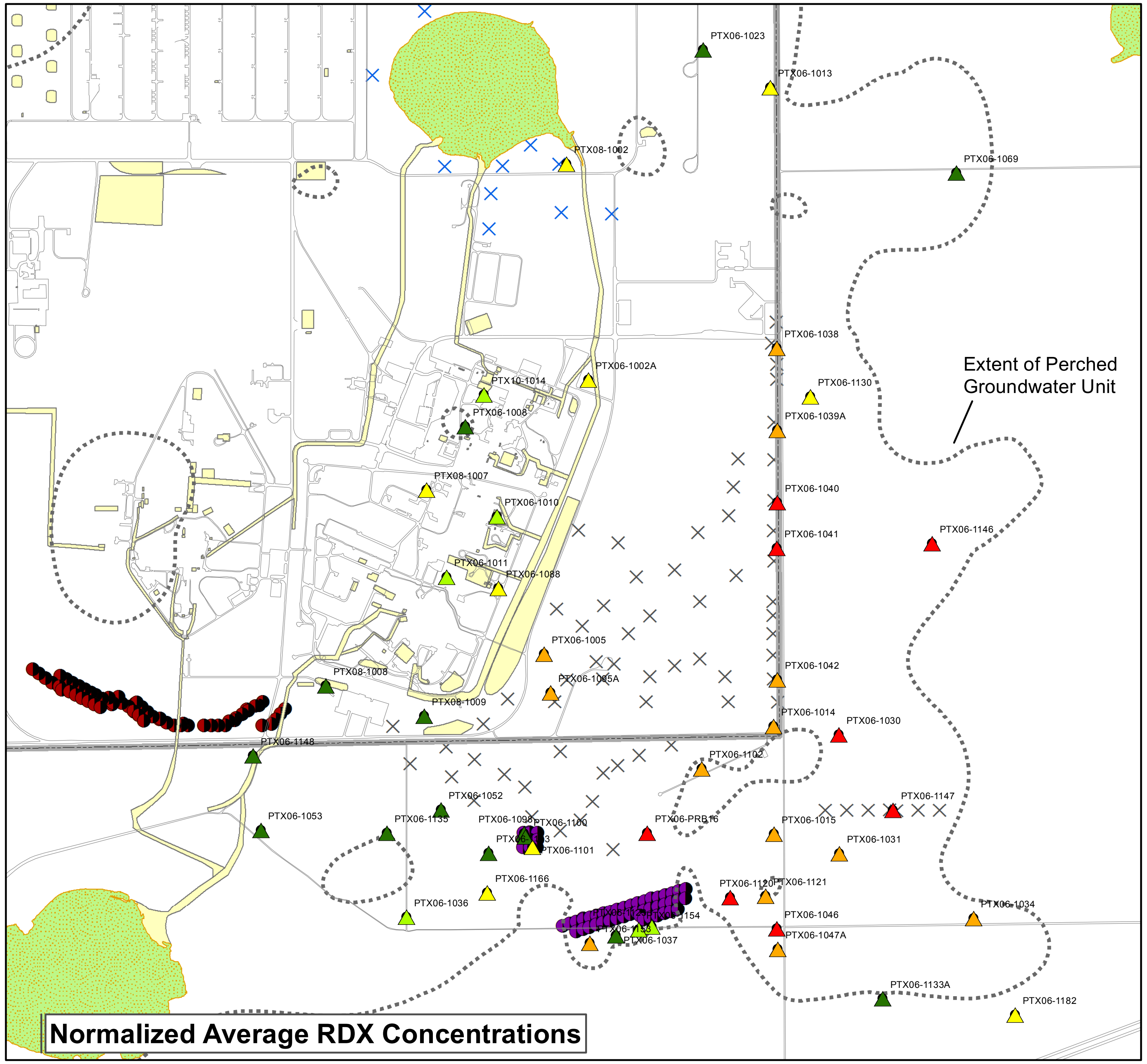
0 1,400 2,800

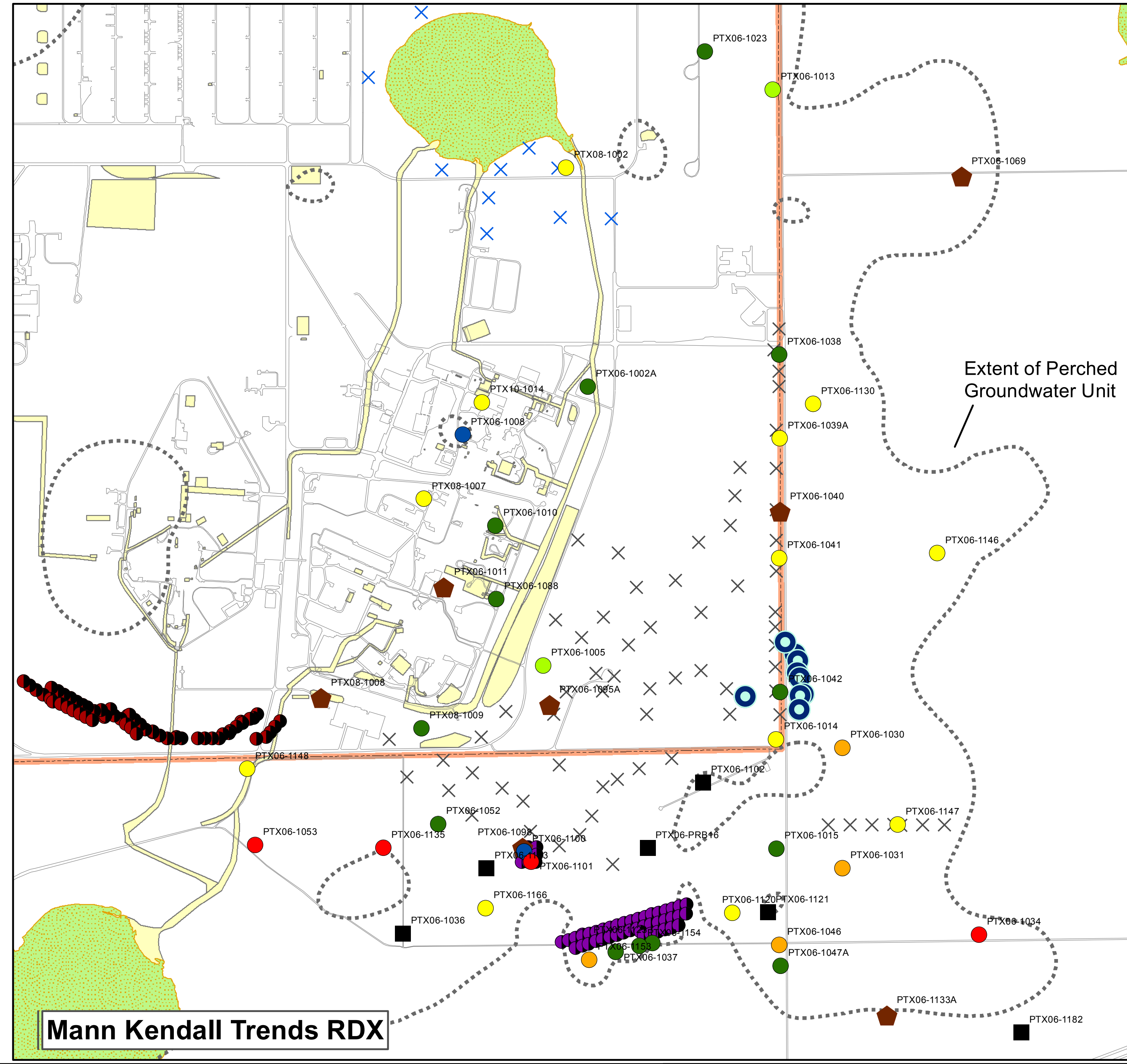
HGL HydroGeoLogic, Inc Exceeding Expectations

PANTEX PERCHED GROUNDWATER INVESTIGATION AND REMEDY MONITORING WELL LOCATIONS

Carson County, Texas

GIS Job No.	CN1001	Issued:	25 July, 2017
Drawn By:	MV	Revised:	----
Chk'd By:	MV	Map ID:	----
Appv'd By:	MV		FIGURE 2





Legend

Normalized RDX Concentration

- < 0.5
- 0.5 - 1
- 1 - 100
- 100 - 500
- \> 500

MSC RDX = 2 ug/L

Mann Kendall Trend RDX

- Decreasing
- Probably Decreasing
- Stable
- Probably Increasing
- Increasing
- Non Detect (2012-2016)
- No Trend
- Insufficient Data

RDX First Moments

- First Moments

Remedies

- Southeast P&T
- Playa 1 P&T
- ISB Earea
- ISB Warea

Scale (ft)
0 1,000 2,000

N

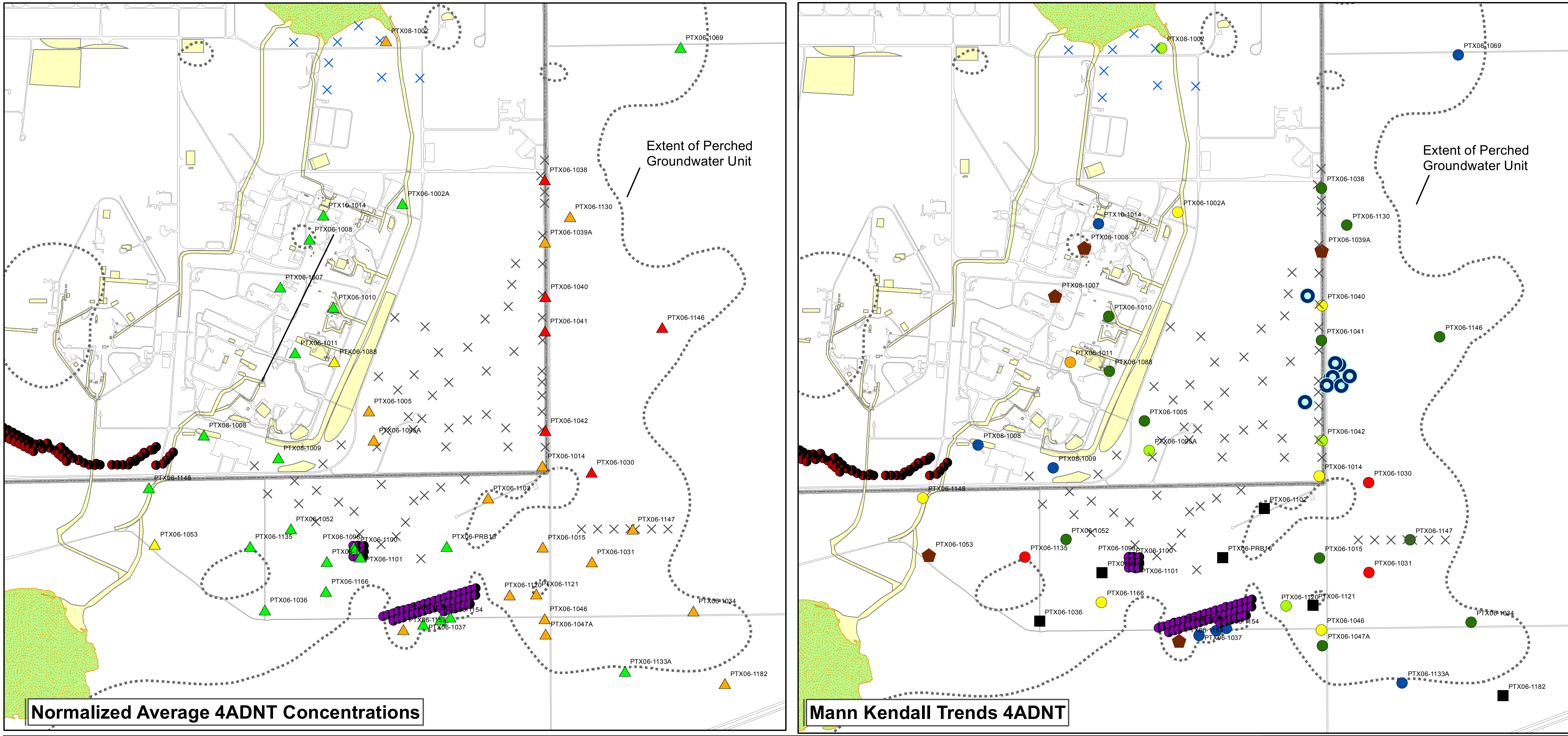
Notes:
1. Normalized average RDX concentrations calculated using the average concentration 2012 - 2016 divided bythe MSC.
2. First Moments are the center of mass for RDX using annually consolidated data.
3. Mann Kendall trends were determined for RDX 2012-2016.

HGL HydroGeoLogic, Inc. Exceeding Expectations

PANTEX SOUTHEAST SECTOR PERCHED RDX AVERAGE CONCENTRATIONS, FIRST MOMENTS AND MANN-KENDALL TRENDS

Carson County, Texas

GIS Job No.	CN1001	Issued:	25 July, 2017
Drawn By:	MV	Revised:	----
Chk'd By:	MV	Map ID:	----
Appv'd By:	Mv		**FIGURE 3**



Legend

Normalized Average 4ADNT Concentration

- <0.5
- 0.5 - 1
- 1 - 100
- 100 - 500
- >500

MSC 4ADNT = 1.2 ug/L

Mann Kendall Trend 4ADNT

- Decreasing
- Probably Decreasing
- Stable
- Probably Increasing
- Increasing
- Non Detect (2000-2007)
- No Trend
- Insufficient Data

4ADNT First Moments

- First Moments

Remedies

- Southeast P&T
- Playa 1 P&T
- ISB Earea
- ISB Warea

Scale (ft)
0 970 1,940

N

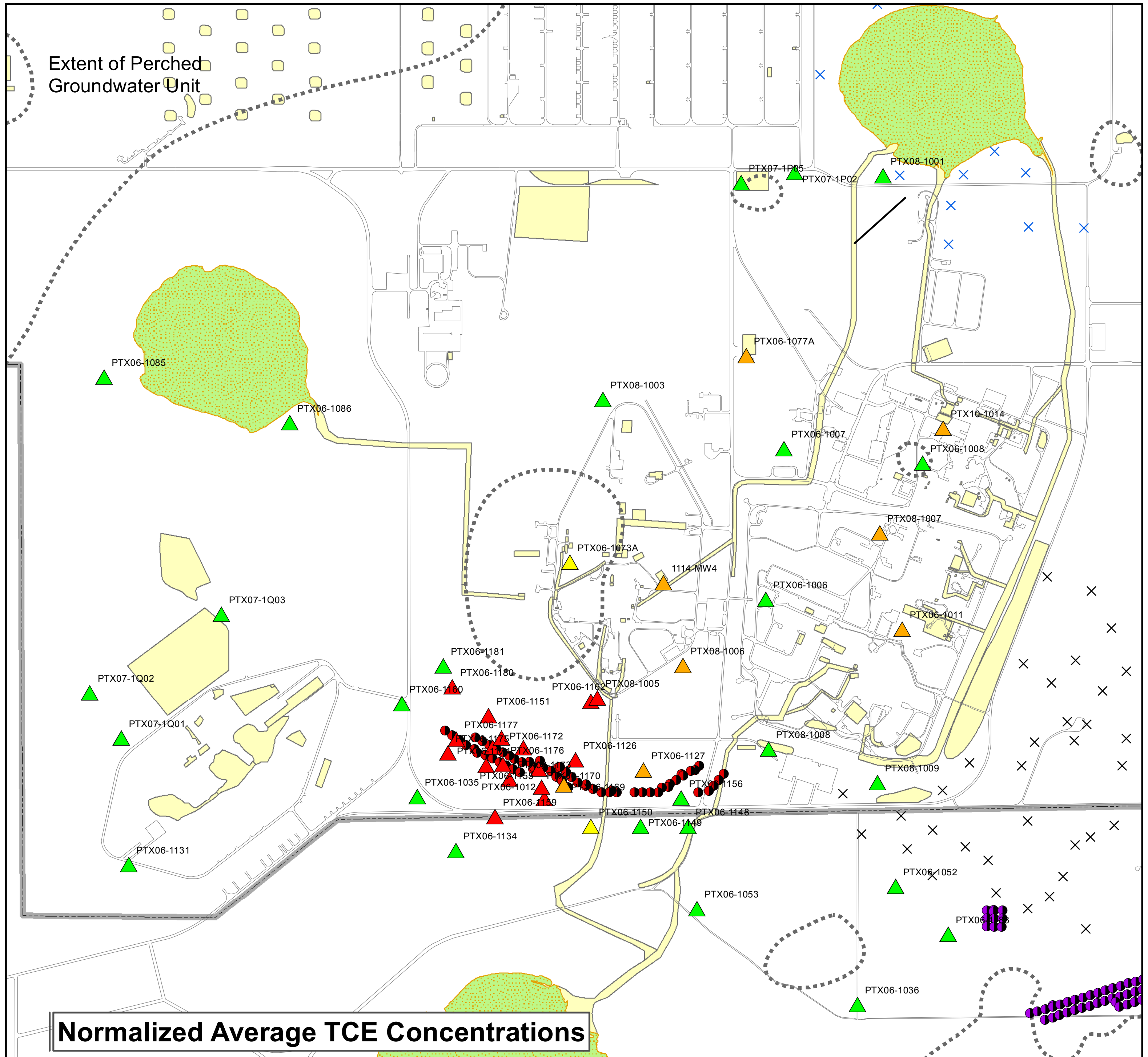
Notes:
1. Normalized average 4ADNT concentrations calculated using the average concentration 2012 - 2016 divided by the MSC.
2. First Moments are the center of mass for 4ADNT using annually consolidated data 2008 - 2016.
3. Mann Kendall trends were determined for 4ADNT 2012-2016.
4. ISB = In situ bioremediation; P&T = Pump and Treat.

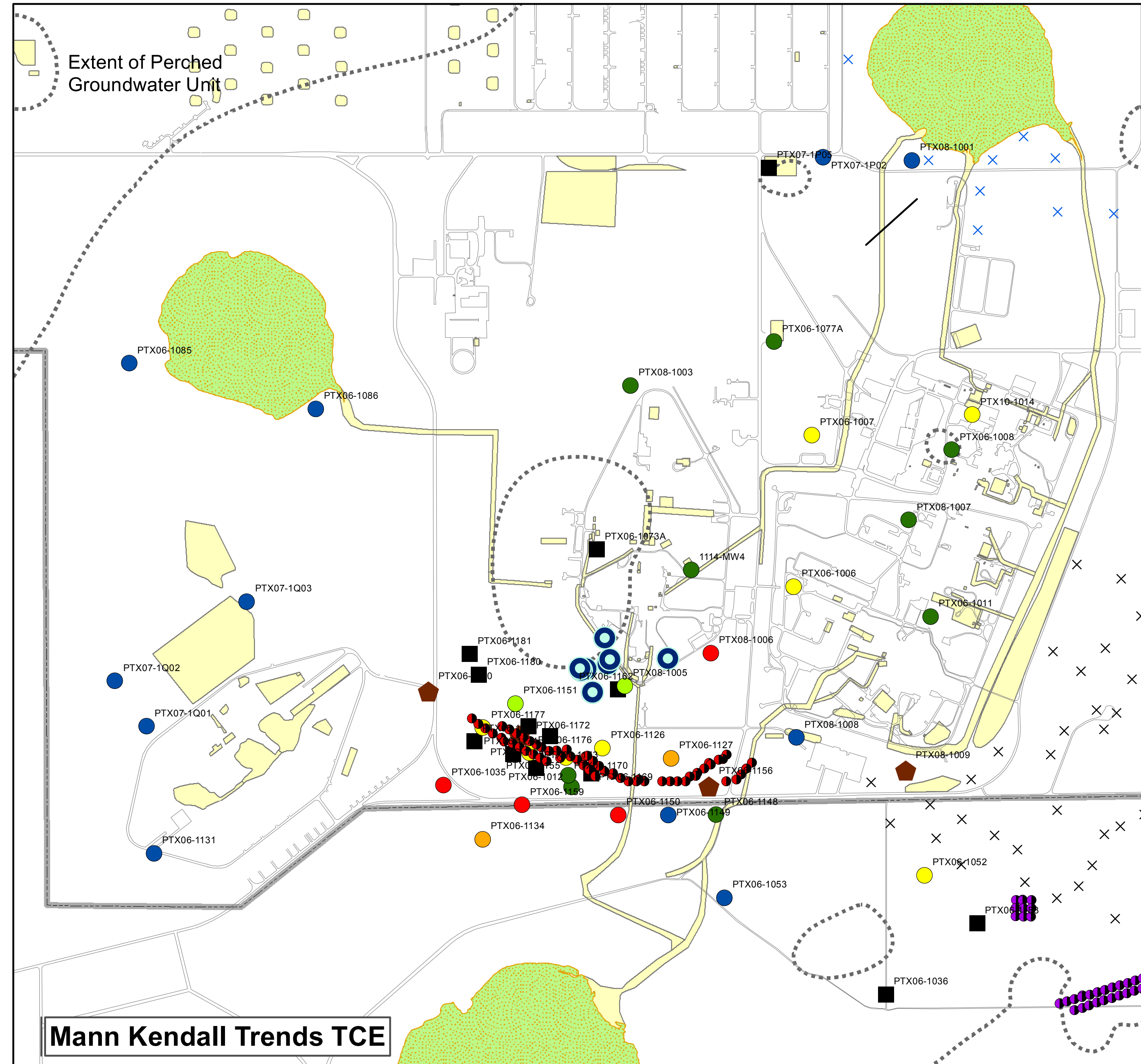
HGL HydroGeoLogic, Inc
Exceeding Expectations

PANTEX SOUTHEAST SECTOR PERCHED 4ADNT AVERAGE CONCENTRATIONS, FIRST MOMENTS AND MANN-KENDALL TRENDS

Carson County, Texas

GIS Job No.	CN1001	Issued:	25 July, 2017
Drawn By:	MV	Revised:	----
Chk'd By:	MV	Map ID:	----
Appv'd By:	MV		**FIGURE 4**





Legend

Normalized Average TCE Concentration

- < 0.05
- 0.05 - 0.5
- 0.5 - 1.0
- 1.0 - 10.0
- >10.0

MSC TCE = 5 ug/L

Mann Kendall Trend TCE

- Decreasing
- Probably Decreasing
- Stable
- Probably Increasing
- Increasing
- Non Detect (2012-2016)
- No Trend
- Insufficient Data

TCE First Moments

- First Moments

Remedies

- Southeast P&T
- Playa 1 P&T
- ISB Earea
- ISB Warea

Scale (FT)

0 1,000 2,000

N

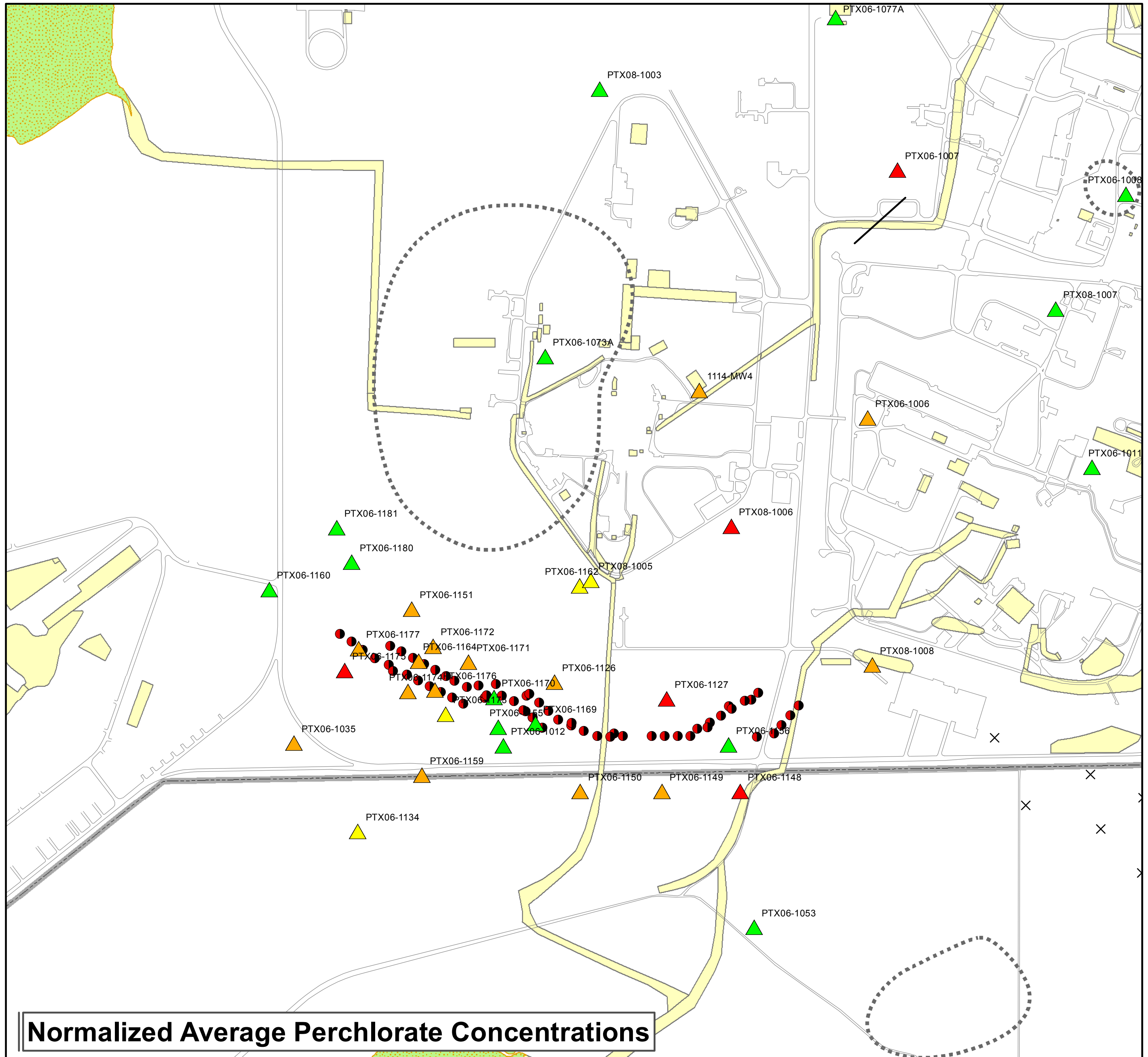
Notes:
1. Normalized average TCE concentrations 2012-2016 divided by MSC.
2. First Moments are the center of mass for TCE using annually consolidated data.
3. Mann Kendall trends were determined for TCE 2012-2016.

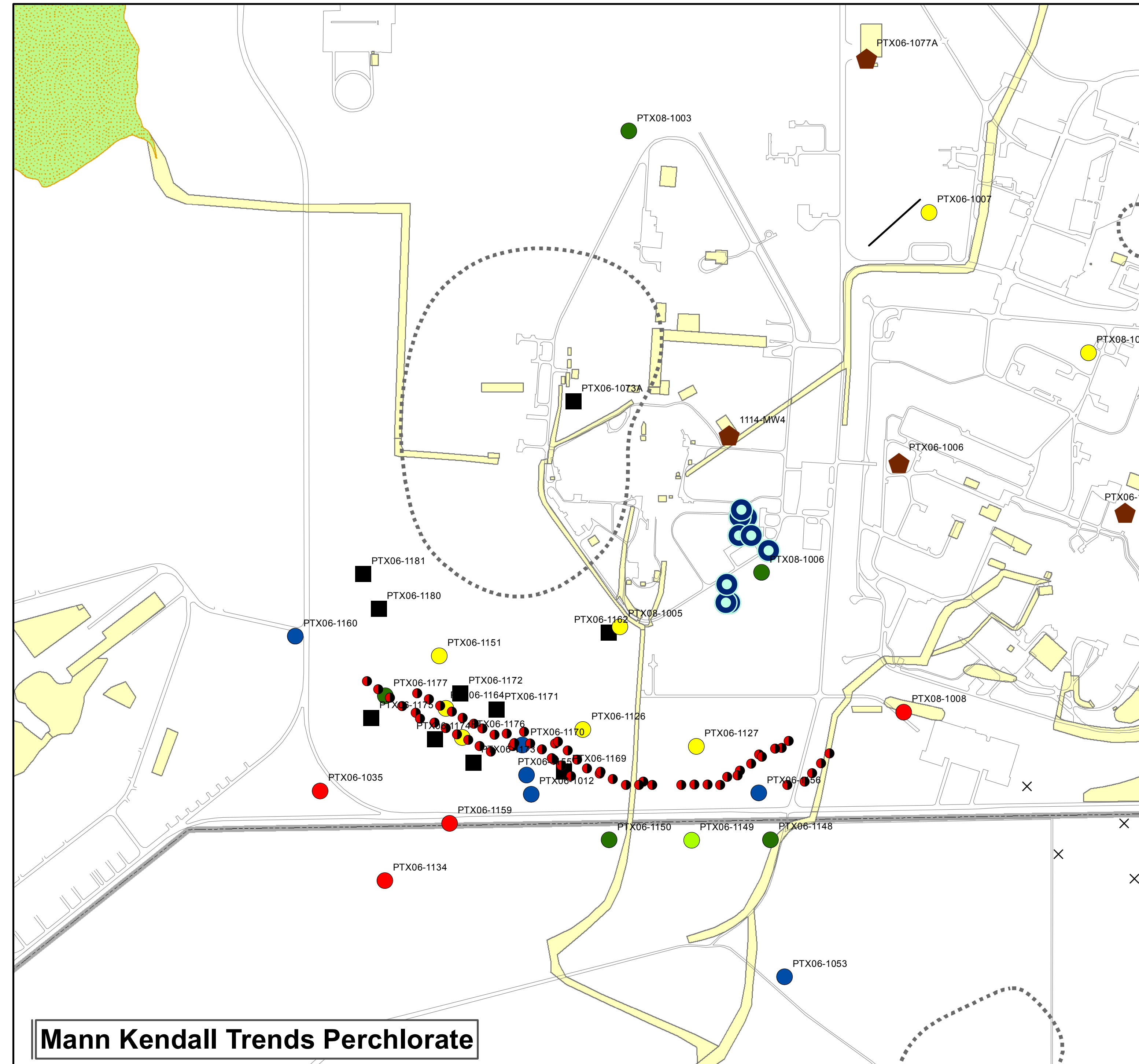
HGL HydroGeoLogic, Inc
Exceeding Expectations

PANTEX SOUTHWEST SECTOR PERCHED TCE AVERAGE CONCENTRATIONS, FIRST MOMENTS AND MANN-KENDALL TRENDS 2012-2016

Carson County, Texas

GIS Job No.	CN1001	Issued:	25 July, 2017
Drawn By:	MV	Revised:	----
Chk'd By:	MV	Map ID:	----
Appv'd By:	MV		**FIGURE 5**





Legend

Normalized Perchlorate Concentration

- < 0.05
- 0.05 - 0.5
- 0.5 - 1.0
- 1.0 - 10.0
- >10.0

MSSL Perchlorate = 26 ug/L

Mann Kendall Trend Perchlorate

- Decreasing
- Probably Decreasing
- Stable
- Probably Increasing
- Increasing
- Non Detect (2012-2016)
- No Trend
- Insufficient Data

Perchlorate First Moments

- First Moments

Remedies

- Southeast P&T
- Playa 1 P&T
- ISB Earea
- ISB Warea

Scale (FT)

0 500 1,000

N

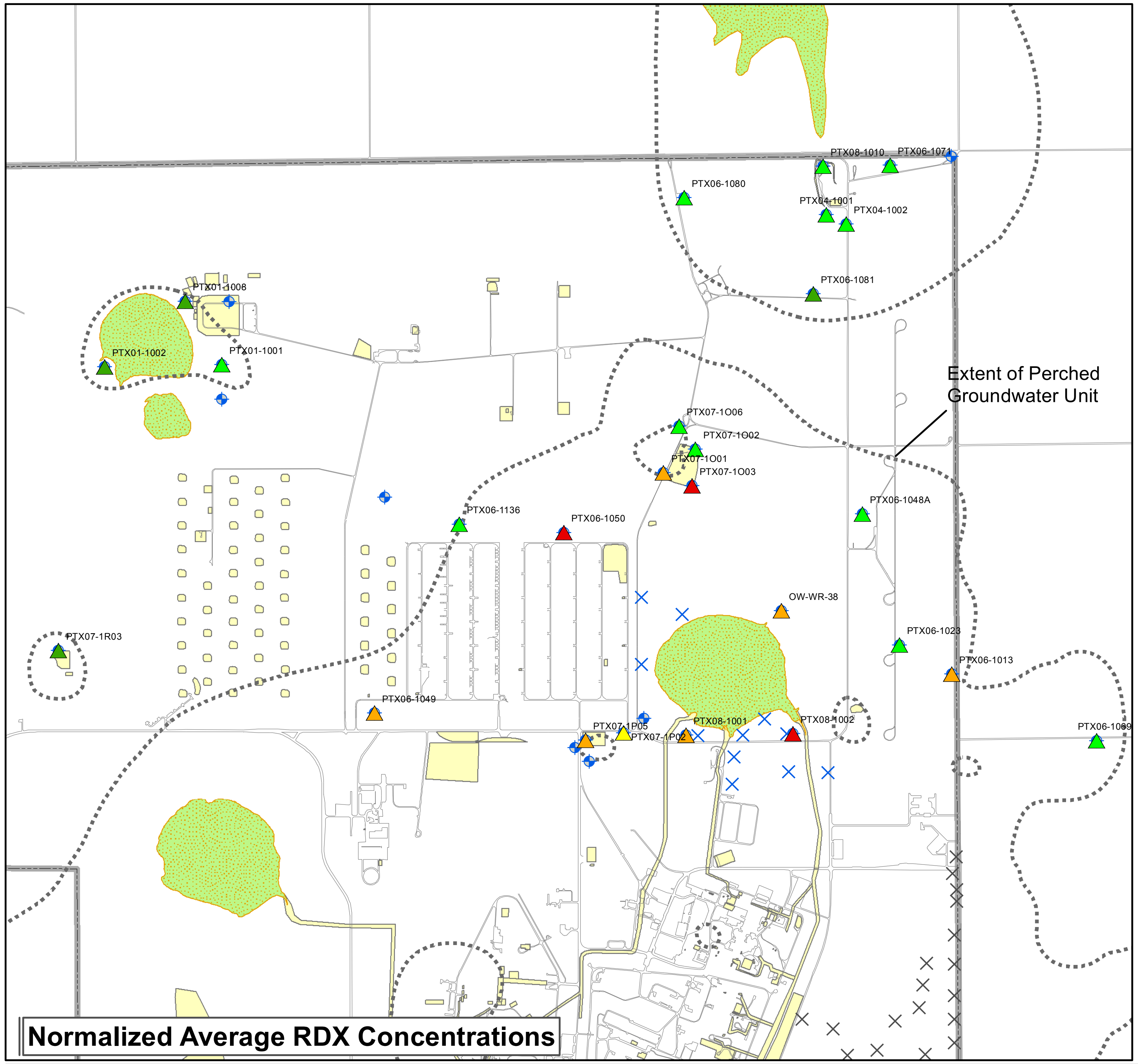
Notes:
1. Normalized average perchlorate concentrations calculated using the average concentration 2012 - 2016 divided bythe MSC.
2. First Moments are the center of mass for perchlorate using annually consolidated data 2008 through 2016.
3. Mann Kendall trends were determined for perchlorate 2012-2016.

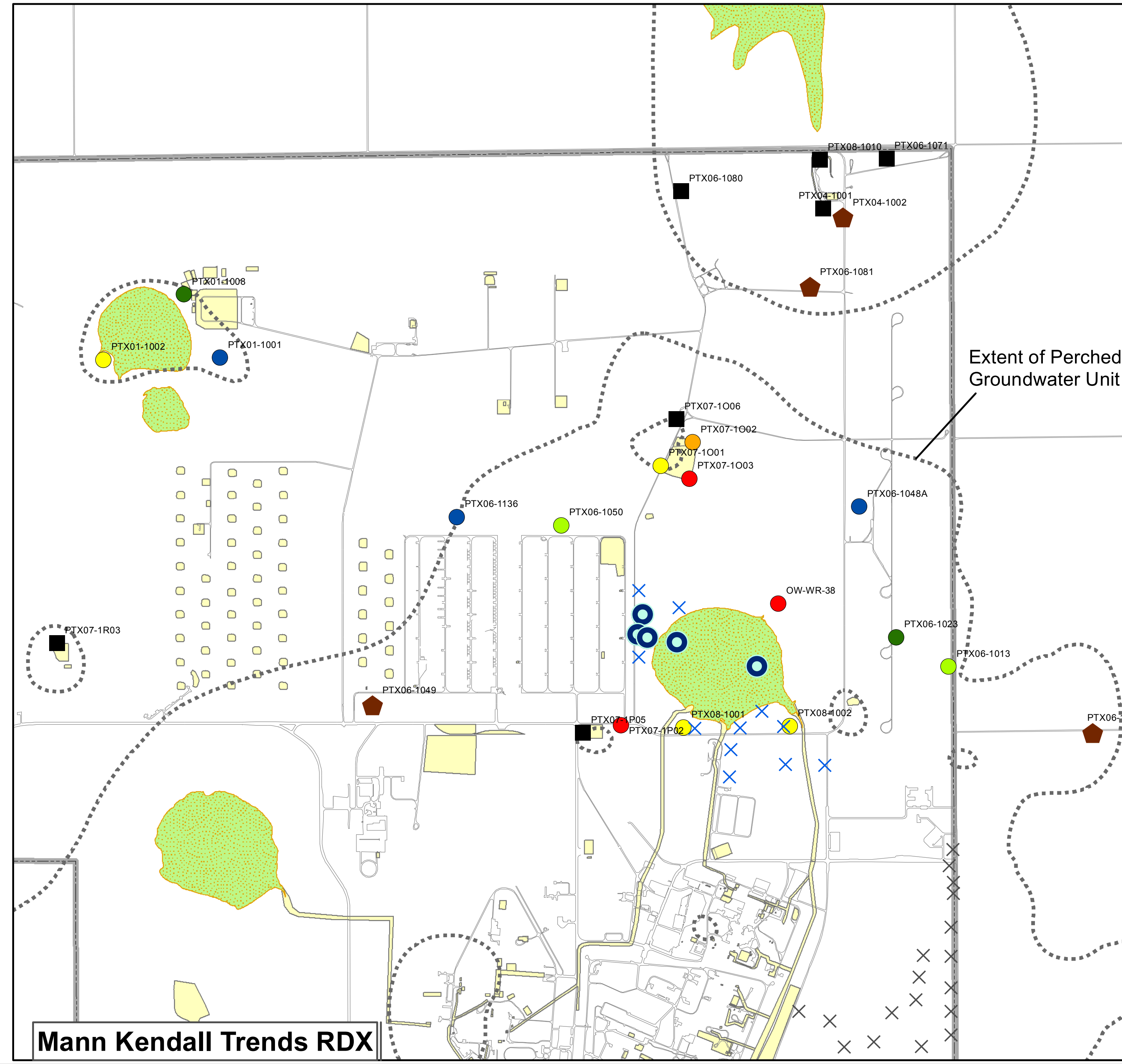
HGL HydroGeoLogic, Inc
Exceeding Expectations

PANTEX SOUTHWEST SECTOR PERCHED PERCHLORATE AVERAGE CONCENTRATIONS, FIRST MOMENTS AND MANN-KENDALL TRENDS

Carson County, Texas

Project No.	CN1001	Issued:	25 July, 2017
Drawn By:	MV	Revised:	----
Chk'd By:	MV	Map ID:	----
Appv'd By:	MV		**FIGURE 6**





Legend

Normalized RDX Concentration

- < 0.05
- 0.05 - 0.5
- 0.5 - 1
- 1 - 10
- > 10

MSC RDX = 2 ug/L

Mann Kendall Trend RDX

- Decreasing
- Probably Decreasing
- Stable
- Probably Increasing
- Increasing
- Non Detect (2012-2016)
- No Trend
- Insufficient Data
- No data 2012 - 2016

Remedies

- Southeast P&T
- Playa 1 P&T

RDX First Moments

- First Moments

Scale (ft)
0 1,300 2,600

N

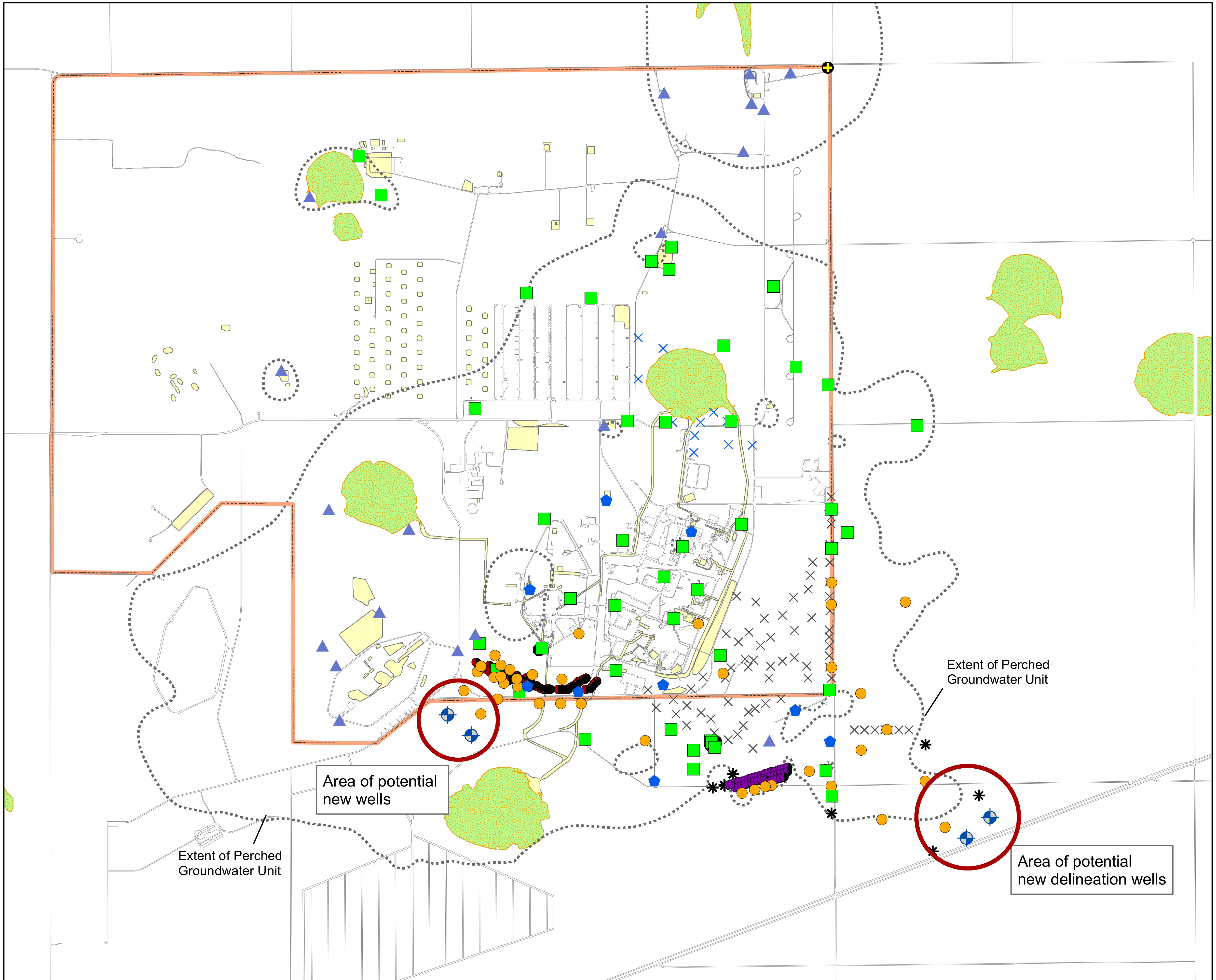
Notes:
1. Average RDX concentrations calculated using lowest detection limit substituted for ND values. Data 2012-2016.
2. First Moments are the center of mass for RDX using annually consolidated data.
3. Mann Kendall trends were determined for RDX 2012-2016.

HGL HydroGeoLogic, Inc
Exceeding Expectations

PANTEX NORTH SECTOR PERCHED
RDX AVERAGE CONCENTRATIONS, FIRST MOMENTS AND MANN-KENDALL TRENDS

Carson County, Texas

GIS Job No.	CN1001	Issued:	25 July 2017
Drawn By:	MV	Revised:	----
Chk'd By:	MV	Map ID:	----
Appv'd By:	MV		**FIGURE 7**



N

Legend

Remedies

- Southeast P&T Extraction Well
- Playa 1 P&T Extraction Well
- ISB Southeast
- ISB Southwest

Recommended Sampling Frequency Investigation Wells

- 5 year
- Biennial
- Annual
- Semi-annual
- Eliminate
- Inactive
- Potential New Well
- Dry (sample for saturation Annually)

Scale (ft)
0 1,400 2,800

HydroGeoLogic, Inc
Exceeding Expectations

PANTEX PERCHED GROUNDWATER
FINAL RECOMMENDED MONITORING NETWORK

Carson County, Texas

GIS Job No.	CN1001	Issued:	25 July, 2017
Drawn By:	MV	Revised:	----
Chk'd By:	MV	Map ID:	----
Appv'd By:	MV		**FIGURE 8**

Appendix B

Data and Results Tables

TABLE B-1
PANTEX PLANT INVESTIGATION MONITORING WELLS 2017: PERCHED GROUNDWATER

LONG-TERM MONITORING OPTIMIZATION
PANTEX PLANT
Carson County, Texas

Well Name	Monitoring Sectors	Well Type	Current Sampling Frequency	Monitoring Objectives	Initial Saturated Thickness [FT]
1114-MW4	SW Sector	IW	Semi-Annual	UM	14.11
OW-WR-38	N Sector	IW	Annual	UM, RA	8
PTX01-1001	N Sector	IW	Semi-Annual	UM/POC	0.36
PTX01-1002	N Sector	IW	Annual	UM	2.2
PTX01-1008	N Sector	IW	Semi-Annual	UM, POC	
PTX04-1001	N Sector	IW	Annual	UM	15.93
PTX04-1002	N Sector	IW	Annual	UM	14.71
PTX06-1002A	SE Sector	IW	Semi-Annual	UM, RA	
PTX06-1005	SE Sector	IW	Semi-Annual	UM, RA	28.13
PTX06-1006	SW Sector	IW	Semi-Annual	PS	
PTX06-1007	SW Sector	IW	Annual	UM	28.26
PTX06-1008	SW Sector/SE	IW	Annual	UM	3.72
PTX06-1010	SE Sector	IW	Semi-Annual	UM	7
PTX06-1011	SW Sector/SE	IW	Annual	UM	23.55
PTX06-1012	SW Sector	ISPM	Quarterly	PS, RA	12.97
PTX06-1013	N Sector/SE	IW	Annual	RA	6.59
PTX06-1014	SE Sector	IW	Semi-Annual	RA	8.86
PTX06-1015	SE Sector	IW	Semi-Annual	RA	7.47
PTX06-1023	N Sector/SE	IW	Semi-Annual	RA, POC	11.96
PTX06-1030	SE Sector	IW	Semi-Annual	RA	1.74
PTX06-1031	SE Sector	IW	Semi-Annual	POC	7.7
PTX06-1034	SE Sector	IW	Semi-Annual	RA, POC	8.05
PTX06-1035	SW Sector	IW	Semi-Annual	PS	6.67
PTX06-1036	SW Sector/SE	IW	Annual	PS	2.75
PTX06-1037	SE Sector	ISPM	Quarterly	RA	0.6
PTX06-1038	SE Sector	IW	Semi-Annual	RA	21.2
PTX06-1039A	SE Sector	IW	Semi-Annual	RA	12.02
PTX06-1040	SE Sector	IW	Semi-Annual	RA	18.21
PTX06-1041	SE Sector	IW	Semi-Annual	RA	35
PTX06-1042	SE Sector	IW	Semi-Annual	RA, POC	17
PTX06-1046	SE Sector	IW	Semi-Annual	RA, POC	11.5
PTX06-1047A	SE Sector	IW	Semi-Annual	RA	4.6
PTX06-1048A	N Sector	IW	Annual	PS, RA	8.15
PTX06-1049	N Sector	IW	Semi-Annual	PS, UM	10
PTX06-1050	N Sector	IW	Semi-Annual	UM, RA, POC	34
PTX06-1052	SW Sector/SE	IW	Semi-Annual	RA, POC	13.92
PTX06-1053	SW Sector/SE	IW	Semi-Annual	PS, UM	5.75
PTX06-1069	N Sector/SE	IW	Annual	PS	5.3
PTX06-1071	N Sector	IW	5 Years	UM	28
PTX06-1073A	SW Sector	IW	Semi-Annual	PS	-2.52
PTX06-1077A	SW Sector	IW	Annual	UM	6.5
PTX06-1080	N Sector	IW	5 Years	UM	16
PTX06-1081	N Sector	IW	Annual	UM	15.8
PTX06-1082	PantexLake	IW	5 Years	UM	9.48
PTX06-1083	PantexLake	IW	5 Years	UM	22.6
PTX06-1085	SW Sector	IW	Annual	UM	21.3
PTX06-1086	SW Sector	IW	Annual	UM	43.7
PTX06-1088	SE Sector	IW	Semi-Annual	UM, RA	-2
PTX06-1095A	SE Sector	IW	Semi-Annual	RA, UM	19.6
PTX06-1098	SE Sector	ISPM	Semi-Annual	RA	

See Notes End of Table

TABLE B-1
PANTEX PLANT INVESTIGATION MONITORING WELLS 2017: PERCHED GROUNDWATER

LONG-TERM MONITORING OPTIMIZATION
PANTEX PLANT
Carson County, Texas

Well Name	Monitoring Sectors	Well Type	Current Sampling Frequency	Monitoring Objectives	Initial Saturated Thickness [FT]
PTX06-1100	SE Sector	ISPM	Annual	RA	4.09
PTX06-1101	SE Sector	ISPM	Annual	RA	
PTX06-1102	SE Sector	IW	Annual	RA	6.1
PTX06-1120	SE Sector	IW	Semi-Annual	PS	7.58
PTX06-1121	SE Sector	IW	Semi-Annual	PS	0
PTX06-1123	SE Sector	ISPM	Quarterly	RA	0
PTX06-1126	SW Sector	IW	Semi-Annual	PS, UM, POC	18.47
PTX06-1127	SW Sector	IW	Semi-Annual	PS, UM, POC	22.38
PTX06-1130	SE Sector	IW	Semi-Annual	RA, POC	18.41
PTX06-1131	SW Sector	IW	Annual	UM	6.62
PTX06-1133A	SE Sector	IW	Semi-Annual	PS	31
PTX06-1134	SW Sector	IW	Semi-Annual	PS	8.24
PTX06-1135	SE Sector	IW	Semi-Annual	PS	3.47
PTX06-1136	N Sector	IW	Annual	PS	15.52
PTX06-1146	SE Sector	IW	Semi-Annual	PS, POC	22.62
PTX06-1147	SE Sector	IW	Semi-Annual	PS	16.58
PTX06-1148	SW Sector/SE	ISPM	Quarterly	PS, RA	
PTX06-1149	SW Sector	ISPM	Quarterly	PS	15
PTX06-1150	SW Sector	ISPM	Quarterly	PS, RA	
PTX06-1151	SW Sector	IW	Semi-Annual	PS	16.22
PTX06-1153	SE Sector	ISPM	Quarterly	RA, POC	5.6
PTX06-1154	SE Sector	ISPM	Quarterly	RA, POC	2.12
PTX06-1155	SW Sector	ISPM	Quarterly	RA, POC	12.84
PTX06-1156	SW Sector	ISPM	Quarterly	UM	22.05
PTX06-1159	SW Sector	IW	Semi-Annual	PS, RA	17
PTX06-1160	SW Sector	IW	Semi-Annual	PS	24.46
PTX06-1162	SW Sector	IW		RA	16.57
PTX06-1164	SW Sector	TZM		RA	19
PTX06-1166	SE Sector	IW	Semi-Annual	PS	7.27
PTX06-1169	SW Sector	TZM	Quarterly	RA	16.85
PTX06-1170	SW Sector	TZM	Quarterly	RA	16.04
PTX06-1171	SW Sector	IW		RA	14.92
PTX06-1172	SW Sector	IW		RA	13.66
PTX06-1173	SW Sector	ISPM	Quarterly	RA	15.71
PTX06-1174	SW Sector	ISPM	Quarterly	RA	14.57
PTX06-1175	SW Sector	ISPM	Quarterly	RA	15.94
PTX06-1176	SW Sector	TZM	Quarterly	RA	16.4
PTX06-1177	SW Sector	TZM	Quarterly	RA	11.71
PTX06-1181	SW Sector	IW		RA	21.8
PTX06-1182	SE Sector	IW	Semi-Annual	PS	6.7
PTX06-1183	SW Sector/SE	IW	Semi-Annual	PS, RA	8.5
PTX06-PRB16	SE Sector	PRB		RA	
PTX07-1O01	N Sector	IW	Annual	PS, UM, RA	4.75
PTX07-1O02	N Sector	IW	Semi-Annual	PS, UM, RA, POC	7.58
PTX07-1O03	N Sector	IW	Annual	PS, UM, RA	10.68
PTX07-1O06	N Sector	IW	Annual	PS, UM, RA	6.4
PTX07-1P02	N Sector/SW	IW	Semi-Annual	UM, POC	22
PTX07-1P05	N Sector/SW	IW	Annual	UM	9.4

See Notes End of Table

TABLE B-1
PANTEX PLANT INVESTIGATION MONITORING WELLS 2017: PERCHED GROUNDWATER

LONG-TERM MONITORING OPTIMIZATION
PANTEX PLANT
Carson County, Texas

Well Name	Monitoring Sectors	Well Type	Current Sampling Frequency	Monitoring Objectives	Initial Saturated Thickness [FT]
PTX07-1Q01	SW Sector	IW	Annual	UM	12.22
PTX07-1Q02	SW Sector	IW	Annual	UM	24.78
PTX07-1Q03	SW Sector	IW	Annual	UM	36.62
PTX07-1R03	N Sector	IW	5 Years	UM	1.4
PTX08-1001	N Sector/SW	IW	Annual	UM, RA	48
PTX08-1002	N Sector/SE	IW	Semi-Annual	UM, RA	30
PTX08-1003	SW Sector	IW	Annual	PS	20.19
PTX08-1005	SW Sector	IW	Semi-Annual	UM	14.4
PTX08-1006	SW Sector	IW	Semi-Annual	UM	32.1
PTX08-1007	SW Sector/SE	IW	Annual	UM	33.3
PTX08-1008	SW Sector/SE	IW	Semi-Annual	UM, RA	28.6
PTX08-1009	SW Sector/SE	IW	Semi-Annual	UM, RA	19.35
PTX08-1010	N Sector	IW	5 Years	UM	24.29
PTX10-1014	SW Sector/SE	IW	Annual	UM	21.15

Notes
1. Wells listed are monitoring locations sampled at least once between 2012 and 2016.
Remedy extraction and in situ injection wells are not included.
2. Monitoring Sectors SE = Southeast; SW = Southwest; N= North. Wells included in two
Sector analyses are indicated.
3. Well Type, Sampling Frequency, Monitoring Objectives and Initial Saturated Thickness are from
CNS Pantex well database (Febraury 2017).
IW = Investigation well; ISPM = in situ performance monitoring;
UM = Uncertainty Management; RA = Remedial Action monitoring; PS = Plume Stability;
POC = Point of Compliance, PRB = Permeable reactive barrier; TZM =Treatment zone monitoring.

TABLE B-2
AQUIFER INPUT PARAMETERS

LONG-TERM MONITORING OPTIMIZATION
PANTEX PLANT
Carson County, Texas

Parameter	Units	Southeast	Southwest	North
Current Plume Length	ft	7000	8000	Various
Maximum Plume Length	ft	7000	8000	Various
Plume Width	ft	6400	6000	Various
Seepage Velocity (ft/yr)*	ft/yr	140	62	70
Distance to Receptors	ft	8000	10000	8000
Groundwater Fluctuations	--	No	No	No
Source Treatment	--	Pump and treat/ In situ bioremediation		
Plume Type	--	Explosives, VOCs		
NAPL Present		No	No	No
Number of investigation wells (2012 - 2016)	--	50	53	27
Parameter		**Value**		
Groundwater flow direction		S/SE	S/SW	Various (45)
Porosity	--	0.25	0.25	0.25
Source Location near Well	--	PTX06-1010	PTX08-1006	Playa 1 (various)
Source X-Coordinate	ft	639886.625	636400.4375	639580.323
Source Y-Coordinate	ft	3758067	3756761.75	3764100.313
Coordinate System		NAD 83 SP Texas North FT		
Average Saturated Thickness Perched Zone	ft	30		
Priority Constituents		**MSC**	**Basis**	**Sectors Affected**
Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	ug/L	7.7	GW-Res$_{c}$	All
4-Amino-2,6-Dinitrotoluene (4ADNT)	ug/L	1.2	GW-Res$_{NCAdj}$	All
2-Amino-4,6-Dinitrotoluene (2ADNT)	ug/L	1.2	GW-Res$_{NCAdj}$	Southeast
2,4,6-Trinitrotoluene (TNT)	ug/L	3.6	GW-Res$_{NCAdj}$	Southeast
2,4-Dinitrotoluene (24DNT)	ug/L	1	PQL	Southeast
Chromium (VI)	ug/L	100	MCL	Southeast
Perchlorate	ug/L	26	GW-Res$_{NC}$	Southwest
Trichloroethene	ug/L	5	MCL	Southwest

Notes:
1. Aquifer data from CMS/FS (BWXT, 2007a) and Subsurface Modeling Report (BWXT, 2004).
2. Priority COCs defined by prevalence, toxicity and mobility.
3. Saturated thickness represents an estimated average for the perched unit, which ranges from 0 to 70 ft in saturated thickness.
4. * = a range of transmissivites are present in the aquifer, and groundwater velocity is estimated for each sector.
5. MSC = Medium Specific Concentration, from CMS/FS (BWXT, 2007b).
   GW-Resc = TCEQ Standard No. 2 Groundwater MSC for Residential Use; NC = Noncarcinogenic; C = Carcinogenic;
   Adj = Value adjusted for a cumulative hazard index of 1; PQL = Practical Quantitation Limit; MCL = EPA Maximum Contaminant Level.

TABLE B-3
PERCHED GROUNDWATER INVESTIGATION WELLS SOUTHEAST SECTOR

LONG-TERM MONITORING OPTIMIZATION
PANTEX PLANT
Carson County, Texas

Well Name	Earliest Sample Date	Most Recent Sample Date	Number of Samples (2012-2016)	Primary COC at Well	Additional Objectives
Southeast Sector					
PTX06-1002A	6/20/2012	9/28/2016	10	RDX	Source
PTX06-1005	6/20/2012	9/28/2016	10	RDX	Source
PTX06-1008	6/20/2012	6/27/2016	5	1,2-DICHLOROETHANE	Source
PTX06-1010	6/20/2012	9/28/2016	10	CHROMIUM, TOTAL	Source
PTX06-1011	6/20/2012	6/27/2016	5	TCE	Source (SW)
PTX06-1013	6/20/2012	6/27/2016	7	RDX	SEPTS (N)
PTX06-1014	8/2/2012	9/28/2016	5	RDX	SEPTS
PTX06-1015	6/20/2012	9/28/2016	10	RDX	SEPTS
PTX06-1023	2/22/2012	9/28/2016	11	BORON	
PTX06-1030	6/20/2012	6/27/2016	9	RDX	East
PTX06-1031	6/20/2012	11/30/2016	10	RDX	East
PTX06-1034	6/20/2012	9/28/2016	13	RDX	East
PTX06-1036	8/2/2012	8/20/2014	3	None	(SW)
PTX06-1037	2/11/2016	11/30/2016	4	BORON	ISPM (Dry)
PTX06-1038	2/22/2012	9/28/2016	11	RDX	SEPTS
PTX06-1039A	2/22/2012	9/28/2016	10	RDX	SEPTS
PTX06-1040	2/22/2012	9/28/2016	10	RDX	SEPTS
PTX06-1041	2/22/2012	9/28/2016	10	RDX	
PTX06-1042	2/22/2012	9/28/2016	11	RDX	SEPTS
PTX06-1046	2/22/2012	9/28/2016	11	RDX	
PTX06-1047A	2/22/2012	9/28/2016	10	RDX	
PTX06-1052	2/22/2012	9/28/2016	11	CHROMIUM, TOTAL	(SW)
PTX06-1053	6/20/2012	11/30/2016	10	None	(SW)
PTX06-1069	8/2/2012	9/28/2016	4	None	Delineation (N)
PTX06-1088	6/20/2012	9/28/2016	10	RDX	Source
PTX06-1095A	6/20/2012	9/28/2016	10	RDX	
PTX06-1098	6/27/2016	11/30/2016	2	BARIUM	ISPM
PTX06-1100	9/28/2016	9/28/2016	1	BARIUM	ISPM
PTX06-1101	6/20/2012	9/28/2016	5	RDX	ISPM
PTX06-1102	8/2/2012	8/2/2012	1	RDX	(Dry)
PTX06-1120	6/20/2012	11/30/2016	10	RDX	
PTX06-1121	6/20/2012	12/19/2012	3	RDX	(Dry)
PTX06-1123	2/22/2012	9/22/2015	15	TNX	ISPM (Dry)
PTX06-1130	2/22/2012	3/11/2015	8	RDX	East
PTX06-1133A	6/20/2012	11/30/2016	5	CHROMIUM, TOTAL	East
PTX06-1135	6/20/2012	6/27/2016	9	BORON	
PTX06-1146	2/22/2012	9/28/2016	10	RDX	East
PTX06-1147	6/20/2012	11/30/2016	10	RDX	East
PTX06-1148	6/20/2012	11/30/2016	16	PERCHLORATE	(SW)
PTX06-1153	2/22/2012	11/30/2016	20	RDX	ISPM
PTX06-1154	2/22/2012	11/30/2016	19	TNX	ISPM

See Notes End of Table

TABLE B-3
PERCHED GROUNDWATER INVESTIGATION WELLS SOUTHEAST SECTOR

LONG-TERM MONITORING OPTIMIZATION
PANTEX PLANT
Carson County, Texas

Well Name	Earliest Sample Date	Most Recent Sample Date	Number of Samples (2012-2016)	Primary COC at Well	Additional Objectives
Southeast Sector					
PTX06-1166	2/19/2013	9/28/2016	10	RDX	
PTX06-1182	11/30/2016	11/30/2016	2	RDX	East
PTX06-1183	11/30/2016	11/30/2016	1	CHROMIUM, TOTAL	
PTX06-PRB16	9/28/2016	9/28/2016	1	RDX	
PTX08-1002	6/20/2012	11/30/2016	8	RDX	(N)
PTX08-1007	6/20/2012	6/27/2016	5	RDX	Source (SW)
PTX08-1008	6/20/2012	11/30/2016	11	CHROMIUM, HEXAVALENT	Source (SW)
PTX08-1009	2/20/2012	11/14/2016	11	None	Source (SW)
PTX10-1014	6/20/2012	6/27/2016	5	TCE	Source (SW)

Notes:
1. Wells listed are investigation wells in current monitoring program. Wells that are intermittently dry are indicated (Dry).
   ISPM = In situ remedy performance monitoring; East = Location east of FM2373; Source = Designated source area well.
   SEPTS = Extraction picket in SE Sector; SE ISB = Southeast In Situ Bioremediation
   (SW) = well also included in Southwest Sector analysis; (N) = well also included in North Sector analysis.
2. Sampling dates for wells range from January 2012 (earliest sample dates) to December 2016 (most recent sample dates).
3. The priority chemical of concern (COC) at each well is the constituent detected at the highest level normalized by the MSC or appropriate RRS.
4. Number of samples is the number of individual sample dates in the database for the priority COC, results from duplicate samples from the same date are averaged.
5. RDX = Hexahydro, 1,3,5-trinitro, 1,3,5-triazine; TCE = trichloroethene.
6. MAROS Goup is the goup assigned for an aggregate trend determination:
7. * = Wells with stainless steel construction can show false positive metal (Cr, Fe, Ni, etc.) detections.
   ** = ISPM wells can have transient high metals cocentration due to redox changes.

TABLE B-4
MONITORING WELL TREND SUMMARY RESULTS SOUTHEAST SECTOR

LONG-TERM MONITORING OPTIMIZATION
PANTEX PLANT
Carson County, Texas

WellName	Number of Samples	Number of Detects	Percent Detection	Maximum Concentration [ug/L]	Maximum Above MSC?	Average Concentration [ug/L]	Average Above MSC?	Mann-Kendall Trend (2008 - 2011)	Mann-Kendall Trend (2012 - 2016)
RDX Southeast Sector									
PTX06-1002A	10	10	100%	**38**	Yes	**16.32**	Yes	D	D
PTX06-1005	10	10	100%	**571**	Yes	**327.59**	Yes	NT	PD
PTX06-1008	5	0	0%	ND	No	ND	No	ND	ND
PTX06-1010	10	10	100%	**2.9**	Yes	1.91	No	S	D
PTX06-1011	5	3	60%	**4**	Yes	1.06	No	S	NT
PTX06-1013	7	7	100%	**7.8**	Yes	**6.61**	Yes	S	PD
PTX06-1014	5	5	100%	**606**	Yes	**489.80**	Yes	D	S
PTX06-1015	10	10	100%	**1,140**	Yes	**888.70**	Yes	I	D
PTX06-1023	11	5	45%	1	No	0.38	No	S	D
PTX06-1030	9	9	100%	**1,200**	Yes	**1,051.78**	Yes	S	PI
PTX06-1031	10	10	100%	**770**	Yes	**540.40**	Yes	D	PI
PTX06-1034	13	13	100%	**1,250**	Yes	**735.20**	Yes	I	I
PTX06-1036	3	3	100%	1	No	1.39	No	NT	N/A
PTX06-1037	20	8	40%	**2**	Yes	0.51	No	D	D
PTX06-1038	11	11	100%	**582**	Yes	**237.45**	Yes	NT	D
PTX06-1039A	10	10	100%	**922**	Yes	**699.00**	Yes	S	S
PTX06-1040	10	10	100%	**1,450**	Yes	**1,081.30**	Yes	NT	NT
PTX06-1041	10	10	100%	**1,220**	Yes	**1,071.50**	Yes	NT	S
PTX06-1042	11	11	100%	**1,010**	Yes	**702.85**	Yes	PD	D
PTX06-1046	11	11	100%	**3,160**	Yes	**1,773.50**	Yes	NT	PI
PTX06-1047A	10	10	100%	**647**	Yes	**212.62**	Yes	I	D
PTX06-1052	11	3	27%	0.26	No	0.14	No	ND	D
PTX06-1053	10	7	70%	0.2	No	0.16	No	ND	I
PTX06-1069	4	2	50%	0.1	No	0.12	No	ND	NT
PTX06-1088	10	10	100%	**124.0**	Yes	**36.20**	Yes	PD	D
PTX06-1095A	10	10	100%	**1,410.0**	Yes	**592.70**	Yes	I	NT
PTX06-1098	10	1	10%	1	No	0.29	No	ND	NT
PTX06-1100	5	0	0%	ND	No	ND	No	ND	ND
PTX06-1101	5	3	60%	**23.1**	Yes	**9.36**	Yes	ND	I
PTX06-1102	1	1	100%	**207.0**	Yes	**207.00**	Yes	I	N/A
PTX06-1120	10	10	100%	**3,850.0**	Yes	**2,629.00**	Yes	N/A	S
PTX06-1121	3	2	67%	**1,330.0**	Yes	**914.28**	Yes	N/A	N/A
PTX06-1123	15	8	53%	**8.6**	Yes	1.93	No	D	D
PTX06-1130	8	8	100%	**130**	Yes	**109.17**	Yes	D	S
PTX06-1133A	5	2	40%	1.1	No	0.36	No	N/A	NT
PTX06-1135	9	9	100%	1	No	0.56	No	D	I
PTX06-1146	10	10	100%	**1,280**	Yes	**1,108.50**	Yes	NT	S
PTX06-1147	10	10	100%	**1,420.0**	Yes	**1,057.00**	Yes	NT	S
PTX06-1148	16	4	25%	1	No	0.18	No	--	S
PTX06-1153	20	20	100%	**450.0**	Yes	**272.55**	Yes	NT	PI
PTX06-1154	20	2	10%	**13**	Yes	**1.23**	No	NT	D
PTX06-1166	10	10	100%	**26**	Yes	**19.43**	Yes	--	S
PTX06-1182	2	2	100%	**17.2**	Yes	**17.15**	Yes	--	N/A
PTX06-1183	1	1	100%	0.2	No	0.15	No	--	N/A
PTX06-PRB16	1	1	100%	**1,340.0**	Yes	**1,340.00**	Yes	--	N/A
PTX08-1002	8	8	100%	**121**	Yes	**66.15**	Yes	I	S
PTX08-1007	5	5	100%	**7**	Yes	**6.29**	Yes	S	S
PTX08-1008	11	1	9%	0.2	No	0.14	No	ND	NT
PTX08-1009	10	9	90%	2	No	0.46	No	I	D
PTX10-1014	5	5	100%	**2.6**	Yes	1.88	No	N/A	S

See notes end of table

TABLE B-4
MONITORING WELL TREND SUMMARY RESULTS SOUTHEAST SECTOR

LONG-TERM MONITORING OPTIMIZATION
PANTEX PLANT
Carson County, Texas

WellName	Number of Samples	Number of Detects	Percent Detection	Maximum Concentration [ug/L]	Maximum Above MSC?	Average Concentration [ug/L]	Average Above MSC?	Mann-Kendall Trend (2008 - 2011)	Mann-Kendall Trend (2012 - 2016)
4ADNT Southeast Sector									
PTX06-1002A	10	5	50%	0.23	No	0.15	No	PD	S
PTX06-1005	10	10	100%	**6.16**	Yes	**2.82**	Yes	S	D
PTX06-1008	5	4	80%	0.18	No	0.14	No	ND	NT
PTX06-1010	10	4	40%	0.18	No	0.15	No	PD	D
PTX06-1011	5	1	20%	0.13	No	0.12	No	ND	PI
PTX06-1013	7	0	0%	ND	No	ND	No	ND	ND
PTX06-1014	5	5	100%	**3.78**	Yes	**3.02**	Yes	S	S
PTX06-1015	10	10	100%	**7.02**	Yes	**4.83**	Yes	D	D
PTX06-1023	11	0	0%	ND	No	ND	No	ND	ND
PTX06-1030	9	9	100%	**18.9**	Yes	**15.37**	Yes	S	I
PTX06-1031	10	10	100%	**2.95**	Yes	**2.47**	Yes	D	I
PTX06-1034	13	13	100%	**12.3**	Yes	**9.15**	Yes	NT	D
PTX06-1036	3	0	0%	ND	No	ND	No	S	N/A
PTX06-1037	20	0	0%	ND	No	ND	No	PD	ND
PTX06-1038	11	11	100%	**17.2**	Yes	**13.09**	Yes	NT	D
PTX06-1039A	10	10	100%	**19.5**	Yes	**11.92**	Yes	S	NT
PTX06-1040	10	10	100%	**27.5**	Yes	**19.64**	Yes	S	S
PTX06-1041	10	10	100%	**20.7**	Yes	**17.54**	Yes	PI	D
PTX06-1042	11	11	100%	**16.6**	Yes	**12.57**	Yes	PD	PD
PTX06-1046	11	11	100%	**9.82**	Yes	**7.04**	Yes	D	S
PTX06-1047A	10	9	90%	**7.38**	Yes	**2.96**	Yes	PD	D
PTX06-1052	11	4	36%	0.27	No	0.15	No	S	D
PTX06-1053	10	10	100%	1.05	No	0.65	No	NT	NT
PTX06-1069	4	0	0%	ND	No	ND	No	ND	ND
PTX06-1088	10	10	100%	**1.67**	Yes	0.67	No	S	D
PTX06-1095A	10	10	100%	**4.14**	Yes	**2.83**	Yes	I	PD
PTX06-1098	10	0	0%	ND	No	ND	No	ND	ND
PTX06-1100	5	0	0%	ND	No	ND	No	ND	ND
PTX06-1101	5	0	0%	ND	No	ND	No	ND	ND
PTX06-1102	1	1	100%	4.09	No	**4.09**	Yes	S	N/A
PTX06-1120	10	10	100%	**11.2**	Yes	**9.48**	Yes	N/A	PD
PTX06-1121	3	2	67%	**5.42**	Yes	**4.62**	Yes	N/A	N/A
PTX06-1123	15	0	0%	ND	No (high DL)	ND	No	D	ND
PTX06-1130	8	8	100%	**9.85**	Yes	**8.14**	Yes	S	D
PTX06-1133A	5	0	0%	ND	No	ND	No	N/A	ND
PTX06-1135	9	7	78%	0.81	No	0.23	No	ND	I
PTX06-1146	10	10	100%	**31.2**	Yes	**24.2**	Yes	NT	D
PTX06-1147	10	10	100%	**6.11**	Yes	**4.49**	Yes	S	D
PTX06-1148	16	1	6%	0.5	No	0.19	No	--	S
PTX06-1153	20	18	90%	**20**	Yes	**3.85**	Yes	I	NT
PTX06-1154	20	0	0%	ND	No (high DL)	ND	No	NT	ND
PTX06-1166	10	10	100%	0.61	No	0.4	No	--	S
PTX06-1182	2	2	100%	**6.46**	Yes	**6.46**	Yes	--	N/A
PTX06-1183	1	1	100%	0.28	No	0.28	No	--	N/A
PTX06-PRB16	1	1	100%	0.23	No	0.23	No	--	N/A
PTX08-1002	8	8	100%	**7.15**	Yes	**3.95**	Yes	I	PD
PTX08-1007	5	3	60%	0.13	No	0.11	No	ND	NT
PTX08-1008	11	0	0%	ND	No	ND	No	ND	ND
PTX08-1009	10	0	0%	ND	No	ND	No	D	ND
PTX10-1014	5	0	0%	ND	No	ND	No	N/A	ND

Notes

1. Trends were evaluated for data collected between January 2012 and December 2016. Trends from 2008- 2011 indicated.
2. Number of Samples is the number of samples for the compound at this location during 2012 - 20116
   Number of Detects is the number of samples where the compound was detected at this location.
3. The maximum concentration for the COC is the maximum analytical result analyzed between 2012 and 2016. Results above MSCs are indicated in **Bold**.
4. MSCs = Medium Specific Concentration from Corrective Measure Study. RDX = 2 ug/L; 4ADNT = 1.2 ug/L.
5. D = Decreasing; PD = Probably Decreasing; S = Stable; PI = Probably Increasing; I = Increasing; N/A = Insufficient Data to determine trend;
   NT = No Trend; ND = well has all non-detect results for COC; ND* = one detection for compound, may be unaffected.
6. Recent Mann-Kendall trend results are illustrated on Figures 3 and 4.

TABLE B-5
SUMMARY STATISTICS RESULTS RDX SOUTHEAST SECTOR

LONG-TERM MONITORING OPTIMIZATION
PANTEX PLANT
Carson County, Texas

WellName	Recent Above MSC	RDX Concentration ug/L Mean	Median	SD	COV	95% UCL RDX	Distribution	Outlier
RDX Southeast Sector								
PTX06-1002A	TRUE	16.3	8.3	14.1	0.86	**26.38**	Lognormal	FALSE
PTX06-1005	TRUE	327.6	307.0	137.3	0.42	**425.81**	Normal	FALSE
PTX06-1008	FALSE	0.1	0.0	0.0	0.00	0.14	Normal	FALSE
PTX06-1010	FALSE	1.9	1.9	0.7	0.35	**2.38**	Normal	FALSE
PTX06-1011	FALSE	1.0	0.5	1.8	**1.82**	**3.07**	Lognormal	TRUE
PTX06-1013	TRUE	6.6	6.6	0.7	0.11	**7.28**	Normal	FALSE
PTX06-1014	TRUE	489.8	467.0	67.2	0.14	**573.25**	Normal	TRUE
PTX06-1015	TRUE	888.7	932.0	190.5	0.21	**1025.00**	Normal	FALSE
PTX06-1023	FALSE	0.5	0.1	0.5	**1.16**	0.69	No distribution	FALSE
PTX06-1030	TRUE	1051.8	1010.0	105.1	0.10	**1132.54**	Normal	FALSE
PTX06-1031	TRUE	540.4	525.0	88.9	0.16	**603.99**	No distribution	TRUE
PTX06-1034	TRUE	707.8	734.0	246.9	0.35	**918.35**	Normal	FALSE
PTX06-1036	FALSE	1.4	1.4	0.1	0.05	1.58	Normal	FALSE
PTX06-1037	FALSE	2.0	0.0	0.0	0.00	0.79	No distribution	FALSE
PTX06-1038	TRUE	231.6	190.0	134.5	0.58	**337.84**	Lognormal	TRUE
PTX06-1039A	TRUE	699.0	658.0	120.7	0.17	**785.32**	Normal	FALSE
PTX06-1040	TRUE	1081.3	1010.0	170.0	0.16	**1202.92**	Normal	FALSE
PTX06-1041	TRUE	1071.5	1090.0	126.8	0.12	**1162.20**	Normal	FALSE
PTX06-1042	TRUE	708.0	758.0	161.6	0.23	**824.06**	Normal	FALSE
PTX06-1046	TRUE	1765.5	1650.0	509.3	0.29	**2157.01**	Lognormal	TRUE
PTX06-1047A	TRUE	212.6	30.5	247.5	**1.16**	**389.67**	Lognormal	FALSE
PTX06-1052	FALSE	0.1	0.0	0.1	0.51	0.17	No distribution	TRUE
PTX06-1053	FALSE	0.1	0.0	0.1	0.44	0.19	Normal	FALSE
PTX06-1069	FALSE	0.1	0.0	0.0	0.00	0.15	Normal	FALSE
PTX06-1088	TRUE	36.2	17.8	36.9	**1.02**	**62.57**	Lognormal	FALSE
PTX06-1095A	TRUE	592.7	465.0	424.6	0.72	**896.41**	Lognormal	FALSE
PTX06-1098	FALSE	1.0	0.0	0.0	0.00	0.50	No distribution	TRUE
PTX06-1100	FALSE	0.5	0.0	0.0	0.00	0.42	Lognormal	TRUE
PTX06-1101	TRUE	9.3	9.4	10.8	**1.16**	**21.46**	Normal	FALSE
PTX06-1102	TRUE	207.0	0.0	0.0	0.00	N/A	No distribution	FALSE
PTX06-1120	TRUE	2629.0	2470.0	495.9	0.19	**2983.72**	No distribution	FALSE
PTX06-1121	TRUE	609.5	0.0	775.9	1.27	N/A	No distribution	FALSE
PTX06-1123	FALSE	1.4	0.0	2.9	2.11	**3.62**	No distribution	FALSE
PTX06-1130	TRUE	112.6	108.0	14.0	0.12	**121.30**	Normal	FALSE
PTX06-1133A	FALSE	0.3	0.1	0.6	2.09	0.87	Lognormal	TRUE
PTX06-1135	FALSE	0.6	0.5	0.3	0.58	0.82	Lognormal	TRUE
PTX06-1146	TRUE	1113.3	1150.0	117.6	0.11	**1193.28**	Normal	FALSE
PTX06-1147	TRUE	1057.0	1070.0	215.6	0.20	**1211.24**	Normal	FALSE
PTX06-1148	FALSE	0.5	0.0	0.0	0.00	0.27	No distribution	FALSE
PTX06-1153	TRUE	272.6	260.0	63.7	0.23	**302.36**	Lognormal	FALSE
PTX06-1154	FALSE	1.0	0.0	4.5	4.44	**2.72**	No distribution	TRUE
PTX06-1166	TRUE	18.6	16.6	3.1	0.17	**22.30**	Normal	FALSE
PTX06-1182	TRUE	34.3	0.0	34.3	1.00	N/A	No distribution	FALSE
PTX06-1183	FALSE	0.2	0.0	0.0	0.00	N/A	No distribution	FALSE
PTX06-PRB16	TRUE	1340.0	0.0	0.0	0.00	N/A	No distribution	FALSE
PTX08-1002	TRUE	66.2	60.5	35.1	0.53	**95.48**	Normal	FALSE
PTX08-1007	TRUE	6.3	6.6	0.7	0.11	**7.18**	Normal	TRUE
PTX08-1008	FALSE	0.0	0.0	0.0	0.00	0.15	No distribution	TRUE
PTX08-1009	FALSE	0.5	0.3	0.4	0.86	0.75	Lognormal	TRUE
PTX10-1014	TRUE	1.9	1.7	0.7	0.38	**2.75**	Normal	FALSE

Notes:
1. Summary statistics calculated using Kaplan Meier method.
2. Distribution determined by Shapiro Wilk method. Normal = normal distribution, Lognormal = log normal distribution;
   No distribution = neither normal nor lognormal, other distributions not tested.
3. Outlier in dataset determined by Dixon's method. Outliers are usually high values.
4. N/A = insufficient data. ND = Non-Detect.

TABLE B-6
SPATIAL ANALYSIS SUMMARY RESULTS SOUTHEAST SECTOR

LONG-TERM MONITORING OPTIMIZATION
PANTEX PLANT
Carson County, Texas

Well Name	RDX Average Slope Factor	RDX Slope Factor COV	Area of Influence [FT^2]	4ADNT Average Slope Factor	4 ADNT Slope Factor COV	Recommendation After Qualitative Review
PTX06-1002A	0.31	0.62	5.90E+06	0.74	0.41	Retain for northern source
PTX06-1005	*0.14*	0.18	2.78E+06	*0.15*	0.49	Retain, source
PTX06-1008	0.78	0.04	9.54E+05	0.26	0.31	Retain for 1,2-DCA
PTX06-1010	0.27	0.50	2.70E+06	0.55	0.09	Retain (Cr source)
PTX06-1011	0.49	0.89	2.17E+06	0.38	0.23	Retain (TCE)
PTX06-1013	0.25	0.20	3.63E+06	0.70	0.09	Retain
PTX06-1014	*0.04*	0.00	1.09E+06	*0.19*	0.24	Retain, source
PTX06-1015	*0.12*	0.00	1.32E+06	*0.09*	0.37	May be redundant with PTX06-1031
PTX06-1023	**0.81**	0.84	9.59E+05	**0.81**	0.07	Retain (4ADNT)
PTX06-1030	*0.16*	0.00	2.98E+06	0.36	0.15	Retain
PTX06-1031	*0.06*	0.01	1.67E+06	*0.17*	0.23	Retain
PTX06-1034	*0.04*	0.01	2.41E+06	*0.11*	0.37	Retain
PTX06-1036	0.38	0.10	6.85E+05	0.69	0.19	Reduced monitoring schedule
PTX06-1037	0.67	0.88	4.07E+05	0.65	0.64	Retain
PTX06-1038	*0.15*	0.02	5.72E+06	0.28	0.14	Retain
PTX06-1039A	*0.13*	0.00	1.99E+06	*0.07*	0.29	Retain
PTX06-1040	*0.09*	0.00	2.44E+06	*0.12*	0.17	Retain
PTX06-1041	0.07	0.00	3.63E+06	0.10	0.06	Retain
PTX06-1042	0.04	0.00	2.98E+06	0.15	0.15	Retain
PTX06-1046	0.31	0.00	5.92E+05	0.34	0.24	Retain
PTX06-1047A	0.19	0.21	9.47E+05	0.31	0.73	Retain (may be redundant with PTX06-1046)
PTX06-1052	**0.87**	0.05	1.33E+06	0.69	0.28	Retain [Cr (VI)]
PTX06-1053	0.71	0.35	4.67E+05	0.19	0.47	Retain
PTX06-1069	**0.90**	0.26	3.39E+06	**0.82**	0.05	Retain
PTX06-1088	0.42	0.40	1.60E+06	0.35	0.76	Retain
PTX06-1095A	0.31	0.02	2.65E+06	0.25	0.35	Retain (may be reudundant with PTX06-1005)
PTX06-1098	0.63	0.69	1.14E+06	0.42	0.71	Retain
PTX06-1100	0.67	0.51	7.13E+04	0.41	0.51	Retain
PTX06-1101	0.70	**1.44**	9.53E+05	0.41	0.51	Retain - Pilot test area
PTX06-1102	*0.18*		2.44E+06	*0.08*		Retain (saturation)
PTX06-1120	0.41	0.00	1.09E+06	0.39	0.13	Retain
PTX06-1121	*0.05*		5.17E+05	*0.02*	--	Retain
PTX06-1123	0.40	1.22	8.43E+05	0.51	0.84	Retain
PTX06-1130	*0.14*	0.00	3.86E+06	0.06	0.17	Retain - intermittently dry check for saturation
PTX06-1133A	**0.83**	0.40	8.42E+05	0.72	0.14	Retain
PTX06-1135	*0.16*	0.51	1.93E+06	0.40	0.56	Retain (groundwater divide)
PTX06-1146	*0.12*	0.00	5.49E+06	0.17	0.02	Retain
PTX06-1147	*0.08*	0.00	3.43E+06	*0.14*	0.12	Retain
PTX06-1148	0.57	0.42	5.14E+05	0.62	0.42	Retain
PTX06-1153	0.74	0.01	6.06E+05	0.70	0.23	Retain
PTX06-1154	0.47	**1.02**	2.97E+05	0.54	**0.90**	Retain
PTX06-1166	0.28	0.15	1.01E+06	0.19	0.43	Retain
PTX06-1182	0.41		4.75E+05	0.12	--	Retain (delineation)
PTX06-1183	0.74		5.80E+05	0.13	--	Retain (delineation)
PTX06-PRB16	0.50		2.12E+06	0.46	--	Retain
PTX08-1002	0.54	0.07	3.53E+06	0.72	0.37	Retain
PTX08-1007	0.51	0.08	1.20E+06	0.33	0.21	Retain, source
PTX08-1008	0.63	0.08	2.26E+06	0.39	0.02	Retain
PTX08-1009	0.39	0.74	2.53E+06	0.55	0.01	Retain
PTX10-1014	0.26	0.35	1.74E+06	0.33	0.03	Retain

Notes:
1. Slope Factor (SF) is the difference between the actual concentration and the concentration estimated from nearby wells normalized by the actual concentration. Slope factors close to 1 show the concentrations cannot be estimated from the adjacent wells, and the well is important in the network.
2. Slope factors were calculated using data collected between January 2012 and November 2016.
3. Well locations with slope factors below 0.3 and area ratios below 0.8 were considered for elimination.
4. "--" = Locations with insufficient data between 2012 - 2016 to calculate a slope factor.
5. Locations identified for future elimination should be reviewed, and possibly removed from the program after 5 years of data collection.
6. PTX10-1013 not evaluated for RDX. Evaluated in SW Sector for TCE.

TABLE B-7
SAMPLING FREQUENCY ANALYSIS RESULTS SOUTHEAST SECTOR

LONG-TERM MONITORING OPTIMIZATION
PANTEX PLANT
Carson County, Texas

Well Name	Recent Concentration Rate of Change [mg/yr]	Recent MK Trend (2012-2016)	Sampling Frequency Based on Recent Data (2012-2016)	Overall Concentration Rate of Change [mg/yr]	Overall MK Trend (2008 - 2016)	Sampling Frequency Based on Overall Data (2008 - 2016)	MAROS Recommended Sampling Frequency	LTM Plan Sampling Frequency
RDX Southeast Sector								
PTX06-1002A	-2.14E-05	D	Biennial	-1.91E-05	D	Biennial	Biennial	Semi-Annual
PTX06-1005	-1.15E-04	PD	Biennial	-6.85E-05	S	Biennial	Biennial	Semi-Annual
PTX06-1008	-4.42E-09	ND	Biennial	-2.97E-08	ND	Biennial	Biennial	Annual
PTX06-1010	-7.71E-07	D	Biennial	-1.03E-06	D	Biennial	Biennial	Semi-Annual
PTX06-1011	-1.70E-06	NT	Biennial	9.64E-08	NT	Biennial	Biennial	Annual
PTX06-1013	-8.74E-07	PD	Biennial	-5.14E-07	PD	Biennial	Biennial	Annual
PTX06-1014	-3.34E-05	S	Biennial	-8.44E-05	S	Biennial	Biennial	Semi-Annual
PTX06-1015	-2.44E-04	D	Biennial	-4.02E-06	S	Biennial	Biennial	Semi-Annual
PTX06-1023	-4.02E-07	D	Biennial	-5.71E-07	D	Biennial	Biennial	Semi-Annual
PTX06-1030	1.25E-04	PI	Quarterly	-1.52E-04	S	Biennial	Quarterly	Semi-Annual
PTX06-1031	1.02E-04	PI	Quarterly	-5.91E-06	NT	Biennial	Quarterly	Semi-Annual
PTX06-1034	4.10E-04	I	Quarterly	3.79E-04	I	Quarterly	Quarterly	Semi-Annual
PTX06-1036	0.00E+00	N/A	SemiAnnual	-3.71E-07	S	SemiAnnual	SemiAnnual	Annual
PTX06-1037	-8.36E-07	D	Biennial	-2.89E-04	D	Biennial	Biennial	Quarterly
PTX06-1038	-1.94E-04	D	Biennial	-2.61E-04	D	Biennial	Biennial	Semi-Annual
PTX06-1039A	-5.51E-05	S	Biennial	-6.85E-05	PD	Biennial	Biennial	Semi-Annual
PTX06-1040	7.74E-05	NT	Quarterly	6.23E-05	NT	Quarterly	Quarterly	Semi-Annual
PTX06-1041	-4.66E-06	S	Biennial	6.46E-05	PI	Quarterly	Biennial	Semi-Annual
PTX06-1042	-2.40E-04	D	Biennial	-3.84E-05	S	Biennial	Biennial	Semi-Annual
PTX06-1046	3.82E-04	PI	Quarterly	4.43E-04	I	Quarterly	Quarterly	Semi-Annual
PTX06-1047A	-3.99E-04	D	Biennial	-2.13E-04	D	Biennial	Biennial	Semi-Annual
PTX06-1052	2.60E-08	D	Biennial	-2.65E-08	D	Biennial	Biennial	Semi-Annual
PTX06-1053	6.21E-08	I	Biennial	-1.27E-08	S	Biennial	Biennial	Semi-Annual
PTX06-1069	2.35E-09	NT	Biennial	-4.63E-08	D	Biennial	Biennial	Annual
PTX06-1088	-5.74E-05	D	Biennial	-8.88E-05	D	Biennial	Biennial	Semi-Annual
PTX06-1095A	4.33E-04	NT	Quarterly	3.23E-04	I	Quarterly	Quarterly	Semi-Annual
PTX06-1098	-2.50E-07	NT	Biennial	3.64E-08	NT	Biennial	Biennial	Semi-Annual
PTX06-1100	-2.94E-08	NT	Biennial	4.68E-08	ND	Biennial	Biennial	Annual
PTX06-1101	1.47E-05	I	Quarterly	6.95E-06	I	Quarterly	Quarterly	Annual
PTX06-1102	0.00E+00	N/A	Quarterly	6.84E-05	I	Quarterly	Quarterly	Annual
PTX06-1120	-2.73E-04	S	Biennial	-1.17E-04	S	Biennial	Biennial	Semi-Annual
PTX06-1121	0.00E+00	N/A	Quarterly	0.00E+00	N/A	Quarterly	Quarterly	Semi-Annual
PTX06-1123	-5.62E-06	D	Biennial	-7.27E-04	D	Biennial	Biennial	Quarterly
PTX06-1130	-1.37E-05	S	Biennial	-4.30E-04	D	Biennial	Biennial	Semi-Annual
PTX06-1133A	3.80E-07	NT	Biennial	3.25E-07	S	Biennial	Biennial	Semi-Annual
PTX06-1135	4.63E-07	I	Biennial	-3.10E-07	S	Biennial	Biennial	Semi-Annual
PTX06-1146	-2.80E-05	S	Biennial	-1.73E-04	PD	Biennial	Biennial	Semi-Annual
PTX06-1147	-1.63E-04	S	Biennial	2.58E-04	NT	Quarterly	Biennial	Semi-Annual
PTX06-1148	-6.19E-08	S	Biennial	-1.76E-08	S	Biennial	Biennial	Quarterly
PTX06-1153	2.87E-05	PI	Quarterly	4.82E-05	I	Quarterly	Quarterly	Quarterly
PTX06-1154	-2.80E-06	D	Biennial	-1.10E-04	D	Biennial	Biennial	Quarterly
PTX06-1166	-3.01E-06	S	Biennial	-2.93E-06	S	Biennial	Biennial	Semi-Annual
PTX06-1182	0.00E+00	N/A	Quarterly	0.00E+00	N/A	Quarterly	Quarterly	Semi-Annual
PTX06-1183	0.00E+00	N/A	Annual	0.00E+00	N/A	Annual	Annual	Semi-Annual
PTX06-PRB16	0.00E+00	N/A	Quarterly	0.00E+00	N/A	Quarterly	Quarterly	
PTX08-1002	-3.34E-05	S	Biennial	5.29E-06	S	Annual	Biennial	Semi-Annual
PTX08-1007	-2.01E-07	S	Biennial	1.47E-06	I	Biennial	Biennial	Annual
PTX08-1008	1.38E-08	NT	Biennial	-2.95E-08	D	Biennial	Biennial	Semi-Annual
PTX08-1009	-2.44E-07	D	Biennial	1.65E-08	S	Biennial	Biennial	Semi-Annual
PTX10-1014	-1.55E-07	S	Biennial	1.96E-07	NT	Biennial	Biennial	Annual

Notes:

1. 'Recent' concentration rate of change and MK trends are calculated from data collected 2008 - 2011.
2. MK = Mann Kendall Trend; D = Decreasing, PD = Probably Decreasing, S = Stable, NT = No Trend, PI = Probably Increasing, I = Increasing, ND = Non-detect, N/A = insufficient data, less than 4 sample events for time interval indicated.
3. Overall rate of change and MK trend are for the full data set (2008-2016) for each well.
4. MAROS Recommended Sampling Frequency is the sampling frequency from MAROS based on both recent and overall trends.
5. 2014 LTM Plan (CNS, 2014) is the sampling frequency currently implemented.
6. The final recommended sampling frequency is listed on Table 8, and is based on a combination of qualitative and statistical evaluations.

TABLE B-8
FINAL RECOMMENDED MONITORING NETWORK SOUTHEAST SECTOR

LONG-TERM MONITORING OPTIMIZATION
PANTEX PLANT
Carson County, Texas

	RDX			4ADNT				
Well Name	**Percent Detection**	**Mann Kendall Trend**	**Average SF**	**Percent Detection**	**Mann Kendall Trend**	**Average SF**	**Sampling Recommendation**	**Rationale**
Southeast Sector								
PTX06-1002A	100	D	0.31	50	S	0.74	Annual	UM, RA, North source monitoring for RDX - Demonstrate decreasing source term
PTX06-1005	100	PD	0.14	100	D	0.15	Annual	UM, RA, Downgradient from source, spatially important to track reduction in concentrations.
PTX06-1008	0	ND	0.78	80	NT	0.26	Annual	UM, Zone 11, delineate plumes for Cr, TCE, perchlorate, 1,2-dichloroethane
PTX06-1010	100	D	0.27	40	D	0.55	Annual	UM, Monitors diminishing source discharge, historical total Cr
PTX06-1011	60	NT	0.49	20	PI	0.38	Annual	UM, Historical source of TCE, decreasing trends.
PTX06-1013	100	PD	0.25	0	ND	0.70	Annual	RA, Edge of perched unit east of Playa 1. Monitor for boron and RDX.
PTX06-1014	100	S	0.04	100	S	0.19	Annual	RA, Monitors SEPTS near periodically dry area along FM 2373.
PTX06-1015	100	D	0.12	100	D	0.09	Biennial	RA, Monitors decreasing trends downgradient of SEPTS
PTX06-1023	45	D	0.81	0	ND	0.81	Annual	RA, POC, Edge of perched unit east of Playa 1. Monitor for boron and RDX.
PTX06-1030	100	PI	0.16	100	I	0.36	Semi-annual	RA, Monitors RDX plume east of SEPTS, limited saturation and increasing trends
PTX06-1031	100	PI	0.06	100	I	0.17	Semi-annual	POC, Monitors migration path to southeast edge of unit.
PTX06-1034	100	I	0.04	100	D	0.11	Semi-annual	RA, POC, Monitors southeastern edge of perched unit, increasing RDX trend,
PTX06-1036	100	N/A	0.38	0	N/A	0.69	Biennial	PS, Monitors groundwater divide low concentrations of Cr (VI) and RDX; PS (recommended for UM).
PTX06-1037	40	D	0.67	0	ND	0.65	Semi-annual	RA, ISPM, Remedy performance monitoring for SE ISB remedy.
PTX06-1038	100	D	0.15	100	D	0.28	Annual	RA, Monitors north of SEPTS along FM 2373, Decreasing trends
PTX06-1039A	100	S	0.13	100	NT	0.07	Annual	RA, Monitors variable high mass area along FM2373, monitor response action, stable trends
PTX06-1040	100	NT	0.09	100	S	0.12	Semi-annual	RA, Monitors variable high mass area along FM2373, monitor response action
PTX06-1041	100	S	0.07	100	D	0.10	Semi-annual	RA, Monitors variable high mass area along FM2373, monitor response action
PTX06-1042	100	D	0.04	100	PD	0.15	Semi-annual	RA, Monitors variable high mass area along FM2373, monitor response action
PTX06-1046	100	PI	0.31	100	S	0.34	Semi-annual	RA, POC, Monitors variable high mass area south of SEPTS, monitor response action
PTX06-1047A	100	D	0.19	90	D	0.31	Annual	RA, Monitors decreasing trends downgradient of SEPTS

See notes end of table

TABLE B-8

FINAL RECOMMENDED MONITORING NETWORK SOUTHEAST SECTOR

LONG-TERM MONITORING OPTIMIZATION

PANTEX PLANT

Carson County, Texas

Well Name	RDX Percent Detection	RDX Mann Kendall Trend	RDX Average SF	4ADNT Percent Detection	4ADNT Mann Kendall Trend	4ADNT Average SF	Sampling Recommendation	Rationale
Southeast Sector								
PTX06-1052	27	D	0.87	36	D	0.69	Annual	RA, POC, Monitors near groundwater flow divide; Total Cr and Cr (VI); early warning for movement of COCs to south/southeastern extent of perched groundwater.
PTX06-1053	70	I	0.71	100	NT	0.19	Annual	PS, UM, Upgradient of groundwater divide and downgradient from SW ISB, low to ND concentrations.
PTX06-1069	50	NT	0.90	0	ND	0.82	Annual	PS, Monitors eastern extent of perched unit. Continue to monitor for plume staiblity.
PTX06-1088	100	D	0.42	100	D	0.35	Semi-annual	UM, RA, Monitors decreasing Cr (VI) source.
PTX06-1095A	100	NT	0.31	100	PD	0.25	Semi-annual	RA, UM, Delineates 4ADNT plume to south, near groundwater flow divide, early warning for movement of COCs to south/southeastern extent of perched groundwater.
PTX06-1098	10	NT	0.63	0	ND	0.42	Annual	RA, ISPM for long-term assessment of pilot ISB area.
PTX06-1100	0	ND	0.67	0	ND	0.41	Annual	RA, ISPM for long-term assessment of pilot ISB area.
PTX06-1101	60	I	0.70	0	ND	0.41	Annual	RA, ISPM for long-term assessment of pilot ISB area, recent increasing trends.
PTX06-1102	100	N/A	0.18	100	N/A	0.08	Biennial	RA, Monitors area near SEPTS along limited saturation zone.
PTX06-1120	100	S	0.41	100	PD	0.39	Semi-annual	PS, Monitors highest concentration of RDX in perched unit, cross-gradient from ISB.
PTX06-1121	67	N/A	0.05	67	N/A	0.02	Annual	PS, Adjacent to very high concentration area, limited saturation, monitor for plume migration.
PTX06-1123	53	D	0.40	0	ND	0.51	Semi-annual	RA, ISPM, Remedy performance monitoring for SE ISB remedy.
PTX06-1130	100	S	0.14	100	D	0.06	Annual	RA, Monitors variable high mass area along FM2373, monitor response action, stable trends
PTX06-1133A	40	NT	0.83	0	ND	0.72	Semi-annual	PS, Monitors downgradient edge of perched unit for RDX plume migration.
PTX06-1135	100	I	0.16	78	I	0.40	Annual	PS, Monitors groundwater divide low concentrations of Cr (VI) and RDX; PS (recommended for UM)
PTX06-1146	100	S	0.12	100	D	0.17	Semi-annual	PS, POC, Monitors eastern limit of perched unit, high, but stable concentrations.
PTX06-1147	100	S	0.08	100	D	0.14	Semi-annual	PS, Monitors eastern limit of perched unit, high, but stable concentrations.
PTX06-1148	25	S	0.57	6	S	0.62	Semi-annual	PS, RA, Downgradient from SW ISB remedy, very high perchlorate concentrations confirm decreasing trends; PS, RA
PTX06-1153	100	PI	0.74	90	NT	0.70	Semi-annual	ISPM, RA, POC, Downgradient of SE ISB, monitors anomalous conditions near ISB remedy.

See notes end of table

TABLE B-8
FINAL RECOMMENDED MONITORING NETWORK SOUTHEAST SECTOR

LONG-TERM MONITORING OPTIMIZATION
PANTEX PLANT
Carson County, Texas

Well Name	RDX Percent Detection	RDX Mann Kendall Trend	RDX Average SF	4ADNT Percent Detection	4ADNT Mann Kendall Trend	4ADNT Average SF	Sampling Recommendation	Rationale
Southeast Sector								
PTX06-1154	10	D	0.47	0	ND	0.54	Semi-annual	ISPM, RA, POC, Downgradient of SE ISB, remedy performance monitoring.
PTX06-1166	100	S	0.28	100	S	0.19	Annual	PS, Monitors southern edge of groundwater divide, stable trends with exceedances for boron and RDX, cross-gradient from SE ISB may monitor intermittently saturated hydraulic connection around edge of ISB.
PTX06-1182	100	N/A	0.41	100	N/A	0.12	Semi-annual	PS, Monitors the edge of the southeastern perched unit, delineates the extent of contamination at the leading edge of the RDX plume.
PTX06-1183	100	N/A	0.74	100	N/A	0.13	Annual	PS,RA, SE Sector RDX/Cr (VI) monitoring downgradient from groundwater divide.
PTX06-PRB16	100	N/A	0.50	100	N/A	0.46	5 yr	RA, Upgradient of SE ISB.
PTX08-1002	100	S	0.54	100	PD	0.72	Annual	UM, RA, Monitor high concentration RDX plume south of Playa 1.
PTX08-1007	100	S	0.51	60	NT	0.33	Annual	UM, Monitors Zone 11 source area, decreasing concentrations.
PTX08-1008	9	NT	0.63	0	ND	0.39	Annual	RA, UM, Monitors area south of Zone 11, Cr (VI) and perchlorate plumes.
PTX08-1009	90	D	0.39	0	ND	0.55	Biennial	RA, UM, Monitors area south of Zone 11/12, limited detections of COCs.
PTX10-1014	100	S	0.26	0	ND	0.33	Biennial	UM, Source area, north of Zone 11/12.

Notes:
1. D = Decreasing; PD = Probably Decreasing; S = Stable; PI = Probably Increasing; I = Increasing; N/A = Insufficient Data to determine result; NT = No Trend; ND = well has all non-detect results for COC indicated.
2. Mann-Kendall trends for 2012 - 2016 are shown.
3. SF = Slope Factor. SF close to 1 indicates well provides unique information in network. SF near 0 indicates well may be redundant.
4. Percent detection is the ratio of the number of detections to the number of samples for the compound indicated multiplied by 100.
5. Some wells are evaluated for other COCs in results from Southwest and North Sectors.

TABLE B-9
PERCHED GROUNDWATER INVESTIGATION WELLS SOUTHWEST SECTOR

LONG-TERM MONITORING OPTIMIZATION
PANTEX PLANT
Carson County, Texas

Well Name	Earliest Sample Date[3]	Most Recent Sample Date	Number of Samples (2012-2016)	Primary COC at Well	Additional Objectives
Southwest Sector					
1114-MW4	2/6/2012	11/15/2016	11	PERCHLORATE	Source
PTX06-1006	5/24/2012	6/22/2016	5	PERCHLORATE	Source
PTX06-1007	5/24/2012	6/13/2016	5	4ADNT	Source
PTX06-1008	5/29/2012	6/27/2016	5	1,2-DICHLOROETHANE	Source (SE)
PTX06-1011	5/23/2012	6/8/2016	5	TCE	Source (SE)
PTX06-1012	1/30/2012	10/31/2016	20	TCE	ISPM
PTX06-1035	5/17/2012	8/10/2016	10	PERCHLORATE	
PTX06-1036	7/17/2012	7/16/2014	3	none	(SE)
PTX06-1052	2/2/2012	8/11/2016	11	CHROMIUM, TOTAL	(SE)
PTX06-1053	5/8/2012	11/1/2016	10	none	(SE)
PTX06-1073A	12/18/2013	12/18/2013	1	TCE	(Dry)
PTX06-1077A	7/18/2012	8/2/2016	6	TCE	
PTX06-1085	4/19/2012	4/13/2016	5	none	
PTX06-1086	4/19/2012	4/13/2016	5	none	
PTX06-1126	5/3/2012	11/3/2016	11	TCE	Upgradient ISB
PTX06-1127	5/3/2012	11/3/2016	13	PERCHLORATE	
PTX06-1131	2/9/2012	4/13/2016	1	none	
PTX06-1134	5/7/2012	11/1/2016	10	4ADNT	
PTX06-1148	5/8/2012	11/1/2016	16	PERCHLORATE	ISPM (SE)
PTX06-1149	5/7/2012	11/1/2016	4	ARSENIC	ISPM
PTX06-1150	5/7/2012	11/1/2016	16	PERCHLORATE	ISPM
PTX06-1151	2/16/2012	8/15/2016	10	TCE	
PTX06-1155	1/30/2012	10/31/2016	20	TCE	ISPM
PTX06-1156	1/30/2012	10/31/2016	4	ARSENIC	ISPM
PTX06-1159	1/29/2013	8/10/2016	8	TCE	
PTX06-1160	1/29/2013	8/10/2016	8	none	
PTX06-1162	3/26/2013	3/26/2013	1	TCE	
PTX06-1164	3/23/2015	10/25/2016	7	TCE	ISTZ
PTX06-1169	2/22/2016	2/22/2016	1	ARSENIC	
PTX06-1170	2/5/2015	10/24/2016	9	TCE	ISTZ
PTX06-1171	3/18/2015	5/25/2016	2	TCE	
PTX06-1172	3/18/2015	3/18/2015	1	TCE	
PTX06-1173	6/8/2016	6/8/2016	1	TCE	ISPM
PTX06-1174	6/8/2016	6/8/2016	1	TCE	ISPM
PTX06-1175	6/8/2016	6/8/2016	1	TCE	ISPM
PTX06-1176	3/17/2015	10/24/2016	7	TCE	ISTZ
PTX06-1177	3/17/2015	10/25/2016	6	TCE	ISTZ
PTX06-1180	12/9/2015	12/9/2015	1	TCE	
PTX06-1181	11/15/2016	11/15/2016	1	2ADNT	
PTX06-1183	11/30/2016	11/30/2016	1	CHROMIUM, TOTAL	

See Notes End of Table

TABLE B-9
PERCHED GROUNDWATER INVESTIGATION WELLS SOUTHWEST SECTOR

LONG-TERM MONITORING OPTIMIZATION
PANTEX PLANT
Carson County, Texas

Well Name	Earliest Sample Date[3]	Most Recent Sample Date	Number of Samples (2012-2016)	Primary COC at Well	Additional Objectives
Southwest Sector					
PTX07-1P02	5/10/2012	11/2/2016	11	BORON	(N)
PTX07-1P05	5/10/2012	5/13/2013	2	RDX	(N)
PTX07-1Q01	7/23/2012	7/26/2016	5	none	
PTX07-1Q02	7/23/2012	7/26/2016	5	none	
PTX07-1Q03	7/23/2012	7/27/2016	5	none	
PTX08-1001	5/10/2012	5/24/2016	4	RDX	(N)
PTX08-1003	8/6/2012	6/7/2016	5	none	
PTX08-1005	2/16/2012	8/15/2016	11	TCE	Source
PTX08-1006	2/23/2012	8/15/2016	11	RDX	Source
PTX08-1007	5/24/2012	6/8/2016	5	RDX	Source (SE)
PTX08-1008	5/3/2012	11/14/2016	11	CHROMIUM, HEXAVALENT	Source (SE)
PTX08-1009	2/20/2012	11/14/2016	2	none	Source (SE)
PTX10-1014	5/17/2012	5/24/2016	5	TCE	Source (SE)

Notes:
1. Wells listed are investigation wells in current monitoring program. Wells that are intermittently dry are indicated (Dry).
   ISPM = In situ remedy performance monitoring; ISTZ = In situ treatment zone monitoring
2. Sampling dates for wells range from January 2012 (earliest sample dates) to December 2016 (most recent sample dates).
3. The priority chemical of concern (COC) at each well is the constituent detected at the highest level normalized by the MSC or appropriate RRS.
4. Number of samples is the number of individual sample dates in the database for the priority COC, results from duplicate samples from the same date are averaged.
5. RDX = Hexahydro, 1,3,5-trinitro, 1,3,5-triazine; TCE = trichloroethene; 4ADNT = 4-Amino, 2,6-dinitrotoluene; 2ADNT = 2-Amino, 4,6-dinitrotoluene.
6. Additional monitoring objectives are used to group wells for aggregate trends: SE = well included in southeast sector analysis; N= well included in north sector; Source = wells in Zone 12 near primary sources.
7. * = Wells with stainless steel construction can show false positive metal (Cr, Fe, Ni, etc.) detections.
   ** = ISPM wells can have transient high metals cocentration due to redox changes.

TABLE B-10
MONITORING WELL TREND SUMMARY RESULTS SOUTHWEST SECTOR

LONG-TERM MONITORING OPTIMIZATION
PANTEX PLANT
Carson County, Texas

Well Name	Number of Samples (2012 - 2016)	Number of Detects	Percent Detection	Maximum Concentration [ug/L]	Maximum Above MSC?	Average Concentration [ug/L]	Average Above MSC?	Mann-Kendall Trend 2008 - 2011	Mann-Kendall Trend 2012 - 2016
TCE Southwest Sector									
1114-MW4	10	10	100%	**12.4**	Yes	**9.07**	Yes	S	D
PTX06-1006	5	5	100%	0.7	No	0.6	No	S	S
PTX06-1007	5	5	100%	0.8	No	0.6	No	ND	S
PTX06-1008	5	5	100%	2.1	No	1.2	No	S	D
PTX06-1011	5	5	100%	**21.8**	Yes	**9.8**	Yes	--	D
PTX06-1012	20	20	100%	**470.0**	Yes	**139.3**	Yes	I	D
PTX06-1035	10	10	100%	2.4	No	1.2	No	ND	I
PTX06-1036	3	0	0%	0.5	No	0.5	No	ND	N/A
PTX06-1052	11	7	64%	0.6	No	0.5	No	ND	S
PTX06-1053	10	0	0%	ND	No	ND	No	ND	ND
PTX06-1073A	1	1	100%	3.7	No	3.7	No	N/A	N/A
PTX06-1077A	6	6	100%	6.6	Yes	5.1	Yes	D	D
PTX06-1085	5	0	0%	ND	No	ND	No	N/A	ND
PTX06-1086	5	0	0%	ND	No	ND	No	N/A	ND
PTX06-1126	11	11	100%	**319.0**	Yes	**240.3**	Yes	I	S
PTX06-1127	13	13	100%	**39.8**	Yes	**14.6**	Yes	D	PI
PTX06-1131	7	0	0%	ND	No	ND	No	ND	ND
PTX06-1134	9	4	44%	4.1	No	1.1	No	ND	PI
PTX06-1148	16	16	100%	3.6	No	2.4	No	NT	D
PTX06-1149	16	1	6%	1.5	No	1.2	No	S	I* (ND)
PTX06-1150	16	16	100%	**5.6**	Yes	3.2	No	NT	I
PTX06-1151	10	10	100%	**203.0**	Yes	**140.6**	Yes	I	PD
PTX06-1155	20	19	95%	**450.0**	Yes	**103.5**	Yes	NT	D
PTX06-1156	20	2	10%	2	No	1.4	No	S	NT
PTX06-1159	8	8	100%	**375.0**	Yes	**290.1**	Yes	--	I
PTX06-1160	8	2	25%	0.5	No	0.5	No	--	NT
PTX06-1162	1	1	100%	**142.0**	Yes	**142.0**	Yes	--	--
PTX06-1164	7	7	100%	**170.0**	Yes	**125.5**	Yes	--	NT
PTX06-1169	1	1	100%	**13.0**	Yes	**13.0**	Yes	--	N/A
PTX06-1170	9	9	100%	**500**	Yes	**278.6**	Yes	--	S
PTX06-1171	2	2	100%	**303.0**	Yes	**281.5**	Yes	--	N/A
PTX06-1172	1	1	100%	**180.0**	Yes	**180.0**	Yes	--	--
PTX06-1173	1	1	100%	**100.0**	Yes	**100.0**	Yes	--	N/A
PTX06-1174	1	1	100%	**160.0**	Yes	**160.0**	Yes	--	N/A
PTX06-1175	1	1	100%	**120.0**	Yes	**120.0**	Yes	--	N/A
PTX06-1176	7	7	100%	**205**	Yes	**163.0**	Yes	--	S
PTX06-1177	6	6	100%	**130.0**	Yes	**105.2**	Yes	--	S
PTX06-1180	1	1	100%	**185.0**	Yes	**185.0**	Yes	--	--
PTX06-1181	1	0	0%	ND	No	ND	No	--	N/A
PTX06-1183	1	1	100%	0.5	No	0.5	No	--	N/A
PTX07-1P02	10	0	0%	ND	No	ND	No	--	ND
PTX07-1P05	2	0	0%	ND	No	ND	No	--	N/A
PTX07-1Q01	5	0	0%	ND	No	ND	No	N/A	ND
PTX07-1Q02	5	0	0%	ND	No	ND	No	N/A	ND
PTX07-1Q03	5	0	0%	ND	No	ND	No	N/A	ND
PTX08-1001	4	0	0%	ND	No	ND	No	--	ND
PTX08-1003	5	5	100%	3.7	No	2.5	No	NT	D
PTX08-1005	11	11	100%	**180.0**	Yes	**89.2**	Yes	PI	PD
PTX08-1006	11	11	100%	**36.0**	Yes	**20.3**	Yes	I	I
PTX08-1007	5	5	100%	**23.0**	Yes	**16.6**	Yes	S	D
PTX08-1008	11	0	0%	ND	No	ND	No	S	ND
PTX08-1009	10	2	20%	0.5	No	0.5	No	NT	NT
PTX10-1014	5	5	100%	**38.8**	Yes	**19.8**	Yes	N/A	S

See Notes End of Table

TABLE B-10
MONITORING WELL TREND SUMMARY RESULTS SOUTHWEST SECTOR

LONG-TERM MONITORING OPTIMIZATION
PANTEX PLANT
Carson County, Texas

Well Name	Number of Samples (2012 - 2016)	Number of Detects	Percent Detection	Maximum Concentration [ug/L]	Maximum Above MSC?	Average Concentration [ug/L]	Average Above MSC?	Mann-Kendall Trend 2008 - 2011	Mann-Kendall Trend 2012 - 2016
Perchlorate Southwest Sector									
1114-MW4	11	11	100%	**119.0**	Yes	**95.7**	Yes	S	NT
PTX06-1006	5	5	100%	**139.0**	Yes	**104.4**	Yes	D	NT
PTX06-1007	5	5	100%	**479.0**	Yes	**346.8**	Yes	NT	S
PTX06-1008	5	0	0%	ND	No	ND	No	NT	ND
PTX06-1011	5	1	20%	6.0	No	5.9	No	--	NT
PTX06-1012	20	0	0%	**60***	Yes	9.1	No	NT	ND*
PTX06-1035	10	10	100%	**80.2**	Yes	**53.6**	Yes	I	I
PTX06-1053	9	0	0%	ND	No	ND	No	ND	ND
PTX06-1073A	1	0	0%	ND	No	ND	No	N/A	N/A
PTX06-1077A	5	1	20%	6.0	No	5.7	No	S	NT
PTX06-1126	11	11	100%	**280.0**	Yes	**183.1**	Yes	D	S
PTX06-1127	13	13	100%	**573.5**	Yes	**441.3**	Yes	D	S
PTX06-1134	10	9	90%	**48.9**	Yes	14.4	No	NT	I
PTX06-1148	16	16	100%	**1,290**	Yes	**646.3**	Yes	I	D
PTX06-1149	16	3	19%	**684.0**	Yes	**67.0**	Yes	I	PD
PTX06-1150	16	16	100%	**235.0**	Yes	**130.1**	Yes	I	D
PTX06-1151	10	10	100%	**161.0**	Yes	**112.9**	Yes	D	S
PTX06-1155	20	0	0%	ND	Yes	ND	No	PD	ND
PTX06-1156	20	0	0%	ND	Yes	ND	No	S	ND
PTX06-1159	8	8	100%	**426.0**	Yes	**215.1**	Yes	--	I
PTX06-1160	8	0	0%	ND	No	ND	No	--	ND
PTX06-1162	1	1	100%	17.9	No	17.9	No	--	--
PTX06-1164	6	5	83%	**160.0**	Yes	**103.3**	Yes	--	S
PTX06-1169	1	0	0%	ND	No	ND	No	--	N/A
PTX06-1170	8	0	0%	ND	Yes	ND	No	--	ND
PTX06-1171	2	2	100%	**95.0**	Yes	**85.1**	Yes	--	N/A
PTX06-1172	1	1	100%	**31.0**	Yes	**31.0**	Yes	--	--
PTX06-1173	1	1	100%	16.0	No	16.0	No	--	N/A
PTX06-1174	1	1	100%	**170.0**	Yes	**170.0**	Yes	--	N/A
PTX06-1175	1	1	100%	**340.0**	Yes	**340.0**	Yes	--	N/A
PTX06-1176	5	5	100%	**240.0**	Yes	**183.2**	Yes	--	S
PTX06-1177	5	4	80%	**210.0**	Yes	**141.2**	Yes	--	D
PTX06-1180	1	0	0%	ND	No	ND	No	--	--
PTX06-1181	1	0	0%	ND	No	ND	No	--	N/A
PTX07-1P02	10	0	0%	ND	No	ND	No	--	ND
PTX07-1P05	2	0	0%	ND	No	ND	No	--	N/A
PTX08-1001	4	2	50%	**24.8**	No	13.4	No	--	S
PTX08-1003	6	6	100%	10.4	No	9.8	No	D	D
PTX08-1005	11	9	82%	**60**	Yes	19.2	No	NT	S
PTX08-1006	11	11	100%	**907.5**	Yes	**566.8**	Yes	NT	D
PTX08-1007	5	3	60%	6.0	No	5.7	No	S	S
PTX08-1008	11	9	82%	**300.0**	Yes	**72.3**	Yes	PD	I
PTX10-1014	5	3	60%	8.3	No	6.4	No	N/A	S

Notes

1. Trends were evaluated for data collected between January 2012 and December 2016. Trends from 2008 - 2011 from 2012 LTMO Report.
2. Number of Samples is the number of samples for the compound at this location.
   Number of Detects is the number of samples where the compound was detected at this location.
3. Maximum Result is the maximum concentration for the COC analyzed between 2008 and 2011. Results above MSCs are indicated in **Bold**.
4. Screening level from Corrective Measure Study. TCE = 5 ug/L; Perchlorate = 26 ug/L.
5. Maximum and average concentrations for wells with no detections are representative of the detection limits for the analyses.
6. D = Decreasing; PD = Probably Decreasing; S = Stable; PI = Probably Increasing; I = Increasing; N/A = Insufficient Data to determine trend;
   NT = No Trend; ND = well has all non-detect results for COC, ND* = one detection for compound, may be unaffected.
7. * = Single detection with changing detection limit, results in false trend or detection limits above remedial goals.

TABLE B-11
SUMMARY STATISTICS RESULTS SOUTHWEST SECTOR

LONG-TERM MONITORING OPTIMIZATION
PANTEX PLANT
Carson County, Texas

WellName	Recent Above MSC	TCE Concentration ug/L Mean	Median	SD	COV	95% UCL TCE	Distribution	Outlier
TCE Southwest Sector								
1114-MW4	Yes	9.1	8.4	1.7	0.18	**10.27**	Normal	No
PTX06-1006	No	0.6	0.5	0.1	0.12	0.63	Normal	No
PTX06-1007	No	0.6	0.6	0.1	0.24	0.76	Normal	No
PTX06-1008	No	1.2	0.9	0.9	0.73	2.22	Normal	No
PTX06-1011	No	9.8	7.1	7.0	0.72	**18.48**	Normal	Yes
PTX06-1012	No	139.3	63.0	152.1	1.09	**210.46**	Lognormal	No
PTX06-1035	No	1.2	0.7	0.8	0.64	1.78	Normal	No
PTX06-1036	No	ND	--	--	--	--	--	--
PTX06-1052	No	0.4	0.4	0.1	0.20	0.52	Normal	No
PTX06-1053	No	ND	--	--	--	--	--	--
PTX06-1073A	No	3.7	0.0	0.0	0.00	--	No distribution	No
PTX06-1077A	No	5.1	5.2	1.0	0.19	**6.42**	Normal	No
PTX06-1085	No	ND	--	--	--	--	--	--
PTX06-1086	No	ND	--	--	--	--	--	--
PTX06-1126	Yes	244.4	271.0	63.2	0.26	**286.76**	Normal	No
PTX06-1127	Yes	13.2	8.8	10.2	0.77	**22.76**	No distribution	No
PTX06-1131	No	ND	--	--	--	--	--	--
PTX06-1134	No	1.0	0.0	1.4	1.45	2.00	No distribution	Yes
PTX06-1148	No	2.4	2.1	0.8	0.33	2.83	Lognormal	No
PTX06-1149	No	1.5	0.0	0.0	0.00	1.49	No distribution	No
PTX06-1150	Yes	3.2	2.7	1.2	0.39	3.81	Normal	No
PTX06-1151	Yes	140.6	130.0	30.9	0.22	**162.69**	Normal	No
PTX06-1155	No	103.5	27.0	142.2	1.37	**169.96**	Lognormal	No
PTX06-1156	No	1.5	0.0	0.0	0.00	1.55	No distribution	No
PTX06-1159	Yes	290.1	312.0	84.4	0.29	**360.65**	Normal	No
PTX06-1160	No	0.1	0.0	0.3	2.45	0.52	No distribution	No
PTX06-1162	Yes	142.0	--	--	--	--	No distribution	--
PTX06-1164	Yes	130.4	140.0	39.3	0.30	**168.16**	No distribution	No
PTX06-1169	Yes	13.0	0.0	0.0	0.00	--	No distribution	No
PTX06-1170	Yes	261.4	200.0	170.8	0.65	**424.20**	Normal	No
PTX06-1172	Yes	180.0	--	--	--	--	No distribution	--
PTX06-1171	Yes	281.5	303.0	30.4	0.11	N/A	No distribution	No
PTX06-1173	Yes	100.0	N/A	N/A	N/A	N/A	No distribution	No
PTX06-1174	Yes	160.0	N/A	N/A	N/A	N/A	No distribution	No
PTX06-1175	Yes	120.0	N/A	N/A	N/A	N/A	No distribution	No
PTX06-1176	Yes	175.8	190.0	38.9	0.22	**210.61**	Normal	No
PTX06-1177	Yes	112.4	120.0	30.0	0.27	**160.52**	No distribution	Yes
PTX06-1180	Yes	185.0	--	--	--	--	No distribution	--
PTX06-1181	No	ND	--	--	--	--	--	--
PTX06-1183	No	0.5	0.0	0.0	0.00	--	No distribution	No
PTX07-1P02	No	ND	--	--	--	--	--	--
PTX07-1P05	No	ND	--	--	--	--	--	--
PTX07-1Q01	No	ND	--	--	--	--	--	--
PTX07-1Q02	No	ND	--	--	--	--	--	--
PTX07-1Q03	No	ND	--	--	--	--	--	--
PTX08-1001	No	ND	--	--	--	--	--	--
PTX08-1003	No	2.5	2.9	1.2	0.48	3.92	Normal	No
PTX08-1005	Yes	89.7	94.4	48.4	0.54	125.72	Normal	No
PTX08-1006	Yes	19.7	18.4	6.9	0.35	25.30	Normal	No
PTX08-1007	Yes	16.6	15.7	5.3	0.32	23.08	Normal	No
PTX08-1008	No	ND	--	--	--	--	--	--
PTX08-1009	No	0.5	0.0	0.0	0.00	0.52	No distribution	No
PTX10-1014	Yes	19.8	14.4	12.5	0.63	35.22	Normal	No

Notes:
1. Summary statistics calculated using Kaplan Meier method. -- = Insufficient data to calculate a result.
2. Distribution determined by Shapiro Wilk method. Normal = normal distribution, Lognormal = log normal distribution;
   No distribution = neither normal nor lognormal, other distributions not tested.
3. Outlier in dataset determined by Dixon's method. Outliers are usually high values.
4. N/A = insufficient data. ND = Non-Detect.

TABLE B-12
SPATIAL ANALYSIS SUMMARY RESULTS SOUTHWEST SECTOR

LONG-TERM MONITORING OPTIMIZATION
PANTEX PLANT
Carson County, Texas

Well Name	Perchlorate Average Slope Factor	SF COV	Area of Influence [ft2]	TCE Average Slope Factor	SF COV	Area of Influence [ft2]	Recommendation After Qualitative Review
1114-MW4	*0.12*	0.22	2.19E+06	*0.13*	0.09	2.19E+06	Retain
PTX06-1006	0.23	0.21	2.44E+06	0.53	0.12	2.44E+06	Retain
PTX06-1007	0.55	0.09	2.98E+06	0.46	0.23	2.98E+06	Retain
PTX06-1008	0.24	0.00	1.01E+06	0.54	0.80	1.01E+06	Retain
PTX06-1011	0.30	0.10	2.29E+06	0.29	0.50	2.29E+06	Retain
PTX06-1012	0.30	0.28	3.04E+05	0.19	**1.24**	3.04E+05	Retain
PTX06-1035	0.17	0.08	3.02E+06	0.59	0.57	3.02E+06	Retain
PTX06-1036	0.59	0.17	3.02E+06	0.51	0.01	1.04E+06	Retain
PTX06-1052	0.53		4.15E+06	0.51	0.20	2.19E+06	Retain
PTX06-1053	0.51	0.11	4.05E+06	0.37	0.11	3.02E+06	Retain
PTX06-1073A	0.35	0.13	4.26E+05	0.25		4.15E+06	Retain
PTX06-1077A	0.43	0.01	8.12E+05	*0.19*	0.15	4.05E+06	Retain
PTX06-1085	0.29	0.32	2.25E+06	*0.09*	0.06	2.19E+06	Retain
PTX06-1086	0.61	0.02	9.87E+05	0.48	0.13	8.53E+06	Retain
PTX06-1126	0.45	0.44	6.78E+05	0.32	0.04	4.26E+05	Retain
PTX06-1127	0.36	0.08	1.57E+06	0.26	0.30	8.12E+05	Retain
PTX06-1131	0.32	0.07	6.14E+05	0.46	0.06	1.53E+06	Retain
PTX06-1134	0.28	0.39	7.16E+04	0.59	0.45	2.25E+06	Retain (Delineates TCE SW)
PTX06-1148	0.59	0.16	6.00E+05	0.23	0.25	9.87E+05	Retain
PTX06-1149	0.41	0.02	6.96E+05	0.26	0.65	6.78E+05	Retain
PTX06-1150	0.59	0.24	2.62E+06	0.26	0.20	1.57E+06	Retain
PTX06-1151	0.20		7.14E+05	0.21	0.04	6.14E+05	Retain
PTX06-1155	0.19	0.00	8.15E+04	0.28	**1.65**	7.16E+04	Retain
PTX06-1156	0.15		1.95E+05	0.26	0.23	6.00E+05	Retain (4ADNT)
PTX06-1159	0.37	0.25	1.28E+05	0.35	0.01	6.96E+05	Retain (TCE)
PTX06-1160	0.15	0.01	2.84E+05	0.65	0.37	2.62E+06	Retain (SE)
PTX06-1162	0.29		1.12E+05	0.04		7.14E+05	Eliminate
PTX06-1164	0.24		1.48E+05	*0.04*	0.02	8.15E+04	Retain
PTX06-1169	0.11		1.97E+05	*0.10*		1.95E+05	Retain
PTX06-1170	0.16		3.35E+05	0.26	0.07	1.28E+05	Retain
PTX06-1171	0.25	0.03	6.50E+04	0.13	0.00	2.84E+05	Retain
PTX06-1172	0.19	0.01	2.16E+05	0.01		1.12E+05	Retain
PTX06-1173	0.59		3.65E+05	0.11		1.48E+05	Retain
PTX06-1174	0.49		2.84E+06	0.04		1.97E+05	Retain
PTX06-1175	0.47	0.09	6.17E+05	0.09		3.35E+05	Retain
PTX06-1176	0.64	0.00	1.81E+06	0.09	0.01	6.50E+04	Retain
PTX06-1177	0.21	0.11	1.25E+06	0.09	0.02	2.16E+05	Retain
PTX06-1180	0.50	0.03	8.00E+06	0.25		3.65E+05	Retain
PTX06-1181	0.33	0.27	8.52E+05	**0.73**		2.84E+06	Retain
PTX06-1183	0.56	0.00	1.56E+06	0.05		3.79E+05	Retain
PTX07-1P02	0.45	0.02	1.83E+06	0.30	0.34	6.17E+05	Retain
PTX07-1P05	0.37	0.14	2.44E+06	*0.09*	0.01	1.81E+06	Retain
PTX07-1Q01	0.28	0.06	1.31E+06	0.27	0.03	2.38E+06	Retain
PTX07-1Q02	--	--		0.00	0.00	2.78E+05	Retain
PTX07-1Q03	--	--		*0.08*	0.11	6.22E+06	Retain
PTX08-1001	0.21	0.19	1.25E+06	*0.03*	0.02	1.25E+06	Retain
PTX08-1003	0.50	0.06	8.00E+06	0.23	0.40	8.00E+06	Retain
PTX08-1005	0.34	0.20	1.49E+06	0.19	0.04	8.52E+05	Retain
PTX08-1006	0.56	0.01	1.56E+06	0.18	0.07	1.56E+06	Retain
PTX08-1007	0.45	0.04	1.83E+06	0.48	0.08	1.83E+06	Retain
PTX08-1008	0.37	0.27	2.44E+06	0.47	0.01	2.44E+06	Retain
PTX08-1009	--	--		0.45	0.20	2.63E+06	Retain
PTX10-1014	0.28	0.09	1.31E+06	0.56	0.18	1.31E+06	Retail

Notes:

1. Slope Factor (SF) is the difference between the actual concentration and the concentration estimated from nearby wells normalized by the actual concentration. Slope factors close to 1 show the concentrations cannot be estimated from the nearby wells, and the well is important in the network.
2. Slope factors were calculated using data collected between July 2012and 2016.
3. Well locations with slope factors below 0.3 and area ratios below 0.8 were considered for elimination. Not all wells were sampled for perchlorate.
4. N/A = Locations with insufficient data between 2012 - 2016 to calculate a slope factor.
5. Wells recommended for elimination are not recommended for plugging and abandonment, but should be retained for hydrogeologic monitoring.
6. * = Well included in Southeast network, recommendation based on COCs from Southeast Sector.

TABLE B-13
SAMPLING FREQUENCY ANALYSIS RESULTS SOUTHWEST SECTOR

LONG-TERM MONITORING OPTIMIZATION
PANTEX PLANT
Carson County, Texas

Well Name	Recent Concentration Rate of Change [mg/yr]	Recent MK Trend (2012-2016)	Sampling Frequency Based on Recent Data (2012-2016)	Overall Concentration Rate of Change [mg/yr]	Overall MK Trend (2000 - 2016)	Sampling Frequency Based on Overall Data (2000 - 2016)	MAROS Recommended Sampling Frequency	LTM Plan Sampling Frequency
TCE Southwest Sector								
1114-MW4	-2.43E-06	D	Biennial	5.11E-08	S	Biennial	Biennial	Semi-Annual
PTX06-1006	4.81E-08	S	Biennial	1.54E-08	I	Biennial	Biennial	Semi-Annual
PTX06-1007	-1.22E-07	S	Biennial	-4.18E-10	S	Biennial	Biennial	Annual
PTX06-1008	-1.39E-06	D	Biennial	-3.22E-06	D	Biennial	Biennial	Annual
PTX06-1011	-9.69E-06	D	Biennial	-9.87E-06	D	Biennial	Biennial	Annual
PTX06-1012	-2.52E-04	D	Biennial	2.80E-05	I	Quarterly	Biennial	Quarterly
PTX06-1035	1.39E-06	I	Biennial	1.41E-07	I	Biennial	Biennial	Semi-Annual
PTX06-1036	0.00E+00	N/A	Annual	-7.33E-08	ND	Annual	Annual	Annual
PTX06-1052	-4.46E-08	S	Biennial	-1.35E-07	D	Biennial	Biennial	Semi-Annual
PTX06-1053	0.00E+00	S	Biennial	-2.02E-07	ND	Biennial	Biennial	Semi-Annual
PTX06-1073A	0.00E+00	N/A	SemiAnnual	0.00E+00	N/A	SemiAnnual	SemiAnnual	Semi-Annual
PTX06-1077A	-1.52E-06	D	Biennial	-1.11E-06	PD	Biennial	Biennial	Annual
PTX06-1085	0.00E+00	S	Biennial	0.00E+00	ND	Biennial	Biennial	Annual
PTX06-1086	0.00E+00	S	Biennial	0.00E+00	ND	Biennial	Biennial	Annual
PTX06-1126	-2.21E-05	S	Biennial	3.31E-07	NT	Biennial	Biennial	Semi-Annual
PTX06-1127	1.52E-05	PI	SemiAnnual	1.92E-06	PD	Biennial	SemiAnnual	Semi-Annual
PTX06-1131	0.00E+00	S	Biennial	0.00E+00	ND	Biennial	Biennial	Annual
PTX06-1134	1.37E-06	PI	Biennial	6.66E-07	PI	Biennial	Biennial	Semi-Annual
PTX06-1148	-5.87E-07	D	Biennial	6.85E-07	PI	Biennial	Biennial	Quarterly
PTX06-1149	7.38E-07	I	Biennial	5.02E-07	I	Biennial	Biennial	Quarterly
PTX06-1150	1.95E-06	I	Biennial	1.55E-06	I	Biennial	Biennial	Quarterly
PTX06-1151	-3.01E-05	PD	Biennial	-2.06E-06	NT	Biennial	Biennial	Semi-Annual
PTX06-1155	-1.84E-04	D	Biennial	-2.69E-04	D	Biennial	Biennial	Quarterly
PTX06-1156	3.09E-07	NT	Biennial	-1.36E-06	D	Biennial	Biennial	Quarterly
PTX06-1159	1.51E-04	I	Quarterly	1.48E-04	I	Quarterly	Quarterly	Semi-Annual
PTX06-1160	2.20E-08	NT	Biennial	2.22E-08	NT	Biennial	Biennial	Semi-Annual
PTX06-1162	0.00E+00	N/A	Quarterly	0.00E+00	N/A	Quarterly	Quarterly	
PTX06-1164	-1.56E-05	NT	Biennial	-1.15E-05	NT	Biennial	Biennial	
PTX06-1169	0.00E+00	N/A	Quarterly	0.00E+00	N/A	Quarterly	Quarterly	Quarterly
PTX06-1170	-1.60E-04	S	Biennial	-1.70E-04	S	Biennial	Biennial	Quarterly
PTX06-1171	0.00E+00	N/A	Quarterly	0.00E+00	N/A	Quarterly	Quarterly	
PTX06-1172	0.00E+00	N/A	Quarterly	0.00E+00	N/A	Quarterly	Quarterly	
PTX06-1173	0.00E+00	N/A	Quarterly	0.00E+00	N/A	Quarterly	Quarterly	Quarterly
PTX06-1174	0.00E+00	N/A	Quarterly	0.00E+00	N/A	Quarterly	Quarterly	Quarterly
PTX06-1175	0.00E+00	N/A	Quarterly	0.00E+00	N/A	Quarterly	Quarterly	Quarterly
PTX06-1176	-1.76E-06	NT	Biennial	1.06E-05	S	Annual	Biennial	Quarterly
PTX06-1177	-1.20E-04	S	Biennial	-1.03E-04	S	Biennial	Biennial	Quarterly
PTX06-1180	0.00E+00	N/A	Quarterly	0.00E+00	N/A	Quarterly	Quarterly	
PTX06-1181	0.00E+00	N/A	Annual	0.00E+00	N/A	Annual	Annual	
PTX06-1183	0.00E+00	N/A	Annual	0.00E+00	N/A	Annual	Annual	Semi-Annual
PTX07-1P02	0.00E+00	S	Biennial	-1.06E-07	ND	Biennial	Biennial	Semi-Annual
PTX07-1P05	0.00E+00	N/A	Annual	0.00E+00	N/A	Annual	Annual	Annual
PTX07-1Q01	0.00E+00	S	Biennial	-1.40E-07	ND	Biennial	Biennial	Annual
PTX07-1Q02	0.00E+00	S	Biennial	-1.40E-07	ND	Biennial	Biennial	Annual
PTX07-1Q03	0.00E+00	S	Biennial	-1.18E-07	ND	Biennial	Biennial	Annual
PTX08-1001	0.00E+00	S	Biennial	-1.21E-07	ND	Biennial	Biennial	Annual
PTX08-1003	-1.98E-06	D	Biennial	3.12E-07	I	Biennial	Biennial	Annual
PTX08-1005	-4.99E-05	PD	Biennial	7.46E-06	NT	Annual	Biennial	Semi-Annual
PTX08-1006	6.96E-06	I	SemiAnnual	3.77E-06	I	Biennial	SemiAnnual	Semi-Annual
PTX08-1007	-8.72E-06	D	Biennial	1.93E-07	S	Biennial	Biennial	Annual
PTX08-1008	0.00E+00	S	Biennial	-1.50E-07	PD	Biennial	Biennial	Semi-Annual
PTX08-1009	2.20E-09	NT	Biennial	-1.11E-07	D	Biennial	Biennial	Semi-Annual
PTX10-1014	-1.06E-05	S	Biennial	-9.51E-06	S	Biennial	Biennial	Annual

See Notes end of table

TABLE B-13
SAMPLING FREQUENCY ANALYSIS RESULTS SOUTHWEST SECTOR

LONG-TERM MONITORING OPTIMIZATION
PANTEX PLANT
Carson County, Texas

Well Name	Recent Concentration Rate of Change [mg/yr]	Recent MK Trend (2012-2016)	Sampling Frequency Based on Recent Data (2012-2016)	Overall Concentration Rate of Change [mg/yr]	Overall MK Trend (2000 - 2016)	Sampling Frequency Based on Overall Data (2000 - 2016)	MAROS Recommended Sampling Frequency	LTM Plan Sampling Frequency
Perchlorate Southwest Sector								
1114-MW4	9.22E-06	NT	Biennial	-3.42E-05	S	Biennial	Biennial	Semi-Annual
PTX06-1006	4.24E-05	NT	Annual	2.19E-05	I	Biennial	Annual	Semi-Annual
PTX06-1007	-1.45E-04	S	Biennial	4.49E-05	I	SemiAnnual	Biennial	Annual
PTX06-1008	0.00E+00	S	Biennial	6.75E-08	NT	Biennial	Biennial	Annual
PTX06-1011	2.63E-07	NT	Biennial	2.68E-07	NT	Biennial	Biennial	Annual
PTX06-1012	6.23E-06	NT	Biennial	-2.27E-06	D	Biennial	Biennial	Quarterly
PTX06-1035	3.95E-05	I	SemiAnnual	1.32E-05	I	Biennial	SemiAnnual	Semi-Annual
PTX06-1053	0.00E+00	S	Biennial	9.17E-08	PI	Biennial	Biennial	Semi-Annual
PTX06-1073A	0.00E+00	N/A	Annual	0.00E+00	N/A	Annual	Annual	Semi-Annual
PTX06-1077A	4.32E-07	NT	Biennial	-2.59E-07	S	Biennial	Biennial	Annual
PTX06-1126	-1.14E-04	S	Biennial	-1.57E-04	D	Biennial	Biennial	Semi-Annual
PTX06-1127	-6.31E-05	S	Biennial	-2.09E-04	D	Biennial	Biennial	Semi-Annual
PTX06-1134	2.23E-05	I	Biennial	1.07E-05	PI	Biennial	Biennial	Semi-Annual
PTX06-1148	-6.34E-04	D	Biennial	-5.22E-05	D	Biennial	Biennial	Quarterly
PTX06-1149	-2.09E-04	PD	Biennial	-4.95E-05	NT	Biennial	Biennial	Quarterly
PTX06-1150	-1.04E-04	D	Biennial	4.39E-06	D	Biennial	Biennial	Quarterly
PTX06-1151	-2.77E-05	S	Biennial	-1.74E-05	D	Biennial	Biennial	Semi-Annual
PTX06-1155	6.27E-06	NT	Biennial	-1.32E-04	D	Biennial	Biennial	Quarterly
PTX06-1156	6.26E-06	NT	Biennial	-6.84E-04	D	Biennial	Biennial	Quarterly
PTX06-1159	2.22E-04	I	Quarterly	2.21E-04	I	Quarterly	Quarterly	Semi-Annual
PTX06-1160	0.00E+00	S	Biennial	0.00E+00	ND	Biennial	Biennial	Semi-Annual
PTX06-1162	0.00E+00	N/A	SemiAnnual	0.00E+00	N/A	SemiAnnual	SemiAnnual	
PTX06-1164	-1.11E-04	S	Biennial	-1.09E-04	S	Biennial	Biennial	
PTX06-1169	0.00E+00	N/A	Annual	0.00E+00	N/A	Annual	Annual	Quarterly
PTX06-1170	3.35E-05	NT	Biennial	3.52E-05	ND	Biennial	Biennial	Quarterly
PTX06-1171	0.00E+00	N/A	Quarterly	0.00E+00	N/A	Quarterly	Quarterly	
PTX06-1172	0.00E+00	N/A	Quarterly	0.00E+00	N/A	Quarterly	Quarterly	
PTX06-1173	0.00E+00	N/A	SemiAnnual	0.00E+00	N/A	SemiAnnual	SemiAnnual	Quarterly
PTX06-1174	0.00E+00	N/A	Quarterly	0.00E+00	N/A	Quarterly	Quarterly	Quarterly
PTX06-1175	0.00E+00	N/A	Quarterly	0.00E+00	N/A	Quarterly	Quarterly	Quarterly
PTX06-1176	-2.13E-04	S	Biennial	-1.87E-04	S	Biennial	Biennial	Quarterly
PTX06-1177	-2.84E-04	D	Biennial	-2.53E-04	D	Biennial	Biennial	Quarterly
PTX06-1180	0.00E+00	N/A	Annual	0.00E+00	N/A	Annual	Annual	
PTX06-1181	0.00E+00	N/A	Annual	0.00E+00	N/A	Annual	Annual	
PTX07-1P02	0.00E+00	S	Biennial	0.00E+00	ND	Biennial	Biennial	Semi-Annual
PTX07-1P05	0.00E+00	N/A	Annual	0.00E+00	N/A	Annual	Annual	Annual
PTX08-1001	-1.39E-05	S	Biennial	-1.06E-05	D	Biennial	Biennial	Annual
PTX08-1003	-8.08E-07	D	Biennial	-5.57E-06	D	Biennial	Biennial	Annual
PTX08-1005	-5.00E-07	S	Biennial	-4.64E-05	D	Biennial	Biennial	Semi-Annual
PTX08-1006	-3.91E-04	D	Biennial	8.40E-05	NT	SemiAnnual	Biennial	Semi-Annual
PTX08-1007	-1.39E-07	S	Biennial	-5.65E-07	D	Biennial	Biennial	Annual
PTX08-1008	1.51E-04	I	Quarterly	1.86E-05	PI	Biennial	Quarterly	Semi-Annual
PTX10-1014	-1.50E-06	S	Biennial	-2.70E-07	S	Biennial	Biennial	Annual

Notes:
1. 'Recent' concentration rate of change and MK trends are calculated from data collected 2008 - 2011.
2. MK = Mann Kendall Trend; D = Decreasing, PD = Probably Decreasing, S = Stable, NT = No Trend, PI = Probably Increasing, I = Increasing, ND = Non-detect, N/A = insufficient data, less than 4 sample events for time interval indicated.
3. Overall rate of change and MK trend are for the full data set (2008-2016) for each well.
4. MAROS Recommended Sampling Frequency is the sampling frequency from MAROS based on both recent and overall trends.
5. 2014 LTM Plan (CNS, 2014) is the sampling frequency currently implemented.
6. The final recommended sampling frequency is listed on Table 8, and is based on a combination of qualitative and statistical evaluations.

TABLE B-14
FINAL RECOMMENDED MONITORING NETWORK SOUTHWEST SECTOR

LONG-TERM MONITORING OPTIMIZATION
PANTEX PLANT
Carson County, Texas

Well Name	TCE Percent Detection	TCE Mann Kendall Trend	TCE Average SF	Perchlorate Percent Detection	Perchlorate Mann Kendall Trend	Perchlorate Average SF	Sampling Recommendation	Rationale
Southwest Sector								
1114-MW4	100%	D	0.13	100%	NT	0.12	Annual	UM, Monitors perchlorate source, decreasing trends.
PTX06-1006	100%	S	0.53	100%	NT	0.23	Annual	PS, Monitors perchlorate source, stable trends.
PTX06-1007	100%	S	0.46	100%	S	0.55	Annual	UM, Monitors perchlorate, RDX and 4ADNT sources.
PTX06-1008	100%	D	0.54	0%	ND	0.24	Annual	UM, Zone 11, delineate northern plumes, exceedances of 1,2-dichloroethane.
PTX06-1011	100%	D	0.29	20%	NT	0.30	Annual	UM, Historical source of TCE, decreasing trends.
PTX06-1012	100%	D	0.19	0%	ND	0.30	Annual	ISPM, RA, PS, TCE remedy monitoring.
PTX06-1035	100%	I	0.59	100%	I	0.17	Semi-annual	PS, Delineates southern edge of plumes, increasing trends.
PTX06-1036	0%	N/A	0.51	0%	0	0.00	Biennial	PS, Monitors groundwater divide low concentrations of Cr (VI) and RDX; (recommended for UM).
PTX06-1052	64%	S	0.51	0%	0	0.00	Annual	RA, POC, Monitors near groundwater flow divide; Total Cr and Cr (VI); early warning for movement of COCs to south/southeastern extent of perched groundwater.
PTX06-1053	0%	ND	0.37	0%	ND	0.59	Annual	PS, UM, Upgradient of groundwater divide and downgradient from SW ISB, low to ND concentrations.
PTX06-1073A	100%	N/A	0.25	0%	N/A	0.53	Biennial	PS, Delineated edge of perchlorate and TCE plume to north; may be intermittently dry.
PTX06-1077A	100%	D	0.19	20%	NT	0.51	Biennial	UM, Delineates Southwest Sector to the north, largely non-detect for all COCs.
PTX06-1085	0%	ND	0.09	0%	0	0.00	5 yrs	UM, Delineates western edge of plume near Playa 2, largely non-detect, reduce monitoring
PTX06-1086	0%	ND	0.48	0%	0	0.00	5 yrs	plumes near Playa 2, largely non-detect, reduce monitoring frequency.
PTX06-1126	100%	S	0.32	100%	S	0.35	Semi-annual	PS, UM, POC, Upgradient of ISB, core of perchlorate and 1,4-dioxane plumes.
PTX06-1127	100%	PI	0.26	100%	S	0.43	Semi-annual	PS, UM, POC, Upgradient of ISB, core of perchlorate and 1,4-dioxane plumes.
PTX06-1131	0%	ND	0.46	0%	0	0.00	5 yrs	UM, Delineates Southwest Sector to the southwest.
PTX06-1134	44%	PI	0.59	90%	I	0.30	Semi-annual	PS, Downgradient from ISB remedy, potentially increasing concentration trends.

See notes end of table.

TABLE B-14
FINAL RECOMMENDED MONITORING NETWORK SOUTHWEST SECTOR

LONG-TERM MONITORING OPTIMIZATION
PANTEX PLANT
Carson County, Texas

Well Name	TCE Percent Detection	TCE Mann Kendall Trend	TCE Average SF	Perchlorate Percent Detection	Perchlorate Mann Kendall Trend	Perchlorate Average SF	Sampling Recommendation	Rationale
Southwest Sector								
PTX06-1148	100%	D	0.24	100%	D	0.61	Semi-annual	PS, RA, Downgradient from ISB remedy, very high perchlorate concentrations confirm decreasing trends.
PTX06-1149	6%	I	0.26	19%	PD	0.45	Semi-annual	PS, Downgradient from ISB remedy, high perchlorate concentrations confirm decreasing trends.
PTX06-1150	100%	I	0.26	100%	D	0.36	Semi-annual	PS, RA, Downgradient from ISB, low but increasing TCE and high perchlorate concentrations.
PTX06-1151	100%	PD	0.22	100%	S	0.32	Semi-annual	PS, RA, Upgradient western edge of ISB, monitors edge of TCE and perchlorate plume.
PTX06-1155	95%	D	0.28	0%	ND	0.28	Semi-annual	Downgradient from ISB, ISPM well, required for TCE remedy performance monitoring; RA, POC
PTX06-1156	10%	NT	0.25	0%	ND	0.59	Biennial	Downgradient from ISB on east side, below remedial goals, important for 1,4-dioxane
PTX06-1159	100%	I	0.35	100%	I	0.41	Semi-annual	PS, RA, Downgradient from ISB, leading edge of TCE and perchlorate plumes.
PTX06-1160	25%	NT	0.65	0%	ND	0.59	5 yrs	RA, Western edge of TCE plume, low concentrations; (recommended as UM well).
PTX06-1162	100%	N/A	0.00	100%	N/A	0.00	Eliminate	Redundant with PTX08-1005
PTX06-1164	100%	NT	0.04	83%	S	0.17	Annual	western ISB remedy with low variablity in concentrations, in situ treatment zone.
PTX06-1169	100%	N/A	0.10	0%	N/A	0.15	Biennial	RA, Monitors central ISB in an area of low TCE concentrations, low uncertainty.
PTX06-1170	100%	S	0.26	0%	ND	0.37	Semi-annual	RA, Monitors in situ treatment zone of the central ISB, high TCE concentrations.
PTX06-1171	100%	N/A	0.13	100%	N/A	0.12	Semi-annual	RA, Upgradient of western ISB, insufficient data to evaluate recent trends.
PTX06-1172	100%	N/A	0.00	100%	N/A	0.00	Semi-annual	RA, Upgradient of western ISB, insufficient data to evaluate recent trends.
PTX06-1173	100%	N/A	0.11	100%	N/A	0.24	Semi-annual	RA, Downgradient of western ISB, insufficient data to evaluate recent trends.
PTX06-1174	100%	N/A	0.04	100%	N/A	0.11	Semi-annual	RA, Downgradient of western ISB, ISPM, insufficient data to evaluate recent trends.
PTX06-1175	100%	N/A	0.09	100%	N/A	0.16	Semi-annual	RA, Downgradient of western ISB, ISPM, insufficient data to evaluate recent trends.
PTX06-1176	100%	S	0.09	100%	S	0.25	Semi-annual	RA, Monitors in situ treatment zone of the western ISB, high TCE and perchlorate concentrations.

See notes end of table.

TABLE B-14
FINAL RECOMMENDED MONITORING NETWORK SOUTHWEST SECTOR

LONG-TERM MONITORING OPTIMIZATION
PANTEX PLANT
Carson County, Texas

	TCE			Perchlorate				
Well Name	**Percent Detection**	**Mann Kendall Trend**	**Average SF**	**Percent Detection**	**Mann Kendall Trend**	**Average SF**	**Sampling Recommendation**	**Rationale**
Southwest Sector								
PTX06-1177	100%	S	0.09	80%	D	0.19	Semi-annual	RA, Monitors in situ treatment zone of the western ISB, high TCE and perchlorate concentrations.
PTX06-1180	100%	N/A	0.00	0%	N/A	0.00	Annual	Monitors western edge of TCE plume cross-gradient from ISB; (recommended for PS monitoring objective)
PTX06-1181	0%	N/A	0.73	0%	N/A	0.49	5 yrs	RA, Delineates TCE plume to the west, low detections.
PTX06-1183	100%	N/A	0.05	0%	0	0.00	Annual	PS, RA, SE Sector RDX/Cr (VI) monitoring downgradient from groundwater divide.
PTX07-1P02	0%	ND	0.30	0%	ND	0.48	Annual	UM, POC, Monitor RDX increasing trend and boron plume west of Playa 1.
PTX07-1P05	0%	N/A	0.09	0%	N/A	0.64	5 yr	UM, Monitor RDX plume west of Playa 1.
PTX07-1Q01	0%	ND	0.27	0%	0	0.00	5 yrs	UM, Delineates Southwest Sector to the southwest.
PTX07-1Q02	0%	ND	0.00	0%	0	0.00	5 yrs	UM, Delineates Southwest Sector to the southwest.
PTX07-1Q03	0%	ND	0.08	0%	0	0.00	5 yrs	UM, Delineates Southwest Sector to the southwest.
PTX08-1001	0%	ND	0.03	50%	S	0.21	Annual	UM, RA, Monitor RDX and boron plumes south of Playa 1.
PTX08-1003	100%	D	0.23	100%	D	0.50	Annual	PS, Delineates TCE northwest of Zone 11, concentrations below remedial goals.
PTX08-1005	100%	PD	0.21	82%	S	0.34	Annual	UM, Monitors area between TCE sources and ISB.
PTX08-1006	100%	I	0.18	100%	D	0.56	Semi-annual	UM, Monitors upgradient area of high perchlorate, TCE, 1,4-dioxane, potential source.
PTX08-1007	100%	D	0.48	60%	S	0.45	Annual	UM, Monitors Zone 11 source area, decreasing concentrations.
PTX08-1008	0%	ND	0.47	82%	I	0.37	Annual	RA, UM, Monitors area south of Zone 11, Cr (VI) and perchlorate plumes.
PTX08-1009	20%	NT	0.45	0%	0	0.00	Biennial	RA, UM, Monitors area south of Zone 11/12, limited detections of COCs.
PTX10-1014	100%	S	0.56	60%	S	0.28	Biennial	UM, Source area, north of Zone 11/12.

Notes:
1. D = Decreasing; PD = Probably Decreasing; S = Stable; PI = Probably Increasing; I = Increasing; N/A = Insufficient Data to determine trend;
   NT = No Trend; ND = well has all non-detect results for COC indicated. NA = Not applicable, no longer in active.
2. Mann-Kendall trends for 2008 - 2011 are shown.
3. SF = Slope Factor. SF close to 1 indicates well provides unique information in network. SF near 0 indicates well may be redundant.
4. * = Well also evaluated for other Sectors.

TABLE B-15
PERCHED GROUNDWATER INVESTIGATION WELLS NORTH SECTOR

LONG-TERM MONITORING OPTIMIZATION
PANTEX PLANT
Carson County, Texas

Well Name	Earliest Sample Date[3]	Most Recent Sample Date	Number of Samples (2012-2016)	Primary COC at Well	Area
North Sector					
OW-WR-38	5/17/2012	4/27/2016	5	RDX	Playa 1
PTX01-1001	5/9/2012	10/26/2016	10	None	Burning Ground
PTX01-1002	5/9/2012	7/28/2016	4	None	Burning Ground
PTX01-1008	5/9/2012	10/26/2016	10	None	Burning Ground
PTX04-1001	4/25/2016	4/25/2016	1	None	North
PTX04-1002	7/19/2012	4/25/2016	5	None	North
PTX06-1013	5/29/2012	4/26/2016	7	RDX	(SE)
PTX06-1023	2/1/2012	8/16/2016	10	Boron	(SE)
PTX06-1048A	4/19/2012	4/27/2016	5	None	Playa 1
PTX06-1049	4/23/2012	10/26/2016	13	4ADNT	Playa 1
PTX06-1050	3/7/2012	11/15/2016	11	RDX	Source/Playa 1
PTX06-1069	7/17/2012	7/20/2016	4	None	Playa 1 (SE)
PTX06-1071	11/30/2016	11/30/2016	1	None	North
PTX06-1080	7/25/2016	7/25/2016	1	None	North
PTX06-1081	7/19/2012	7/25/2016	5	None	North
PTX06-1136	4/23/2012	5/14/2014	5	None	Playa 1
PTX07-1O01	2/8/2012	2/12/2014	5	RDX	Playa 1
PTX07-1O02	2/8/2012	3/16/2015	9	None	Playa 1
PTX07-1O03	7/31/2012	7/28/2016	5	RDX	Playa 1
PTX07-1O06	7/19/2012	7/19/2012	1	None	(Dry)
PTX07-1P02	5/10/2012	11/2/2016	10	Boron	Playa 1 (SW)
PTX07-1P05	5/10/2012	5/13/2013	2	RDX	Playa 1 (SW)
PTX07-1R03	7/27/2016	7/27/2016	1	None	West
PTX08-1001	5/10/2012	5/24/2016	4	RDX	Playa 1 (SW)
PTX08-1002	5/2/2012	11/2/2016	8	RDX	Source/Playa 1 (SE)
PTX08-1010	7/25/2016	7/25/2016	1	None	North
PTX-BEG3	4/25/2012	4/25/2012	1	None	Historical Cr

Notes:
1. Wells listed are investigation wells in current monitoring program. Wells that were dry during the recent five years are not listed. Some wells included in more than one Sector for spatial analysis. N = North; SE = Southeast; SW = Southwest;
2. Data from CNS database received February, 2016.
3. Sampling dates for wells range from January 2012 (earliest sample dates) to December 2016 (most recent sample dates).
4. The priority chemical of concern (COC) at each well is the constituent detected at the highest level normalized by the MSC or appropriate remedial goal.
5. Number of samples is the number of individual sample dates in the database for the priority COC, results from duplicate samples from the same date are averaged.
6. RDX = Hexahydro, 1,3,5-trinitro, 1,3,5-triazine; TCE = trichloroethene; 4ADNT = 4-Amino, 2,6-dinitrotoluene; Cr(VI) = Hexavalent Chromium.
7. MAROS Goup is the goup assigned for an aggregate trend determination:
   SEPTS = Extraction picket in SE Sector; SE ISB = Southeast In Situ Bioremediation
   ISB Zone 11 = In Situ Bioremediation Zone 11; Playa 1 = Perched unit beneath Playa 1.

TABLE B-16
MONITORING WELL TREND SUMMARY RESULTS NORTH SECTOR

LONG-TERM MONITORING OPTIMIZATION
PANTEX PLANT
Carson County, Texas

WellName	Number of Samples (2012 - 2016)	Number of Detects	Percent Detection	Maximum Concentration [ug/L]	Maximum Above MSC?	Average Concentration [ug/L]	Average Above MSC?	Mann-Kendall Trend 2008 - 2011	Mann-Kendall Trend 2012 - 2016
RDX North Sector									
OW-WR-38	5	5	100%	**6.52**	Yes	**3.0**	Yes	N/A	I
PTX01-1001	10	0	0%	ND	No	ND	Yes	S	ND
PTX01-1002	4	1	25%	0.4	No	0.1	No	ND	S
PTX01-1008	11	1	9%	0.7	No	0.1	No	ND	D
PTX04-1001	1	0	0%	ND	No	ND	Yes	ND	ND
PTX04-1002	5	5	100%	0.45	No	0.22	No	S	NT
PTX06-1013	7	7	100%	**7.79**	Yes	**6.61**	Yes	S	PD
PTX06-1023	11	5	45%	1.2	No	0.45	No	S	D
PTX06-1048A	5	0	0%	ND	No	ND	Yes	ND	ND
PTX06-1049	13	13	100%	**3.34**	Yes	**2.4**	Yes	NT	NT
PTX06-1050	11	11	100%	**334**	Yes	**172.67**	Yes	D	PD
PTX06-1069	4	2	50%	0.1	No	0.1	No	ND	NT
PTX06-1071	1	1	100%	0.4	No	0.4	No	ND	N/A
PTX06-1080	1	0	0%	ND	No	ND	Yes	ND	N/A
PTX06-1081	5	1	20%	0.5	No	0.1	No	ND	NT
PTX06-1136	5	0	0%	ND	No	ND	Yes	ND	ND
PTX07-1O01	5	5	100%	**21.9**	Yes	**16.8**	Yes	S	S
PTX07-1O02	9	9	100%	0.48	No	0.19	No	PD	PI
PTX07-1O03	5	5	100%	**46.8**	Yes	**40.26**	Yes	S	I
PTX07-1O06	1	1	100%	0.15	No	0.15	No	--	N/A
PTX07-1P02	11	8	73%	**5.12**	Yes	1.83	No	S	I
PTX07-1P05	2	2	100%	**7.38**	Yes	**7.32**	Yes	N/A	N/A
PTX07-1R03	1	1	100%	0.1	No	0.1	No	ND	N/A
PTX08-1001	4	4	100%	**23.5**	Yes	**16.88**	Yes	NT	S
PTX08-1002	8	8	100%	**121**	Yes	**66.15**	Yes	I	S
PTX08-1010	1	0	0%	ND	No	ND	Yes	NT	N/A
PTX-BEG3	Not sampled for RDX								
4ADNT North Sector									
PTX01-1001	10	2	20%	0.2	No	0.1	No	ND	S
PTX06-1048A	5	5	100%	0.15	No	0.13	No	D	D
PTX06-1049	13	13	100%	**3.47**	Yes	**2.6**	Yes	NT	D
PTX06-1050	11	11	100%	**11.10**	Yes	**8.66**	Yes	NT	D
PTX07-1O01	5	5	100%	0.33	No	0.27	No	D	NT
PTX08-1001	4	1	25%	0.13	No	0.13	No	ND	S
PTX08-1002	8	8	100%	**7**	Yes	**3.95**	Yes	NT	PD

See Notes End of Table

TABLE B-16
MONITORING WELL TREND SUMMARY RESULTS NORTH SECTOR

LONG-TERM MONITORING OPTIMIZATION
PANTEX PLANT
Carson County, Texas

WellName	Number of Samples (2012 - 2016)	Number of Detects	Percent Detection	Maximum Concentration [ug/L]	Maximum Above MSC?	Average Concentration [ug/L]	Average Above MSC?	Mann-Kendall Trend 2008 - 2011	Mann-Kendall Trend 2012 - 2016
Boron									
OW-WR-38	5	5	100%	**294.0**	Yes	**274.2**	Yes	--	NT
PTX01-1001	10	10	100%	72.90	No	60.87	No	--	S
PTX01-1002	4	4	100%	62.70	No	52.3	No	--	NT
PTX01-1008	10	10	100%	62.60	No	55.86	No	--	S
PTX04-1001	1	1	100%	101.00	No	101.00	No	--	N/A
PTX04-1002	5	5	100%	118	No	112.8	No	--	NT
PTX06-1013	7	7	100%	**569**	Yes	**516**	Yes	--	PD
PTX06-1023	11	11	100%	**246.0**	Yes	121.7	No	--	S
PTX06-1048A	5	5	100%	82.80	No	78.72	No	--	S
PTX06-1049	13	13	100%	**118.50**	No	106.02	No	--	PI
PTX06-1050	11	11	100%	**928.00**	Yes	**750.6**	Yes	--	D
PTX06-1069	4	4	100%	133.00	No	126.75	No	--	S
PTX06-1071	1	1	100%	95.1	No	95.1	No	--	N/A
PTX06-1080	1	1	100%	**70**	No	70.4	No	--	N/A
PTX06-1081	5	5	100%	90.3	No	71.9	No	--	NT
PTX06-1136	5	5	100%	117.00	No	107.5	No	--	S
PTX07-1O01	5	5	100%	**439.00**	Yes	**342.6**	Yes	--	S
PTX07-1O02	10	10	100%	**92.90**	No	84.11	No	--	S
PTX07-1O03	5	5	100%	**600.00**	Yes	**529.20**	Yes	--	NT
PTX07-1P02	11	11	100%	**958**	Yes	**580.5**	Yes	--	NT
PTX07-1P05	2	2	100%	**547**	Yes	**509.5**	Yes	--	N/A
PTX07-1R03	1	1	100%	137.0	No	137.0	No	--	N/A
PTX08-1001	4	4	100%	**983.00**	Yes	**557**	Yes	--	S
PTX08-1002	8	8	100%	**926.00**	Yes	**747.88**	Yes	--	PD
PTX08-1010	1	1	100%	141.00	No	141	No	--	N/A
Chromium North Sector									
No exceedances for Cr (VI) or Total Cr 2012 - 2016									
TCE North Sector									
No exceedances for TCE 2012 - 2016									

Notes

1. Only wells where the COC indicated was detected are shown. Trends were evaluated for data collected between January 2012 and December 2016.
2. Number of Samples is the number of samples for the compound at this location during 2012 - 2016.
   Number of Detects is the number of samples where the compound was detected at this location.
3. The maximum concentration for the COC is the maximum analytical result analyzed between 2012 and 2016. Results above MSCs are indicated in **Bold**.
4. MSCs = Medium Specific Concentration from Corrective Measure Study. RDX = 7.7 ug/L; 4ADNT = 1.2 ug/L; TCE = 5ug/L; Cr = 100 ug/L; Perchlorate = 26ug/L.
5. No exceedances of Cr(VI) were found in North Sector wells.
6. D = Decreasing; PD = Probably Decreasing; S = Stable; PI = Probably Increasing; I = Increasing; N/A = Insufficient Data to determine trend;
   NT = No Trend; ND = well has all non-detect results for COC; ND* = one detection for compound, may be unaffected.

TABLE B-17
FINAL RECOMMENDED GROUNDWATER MONITORING NETWORK NORTH SECTOR

LONG-TERM MONITORING OPTIMIZATION
PANTEX PLANT
Carson County, Texas

Well Name	Priority COPC	Maximum Above MSC?	MK Trend	Sampling Frequency Recommendation	Rationale
North Sector					
OW-WR-38	RDX	Yes	I	Annual	UM, RA, Monitors source area in north adjacent to Playa 1
PTX01-1001	None	No	S	Annual	UM and POC in Burning Ground, limited saturated thickness
PTX01-1002	None	No	--	5 yr	UM in Burning Ground
PTX01-1008	None	No	--	Annual	UM and POC in Burning Ground, limited saturated thickness
PTX04-1001	None	No	--	5 yr	UM in NE corner of DOE property.
PTX04-1002	None	No	--	5 yr	UM in NE corner of DOE property.
PTX06-1013	RDX	Yes	PD	Annual	Playa 1. Monitor for boron and RDX.
PTX06-1023	Boron	No	S	Annual	of Playa 1. Monitor for boron and RDX.
PTX06-1048A	None	No	--	Annual	PS, RA, Low level detections of TCE; Delineates north/northeast of perched unit.
PTX06-1049	4ADNT	Yes	D	Annual	PS, UM, Trace detections of COCs, delineates northwest of Zone 11
PTX06-1050	RDX	Yes	PD	Annual	UM, RA, POC, Monitors area northwest of Playa 1, area of highest concentration in North Sector.
PTX06-1069	None	No	--	Annual	PS, Monitors eastern extent of perched unit. Continue to monitor for plume staiblity.
PTX06-1071	None	No	--	5 yr	UM, Unaffected. Monitors SWMU 140, NE corner of DOE property.
PTX06-1080	None	No	--	5 yr	No confirmed detections of COPCs, Monitors SWMU 140, NE corner of DOE property.
PTX06-1081	None	No	--	5 yr	UM, Monitors SWMU 140, NE corner of DOE property.
PTX06-1136	None	No	--	Annual	PS, Delineates RDX plume west of PTX06-1050.

See Notes End of Table

TABLE B-17
FINAL RECOMMENDED GROUNDWATER MONITORING NETWORK NORTH SECTOR

LONG-TERM MONITORING OPTIMIZATION
PANTEX PLANT
Carson County, Texas

Well Name	Priority COPC	Maximum Above MSC?	MK Trend	Sampling Frequency Recommendation	Rationale
North Sector					
PTX07-1O01	RDX	Yes	S	Annual	PS, UM, RA, Monitors SWMU 68b. Continue monitoring to characterize RDX plume in this area.
PTX07-1O02	None	No	N/A	Annual	PS, UM, RA, POC, Monitors SWMU 68b.
PTX07-1O03	RDX	Yes	I	Annual	PS, UM, RA, Monitors SWMU 68b. Continue monitoring to characterize RDX plume in this area.
PTX07-1O06	None	No		5 yr	PS, UM, RA, Limited detections north of SWMU68b.
PTX07-1P02	Boron	Yes	NT	Annual	UM, POC, Monitor RDX increasing trend and boron plume west of Playa 1.
PTX07-1P05	RDX	Yes	N/A	5 yr	UM, Monitor RDX plume west of Playa 1.
PTX07-1R03	None	No	--	5 yr	UM, Monitors isolated area of groundwater.
PTX08-1001	RDX	Yes	S	Annual	UM, RA, Monitor RDX and boron plumes south of Playa 1.
PTX08-1002	RDX	Yes	S	Annual	UM, RA, Monitor high concentration RDX plume south of Playa 1.
PTX08-1010	None	No	--	5 yr	UM, RA, Sporadic trace detections of COPCs, detections of HMX below MSCs, NE corner of DOE property.
PTX-BEG3	None	No	--	Eliminate	Inactive

Notes:
1. MSC = Medium Specific Concentration.
2. D = Decreasing; PD = Probably Decreasing; S = Stable; PI = Probably Increasing; I = Increasing; N/A = Insufficient Data to determine trend; NT = No Trend; ND = well has all non-detect results for COC indicated; N/C not calculated.
3. Mann-Kendall trends for 2012 - 2016 are shown.
4. PS = Plume Stability, RA = Remedial Action, UM = Uncertainty Management, POC = Point of Compliance.

TABLE B-18
SUMMARY MONITORING NETWORK RECOMMENDATIONS

LONG-TERM MONITORING OPTIMIZATION
PANTEX PLANT
Carson County, Texas

Well Name	MAROS Analysis Sector	Indicator Area/Secondary Objectives	Priority COC at Well	LTM Objectives	Frequency Analysis Result
1114-MW4	Southwest	Source	PERCHLORATE	UM	Annual
OW-WR-38	North	Playa 1	RDX	UM, RA	Annual
PTX01-1001	North	Burning Ground	None	UM/POC	Annual
PTX01-1002	North	Burning Ground	None	UM	5 yr
PTX01-1008	North	Burning Ground	None	UM, POC	Annual
PTX04-1001	North	North	None	UM	5 yr
PTX04-1002	North	North	None	UM	5 yr
PTX06-1002A	Southeast	Source	RDX	UM, RA	Annual
PTX06-1005	Southeast	Source	RDX	UM, RA	Annual
PTX06-1006	Southwest	Source	PERCHLORATE	PS	Annual
PTX06-1007	Southwest	Source	4ADNT	UM	Annual
PTX06-1008	Southwest/SE	Source	DICHLOROETHANE	UM	Annual
PTX06-1010	Southeast	Source	CHROMIUM, TOTAL	UM	Annual
PTX06-1011	Southwest/SE	Source	TCE	UM	Annual
PTX06-1012	Southwest	ISPM	TCE	PS, RA	Annual
PTX06-1013	North/SE	P1PTS	RDX	RA	Annual
PTX06-1014	Southeast	SEPTS	RDX	RA	Annual
PTX06-1015	Southeast	SEPTS	RDX	RA	Biennial
PTX06-1023	North/SE	P1PTS	Boron	RA, POC	Annual
PTX06-1030	Southeast	East edge	RDX	RA	Semi-annual
PTX06-1031	Southeast	East edge	RDX	POC?	Semi-annual
PTX06-1034	Southeast	East edge	RDX	RA, POC	Semi-annual
PTX06-1035	Southwest	ISPM	PERCHLORATE	PS	Annual
PTX06-1036	Southwest/SE	ISPM	None	PS	Biennial
PTX06-1037	Southeast	ISPM Pilot (Dry)	ARSENIC	RA	Semi-annual
PTX06-1038	Southeast	SEPTS	RDX	RA	Annual
PTX06-1039A	Southeast	SEPTS	RDX	RA	Annual
PTX06-1040	Southeast	SEPTS	RDX	RA	Semi-annual
PTX06-1041	Southeast	SEPTS	RDX	RA	Semi-annual
PTX06-1042	Southeast	SEPTS	RDX	RA, POC	Semi-annual
PTX06-1046	Southeast	SE Migration	RDX	RA, POC	Semi-annual
PTX06-1047A	Southeast	SE Migration	RDX	RA	Annual
PTX06-1048A	North	Playa 1	None	PS, RA	Annual
PTX06-1049	North	Playa 1	4ADNT	PS, UM	Annual
PTX06-1050	North	Source/Playa 1	RDX	UM, RA, POC	Annual
PTX06-1052	Southwest/SE	ISPM	CHROMIUM, TOTAL	RA, POC	Annual
PTX06-1053	Southwest/SE	ISPM	None	PS, UM	Annual
PTX06-1069	North/SE	East edge	None	PS	Annual
PTX06-1071	North	North	None	UM	5 yr

See notes end of table

TABLE B-18
SUMMARY MONITORING NETWORK RECOMMENDATIONS

LONG-TERM MONITORING OPTIMIZATION
PANTEX PLANT
Carson County, Texas

Well Name	MAROS Analysis Sector	Indicator Area/Secondary Objectives	Priority COC at Well	LTM Objectives	Frequency Analysis Result
PTX06-1073A	Southwest	(Dry)	TCE	PS	Biennial
PTX06-1077A	Southwest	Zone 11	TCE	UM	Biennial
PTX06-1080	North	North	None	UM	5 yr
PTX06-1081	North	North	None	UM	5 yr
PTX06-1085	Southwest	Playa 2	None	UM	5 yrs
PTX06-1086	Southwest	Playa 2	None	UM	5 yrs
PTX06-1088	Southeast	Source	RDX	UM, RA	Semi-annual
PTX06-1095A	Southeast	Source	RDX	RA, UM	Semi-annual
PTX06-1098	Southeast	ISPM Pilot	BARIUM	RA	Annual
PTX06-1100	Southeast	ISPM Pilot	BARIUM	RA	Annual
PTX06-1101	Southeast	ISPM Pilot	RDX	RA	Annual
PTX06-1102	Southeast	SEPTS (Dry)	RDX	RA	Biennial
PTX06-1120	Southeast	SE Migration	RDX	PS	Semi-annual
PTX06-1121	Southeast	SE Migration (Dry)	RDX	PS	Annual
PTX06-1123	Southeast	ISPM (Dry)	TNX	RA	Semi-annual
PTX06-1126	Southwest	Upgradient ISB	TCE	PS, UM, POC	Semi-annual
PTX06-1127	Southwest	Upgradient ISB	PERCHLORATE	PS, UM, POC	Semi-annual
PTX06-1130	Southeast	East edge	RDX	RA, POC	Annual
PTX06-1131	Southwest	Zone 10	none	UM	5 yrs
PTX06-1133A	Southeast	SE Migration	CHROMIUM, TOTAL	PS	Semi-annual
PTX06-1134	Southwest	SW Migration	4ADNT	PS	Semi-annual
PTX06-1135	Southeast	GW Divide	DNX	PS	Annual
PTX06-1136	North	Playa 1	None	PS	Annual
PTX06-1146	Southeast	East edge	RDX	PS, POC	Semi-annual
PTX06-1147	Southeast	East edge	RDX	PS	Semi-annual
PTX06-1148	Southwest/SE	ISPM	PERCHLORATE	PS, RA	Semi-annual
PTX06-1149	Southwest	ISPM	ARSENIC	PS	Semi-annual
PTX06-1150	Southwest	ISPM	PERCHLORATE	PS, RA	Semi-annual
PTX06-1151	Southwest	Upgradient ISB	TCE	PS	Semi-annual
PTX06-1153	Southeast	ISPM	RDX	RA, POC	Semi-annual
PTX06-1154	Southeast	ISPM	TNX	RA, POC	Semi-annual
PTX06-1155	Southwest	ISPM	TCE	RA, POC	Semi-annual
PTX06-1156	Southwest	ISPM	ARSENIC	UM	Biennial
PTX06-1159	Southwest	SW Migration	TCE	PS, RA	Semi-annual
PTX06-1160	Southwest	SW Migration	None	PS	5 yrs
PTX06-1162	Southwest	--	TCE	RA	Eliminate
PTX06-1164	Southwest	ISTZ	TCE	RA	Annual
PTX06-1166	Southeast	GW Divide	RDX	PS	Annual
PTX06-1169	Southwest	ISTZ	ARSENIC	RA	Biennial
PTX06-1170	Southwest	ISTZ	TCE	RA	Semi-annual
PTX06-1171	Southwest	ISPM	TCE	RA	Semi-annual
PTX06-1172	Southwest	ISPM	TCE	RA	Semi-annual
PTX06-1173	Southwest	ISPM	TCE	RA	Semi-annual
PTX06-1174	Southwest	ISPM	TCE	RA	Semi-annual
PTX06-1175	Southwest	ISPM	TCE	RA	Semi-annual
PTX06-1176	Southwest	ISTZ	TCE	RA	Semi-annual
PTX06-1177	Southwest	ISTZ	TCE	RA	Semi-annual
PTX06-1180	Southwest	ISB	TCE		Annual
PTX06-1181	Southwest	ISB	2ADNT	RA	5 yrs

See notes end of table

TABLE B-18
SUMMARY MONITORING NETWORK RECOMMENDATIONS

LONG-TERM MONITORING OPTIMIZATION
PANTEX PLANT
Carson County, Texas

Well Name	MAROS Analysis Sector	Indicator Area/Secondary Objectives	Priority COC at Well	LTM Objectives	Frequency Analysis Result
PTX06-1182	Southeast	SE Migration	RDX	PS	Semi-annual
PTX06-1183	Southwest/SE	GW Divide	CHROMIUM, TOTAL	PS, RA	Annual
PTX06-PRB16	Southeast	SE Migration	RDX	RA	5 yr
PTX07-1O01	North	Playa 1	RDX	PS, UM, RA	Annual
PTX07-1O02	North	Playa 1	None	PS, UM, RA, POC	Annual
PTX07-1O03	North	Playa 1	RDX	PS, UM, RA	Annual
PTX07-1O06	North	North (Dry)	None	PS, UM, RA	5 yr
PTX07-1P02	North/SW	Playa 1	Boron	UM, POC	Annual
PTX07-1P05	North/SW	Playa 1	RDX	UM	5 yrs
PTX07-1Q01	Southwest	Zone 10	none	UM	5 yrs
PTX07-1Q02	Southwest	Zone 10	none	UM	5 yrs
PTX07-1Q03	Southwest	Zone 10	none	UM	5 yrs
PTX07-1R03	North	West perched	None	UM	5 yr
PTX08-1001	North/SW	Playa 1	RDX	UM, RA	Annual
PTX08-1002	North/SE	Source/Playa 1	RDX	UM, RA	Annual
PTX08-1003	Southwest	Zone 11	None	PS	Annual
PTX08-1005	Southwest	Source	TCE	UM	Annual
PTX08-1006	Southwest	Source	RDX	UM	Semi-annual
PTX08-1007	Southwest/SE	Source	RDX	UM	Annual
PTX08-1008	Southwest/SE	Source	CHROMIUM, HEXAVALENT	UM/RA	Annual
PTX08-1009	Southwest/SE	Source	None	UM, RA	Biennial
PTX08-1010	North	North edge	None	UM	5 yr
PTX10-1014	Southwest/SE	Source	TCE	UM	Biennial
PTX-BEG3	North	--	None		Eliminate
Four Potential New Wells					
Southeast	Southeast of PTX06-1034		Southeast	PS, UM	Semi-annual
Southeast	South/southwest of PTX06-1182		Southeast	PS, UM	Semi-annual
Zone 11	Downgradient of PTX06-1035		Southwest	PS, RA	Semi-annual
Zone 11	Downgradient of PTX06-1134		Southwest	PS, RA	Semi-annual

Notes:

1. SW = Southwest, N = North, SE = Southeast, ISPM = In situ performance monitoring, ISTZ = In situ treatment zone
   SEPTS = Southeast Pump and Treat System; P1PTS = Playa 1 Pump and Treat System; ISB = In situ bioremediation,
   GW = groundwater, Dry = well intermittently dry
2. Priority COCs represent the highest ratio of average concentration to remedial goal
3. LTM Monitoring Objectives: PS = Plume Stability; UM = Uncertainty Management; RA = Response Action Effectiveness
4. Monitoring frequency recommendation from MAROS analysis and qualitative review

Appendix C

MAROS Reports

Southeast Sector MAROS Reports

MAROS COC Assessment

Project: Pantex | **User Name:** MV
Location: Southeast | **State:** Texas

Toxicity:

Contaminant of Concern	Representative Concentration (mg/L)	PRG (mg/L)	Percent Above PRG
HEXAHYDRO-1,3,5-TRINITRO-1,3,5-TRIAZINE	3.6E-01	2.0E-03	18132.6%
TNX	2.0E-02	2.0E-03	897.0%
PERCHLORATE	1.1E-01	2.6E-02	311.3%
CHROMIUM, TOTAL	2.0E-01	1.0E-01	96.6%
MNX	3.6E-03	2.0E-03	79.4%
CHROMIUM, HEXAVALENT	1.5E-01	1.0E-01	48.3%
ARSENIC	1.2E-02	1.2E-02	0.2%

Note: Top COCs by toxicity were determined by examining a representative concentration for each compound over the entire site. The compound representative concentrations are then compared with the chosen PRG for that compound, with the percentage exceedance from the PRG determining the compound's toxicity. All compounds above exceed the PRG.

Prevalence:

Contaminant of Concern	Class	Total Wells	Total Exceedance	Percent Exceedances	Total Detects
HEXAHYDRO-1,3,5-TRINITRO-1,3,5-TRIAZINE	ORG	50	30	60.0%	48
TNX	ORG	50	26	52.0%	36
PERCHLORATE	INO	7	2	28.6%	5
CHROMIUM, TOTAL	MET	50	9	18.0%	47
ARSENIC	MET	18	3	16.7%	17
CHROMIUM, HEXAVALENT	MET	48	6	12.5%	45
MNX	ORG	50	5	10.0%	23

Note: Top COCs by prevalence were determined by examining a representative concentration for each well location at the site. The total exceedances (values above the chosen PRGs) are compared to the total number of wells to determine the prevalence of the compound.

Mobility:

Contaminant of Concern	Kd/Koc
TNX	
PERCHLORATE	
MNX	
CHROMIUM, TOTAL	
HEXAHYDRO-1,3,5-TRINITRO-1,3,5-TRIAZINE	0.00741
CHROMIUM, HEXAVALENT	14
ARSENIC	25

MAROS COC Assessment

Project: Pantex **User Name:** MV

Location: Southeast **State:** Texas

Note: Top COCs by mobility were determined by examining each detected compound in the dataset and comparing their mobilities (Koc's for organics, assuming foc = 0.001, and Kd's for metals).

Priority Constituents by Well:

Well Name	Average	Max
PTX06-1002A	HEXAHYDRO-1,3,5-TRINITR	HEXAHYDRO-1,3,5-TRINIT
PTX06-1005	HEXAHYDRO-1,3,5-TRINITR	HEXAHYDRO-1,3,5-TRINIT
PTX06-1008	1,2-DICHLOROETHANE	1,2-DICHLOROETHANE
PTX06-1010	CHROMIUM, TOTAL	CHROMIUM, TOTAL
PTX06-1011	CHROMIUM, TOTAL	TRICHLOROETHYLENE (TCE
PTX06-1013	HEXAHYDRO-1,3,5-TRINITR	HEXAHYDRO-1,3,5-TRINIT
PTX06-1014	HEXAHYDRO-1,3,5-TRINITR	HEXAHYDRO-1,3,5-TRINIT
PTX06-1015	HEXAHYDRO-1,3,5-TRINITR	HEXAHYDRO-1,3,5-TRINIT
PTX06-1023	TNX	HEXAHYDRO-1,3,5-TRINIT
PTX06-1030	HEXAHYDRO-1,3,5-TRINITR	HEXAHYDRO-1,3,5-TRINIT
PTX06-1031	HEXAHYDRO-1,3,5-TRINITR	HEXAHYDRO-1,3,5-TRINIT
PTX06-1034	HEXAHYDRO-1,3,5-TRINITR	HEXAHYDRO-1,3,5-TRINIT
PTX06-1036	HEXAHYDRO-1,3,5-TRINITR	HEXAHYDRO-1,3,5-TRINIT
PTX06-1037	ARSENIC	ARSENIC
PTX06-1038	HEXAHYDRO-1,3,5-TRINITR	HEXAHYDRO-1,3,5-TRINIT
PTX06-1039A	HEXAHYDRO-1,3,5-TRINITR	HEXAHYDRO-1,3,5-TRINIT
PTX06-1040	HEXAHYDRO-1,3,5-TRINITR	HEXAHYDRO-1,3,5-TRINIT
PTX06-1041	HEXAHYDRO-1,3,5-TRINITR	HEXAHYDRO-1,3,5-TRINIT
PTX06-1042	HEXAHYDRO-1,3,5-TRINITR	HEXAHYDRO-1,3,5-TRINIT
PTX06-1046	HEXAHYDRO-1,3,5-TRINITR	HEXAHYDRO-1,3,5-TRINIT
PTX06-1047A	HEXAHYDRO-1,3,5-TRINITR	HEXAHYDRO-1,3,5-TRINIT
PTX06-1052	CHROMIUM, TOTAL	CHROMIUM, TOTAL
PTX06-1053	2,6-DINITROTOLUENE	2-AMINO-4,6-DINITROTOL
PTX06-1069	MANGANESE	CHROMIUM, TOTAL
PTX06-1088	HEXAHYDRO-1,3,5-TRINITR	HEXAHYDRO-1,3,5-TRINIT
PTX06-1095A	HEXAHYDRO-1,3,5-TRINITR	HEXAHYDRO-1,3,5-TRINIT
PTX06-1098	BARIUM	BARIUM
PTX06-1100	BARIUM	BARIUM
PTX06-1101	HEXAHYDRO-1,3,5-TRINITR	HEXAHYDRO-1,3,5-TRINIT
PTX06-1102	HEXAHYDRO-1,3,5-TRINITR	HEXAHYDRO-1,3,5-TRINIT

MAROS COC Assessment

Project: Pantex **User Name:** MV

Location: Southeast **State:** Texas

PTX06-1120	HEXAHYDRO-1,3,5-TRINITR	HEXAHYDRO-1,3,5-TRINIT
PTX06-1121	HEXAHYDRO-1,3,5-TRINITR	HEXAHYDRO-1,3,5-TRINIT
PTX06-1123	TNX	TNX
PTX06-1130	HEXAHYDRO-1,3,5-TRINITR	HEXAHYDRO-1,3,5-TRINIT
PTX06-1133A	CHROMIUM, TOTAL	CHROMIUM, TOTAL
PTX06-1135	DNX	CHROMIUM, TOTAL
PTX06-1146	HEXAHYDRO-1,3,5-TRINITR	HEXAHYDRO-1,3,5-TRINIT
PTX06-1147	HEXAHYDRO-1,3,5-TRINITR	HEXAHYDRO-1,3,5-TRINIT
PTX06-1148	PERCHLORATE	PERCHLORATE
PTX06-1153	HEXAHYDRO-1,3,5-TRINITR	HEXAHYDRO-1,3,5-TRINIT
PTX06-1154	TNX	TNX
PTX06-1166	HEXAHYDRO-1,3,5-TRINITR	HEXAHYDRO-1,3,5-TRINIT
PTX06-1182	HEXAHYDRO-1,3,5-TRINITR	HEXAHYDRO-1,3,5-TRINIT
PTX06-1183	CHROMIUM, TOTAL	CHROMIUM, TOTAL
PTX06-PRB16	HEXAHYDRO-1,3,5-TRINITR	HEXAHYDRO-1,3,5-TRINIT
PTX08-1002	HEXAHYDRO-1,3,5-TRINITR	HEXAHYDRO-1,3,5-TRINIT
PTX08-1007	HEXAHYDRO-1,3,5-TRINITR	TRICHLOROETHYLENE (TCE
PTX08-1008	CHROMIUM, HEXAVALENT	CHROMIUM, HEXAVALENT
PTX08-1009	2,4,6-TRINITROTOLUENE	HEXAHYDRO-1,3,5-TRINIT
PTX10-1014	TRICHLOROETHYLENE (TCE)	TRICHLOROETHYLENE (TCE

MAROS Mann-Kendall Statistics Summary

Project: Pantex **User Name:** MV

Location: Southeast **State:** Texas

Time Period: 2/22/2012 **to** 11/30/2016
Consolidation Period: No Time Consolidation
Consolidation Type: Median
Duplicate Consolidation: Average
ND Values: 1/2 Detection Limit
J Flag Values : Actual Value

Well	Number of Samples	Number of Detects	Coefficient of Variation	Mann-Kendall Statistic	Confidence in Trend	All Samples "ND" ?	Concentration Trend
4-AMINO-2,6-DINITROTOLUENE							
PTX06-1002A	10	5	0.32	-8	72.9%	No	S
PTX06-1005	10	10	0.68	-29	99.5%	No	D
PTX06-1008	5	4	0.27	3	67.5%	No	NT
PTX06-1010	10	4	0.12	-23	97.7%	No	D
PTX06-1011	5	1	0.16	7	92.1%	No	PI
PTX06-1013	7	0	0.02	-6	76.4%	Yes	ND
PTX06-1014	5	5	0.25	-6	88.3%	No	S
PTX06-1015	10	10	0.30	-27	99.2%	No	D
PTX06-1023	10	0	0.02	-7	70.0%	Yes	ND
PTX06-1030	9	9	0.18	22	98.8%	No	I
PTX06-1031	10	10	0.11	25	98.6%	No	I
PTX06-1034	10	10	0.20	-25	98.6%	No	D
PTX06-1036	3	0	0.00	0	0.0%	Yes	ND
PTX06-1037	20	0	1.46	-30	82.4%	Yes	ND
PTX06-1038	10	10	0.22	-29	99.5%	No	D
PTX06-1039A	10	10	0.35	3	56.9%	No	NT
PTX06-1040	10	10	0.23	-13	85.4%	No	S
PTX06-1041	10	10	0.10	-20	95.5%	No	D
PTX06-1042	10	10	0.23	-19	94.6%	No	PD
PTX06-1046	10	10	0.22	-9	75.8%	No	S
PTX06-1047A	10	9	0.92	-27	99.2%	No	D
PTX06-1052	10	4	0.35	-20	95.5%	No	D
PTX06-1053	10	10	0.34	15	89.2%	No	NT
PTX06-1069	4	0	0.02	-2	62.5%	Yes	ND
PTX06-1088	10	10	0.75	-33	99.9%	No	D
PTX06-1095A	10	10	0.35	-17	92.2%	No	PD

MAROS Mann-Kendall Statistics Summary

Project: Pantex **User Name:** MV

Location: Southeast **State:** Texas

4-AMINO-2,6-DINITROTOLUENE

Well	Number of Samples	Number of Detects	Coefficient of Variation	Mann-Kendall Statistic	Confidence in Trend	All Samples "ND" ?	Concentration Trend
PTX06-1098	10	0	1.04	-8	72.9%	Yes	ND
PTX06-1100	5	0	0.82	1	50.0%	Yes	ND
PTX06-1101	5	0	0.82	1	50.0%	Yes	ND
PTX06-1102	1	1	0.00	0	0.0%	No	N/A
PTX06-1120	10	10	0.16	-19	94.6%	No	PD
PTX06-1121	2	2	0.00	0	0.0%	No	N/A
PTX06-1123	15	0	1.26	-36	95.9%	Yes	ND
PTX06-1130	7	7	0.16	-13	96.5%	No	D
PTX06-1133A	5	0	0.03	-8	95.8%	Yes	ND
PTX06-1135	9	7	0.97	26	99.7%	No	I
PTX06-1146	10	10	0.17	-23	97.7%	No	D
PTX06-1147	10	10	0.22	-21	96.4%	No	D
PTX06-1148	16	1	0.84	-18	77.5%	No	S
PTX06-1153	20	18	1.08	-39	89.0%	No	NT
PTX06-1154	20	0	1.96	-66	98.3%	Yes	ND
PTX06-1166	8	8	0.24	-4	64.0%	No	S
PTX06-1182	1	1	0.00	0	0.0%	No	N/A
PTX06-1183	1	1	0.00	0	0.0%	No	N/A
PTX06-PRB16	1	1	0.00	0	0.0%	No	N/A
PTX08-1002	8	8	0.52	-14	94.6%	No	PD
PTX08-1007	5	3	0.18	6	88.3%	No	NT
PTX08-1008	10	0	0.02	0	46.4%	Yes	ND
PTX08-1009	10	0	0.02	20	95.5%	Yes	ND
PTX10-1014	5	0	0.02	-3	67.5%	Yes	ND
CHROMIUM, HEXAVALENT							
PTX06-1002A	10	3	0.31	-18	93.4%	No	PD
PTX06-1005	10	10	1.34	-29	99.5%	No	D
PTX06-1008	5	3	0.78	-2	59.2%	No	S
PTX06-1010	10	10	0.48	-11	81.0%	No	S
PTX06-1011	5	5	0.61	2	59.2%	No	NT
PTX06-1013	7	0	0.22	-12	94.9%	Yes	ND
PTX06-1014	5	3	0.52	-6	88.3%	No	S
PTX06-1015	11	10	0.80	19	91.8%	No	PI

MAROS Mann-Kendall Statistics Summary

Project: Pantex **User Name:** MV

Location: Southeast **State:** Texas

CHROMIUM, HEXAVALENT

Well	Number of Samples	Number of Detects	Coefficient of Variation	Mann-Kendall Statistic	Confidence in Trend	All Samples "ND" ?	Concentration Trend
PTX06-1023	10	1	0.21	-19	94.6%	No	PD
PTX06-1030	7	6	0.39	-5	71.9%	No	S
PTX06-1031	10	7	0.32	-16	90.7%	No	PD
PTX06-1034	10	5	0.38	-17	92.2%	No	PD
PTX06-1036	3	3	0.00	0	0.0%	No	N/A
PTX06-1037	20	4	0.22	-78	99.4%	No	D
PTX06-1038	11	7	0.43	-12	79.9%	No	S
PTX06-1039A	10	3	0.43	-18	93.4%	No	PD
PTX06-1040	11	7	0.25	-5	61.9%	No	S
PTX06-1041	10	6	0.42	-24	98.2%	No	D
PTX06-1042	11	3	0.79	-20	92.9%	No	PD
PTX06-1046	11	9	0.34	10	75.3%	No	NT
PTX06-1047A	11	3	0.69	-12	79.9%	No	S
PTX06-1052	10	10	0.78	-43	100.0%	No	D
PTX06-1053	10	2	0.28	-14	87.3%	No	S
PTX06-1069	4	1	0.37	-1	50.0%	No	S
PTX06-1088	10	9	0.97	-5	63.6%	No	S
PTX06-1095A	10	8	1.70	-2	53.5%	No	NT
PTX06-1098	10	6	0.85	-23	97.7%	No	D
PTX06-1100	5	3	1.67	-7	92.1%	No	PD
PTX06-1101	5	2	0.49	-7	92.1%	No	PD
PTX06-1102	1	1	0.00	0	0.0%	No	N/A
PTX06-1120	10	10	0.79	10	78.4%	No	NT
PTX06-1121	2	2	0.00	0	0.0%	No	N/A
PTX06-1123	14	1	0.26	-53	99.8%	No	D
PTX06-1130	7	3	0.32	-14	97.5%	No	D
PTX06-1133A	5	1	0.22	-4	75.8%	No	S
PTX06-1135	8	3	0.34	-6	72.6%	No	S
PTX06-1146	10	7	0.47	4	60.3%	No	NT
PTX06-1147	10	3	0.24	-20	95.5%	No	D
PTX06-1153	20	20	0.32	-74	99.2%	No	D
PTX06-1154	20	13	0.70	-8	58.9%	No	S
PTX06-1166	8	7	0.96	14	94.6%	No	PI

MAROS Mann-Kendall Statistics Summary

Project: Pantex **User Name:** MV

Location: Southeast **State:** Texas

Well	Number of Samples	Number of Detects	Coefficient of Variation	Mann-Kendall Statistic	Confidence in Trend	All Samples "ND" ?	Concentration Trend
CHROMIUM, HEXAVALENT							
PTX06-1182	1	0	0.00	0	0.0%	Yes	ND
PTX06-1183	1	1	0.00	0	0.0%	No	N/A
PTX08-1002	8	0	0.17	-7	76.4%	Yes	ND
PTX08-1007	5	1	0.25	-8	95.8%	No	D
PTX08-1008	10	10	1.39	-21	96.4%	No	D
PTX08-1009	10	6	0.66	26	98.9%	No	I
PTX10-1014	5	3	0.27	-4	75.8%	No	S
HEXAHYDRO-1,3,5-TRINITRO-1,3,5-TRIAZIN							
PTX06-1002A	10	10	0.86	-23	97.7%	No	D
PTX06-1005	10	10	0.42	-16	90.7%	No	PD
PTX06-1008	5	0	0.03	-4	75.8%	Yes	ND
PTX06-1010	10	10	0.35	-23	97.7%	No	D
PTX06-1011	5	3	1.54	2	59.2%	No	NT
PTX06-1013	7	7	0.11	-11	93.2%	No	PD
PTX06-1014	5	5	0.14	-2	59.2%	No	S
PTX06-1015	10	10	0.21	-23	97.7%	No	D
PTX06-1023	10	4	1.13	-23	97.7%	No	D
PTX06-1030	9	9	0.10	15	92.5%	No	PI
PTX06-1031	10	10	0.16	19	94.6%	No	PI
PTX06-1034	10	10	0.35	31	99.8%	No	I
PTX06-1036	3	3	0.00	0	0.0%	No	N/A
PTX06-1037	20	8	1.19	-107	100.0%	No	D
PTX06-1038	10	10	0.59	-31	99.8%	No	D
PTX06-1039A	10	10	0.17	-5	63.6%	No	S
PTX06-1040	10	10	0.16	9	75.8%	No	NT
PTX06-1041	10	10	0.12	-1	50.0%	No	S
PTX06-1042	10	10	0.24	-25	98.6%	No	D
PTX06-1046	10	10	0.30	16	90.7%	No	PI
PTX06-1047A	10	10	1.16	-27	99.2%	No	D
PTX06-1052	10	3	0.30	-20	95.5%	No	D
PTX06-1053	10	7	0.33	22	97.1%	No	I
PTX06-1069	4	2	0.21	2	62.5%	No	NT
PTX06-1088	10	10	1.02	-39	100.0%	No	D

MAROS Mann-Kendall Statistics Summary

Project: Pantex **User Name:** MV

Location: Southeast **State:** Texas

HEXAHYDRO-1,3,5-TRINITRO-1,3,5-TRIAZIN

Well	Number of Samples	Number of Detects	Coefficient of Variation	Mann-Kendall Statistic	Confidence in Trend	All Samples "ND" ?	Concentration Trend
PTX06-1095A	10	10	0.72	1	50.0%	No	NT
PTX06-1098	10	1	1.01	-8	72.9%	No	NT
PTX06-1100	5	0	0.82	1	50.0%	Yes	ND
PTX06-1101	5	3	1.04	10	99.2%	No	I
PTX06-1102	1	1	0.00	0	0.0%	No	N/A
PTX06-1120	10	10	0.19	-7	70.0%	No	S
PTX06-1121	2	2	0.00	0	0.0%	No	N/A
PTX06-1123	15	8	1.58	-72	100.0%	No	D
PTX06-1130	7	7	0.12	-7	80.9%	No	S
PTX06-1133A	5	2	1.12	4	75.8%	No	NT
PTX06-1135	9	9	0.58	19	97.0%	No	I
PTX06-1146	10	10	0.11	0	46.4%	No	S
PTX06-1147	10	10	0.20	-14	87.3%	No	S
PTX06-1148	16	4	0.86	-14	71.8%	No	S
PTX06-1153	20	20	0.23	45	92.3%	No	PI
PTX06-1154	20	2	2.57	-66	98.3%	No	D
PTX06-1166	8	8	0.18	-11	88.7%	No	S
PTX06-1182	1	1	0.00	0	0.0%	No	N/A
PTX06-1183	1	1	0.00	0	0.0%	No	N/A
PTX06-PRB16	1	1	0.00	0	0.0%	No	N/A
PTX08-1002	8	8	0.53	-8	80.1%	No	S
PTX08-1007	5	5	0.11	0	40.8%	No	S
PTX08-1008	10	1	0.13	11	81.0%	No	NT
PTX08-1009	10	9	0.85	-31	99.8%	No	D
PTX10-1014	5	5	0.38	-2	59.2%	No	S
TNX							
PTX06-1002A	10	10	0.82	-27	99.2%	No	D
PTX06-1005	10	10	1.09	-37	100.0%	No	D
PTX06-1008	5	0	0.03	-4	75.8%	Yes	ND
PTX06-1010	10	5	0.14	7	70.0%	No	NT
PTX06-1011	5	3	1.40	0	40.8%	No	NT
PTX06-1013	7	7	0.08	-6	76.4%	No	S
PTX06-1014	5	5	0.28	-2	59.2%	No	S

MAROS Mann-Kendall Statistics Summary

Project: Pantex **User Name:** MV

Location: Southeast **State:** Texas

TNX

Well	Number of Samples	Number of Detects	Coefficient of Variation	Mann-Kendall Statistic	Confidence in Trend	All Samples "ND" ?	Concentration Trend
PTX06-1015	10	10	0.19	-25	98.6%	No	D
PTX06-1023	10	2	0.20	-2	53.5%	No	S
PTX06-1030	9	9	0.33	-12	87.0%	No	S
PTX06-1031	10	10	0.32	33	99.9%	No	I
PTX06-1034	10	10	0.21	9	75.8%	No	NT
PTX06-1036	3	0	0.00	0	0.0%	Yes	ND
PTX06-1037	20	19	0.92	-131	100.0%	No	D
PTX06-1038	10	10	0.43	-41	100.0%	No	D
PTX06-1039A	10	10	0.23	15	89.2%	No	NT
PTX06-1040	10	10	0.31	28	99.4%	No	I
PTX06-1041	10	10	0.24	-27	99.2%	No	D
PTX06-1042	10	10	0.43	-41	100.0%	No	D
PTX06-1046	10	10	0.28	21	96.4%	No	I
PTX06-1047A	10	9	1.22	-29	99.5%	No	D
PTX06-1052	10	0	0.02	-19	94.6%	Yes	ND
PTX06-1053	10	0	0.02	2	53.5%	Yes	ND
PTX06-1069	4	0	0.02	-2	62.5%	Yes	ND
PTX06-1088	10	10	0.69	-13	85.4%	No	S
PTX06-1095A	10	10	0.43	-13	85.4%	No	S
PTX06-1098	10	0	1.14	-24	98.2%	Yes	ND
PTX06-1100	5	0	0.95	-3	67.5%	Yes	ND
PTX06-1101	5	1	1.09	-2	59.2%	No	NT
PTX06-1102	1	1	0.00	0	0.0%	No	N/A
PTX06-1120	10	10	0.23	-19	94.6%	No	PD
PTX06-1121	2	2	0.00	0	0.0%	No	N/A
PTX06-1123	15	15	1.21	-70	100.0%	No	D
PTX06-1130	7	7	0.10	7	80.9%	No	NT
PTX06-1133A	5	0	0.03	-8	95.8%	Yes	ND
PTX06-1135	9	0	0.02	6	69.4%	Yes	ND
PTX06-1146	10	10	0.23	17	92.2%	No	PI
PTX06-1147	10	10	0.15	-19	94.6%	No	PD
PTX06-1148	16	0	1.12	-7	60.5%	Yes	ND
PTX06-1153	20	18	1.84	42	90.7%	No	PI

MAROS Mann-Kendall Statistics Summary

Project: Pantex **User Name:** MV

Location: Southeast **State:** Texas

TNX

Well	Number of Samples	Number of Detects	Coefficient of Variation	Mann-Kendall Statistic	Confidence in Trend	All Samples "ND" ?	Concentration Trend
PTX06-1154	19	13	1.64	-132	100.0%	No	D
PTX06-1166	8	2	0.13	16	96.9%	No	I
PTX06-1182	1	0	0.00	0	0.0%	Yes	ND
PTX06-1183	1	0	0.00	0	0.0%	Yes	ND
PTX06-PRB16	1	1	0.00	0	0.0%	No	N/A
PTX08-1002	8	8	0.41	-18	98.4%	No	D
PTX08-1007	5	5	0.15	-5	82.1%	No	S
PTX08-1008	10	0	0.02	0	46.4%	Yes	ND
PTX08-1009	10	0	0.02	20	95.5%	Yes	ND
PTX10-1014	5	5	0.40	0	40.8%	No	S

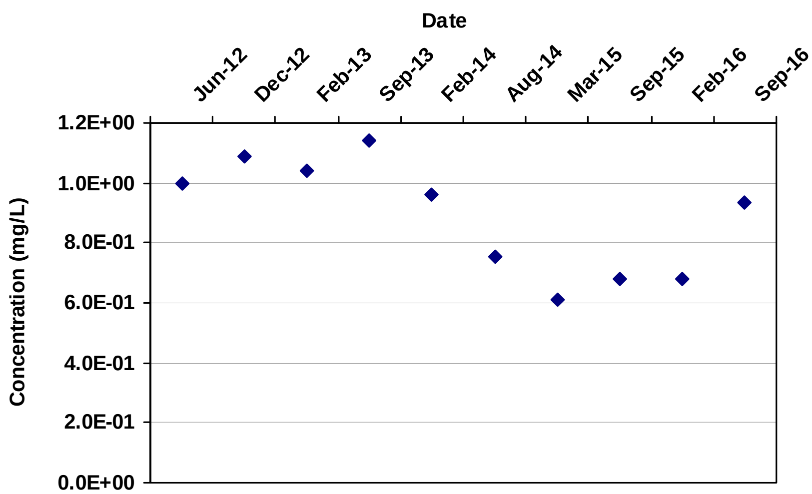
Note: Increasing (I); Probably Increasing (PI); Stable (S); Probably Decreasing (PD); Decreasing (D); No Trend (NT); Not Applicable (N/A)-Due to insufficient Data (< 4 sampling events).

The Number of Samples and Number of Detects shown above are post-consolidation values.

MAROS Mann-Kendall Statistics Summary

Project: Pantex | **User Name:** MV
Location: Southeast | **State:** Texas

Well:	PTX06-1015	**Time Period:**	2/22/2012 **to** 11/30/2016
Well Type:	SEPTS	**Consolidation Period:**	No Time Consolidation
COC:	HEXAHYDRO-1,3,5-TRINITRO-1,3,5-	**Duplicate Consolidation:**	Median
		Consolidation Type:	Average
		ND Values:	1/2 Detection Limit
		J Flag Values :	Actual Value



Mann Kendall S Statistic:

-23

Confidence in Trend:

97.7%

Coefficient of Variation:

0.21

Mann Kendall Concentration Trend: (See Note)

D

Data Table:

Well	Effective Date	Constituent	Result (mg/L)	Flag	Number of Samples	Number of Detects
PTX06-1015	6/20/2012	HEXAHYDRO-1,3,5-TRINITRO-	1.0E+00		1	1
PTX06-1015	12/19/2012	HEXAHYDRO-1,3,5-TRINITRO-	1.1E+00		1	1
PTX06-1015	2/19/2013	HEXAHYDRO-1,3,5-TRINITRO-	1.0E+00		1	1
PTX06-1015	9/3/2013	HEXAHYDRO-1,3,5-TRINITRO-	1.1E+00		1	1
PTX06-1015	2/19/2014	HEXAHYDRO-1,3,5-TRINITRO-	9.6E-01		1	1
PTX06-1015	8/20/2014	HEXAHYDRO-1,3,5-TRINITRO-	7.5E-01		1	1
PTX06-1015	3/11/2015	HEXAHYDRO-1,3,5-TRINITRO-	6.1E-01		1	1
PTX06-1015	9/22/2015	HEXAHYDRO-1,3,5-TRINITRO-	6.8E-01		1	1
PTX06-1015	2/11/2016	HEXAHYDRO-1,3,5-TRINITRO-	6.8E-01		1	1

MAROS Mann-Kendall Statistics Summary

Project: Pantex **User Name:** MV

Location: Southeast **State:** Texas

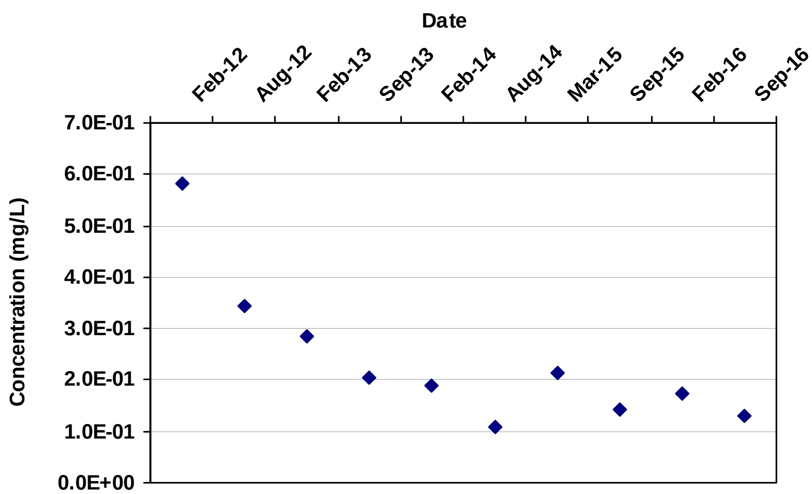
Well	Effective Date	Constituent	Result (mg/L)	Flag	Number of Samples	Number of Detects
PTX06-1015	9/28/2016	HEXAHYDRO-1,3,5-TRINITRO-	9.3E-01		1	1

Note: Increasing (I); Probably Increasing (PI); Stable (S); Probably Decreasing (PD); Decreasing (D); No Trend (NT); Not Applicable (N/A) - Due to insufficient Data (< 4 sampling events); ND = Non-detect

MAROS Mann-Kendall Statistics Summary

Project:	Pantex	**User Name:**	MV
Location:	Southeast	**State:**	Texas

Well:	PTX06-1038	**Time Period:**	2/22/2012 **to** 11/30/2016
Well Type:	SEPTS	**Consolidation Period:**	No Time Consolidation
COC:	HEXAHYDRO-1,3,5-TRINITRO-1,3,5-	**Duplicate Consolidation:**	Median
		Consolidation Type:	Average
		ND Values:	1/2 Detection Limit
		J Flag Values :	Actual Value



Mann Kendall S Statistic:

-31

Confidence in Trend:

99.8%

Coefficient of Variation:

0.59

Mann Kendall Concentration Trend: (See Note)

D

Data Table:

Well	Effective Date	Constituent	Result (mg/L)	Flag	Number of Samples	Number of Detects
PTX06-1038	2/22/2012	HEXAHYDRO-1,3,5-TRINITRO-	5.8E-01		1	1
PTX06-1038	8/2/2012	HEXAHYDRO-1,3,5-TRINITRO-	3.4E-01		1	1
PTX06-1038	2/19/2013	HEXAHYDRO-1,3,5-TRINITRO-	2.8E-01		1	1
PTX06-1038	9/3/2013	HEXAHYDRO-1,3,5-TRINITRO-	2.1E-01		1	1
PTX06-1038	2/19/2014	HEXAHYDRO-1,3,5-TRINITRO-	1.9E-01		1	1
PTX06-1038	8/20/2014	HEXAHYDRO-1,3,5-TRINITRO-	1.1E-01		1	1
PTX06-1038	3/11/2015	HEXAHYDRO-1,3,5-TRINITRO-	2.1E-01		1	1
PTX06-1038	9/22/2015	HEXAHYDRO-1,3,5-TRINITRO-	1.4E-01		1	1
PTX06-1038	2/11/2016	HEXAHYDRO-1,3,5-TRINITRO-	1.7E-01		2	2

MAROS Mann-Kendall Statistics Summary

Project: Pantex **User Name:** MV

Location: Southeast **State:** Texas

Well	Effective Date	Constituent	Result (mg/L)	Flag	Number of Samples	Number of Detects
PTX06-1038	9/28/2016	HEXAHYDRO-1,3,5-TRINITRO-	1.3E-01		1	1

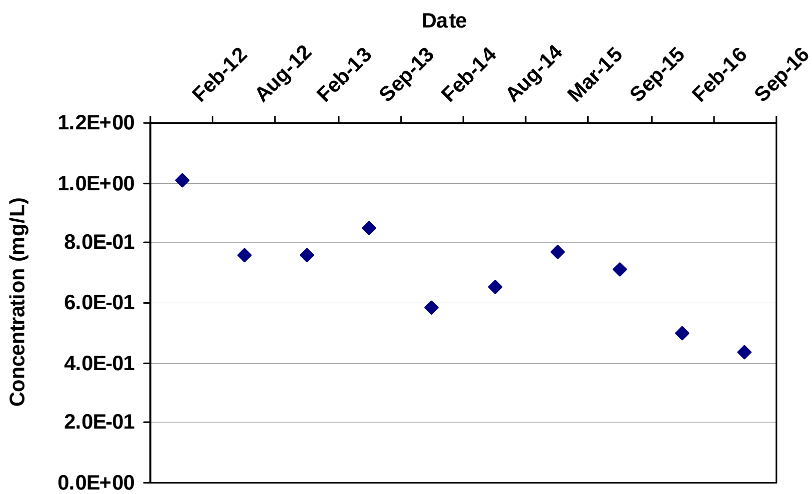
Note: Increasing (I); Probably Increasing (PI); Stable (S); Probably Decreasing (PD); Decreasing (D); No Trend (NT); Not Applicable (N/A) - Due to insufficient Data (< 4 sampling events); ND = Non-detect

MAROS Mann-Kendall Statistics Summary

Project: Pantex | **User Name:** MV
Location: Southeast | **State:** Texas

Well: PTX06-1042
Well Type: SEPTS
COC: HEXAHYDRO-1,3,5-TRINITRO-1,3,5-

Time Period: 2/22/2012 **to** 11/30/2016
Consolidation Period: No Time Consolidation
Duplicate Consolidation: Median
Consolidation Type: Average
ND Values: 1/2 Detection Limit
J Flag Values : Actual Value



Mann Kendall S Statistic:

-25

Confidence in Trend:

98.6%

Coefficient of Variation:

0.24

Mann Kendall Concentration Trend: (See Note)

D

Data Table:

Well	Effective Date	Constituent	Result (mg/L)	Flag	Number of Samples	Number of Detects
PTX06-1042	2/22/2012	HEXAHYDRO-1,3,5-TRINITRO-	1.0E+00		1	1
PTX06-1042	8/2/2012	HEXAHYDRO-1,3,5-TRINITRO-	7.6E-01		1	1
PTX06-1042	2/19/2013	HEXAHYDRO-1,3,5-TRINITRO-	7.6E-01		2	2
PTX06-1042	9/3/2013	HEXAHYDRO-1,3,5-TRINITRO-	8.5E-01		1	1
PTX06-1042	2/19/2014	HEXAHYDRO-1,3,5-TRINITRO-	5.8E-01		1	1
PTX06-1042	8/20/2014	HEXAHYDRO-1,3,5-TRINITRO-	6.5E-01		1	1
PTX06-1042	3/11/2015	HEXAHYDRO-1,3,5-TRINITRO-	7.7E-01		1	1
PTX06-1042	9/22/2015	HEXAHYDRO-1,3,5-TRINITRO-	7.1E-01		1	1
PTX06-1042	2/11/2016	HEXAHYDRO-1,3,5-TRINITRO-	5.0E-01		1	1

MAROS Mann-Kendall Statistics Summary

Project: Pantex **User Name:** MV

Location: Southeast **State:** Texas

Well	Effective Date	Constituent	Result (mg/L)	Flag	Number of Samples	Number of Detects
PTX06-1042	9/28/2016	HEXAHYDRO-1,3,5-TRINITRO-	4.3E-01		1	1

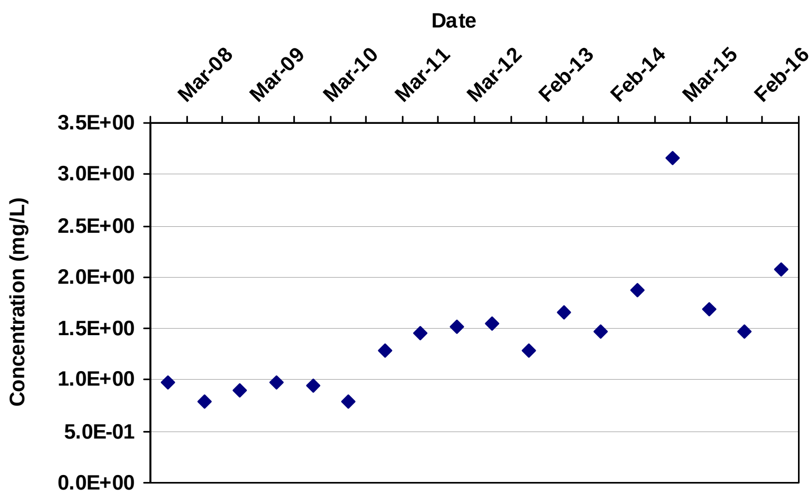
Note: Increasing (I); Probably Increasing (PI); Stable (S); Probably Decreasing (PD); Decreasing (D); No Trend (NT); Not Applicable (N/A) - Due to insufficient Data (< 4 sampling events); ND = Non-detect

MAROS Mann-Kendall Statistics Summary

Project: Pantex | **User Name:** MV

Location: Southeast | **State:** Texas

Well:	PTX06-1046	**Time Period:**	2/19/2008 **to** 11/30/2016
Well Type:	T	**Consolidation Period:**	No Time Consolidation
COC:	HEXAHYDRO-1,3,5-TRINITRO-1,3,5-	**Duplicate Consolidation:**	Median
		Consolidation Type:	Average
		ND Values:	1/2 Detection Limit
		J Flag Values :	Actual Value



Mann Kendall S Statistic:

103

Confidence in Trend:

100.0%

Coefficient of Variation:

0.40

Mann Kendall Concentration Trend: (See Note)

I

Data Table:

Well	Effective Date	Constituent	Result (mg/L)	Flag	Number of Samples	Number of Detects
PTX06-1046	3/20/2008	HEXAHYDRO-1,3,5-TRINITRO-	9.7E-01		2	2
PTX06-1046	8/28/2008	HEXAHYDRO-1,3,5-TRINITRO-	8.0E-01		2	2
PTX06-1046	3/31/2009	HEXAHYDRO-1,3,5-TRINITRO-	9.0E-01		2	2
PTX06-1046	9/30/2009	HEXAHYDRO-1,3,5-TRINITRO-	9.8E-01		1	1
PTX06-1046	3/30/2010	HEXAHYDRO-1,3,5-TRINITRO-	9.4E-01		1	1
PTX06-1046	9/20/2010	HEXAHYDRO-1,3,5-TRINITRO-	8.0E-01		1	1
PTX06-1046	3/8/2011	HEXAHYDRO-1,3,5-TRINITRO-	1.3E+00		1	1
PTX06-1046	8/24/2011	HEXAHYDRO-1,3,5-TRINITRO-	1.5E+00		1	1
PTX06-1046	3/31/2012	HEXAHYDRO-1,3,5-TRINITRO-	1.5E+00		1	1

MAROS Mann-Kendall Statistics Summary

Project: Pantex　　**User Name:** MV

Location: Southeast　　**State:** Texas

Well	Effective Date	Constituent	Result (mg/L)	Flag	Number of Samples	Number of Detects
PTX06-1046	8/2/2012	HEXAHYDRO-1,3,5-TRINITRO-	1.6E+00		1	1
PTX06-1046	2/19/2013	HEXAHYDRO-1,3,5-TRINITRO-	1.3E+00		1	1
PTX06-1046	9/3/2013	HEXAHYDRO-1,3,5-TRINITRO-	1.7E+00		1	1
PTX06-1046	2/19/2014	HEXAHYDRO-1,3,5-TRINITRO-	1.5E+00		1	1
PTX06-1046	8/20/2014	HEXAHYDRO-1,3,5-TRINITRO-	1.9E+00		1	1
PTX06-1046	3/11/2015	HEXAHYDRO-1,3,5-TRINITRO-	3.2E+00		1	1
PTX06-1046	9/22/2015	HEXAHYDRO-1,3,5-TRINITRO-	1.7E+00		2	2
PTX06-1046	2/11/2016	HEXAHYDRO-1,3,5-TRINITRO-	1.5E+00		1	1
PTX06-1046	9/28/2016	HEXAHYDRO-1,3,5-TRINITRO-	2.1E+00		1	1

Note: Increasing (I); Probably Increasing (PI); Stable (S); Probably Decreasing (PD); Decreasing (D); No Trend (NT); Not Applicable (N/A) - Due to insufficient Data (< 4 sampling events); ND = Non-detect

MAROS Mann-Kendall Statistics Summary

Project: Pantex **User Name:** MV

Location: Southeast **State:** Texas

Well: PTX06-1034 **Time Period:** 2/22/2012 **to** 11/30/2016

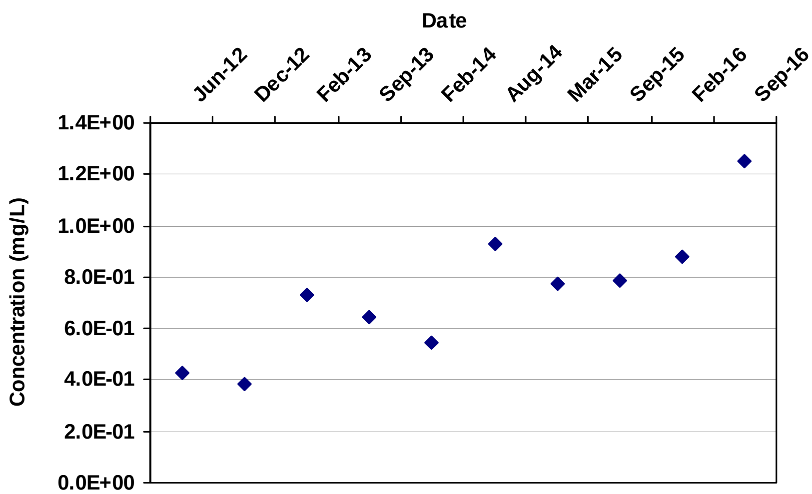
Well Type: Tail **Consolidation Period:** No Time Consolidation

COC: HEXAHYDRO-1,3,5-TRINITRO-1,3,5- **Duplicate Consolidation:** Median

Consolidation Type: Average

ND Values: 1/2 Detection Limit

J Flag Values : Actual Value



Mann Kendall S Statistic:

31

Confidence in Trend:

99.8%

Coefficient of Variation:

0.35

Mann Kendall Concentration Trend: (See Note)

I

Data Table:

Well	Effective Date	Constituent	Result (mg/L)	Flag	Number of Samples	Number of Detects
PTX06-1034	6/20/2012	HEXAHYDRO-1,3,5-TRINITRO-	4.3E-01		2	2
PTX06-1034	12/19/2012	HEXAHYDRO-1,3,5-TRINITRO-	3.8E-01		1	1
PTX06-1034	2/19/2013	HEXAHYDRO-1,3,5-TRINITRO-	7.3E-01		1	1
PTX06-1034	9/3/2013	HEXAHYDRO-1,3,5-TRINITRO-	6.5E-01		1	1
PTX06-1034	2/19/2014	HEXAHYDRO-1,3,5-TRINITRO-	5.4E-01		2	2
PTX06-1034	8/20/2014	HEXAHYDRO-1,3,5-TRINITRO-	9.3E-01		1	1
PTX06-1034	3/11/2015	HEXAHYDRO-1,3,5-TRINITRO-	7.7E-01		1	1
PTX06-1034	9/22/2015	HEXAHYDRO-1,3,5-TRINITRO-	7.9E-01		1	1
PTX06-1034	2/11/2016	HEXAHYDRO-1,3,5-TRINITRO-	8.8E-01		2	2

MAROS Mann-Kendall Statistics Summary

Project: Pantex **User Name:** MV

Location: Southeast **State:** Texas

Well	Effective Date	Constituent	Result (mg/L)	Flag	Number of Samples	Number of Detects
PTX06-1034	9/28/2016	HEXAHYDRO-1,3,5-TRINITRO-	1.3E+00		1	1

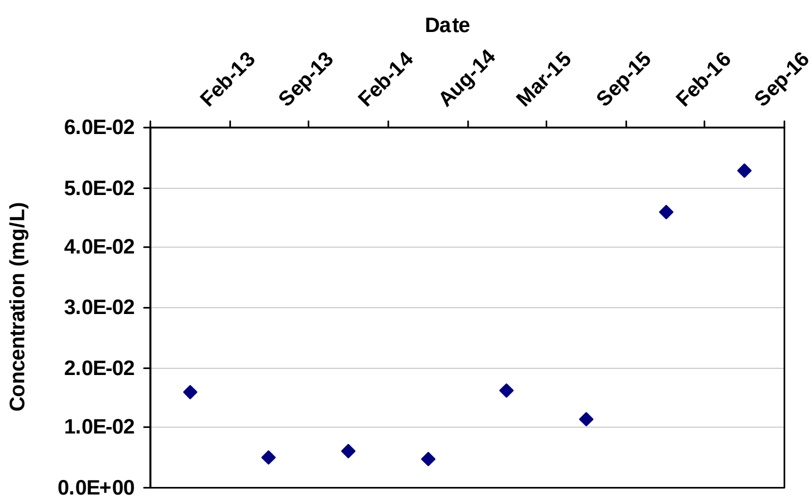
Note: Increasing (I); Probably Increasing (PI); Stable (S); Probably Decreasing (PD); Decreasing (D); No Trend (NT); Not Applicable (N/A) - Due to insufficient Data (< 4 sampling events); ND = Non-detect

MAROS Mann-Kendall Statistics Summary

Project: Pantex **User Name:** MV

Location: Southeast **State:** Texas

Well:	PTX06-1166	**Time Period:**	2/22/2012 **to** 11/30/2016
Well Type:	Tail	**Consolidation Period:**	No Time Consolidation
COC:	CHROMIUM, HEXAVALENT	**Duplicate Consolidation:**	Median
		Consolidation Type:	Average
		ND Values:	1/2 Detection Limit
		J Flag Values :	Actual Value



Mann Kendall S Statistic:

14

Confidence in Trend:

94.6%

Coefficient of Variation:

0.96

Mann Kendall Concentration Trend: (See Note)

PI

Data Table:

Well	Effective Date	Constituent	Result (mg/L)	Flag	Number of Samples	Number of Detects
PTX06-1166	2/19/2013	CHROMIUM, HEXAVALENT	1.6E-02		1	1
PTX06-1166	9/3/2013	CHROMIUM, HEXAVALENT	5.0E-03	ND	1	0
PTX06-1166	2/19/2014	CHROMIUM, HEXAVALENT	6.2E-03		1	1
PTX06-1166	8/20/2014	CHROMIUM, HEXAVALENT	4.7E-03		2	1
PTX06-1166	3/11/2015	CHROMIUM, HEXAVALENT	1.6E-02		1	1
PTX06-1166	9/22/2015	CHROMIUM, HEXAVALENT	1.2E-02		1	1
PTX06-1166	2/11/2016	CHROMIUM, HEXAVALENT	4.6E-02		1	1
PTX06-1166	9/28/2016	CHROMIUM, HEXAVALENT	5.3E-02		1	1

MAROS Mann-Kendall Statistics Summary

Project: Pantex **User Name:** MV

Location: Southeast **State:** Texas

Well	Effective Date	Constituent	Result (mg/L)	Flag	Number of Samples	Number of Detects

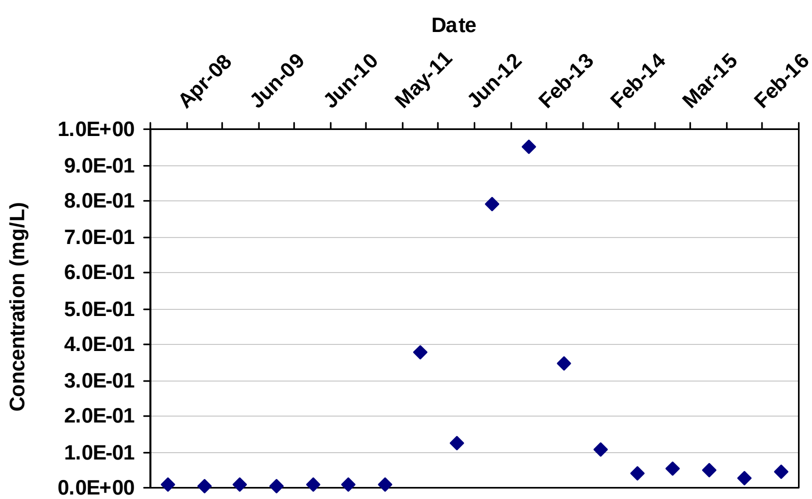
Note: Increasing (I); Probably Increasing (PI); Stable (S); Probably Decreasing (PD); Decreasing (D); No Trend (NT); Not Applicable (N/A) - Due to insufficient Data (< 4 sampling events); ND = Non-detect

MAROS Mann-Kendall Statistics Summary

Project: Pantex　　**User Name:** MV

Location: Southeast　　**State:** Texas

Well:	PTX06-1005	**Time Period:**	2/19/2008 **to** 11/30/2016
Well Type:	T	**Consolidation Period:**	No Time Consolidation
COC:	CHROMIUM, HEXAVALENT	**Duplicate Consolidation:**	Median
		Consolidation Type:	Average
		ND Values:	1/2 Detection Limit
		J Flag Values :	Actual Value



Mann Kendall S Statistic:

41

Confidence in Trend:

93.4%

Coefficient of Variation:

1.71

Mann Kendall Concentration Trend: (See Note)

PI

Data Table:

Well	Effective Date	Constituent	Result (mg/L)	Flag	Number of Samples	Number of Detects
PTX06-1005	4/22/2008	CHROMIUM, HEXAVALENT	8.0E-03		1	1
PTX06-1005	12/18/2008	CHROMIUM, HEXAVALENT	6.0E-03		1	1
PTX06-1005	6/22/2009	CHROMIUM, HEXAVALENT	8.0E-03		1	1
PTX06-1005	12/16/2009	CHROMIUM, HEXAVALENT	6.0E-03		1	1
PTX06-1005	6/17/2010	CHROMIUM, HEXAVALENT	7.5E-03	ND	1	0
PTX06-1005	11/29/2010	CHROMIUM, HEXAVALENT	8.0E-03		1	1
PTX06-1005	5/31/2011	CHROMIUM, HEXAVALENT	7.0E-03		1	1
PTX06-1005	12/15/2011	CHROMIUM, HEXAVALENT	3.8E-01		1	1
PTX06-1005	6/20/2012	CHROMIUM, HEXAVALENT	1.2E-01		1	1

MAROS Mann-Kendall Statistics Summary

Project: Pantex **User Name:** MV

Location: Southeast **State:** Texas

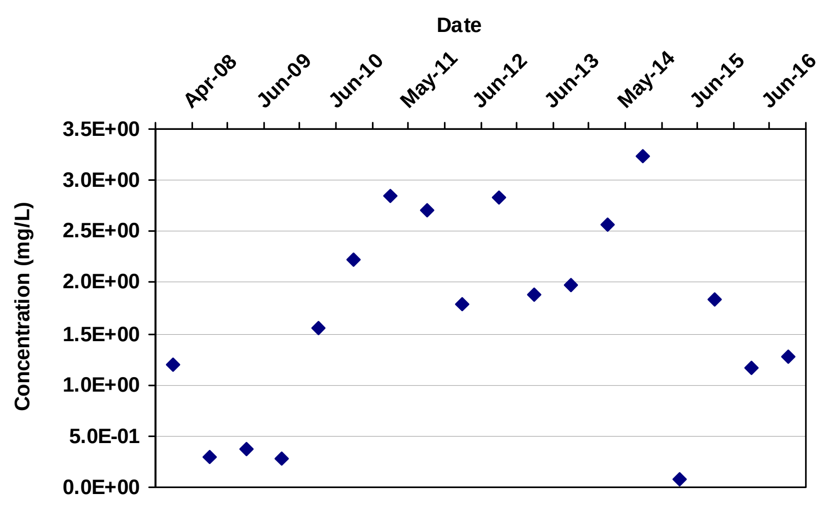
Well	Effective Date	Constituent	Result (mg/L)	Flag	Number of Samples	Number of Detects
PTX06-1005	12/19/2012	CHROMIUM, HEXAVALENT	7.9E-01		1	1
PTX06-1005	2/19/2013	CHROMIUM, HEXAVALENT	9.5E-01		1	1
PTX06-1005	9/3/2013	CHROMIUM, HEXAVALENT	3.5E-01		1	1
PTX06-1005	2/19/2014	CHROMIUM, HEXAVALENT	1.1E-01		2	2
PTX06-1005	8/20/2014	CHROMIUM, HEXAVALENT	4.0E-02		1	1
PTX06-1005	3/11/2015	CHROMIUM, HEXAVALENT	5.4E-02		1	1
PTX06-1005	9/22/2015	CHROMIUM, HEXAVALENT	5.1E-02		1	1
PTX06-1005	2/11/2016	CHROMIUM, HEXAVALENT	2.7E-02		1	1
PTX06-1005	9/28/2016	CHROMIUM, HEXAVALENT	4.6E-02		1	1

Note: Increasing (I); Probably Increasing (PI); Stable (S); Probably Decreasing (PD); Decreasing (D); No Trend (NT); Not Applicable (N/A) - Due to insufficient Data (< 4 sampling events); ND = Non-detect

MAROS Mann-Kendall Statistics Summary

Project: Pantex | **User Name:** MV
Location: Southeast | **State:** Texas

Well:	PTX06-1010	**Time Period:**	2/19/2008 **to** 11/30/2016
Well Type:	S	**Consolidation Period:**	No Time Consolidation
COC:	CHROMIUM, HEXAVALENT	**Duplicate Consolidation:**	Median
		Consolidation Type:	Average
		ND Values:	1/2 Detection Limit
		J Flag Values :	Actual Value



Mann Kendall S Statistic:

21

Confidence in Trend:

77.3%

Coefficient of Variation:

0.58

Mann Kendall Concentration Trend: (See Note)

NT

Data Table:

Well	Effective Date	Constituent	Result (mg/L)	Flag	Number of Samples	Number of Detects
PTX06-1010	4/24/2008	CHROMIUM, HEXAVALENT	1.2E+00		1	1
PTX06-1010	12/18/2008	CHROMIUM, HEXAVALENT	2.9E-01		1	1
PTX06-1010	6/22/2009	CHROMIUM, HEXAVALENT	3.7E-01		1	1
PTX06-1010	12/16/2009	CHROMIUM, HEXAVALENT	2.9E-01		1	1
PTX06-1010	6/17/2010	CHROMIUM, HEXAVALENT	1.6E+00		2	2
PTX06-1010	11/29/2010	CHROMIUM, HEXAVALENT	2.2E+00		1	1
PTX06-1010	5/31/2011	CHROMIUM, HEXAVALENT	2.8E+00		1	1
PTX06-1010	12/15/2011	CHROMIUM, HEXAVALENT	2.7E+00		1	1
PTX06-1010	6/20/2012	CHROMIUM, HEXAVALENT	1.8E+00		1	1

MAROS Mann-Kendall Statistics Summary

Project: Pantex **User Name:** MV

Location: Southeast **State:** Texas

Well	Effective Date	Constituent	Result (mg/L)	Flag	Number of Samples	Number of Detects
PTX06-1010	12/19/2012	CHROMIUM, HEXAVALENT	2.8E+00		1	1
PTX06-1010	6/18/2013	CHROMIUM, HEXAVALENT	1.9E+00		1	1
PTX06-1010	11/20/2013	CHROMIUM, HEXAVALENT	2.0E+00		1	1
PTX06-1010	5/21/2014	CHROMIUM, HEXAVALENT	2.6E+00		1	1
PTX06-1010	11/10/2014	CHROMIUM, HEXAVALENT	3.2E+00		1	1
PTX06-1010	6/22/2015	CHROMIUM, HEXAVALENT	8.3E-02		1	1
PTX06-1010	12/8/2015	CHROMIUM, HEXAVALENT	1.8E+00		1	1
PTX06-1010	6/27/2016	CHROMIUM, HEXAVALENT	1.2E+00		1	1
PTX06-1010	9/28/2016	CHROMIUM, HEXAVALENT	1.3E+00		3	3

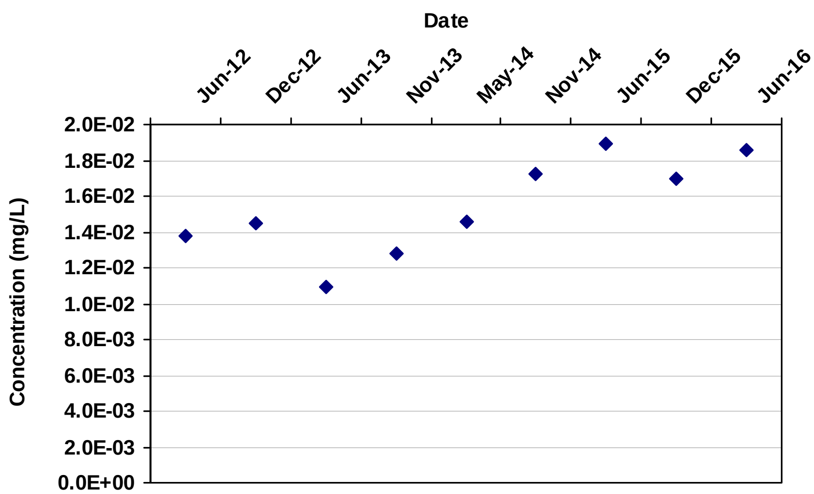
Note: Increasing (I); Probably Increasing (PI); Stable (S); Probably Decreasing (PD); Decreasing (D); No Trend (NT); Not Applicable (N/A) - Due to insufficient Data (< 4 sampling events); ND = Non-detect

MAROS Mann-Kendall Statistics Summary

Project: Pantex **User Name:** MV

Location: Southeast **State:** Texas

Well:	PTX06-1030	**Time Period:**	2/22/2012 **to** 11/30/2016
Well Type:	Tail	**Consolidation Period:**	No Time Consolidation
COC:	4-AMINO-2,6-DINITROTOLUENE	**Duplicate Consolidation:**	Median
		Consolidation Type:	Average
		ND Values:	1/2 Detection Limit
		J Flag Values :	Actual Value



Mann Kendall S Statistic:

22

Confidence in Trend:

98.8%

Coefficient of Variation:

0.18

Mann Kendall Concentration Trend: (See Note)

I

Data Table:

Well	Effective Date	Constituent	Result (mg/L)	Flag	Number of Samples	Number of Detects
PTX06-1030	6/20/2012	4-AMINO-2,6-DINITROTOLUE	1.4E-02		1	1
PTX06-1030	12/19/2012	4-AMINO-2,6-DINITROTOLUE	1.5E-02		1	1
PTX06-1030	6/18/2013	4-AMINO-2,6-DINITROTOLUE	1.1E-02		1	1
PTX06-1030	11/20/2013	4-AMINO-2,6-DINITROTOLUE	1.3E-02		1	1
PTX06-1030	5/21/2014	4-AMINO-2,6-DINITROTOLUE	1.5E-02		1	1
PTX06-1030	11/10/2014	4-AMINO-2,6-DINITROTOLUE	1.7E-02		1	1
PTX06-1030	6/22/2015	4-AMINO-2,6-DINITROTOLUE	1.9E-02		1	1
PTX06-1030	12/8/2015	4-AMINO-2,6-DINITROTOLUE	1.7E-02		1	1
PTX06-1030	6/27/2016	4-AMINO-2,6-DINITROTOLUE	1.9E-02		1	1

MAROS Mann-Kendall Statistics Summary

Project: Pantex **User Name:** MV

Location: Southeast **State:** Texas

Well	Effective Date	Constituent	Result (mg/L)	Flag	Number of Samples	Number of Detects

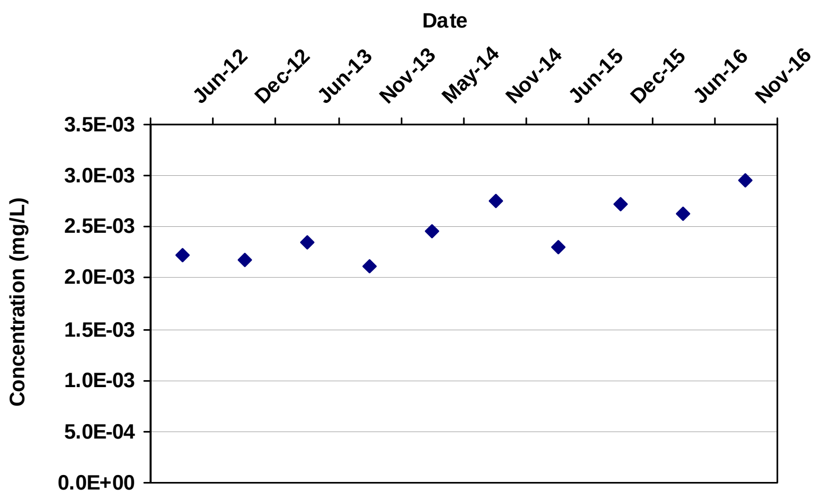
Note: Increasing (I); Probably Increasing (PI); Stable (S); Probably Decreasing (PD); Decreasing (D); No Trend (NT); Not Applicable (N/A) - Due to insufficient Data (< 4 sampling events); ND = Non-detect

MAROS Mann-Kendall Statistics Summary

Project: Pantex | **User Name:** MV

Location: Southeast | **State:** Texas

Well:	PTX06-1031	**Time Period:**	2/22/2012 **to** 11/30/2016
Well Type:	Tail	**Consolidation Period:**	No Time Consolidation
COC:	4-AMINO-2,6-DINITROTOLUENE	**Duplicate Consolidation:**	Median
		Consolidation Type:	Average
		ND Values:	1/2 Detection Limit
		J Flag Values :	Actual Value



Mann Kendall S Statistic:

25

Confidence in Trend:

98.6%

Coefficient of Variation:

0.11

Mann Kendall Concentration Trend: (See Note)

I

Data Table:

Well	Effective Date	Constituent	Result (mg/L)	Flag	Number of Samples	Number of Detects
PTX06-1031	6/20/2012	4-AMINO-2,6-DINITROTOLUE	2.2E-03		1	1
PTX06-1031	12/19/2012	4-AMINO-2,6-DINITROTOLUE	2.2E-03		1	1
PTX06-1031	6/18/2013	4-AMINO-2,6-DINITROTOLUE	2.4E-03		1	1
PTX06-1031	11/20/2013	4-AMINO-2,6-DINITROTOLUE	2.1E-03		1	1
PTX06-1031	5/21/2014	4-AMINO-2,6-DINITROTOLUE	2.5E-03		1	1
PTX06-1031	11/10/2014	4-AMINO-2,6-DINITROTOLUE	2.8E-03		1	1
PTX06-1031	6/22/2015	4-AMINO-2,6-DINITROTOLUE	2.3E-03		1	1
PTX06-1031	12/8/2015	4-AMINO-2,6-DINITROTOLUE	2.7E-03		1	1
PTX06-1031	6/27/2016	4-AMINO-2,6-DINITROTOLUE	2.6E-03		1	1

MAROS Mann-Kendall Statistics Summary

Project: Pantex **User Name:** MV

Location: Southeast **State:** Texas

Well	Effective Date	Constituent	Result (mg/L)	Flag	Number of Samples	Number of Detects
PTX06-1031	11/30/2016	4-AMINO-2,6-DINITROTOLUE	3.0E-03		1	1

Note: Increasing (I); Probably Increasing (PI); Stable (S); Probably Decreasing (PD); Decreasing (D); No Trend (NT); Not Applicable (N/A) - Due to insufficient Data (< 4 sampling events); ND = Non-detect

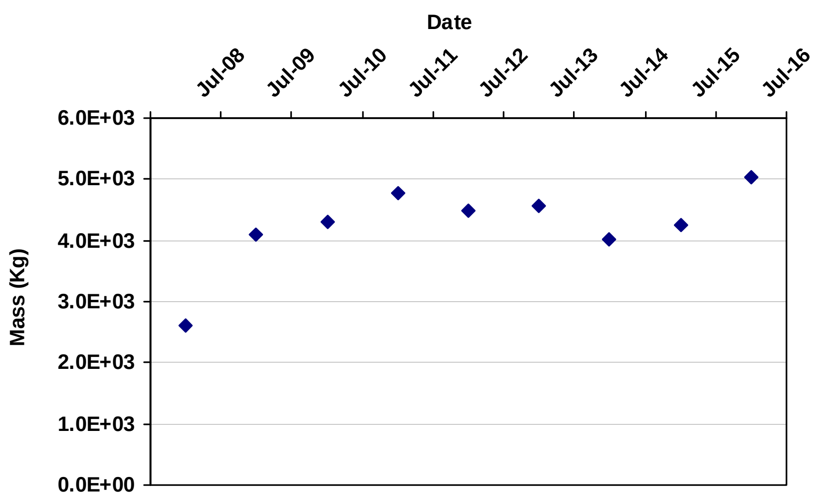
MAROS Zeroth Moment Analysis

Project: Pantex **User Name:** MV

Location: Southeast **State:** Texas

Change in Dissolved Mass Over Time

COC: HEXAHYDRO-1,3,5-TRINITRO-1,3,5-TRIAZINE



Porosity: 0.25

Saturated Thickness:

Uniform: 30 ft

Mann-Kendall S Statistic:

14

Confidence in Trend:

91.0%

Coefficient of Variation:

0.16

Zeroth Moment Trend:

PI

Data Table:

Effective Date	Constituent	Estimated Mass (Kg)	Number of Wells
7/1/2008	HEXAHYDRO-1,3,5-TRINITRO-1,3,	2.6E+03	36
7/1/2009	HEXAHYDRO-1,3,5-TRINITRO-1,3,	4.1E+03	41
7/1/2010	HEXAHYDRO-1,3,5-TRINITRO-1,3,	4.3E+03	45
7/1/2011	HEXAHYDRO-1,3,5-TRINITRO-1,3,	4.8E+03	45
7/1/2012	HEXAHYDRO-1,3,5-TRINITRO-1,3,	4.5E+03	46
7/1/2013	HEXAHYDRO-1,3,5-TRINITRO-1,3,	4.6E+03	45
7/1/2014	HEXAHYDRO-1,3,5-TRINITRO-1,3,	4.0E+03	43
7/1/2015	HEXAHYDRO-1,3,5-TRINITRO-1,3,	4.3E+03	43
7/1/2016	HEXAHYDRO-1,3,5-TRINITRO-1,3,	5.0E+03	45

Note: Increasing (I); Probably Increasing (PI); Stable (S); Probably Decreasing (PD); Decreasing (D); No Trend (NT); Not Applicable (N/A) - Due to insufficient Data (< 4 sampling events); ND = Non-detect. Moments are not calculated for sample events with less than 6 wells.

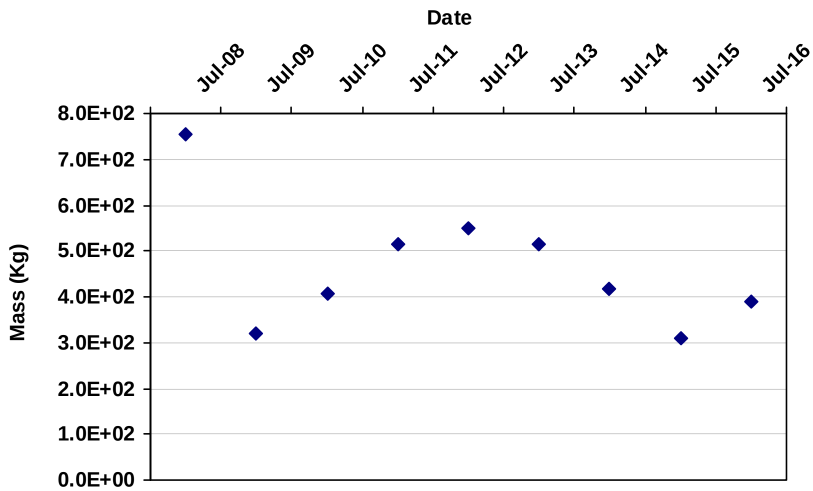
MAROS Zeroth Moment Analysis

Project: Pantex **User Name:** MV

Location: Southeast **State:** Texas

Change in Dissolved Mass Over Time

COC: CHROMIUM, HEXAVALENT



Porosity: 0.25

Saturated Thickness:

Uniform: 30 ft

Mann-Kendall S Statistic:

-12

Confidence in Trend:

87.0%

Coefficient of Variation:

0.30

Zeroth Moment Trend:

S

Data Table:

Effective Date	Constituent	Estimated Mass (Kg)	Number of Wells
7/1/2008	CHROMIUM, HEXAVALENT	7.6E+02	31
7/1/2009	CHROMIUM, HEXAVALENT	3.2E+02	41
7/1/2010	CHROMIUM, HEXAVALENT	4.1E+02	45
7/1/2011	CHROMIUM, HEXAVALENT	5.2E+02	43
7/1/2012	CHROMIUM, HEXAVALENT	5.5E+02	45
7/1/2013	CHROMIUM, HEXAVALENT	5.1E+02	44
7/1/2014	CHROMIUM, HEXAVALENT	4.2E+02	42
7/1/2015	CHROMIUM, HEXAVALENT	3.1E+02	42
7/1/2016	CHROMIUM, HEXAVALENT	3.9E+02	41

Note: Increasing (I); Probably Increasing (PI); Stable (S); Probably Decreasing (PD); Decreasing (D); No Trend (NT); Not Applicable (N/A) - Due to insufficient Data (< 4 sampling events); ND = Non-detect. Moments are not calculated for sample events with less than 6 wells.

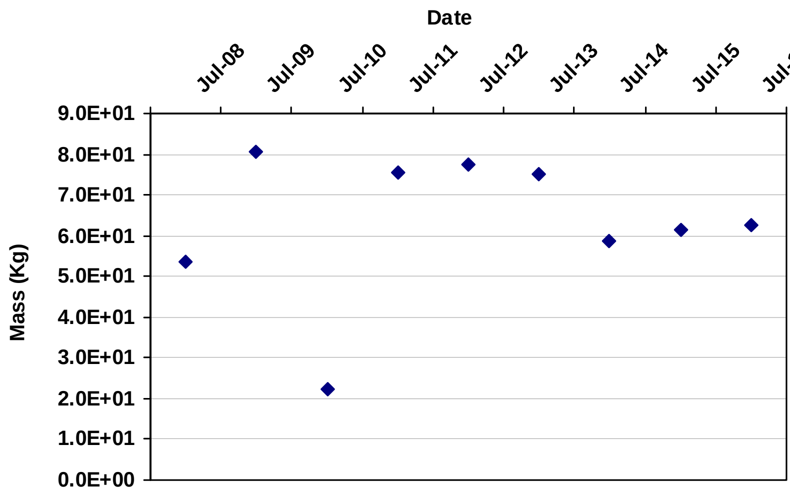
MAROS Zeroth Moment Analysis

Project: Pantex **User Name:** MV

Location: Southeast **State:** Texas

Change in Dissolved Mass Over Time

COC: 4-AMINO-2,6-DINITROTOLUENE



Porosity: 0.25

Saturated Thickness:

Uniform: 30 ft

Mann-Kendall S Statistic:

-2

Confidence in Trend:

54.0%

Coefficient of Variation:

0.28

Zeroth Moment Trend:

S

Data Table:

Effective Date	Constituent	Estimated Mass (Kg)	Number of Wells
7/1/2008	4-AMINO-2,6-DINITROTOLUENE	5.4E+01	36
7/1/2009	4-AMINO-2,6-DINITROTOLUENE	8.1E+01	40
7/1/2010	4-AMINO-2,6-DINITROTOLUENE	2.2E+01	45
7/1/2011	4-AMINO-2,6-DINITROTOLUENE	7.5E+01	45
7/1/2012	4-AMINO-2,6-DINITROTOLUENE	7.7E+01	46
7/1/2013	4-AMINO-2,6-DINITROTOLUENE	7.5E+01	45
7/1/2014	4-AMINO-2,6-DINITROTOLUENE	5.9E+01	43
7/1/2015	4-AMINO-2,6-DINITROTOLUENE	6.1E+01	43
7/1/2016	4-AMINO-2,6-DINITROTOLUENE	6.2E+01	45

Note: Increasing (I); Probably Increasing (PI); Stable (S); Probably Decreasing (PD); Decreasing (D); No Trend (NT); Not Applicable (N/A) - Due to insufficient Data (< 4 sampling events); ND = Non-detect. Moments are not calculated for sample events with less than 6 wells.

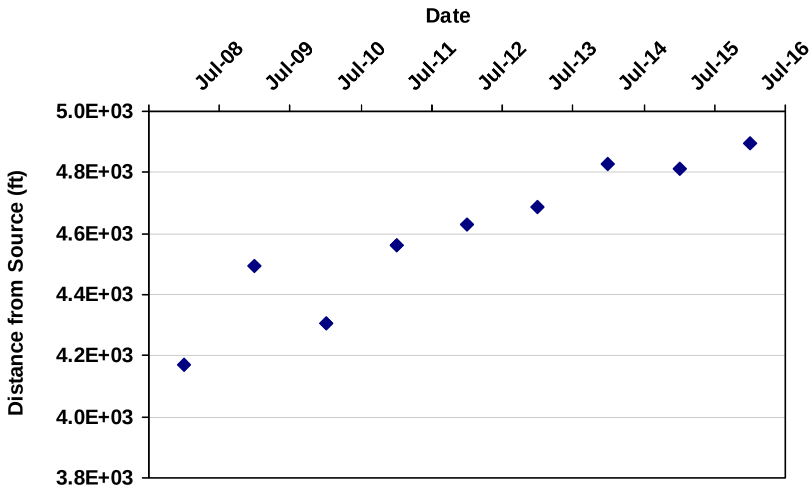
MAROS First Moment Analysis

Project: Pantex **User Name:** MV

Location: Southeast **State:** Texas

COC: HEXAHYDRO-1,3,5-TRINITRO-1,3,5-TRIAZINE

Distance from Source to Center of Mass



Mann-Kendall S Statistic:
32

Confidence in Trend:
100.0%

Coefficient of Variation:
0.05

First Moment Trend:
I

DATA TABLE

Effective Date	Constituent	Xc (ft)	Yc (ft)	Distance from Source	Number of Wells
7/1/2008	HEXAHYDRO-1,3,5-TRINITRO-	643,332	3,755,720	4,168	36
7/1/2009	HEXAHYDRO-1,3,5-TRINITRO-	644,020	3,756,304	4,493	41
7/1/2010	HEXAHYDRO-1,3,5-TRINITRO-	643,886	3,756,466	4,308	45
7/1/2011	HEXAHYDRO-1,3,5-TRINITRO-	644,055	3,756,210	4,563	45
7/1/2012	HEXAHYDRO-1,3,5-TRINITRO-	644,054	3,756,055	4,627	46
7/1/2013	HEXAHYDRO-1,3,5-TRINITRO-	644,081	3,755,978	4,685	45
7/1/2014	HEXAHYDRO-1,3,5-TRINITRO-	644,128	3,755,761	4,828	43
7/1/2015	HEXAHYDRO-1,3,5-TRINITRO-	644,092	3,755,731	4,810	43
7/1/2016	HEXAHYDRO-1,3,5-TRINITRO-	644,079	3,755,539	4,895	45

Note: Increasing (I); Probably Increasing (PI); Stable (S); Probably Decreasing (PD); Decreasing (D); No Trend (NT); Not Applicable (N/A) - Due to insufficient Data (< 4 sampling events). Moments are not calculated for sample events with less than 6 wells.

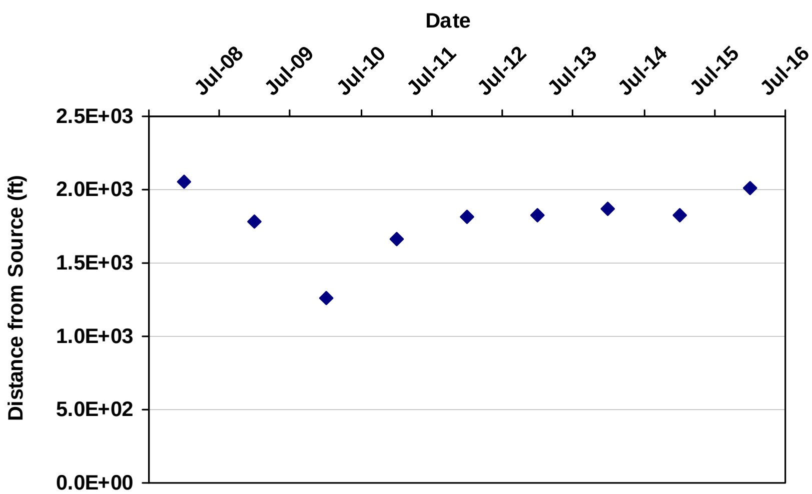
MAROS First Moment Analysis

Project: Pantex **User Name:** MV

Location: Southeast **State:** Texas

COC: CHROMIUM, HEXAVALENT

Distance from Source to Center of Mass



Mann-Kendall S Statistic:

12

Confidence in Trend:

87.0%

Coefficient of Variation:

0.13

First Moment Trend:

NT

DATA TABLE

Effective Date	Constituent	Xc (ft)	Yc (ft)	Distance from Source	Number of Wells
7/1/2008	CHROMIUM, HEXAVALENT	640,226	3,756,042	2,054	31
7/1/2009	CHROMIUM, HEXAVALENT	640,898	3,756,604	1,778	41
7/1/2010	CHROMIUM, HEXAVALENT	640,758	3,757,162	1,256	45
7/1/2011	CHROMIUM, HEXAVALENT	641,105	3,756,941	1,659	43
7/1/2012	CHROMIUM, HEXAVALENT	641,099	3,756,714	1,816	45
7/1/2013	CHROMIUM, HEXAVALENT	641,213	3,756,806	1,830	44
7/1/2014	CHROMIUM, HEXAVALENT	640,801	3,756,442	1,864	42
7/1/2015	CHROMIUM, HEXAVALENT	641,177	3,756,769	1,829	42
7/1/2016	CHROMIUM, HEXAVALENT	640,714	3,756,234	2,011	41

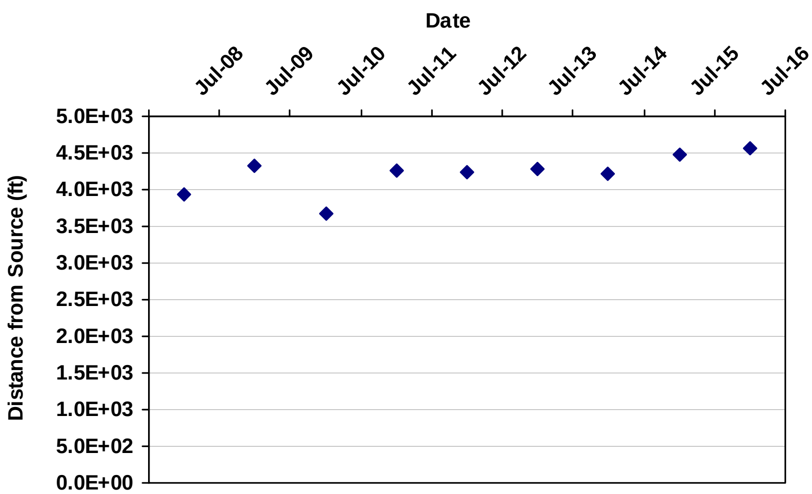
Note: Increasing (I); Probably Increasing (PI); Stable (S); Probably Decreasing (PD); Decreasing (D); No Trend (NT); Not Applicable (N/A) - Due to insufficient Data (< 4 sampling events). Moments are not calculated for sample events with less than 6 wells.

MAROS First Moment Analysis

Project: Pantex | **User Name:** MV
Location: Southeast | **State:** Texas

COC: 4-AMINO-2,6-DINITROTOLUENE

Distance from Source to Center of Mass



Mann-Kendall S Statistic:
16

Confidence in Trend:
94.0%

Coefficient of Variation:
0.06

First Moment Trend:
PI

DATA TABLE

Effective Date	Constituent	Xc (ft)	Yc (ft)	Distance from Source	Number of Wells
7/1/2008	4-AMINO-2,6-DINITROTOLUE	643,498	3,756,491	3,940	36
7/1/2009	4-AMINO-2,6-DINITROTOLUE	644,128	3,757,178	4,334	40
7/1/2010	4-AMINO-2,6-DINITROTOLUE	643,545	3,758,449	3,678	45
7/1/2011	4-AMINO-2,6-DINITROTOLUE	644,058	3,757,205	4,259	45
7/1/2012	4-AMINO-2,6-DINITROTOLUE	643,969	3,756,927	4,238	46
7/1/2013	4-AMINO-2,6-DINITROTOLUE	644,010	3,756,949	4,272	45
7/1/2014	4-AMINO-2,6-DINITROTOLUE	643,906	3,756,796	4,216	43
7/1/2015	4-AMINO-2,6-DINITROTOLUE	644,170	3,756,790	4,470	43
7/1/2016	4-AMINO-2,6-DINITROTOLUE	644,322	3,756,968	4,569	45

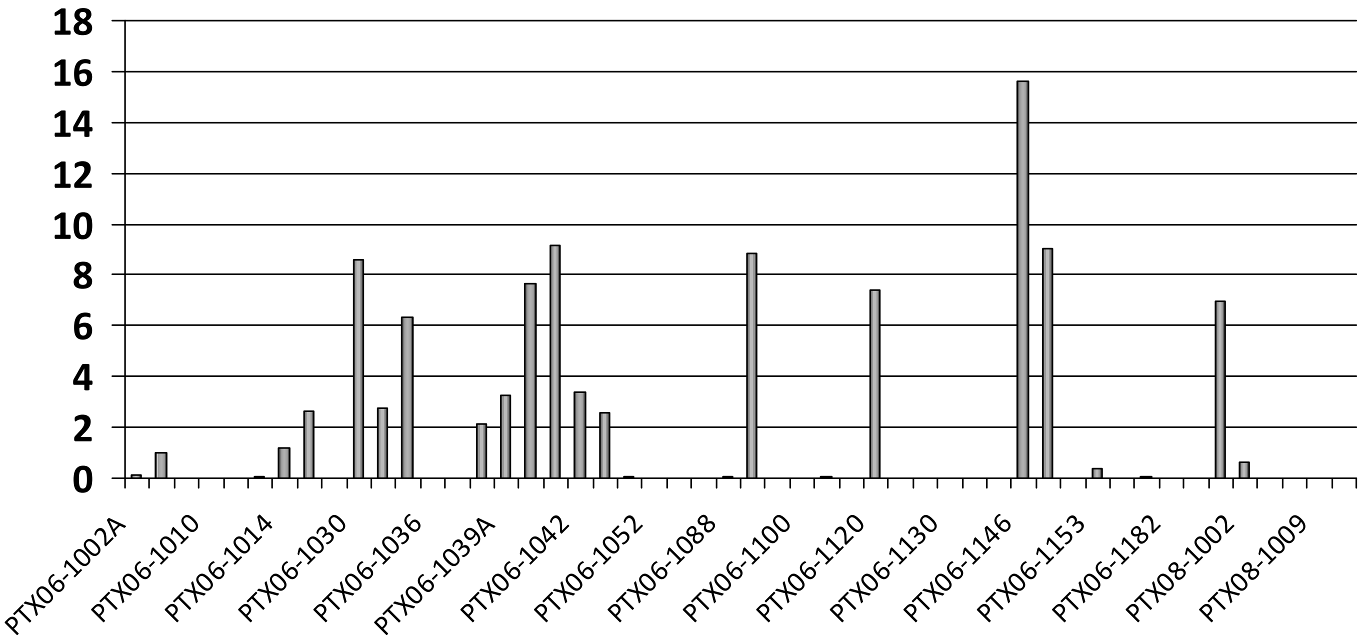
Note: Increasing (I); Probably Increasing (PI); Stable (S); Probably Decreasing (PD); Decreasing (D); No Trend (NT); Not Applicable (N/A) - Due to insufficient Data (< 4 sampling events). Moments are not calculated for sample events with less than 6 wells.

MAROS Percent of Mass by Well

Project: Pantex **User Name:** MV

Location: Southeast **State:** Texas

HEXAHYDRO-1,3,5-TRINITRO-1,3,5-TRIAZINE 7/1/2016



Well	Area (ft2)	Mass (mg)	Percent of Mass	Percent of Area
PTX06-1002A	5,898,553.56	12,170.19	0.11	6.09
PTX06-1005	2,780,965.17	106,178.99	0.99	2.87
PTX06-1008	954,160.68	31.93	0.00	0.98
PTX06-1010	2,700,073.87	599.26	0.01	2.79
PTX06-1011	2,169,869.21	328.65	0.00	2.24
PTX06-1013	3,626,944.53	5,369.69	0.05	3.74
PTX06-1014	1,093,970.16	126,927.89	1.19	1.13
PTX06-1015	1,324,787.40	280,118.03	2.62	1.37
PTX06-1023	959,172.23	27.90	0.00	0.99
PTX06-1030	2,977,515.14	914,469.38	8.57	3.07
PTX06-1031	1,670,955.38	294,975.86	2.76	1.72
PTX06-1034	2,414,519.71	674,216.93	6.32	2.49
PTX06-1036	684,787.18	179.76	0.00	0.71
PTX06-1037	406,879.34	13.83	0.00	0.42

MAROS Percent of Mass by Well

Project: Pantex **User Name:** MV

Location: Southeast **State:** Texas

Well	Area (ft2)	Mass (mg)	Percent of Mass	Percent of Area
PTX06-1038	5,720,024.85	228,604.38	2.14	5.90
PTX06-1039A	1,994,280.36	351,005.82	3.29	2.06
PTX06-1040	2,435,227.30	818,236.41	7.66	2.51
PTX06-1041	3,629,713.53	977,572.64	9.16	3.75
PTX06-1042	2,977,062.19	363,778.41	3.41	3.07
PTX06-1046	591,554.05	274,850.82	2.57	0.61
PTX06-1047A	947,060.87	6,998.19	0.07	0.98
PTX06-1052	1,327,447.84	61.52	0.00	1.37
PTX06-1053	466,526.33	26.21	0.00	0.48
PTX06-1069	3,390,949.03	121.06	0.00	3.50
PTX06-1088	1,598,085.73	3,943.28	0.04	1.65
PTX06-1095A	2,651,449.16	943,087.37	8.83	2.74
PTX06-1098	1,144,173.42	38.89	0.00	1.18
PTX06-1100	71,341.35	2.46	0.00	0.07
PTX06-1101	952,746.22	5,777.22	0.05	0.98
PTX06-1102	2,444,361.96	641.65	0.01	2.52
PTX06-1120	1,092,498.57	787,213.54	7.37	1.13
PTX06-1121	516,703.16	135.63	0.00	0.53
PTX06-1123	843,440.38	221.40	0.00	0.87
PTX06-1130	3,861,086.71	1,013.54	0.01	3.99
PTX06-1133A	841,645.35	156.42	0.00	0.87
PTX06-1135	1,931,066.98	674.18	0.01	1.99
PTX06-1146	5,493,266.26	1,665,489.74	15.60	5.67
PTX06-1147	3,428,772.14	967,106.66	9.06	3.54
PTX06-1148	514,389.34	17.49	0.00	0.53
PTX06-1153	606,017.64	43,031.04	0.40	0.63
PTX06-1154	297,271.88	10.01	0.00	0.31
PTX06-1166	1,013,436.57	4,336.24	0.04	1.05
PTX06-1182	475,401.59	2,140.20	0.02	0.49
PTX06-1183	580,191.68	23.00	0.00	0.60
PTX06-PRB16	2,119,512.46	745,538.54	6.98	2.19

MAROS Percent of Mass by Well

Project: Pantex **User Name:** MV

Location: Southeast **State:** Texas

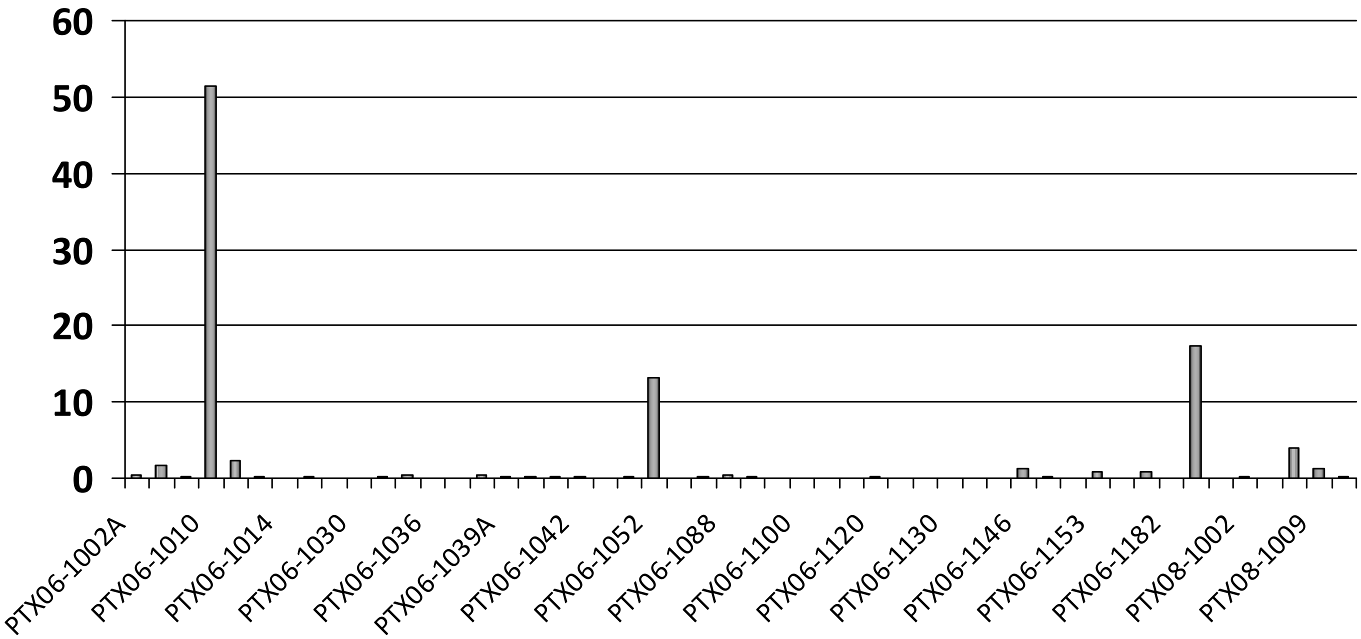
Well	Area (ft2)	Mass (mg)	Percent of Mass	Percent of Area
PTX08-1002	3,530,174.71	64,079.29	0.60	3.64
PTX08-1007	1,202,127.31	2,133.18	0.02	1.24
PTX08-1008	2,258,743.43	93.38	0.00	2.33
PTX08-1009	2,528,484.34	87.11	0.00	2.61
PTX10-1014	1,735,116.57	1,188.77	0.01	1.79
	96,874,504.8	10,675,044.0	100	100

MAROS Percent of Mass by Well

Project: Pantex **User Name:** MV

Location: Southeast **State:** Texas

CHROMIUM, HEXAVALENT 7/1/2016



Well	Area (ft2)	Mass (mg)	Percent of Mass	Percent of Area
PTX06-1002A	5,898,553.56	7,741.85	0.46	6.09
PTX06-1005	2,780,965.17	26,535.62	1.58	2.87
PTX06-1008	954,160.68	5,159.62	0.31	0.98
PTX06-1010	2,700,073.87	865,008.73	51.49	2.79
PTX06-1011	2,169,869.21	37,479.07	2.23	2.24
PTX06-1013	3,626,944.53	4,760.36	0.28	3.74
PTX06-1014	1,093,970.16	792.98	0.05	1.13
PTX06-1015	1,324,787.40	4,746.88	0.28	1.37
PTX06-1023	959,172.23	1,258.91	0.07	0.99
PTX06-1030	2,977,515.14	781.60	0.05	3.07
PTX06-1031	1,670,955.38	1,978.20	0.12	1.72
PTX06-1034	2,414,519.71	5,482.47	0.33	2.49
PTX06-1036	684,787.18	179.76	0.01	0.71
PTX06-1037	406,879.34	534.03	0.03	0.42

MAROS Percent of Mass by Well

Project: Pantex **User Name:** MV

Location: Southeast **State:** Texas

Well	Area (ft2)	Mass (mg)	Percent of Mass	Percent of Area
PTX06-1038	5,720,024.85	7,507.53	0.45	5.90
PTX06-1039A	1,994,280.36	2,617.49	0.16	2.06
PTX06-1040	2,435,227.30	3,196.24	0.19	2.51
PTX06-1041	3,629,713.53	3,963.65	0.24	3.75
PTX06-1042	2,977,062.19	3,907.39	0.23	3.07
PTX06-1046	591,554.05	1,407.64	0.08	0.61
PTX06-1047A	947,060.87	3,231.85	0.19	0.98
PTX06-1052	1,327,447.84	222,488.57	13.24	1.37
PTX06-1053	466,526.33	612.32	0.04	0.48
PTX06-1069	3,390,949.03	4,450.62	0.26	3.50
PTX06-1088	1,598,085.73	6,565.14	0.39	1.65
PTX06-1095A	2,651,449.16	4,631.92	0.28	2.74
PTX06-1098	1,144,173.42	1,528.76	0.09	1.18
PTX06-1100	71,341.35	93.64	0.01	0.07
PTX06-1101	952,746.22	1,250.48	0.07	0.98
PTX06-1102	2,444,361.96	641.65	0.04	2.52
PTX06-1120	1,092,498.57	2,262.70	0.13	1.13
PTX06-1121	516,703.16	135.63	0.01	0.53
PTX06-1123	843,440.38	221.40	0.01	0.87
PTX06-1130	3,861,086.71	1,013.54	0.06	3.99
PTX06-1133A	841,645.35	1,104.66	0.07	0.87
PTX06-1135	1,931,066.98	506.91	0.03	1.99
PTX06-1146	5,493,266.26	21,081.78	1.25	5.67
PTX06-1147	3,428,772.14	4,500.26	0.27	3.54
PTX06-1148	514,389.34	135.03	0.01	0.53
PTX06-1153	606,017.64	13,330.87	0.79	0.63
PTX06-1154	297,271.88	1,443.63	0.09	0.31
PTX06-1166	1,013,436.57	13,141.74	0.78	1.05
PTX06-1182	475,401.59	623.96	0.04	0.49
PTX06-1183	580,191.68	292,416.62	17.40	0.60
PTX06-PRB16	2,119,512.46	556.37	0.03	2.19

MAROS Percent of Mass by Well

Project: Pantex **User Name:** MV

Location: Southeast **State:** Texas

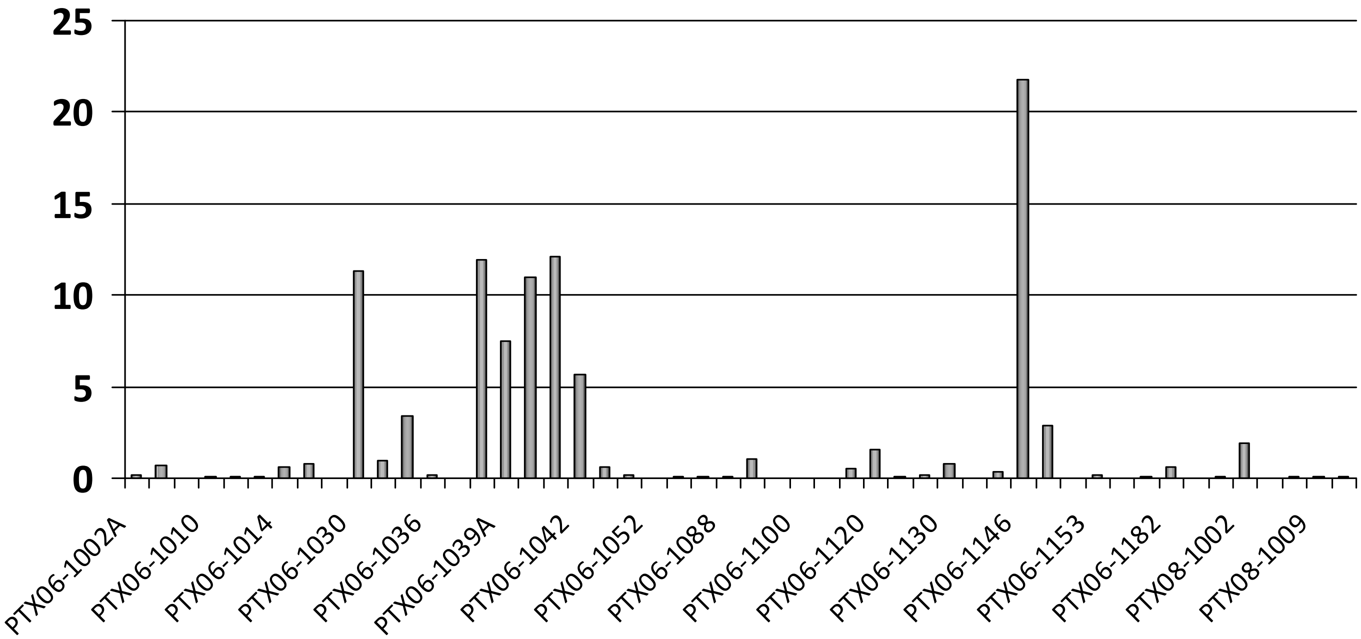
Well	Area (ft2)	Mass (mg)	Percent of Mass	Percent of Area
PTX08-1002	3,530,174.71	4,633.35	0.28	3.64
PTX08-1007	1,202,127.31	1,407.39	0.08	1.24
PTX08-1008	2,258,743.43	66,911.04	3.98	2.33
PTX08-1009	2,528,484.34	20,874.22	1.24	2.61
PTX10-1014	1,735,116.57	3,252.04	0.19	1.79
	96,874,504.8	1,680,088.1	100	100

MAROS Percent of Mass by Well

Project: Pantex **User Name:** MV

Location: Southeast **State:** Texas

4-AMINO-2,6-DINITROTOLUENE 7/1/2016



Well	Area (ft2)	Mass (mg)	Percent of Mass	Percent of Area
PTX06-1002A	5,898,553.56	205.16	0.16	6.09
PTX06-1005	2,780,965.17	945.72	0.73	2.87
PTX06-1008	954,160.68	42.58	0.03	0.98
PTX06-1010	2,700,073.87	92.32	0.07	2.79
PTX06-1011	2,169,869.21	76.61	0.06	2.24
PTX06-1013	3,626,944.53	123.77	0.10	3.74
PTX06-1014	1,093,970.16	749.51	0.58	1.13
PTX06-1015	1,324,787.40	999.80	0.78	1.37
PTX06-1023	959,172.23	32.92	0.03	0.99
PTX06-1030	2,977,515.14	14,537.72	11.29	3.07
PTX06-1031	1,670,955.38	1,223.77	0.95	1.72
PTX06-1034	2,414,519.71	4,400.24	3.42	2.49
PTX06-1036	684,787.18	179.76	0.14	0.71
PTX06-1037	406,879.34	13.83	0.01	0.42

MAROS Percent of Mass by Well

Project: Pantex **User Name:** MV

Location: Southeast **State:** Texas

Well	Area (ft2)	Mass (mg)	Percent of Mass	Percent of Area
PTX06-1038	5,720,024.85	15,390.44	11.95	5.90
PTX06-1039A	1,994,280.36	9,658.55	7.50	2.06
PTX06-1040	2,435,227.30	14,127.36	10.97	2.51
PTX06-1041	3,629,713.53	15,578.28	12.10	3.75
PTX06-1042	2,977,062.19	7,267.75	5.64	3.07
PTX06-1046	591,554.05	806.69	0.63	0.61
PTX06-1047A	947,060.87	184.34	0.14	0.98
PTX06-1052	1,327,447.84	45.21	0.04	1.37
PTX06-1053	466,526.33	110.16	0.09	0.48
PTX06-1069	3,390,949.03	121.06	0.09	3.50
PTX06-1088	1,598,085.73	87.88	0.07	1.65
PTX06-1095A	2,651,449.16	1,294.57	1.01	2.74
PTX06-1098	1,144,173.42	38.89	0.03	1.18
PTX06-1100	71,341.35	2.46	0.00	0.07
PTX06-1101	952,746.22	32.51	0.03	0.98
PTX06-1102	2,444,361.96	641.65	0.50	2.52
PTX06-1120	1,092,498.57	2,018.94	1.57	1.13
PTX06-1121	516,703.16	135.63	0.11	0.53
PTX06-1123	843,440.38	221.40	0.17	0.87
PTX06-1130	3,861,086.71	1,013.54	0.79	3.99
PTX06-1133A	841,645.35	28.39	0.02	0.87
PTX06-1135	1,931,066.98	410.09	0.32	1.99
PTX06-1146	5,493,266.26	28,046.56	21.78	5.67
PTX06-1147	3,428,772.14	3,717.22	2.89	3.54
PTX06-1148	514,389.34	17.49	0.01	0.53
PTX06-1153	606,017.64	279.98	0.22	0.63
PTX06-1154	297,271.88	10.01	0.01	0.31
PTX06-1166	1,013,436.57	89.39	0.07	1.05
PTX06-1182	475,401.59	805.54	0.63	0.49
PTX06-1183	580,191.68	42.19	0.03	0.60
PTX06-PRB16	2,119,512.46	126.30	0.10	2.19

MAROS Percent of Mass by Well

Project: Pantex **User Name:** MV

Location: Southeast **State:** Texas

Well	Area (ft2)	Mass (mg)	Percent of Mass	Percent of Area
PTX08-1002	3,530,174.71	2,511.28	1.95	3.64
PTX08-1007	1,202,127.31	41.97	0.03	1.24
PTX08-1008	2,258,743.43	76.49	0.06	2.33
PTX08-1009	2,528,484.34	89.27	0.07	2.61
PTX10-1014	1,735,116.57	58.98	0.05	1.79
	96,874,504.8	128,752.1	100	100

Southwest Sector MAROS Reports

MAROS COC Assessment

Project: Pantex **User Name:** MV

Location: Southwest Sector **State:** Texas

Toxicity:

Contaminant of Concern	Representative Concentration (mg/L)	PRG (mg/L)	Percent Above PRG
TRICHLOROETHYLENE (TCE)	4.9E-02	5.0E-03	888.9%
PERCHLORATE	1.1E-01	2.6E-02	307.9%
HEXAHYDRO-1,3,5-TRINITRO-1,3,5-TRIAZINE	7.3E-03	2.0E-03	265.2%
4-AMINO-2,6-DINITROTOLUENE	2.3E-03	1.2E-03	91.4%
CHROMIUM, HEXAVALENT	1.9E-01	1.0E-01	86.3%
CHROMIUM, TOTAL	1.4E-01	1.0E-01	38.2%
ARSENIC	1.0E-02	1.0E-02	3.8%

Note: Top COCs by toxicity were determined by examining a representative concentration for each compound over the entire site. The compound representative concentrations are then compared with the chosen PRG for that compound, with the percentage exceedance from the PRG determining the compound's toxicity. All compounds above exceed the PRG.

Prevalence:

Contaminant of Concern	Class	Total Wells	Total Exceedance	Percent Exceedances	Total Detects
PERCHLORATE	INO	40	19	47.5%	28
TRICHLOROETHYLENE (TCE)	ORG	50	22	44.0%	37
4-AMINO-2,6-DINITROTOLUENE	ORG	45	11	24.4%	23
HEXAHYDRO-1,3,5-TRINITRO-1,3,5-TRIAZINE	ORG	45	8	17.8%	30
ARSENIC	MET	35	6	17.1%	31
CHROMIUM, HEXAVALENT	MET	25	3	12.0%	15
CHROMIUM, TOTAL	MET	40	4	10.0%	30

Note: Top COCs by prevalence were determined by examining a representative concentration for each well location at the site. The total exceedances (values above the chosen PRGs) are compared to the total number of wells to determine the prevalence of the compound.

Mobility:

Contaminant of Concern	Kd/Koc
PERCHLORATE	
CHROMIUM, TOTAL	
HEXAHYDRO-1,3,5-TRINITRO-1,3,5-TRIAZINE	0.00741
4-AMINO-2,6-DINITROTOLUENE	0.0985
TRICHLOROETHYLENE (TCE)	0.297
CHROMIUM, HEXAVALENT	14
ARSENIC	25

MAROS COC Assessment

Project: Pantex **User Name:** MV

Location: Southwest Sector **State:** Texas

Note: Top COCs by mobility were determined by examining each detected compound in the dataset and comparing their mobilities (Koc's for organics, assuming foc = 0.001, and Kd's for metals).

Priority Constituents by Well:

Well Name	Average	Max
1114-MW4	PERCHLORATE	PERCHLORATE
PTX06-1006	PERCHLORATE	HEXAHYDRO-1,3,5-TRINIT
PTX06-1007	4-AMINO-2,6-DINITROTOL	4-AMINO-2,6-DINITROTOL
PTX06-1008	1,2-DICHLOROETHANE	1,2-DICHLOROETHANE
PTX06-1011	TRICHLOROETHYLENE (TCE)	TRICHLOROETHYLENE (TCE
PTX06-1012	TRICHLOROETHYLENE (TCE)	TRICHLOROETHYLENE (TCE
PTX06-1035	PERCHLORATE	PERCHLORATE
PTX06-1036	DNX	HEXAHYDRO-1,3,5-TRINIT
PTX06-1052	CHROMIUM, TOTAL	CHROMIUM, TOTAL
PTX06-1053	PERCHLORATE	2-AMINO-4,6-DINITROTOL
PTX06-1073A	TNX	TRICHLOROETHYLENE (TCE
PTX06-1077A	TRICHLOROETHYLENE (TCE)	TRICHLOROETHYLENE (TCE
PTX06-1085	VINYL CHLORIDE	BARIUM
PTX06-1086	MANGANESE	BARIUM
PTX06-1126	TRICHLOROETHYLENE (TCE)	TRICHLOROETHYLENE (TCE
PTX06-1127	PERCHLORATE	PERCHLORATE
PTX06-1131	ARSENIC	CHROMIUM, TOTAL
PTX06-1134	4-AMINO-2,6-DINITROTOL	4-AMINO-2,6-DINITROTOL
PTX06-1148	PERCHLORATE	PERCHLORATE
PTX06-1149	ARSENIC	PERCHLORATE
PTX06-1150	PERCHLORATE	PERCHLORATE
PTX06-1151	TRICHLOROETHYLENE (TCE)	TRICHLOROETHYLENE (TCE
PTX06-1155	TRICHLOROETHYLENE (TCE)	TRICHLOROETHYLENE (TCE
PTX06-1156	ARSENIC	ARSENIC
PTX06-1159	TRICHLOROETHYLENE (TCE)	TRICHLOROETHYLENE (TCE
PTX06-1160	cis-1,2-DICHLOROETHYLEN	BARIUM
PTX06-1164	TRICHLOROETHYLENE (TCE)	TRICHLOROETHYLENE (TCE
PTX06-1169	ARSENIC	ARSENIC
PTX06-1170	TRICHLOROETHYLENE (TCE)	TRICHLOROETHYLENE (TCE
PTX06-1171	TRICHLOROETHYLENE (TCE)	TRICHLOROETHYLENE (TCE

MAROS COC Assessment

Project: Pantex **User Name:** MV

Location: Southwest Sector **State:** Texas

PTX06-1173	TRICHLOROETHYLENE (TCE)	TRICHLOROETHYLENE (TCE
PTX06-1174	TRICHLOROETHYLENE (TCE)	TRICHLOROETHYLENE (TCE
PTX06-1175	TRICHLOROETHYLENE (TCE)	TRICHLOROETHYLENE (TCE
PTX06-1176	TRICHLOROETHYLENE (TCE)	TRICHLOROETHYLENE (TCE
PTX06-1177	TRICHLOROETHYLENE (TCE)	TRICHLOROETHYLENE (TCE
PTX06-1181	HEXAHYDRO-1,3,5-TRINITR	BORON
PTX06-1183	CHROMIUM, TOTAL	CHROMIUM, TOTAL
PTX07-1P02	TNX	HEXAHYDRO-1,3,5-TRINIT
PTX07-1P05	HEXAHYDRO-1,3,5-TRINITR	HEXAHYDRO-1,3,5-TRINIT
PTX07-1Q01	BARIUM	ARSENIC
PTX07-1Q02	1,2-DICHLOROETHANE	ARSENIC
PTX07-1Q03	VINYL CHLORIDE	ARSENIC
PTX08-1001	HEXAHYDRO-1,3,5-TRINITR	TNX
PTX08-1003	cis-1,2-DICHLOROETHYLEN	TRICHLOROETHYLENE (TCE
PTX08-1005	TRICHLOROETHYLENE (TCE)	TRICHLOROETHYLENE (TCE
PTX08-1006	HEXAHYDRO-1,3,5-TRINITR	HEXAHYDRO-1,3,5-TRINIT
PTX08-1007	TRICHLOROETHYLENE (TCE)	TRICHLOROETHYLENE (TCE
PTX08-1008	CHROMIUM, HEXAVALENT	CHROMIUM, HEXAVALENT
PTX08-1009	1,2-DICHLOROETHANE	HEXAHYDRO-1,3,5-TRINIT
PTX10-1014	TRICHLOROETHYLENE (TCE)	TRICHLOROETHYLENE (TCE

MAROS Mann-Kendall Statistics Summary

Project: Pantex | **User Name:** MV
Location: Southwest Sector | **State:** Texas

Time Period: 2/23/2012 **to** 11/30/2016
Consolidation Period: No Time Consolidation
Consolidation Type: Median
Duplicate Consolidation: Average
ND Values: 1/2 Detection Limit
J Flag Values : Actual Value

Well	Number of Samples	Number of Detects	Coefficient of Variation	Mann-Kendall Statistic	Confidence in Trend	All Samples "ND" ?	Concentration Trend
1,4-DIOXANE (P-DIOXANE)							
1114-MW4	10	8	0.38	16	90.7%	No	PI
PTX06-1006	5	5	0.12	5	82.1%	No	NT
PTX06-1007	5	5	0.37	-2	59.2%	No	S
PTX06-1008	5	1	0.17	-4	75.8%	No	S
PTX06-1011	5	5	0.80	-8	95.8%	No	D
PTX06-1012	20	18	0.43	145	100.0%	No	I
PTX06-1035	10	0	0.00	0	46.4%	Yes	ND
PTX06-1053	10	0	0.00	0	46.4%	Yes	ND
PTX06-1073A	1	0	0.00	0	0.0%	Yes	ND
PTX06-1077A	5	1	0.12	-4	75.8%	No	S
PTX06-1085	1	0	0.00	0	0.0%	Yes	ND
PTX06-1086	1	0	0.00	0	0.0%	Yes	ND
PTX06-1126	10	10	0.36	-10	78.4%	No	S
PTX06-1127	10	10	0.37	-11	81.0%	No	S
PTX06-1131	1	0	0.00	0	0.0%	Yes	ND
PTX06-1134	10	10	0.42	12	83.2%	No	NT
PTX06-1148	16	3	0.47	26	86.7%	No	NT
PTX06-1149	16	3	0.46	30	90.3%	No	PI
PTX06-1150	16	0	0.45	48	98.4%	Yes	ND
PTX06-1151	10	10	0.16	-1	50.0%	No	S
PTX06-1155	20	20	0.48	109	100.0%	No	I
PTX06-1156	20	18	0.36	10	61.3%	No	NT
PTX06-1159	8	8	0.21	6	72.6%	No	NT
PTX06-1160	8	0	0.00	0	45.2%	Yes	ND
PTX06-1162	1	1	0.00	0	0.0%	No	N/A
PTX06-1171	1	1	0.00	0	0.0%	No	N/A

MAROS Mann-Kendall Statistics Summary

Project: Pantex | **User Name:** MV

Location: Southwest Sector | **State:** Texas

1,4-DIOXANE (P-DIOXANE)

Well	Number of Samples	Number of Detects	Coefficient of Variation	Mann-Kendall Statistic	Confidence in Trend	All Samples "ND" ?	Concentration Trend
PTX06-1173	1	1	0.00	0	0.0%	No	N/A
PTX06-1174	1	1	0.00	0	0.0%	No	N/A
PTX06-1175	1	1	0.00	0	0.0%	No	N/A
PTX06-1180	1	1	0.00	0	0.0%	No	N/A
PTX06-1181	1	0	0.00	0	0.0%	Yes	ND
PTX07-1P02	10	10	0.24	-27	99.2%	No	D
PTX07-1P05	2	2	0.00	0	0.0%	No	N/A
PTX07-1Q01	1	0	0.00	0	0.0%	Yes	ND
PTX07-1Q02	1	0	0.00	0	0.0%	Yes	ND
PTX07-1Q03	1	0	0.00	0	0.0%	Yes	ND
PTX08-1001	4	1	1.31	1	50.0%	No	NT
PTX08-1003	5	3	0.75	3	67.5%	No	NT
PTX08-1005	10	9	0.52	-17	92.2%	No	PD
PTX08-1006	10	10	0.68	-41	100.0%	No	D
PTX08-1007	5	5	0.09	7	92.1%	No	PI
PTX08-1008	10	2	0.60	17	92.2%	No	PI
PTX08-1009	1	0	0.00	0	0.0%	Yes	ND
PTX10-1014	5	2	0.61	5	82.1%	No	NT
CHROMIUM, HEXAVALENT							
1114-MW4	1	0	0.00	0	0.0%	Yes	ND
PTX06-1007	1	1	0.00	0	0.0%	No	N/A
PTX06-1008	5	3	0.78	-2	59.2%	No	S
PTX06-1011	5	5	0.61	2	59.2%	No	NT
PTX06-1036	3	3	0.00	0	0.0%	No	N/A
PTX06-1052	10	10	0.78	-43	100.0%	No	D
PTX06-1053	10	2	0.28	-14	87.3%	No	S
PTX06-1085	1	0	0.00	0	0.0%	Yes	ND
PTX06-1086	1	0	0.00	0	0.0%	Yes	ND
PTX06-1126	6	5	0.41	9	93.2%	No	PI
PTX06-1127	6	3	0.85	-4	70.3%	No	S
PTX06-1131	1	0	0.00	0	0.0%	Yes	ND
PTX06-1181	1	0	0.00	0	0.0%	Yes	ND
PTX06-1183	1	1	0.00	0	0.0%	No	N/A

MAROS Mann-Kendall Statistics Summary

Project: Pantex **User Name:** MV

Location: Southwest Sector **State:** Texas

CHROMIUM, HEXAVALENT

Well	Number of Samples	Number of Detects	Coefficient of Variation	Mann-Kendall Statistic	Confidence in Trend	All Samples "ND" ?	Concentration Trend
PTX07-1P02	1	0	0.00	0	0.0%	Yes	ND
PTX07-1Q01	1	0	0.00	0	0.0%	Yes	ND
PTX07-1Q02	1	0	0.00	0	0.0%	Yes	ND
PTX07-1Q03	1	1	0.00	0	0.0%	No	N/A
PTX08-1001	1	0	0.00	0	0.0%	Yes	ND
PTX08-1005	6	6	0.79	-9	93.2%	No	PD
PTX08-1006	1	0	0.00	0	0.0%	Yes	ND
PTX08-1007	5	1	0.25	-8	95.8%	No	D
PTX08-1008	10	10	1.39	-21	96.4%	No	D
PTX08-1009	10	6	0.66	26	98.9%	No	I
PTX10-1014	5	3	0.27	-4	75.8%	No	S

cis-1,2-DICHLOROETHYLENE

Well	Number of Samples	Number of Detects	Coefficient of Variation	Mann-Kendall Statistic	Confidence in Trend	All Samples "ND" ?	Concentration Trend
1114-MW4	10	0	0.00	0	46.4%	Yes	ND
PTX06-1006	5	0	0.00	0	40.8%	Yes	ND
PTX06-1007	5	0	0.00	0	40.8%	Yes	ND
PTX06-1008	5	0	0.00	0	40.8%	Yes	ND
PTX06-1011	5	0	0.00	0	40.8%	Yes	ND
PTX06-1012	20	20	0.62	100	100.0%	No	I
PTX06-1035	10	0	0.00	0	46.4%	Yes	ND
PTX06-1036	3	0	0.00	0	0.0%	Yes	ND
PTX06-1052	10	0	0.00	0	46.4%	Yes	ND
PTX06-1053	10	0	0.00	0	46.4%	Yes	ND
PTX06-1073A	1	0	0.00	0	0.0%	Yes	ND
PTX06-1077A	5	5	0.37	-10	99.2%	No	D
PTX06-1085	5	0	0.00	0	40.8%	Yes	ND
PTX06-1086	5	0	0.00	0	40.8%	Yes	ND
PTX06-1126	10	10	0.35	-33	99.9%	No	D
PTX06-1127	10	10	0.40	15	89.2%	No	NT
PTX06-1131	7	0	0.00	0	43.7%	Yes	ND
PTX06-1134	9	1	0.10	-8	76.2%	No	S
PTX06-1148	16	0	0.45	48	98.4%	Yes	ND
PTX06-1149	16	0	0.45	48	98.4%	Yes	ND
PTX06-1150	16	6	0.73	21	81.3%	No	NT

MAROS Mann-Kendall Statistics Summary

Project: Pantex **User Name:** MV

Location: Southwest Sector **State:** Texas

cis-1,2-DICHLOROETHYLENE

Well	Number of Samples	Number of Detects	Coefficient of Variation	Mann-Kendall Statistic	Confidence in Trend	All Samples "ND" ?	Concentration Trend
PTX06-1151	10	10	0.21	-5	63.6%	No	S
PTX06-1155	20	20	0.52	50	94.4%	No	PI
PTX06-1156	20	19	0.59	-3	52.6%	No	S
PTX06-1159	8	8	0.29	23	99.9%	No	I
PTX06-1160	8	0	0.00	0	45.2%	Yes	ND
PTX06-1162	1	1	0.00	0	0.0%	No	N/A
PTX06-1164	6	6	0.85	9	93.2%	No	PI
PTX06-1169	1	1	0.00	0	0.0%	No	N/A
PTX06-1170	8	8	0.44	-8	80.1%	No	S
PTX06-1171	2	2	0.00	0	0.0%	No	N/A
PTX06-1172	1	1	0.00	0	0.0%	No	N/A
PTX06-1173	1	1	0.00	0	0.0%	No	N/A
PTX06-1174	1	1	0.00	0	0.0%	No	N/A
PTX06-1175	1	1	0.00	0	0.0%	No	N/A
PTX06-1176	5	5	0.11	1	50.0%	No	NT
PTX06-1177	5	5	1.19	0	40.8%	No	NT
PTX06-1180	1	1	0.00	0	0.0%	No	N/A
PTX06-1181	1	0	0.00	0	0.0%	Yes	ND
PTX06-1183	1	0	0.00	0	0.0%	Yes	ND
PTX07-1P02	10	0	0.00	0	46.4%	Yes	ND
PTX07-1P05	2	0	0.00	0	0.0%	Yes	ND
PTX07-1Q01	5	0	0.00	0	40.8%	Yes	ND
PTX07-1Q02	5	0	0.00	0	40.8%	Yes	ND
PTX07-1Q03	5	0	0.00	0	40.8%	Yes	ND
PTX08-1001	4	0	0.00	0	37.5%	Yes	ND
PTX08-1003	5	4	0.37	-4	75.8%	No	S
PTX08-1005	10	10	0.57	-27	99.2%	No	D
PTX08-1006	10	10	0.62	-37	100.0%	No	D
PTX08-1007	5	0	0.00	0	40.8%	Yes	ND
PTX08-1008	10	0	0.00	0	46.4%	Yes	ND
PTX08-1009	10	0	0.00	0	46.4%	Yes	ND
PTX10-1014	5	0	0.00	0	40.8%	Yes	ND

PERCHLORATE

MAROS Mann-Kendall Statistics Summary

Project: Pantex **User Name:** MV

Location: Southwest Sector **State:** Texas

PERCHLORATE

Well	Number of Samples	Number of Detects	Coefficient of Variation	Mann-Kendall Statistic	Confidence in Trend	All Samples "ND" ?	Concentration Trend
1114-MW4	10	10	0.13	13	85.4%	No	NT
PTX06-1006	5	5	0.27	6	88.3%	No	NT
PTX06-1007	5	5	0.38	-2	59.2%	No	S
PTX06-1008	5	0	0.00	0	40.8%	Yes	ND
PTX06-1011	5	1	0.04	4	75.8%	No	NT
PTX06-1012	20	0	1.32	-17	69.6%	Yes	ND
PTX06-1035	10	10	0.41	41	100.0%	No	I
PTX06-1053	9	0	0.00	0	46.0%	Yes	ND
PTX06-1073A	1	0	0.00	0	0.0%	Yes	ND
PTX06-1077A	5	1	0.13	2	59.2%	No	NT
PTX06-1126	10	10	0.49	-15	89.2%	No	S
PTX06-1127	10	10	0.15	-15	89.2%	No	S
PTX06-1134	10	9	1.06	25	98.6%	No	I
PTX06-1148	16	16	0.54	-92	100.0%	No	D
PTX06-1149	16	3	2.55	-32	91.7%	No	PD
PTX06-1150	16	16	0.41	-106	100.0%	No	D
PTX06-1151	10	10	0.26	-11	81.0%	No	S
PTX06-1155	20	0	1.32	-17	69.6%	Yes	ND
PTX06-1156	20	0	1.32	-17	69.6%	Yes	ND
PTX06-1159	8	8	0.49	28	100.0%	No	I
PTX06-1160	8	0	0.00	0	45.2%	Yes	ND
PTX06-1162	1	1	0.00	0	0.0%	No	N/A
PTX06-1164	6	5	0.35	-7	86.4%	No	S
PTX06-1169	1	0	0.00	0	0.0%	Yes	ND
PTX06-1170	8	0	1.50	5	68.3%	Yes	ND
PTX06-1171	2	2	0.00	0	0.0%	No	N/A
PTX06-1172	1	1	0.00	0	0.0%	No	N/A
PTX06-1173	1	1	0.00	0	0.0%	No	N/A
PTX06-1174	1	1	0.00	0	0.0%	No	N/A
PTX06-1175	1	1	0.00	0	0.0%	No	N/A
PTX06-1176	5	5	0.36	-6	88.3%	No	S
PTX06-1177	5	4	0.58	-10	99.2%	No	D
PTX06-1180	1	0	0.00	0	0.0%	Yes	ND

MAROS Mann-Kendall Statistics Summary

Project: Pantex **User Name:** MV

Location: Southwest Sector **State:** Texas

PERCHLORATE

Well	Number of Samples	Number of Detects	Coefficient of Variation	Mann-Kendall Statistic	Confidence in Trend	All Samples "ND" ?	Concentration Trend
PTX06-1181	1	0	0.00	0	0.0%	Yes	ND
PTX07-1P02	10	0	0.00	0	46.4%	Yes	ND
PTX07-1P05	2	0	0.00	0	0.0%	Yes	ND
PTX08-1001	4	2	0.68	-5	89.6%	No	S
PTX08-1003	5	5	0.05	-8	95.8%	No	D
PTX08-1005	10	8	0.95	-6	66.8%	No	S
PTX08-1006	10	10	0.40	-41	100.0%	No	D
PTX08-1007	5	3	0.08	-3	67.5%	No	S
PTX08-1008	10	9	1.36	37	100.0%	No	I
PTX10-1014	5	3	0.17	-5	82.1%	No	S
TRICHLOROETHYLENE (TCE)							
1114-MW4	10	10	0.18	-33	99.9%	No	D
PTX06-1006	5	5	0.12	0	40.8%	No	S
PTX06-1007	5	5	0.24	-4	75.8%	No	S
PTX06-1008	5	5	0.73	-10	99.2%	No	D
PTX06-1011	5	5	0.72	-8	95.8%	No	D
PTX06-1012	20	20	1.09	-160	100.0%	No	D
PTX06-1035	10	10	0.64	33	99.9%	No	I
PTX06-1036	3	0	0.00	0	0.0%	Yes	ND
PTX06-1052	10	6	0.16	-11	81.0%	No	S
PTX06-1053	10	0	0.00	0	46.4%	Yes	ND
PTX06-1073A	1	1	0.00	0	0.0%	No	N/A
PTX06-1077A	5	5	0.22	-8	95.8%	No	D
PTX06-1085	5	0	0.00	0	40.8%	Yes	ND
PTX06-1086	5	0	0.00	0	40.8%	Yes	ND
PTX06-1126	10	10	0.27	-5	63.6%	No	S
PTX06-1127	10	10	0.78	19	94.6%	No	PI
PTX06-1131	7	0	0.00	0	43.7%	Yes	ND
PTX06-1134	9	4	1.18	16	94.0%	No	PI
PTX06-1148	16	16	0.33	-44	97.4%	No	D
PTX06-1149	16	1	0.37	51	98.9%	No	I
PTX06-1150	16	16	0.39	78	100.0%	No	I
PTX06-1151	10	10	0.22	-17	92.2%	No	PD

MAROS Mann-Kendall Statistics Summary

Project: Pantex **User Name:** MV

Location: Southwest Sector **State:** Texas

TRICHLOROETHYLENE (TCE)

Well	Number of Samples	Number of Detects	Coefficient of Variation	Mann-Kendall Statistic	Confidence in Trend	All Samples "ND" ?	Concentration Trend
PTX06-1155	20	19	1.37	-106	100.0%	No	D
PTX06-1156	20	2	0.23	35	86.3%	No	NT
PTX06-1159	8	8	0.29	20	99.3%	No	I
PTX06-1160	8	2	0.03	11	88.7%	No	NT
PTX06-1162	1	1	0.00	0	0.0%	No	N/A
PTX06-1164	6	6	0.32	1	50.0%	No	NT
PTX06-1169	1	1	0.00	0	0.0%	No	N/A
PTX06-1170	8	8	0.63	-4	64.0%	No	S
PTX06-1171	2	2	0.00	0	0.0%	No	N/A
PTX06-1172	1	1	0.00	0	0.0%	No	N/A
PTX06-1173	1	1	0.00	0	0.0%	No	N/A
PTX06-1174	1	1	0.00	0	0.0%	No	N/A
PTX06-1175	1	1	0.00	0	0.0%	No	N/A
PTX06-1176	5	5	0.24	0	40.8%	No	S
PTX06-1177	5	5	0.42	-4	75.8%	No	S
PTX06-1180	1	1	0.00	0	0.0%	No	N/A
PTX06-1181	1	0	0.00	0	0.0%	Yes	ND
PTX06-1183	1	1	0.00	0	0.0%	No	N/A
PTX07-1P02	10	0	0.00	0	46.4%	Yes	ND
PTX07-1P05	2	0	0.00	0	0.0%	Yes	ND
PTX07-1Q01	5	0	0.00	0	40.8%	Yes	ND
PTX07-1Q02	5	0	0.00	0	40.8%	Yes	ND
PTX07-1Q03	5	0	0.00	0	40.8%	Yes	ND
PTX08-1001	4	0	0.00	0	37.5%	Yes	ND
PTX08-1003	5	5	0.48	-8	95.8%	No	D
PTX08-1005	10	10	0.57	-19	94.6%	No	PD
PTX08-1006	10	10	0.35	21	96.4%	No	I
PTX08-1007	5	5	0.32	-10	99.2%	No	D
PTX08-1008	10	0	0.00	0	46.4%	Yes	ND
PTX08-1009	10	2	0.16	1	50.0%	No	NT
PTX10-1014	5	5	0.63	-2	59.2%	No	S

MAROS Mann-Kendall Statistics Summary

Project: Pantex **User Name:** MV

Location: Southwest Sector **State:** Texas

TRICHLOROETHYLENE (TCE)

Well	Number of Samples	Number of Detects	Coefficient of Variation	Mann-Kendall Statistic	Confidence in Trend	All Samples "ND" ?	Concentration Trend

Note: Increasing (I); Probably Increasing (PI); Stable (S); Probably Decreasing (PD); Decreasing (D); No Trend (NT); Not Applicable (N/A)-Due to insufficient Data (< 4 sampling events).

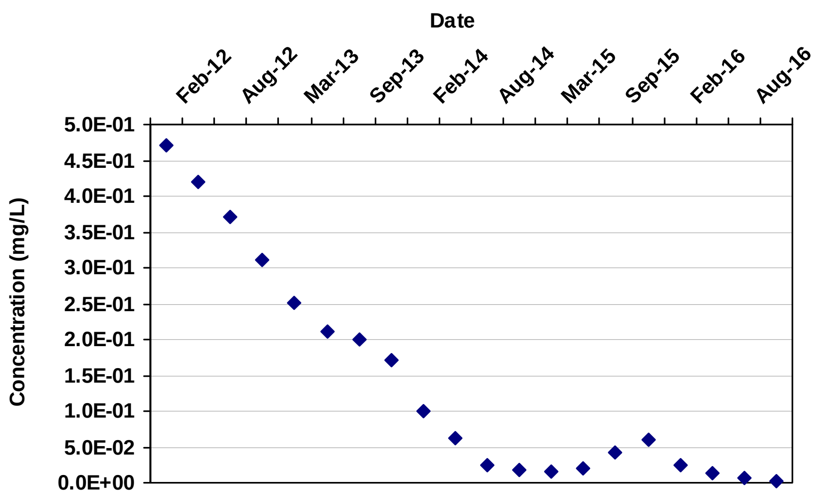
The Number of Samples and Number of Detects shown above are post-consolidation values.

MAROS Mann-Kendall Statistics Summary

Project: Pantex **User Name:** MV

Location: Southwest Sector **State:** Texas

Well:	PTX06-1012	**Time Period:**	2/23/2012 **to** 11/30/2016
Well Type:	ISPM	**Consolidation Period:**	No Time Consolidation
COC:	TRICHLOROETHYLENE (TCE)	**Duplicate Consolidation:**	Median
		Consolidation Type:	Average
		ND Values:	1/2 Detection Limit
		J Flag Values :	Actual Value



Mann Kendall S Statistic:

-160

Confidence in Trend:

100.0%

Coefficient of Variation:

1.09

Mann Kendall Concentration Trend: (See Note)

D

Data Table:

Well	Effective Date	Constituent	Result (mg/L)	Flag	Number of Samples	Number of Detects
PTX06-1012	2/23/2012	TRICHLOROETHYLENE (TCE)	4.7E-01		1	1
PTX06-1012	5/29/2012	TRICHLOROETHYLENE (TCE)	4.2E-01		1	1
PTX06-1012	8/6/2012	TRICHLOROETHYLENE (TCE)	3.7E-01		1	1
PTX06-1012	11/1/2012	TRICHLOROETHYLENE (TCE)	3.1E-01		1	1
PTX06-1012	3/26/2013	TRICHLOROETHYLENE (TCE)	2.5E-01		1	1
PTX06-1012	6/18/2013	TRICHLOROETHYLENE (TCE)	2.1E-01		1	1
PTX06-1012	9/3/2013	TRICHLOROETHYLENE (TCE)	2.0E-01		1	1
PTX06-1012	12/18/2013	TRICHLOROETHYLENE (TCE)	1.7E-01		1	1
PTX06-1012	2/24/2014	TRICHLOROETHYLENE (TCE)	1.0E-01		1	1

MAROS Mann-Kendall Statistics Summary

Project: Pantex | **User Name:** MV

Location: Southwest Sector | **State:** Texas

Well	Effective Date	Constituent	Result (mg/L)	Flag	Number of Samples	Number of Detects
PTX06-1012	5/22/2014	TRICHLOROETHYLENE (TCE)	6.3E-02		1	1
PTX06-1012	8/12/2014	TRICHLOROETHYLENE (TCE)	2.4E-02		1	1
PTX06-1012	11/13/2014	TRICHLOROETHYLENE (TCE)	1.7E-02		1	1
PTX06-1012	3/23/2015	TRICHLOROETHYLENE (TCE)	1.5E-02		1	1
PTX06-1012	6/22/2015	TRICHLOROETHYLENE (TCE)	2.1E-02		1	1
PTX06-1012	9/24/2015	TRICHLOROETHYLENE (TCE)	4.2E-02		1	1
PTX06-1012	10/26/2015	TRICHLOROETHYLENE (TCE)	5.9E-02		1	1
PTX06-1012	2/24/2016	TRICHLOROETHYLENE (TCE)	2.5E-02		1	1
PTX06-1012	6/27/2016	TRICHLOROETHYLENE (TCE)	1.3E-02		1	1
PTX06-1012	8/15/2016	TRICHLOROETHYLENE (TCE)	5.6E-03		1	1
PTX06-1012	11/30/2016	TRICHLOROETHYLENE (TCE)	1.2E-03		1	1

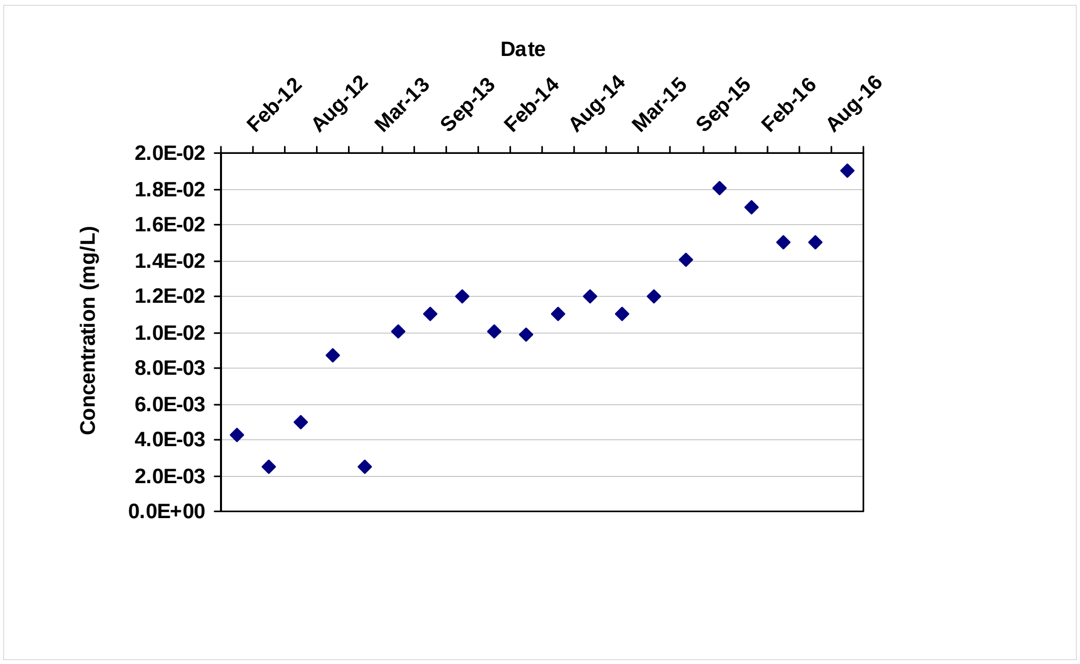
Note: Increasing (I); Probably Increasing (PI); Stable (S); Probably Decreasing (PD); Decreasing (D); No Trend (NT); Not Applicable (N/A) - Due to insufficient Data (< 4 sampling events); ND = Non-detect

MAROS Mann-Kendall Statistics Summary

Project: Pantex **User Name:** MV

Location: Southwest Sector **State:** Texas

Well:	PTX06-1012	**Time Period:**	2/23/2012 **to** 11/30/2016
Well Type:	ISPM	**Consolidation Period:**	No Time Consolidation
COC:	1,4-DIOXANE (P-DIOXANE)	**Duplicate Consolidation:**	Median
		Consolidation Type:	Average
		ND Values:	1/2 Detection Limit
		J Flag Values :	Actual Value



Mann Kendall S Statistic:

145

Confidence in Trend:

100.0%

Coefficient of Variation:

0.43

Mann Kendall Concentration Trend: (See Note)

I

Data Table:

Well	Effective Date	Constituent	Result (mg/L)	Flag	Number of Samples	Number of Detects
PTX06-1012	2/23/2012	1,4-DIOXANE (P-DIOXANE)	4.3E-03		1	1
PTX06-1012	5/29/2012	1,4-DIOXANE (P-DIOXANE)	2.5E-03	ND	1	0
PTX06-1012	8/6/2012	1,4-DIOXANE (P-DIOXANE)	5.0E-03		1	1
PTX06-1012	11/1/2012	1,4-DIOXANE (P-DIOXANE)	8.7E-03		1	1
PTX06-1012	3/26/2013	1,4-DIOXANE (P-DIOXANE)	2.5E-03	ND	1	0
PTX06-1012	6/18/2013	1,4-DIOXANE (P-DIOXANE)	1.0E-02		1	1
PTX06-1012	9/3/2013	1,4-DIOXANE (P-DIOXANE)	1.1E-02		1	1
PTX06-1012	12/18/2013	1,4-DIOXANE (P-DIOXANE)	1.2E-02		1	1
PTX06-1012	2/24/2014	1,4-DIOXANE (P-DIOXANE)	1.0E-02		1	1

MAROS Mann-Kendall Statistics Summary

Project: Pantex **User Name:** MV

Location: Southwest Sector **State:** Texas

Well	Effective Date	Constituent	Result (mg/L)	Flag	Number of Samples	Number of Detects
PTX06-1012	5/22/2014	1,4-DIOXANE (P-DIOXANE)	9.9E-03		1	1
PTX06-1012	8/12/2014	1,4-DIOXANE (P-DIOXANE)	1.1E-02		1	1
PTX06-1012	11/13/2014	1,4-DIOXANE (P-DIOXANE)	1.2E-02		1	1
PTX06-1012	3/23/2015	1,4-DIOXANE (P-DIOXANE)	1.1E-02		1	1
PTX06-1012	6/22/2015	1,4-DIOXANE (P-DIOXANE)	1.2E-02		1	1
PTX06-1012	9/24/2015	1,4-DIOXANE (P-DIOXANE)	1.4E-02		1	1
PTX06-1012	10/26/2015	1,4-DIOXANE (P-DIOXANE)	1.8E-02		1	1
PTX06-1012	2/24/2016	1,4-DIOXANE (P-DIOXANE)	1.7E-02		1	1
PTX06-1012	6/27/2016	1,4-DIOXANE (P-DIOXANE)	1.5E-02		1	1
PTX06-1012	8/15/2016	1,4-DIOXANE (P-DIOXANE)	1.5E-02		1	1
PTX06-1012	11/30/2016	1,4-DIOXANE (P-DIOXANE)	1.9E-02		1	1

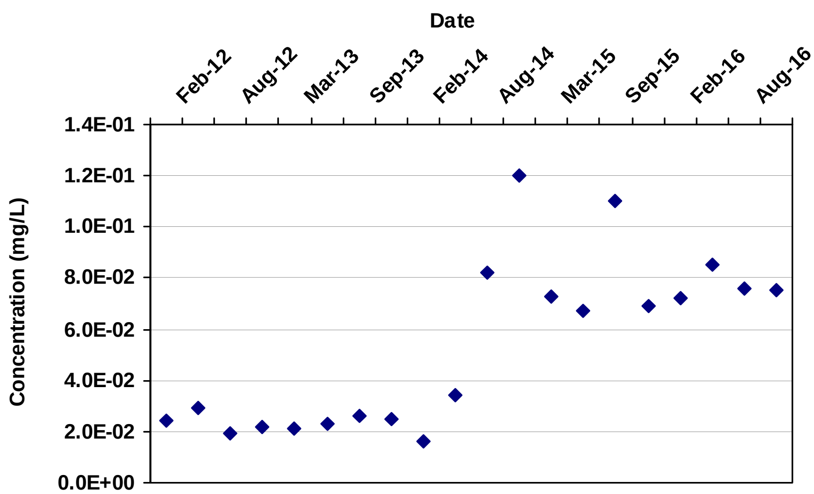
Note: Increasing (I); Probably Increasing (PI); Stable (S); Probably Decreasing (PD); Decreasing (D); No Trend (NT); Not Applicable (N/A) - Due to insufficient Data (< 4 sampling events); ND = Non-detect

MAROS Mann-Kendall Statistics Summary

Project: Pantex | **User Name:** MV
Location: Southwest Sector | **State:** Texas

Well: PTX06-1012
Well Type: ISPM
COC: cis-1,2-DICHLOROETHYLENE

Time Period: 2/23/2012 **to** 11/30/2016
Consolidation Period: No Time Consolidation
Duplicate Consolidation: Median
Consolidation Type: Average
ND Values: 1/2 Detection Limit
J Flag Values : Actual Value



Mann Kendall S Statistic:

100

Confidence in Trend:

100.0%

Coefficient of Variation:

0.62

Mann Kendall Concentration Trend: (See Note)

I

Data Table:

Well	Effective Date	Constituent	Result (mg/L)	Flag	Number of Samples	Number of Detects
PTX06-1012	2/23/2012	cis-1,2-DICHLOROETHYLENE	2.4E-02		1	1
PTX06-1012	5/29/2012	cis-1,2-DICHLOROETHYLENE	2.9E-02		1	1
PTX06-1012	8/6/2012	cis-1,2-DICHLOROETHYLENE	1.9E-02		1	1
PTX06-1012	11/1/2012	cis-1,2-DICHLOROETHYLENE	2.2E-02		1	1
PTX06-1012	3/26/2013	cis-1,2-DICHLOROETHYLENE	2.1E-02		1	1
PTX06-1012	6/18/2013	cis-1,2-DICHLOROETHYLENE	2.3E-02		1	1
PTX06-1012	9/3/2013	cis-1,2-DICHLOROETHYLENE	2.6E-02		1	1
PTX06-1012	12/18/2013	cis-1,2-DICHLOROETHYLENE	2.5E-02		1	1
PTX06-1012	2/24/2014	cis-1,2-DICHLOROETHYLENE	1.6E-02		1	1

MAROS Mann-Kendall Statistics Summary

Project: Pantex **User Name:** MV

Location: Southwest Sector **State:** Texas

Well	Effective Date	Constituent	Result (mg/L)	Flag	Number of Samples	Number of Detects
PTX06-1012	5/22/2014	cis-1,2-DICHLOROETHYLENE	3.4E-02		1	1
PTX06-1012	8/12/2014	cis-1,2-DICHLOROETHYLENE	8.2E-02		1	1
PTX06-1012	11/13/2014	cis-1,2-DICHLOROETHYLENE	1.2E-01		1	1
PTX06-1012	3/23/2015	cis-1,2-DICHLOROETHYLENE	7.3E-02		1	1
PTX06-1012	6/22/2015	cis-1,2-DICHLOROETHYLENE	6.7E-02		1	1
PTX06-1012	9/24/2015	cis-1,2-DICHLOROETHYLENE	1.1E-01		1	1
PTX06-1012	10/26/2015	cis-1,2-DICHLOROETHYLENE	6.9E-02		1	1
PTX06-1012	2/24/2016	cis-1,2-DICHLOROETHYLENE	7.2E-02		1	1
PTX06-1012	6/27/2016	cis-1,2-DICHLOROETHYLENE	8.5E-02		1	1
PTX06-1012	8/15/2016	cis-1,2-DICHLOROETHYLENE	7.6E-02		1	1
PTX06-1012	11/30/2016	cis-1,2-DICHLOROETHYLENE	7.5E-02		1	1

Note: Increasing (I); Probably Increasing (PI); Stable (S); Probably Decreasing (PD); Decreasing (D); No Trend (NT); Not Applicable (N/A) - Due to insufficient Data (< 4 sampling events); ND = Non-detect

MAROS Mann-Kendall Statistics Summary

Project: Pantex **User Name:** MV

Location: Southwest Sector **State:** Texas

Well: PTX06-1159

Well Type: Downgradient

COC: TRICHLOROETHYLENE (TCE)

Time Period: 2/23/2012 **to** 11/30/2016

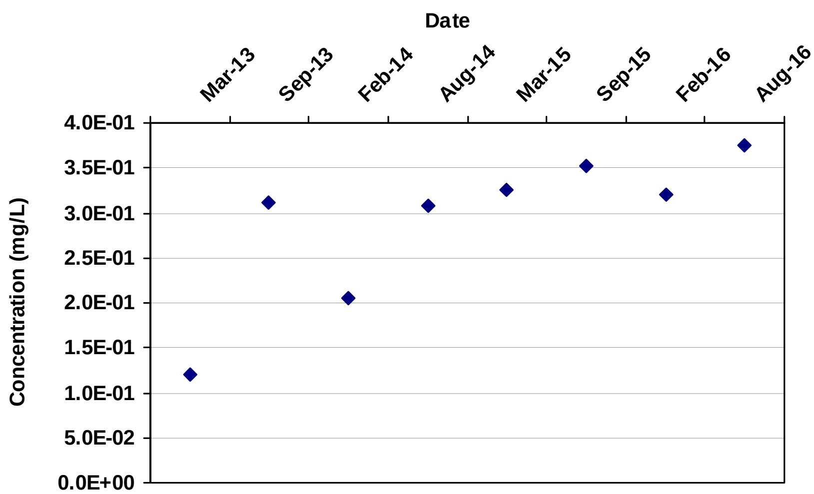
Consolidation Period: No Time Consolidation

Duplicate Consolidation: Median

Consolidation Type: Average

ND Values: 1/2 Detection Limit

J Flag Values : Actual Value



Mann Kendall S Statistic:

20

Confidence in Trend:

99.3%

Coefficient of Variation:

0.29

Mann Kendall Concentration Trend: (See Note)

I

Data Table:

Well	Effective Date	Constituent	Result (mg/L)	Flag	Number of Samples	Number of Detects
PTX06-1159	3/26/2013	TRICHLOROETHYLENE (TCE)	1.2E-01		1	1
PTX06-1159	9/3/2013	TRICHLOROETHYLENE (TCE)	3.1E-01		1	1
PTX06-1159	2/24/2014	TRICHLOROETHYLENE (TCE)	2.1E-01		1	1
PTX06-1159	8/12/2014	TRICHLOROETHYLENE (TCE)	3.1E-01		1	1
PTX06-1159	3/23/2015	TRICHLOROETHYLENE (TCE)	3.3E-01		1	1
PTX06-1159	9/24/2015	TRICHLOROETHYLENE (TCE)	3.5E-01		1	1
PTX06-1159	2/24/2016	TRICHLOROETHYLENE (TCE)	3.2E-01		1	1
PTX06-1159	8/15/2016	TRICHLOROETHYLENE (TCE)	3.8E-01		1	1

MAROS Mann-Kendall Statistics Summary

Project: Pantex **User Name:** MV

Location: Southwest Sector **State:** Texas

Well	Effective Date	Constituent	Result (mg/L)	Flag	Number of Samples	Number of Detects

Note: Increasing (I); Probably Increasing (PI); Stable (S); Probably Decreasing (PD); Decreasing (D); No Trend (NT); Not Applicable (N/A) - Due to insufficient Data (< 4 sampling events); ND = Non-detect

MAROS Mann-Kendall Statistics Summary

Project: Pantex　　**User Name:** MV

Location: Southwest Sector　　**State:** Texas

Well: PTX06-1159

Well Type: RA

COC: cis-1,2-DICHLOROETHYLENE

Time Period: 2/23/2012 **to** 11/30/2016

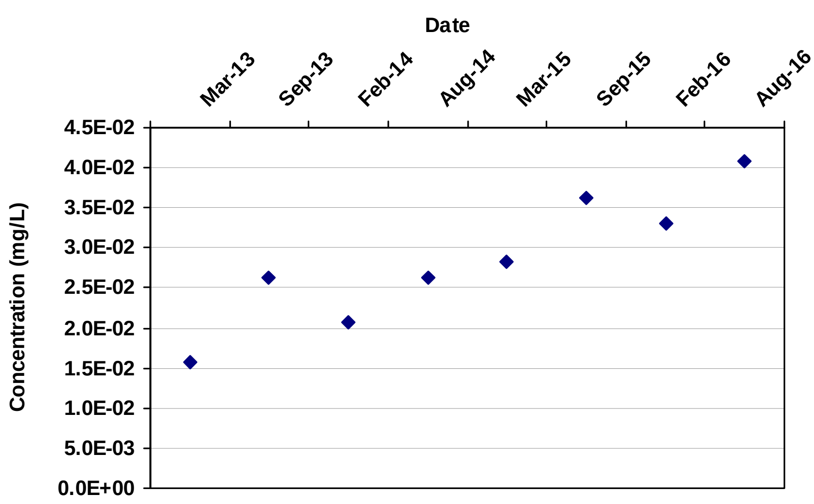
Consolidation Period: No Time Consolidation

Duplicate Consolidation: Median

Consolidation Type: Average

ND Values: 1/2 Detection Limit

J Flag Values : Actual Value



Mann Kendall S Statistic:

23

Confidence in Trend:

99.9%

Coefficient of Variation:

0.29

Mann Kendall Concentration Trend: (See Note)

I

Data Table:

Well	Effective Date	Constituent	Result (mg/L)	Flag	Number of Samples	Number of Detects
PTX06-1159	3/26/2013	cis-1,2-DICHLOROETHYLENE	1.6E-02		1	1
PTX06-1159	9/3/2013	cis-1,2-DICHLOROETHYLENE	2.6E-02		1	1
PTX06-1159	2/24/2014	cis-1,2-DICHLOROETHYLENE	2.1E-02		1	1
PTX06-1159	8/12/2014	cis-1,2-DICHLOROETHYLENE	2.6E-02		1	1
PTX06-1159	3/23/2015	cis-1,2-DICHLOROETHYLENE	2.8E-02		1	1
PTX06-1159	9/24/2015	cis-1,2-DICHLOROETHYLENE	3.6E-02		1	1
PTX06-1159	2/24/2016	cis-1,2-DICHLOROETHYLENE	3.3E-02		1	1
PTX06-1159	8/15/2016	cis-1,2-DICHLOROETHYLENE	4.1E-02		1	1

MAROS Mann-Kendall Statistics Summary

Project: Pantex **User Name:** MV

Location: Southwest Sector **State:** Texas

Well	Effective Date	Constituent	Result (mg/L)	Flag	Number of Samples	Number of Detects

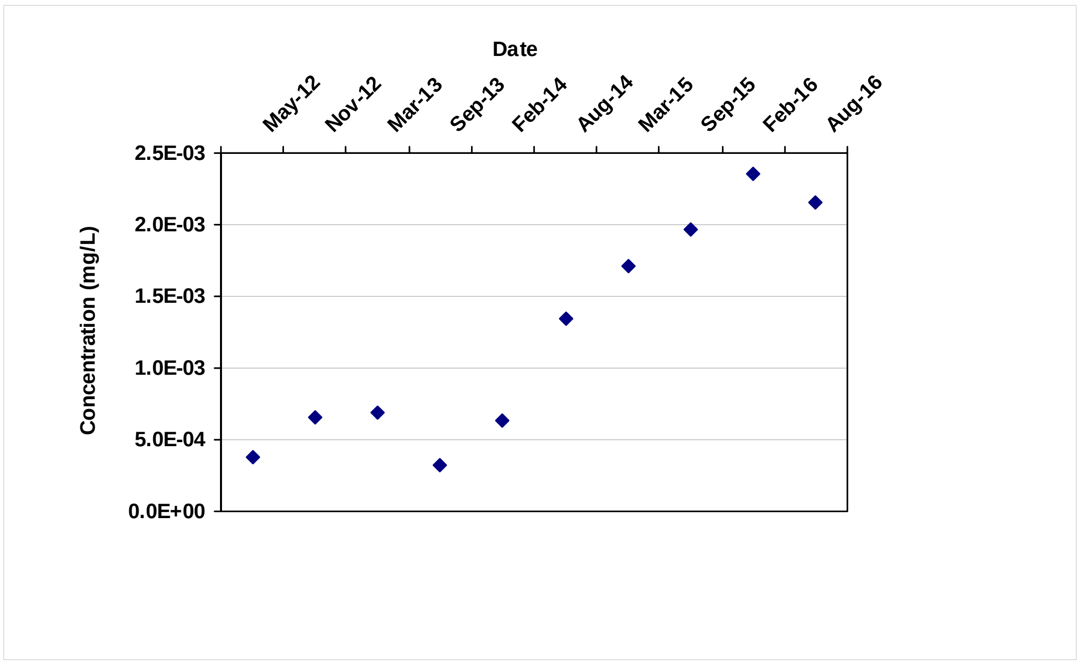
Note: Increasing (I); Probably Increasing (PI); Stable (S); Probably Decreasing (PD); Decreasing (D); No Trend (NT); Not Applicable (N/A) - Due to insufficient Data (< 4 sampling events); ND = Non-detect

MAROS Mann-Kendall Statistics Summary

Project: Pantex **User Name:** MV

Location: Southwest Sector **State:** Texas

Well:	PTX06-1035	**Time Period:**	2/23/2012 **to** 11/30/2016
Well Type:	Downgradient	**Consolidation Period:**	No Time Consolidation
COC:	TRICHLOROETHYLENE (TCE)	**Duplicate Consolidation:**	Median
		Consolidation Type:	Average
		ND Values:	1/2 Detection Limit
		J Flag Values :	Actual Value



Mann Kendall S Statistic:

33

Confidence in Trend:

99.9%

Coefficient of Variation:

0.64

Mann Kendall Concentration Trend: (See Note)

I

Data Table:

Well	Effective Date	Constituent	Result (mg/L)	Flag	Number of Samples	Number of Detects
PTX06-1035	5/29/2012	TRICHLOROETHYLENE (TCE)	3.8E-04		1	1
PTX06-1035	11/1/2012	TRICHLOROETHYLENE (TCE)	6.6E-04		1	1
PTX06-1035	3/26/2013	TRICHLOROETHYLENE (TCE)	6.9E-04		1	1
PTX06-1035	9/3/2013	TRICHLOROETHYLENE (TCE)	3.2E-04		1	1
PTX06-1035	2/24/2014	TRICHLOROETHYLENE (TCE)	6.3E-04		1	1
PTX06-1035	8/12/2014	TRICHLOROETHYLENE (TCE)	1.3E-03		1	1
PTX06-1035	3/23/2015	TRICHLOROETHYLENE (TCE)	1.7E-03		1	1
PTX06-1035	9/24/2015	TRICHLOROETHYLENE (TCE)	2.0E-03		1	1
PTX06-1035	2/24/2016	TRICHLOROETHYLENE (TCE)	2.4E-03		1	1

MAROS Mann-Kendall Statistics Summary

Project: Pantex **User Name:** MV

Location: Southwest Sector **State:** Texas

Well	Effective Date	Constituent	Result (mg/L)	Flag	Number of Samples	Number of Detects
PTX06-1035	8/15/2016	TRICHLOROETHYLENE (TCE)	2.2E-03		1	1

Note: Increasing (I); Probably Increasing (PI); Stable (S); Probably Decreasing (PD); Decreasing (D); No Trend (NT); Not Applicable (N/A) - Due to insufficient Data (< 4 sampling events); ND = Non-detect

MAROS Mann-Kendall Statistics Summary

Project: Pantex **User Name:** MV

Location: Southwest Sector **State:** Texas

Well: PTX06-1035 **Time Period:** 2/23/2012 **to** 11/30/2016

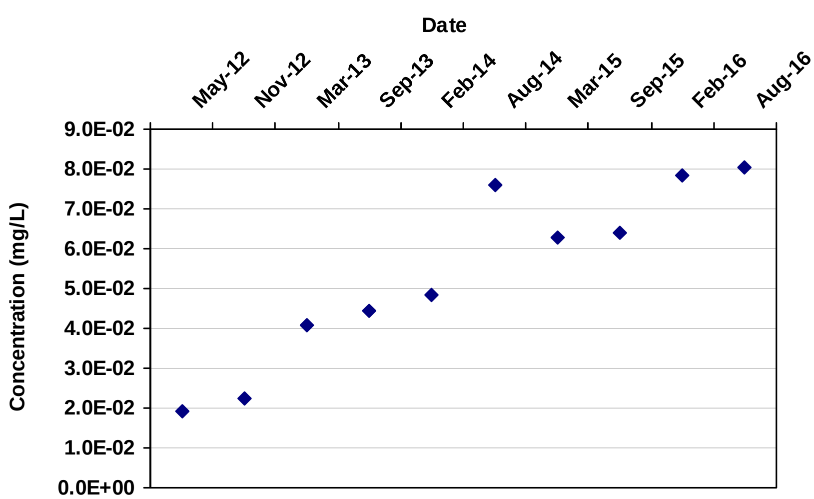
Well Type: Downgradient **Consolidation Period:** No Time Consolidation

COC: PERCHLORATE **Duplicate Consolidation:** Median

Consolidation Type: Average

ND Values: 1/2 Detection Limit

J Flag Values : Actual Value



Mann Kendall S Statistic:

41

Confidence in Trend:

100.0%

Coefficient of Variation:

0.41

Mann Kendall Concentration Trend: (See Note)

I

Data Table:

Well	Effective Date	Constituent	Result (mg/L)	Flag	Number of Samples	Number of Detects
PTX06-1035	5/29/2012	PERCHLORATE	1.9E-02		1	1
PTX06-1035	11/1/2012	PERCHLORATE	2.3E-02		1	1
PTX06-1035	3/26/2013	PERCHLORATE	4.1E-02		1	1
PTX06-1035	9/3/2013	PERCHLORATE	4.4E-02		1	1
PTX06-1035	2/24/2014	PERCHLORATE	4.8E-02		1	1
PTX06-1035	8/12/2014	PERCHLORATE	7.6E-02		1	1
PTX06-1035	3/23/2015	PERCHLORATE	6.3E-02		1	1
PTX06-1035	9/24/2015	PERCHLORATE	6.4E-02		1	1
PTX06-1035	2/24/2016	PERCHLORATE	7.8E-02		1	1

MAROS Mann-Kendall Statistics Summary

Project: Pantex **User Name:** MV

Location: Southwest Sector **State:** Texas

Well	Effective Date	Constituent	Result (mg/L)	Flag	Number of Samples	Number of Detects
PTX06-1035	8/15/2016	PERCHLORATE	8.0E-02		1	1

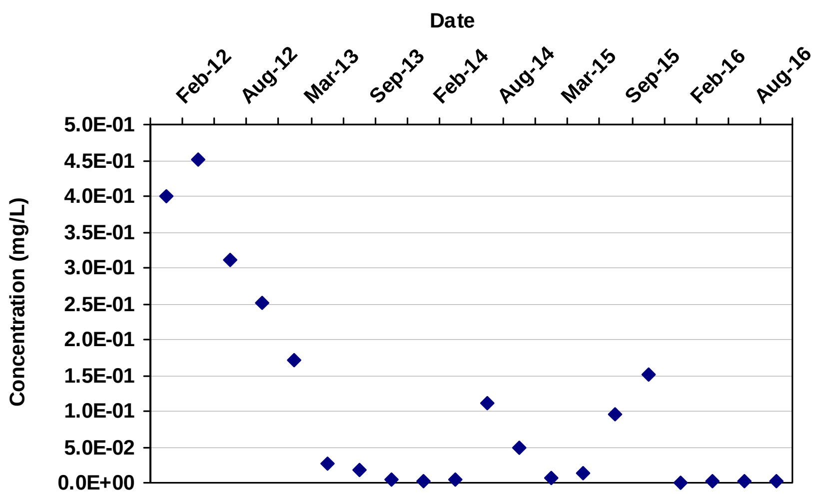
Note: Increasing (I); Probably Increasing (PI); Stable (S); Probably Decreasing (PD); Decreasing (D); No Trend (NT); Not Applicable (N/A) - Due to insufficient Data (< 4 sampling events); ND = Non-detect

MAROS Mann-Kendall Statistics Summary

Project: Pantex **User Name:** MV

Location: Southwest Sector **State:** Texas

Well:	PTX06-1155	**Time Period:**	2/23/2012 **to** 11/30/2016
Well Type:	ISPM	**Consolidation Period:**	No Time Consolidation
COC:	TRICHLOROETHYLENE (TCE)	**Duplicate Consolidation:**	Median
		Consolidation Type:	Average
		ND Values:	1/2 Detection Limit
		J Flag Values :	Actual Value



Mann Kendall S Statistic:

-106

Confidence in Trend:

100.0%

Coefficient of Variation:

1.37

Mann Kendall Concentration Trend: (See Note)

D

Data Table:

Well	Effective Date	Constituent	Result (mg/L)	Flag	Number of Samples	Number of Detects
PTX06-1155	2/23/2012	TRICHLOROETHYLENE (TCE)	4.0E-01		1	1
PTX06-1155	5/29/2012	TRICHLOROETHYLENE (TCE)	4.5E-01		1	1
PTX06-1155	8/6/2012	TRICHLOROETHYLENE (TCE)	3.1E-01		1	1
PTX06-1155	11/1/2012	TRICHLOROETHYLENE (TCE)	2.5E-01		1	1
PTX06-1155	3/26/2013	TRICHLOROETHYLENE (TCE)	1.7E-01		1	1
PTX06-1155	6/18/2013	TRICHLOROETHYLENE (TCE)	2.7E-02		1	1
PTX06-1155	9/3/2013	TRICHLOROETHYLENE (TCE)	1.8E-02		1	1
PTX06-1155	12/18/2013	TRICHLOROETHYLENE (TCE)	4.8E-03		1	1
PTX06-1155	2/24/2014	TRICHLOROETHYLENE (TCE)	3.0E-03		1	1

MAROS Mann-Kendall Statistics Summary

Project: Pantex **User Name:** MV

Location: Southwest Sector **State:** Texas

Well	Effective Date	Constituent	Result (mg/L)	Flag	Number of Samples	Number of Detects
PTX06-1155	5/22/2014	TRICHLOROETHYLENE (TCE)	5.4E-03		1	1
PTX06-1155	8/12/2014	TRICHLOROETHYLENE (TCE)	1.1E-01		1	1
PTX06-1155	11/13/2014	TRICHLOROETHYLENE (TCE)	4.8E-02		1	1
PTX06-1155	3/23/2015	TRICHLOROETHYLENE (TCE)	7.1E-03		1	1
PTX06-1155	6/22/2015	TRICHLOROETHYLENE (TCE)	1.4E-02		1	1
PTX06-1155	9/24/2015	TRICHLOROETHYLENE (TCE)	9.6E-02		1	1
PTX06-1155	10/26/2015	TRICHLOROETHYLENE (TCE)	1.5E-01		1	1
PTX06-1155	2/24/2016	TRICHLOROETHYLENE (TCE)	8.0E-04		1	1
PTX06-1155	6/27/2016	TRICHLOROETHYLENE (TCE)	2.8E-03		1	1
PTX06-1155	8/15/2016	TRICHLOROETHYLENE (TCE)	1.4E-03		1	1
PTX06-1155	11/30/2016	TRICHLOROETHYLENE (TCE)	1.5E-03	ND	1	0

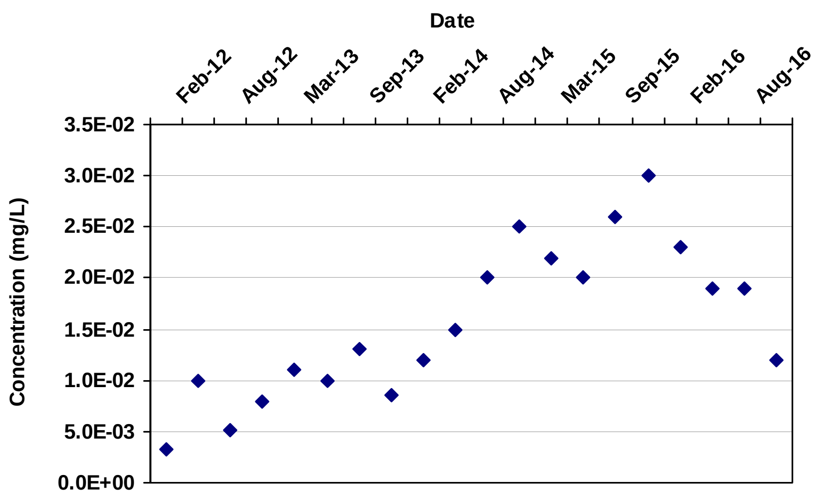
Note: Increasing (I); Probably Increasing (PI); Stable (S); Probably Decreasing (PD); Decreasing (D); No Trend (NT); Not Applicable (N/A) - Due to insufficient Data (< 4 sampling events); ND = Non-detect

MAROS Mann-Kendall Statistics Summary

Project: Pantex | **User Name:** MV

Location: Southwest Sector | **State:** Texas

Well:	PTX06-1155	**Time Period:**	2/23/2012 **to** 11/30/2016
Well Type:	ISPM	**Consolidation Period:**	No Time Consolidation
COC:	1,4-DIOXANE (P-DIOXANE)	**Duplicate Consolidation:**	Median
		Consolidation Type:	Average
		ND Values:	1/2 Detection Limit
		J Flag Values :	Actual Value



Mann Kendall S Statistic:

109

Confidence in Trend:

100.0%

Coefficient of Variation:

0.48

Mann Kendall Concentration Trend: (See Note)

I

Data Table:

Well	Effective Date	Constituent	Result (mg/L)	Flag	Number of Samples	Number of Detects
PTX06-1155	2/23/2012	1,4-DIOXANE (P-DIOXANE)	3.3E-03		1	1
PTX06-1155	5/29/2012	1,4-DIOXANE (P-DIOXANE)	9.9E-03		1	1
PTX06-1155	8/6/2012	1,4-DIOXANE (P-DIOXANE)	5.1E-03		1	1
PTX06-1155	11/1/2012	1,4-DIOXANE (P-DIOXANE)	7.9E-03		1	1
PTX06-1155	3/26/2013	1,4-DIOXANE (P-DIOXANE)	1.1E-02		1	1
PTX06-1155	6/18/2013	1,4-DIOXANE (P-DIOXANE)	1.0E-02		1	1
PTX06-1155	9/3/2013	1,4-DIOXANE (P-DIOXANE)	1.3E-02		1	1
PTX06-1155	12/18/2013	1,4-DIOXANE (P-DIOXANE)	8.6E-03		1	1
PTX06-1155	2/24/2014	1,4-DIOXANE (P-DIOXANE)	1.2E-02		1	1

MAROS Mann-Kendall Statistics Summary

Project: Pantex **User Name:** MV

Location: Southwest Sector **State:** Texas

Well	Effective Date	Constituent	Result (mg/L)	Flag	Number of Samples	Number of Detects
PTX06-1155	5/22/2014	1,4-DIOXANE (P-DIOXANE)	1.5E-02		1	1
PTX06-1155	8/12/2014	1,4-DIOXANE (P-DIOXANE)	2.0E-02		1	1
PTX06-1155	11/13/2014	1,4-DIOXANE (P-DIOXANE)	2.5E-02		1	1
PTX06-1155	3/23/2015	1,4-DIOXANE (P-DIOXANE)	2.2E-02		1	1
PTX06-1155	6/22/2015	1,4-DIOXANE (P-DIOXANE)	2.0E-02		1	1
PTX06-1155	9/24/2015	1,4-DIOXANE (P-DIOXANE)	2.6E-02		1	1
PTX06-1155	10/26/2015	1,4-DIOXANE (P-DIOXANE)	3.0E-02		1	1
PTX06-1155	2/24/2016	1,4-DIOXANE (P-DIOXANE)	2.3E-02		1	1
PTX06-1155	6/27/2016	1,4-DIOXANE (P-DIOXANE)	1.9E-02		1	1
PTX06-1155	8/15/2016	1,4-DIOXANE (P-DIOXANE)	1.9E-02		1	1
PTX06-1155	11/30/2016	1,4-DIOXANE (P-DIOXANE)	1.2E-02		1	1

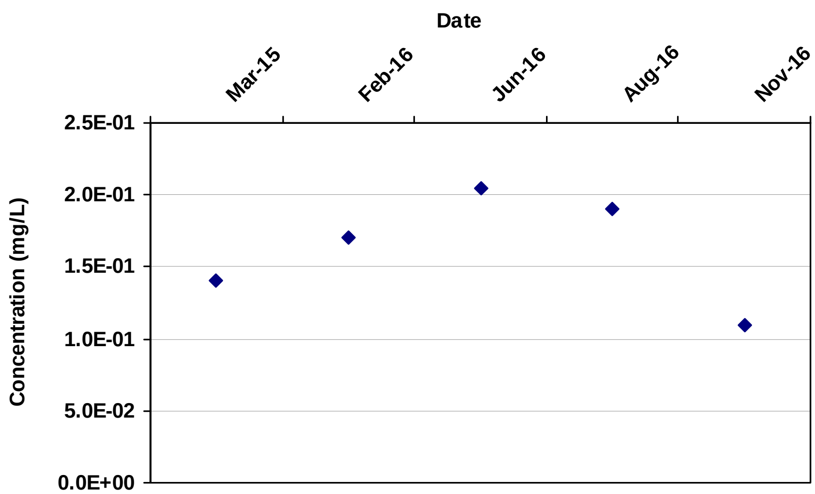
Note: Increasing (I); Probably Increasing (PI); Stable (S); Probably Decreasing (PD); Decreasing (D); No Trend (NT); Not Applicable (N/A) - Due to insufficient Data (< 4 sampling events); ND = Non-detect

MAROS Mann-Kendall Statistics Summary

Project: Pantex | **User Name:** MV

Location: Southwest Sector | **State:** Texas

Well:	PTX06-1176	**Time Period:**	2/23/2012 **to** 11/30/2016
Well Type:	ISB	**Consolidation Period:**	No Time Consolidation
COC:	TRICHLOROETHYLENE (TCE)	**Duplicate Consolidation:**	Median
		Consolidation Type:	Average
		ND Values:	1/2 Detection Limit
		J Flag Values :	Actual Value



Mann Kendall S Statistic:

0

Confidence in Trend:

40.8%

Coefficient of Variation:

0.24

Mann Kendall Concentration Trend: (See Note)

S

Data Table:

Well	Effective Date	Constituent	Result (mg/L)	Flag	Number of Samples	Number of Detects
PTX06-1176	3/23/2015	TRICHLOROETHYLENE (TCE)	1.4E-01		1	1
PTX06-1176	2/24/2016	TRICHLOROETHYLENE (TCE)	1.7E-01		2	2
PTX06-1176	6/27/2016	TRICHLOROETHYLENE (TCE)	2.1E-01		2	2
PTX06-1176	8/15/2016	TRICHLOROETHYLENE (TCE)	1.9E-01		1	1
PTX06-1176	11/30/2016	TRICHLOROETHYLENE (TCE)	1.1E-01		1	1

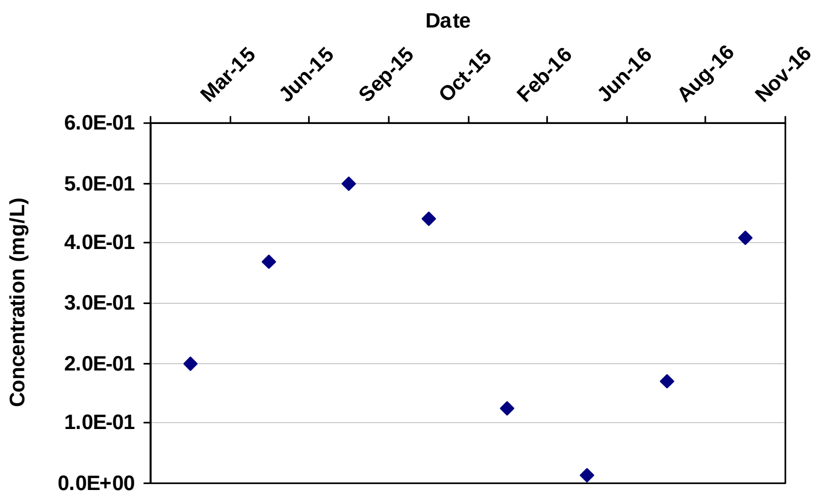
Note: Increasing (I); Probably Increasing (PI); Stable (S); Probably Decreasing (PD); Decreasing (D); No Trend (NT); Not Applicable (N/A) - Due to insufficient Data (< 4 sampling events); ND = Non-detect

MAROS Mann-Kendall Statistics Summary

Project: Pantex **User Name:** MV

Location: Southwest Sector **State:** Texas

Well:	PTX06-1170	**Time Period:**	2/23/2012 **to** 11/30/2016
Well Type:	ISB	**Consolidation Period:**	No Time Consolidation
COC:	TRICHLOROETHYLENE (TCE)	**Duplicate Consolidation:**	Median
		Consolidation Type:	Average
		ND Values:	1/2 Detection Limit
		J Flag Values :	Actual Value



Mann Kendall S Statistic:

-4

Confidence in Trend:

64.0%

Coefficient of Variation:

0.63

Mann Kendall Concentration Trend: (See Note)

S

Data Table:

Well	Effective Date	Constituent	Result (mg/L)	Flag	Number of Samples	Number of Detects
PTX06-1170	3/23/2015	TRICHLOROETHYLENE (TCE)	2.0E-01		1	1
PTX06-1170	6/22/2015	TRICHLOROETHYLENE (TCE)	3.7E-01		1	1
PTX06-1170	9/24/2015	TRICHLOROETHYLENE (TCE)	5.0E-01		1	1
PTX06-1170	10/26/2015	TRICHLOROETHYLENE (TCE)	4.4E-01		1	1
PTX06-1170	2/24/2016	TRICHLOROETHYLENE (TCE)	1.2E-01		2	2
PTX06-1170	6/27/2016	TRICHLOROETHYLENE (TCE)	1.4E-02		1	1
PTX06-1170	8/15/2016	TRICHLOROETHYLENE (TCE)	1.7E-01		1	1
PTX06-1170	11/30/2016	TRICHLOROETHYLENE (TCE)	4.1E-01		1	1

MAROS Mann-Kendall Statistics Summary

Project: Pantex | **User Name:** MV

Location: Southwest Sector | **State:** Texas

Well	Effective Date	Constituent	Result (mg/L)	Flag	Number of Samples	Number of Detects

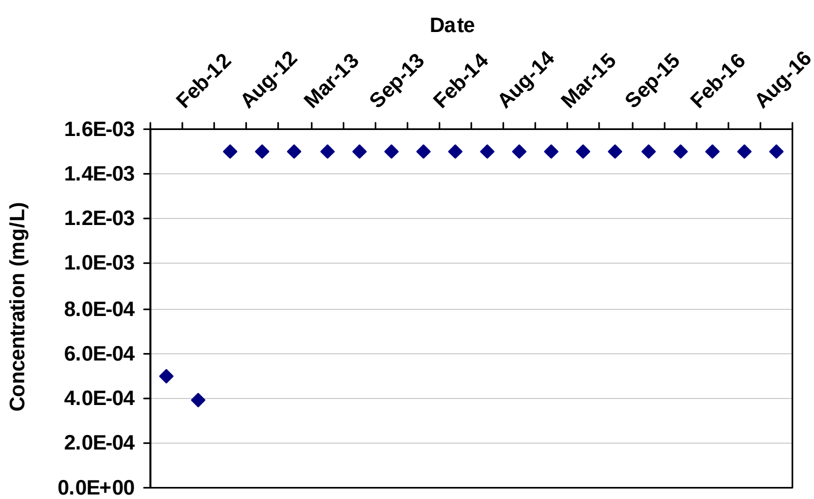
Note: Increasing (I); Probably Increasing (PI); Stable (S); Probably Decreasing (PD); Decreasing (D); No Trend (NT); Not Applicable (N/A) - Due to insufficient Data (< 4 sampling events); ND = Non-detect

MAROS Mann-Kendall Statistics Summary

Project: Pantex **User Name:** MV

Location: Southwest Sector **State:** Texas

Well:	PTX06-1156	**Time Period:**	2/23/2012 **to** 11/30/2016
Well Type:	ISPM	**Consolidation Period:**	No Time Consolidation
COC:	TRICHLOROETHYLENE (TCE)	**Duplicate Consolidation:**	Median
		Consolidation Type:	Average
		ND Values:	1/2 Detection Limit
		J Flag Values :	Actual Value



Mann Kendall S Statistic:

35

Confidence in Trend:

86.3%

Coefficient of Variation:

0.23

Mann Kendall Concentration Trend: (See Note)

NT

Data Table:

Well	Effective Date	Constituent	Result (mg/L)	Flag	Number of Samples	Number of Detects
PTX06-1156	2/23/2012	TRICHLOROETHYLENE (TCE)	5.0E-04		1	1
PTX06-1156	5/29/2012	TRICHLOROETHYLENE (TCE)	3.9E-04		1	1
PTX06-1156	8/6/2012	TRICHLOROETHYLENE (TCE)	1.5E-03	ND	1	0
PTX06-1156	11/1/2012	TRICHLOROETHYLENE (TCE)	1.5E-03	ND	1	0
PTX06-1156	3/26/2013	TRICHLOROETHYLENE (TCE)	1.5E-03	ND	1	0
PTX06-1156	6/18/2013	TRICHLOROETHYLENE (TCE)	1.5E-03	ND	1	0
PTX06-1156	9/3/2013	TRICHLOROETHYLENE (TCE)	1.5E-03	ND	1	0
PTX06-1156	12/18/2013	TRICHLOROETHYLENE (TCE)	1.5E-03	ND	1	0
PTX06-1156	2/24/2014	TRICHLOROETHYLENE (TCE)	1.5E-03	ND	1	0

MAROS Mann-Kendall Statistics Summary

Project: Pantex **User Name:** MV

Location: Southwest Sector **State:** Texas

Well	Effective Date	Constituent	Result (mg/L)	Flag	Number of Samples	Number of Detects
PTX06-1156	5/22/2014	TRICHLOROETHYLENE (TCE)	1.5E-03	ND	1	0
PTX06-1156	8/12/2014	TRICHLOROETHYLENE (TCE)	1.5E-03	ND	1	0
PTX06-1156	11/13/2014	TRICHLOROETHYLENE (TCE)	1.5E-03	ND	1	0
PTX06-1156	3/23/2015	TRICHLOROETHYLENE (TCE)	1.5E-03	ND	1	0
PTX06-1156	6/22/2015	TRICHLOROETHYLENE (TCE)	1.5E-03	ND	1	0
PTX06-1156	9/24/2015	TRICHLOROETHYLENE (TCE)	1.5E-03	ND	1	0
PTX06-1156	10/26/2015	TRICHLOROETHYLENE (TCE)	1.5E-03	ND	1	0
PTX06-1156	2/24/2016	TRICHLOROETHYLENE (TCE)	1.5E-03	ND	1	0
PTX06-1156	6/27/2016	TRICHLOROETHYLENE (TCE)	1.5E-03	ND	1	0
PTX06-1156	8/15/2016	TRICHLOROETHYLENE (TCE)	1.5E-03	ND	1	0
PTX06-1156	11/30/2016	TRICHLOROETHYLENE (TCE)	1.5E-03	ND	1	0

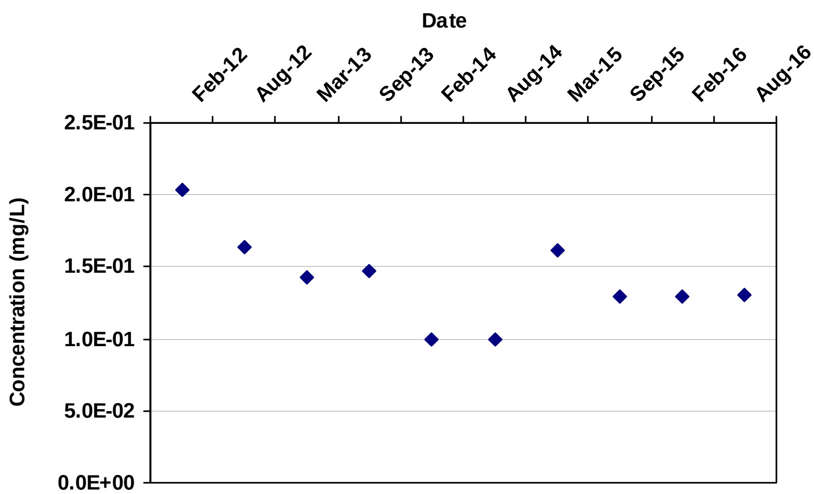
Note: Increasing (I); Probably Increasing (PI); Stable (S); Probably Decreasing (PD); Decreasing (D); No Trend (NT); Not Applicable (N/A) - Due to insufficient Data (< 4 sampling events); ND = Non-detect

MAROS Mann-Kendall Statistics Summary

Project: Pantex **User Name:** MV

Location: Southwest Sector **State:** Texas

Well:	PTX06-1151	**Time Period:**	2/23/2012 **to** 11/30/2016
Well Type:	Upgradient	**Consolidation Period:**	No Time Consolidation
COC:	TRICHLOROETHYLENE (TCE)	**Duplicate Consolidation:**	Median
		Consolidation Type:	Average
		ND Values:	1/2 Detection Limit
		J Flag Values :	Actual Value



Mann Kendall S Statistic:

-17

Confidence in Trend:

92.2%

Coefficient of Variation:

0.22

Mann Kendall Concentration Trend: (See Note)

PD

Data Table:

Well	Effective Date	Constituent	Result (mg/L)	Flag	Number of Samples	Number of Detects
PTX06-1151	2/23/2012	TRICHLOROETHYLENE (TCE)	2.0E-01		1	1
PTX06-1151	8/6/2012	TRICHLOROETHYLENE (TCE)	1.6E-01		1	1
PTX06-1151	3/26/2013	TRICHLOROETHYLENE (TCE)	1.4E-01		1	1
PTX06-1151	9/3/2013	TRICHLOROETHYLENE (TCE)	1.5E-01		1	1
PTX06-1151	2/24/2014	TRICHLOROETHYLENE (TCE)	1.0E-01		1	1
PTX06-1151	8/12/2014	TRICHLOROETHYLENE (TCE)	1.0E-01		1	1
PTX06-1151	3/23/2015	TRICHLOROETHYLENE (TCE)	1.6E-01		1	1
PTX06-1151	9/24/2015	TRICHLOROETHYLENE (TCE)	1.3E-01		1	1
PTX06-1151	2/24/2016	TRICHLOROETHYLENE (TCE)	1.3E-01		1	1

MAROS Mann-Kendall Statistics Summary

Project: Pantex **User Name:** MV

Location: Southwest Sector **State:** Texas

Well	Effective Date	Constituent	Result (mg/L)	Flag	Number of Samples	Number of Detects
PTX06-1151	8/15/2016	TRICHLOROETHYLENE (TCE)	1.3E-01		1	1

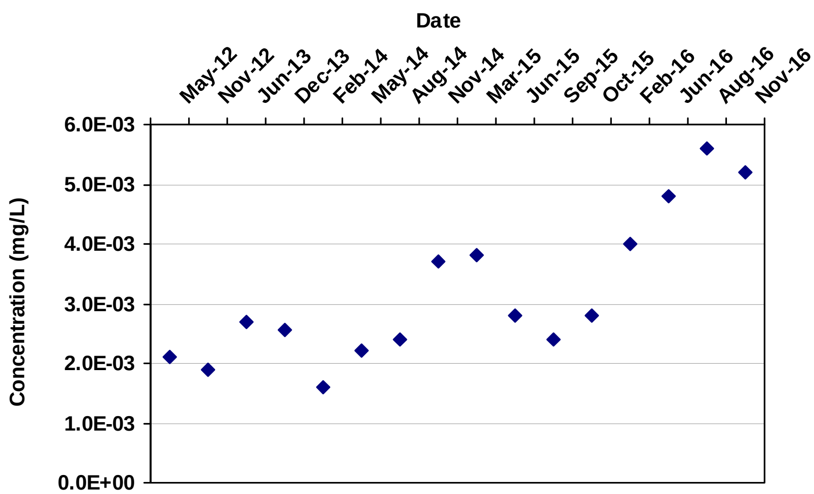
Note: Increasing (I); Probably Increasing (PI); Stable (S); Probably Decreasing (PD); Decreasing (D); No Trend (NT); Not Applicable (N/A) - Due to insufficient Data (< 4 sampling events); ND = Non-detect

MAROS Mann-Kendall Statistics Summary

Project: Pantex | **User Name:** MV

Location: Southwest Sector | **State:** Texas

Well:	PTX06-1150	**Time Period:**	2/23/2012 **to** 11/30/2016
Well Type:	ISPM	**Consolidation Period:**	No Time Consolidation
COC:	TRICHLOROETHYLENE (TCE)	**Duplicate Consolidation:**	Median
		Consolidation Type:	Average
		ND Values:	1/2 Detection Limit
		J Flag Values :	Actual Value



Mann Kendall S Statistic:

78

Confidence in Trend:

100.0%

Coefficient of Variation:

0.39

Mann Kendall Concentration Trend: (See Note)

I

Data Table:

Well	Effective Date	Constituent	Result (mg/L)	Flag	Number of Samples	Number of Detects
PTX06-1150	5/29/2012	TRICHLOROETHYLENE (TCE)	2.1E-03		1	1
PTX06-1150	11/1/2012	TRICHLOROETHYLENE (TCE)	1.9E-03		1	1
PTX06-1150	6/18/2013	TRICHLOROETHYLENE (TCE)	2.7E-03		1	1
PTX06-1150	12/18/2013	TRICHLOROETHYLENE (TCE)	2.6E-03		1	1
PTX06-1150	2/24/2014	TRICHLOROETHYLENE (TCE)	1.6E-03		1	1
PTX06-1150	5/22/2014	TRICHLOROETHYLENE (TCE)	2.2E-03		1	1
PTX06-1150	8/12/2014	TRICHLOROETHYLENE (TCE)	2.4E-03		1	1
PTX06-1150	11/13/2014	TRICHLOROETHYLENE (TCE)	3.7E-03		1	1
PTX06-1150	3/23/2015	TRICHLOROETHYLENE (TCE)	3.8E-03		1	1

MAROS Mann-Kendall Statistics Summary

Project: Pantex **User Name:** MV

Location: Southwest Sector **State:** Texas

Well	Effective Date	Constituent	Result (mg/L)	Flag	Number of Samples	Number of Detects
PTX06-1150	6/22/2015	TRICHLOROETHYLENE (TCE)	2.8E-03		1	1
PTX06-1150	9/24/2015	TRICHLOROETHYLENE (TCE)	2.4E-03		1	1
PTX06-1150	10/26/2015	TRICHLOROETHYLENE (TCE)	2.8E-03		1	1
PTX06-1150	2/24/2016	TRICHLOROETHYLENE (TCE)	4.0E-03		1	1
PTX06-1150	6/27/2016	TRICHLOROETHYLENE (TCE)	4.8E-03		1	1
PTX06-1150	8/15/2016	TRICHLOROETHYLENE (TCE)	5.6E-03		1	1
PTX06-1150	11/30/2016	TRICHLOROETHYLENE (TCE)	5.2E-03		1	1

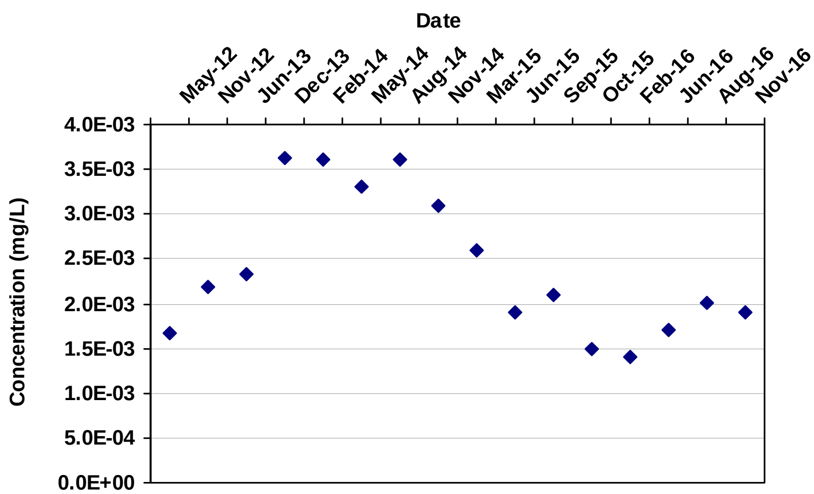
Note: Increasing (I); Probably Increasing (PI); Stable (S); Probably Decreasing (PD); Decreasing (D); No Trend (NT); Not Applicable (N/A) - Due to insufficient Data (< 4 sampling events); ND = Non-detect

MAROS Mann-Kendall Statistics Summary

Project: Pantex | **User Name:** MV
Location: Southwest Sector | **State:** Texas

Well: PTX06-1148
Well Type: ISPM
COC: TRICHLOROETHYLENE (TCE)

Time Period: 2/23/2012 **to** 11/30/2016
Consolidation Period: No Time Consolidation
Duplicate Consolidation: Median
Consolidation Type: Average
ND Values: 1/2 Detection Limit
J Flag Values : Actual Value



Mann Kendall S Statistic:

-44

Confidence in Trend:

97.4%

Coefficient of Variation:

0.33

Mann Kendall Concentration Trend: (See Note)

D

Data Table:

Well	Effective Date	Constituent	Result (mg/L)	Flag	Number of Samples	Number of Detects
PTX06-1148	5/29/2012	TRICHLOROETHYLENE (TCE)	1.7E-03		1	1
PTX06-1148	11/1/2012	TRICHLOROETHYLENE (TCE)	2.2E-03		1	1
PTX06-1148	6/18/2013	TRICHLOROETHYLENE (TCE)	2.3E-03		1	1
PTX06-1148	12/18/2013	TRICHLOROETHYLENE (TCE)	3.6E-03		1	1
PTX06-1148	2/24/2014	TRICHLOROETHYLENE (TCE)	3.6E-03		1	1
PTX06-1148	5/22/2014	TRICHLOROETHYLENE (TCE)	3.3E-03		1	1
PTX06-1148	8/12/2014	TRICHLOROETHYLENE (TCE)	3.6E-03		1	1
PTX06-1148	11/13/2014	TRICHLOROETHYLENE (TCE)	3.1E-03		1	1
PTX06-1148	3/23/2015	TRICHLOROETHYLENE (TCE)	2.6E-03		1	1

MAROS Mann-Kendall Statistics Summary

Project: Pantex **User Name:** MV

Location: Southwest Sector **State:** Texas

Well	Effective Date	Constituent	Result (mg/L)	Flag	Number of Samples	Number of Detects
PTX06-1148	6/22/2015	TRICHLOROETHYLENE (TCE)	1.9E-03		1	1
PTX06-1148	9/24/2015	TRICHLOROETHYLENE (TCE)	2.1E-03		1	1
PTX06-1148	10/26/2015	TRICHLOROETHYLENE (TCE)	1.5E-03		1	1
PTX06-1148	2/24/2016	TRICHLOROETHYLENE (TCE)	1.4E-03		1	1
PTX06-1148	6/27/2016	TRICHLOROETHYLENE (TCE)	1.7E-03		1	1
PTX06-1148	8/15/2016	TRICHLOROETHYLENE (TCE)	2.0E-03		1	1
PTX06-1148	11/30/2016	TRICHLOROETHYLENE (TCE)	1.9E-03		1	1

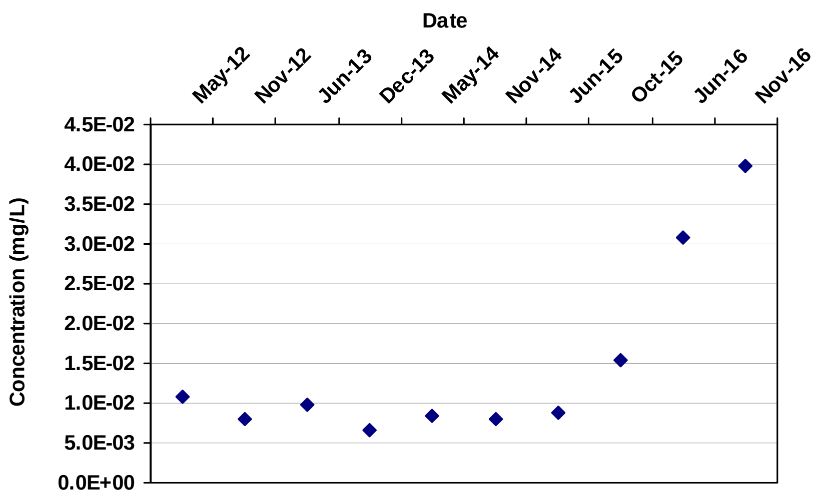
Note: Increasing (I); Probably Increasing (PI); Stable (S); Probably Decreasing (PD); Decreasing (D); No Trend (NT); Not Applicable (N/A) - Due to insufficient Data (< 4 sampling events); ND = Non-detect

MAROS Mann-Kendall Statistics Summary

Project: Pantex | **User Name:** MV

Location: Southwest Sector | **State:** Texas

Well:	PTX06-1127	**Time Period:**	2/23/2012 **to** 11/30/2016
Well Type:	Upgradient	**Consolidation Period:**	No Time Consolidation
COC:	TRICHLOROETHYLENE (TCE)	**Duplicate Consolidation:**	Median
		Consolidation Type:	Average
		ND Values:	1/2 Detection Limit
		J Flag Values :	Actual Value



Mann Kendall S Statistic:

19

Confidence in Trend:

94.6%

Coefficient of Variation:

0.78

Mann Kendall Concentration Trend: (See Note)

PI

Data Table:

Well	Effective Date	Constituent	Result (mg/L)	Flag	Number of Samples	Number of Detects
PTX06-1127	5/29/2012	TRICHLOROETHYLENE (TCE)	1.1E-02		2	2
PTX06-1127	11/1/2012	TRICHLOROETHYLENE (TCE)	8.1E-03		2	2
PTX06-1127	6/18/2013	TRICHLOROETHYLENE (TCE)	9.7E-03		1	1
PTX06-1127	12/18/2013	TRICHLOROETHYLENE (TCE)	6.6E-03		2	2
PTX06-1127	5/22/2014	TRICHLOROETHYLENE (TCE)	8.4E-03		1	1
PTX06-1127	11/13/2014	TRICHLOROETHYLENE (TCE)	8.0E-03		1	1
PTX06-1127	6/22/2015	TRICHLOROETHYLENE (TCE)	8.8E-03		1	1
PTX06-1127	10/26/2015	TRICHLOROETHYLENE (TCE)	1.5E-02		1	1
PTX06-1127	6/27/2016	TRICHLOROETHYLENE (TCE)	3.1E-02		1	1

MAROS Mann-Kendall Statistics Summary

Project: Pantex **User Name:** MV

Location: Southwest Sector **State:** Texas

Well	Effective Date	Constituent	Result (mg/L)	Flag	Number of Samples	Number of Detects
PTX06-1127	11/30/2016	TRICHLOROETHYLENE (TCE)	4.0E-02		1	1

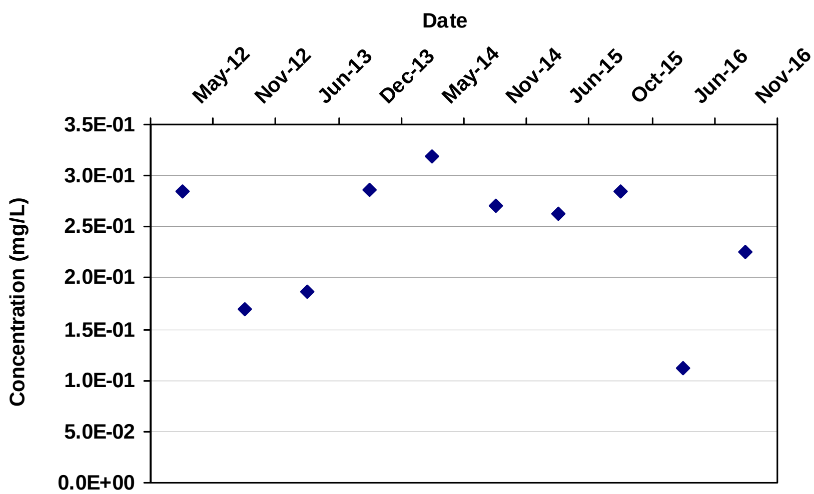
Note: Increasing (I); Probably Increasing (PI); Stable (S); Probably Decreasing (PD); Decreasing (D); No Trend (NT); Not Applicable (N/A) - Due to insufficient Data (< 4 sampling events); ND = Non-detect

MAROS Mann-Kendall Statistics Summary

Project: Pantex | **User Name:** MV

Location: Southwest Sector | **State:** Texas

Well:	PTX06-1126	**Time Period:**	2/23/2012 **to** 11/30/2016
Well Type:	Upgradient ISB	**Consolidation Period:**	No Time Consolidation
COC:	TRICHLOROETHYLENE (TCE)	**Duplicate Consolidation:**	Median
		Consolidation Type:	Average
		ND Values:	1/2 Detection Limit
		J Flag Values :	Actual Value



Mann Kendall S Statistic:

-5

Confidence in Trend:

63.6%

Coefficient of Variation:

0.27

Mann Kendall Concentration Trend: (See Note)

S

Data Table:

Well	Effective Date	Constituent	Result (mg/L)	Flag	Number of Samples	Number of Detects
PTX06-1126	5/29/2012	TRICHLOROETHYLENE (TCE)	2.8E-01		1	1
PTX06-1126	11/1/2012	TRICHLOROETHYLENE (TCE)	1.7E-01		1	1
PTX06-1126	6/18/2013	TRICHLOROETHYLENE (TCE)	1.9E-01		1	1
PTX06-1126	12/18/2013	TRICHLOROETHYLENE (TCE)	2.9E-01		2	2
PTX06-1126	5/22/2014	TRICHLOROETHYLENE (TCE)	3.2E-01		1	1
PTX06-1126	11/13/2014	TRICHLOROETHYLENE (TCE)	2.7E-01		1	1
PTX06-1126	6/22/2015	TRICHLOROETHYLENE (TCE)	2.6E-01		1	1
PTX06-1126	10/26/2015	TRICHLOROETHYLENE (TCE)	2.9E-01		1	1
PTX06-1126	6/27/2016	TRICHLOROETHYLENE (TCE)	1.1E-01		1	1

MAROS Mann-Kendall Statistics Summary

Project: Pantex **User Name:** MV

Location: Southwest Sector **State:** Texas

Well	Effective Date	Constituent	Result (mg/L)	Flag	Number of Samples	Number of Detects
PTX06-1126	11/30/2016	TRICHLOROETHYLENE (TCE)	2.3E-01		1	1

Note: Increasing (I); Probably Increasing (PI); Stable (S); Probably Decreasing (PD); Decreasing (D); No Trend (NT); Not Applicable (N/A) - Due to insufficient Data (< 4 sampling events); ND = Non-detect

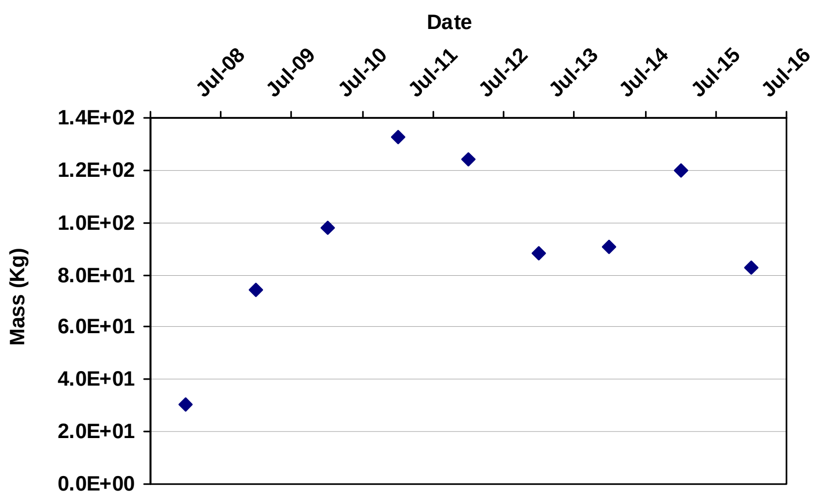
MAROS Zeroth Moment Analysis

Project: Pantex **User Name:** MV

Location: Southwest Sector **State:** Texas

Change in Dissolved Mass Over Time

COC: TRICHLOROETHYLENE (TCE)



Porosity: 0.25

Saturated Thickness:

Uniform: 30 ft

Mann-Kendall S Statistic:

6

Confidence in Trend:

69.4%

Coefficient of Variation:

0.33

Zeroth Moment Trend:

NT

Data Table:

Effective Date	Constituent	Estimated Mass (Kg)	Number of Wells
7/1/2008	TRICHLOROETHYLENE (TCE)	3.0E+01	23
7/1/2009	TRICHLOROETHYLENE (TCE)	7.4E+01	32
7/1/2010	TRICHLOROETHYLENE (TCE)	9.8E+01	32
7/1/2011	TRICHLOROETHYLENE (TCE)	1.3E+02	32
7/1/2012	TRICHLOROETHYLENE (TCE)	1.2E+02	36
7/1/2013	TRICHLOROETHYLENE (TCE)	8.8E+01	38
7/1/2014	TRICHLOROETHYLENE (TCE)	9.1E+01	37
7/1/2015	TRICHLOROETHYLENE (TCE)	1.2E+02	41
7/1/2016	TRICHLOROETHYLENE (TCE)	8.3E+01	47

Note: Increasing (I); Probably Increasing (PI); Stable (S); Probably Decreasing (PD); Decreasing (D); No Trend (NT); Not Applicable (N/A) - Due to insufficient Data (< 4 sampling events); ND = Non-detect. Moments are not calculated for sample events with less than 6 wells.

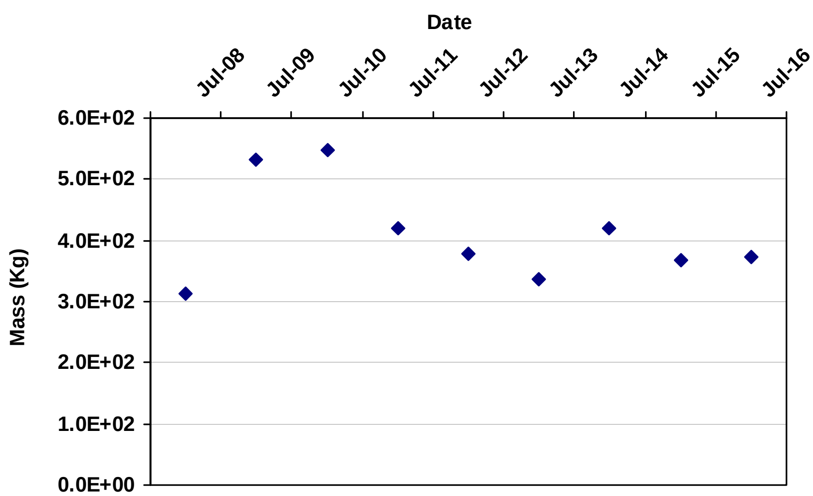
MAROS Zeroth Moment Analysis

Project: Pantex **User Name:** MV

Location: Southwest Sector **State:** Texas

Change in Dissolved Mass Over Time

COC: PERCHLORATE



Porosity: 0.25

Saturated Thickness:

Uniform: 30 ft

Mann-Kendall S Statistic:

-6

Confidence in Trend:

69.4%

Coefficient of Variation:

0.20

Zeroth Moment Trend:

S

Data Table:

Effective Date	Constituent	Estimated Mass (Kg)	Number of Wells
7/1/2008	PERCHLORATE	3.1E+02	22
7/1/2009	PERCHLORATE	5.3E+02	25
7/1/2010	PERCHLORATE	5.5E+02	24
7/1/2011	PERCHLORATE	4.2E+02	23
7/1/2012	PERCHLORATE	3.8E+02	27
7/1/2013	PERCHLORATE	3.4E+02	29
7/1/2014	PERCHLORATE	4.2E+02	28
7/1/2015	PERCHLORATE	3.7E+02	33
7/1/2016	PERCHLORATE	3.7E+02	38

Note: Increasing (I); Probably Increasing (PI); Stable (S); Probably Decreasing (PD); Decreasing (D); No Trend (NT); Not Applicable (N/A) - Due to insufficient Data (< 4 sampling events); ND = Non-detect. Moments are not calculated for sample events with less than 6 wells.

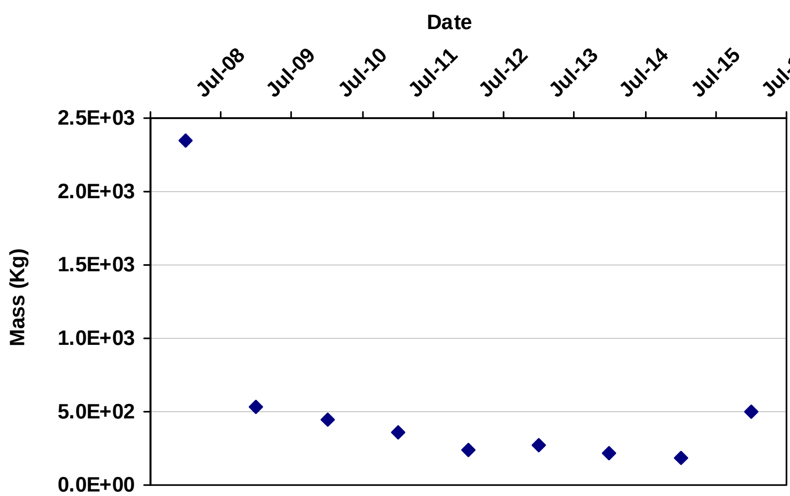
MAROS Zeroth Moment Analysis

Project: Pantex **User Name:** MV

Location: Southwest Sector **State:** Texas

Change in Dissolved Mass Over Time

COC: CHROMIUM, TOTAL



Porosity: 0.25

Saturated Thickness:

Uniform: 30 ft

Mann-Kendall S Statistic:

-22

Confidence in Trend:

98.8%

Coefficient of Variation:

1.20

Zeroth Moment Trend:

D

Data Table:

Effective Date	Constituent	Estimated Mass (Kg)	Number of Wells
7/1/2008	CHROMIUM, TOTAL	2.3E+03	23
7/1/2009	CHROMIUM, TOTAL	5.4E+02	17
7/1/2010	CHROMIUM, TOTAL	4.4E+02	11
7/1/2011	CHROMIUM, TOTAL	3.6E+02	24
7/1/2012	CHROMIUM, TOTAL	2.4E+02	12
7/1/2013	CHROMIUM, TOTAL	2.8E+02	12
7/1/2014	CHROMIUM, TOTAL	2.1E+02	18
7/1/2015	CHROMIUM, TOTAL	1.9E+02	21
7/1/2016	CHROMIUM, TOTAL	5.0E+02	35

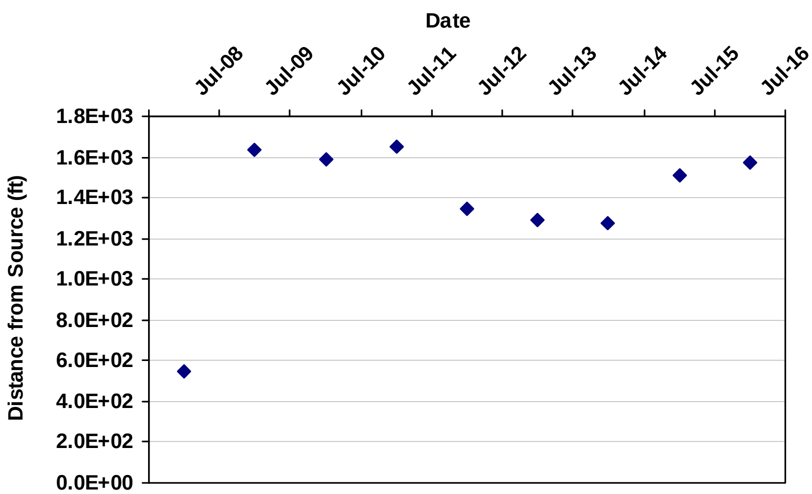
Note: Increasing (I); Probably Increasing (PI); Stable (S); Probably Decreasing (PD); Decreasing (D); No Trend (NT); Not Applicable (N/A) - Due to insufficient Data (< 4 sampling events); ND = Non-detect. Moments are not calculated for sample events with less than 6 wells.

MAROS First Moment Analysis

Project: Pantex | **User Name:** MV
Location: Southwest Sector | **State:** Texas

COC: TRICHLOROETHYLENE (TCE)

Distance from Source to Center of Mass



Mann-Kendall S Statistic:
-2

Confidence in Trend:
54.0%

Coefficient of Variation:
0.25

First Moment Trend:
S

DATA TABLE

Effective Date	Constituent	Xc (ft)	Yc (ft)	Distance from Source	Number of Wells
7/1/2008	TRICHLOROETHYLENE (TCE)	635,860	3,756,696	544	23
7/1/2009	TRICHLOROETHYLENE (TCE)	634,774	3,756,564	1,638	32
7/1/2010	TRICHLOROETHYLENE (TCE)	634,824	3,756,562	1,589	32
7/1/2011	TRICHLOROETHYLENE (TCE)	634,765	3,756,545	1,650	32
7/1/2012	TRICHLOROETHYLENE (TCE)	635,065	3,756,956	1,349	36
7/1/2013	TRICHLOROETHYLENE (TCE)	635,117	3,756,642	1,289	38
7/1/2014	TRICHLOROETHYLENE (TCE)	635,129	3,756,683	1,273	37
7/1/2015	TRICHLOROETHYLENE (TCE)	634,922	3,756,431	1,514	41
7/1/2016	TRICHLOROETHYLENE (TCE)	634,907	3,756,269	1,572	47

Note: Increasing (I); Probably Increasing (PI); Stable (S); Probably Decreasing (PD); Decreasing (D); No Trend (NT); Not Applicable (N/A) - Due to insufficient Data (< 4 sampling events). Moments are not calculated for sample events with less than 6 wells.

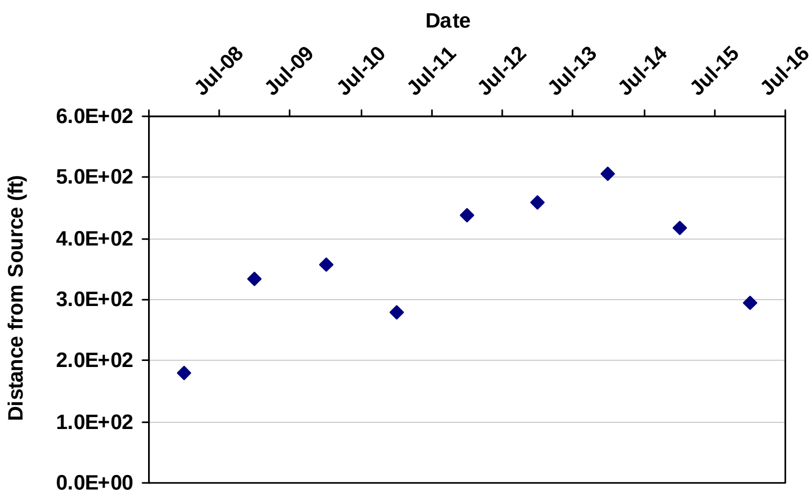
MAROS First Moment Analysis

Project: Pantex **User Name:** MV

Location: Southwest Sector **State:** Texas

COC: PERCHLORATE

Distance from Source to Center of Mass



Mann-Kendall S Statistic:

14

Confidence in Trend:

91.0%

Coefficient of Variation:

0.28

First Moment Trend:

PI

DATA TABLE

Effective Date	Constituent	Xc (ft)	Yc (ft)	Distance from Source	Number of Wells
7/1/2008	PERCHLORATE	636,455	3,756,933	180	22
7/1/2009	PERCHLORATE	636,155	3,756,535	334	25
7/1/2010	PERCHLORATE	636,125	3,756,533	358	24
7/1/2011	PERCHLORATE	636,136	3,756,673	279	23
7/1/2012	PERCHLORATE	636,286	3,757,186	439	27
7/1/2013	PERCHLORATE	636,236	3,757,190	458	29
7/1/2014	PERCHLORATE	636,246	3,757,244	506	28
7/1/2015	PERCHLORATE	636,139	3,757,087	417	33
7/1/2016	PERCHLORATE	636,320	3,757,046	295	38

Note: Increasing (I); Probably Increasing (PI); Stable (S); Probably Decreasing (PD); Decreasing (D); No Trend (NT); Not Applicable (N/A) - Due to insufficient Data (< 4 sampling events). Moments are not calculated for sample events with less than 6 wells.

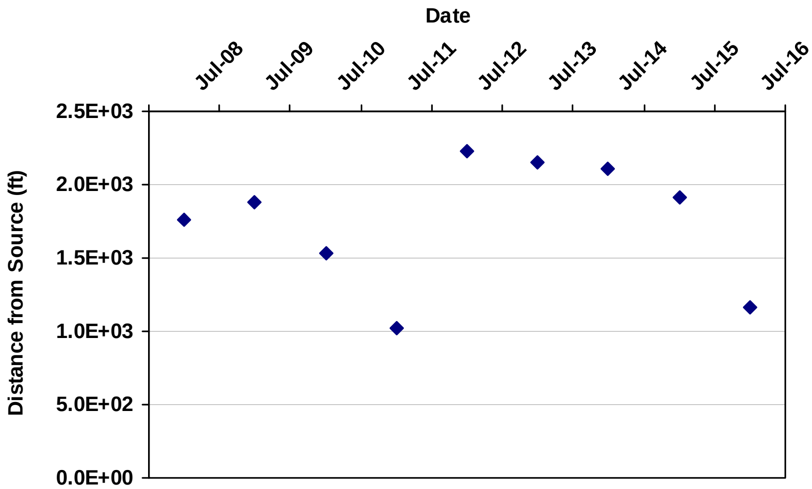
MAROS First Moment Analysis

Project: Pantex **User Name:** MV

Location: Southwest Sector **State:** Texas

COC: CHROMIUM, TOTAL

Distance from Source to Center of Mass



Mann-Kendall S Statistic:
0

Confidence in Trend:
46.0%

Coefficient of Variation:
0.25

First Moment Trend:
S

DATA TABLE

Effective Date	Constituent	Xc (ft)	Yc (ft)	Distance from Source	Number of Wells
7/1/2008	CHROMIUM, TOTAL	637,772	3,757,858	1,756	23
7/1/2009	CHROMIUM, TOTAL	638,214	3,756,282	1,876	17
7/1/2010	CHROMIUM, TOTAL	637,681	3,755,923	1,531	11
7/1/2011	CHROMIUM, TOTAL	636,654	3,755,771	1,023	24
7/1/2012	CHROMIUM, TOTAL	638,160	3,755,396	2,228	12
7/1/2013	CHROMIUM, TOTAL	638,193	3,755,578	2,149	12
7/1/2014	CHROMIUM, TOTAL	637,808	3,755,196	2,106	18
7/1/2015	CHROMIUM, TOTAL	638,009	3,755,727	1,913	21
7/1/2016	CHROMIUM, TOTAL	637,400	3,756,169	1,163	35

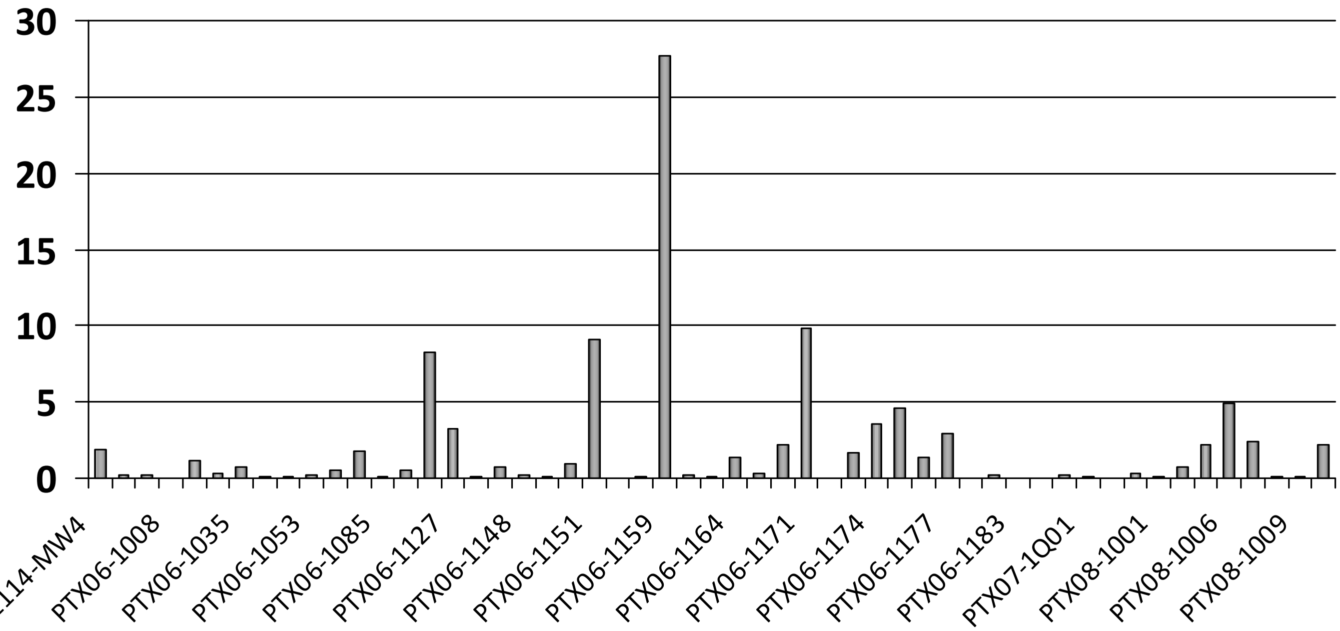
Note: Increasing (I); Probably Increasing (PI); Stable (S); Probably Decreasing (PD); Decreasing (D); No Trend (NT); Not Applicable (N/A) - Due to insufficient Data (< 4 sampling events). Moments are not calculated for sample events with less than 6 wells.

MAROS Percent of Mass by Well

Project: Pantex **User Name:** MV

Location: Southwest Sector **State:** Texas

TRICHLOROETHYLENE (TCE) 7/1/2016



Well	Area (ft2)	Mass (mg)	Percent of Mass	Percent of Area
1114-MW4	2,187,942.97	4,336.23	1.89	2.44
PTX06-1006	2,435,332.46	421.92	0.18	2.72
PTX06-1007	2,977,699.96	383.01	0.17	3.33
PTX06-1008	1,006,773.04	81.93	0.04	1.12
PTX06-1011	2,294,535.02	2,583.93	1.13	2.56
PTX06-1012	304,319.09	742.92	0.32	0.34
PTX06-1035	3,020,389.90	1,787.88	0.78	3.37
PTX06-1036	1,041,733.69	273.46	0.12	1.16
PTX06-1052	2,194,563.85	241.95	0.11	2.45
PTX06-1053	3,022,608.92	396.72	0.17	3.38
PTX06-1073A	4,150,459.00	1,089.50	0.48	4.64
PTX06-1077A	4,049,820.15	4,146.00	1.81	4.52
PTX06-1085	2,190,843.49	287.55	0.13	2.45
PTX06-1086	8,529,727.81	1,119.53	0.49	9.53

MAROS Percent of Mass by Well

Project: Pantex **User Name:** MV

Location: Southwest Sector **State:** Texas

Well	Area (ft2)	Mass (mg)	Percent of Mass	Percent of Area
PTX06-1126	425,738.10	18,886.81	8.24	0.48
PTX06-1127	812,361.18	7,527.54	3.28	0.91
PTX06-1131	1,529,074.53	200.69	0.09	1.71
PTX06-1134	2,246,318.53	1,766.03	0.77	2.51
PTX06-1148	986,811.37	466.27	0.20	1.10
PTX06-1149	678,258.85	267.06	0.12	0.76
PTX06-1150	1,565,024.38	2,054.09	0.90	1.75
PTX06-1151	614,409.91	20,886.10	9.11	0.69
PTX06-1155	71,583.99	27.25	0.01	0.08
PTX06-1156	600,205.08	236.33	0.10	0.67
PTX06-1159	696,054.30	63,493.21	27.69	0.78
PTX06-1160	2,621,764.59	364.75	0.16	2.93
PTX06-1162	714,320.86	187.51	0.08	0.80
PTX06-1164	81,488.74	3,101.67	1.35	0.09
PTX06-1169	194,627.14	664.17	0.29	0.22
PTX06-1170	128,479.15	4,966.12	2.17	0.14
PTX06-1171	283,817.67	22,574.15	9.85	0.32
PTX06-1172	112,060.46	29.42	0.01	0.13
PTX06-1173	147,623.99	3,875.13	1.69	0.16
PTX06-1174	196,538.36	8,254.61	3.60	0.22
PTX06-1175	334,505.12	10,536.91	4.60	0.37
PTX06-1176	64,962.02	3,069.46	1.34	0.07
PTX06-1177	215,571.53	6,790.50	2.96	0.24
PTX06-1180	364,995.60	95.81	0.04	0.41
PTX06-1181	2,839,455.80	372.68	0.16	3.17
PTX06-1183	378,842.93	45.75	0.02	0.42
PTX07-1P02	616,645.36	80.93	0.04	0.69
PTX07-1P05	1,810,166.45	475.17	0.21	2.02
PTX07-1Q01	2,383,680.14	312.86	0.14	2.66
PTX07-1Q02	277,970.92	36.48	0.02	0.31
PTX07-1Q03	6,220,267.64	816.41	0.36	6.95

MAROS Percent of Mass by Well

Project: Pantex | **User Name:** MV
Location: Southwest Sector | **State:** Texas

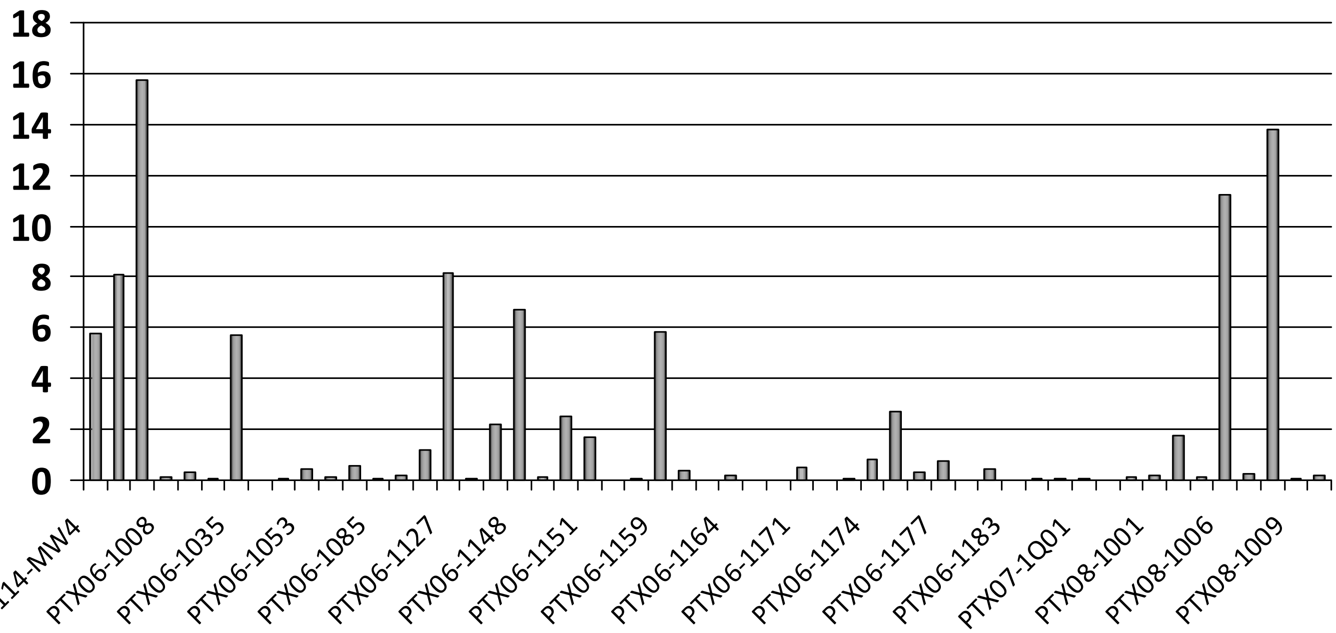
Well	Area (ft2)	Mass (mg)	Percent of Mass	Percent of Area
PTX08-1001	1,251,956.44	164.32	0.07	1.40
PTX08-1003	8,003,427.39	1,638.70	0.71	8.94
PTX08-1005	852,230.18	4,921.63	2.15	0.95
PTX08-1006	1,563,013.25	11,159.92	4.87	1.75
PTX08-1007	1,829,804.09	5,475.69	2.39	2.04
PTX08-1008	2,443,406.26	320.70	0.14	2.73
PTX08-1009	2,628,961.80	279.49	0.12	2.94
PTX10-1014	1,308,496.52	4,946.12	2.16	1.46
	89,501,669.9	229,260.9	100	100

MAROS Percent of Mass by Well

Project: Pantex | **User Name:** MV

Location: Southwest Sector | **State:** Texas

PERCHLORATE 7/1/2016



Well	Area (ft2)	Mass (mg)	Percent of Mass	Percent of Area
1114-MW4	2,187,942.97	63,464.02	5.79	2.44
PTX06-1006	2,435,332.46	88,859.20	8.11	2.72
PTX06-1007	2,977,699.96	172,743.83	15.76	3.33
PTX06-1008	1,006,773.04	1,585.67	0.14	1.12
PTX06-1011	2,294,535.02	3,613.89	0.33	2.56
PTX06-1012	304,319.09	479.30	0.04	0.34
PTX06-1035	3,020,389.90	62,873.19	5.74	3.37
PTX06-1036	1,041,733.69	273.46	0.02	1.16
PTX06-1052	2,194,563.85	576.07	0.05	2.45
PTX06-1053	3,022,608.92	4,760.61	0.43	3.38
PTX06-1073A	4,150,459.00	1,089.50	0.10	4.64
PTX06-1077A	4,049,820.15	6,378.47	0.58	4.52
PTX06-1085	2,190,843.49	575.10	0.05	2.45
PTX06-1086	8,529,727.81	2,239.05	0.20	9.53

MAROS Percent of Mass by Well

Project: Pantex **User Name:** MV

Location: Southwest Sector **State:** Texas

Well	Area (ft2)	Mass (mg)	Percent of Mass	Percent of Area
PTX06-1126	425,738.10	13,058.72	1.19	0.48
PTX06-1127	812,361.18	89,456.20	8.16	0.91
PTX06-1131	1,529,074.53	401.38	0.04	1.71
PTX06-1134	2,246,318.53	24,087.56	2.20	2.51
PTX06-1148	986,811.37	73,825.83	6.74	1.10
PTX06-1149	678,258.85	1,068.26	0.10	0.76
PTX06-1150	1,565,024.38	27,524.87	2.51	1.75
PTX06-1151	614,409.91	18,305.58	1.67	0.69
PTX06-1155	71,583.99	112.74	0.01	0.08
PTX06-1156	600,205.08	945.32	0.09	0.67
PTX06-1159	696,054.30	63,949.99	5.83	0.78
PTX06-1160	2,621,764.59	4,129.28	0.38	2.93
PTX06-1162	714,320.86	187.51	0.02	0.80
PTX06-1164	81,488.74	1,818.22	0.17	0.09
PTX06-1169	194,627.14	306.54	0.03	0.22
PTX06-1170	128,479.15	202.35	0.02	0.14
PTX06-1171	283,817.67	5,602.56	0.51	0.32
PTX06-1172	112,060.46	29.42	0.00	0.13
PTX06-1173	147,623.99	620.02	0.06	0.16
PTX06-1174	196,538.36	8,770.52	0.80	0.22
PTX06-1175	334,505.12	29,854.58	2.72	0.37
PTX06-1176	64,962.02	3,154.72	0.29	0.07
PTX06-1177	215,571.53	8,205.19	0.75	0.24
PTX06-1180	364,995.60	95.81	0.01	0.41
PTX06-1181	2,839,455.80	4,472.14	0.41	3.17
PTX06-1183	378,842.93	99.45	0.01	0.42
PTX07-1P02	616,645.36	971.22	0.09	0.69
PTX07-1P05	1,810,166.45	475.17	0.04	2.02
PTX07-1Q01	2,383,680.14	625.72	0.06	2.66
PTX07-1Q02	277,970.92	72.97	0.01	0.31
PTX07-1Q03	6,220,267.64	1,632.82	0.15	6.95

MAROS Percent of Mass by Well

Project: Pantex　　**User Name:** MV

Location: Southwest Sector　　**State:** Texas

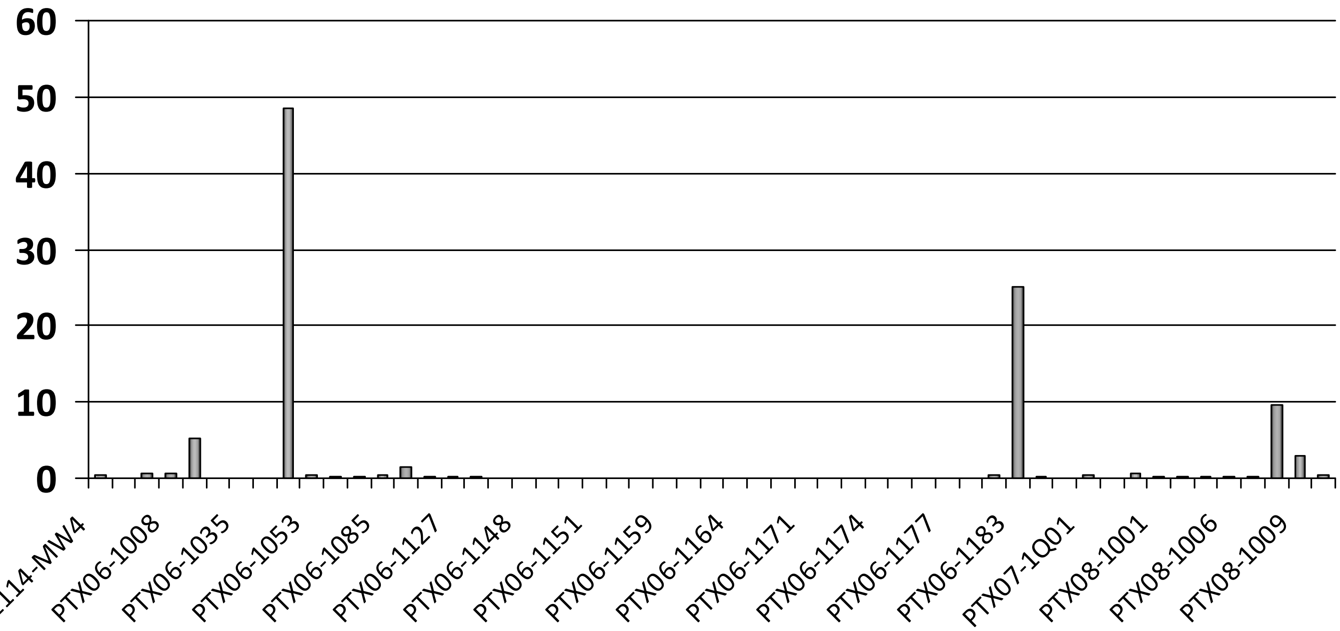
Well	Area (ft2)	Mass (mg)	Percent of Mass	Percent of Area
PTX08-1001	1,251,956.44	1,971.83	0.18	1.40
PTX08-1003	8,003,427.39	19,349.29	1.77	8.94
PTX08-1005	852,230.18	1,342.26	0.12	0.95
PTX08-1006	1,563,013.25	123,087.30	11.23	1.75
PTX08-1007	1,829,804.09	2,814.70	0.26	2.04
PTX08-1008	2,443,406.26	151,369.03	13.81	2.73
PTX08-1009	2,628,961.80	690.10	0.06	2.94
PTX10-1014	1,308,496.52	1,844.49	0.17	1.46
	89,501,669.9	1,096,043.0	100	100

MAROS Percent of Mass by Well

Project: Pantex **User Name:** MV

Location: Southwest Sector **State:** Texas

CHROMIUM, HEXAVALENT 7/1/2016



Well	Area (ft2)	Mass (mg)	Percent of Mass	Percent of Area
1114-MW4	2,187,942.97	2,871.68	0.38	2.44
PTX06-1006	2,435,332.46	639.27	0.08	2.72
PTX06-1007	2,977,699.96	4,447.57	0.59	3.33
PTX06-1008	1,006,773.04	5,444.13	0.72	1.12
PTX06-1011	2,294,535.02	39,632.36	5.22	2.56
PTX06-1012	304,319.09	79.88	0.01	0.34
PTX06-1035	3,020,389.90	792.85	0.10	3.37
PTX06-1036	1,041,733.69	273.46	0.04	1.16
PTX06-1052	2,194,563.85	367,822.64	48.42	2.45
PTX06-1053	3,022,608.92	3,967.17	0.52	3.38
PTX06-1073A	4,150,459.00	1,089.50	0.14	4.64
PTX06-1077A	4,049,820.15	1,063.08	0.14	4.52
PTX06-1085	2,190,843.49	2,875.48	0.38	2.45
PTX06-1086	8,529,727.81	11,195.27	1.47	9.53

MAROS Percent of Mass by Well

Project: Pantex **User Name:** MV

Location: Southwest Sector **State:** Texas

Well	Area (ft2)	Mass (mg)	Percent of Mass	Percent of Area
PTX06-1126	425,738.10	1,053.30	0.14	0.48
PTX06-1127	812,361.18	1,066.22	0.14	0.91
PTX06-1131	1,529,074.53	2,006.91	0.26	1.71
PTX06-1134	2,246,318.53	589.66	0.08	2.51
PTX06-1148	986,811.37	259.04	0.03	1.10
PTX06-1149	678,258.85	178.04	0.02	0.76
PTX06-1150	1,565,024.38	410.82	0.05	1.75
PTX06-1151	614,409.91	161.28	0.02	0.69
PTX06-1155	71,583.99	18.79	0.00	0.08
PTX06-1156	600,205.08	157.55	0.02	0.67
PTX06-1159	696,054.30	182.71	0.02	0.78
PTX06-1160	2,621,764.59	688.21	0.09	2.93
PTX06-1162	714,320.86	187.51	0.02	0.80
PTX06-1164	81,488.74	21.39	0.00	0.09
PTX06-1169	194,627.14	51.09	0.01	0.22
PTX06-1170	128,479.15	33.73	0.00	0.14
PTX06-1171	283,817.67	74.50	0.01	0.32
PTX06-1172	112,060.46	29.42	0.00	0.13
PTX06-1173	147,623.99	38.75	0.01	0.16
PTX06-1174	196,538.36	51.59	0.01	0.22
PTX06-1175	334,505.12	87.81	0.01	0.37
PTX06-1176	64,962.02	17.05	0.00	0.07
PTX06-1177	215,571.53	56.59	0.01	0.24
PTX06-1180	364,995.60	95.81	0.01	0.41
PTX06-1181	2,839,455.80	3,726.79	0.49	3.17
PTX06-1183	378,842.93	190,936.85	25.14	0.42
PTX07-1P02	616,645.36	809.35	0.11	0.69
PTX07-1P05	1,810,166.45	475.17	0.06	2.02
PTX07-1Q01	2,383,680.14	3,128.58	0.41	2.66
PTX07-1Q02	277,970.92	364.84	0.05	0.31
PTX07-1Q03	6,220,267.64	5,127.06	0.67	6.95

MAROS Percent of Mass by Well

Project: Pantex **User Name:** MV

Location: Southwest Sector **State:** Texas

Well	Area (ft2)	Mass (mg)	Percent of Mass	Percent of Area
PTX08-1001	1,251,956.44	1,643.19	0.22	1.40
PTX08-1003	8,003,427.39	2,100.90	0.28	8.94
PTX08-1005	852,230.18	857.93	0.11	0.95
PTX08-1006	1,563,013.25	2,051.45	0.27	1.75
PTX08-1007	1,829,804.09	2,142.24	0.28	2.04
PTX08-1008	2,443,406.26	72,381.33	9.53	2.73
PTX08-1009	2,628,961.80	21,703.72	2.86	2.94
PTX10-1014	1,308,496.52	2,452.45	0.32	1.46
	89,501,669.9	759,614.0	100	100

North Sector MAROS Reports

MAROS COC Assessment

Project: Pantex **User Name:** MV

Location: North **State:** Texas

Toxicity:

Contaminant of Concern	Representative Concentration (mg/L)	PRG (mg/L)	Percent Above PRG
HEXAHYDRO-1,3,5-TRINITRO-1,3,5-TRIAZINE	1.3E-02	2.0E-03	566.0%
BORON	2.5E-01	1.9E-01	31.9%

Note: Top COCs by toxicity were determined by examining a representative concentration for each compound over the entire site. The compound representative concentrations are then compared with the chosen PRG for that compound, with the percentage exceedance from the PRG determining the compound's toxicity. All compounds above exceed the PRG.

Prevalence:

Contaminant of Concern	Class	Total Wells	Total Exceedance	Percent Exceedances	Total Detects
BORON	MET	25	9	36.0%	25
HEXAHYDRO-1,3,5-TRINITRO-1,3,5-TRIAZINE	ORG	26	9	34.6%	20

Note: Top COCs by prevalence were determined by examining a representative concentration for each well location at the site. The total exceedances (values above the chosen PRGs) are compared to the total number of wells to determine the prevalence of the compound.

Mobility:

Contaminant of Concern	Kd/Koc
BORON	
HEXAHYDRO-1,3,5-TRINITRO-1,3,5-TRIAZINE	0.00741

Note: Top COCs by mobility were determined by examining each detected compound in the dataset and comparing their mobilities (Koc's for organics, assuming foc = 0.001, and Kd's for metals).

Priority Constituents by Well:

Well Name	Average	Max
OW-WR-38	BORON	HEXAHYDRO-1,3,5-TRINIT
PTX01-1001	MANGANESE	PERCHLORATE
PTX01-1002	ARSENIC	BORON
PTX01-1008	1,4-DIOXANE (P-DIOXANE)	BORON
PTX04-1001	SELENIUM	BORON
PTX04-1002	TRICHLOROETHYLENE (TCE)	BORON
PTX06-1013	HEXAHYDRO-1,3,5-TRINITR	HEXAHYDRO-1,3,5-TRINIT
PTX06-1023	TRICHLOROETHYLENE (TCE)	BORON
PTX06-1048A	2,4,6-TRINITROTOLUENE	TRICHLOROETHYLENE (TCE
PTX06-1049	4-AMINO-2,6-DINITROTOL	4-AMINO-2,6-DINITROTOL

MAROS COC Assessment

Project: Pantex **User Name:** MV

Location: North **State:** Texas

PTX06-1050	HEXAHYDRO-1,3,5-TRINITR	HEXAHYDRO-1,3,5-TRINIT
PTX06-1069	BARIUM	BORON
PTX06-1071	1,4-DIOXANE (P-DIOXANE)	BORON
PTX06-1080	OCTAHYDRO-1,3,5,7-TETRA	BORON
PTX06-1081	TRICHLOROETHYLENE (TCE)	BORON
PTX06-1136	TRICHLOROETHYLENE (TCE)	BORON
PTX07-1O01	HEXAHYDRO-1,3,5-TRINITR	HEXAHYDRO-1,3,5-TRINIT
PTX07-1O02	OCTAHYDRO-1,3,5,7-TETRA	BORON
PTX07-1O03	HEXAHYDRO-1,3,5-TRINITR	HEXAHYDRO-1,3,5-TRINIT
PTX07-1O06	2-AMINO-4,6-DINITROTOL	HEXAHYDRO-1,3,5-TRINIT
PTX07-1P02	BORON	BORON
PTX07-1P05	HEXAHYDRO-1,3,5-TRINITR	HEXAHYDRO-1,3,5-TRINIT
PTX07-1R03	2,4,6-TRINITROTOLUENE	BORON
PTX08-1001	HEXAHYDRO-1,3,5-TRINITR	TNX
PTX08-1002	HEXAHYDRO-1,3,5-TRINITR	HEXAHYDRO-1,3,5-TRINIT
PTX08-1010	BARIUM	BORON

MAROS Mann-Kendall Statistics Summary

Project: Pantex **User Name:** MV

Location: North **State:** Texas

Time Period: 3/7/2012 **to** 10/26/2016
Consolidation Period: No Time Consolidation
Consolidation Type: Median
Duplicate Consolidation: Average
ND Values: 1/2 Detection Limit
J Flag Values : Actual Value

Well	Number of Samples	Number of Detects	Coefficient of Variation	Mann-Kendall Statistic	Confidence in Trend	All Samples "ND" ?	Concentration Trend
4-AMINO-2,6-DINITROTOLUENE							
OW-WR-38	5	0	0.03	-2	59.2%	Yes	ND
PTX01-1001	10	2	0.25	-11	81.0%	No	S
PTX01-1002	4	0	0.02	-2	62.5%	Yes	ND
PTX01-1008	10	0	0.01	-9	75.8%	Yes	ND
PTX04-1001	1	0	0.00	0	0.0%	Yes	ND
PTX04-1002	5	0	0.01	-1	50.0%	Yes	ND
PTX06-1013	7	0	0.02	-6	76.4%	Yes	ND
PTX06-1023	10	0	0.02	-7	70.0%	Yes	ND
PTX06-1048A	5	5	0.16	-8	95.8%	No	D
PTX06-1049	10	10	0.33	-25	98.6%	No	D
PTX06-1050	10	10	0.15	-25	98.6%	No	D
PTX06-1069	4	0	0.02	-2	62.5%	Yes	ND
PTX06-1071	1	0	0.00	0	0.0%	Yes	ND
PTX06-1080	1	0	0.00	0	0.0%	Yes	ND
PTX06-1081	5	0	0.02	1	50.0%	Yes	ND
PTX06-1136	5	0	0.02	5	82.1%	Yes	ND
PTX07-1O01	5	5	0.20	6	88.3%	No	NT
PTX07-1O02	7	0	0.02	-10	90.7%	Yes	ND
PTX07-1O03	5	0	0.02	-4	75.8%	Yes	ND
PTX07-1O06	1	0	0.00	0	0.0%	Yes	ND
PTX07-1P02	10	0	0.02	-6	66.8%	Yes	ND
PTX07-1P05	2	0	0.00	0	0.0%	Yes	ND
PTX07-1R03	1	0	0.00	0	0.0%	Yes	ND
PTX08-1001	4	1	0.19	-1	50.0%	No	S
PTX08-1002	8	8	0.52	-14	94.6%	No	PD
PTX08-1010	1	0	0.00	0	0.0%	Yes	ND

MAROS Mann-Kendall Statistics Summary

Project: Pantex **User Name:** MV

Location: North **State:** Texas

BORON

Well	Number of Samples	Number of Detects	Coefficient of Variation	Mann-Kendall Statistic	Confidence in Trend	All Samples "ND" ?	Concentration Trend
BORON							
OW-WR-38	5	5	0.10	2	59.2%	No	NT
PTX01-1001	10	10	0.11	-2	53.5%	No	S
PTX01-1002	4	4	0.13	4	83.3%	No	NT
PTX01-1008	10	10	0.10	-11	81.0%	No	S
PTX04-1001	1	1	0.00	0	0.0%	No	N/A
PTX04-1002	5	5	0.04	1	50.0%	No	NT
PTX06-1013	7	7	0.08	-11	93.2%	No	PD
PTX06-1023	10	10	0.41	-7	70.0%	No	S
PTX06-1048A	5	5	0.04	-4	75.8%	No	S
PTX06-1049	10	10	0.09	18	93.4%	No	PI
PTX06-1050	10	10	0.15	-21	96.4%	No	D
PTX06-1069	4	4	0.05	-2	62.5%	No	S
PTX06-1071	1	1	0.00	0	0.0%	No	N/A
PTX06-1080	1	1	0.00	0	0.0%	No	N/A
PTX06-1081	5	5	0.16	4	75.8%	No	NT
PTX06-1136	5	5	0.09	-4	75.8%	No	S
PTX07-1O01	5	5	0.16	-4	75.8%	No	S
PTX07-1O02	8	8	0.08	0	45.2%	No	S
PTX07-1O03	5	5	0.10	4	75.8%	No	NT
PTX07-1P02	10	10	0.29	5	63.6%	No	NT
PTX07-1P05	2	2	0.00	0	0.0%	No	N/A
PTX07-1R03	1	1	0.00	0	0.0%	No	N/A
PTX08-1001	4	4	0.55	-4	83.3%	No	S
PTX08-1002	8	8	0.14	-14	94.6%	No	PD
PTX08-1010	1	1	0.00	0	0.0%	No	N/A
CHROMIUM, HEXAVALENT							
OW-WR-38	1	0	0.00	0	0.0%	Yes	ND
PTX01-1001	1	0	0.00	0	0.0%	Yes	ND
PTX01-1002	1	1	0.00	0	0.0%	No	N/A
PTX01-1008	1	0	0.00	0	0.0%	Yes	ND
PTX04-1001	1	0	0.00	0	0.0%	Yes	ND

MAROS Mann-Kendall Statistics Summary

Project: Pantex **User Name:** MV

Location: North **State:** Texas

CHROMIUM, HEXAVALENT

Well	Number of Samples	Number of Detects	Coefficient of Variation	Mann-Kendall Statistic	Confidence in Trend	All Samples "ND" ?	Concentration Trend
PTX04-1002	1	1	0.00	0	0.0%	No	N/A
PTX06-1013	7	0	0.22	-12	94.9%	Yes	ND
PTX06-1023	10	1	0.21	-19	94.6%	No	PD
PTX06-1069	4	1	0.37	-1	50.0%	No	S
PTX06-1071	1	1	0.00	0	0.0%	No	N/A
PTX07-1O01	1	0	0.00	0	0.0%	Yes	ND
PTX07-1O03	1	0	0.00	0	0.0%	Yes	ND
PTX07-1P02	1	0	0.00	0	0.0%	Yes	ND
PTX07-1R03	1	1	0.00	0	0.0%	No	N/A
PTX08-1001	1	0	0.00	0	0.0%	Yes	ND
PTX08-1002	8	0	0.17	-7	76.4%	Yes	ND
PTX08-1010	1	0	0.00	0	0.0%	Yes	ND
PTX-BEG3	1	0	0.00	0	0.0%	Yes	ND

CHROMIUM, TOTAL

Well	Number of Samples	Number of Detects	Coefficient of Variation	Mann-Kendall Statistic	Confidence in Trend	All Samples "ND" ?	Concentration Trend
OW-WR-38	1	1	0.00	0	0.0%	No	N/A
PTX01-1001	1	0	0.00	0	0.0%	Yes	ND
PTX01-1002	1	1	0.00	0	0.0%	No	N/A
PTX01-1008	1	0	0.00	0	0.0%	Yes	ND
PTX04-1001	1	1	0.00	0	0.0%	No	N/A
PTX04-1002	1	1	0.00	0	0.0%	No	N/A
PTX06-1013	7	6	1.37	-15	98.5%	No	D
PTX06-1023	10	2	0.20	11	81.0%	No	NT
PTX06-1069	4	4	0.63	-4	83.3%	No	S
PTX06-1071	1	0	0.00	0	0.0%	Yes	ND
PTX07-1O03	1	1	0.00	0	0.0%	No	N/A
PTX07-1P02	1	0	0.00	0	0.0%	Yes	ND
PTX07-1R03	1	1	0.00	0	0.0%	No	N/A
PTX08-1001	1	1	0.00	0	0.0%	No	N/A
PTX08-1002	8	3	0.20	-8	80.1%	No	S
PTX08-1010	1	0	0.00	0	0.0%	Yes	ND
PTX-BEG3	1	0	0.00	0	0.0%	Yes	ND

HEXAHYDRO-1,3,5-TRINITRO-1,3,5-TRIAZIN

MAROS Mann-Kendall Statistics Summary

Project: Pantex **User Name:** MV

Location: North **State:** Texas

HEXAHYDRO-1,3,5-TRINITRO-1,3,5-TRIAZIN

Well	Number of Samples	Number of Detects	Coefficient of Variation	Mann-Kendall Statistic	Confidence in Trend	All Samples "ND" ?	Concentration Trend
OW-WR-38	5	5	0.66	10	99.2%	No	I
PTX01-1001	10	0	0.02	-14	87.3%	Yes	ND
PTX01-1002	4	1	0.63	-2	62.5%	No	S
PTX01-1008	11	1	0.88	-23	95.7%	No	D
PTX04-1001	1	0	0.00	0	0.0%	Yes	ND
PTX04-1002	5	5	0.61	2	59.2%	No	NT
PTX06-1013	7	7	0.11	-11	93.2%	No	PD
PTX06-1023	10	4	1.13	-23	97.7%	No	D
PTX06-1048A	5	0	0.02	-4	75.8%	Yes	ND
PTX06-1049	10	10	0.35	5	63.6%	No	NT
PTX06-1050	10	10	0.40	-17	92.2%	No	PD
PTX06-1069	4	2	0.21	2	62.5%	No	NT
PTX06-1071	1	1	0.00	0	0.0%	No	N/A
PTX06-1080	1	0	0.00	0	0.0%	Yes	ND
PTX06-1081	5	1	0.77	1	50.0%	No	NT
PTX06-1136	5	0	0.02	5	82.1%	Yes	ND
PTX07-1O01	5	5	0.18	-4	75.8%	No	S
PTX07-1O02	7	7	0.64	11	93.2%	No	PI
PTX07-1O03	5	5	0.17	8	95.8%	No	I
PTX07-1O06	1	1	0.00	0	0.0%	No	N/A
PTX07-1P02	10	7	0.91	22	97.1%	No	I
PTX07-1P05	2	2	0.00	0	0.0%	No	N/A
PTX07-1R03	1	1	0.00	0	0.0%	No	N/A
PTX08-1001	4	4	0.38	-2	62.5%	No	S
PTX08-1002	8	8	0.53	-8	80.1%	No	S
PTX08-1010	1	0	0.00	0	0.0%	Yes	ND

Note: Increasing (I); Probably Increasing (PI); Stable (S); Probably Decreasing (PD); Decreasing (D); No Trend (NT); Not Applicable (N/A)-Due to insufficient Data (< 4 sampling events).

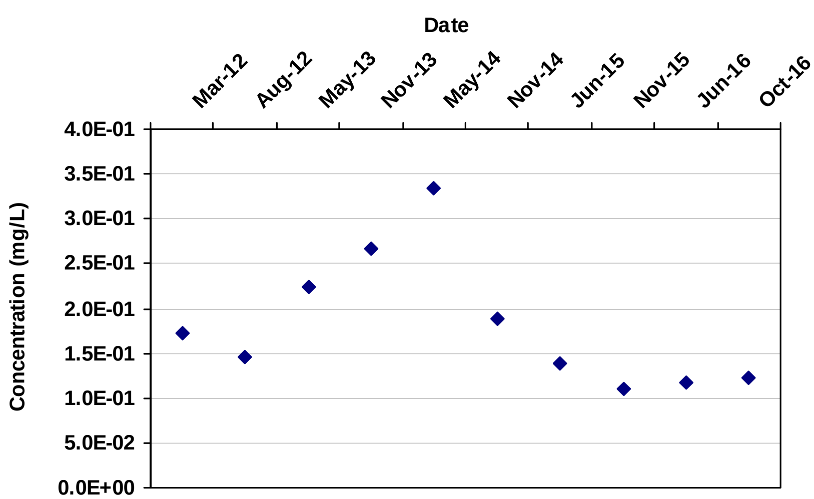
The Number of Samples and Number of Detects shown above are post-consolidation values.

MAROS Mann-Kendall Statistics Summary

Project: Pantex | **User Name:** MV

Location: North | **State:** Texas

Well:	PTX06-1050	**Time Period:**	3/7/2012 **to** 10/26/2016
Well Type:	Tail	**Consolidation Period:**	No Time Consolidation
COC:	HEXAHYDRO-1,3,5-TRINITRO-1,3,5-	**Duplicate Consolidation:**	Median
		Consolidation Type:	Average
		ND Values:	1/2 Detection Limit
		J Flag Values :	Actual Value



Mann Kendall S Statistic:

-17

Confidence in Trend:

92.2%

Coefficient of Variation:

0.40

Mann Kendall Concentration Trend: (See Note)

PD

Data Table:

Well	Effective Date	Constituent	Result (mg/L)	Flag	Number of Samples	Number of Detects
PTX06-1050	3/7/2012	HEXAHYDRO-1,3,5-TRINITRO-	1.7E-01		1	1
PTX06-1050	8/1/2012	HEXAHYDRO-1,3,5-TRINITRO-	1.5E-01		1	1
PTX06-1050	5/15/2013	HEXAHYDRO-1,3,5-TRINITRO-	2.2E-01		1	1
PTX06-1050	11/21/2013	HEXAHYDRO-1,3,5-TRINITRO-	2.7E-01		2	2
PTX06-1050	5/22/2014	HEXAHYDRO-1,3,5-TRINITRO-	3.3E-01		1	1
PTX06-1050	11/13/2014	HEXAHYDRO-1,3,5-TRINITRO-	1.9E-01		1	1
PTX06-1050	6/19/2015	HEXAHYDRO-1,3,5-TRINITRO-	1.4E-01		1	1
PTX06-1050	11/23/2015	HEXAHYDRO-1,3,5-TRINITRO-	1.1E-01		1	1
PTX06-1050	6/21/2016	HEXAHYDRO-1,3,5-TRINITRO-	1.2E-01		1	1

MAROS Mann-Kendall Statistics Summary

Project: Pantex **User Name:** MV

Location: North **State:** Texas

Well	Effective Date	Constituent	Result (mg/L)	Flag	Number of Samples	Number of Detects
PTX06-1050	10/26/2016	HEXAHYDRO-1,3,5-TRINITRO-	1.2E-01		1	1

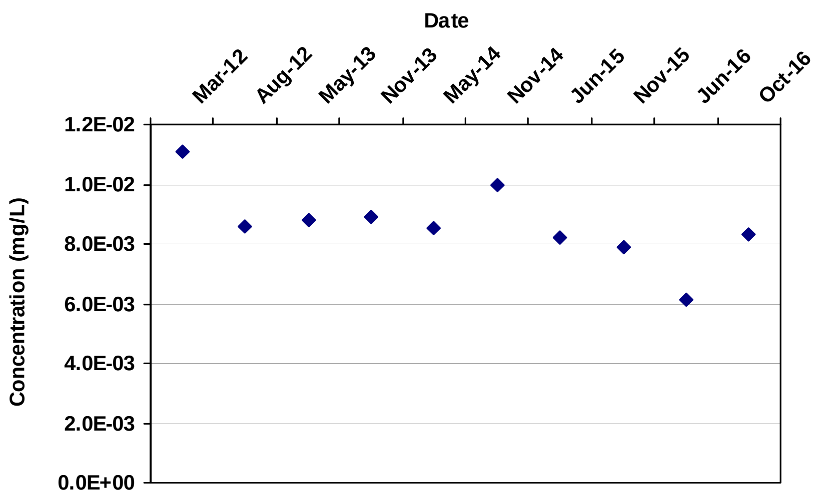
Note: Increasing (I); Probably Increasing (PI); Stable (S); Probably Decreasing (PD); Decreasing (D); No Trend (NT); Not Applicable (N/A) - Due to insufficient Data (< 4 sampling events); ND = Non-detect

MAROS Mann-Kendall Statistics Summary

Project: Pantex **User Name:** MV

Location: North **State:** Texas

Well:	PTX06-1050	**Time Period:**	3/7/2012 **to** 10/26/2016
Well Type:	Tail	**Consolidation Period:**	No Time Consolidation
COC:	4-AMINO-2,6-DINITROTOLUENE	**Duplicate Consolidation:**	Median
		Consolidation Type:	Average
		ND Values:	1/2 Detection Limit
		J Flag Values :	Actual Value



Mann Kendall S Statistic:

-25

Confidence in Trend:

98.6%

Coefficient of Variation:

0.15

Mann Kendall Concentration Trend: (See Note)

D

Data Table:

Well	Effective Date	Constituent	Result (mg/L)	Flag	Number of Samples	Number of Detects
PTX06-1050	3/7/2012	4-AMINO-2,6-DINITROTOLUE	1.1E-02		1	1
PTX06-1050	8/1/2012	4-AMINO-2,6-DINITROTOLUE	8.6E-03		1	1
PTX06-1050	5/15/2013	4-AMINO-2,6-DINITROTOLUE	8.8E-03		1	1
PTX06-1050	11/21/2013	4-AMINO-2,6-DINITROTOLUE	8.9E-03		2	2
PTX06-1050	5/22/2014	4-AMINO-2,6-DINITROTOLUE	8.5E-03		1	1
PTX06-1050	11/13/2014	4-AMINO-2,6-DINITROTOLUE	1.0E-02		1	1
PTX06-1050	6/19/2015	4-AMINO-2,6-DINITROTOLUE	8.2E-03		1	1
PTX06-1050	11/23/2015	4-AMINO-2,6-DINITROTOLUE	7.9E-03		1	1
PTX06-1050	6/21/2016	4-AMINO-2,6-DINITROTOLUE	6.1E-03		1	1

MAROS Mann-Kendall Statistics Summary

Project: Pantex **User Name:** MV

Location: North **State:** Texas

Well	Effective Date	Constituent	Result (mg/L)	Flag	Number of Samples	Number of Detects
PTX06-1050	10/26/2016	4-AMINO-2,6-DINITROTOLUE	8.3E-03		1	1

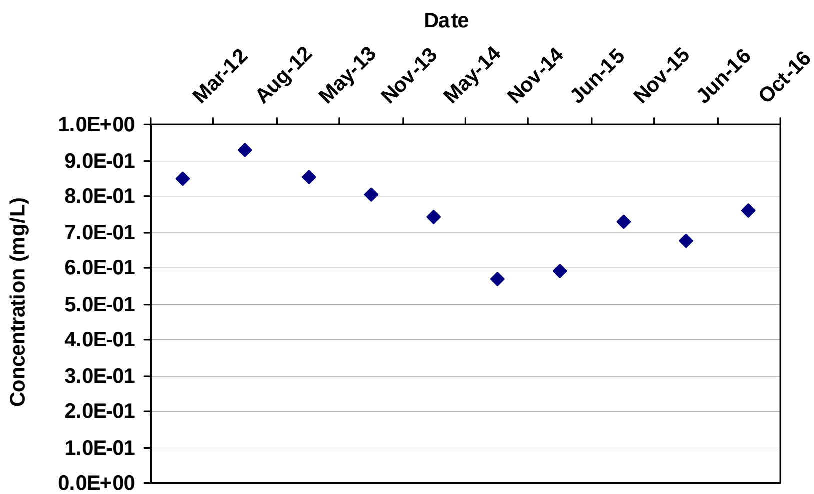
Note: Increasing (I); Probably Increasing (PI); Stable (S); Probably Decreasing (PD); Decreasing (D); No Trend (NT); Not Applicable (N/A) - Due to insufficient Data (< 4 sampling events); ND = Non-detect

MAROS Mann-Kendall Statistics Summary

Project: Pantex **User Name:** MV

Location: North **State:** Texas

Well:	PTX06-1050	**Time Period:**	3/7/2012 **to** 10/26/2016
Well Type:	Tail	**Consolidation Period:**	No Time Consolidation
COC:	BORON	**Duplicate Consolidation:**	Median
		Consolidation Type:	Average
		ND Values:	1/2 Detection Limit
		J Flag Values :	Actual Value



Mann Kendall S Statistic:

-21

Confidence in Trend:

96.4%

Coefficient of Variation:

0.15

Mann Kendall Concentration Trend: (See Note)

D

Data Table:

Well	Effective Date	Constituent	Result (mg/L)	Flag	Number of Samples	Number of Detects
PTX06-1050	3/7/2012	BORON	8.5E-01		1	1
PTX06-1050	8/1/2012	BORON	9.3E-01		1	1
PTX06-1050	5/15/2013	BORON	8.6E-01		1	1
PTX06-1050	11/21/2013	BORON	8.0E-01		2	2
PTX06-1050	5/22/2014	BORON	7.4E-01		1	1
PTX06-1050	11/13/2014	BORON	5.7E-01		1	1
PTX06-1050	6/19/2015	BORON	5.9E-01		1	1
PTX06-1050	11/23/2015	BORON	7.3E-01		1	1
PTX06-1050	6/21/2016	BORON	6.8E-01		1	1

MAROS Mann-Kendall Statistics Summary

Project: Pantex **User Name:** MV

Location: North **State:** Texas

Well	Effective Date	Constituent	Result (mg/L)	Flag	Number of Samples	Number of Detects
PTX06-1050	10/26/2016	BORON	7.6E-01		1	1

Note: Increasing (I); Probably Increasing (PI); Stable (S); Probably Decreasing (PD); Decreasing (D); No Trend (NT); Not Applicable (N/A) - Due to insufficient Data (< 4 sampling events); ND = Non-detect

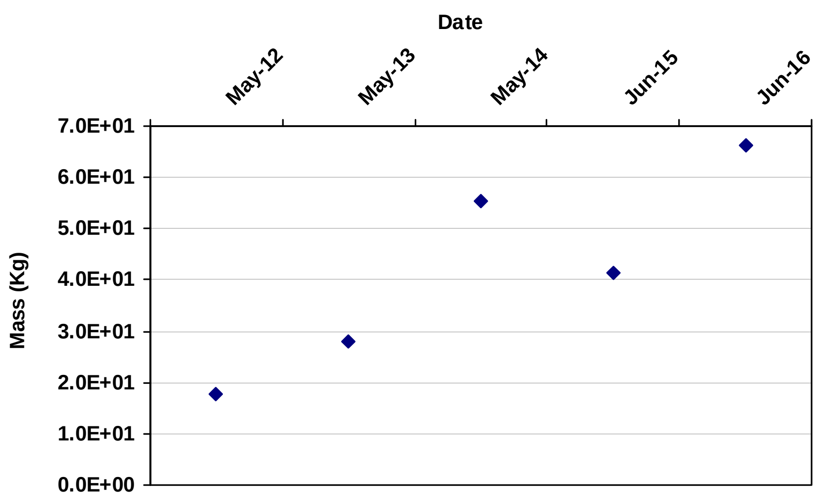
MAROS Zeroth Moment Analysis

Project: Pantex **User Name:** MV

Location: North **State:** Texas

Change in Dissolved Mass Over Time

COC: HEXAHYDRO-1,3,5-TRINITRO-1,3,5-TRIAZINE



Porosity: 0.25

Saturated Thickness:

Uniform: 30 ft

Mann-Kendall S Statistic:

8

Confidence in Trend:

95.8%

Coefficient of Variation:

0.47

Zeroth Moment Trend:

I

Data Table:

Effective Date	Constituent	Estimated Mass (Kg)	Number of Wells
5/29/2012	HEXAHYDRO-1,3,5-TRINITRO-1,3,	1.8E+01	9
5/15/2013	HEXAHYDRO-1,3,5-TRINITRO-1,3,	2.8E+01	8
5/22/2014	HEXAHYDRO-1,3,5-TRINITRO-1,3,	5.5E+01	9
6/19/2015	HEXAHYDRO-1,3,5-TRINITRO-1,3,	4.1E+01	8
6/21/2016	HEXAHYDRO-1,3,5-TRINITRO-1,3,	6.6E+01	8

Note: Increasing (I); Probably Increasing (PI); Stable (S); Probably Decreasing (PD); Decreasing (D); No Trend (NT); Not Applicable (N/A) - Due to insufficient Data (< 4 sampling events); ND = Non-detect. Moments are not calculated for sample events with less than 6 wells.

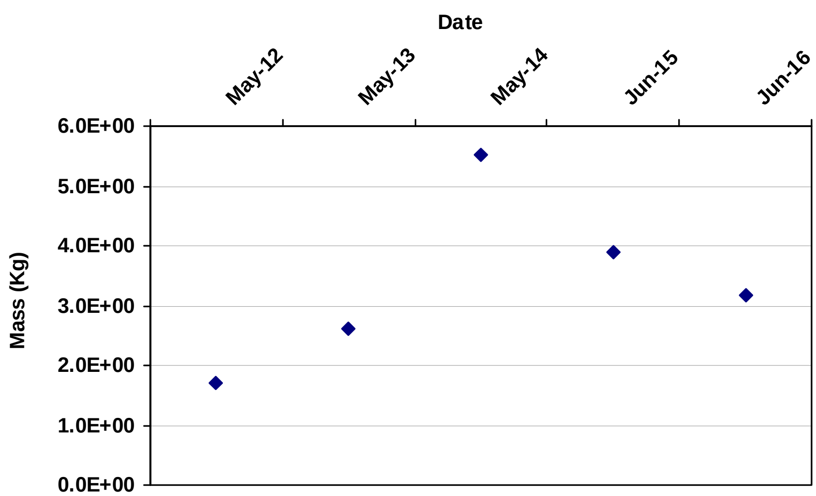
MAROS Zeroth Moment Analysis

Project: Pantex **User Name:** MV

Location: North **State:** Texas

Change in Dissolved Mass Over Time

COC: 4-AMINO-2,6-DINITROTOLUENE



Porosity: 0.25

Saturated Thickness:

Uniform: 30 ft

Mann-Kendall S Statistic:

4

Confidence in Trend:

75.8%

Coefficient of Variation:

0.43

Zeroth Moment Trend:

NT

Data Table:

Effective Date	Constituent	Estimated Mass (Kg)	Number of Wells
5/29/2012	4-AMINO-2,6-DINITROTOLUENE	1.7E+00	9
5/15/2013	4-AMINO-2,6-DINITROTOLUENE	2.6E+00	8
5/22/2014	4-AMINO-2,6-DINITROTOLUENE	5.5E+00	9
6/19/2015	4-AMINO-2,6-DINITROTOLUENE	3.9E+00	8
6/21/2016	4-AMINO-2,6-DINITROTOLUENE	3.2E+00	8

Note: Increasing (I); Probably Increasing (PI); Stable (S); Probably Decreasing (PD); Decreasing (D); No Trend (NT); Not Applicable (N/A) - Due to insufficient Data (< 4 sampling events); ND = Non-detect. Moments are not calculated for sample events with less than 6 wells.

MAROS Spatial Moment Analysis Summary

Project: Pantex

User Name: MV

Location: North

State: Texas

Effective Date	0th Moment Estimated Mass (Kg)	1st Moment (Center of Mass) Xc (ft)	Yc (ft)	Source Distance	2nd Moment (Spread) Sigma XX (sq ft)	Sigma YY (sq ft)	Number of Wells
4-AMINO-2,6-DINITROTOLUENE							
5/29/2012	1.7E+00	638,493	3,764,552	1,177	7,066,002	571,317	9
5/15/2013	2.6E+00	637,840	3,765,140	2,027	3,971,676	600,396	8
5/22/2014	5.5E+00	637,022	3,764,859	2,668	4,244,876	552,347	9
6/19/2015	3.9E+00	637,545	3,764,670	2,113	3,982,669	460,947	8
6/21/2016	3.2E+00	637,741	3,764,684	1,929	4,276,609	479,981	8
HEXAHYDRO-1,3,5-TRINITRO-1,3,5-TRIAZIN							
5/29/2012	1.8E+01	640,267	3,764,088	688	3,680,310	297,940	9
5/15/2013	2.8E+01	638,208	3,765,022	1,653	2,834,150	464,544	8
5/22/2014	5.5E+01	638,119	3,764,659	1,564	4,832,588	493,127	9
6/19/2015	4.1E+01	638,291	3,764,605	1,384	4,257,246	419,426	8
6/21/2016	6.6E+01	638,824	3,764,523	866	3,929,354	435,412	8

MAROS Spatial Moment Analysis Summary

Project: Pantex **User Name:** MV

Location: North **State:** Texas

Spatial Moment Analysis Summary:

Moment Type	Constituent	Coefficient of Variation	Mann-Kendall S Statistic	Confidence in Trend	Moment Trend
0th Moment	4-AMINO-2,6-DINITROTOLU	0.43	4	75.8%	NT
0th Moment	HEXAHYDRO-1,3,5-TRINITR	0.47	8	95.8%	I
First Moment	4-AMINO-2,6-DINITROTOLU	0.27	2	59.2%	NT
First Moment	HEXAHYDRO-1,3,5-TRINITR	0.35	-2	59.2%	S
Second Moment X	4-AMINO-2,6-DINITROTOLU	0.28	0	40.8%	S
Second Moment X	HEXAHYDRO-1,3,5-TRINITR	0.19	2	59.2%	NT
Second Moment Y	4-AMINO-2,6-DINITROTOLU	0.11	-6	88.3%	S
Second Moment Y	HEXAHYDRO-1,3,5-TRINITR	0.18	2	59.2%	NT

Note: The following assumptions were applied for the calculation of the Zeroth Moment:

Porosity: 0.25 **Saturated Thickness:** Uniform: 30 ft

Mann-Kendall Trend test performed on all sample events for each constituent. Increasing (I); Probably Increasing (PI); Stable (S); Probably Decreasing (PD); Decreasing (D); No Trend (NT); Not Applicable (N/A)-Due to insufficient Data (< 4 sampling events); (ND) Non Detect.

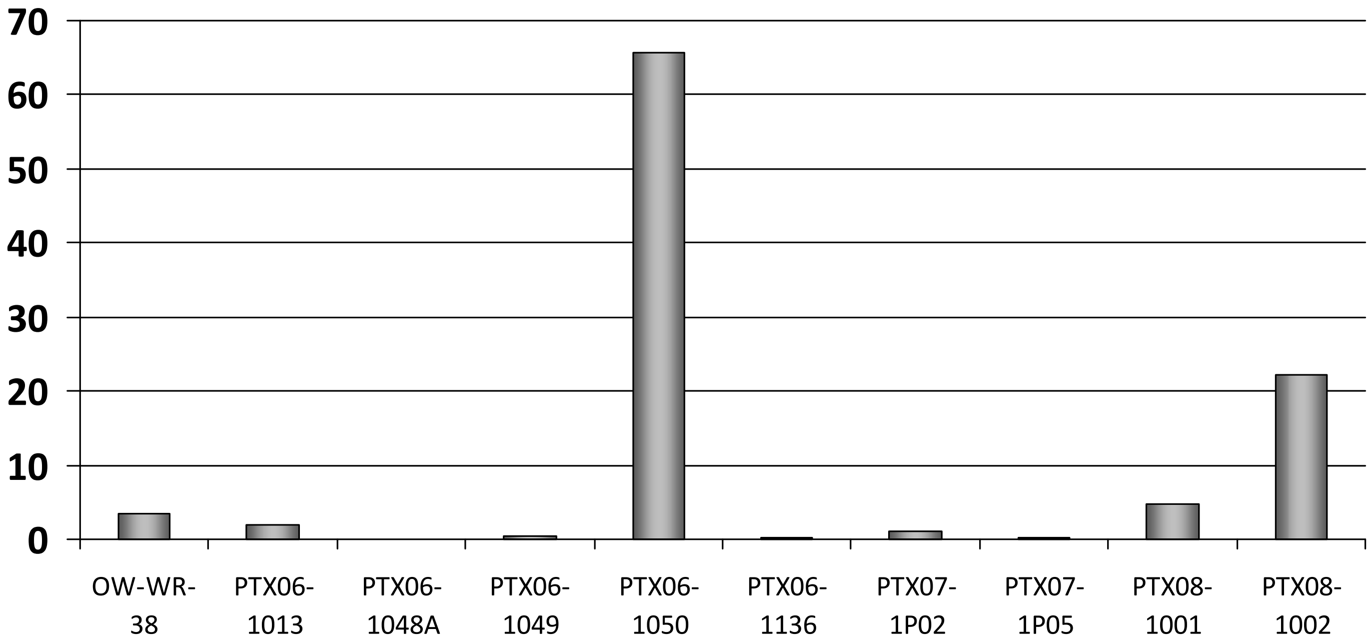
Note: The Sigma XX and Sigma YY components are estimated using the given field coordinate system and then rotated to align with the estimated groundwater flow direction. Moments are not calculated for sample events with less than 6 wells.

MAROS Percent of Mass by Well

Project: Pantex **User Name:** MV

Location: North **State:** Texas

HEXAHYDRO-1,3,5-TRINITRO-1,3,5-TRIAZINE 6/21/2016



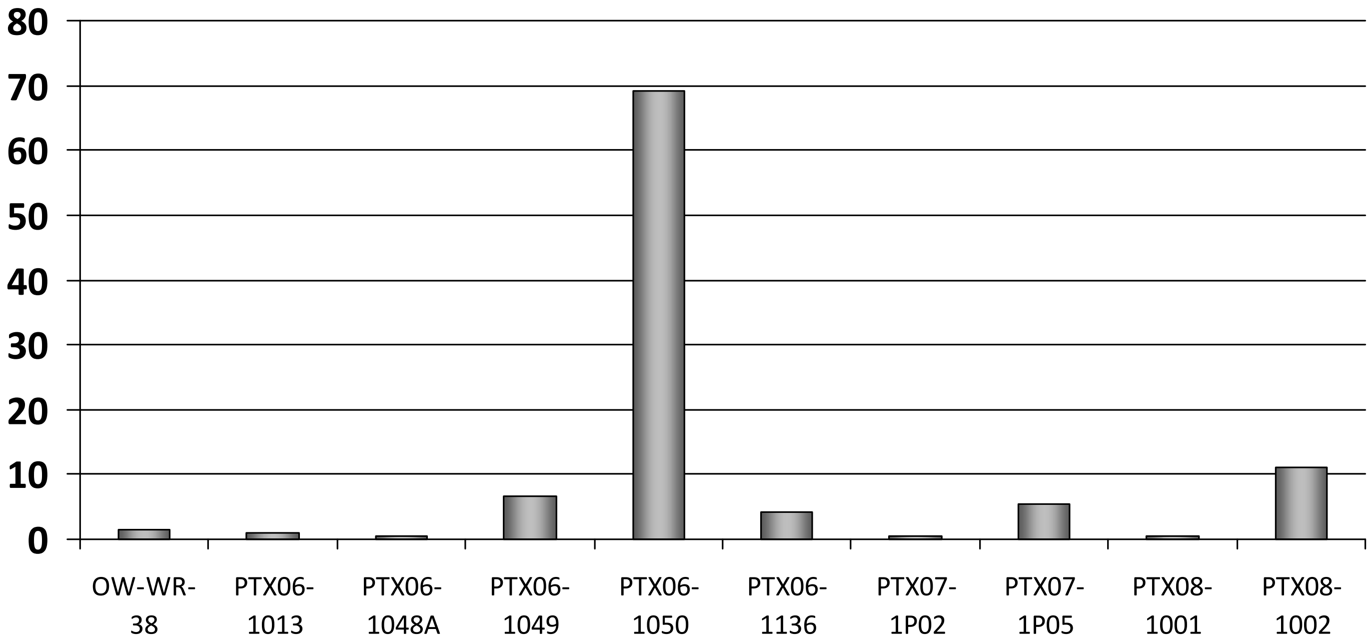
Well	Area (ft2)	Mass (mg)	Percent of Mass	Percent of Area
OW-WR-38	6,036,558.40	10,331.57	3.45	13.31
PTX06-1013	3,911,133.11	5,790.43	1.93	8.63
PTX06-1048A	2,471,090.29	86.27	0.03	5.45
PTX06-1049	3,009,242.59	1,129.59	0.38	6.64
PTX06-1050	6,366,946.45	197,216.18	65.76	14.04
PTX06-1136	2,296,175.87	602.75	0.20	5.06
PTX07-1P02	2,346,859.01	3,154.18	1.05	5.18
PTX07-1P05	3,043,336.40	798.88	0.27	6.71
PTX08-1001	2,505,624.98	14,009.58	4.67	5.53
PTX08-1002	2,660,406.13	66,762.89	22.26	5.87
	34,647,373.2	299,882.3	100	76.4141831995

MAROS Percent of Mass by Well

Project: Pantex **User Name:** MV

Location: North **State:** Texas

4-AMINO-2,6-DINITROTOLUENE 6/21/2016



Well	Area (ft2)	Mass (mg)	Percent of Mass	Percent of Area
OW-WR-38	6,036,558.40	205.21	1.38	13.31
PTX06-1013	3,911,133.11	133.47	0.90	8.63
PTX06-1048A	2,471,090.29	64.15	0.43	5.45
PTX06-1049	3,009,242.59	999.26	6.74	6.64
PTX06-1050	6,366,946.45	10,245.21	69.11	14.04
PTX06-1136	2,296,175.87	602.75	4.07	5.06
PTX07-1P02	2,346,859.01	78.55	0.53	5.18
PTX07-1P05	3,043,336.40	798.88	5.39	6.71
PTX08-1001	2,505,624.98	55.51	0.37	5.53
PTX08-1002	2,660,406.13	1,641.14	11.07	5.87
	34,647,373.2	14,824.1	100	76.4141831995

Appendix D

Table of Long-Term Monitoring Wells and Coordinates

Long-Term Monitoring Wells and Coordinates

Well	Aquifer	Type	Installation Date	Easting (ft NAD83)	Northing (ft NAD83)
1114-MW4	Perched	IW	04/03/92	636151.9	3757809.4
OW-WR-38	Perched	IW	08/30/11	640649.0	3765214.2
PTX01-1001	Perched	IW	04/13/94	630593.0	3769641.9
PTX01-1004	Perched	IW	08/24/99	630729.8	3770768.7
PTX01-1008	Perched	IW	09/25/99	629943.0	3770782.9
PTX01-1009	Perched	IW	02/15/00	630594.7	3769018.5
PTX01-1010	Ogallala	IW	04/04/00	630576.9	3771397.3
PTX01-1011	Ogallala	IW	04/26/00	629986.5	3771397.3
PTX01-1012	Ogallala	IW	04/30/00	632664.2	3773264.1
PTX01-1013	Ogallala	IW	05/13/00	628976.9	3773218.3
PTX04-1002	Perched	IW	03/29/98	641818.0	3772165.3
PTX06-1002A	Perched	IW	02/09/93	641161.6	3759984.0
PTX06-1005	Perched	IW	01/11/93	640545.4	3756139.9
PTX06-1006	Perched	IW	12/09/92	637450.2	3757599.8
PTX06-1007	Perched	IW	01/24/93	637679.4	3759513.0
PTX06-1008	Perched	IW	12/08/92	639441.9	3759325.3
PTX06-1010	Perched	IW	10/23/92	639886.6	3758067.0
PTX06-1011	Perched	IW	11/05/92	639178.9	3757219.8
PTX06-1012	Perched	ISPM	05/03/95	634640.9	3755068.8
PTX06-1013	Perched	IW	05/24/95	643710.4	3764075.1
PTX06-1014	Perched	IW	05/23/95	643758.9	3755125.7
PTX06-1015	Perched	IW	03/10/95	643765.0	3753617.0
PTX06-1023	Perched	IW	10/05/95	642773.8	3764603.1
PTX06-1030	Perched	IW	05/09/96	644670.4	3755008.0
PTX06-1031	Perched	IW	05/06/96	644674.9	3753348.0
PTX06-1034	Perched	IW	02/06/98	646555.6	3752435.0
PTX06-1035	Perched	IW	02/26/98	633027.5	3755092.6
PTX06-1036	Perched	IW	02/11/98	638615.4	3752455.6
PTX06-1037	Perched	ISPM	03/12/98	641549.3	3752194.1
PTX06-1038	Perched	IW	03/05/98	643802.0	3760426.4
PTX06-1039A	Perched	IW	06/14/98	643807.5	3759272.6
PTX06-1040	Perched	IW	06/17/98	643811.2	3758262.9
PTX06-1041	Perched	IW	06/18/99	643803.6	3757622.8
PTX06-1042	Perched	IW	06/25/99	643812.2	3755779.9
PTX06-1043	Ogallala	IW	08/20/99	640711.0	3765225.2
PTX06-1044	Ogallala	IW	08/27/99	642706.2	3764538.5
PTX06-1045	Perched	ISPM	11/15/99	642697.7	3752300.0
PTX06-1046	Perched	IW	11/19/99	643802.6	3752292.6
PTX06-1047A	Perched	IW	02/29/00	643817.5	3752004.4
PTX06-1048A	Perched	IW	02/11/00	642103.4	3766957.6
PTX06-1049	Perched	IW	02/16/00	633343.5	3763377.0
PTX06-1050	Perched	IW	02/23/00	636746.0	3766622.1
PTX06-1051	Perched	IW	02/26/00	640332.9	3752279.1
PTX06-1052	Perched	IW	02/27/00	639100.9	3753957.7
PTX06-1053	Perched	IW	03/01/00	636576.7	3753672.1
PTX06-1056	Ogallala	IW	05/15/00	643767.0	3754642.9

Long-Term Monitoring Wells and Coordinates

Well	Aquifer	Type	Installation Date	Easting (ft NAD83)	Northing (ft NAD83)
PTX06-1057A	Ogallala	IW	08/29/00	629630.0	3768142.2
PTX06-1058	Ogallala	IW	08/26/00	624894.0	3759747.1
PTX06-1061	Ogallala	IW	09/22/00	625651.6	3773186.6
PTX06-1062A	Ogallala	IW	05/14/01	633017.2	3771685.2
PTX06-1064	Ogallala	IW	05/31/01	635900.5	3773557.9
PTX06-1068	Ogallala	IW	05/16/01	643403.7	3773360.3
PTX06-1069	Perched	IW	05/02/01	646317.0	3762879.6
PTX06-1071	Perched	IW	05/31/01	642601.5	3773219.4
PTX06-1072	Ogallala	IW	05/19/01	635047.5	3758434.6
PTX06-1073A	Perched	IW	12/05/01	634963.3	3758072.0
PTX06-1076	Ogallala	IW	03/25/02	637327.3	3752978.4
PTX06-1077A	Perched	IW	01/22/02	637201.8	3760689.5
PTX06-1082	Perched	IW	08/17/02	653856.3	3780321.6
PTX06-1083	Perched	IW	08/19/02	658643.5	3779777.8
PTX06-1085	Perched	IW	08/25/02	629059.8	3760418.3
PTX06-1086	Perched	IW	08/28/02	631411.8	3759843.3
PTX06-1088	Perched	IW	08/27/02	639902.1	3757059.4
PTX06-1089	Perched	IW	07/17/03	646637.3	3760259.0
PTX06-1090	Perched	IW	07/21/03	647727.5	3757684.4
PTX06-1091	Perched	IW	08/02/03	646554.0	3756363.4
PTX06-1093	Perched	IW	08/04/03	645529.0	3759922.3
PTX06-1095A	Perched	IW	08/29/04	640634.9	3755598.6
PTX06-1097	Perched	IW	08/29/05	633104.4	3765068.6
PTX06-1098	Perched	ISPM	09/29/05	640266.1	3753628.4
PTX06-1100	Perched	ISPM	09/29/05	640286.0	3753579.5
PTX06-1101	Perched	ISPM	09/29/05	640383.6	3753437.1
PTX06-1102	Perched	IW	10/02/96	642751.1	3754532.9
PTX06-1103	Perched	IW	08/05/10	641222.6	3752963.4
PTX06-1120	Perched	IW	07/22/07	643152.4	3752735.0
PTX06-1121	Perched	IW	07/24/07	643645.6	3752750.1
PTX06-1122	Perched	IW	07/11/07	640677.3	3752308.7
PTX06-1123	Perched	ISPM	07/26/07	642052.0	3752319.9
PTX06-1125	Perched	IW	07/09/07	643377.5	3752331.1
PTX06-1126	Perched	IW	01/15/08	635034.7	3755562.9
PTX06-1127	Perched	IW	01/09/08	635901.9	3755432.0
PTX06-1130	Perched	IW	10/23/08	644270.4	3759745.0
PTX06-1131	Perched	IW	10/15/08	629371.7	3754232.9
PTX06-1133A	Perched	IW	11/17/08	645287.4	3751315.7
PTX06-1134	Perched	IW	03/15/09	633520.1	3754409.2
PTX06-1135	Perched	IW	10/08/08	638343.8	3753631.9
PTX06-1136	Perched	IW	11/01/08	634860.8	3766771.8
PTX06-1137A	Ogallala	IW	02/15/09	647900.9	3758635.7
PTX06-1138	Ogallala	IW	01/21/09	646285.3	3760503.8
PTX06-1139	Ogallala	IW	01/29/09	646768.7	3756376.1
PTX06-1140	Ogallala	IW	02/05/09	646959.4	3762807.7
PTX06-1141	Ogallala	IW	02/17/09	633445.4	3766872.9

Long-Term Monitoring Wells and Coordinates

Well	Aquifer	Type	Installation Date	Easting (ft NAD83)	Northing (ft NAD83)
PTX06-1143	Ogallala	IW	02/25/09	639244.7	3770496.8
PTX06-1144	Ogallala	IW	02/26/09	640253.0	3773320.5
PTX06-1146	Perched	IW	10/30/08	645978.9	3757691.9
PTX06-1147	Perched	IW	11/05/08	645431.9	3753953.2
PTX06-1148	Perched	ISPM	08/29/08	636467.0	3754719.7
PTX06-1149	Perched	ISPM	09/07/13	635864.1	3754717.6
PTX06-1150	Perched	ISPM	08/28/08	635234.0	3754718.2
PTX06-1151	Perched	IW	03/13/09	633936.0	3756123.6
PTX06-1153	Perched	ISPM	08/22/09	641184.1	3752089.4
PTX06-1154	Perched	ISPM	08/22/09	641870.5	3752278.9
PTX06-1155	Perched	ISPM	09/17/09	634603.7	3755215.6
PTX06-1156	Perched	ISPM	09/17/09	636378.9	3755076.5
PTX06-1157	Ogallala	IW	04/01/10	647102.0	3753702.0
PTX06-1158	Perched	IW	08/12/12	648138.0	3752025.9
PTX06-1159	Perched	IW	08/15/12	634015.0	3754843.5
PTX06-1160	Perched	IW	08/13/12	632835.7	3756274.1
PTX06-1166	Perched	IW	09/19/12	639750.3	3752799.7
PTX06-1167	Perched	IW	07/30/13	640913.7	3752653.0
PTX06-1171	Perched	IW	07/28/14	634374.0	3755715.1
PTX06-1173	Perched	ISPM	09/07/14	634197.6	3755312.4
PTX06-1174	Perched	ISPM	06/20/14	633904.6	3755489.2
PTX06-1175	Perched	ISPM	08/22/14	633417.0	3755651.1
PTX06-1180	Perched	IW	11/02/15	633474.1	3756487.9
PTX06-1182	Perched	IW	7/8/2016	647140.2	3751088.5
PTX06-1183	Perched	IW	07/13/16	639765.8	3753350.4
PTX06-1184	Perched	IW	05/04/17	646625.1	3750638.3
PTX06-1185	Perched	IW	05/06/17	647878.4	3751139.8
PTX06-1190	Perched	IW	11/20/17	648281.3	3751439.5
PTX06-1191	Perched	ISPM	01/22/18	648996.9	3750720.9
PTX06-1192	Perched	IW	01/19/18	649119.3	3749893.1
PTX06-1193	Perched	IW	01/24/18	646719.1	3749346.8
PTX06-1194	Perched	ISPM	01/27/18	648355.4	3750477.8
PTX06-1195	Perched	IW	01/30/18	649096.8	3751968.7
PTX06-1196	Perched	ISPM	07/20/18	649710.3	3750989.9
PTX06-1197	Perched	IW	07/17/18	649782.1	3750355.3
PTX06-1199	Perched	IW	07/11/18	650525.5	3750905.5
PTX06-1200	Perched	IW	01/07/19	651557.9	3749356.3
PTX06-1201	Perched	IW	01/10/19	650585.1	3749355.5
PTX06-1202	Perched	IW	01/12/19	651359.0	3750361.8
PTX06-1194	Perched	ISPM	01/27/18	648355.4	3750477.8
PTX06-1195	Perched	IW	01/30/18	649096.8	3751968.7
PTX06-1196	Perched	ISPM	07/20/18	649710.3	3750989.9
PTX06-1197	Perched	IW	07/17/18	649782.1	3750355.3
PTX06-1199	Perched	IW	07/11/18	650525.5	3750905.5
PTX06-1200	Perched	IW	01/07/19	651557.9	3749356.3
PTX06-1201	Perched	IW	01/10/19	650585.1	3749355.5

Long-Term Monitoring Wells and Coordinates

Well	Aquifer	Type	Installation Date	Easting (ft NAD83)	Northing (ft NAD83)
PTX06-1202	Perched	IW	01/12/19	651359.0	3750361.8
PTX06-1203	Perched	IW	01/25/19	650588.3	3749879.4
PTX06-1204	Perched	IW	01/29/19	650997.8	3749052.0
PTX06-ISB014	Perched	ISB	10/01/07	641188.3	3752451.5
PTX06-ISB019	Perched	ISB	09/19/07	641666.3	3752597.6
PTX06-ISB024	Perched	ISB	07/18/07	642144.6	3752737.7
PTX06-ISB030B	Perched	ISB	09/17/07	641094.7	3752286.3
PTX06-ISB038	Perched	ISB	08/14/07	641850.2	3752524.2
PTX06-ISB042	Perched	ISB	08/25/07	642233.4	3752641.0
PTX06-ISB046	Perched	ISB	10/24/07	641939.3	3752422.7
PTX06-ISB048	Perched	ISB	10/24/07	642131.8	3752479.9
PTX06-ISB055	Perched	ISB	03/04/09	636606.1	3755477.4
PTX06-ISB059	Perched	ISB	02/25/09	636234.2	3755246.1
PTX06-ISB063	Perched	ISB	02/19/09	635886.3	3755141.1
PTX06-ISB069A	Perched	ISB	02/11/09	635170.0	3755241.0
PTX06-ISB071	Perched	ISB	11/25/08	634991.2	3755334.1
PTX06-ISB073	Perched	ISB	09/29/11	634821.3	3755453.7
PTX06-ISB075	Perched	ISB	09/28/12	634813.2	3755333.9
PTX06-ISB077	Perched	ISB	11/13/08	634942.8	3755207.6
PTX06-ISB082	Perched	ISB	08/26/09	636597.9	3755139.4
PTX07-1O01	Perched	IW	05/19/94	638532.5	3767695.2
PTX07-1O02	Perched	IW	05/31/94	639106.6	3768117.5
PTX07-1O03	Perched	IW	06/14/94	639046.6	3767462.6
PTX07-1P02	Perched	IW	07/12/94	637817.7	3763019.1
PTX07-1P05	Perched	IW	09/28/98	637136.1	3762886.8
PTX07-1Q01	Perched	IW	04/12/94	629274.8	3755836.1
PTX07-1Q02	Perched	IW	04/22/94	628877.0	3756408.7
PTX07-1R01	Ogallala	IW	04/16/00	627914.3	3764159.9
PTX07-1R03	Perched	IW	08/22/99	627664.4	3764501.8
PTX08-1001	Perched	IW	09/21/13	638941.5	3762976.3
PTX08-1002	Perched	IW	08/27/13	640859.0	3763003.2
PTX08-1003	Perched	IW	10/07/92	635385.4	3760136.6
PTX08-1005	Perched	IW	10/20/92	635316.7	3756346.2
PTX08-1006	Perched	IW	11/02/92	636400.4	3756761.9
PTX08-1007	Perched	IW	09/01/11	638900.0	3758440.5
PTX08-1008	Perched	IW	01/10/93	637485.1	3755695.5
PTX08-1009	Perched	IW	02/10/93	638867.0	3755275.0
PTX08-1010	Perched	IW	09/16/92	641401.5	3773206.7
PTX10-1014	Perched	IW	06/29/92	639701.7	3759769.7

IW - Investigation/Monitoring Well

ISPM – In Situ Performance Monitoring Well

ISB - ISB Injection Well