Work Plan
Remedial Investigation and Feasibility Study
Pederson's Fryer Farms
Pierce County, Washington

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Prepared for

Washington State Department of Ecology

LANDAU ASSOCIATES
950 Pacific Avenue, Suite 515
Tacoma, WA 98402
(253) 926-2493

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1.0 INTRODUCTION

This document presents a work plan for a remedial investigation (RI) and feasibility study (FS) at the former Pederson's Fryer Farms (PFF) property located at 2901 72nd Street East in Tacoma, Washington (site). Leaking underground storage tanks (USTs) at the site have resulted in releases of total petroleum hydrocarbons (TPH) and related constituents to soil and groundwater. Some preliminary cleanup actions have included UST and TPH-impacted soil removal, however, soil and groundwater contamination still remains. This work plan describes activities that will be conducted to characterize the nature and extent of contamination at the PFF property and adjacent impacted properties, and evaluate site remediation alternatives. The location of the site is shown on the vicinity map on Figure 1.

Regulatory authority over the site lies with the Washington State Department of Ecology (Ecology) and with the Tacoma Pierce County Health Department (TPCHD). TPCHD has authority to require cleanup of leaking underground storage tank sites in Pierce County. Management of investigation and cleanup activities is being conducted directly by Ecology. Landau Associates has been contracted by the Ecology to implement the RI/FS.

2.0 BACKGROUND

PFF operated as a poultry processing facility from 1948 to 1998. The former PFF property originally consisted of six separate parcels [Environmental Partners, Inc. (EPI) 2003a]. According to information on file at the Tacoma Public Library, PFF declared bankruptcy in 1996 and the business was sold to Foster Farms of Modesto, California in 1997. The poultry processing facility continued to operate until 1998 (EPI 2003a) when it was apparently closed. All six parcels have been sold and are owned by various entities. For convenience these parcels have been designated as Parcels 1 through 6. Parcel locations and numbers are shown on Figure 2. Also included on Figure 2 are the current parcel owners based on tax assessor records.

Parcels 3 and 4 were determined to be clean and were sold in 2001 by the bankruptcy trustee, Steinberg and Associates (Environmental Associates 2001; EPI 2003a). The southern portion of Parcel 6 had a gas station (known as Dee Dee's Grocery). Remedial actions were implemented in the vicinity of the gas station and the site received a no further action (NFA) determination from Ecology in February 1998 (Facility Site ID 78151695). The primary focus of current remedial actions is on Parcels 1 and 2, currently owned by Waller Enterprises, LLC (herein referred to as the PFF property). Parcel 1 is the primary location of the former poultry processing plant where 10 separate USTs have been identified. Parcel 2 is an adjacent residential property where a single UST has been identified. Pipeline Road, owned by Tacoma City Water separates Parcels 1 through 5 from Parcel 6. The Pipeline Road parcel (i.e., Parcel 7) is of interest since it appears to be impacted by releases from the PFF property (EPI 2003a). The location of Parcel 7 is also shown on Figure 2.

2.1 UNDERGROUND STORAGE TANKS

Site documentation has identified eleven historical gasoline, diesel, and/or oil USTs at seven locations on PFF property. For convenience each of these seven locations has been labeled as separate areas "A" through "G." A description of each UST area is presented in Table 1 along with the current status of each of the eleven USTs. Each UST area is shown on Figure 3.

In 1994, a total of three USTs in Areas B and C were removed. In 1997, the remaining eight USTs were located and temporarily closed in place by Langseth Environmental Services, Inc. (LESI) (Langseth 1997). Closure consisted of pumping out product, flushing and triple rinsing each tank. Fill ports were plugged with slurry and capped (Langseth 1997). Later, all but the two USTs in Areas D and E were removed (EPI 2003a). A description of UST abandonment, removal and associated remedial actions is described below by area.

2.1.1 AREA A

A total of four USTs were located in Area A, also known as the northern tank farm. The Area A USTs included a 12,000-gallon diesel tank, an 8,000-gallon gasoline tank, a 6,000-gallon diesel tank and a 550-gallon oil[1] tank. After these USTs were closed in place in 1997 by LESI, they were removed by Environmental Partners, Inc. (EPI) in 1998 (EPI 2000). During UST removal, 350 cubic yards of total petroleum hydrocarbon (TPH) contaminated soil were removed from the combined excavation and stockpiled on the property; however, TPH contaminated soil remained in the sidewalls and bottom of the excavation. Additional test pit excavation indicated that the extent of TPH impacts extended to a depth of at least 30 ft below ground surface (BGS) (EPI 2003a).

Additional soil excavation was completed between August and October 2000. The excavation was about 60 ft by 65 ft and extended to a depth of 27 ft BGS. A total of approximately 3,737 cubic yards of soil were removed from the excavation and stockpiled. The excavation depth terminated at 27 ft BGS due to sidewall sloughing concerns. Sixty-four sidewall and 44 bottom confirmation soil samples were collected. Twenty-eight confirmation soil samples exceeded the MTCA Method A cleanup level for diesel range TPH of 2,000 mg/kg. The highest confirmation soil sampling result was 48,000 mg/kg along the east side wall at 12 ft BGS. Monitoring wells were also drilled around the perimeter of the excavation (see Section 2.2). Soil samples collected in wells MW-4, MW-7R, MW-18 and MW-19 indicated that soil contamination extended beyond and below the limits of the excavation. For example diesel-range TPH was detected at 5,500 mg/kg in the 35 ft BGS sample at MW-4 and 2,700 mg/kg in the 55 ft BGS sample at MW-7R (EPI 2003a). A summary of Area A UST excavation confirmation samples that exceeded cleanup levels is presented on Figure 4.

Due to the large volume of soil removed from the Area A excavation as well as additional soil removed from the Area F and G excavations (see Sections 2.1.6 and 2.1.7), a decision was made to bioremediate the soil onsite (EPI 2003a). Approximately 3,780 cubic yards of soil was placed in nine separate windrows at three locations on Parcels 3, 5 and 6. Bioremediation performance monitoring was conducted on the treated soil, which included sampling and testing for TPH and carcinogenic polycyclic aromatic hydrocarbons (cPAH). TPH final performance monitoring results were all below 2,000 mg/kg (the current MTCA Method A cleanup level for diesel range TPH). Some of the bioremediated soil exceeded MTCA Method A cleanup levels for cPAHs. Consequently, cPAH final performance monitoring results were used to categorize soil into three groups based on concentrations adjusted for toxicity equivalency factors (TEFs) [WAC 173-340-708(8)(e)(ii)]. Based on the categorization, the soil was used as backfill or hauled offsite for disposal as follows:

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[1] This oil tank is referred to as a "new" oil tank. It is not clear what is meant by the term "new" since it was not defined in historical environmental reports.

- Treated soil with a TEF-modified cPAH concentration less than or equal to 0.1 mg/kg (the MTCA Method A cleanup level for cPAHs) was used as excavation backfill from 0 to 15 ft BGS (1,495 cubic yards)
- Treated soil with a TEF-modified cPAH concentration greater than or equal to 0.1 mg/kg but less than or equal to 2 mg/kg was used as excavation backfill below 15 ft BGS (1,053 cubic yards)
- Treated soil with a TEF-modified cPAH concentration greater than 2.0 mg/kg was hauled offsite for disposal (626 cubic yards).

Treated soil was used to backfill the Area A excavation with the concurrence of Ecology and TPCHD. In addition to the treated soil, 1,626 cubic yards of clean imported backfill was used to supplement treated soil. At the Area A excavation, an impermeable liner was placed at 10 ft BGS in anticipation of an additional remediation scheme that was never implemented (EPI 2003a). The location of the soil windrows are shown on Figure 5.

After windrow soil was removed for backfill or offsite disposal, confirmation soil samples were collected from the windrow locations (EPI 2003a). Windrows on Parcel 3 were sampled in 2001 for TPH and BTEX. None of the samples exceeded MTCA cleanup levels. Windrows on Parcels 5 and 6 were sampled in September 2002 for TPH and cPAHs. One of the windrows on Parcel 6 exceeded the MTCA Method A cleanup level for cPAHs. Additional soil was excavated and the area was resampled in November 2002. The resample soil concentrations met the cPAH cleanup level.

2.1.2 AREA B

In 1994, the two USTs from Area B were removed (Saltbush 1994). The USTs were a 6,000-gallon unleaded gasoline tank and a 3,000-gallon diesel tank and included two pump islands. The tanks were removed along with approximately 100 to 120 cubic yards of TPH contaminated soil that was stockpiled northwest of the storage building. Soil confirmation samples associated with the diesel and gas tanks were below current MTCA Method A cleanup levels for gasoline[2] and diesel (30 mg/kg and 2,000 mg/kg respectively). During the excavation, there was no field evidence of a leak from these tanks though there was evidence of a release around the pump islands (Saltbush 1994). Near the pump islands location, gasoline range TPH was detected in the excavation east side wall at 31 mg/kg by Method HCID. The excavation extended down to 15 ft BGS based on confirmation sample identification numbers. The tank locations are shown on Figure 6. The soil stockpile location is shown on Figure 5.

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[2] The MTCA Method A cleanup level for soil is either 30 mg/kg or 100 mg/kg depending on the concentration of BTEX constituents. The cleanup level has preliminarily been set at 30 mg/kg until the percentage of BTEX in soil can be documented.

Soil was also excavated around the pump islands. During this excavation, there was a noticeable gasoline odor at 3 ft to 4 ft BGS. After completing the excavation, bottom and confirmation soil samples were collected. The western sidewall sample at 14 ft detected TPH at 2,420 mg/kg by Method WTPH-418.1. This western sidewall sample also detected xylenes at 46.4 mg/kg, above the current MTCA Method A cleanup level of 9 mg/kg. Two bottom confirmation samples detected TPH above 30 mg/kg, the highest being 1,470 mg/kg at 14 ft. The location of the pump islands and the four confirmation samples exceeding cleanup levels are shown on Figure 6.

2.1.3 AREA C

In 1994, the UST from Area C was removed in conjunction with Area B UST removal project (Saltbush 1994). The Area C UST was a 300-gallon waste oil tank. The tank was apparently formerly an above ground tank that was later buried. During excavation, it was noticed that the tank was damaged. Approximately 50 to 60 cubic yards of TPH contaminated soil was removed and placed with the stockpile for Area B USTs. Confirmation samples were collected for TPH by Method WTPH-418.1. Semivolatile organic compound (SVOC) and PCB analyses were also apparently collected though the results were not reported (Saltbush 1994). It appears that the total excavation depth was about 6 ft BGS from drawings in the UST removal report. Some contamination was left in place on the north sidewall underneath the adjacent building. Three north sidewall confirmation soil sample results exceeded MTCA Method A cleanup levels. The maximum concentration was 52,000 mg/kg diesel (Method WTPH-418.1). The tank excavation location and confirmation soil sample results exceeding cleanup levels are shown on Figure 7.

2.1.4 AREA D

Area D consists of a 500-gallon heating oil tank associated with a residence on Parcel 2. The heating oil tank was closed in place in 1997 (Langseth 1997). The tank has not been removed and no investigations have been conducted. During a site reconnaissance visit by Landau Associates on November 4, 2010 the exact location of the tank could not be identified. The approximate tank location based on the LESI closure report is shown on Figure 3.

2.1.5 AREA E

Area E consists of an 8,000-gallon diesel/heating oil tank located beneath one of the Parcel 1 buildings. The tank was closed in place in 1997 (Langseth 1997). The tank has not been removed and no investigations have been conducted. During a site reconnaissance visit by Landau Associates on November 4, 2010 the exact location of the tank could not be identified, however it appeared that the general area of the tank location had limited overhead access. The ceiling height of the portion of the building built over the tank is believed to be approximately 12 ft. Additionally, the doorway opening height leading into that portion of the building is 7 ft. The approximate tank location based on the LESI closure report is shown on Figure 3.

2.1.6 AREA F

A single 2,000-gallon gasoline UST was located in Area F. The UST was located on the east side of the large southern-most building on Parcel 1. The UST was closed in place in 1997 and removed by EPI in August 2000 (EPI 2003a). The tank was reported in good condition but tank piping appeared to be cracked and there was visual and olfactory evidence of TPH contamination during excavation. The excavation extended to a depth of 14 ft BGS between two buildings; the maximum extent of the excavation was 25 ft BGS. The lateral extent of the excavation was limited by concerns that building footings may be undermined. A total of 910 cubic yards of TPH contaminated soil was removed. The soil was treated onsite as part of the bioremediation remedy discussed in Section 2.1.1.

Forty-seven final confirmation soil samples were collected. Eleven of these samples exceeded current MTCA Method A cleanup levels primarily for gasoline range TPH. At least one BTEX constituent exceeded MTCA Method A cleanup samples in three locations. The maximum concentration was 3,000 mg/kg for gasoline range TPH. The tank excavation location and confirmation soil sample results exceeding cleanup levels are shown on Figure 8.

In addition to TPH and BTEX analyses, two samples were collected from the excavated soil and sampled for lead. The maximum lead concentration was 6 mg/kg. This value is consistent with background soil lead concentrations (Ecology 1994).

2.1.7 AREA G

A single 500-gallon gasoline UST was located in Area G. The UST was located on the south side of the large southern most building. The UST was closed in place in 1997 and removed by EPI in August 2000 (EPI 2003a). The excavation extended to a depth of 14 ft BGS. The lateral extent of the excavation was limited by concerns that the building footings may be undermined. A total of 145 cubic yards of TPH contaminated soil was removed. The soil was treated onsite as part of the bioremediation remedy discussed in Section 2.1.1.

Twenty-seven final confirmation soil samples were collected. Only three samples exceeded current MTCA Method A cleanup samples for gasoline range TPH or BTEX constituents. The maximum gasoline range TPH was 183 mg/kg. The tank excavation location and confirmation soil sample results exceeding cleanup levels are shown on Figure 9.

In addition to TPH and BTEX analyses, two samples were collected from the excavated soil and sampled for lead. The maximum lead concentration was 4 mg/kg. This value is consistent with background soil lead concentrations (Ecology 1994).

2.2 PRELIMINARY HYDROGEOLOGICAL CONCEPTUAL MODEL

A preliminary hydrogeologic conceptual model was developed to assist with preliminary data evaluation and scope for the RI. The conceptual model was based on review of existing reports by EPI and review of boring logs and groundwater level data.

2.2.1 GEOLOGY

The site is located in a broad Vashon-age glacial drift plain that encompasses much of south Tacoma. The drift plain consists of glacial till at the surface underlain by Vashon advance outwash that is in turn underlain by older interglacial and glacial deposits. Vashon recessional deposits are locally present overlying the till in places. This entire sequence has been mapped as being present along the Swan Creek drainage about 1.5 miles north of the site in Swan Creek Park (Troost, in review). The regional surface geology and stratigraphy of the drift plain has been defined by a number of regional geologic studies by the United States Geologic Survey (USGS) (Troost, in review), Jones et al. (1999), and others, (Brown and Caldwell et al. 1991).

Based on existing boring logs, the site geology appears to be consistent with a typical model of Vashon glacial stratigraphy. The upper 5 to 10 ft of soil appears to be a recessional glacial lacustrine deposit of silt and clay. This silt layer is underlain by about 40 ft of glacial till. The glacial till overlies a Vashon advance outwash deposit. A preliminary interpretation of site geology is presented in two site cross sections. Cross section locations are shown on Figure 3; cross section A-A' is presented on Figure 10; cross section B-B' is presented on Figure 11.

2.2.2 GROUNDWATER OCCURRENCE AND FLOW

Previous investigations at the site have identified a shallow groundwater bearing zone within the till based on the presence of groundwater in wells. The wells are typically screened over a 20- to 30-ft interval entirely within the till. Wells screened in this manner in a low permeability deposit typically act as sumps where groundwater seeps into the screen interval collecting in the bottom of the well. The groundwater accumulates in thickness until the rate of seepage out equals the rate of seepage into the well. The water level elevation in the well appears to be more of a function of the elevation of the bottom of the well screen than of hydrostatic pressure in the glacial till. This characterization is supported by observations during UST excavations where little to no seepage was observed when digging pits down to 25 ft to 30 ft BGS (EPI 2003a). Seasonal groundwater level fluctuations from shallow[3] wells screened in the till are variable and relatively limited. Groundwater level elevations from till wells also do not demonstrate a consistent gradient. Hydrographs for select glacial till wells are shown on Figure 12. Groundwater level elevations from till wells are shown on Figure 13 for a December 2010 measurement event conducted by Landau Associates.

The primary aquifer at the site is the deep[4] aquifer that occurs in saturated portions of Vashon advance outwash below the till. Groundwater levels in deep wells screened in the northern portion of the site fluctuate in a consistent seasonal pattern approximately 10 ft per year. In the northern portion of the site, groundwater level elevations from the deep aquifer also demonstrate a relatively uniform gradient indicative of groundwater flow to the northeast in the direction of the Puyallup River. Hydrographs for select deep wells are shown on Figure 14. Groundwater level elevations from deep wells are shown on Figure 15 for a December 2010 measurement event conducted by Landau Associates.

In the southern portion of the site, three deep wells MW-12, MW-13 and MW-14 are often dry especially in the summer. These wells are screened from 15 ft to 50 ft BGS, through the till all the way to the advance outwash deposits below the till. Therefore, the limited glacial till seepage that enters these wells would simply drain out into the permeable advance outwash. Groundwater levels in these wells are not consistent with gradients observed in the deep aquifer (see Figure 15). Seasonal fluctuations are also more consistent with shallow wells than deep wells. For example, the seasonal fluctuation observed at well MW-12 was only about 3 ft compared to about 10 ft for other deep wells on the northern portion of the site (see Figure 15).

[3] Shallow wells are defined as having a bottom of screen depth 45 ft or less BGS. See Table 2.
[4] Deep wells are defined as having a bottom of screen depth greater than 45 ft BGS. See Table 2.

3.0 INITIAL EVALUATION

As part of scoping activities associated with the RI, Landau Associates did some initial evaluations. These evaluations included limited field work and data evaluation. The purpose of these evaluations was to verify current conditions because sampling and analysis had not been conducted at the site since 2005.

3.1 MONITORING WELLS

There are currently 22 monitoring wells that have been installed at the site. The wells were installed between April 2001 and July 2004 (EPI 2003c; EPI 2004). Based on an initial evaluation, it did not appear that the wells were screened in a consistent manner in relationship to the site stratigraphy. For evaluation purposes, wells are categorized as either shallow or deep. Shallow wells are designated as having a bottom of screen depth at 45 ft BGS or less. Based on this maximum screen depth, these wells should be screened entirely within the till. Deep wells are designated as having a bottom screen depth greater than 45 ft BGS. All deep wells are interpreted to be screened at least partially in the deep aquifer. Well designations are summarized in Table 2. Shallow wells are shown on Figure 13; deep wells are shown on Figure 15.

3.1.1 SURVEY

The 22 initial wells were surveyed to a site datum (EPI 2003a). There was also no record that wells had been surveyed by a professional surveyor. Landau Associates contracted with KPG Inc. to perform a professional survey of site monitoring wells. The survey was conducted on December 16, 2010. The survey horizontal datum is in Washington State Plane coordinates [NAD 83(91)]. The survey vertical datum is NAVD88. The top of the monitoring well and the outer monument rim were surveyed. If the well had a stickup monument (MW-2, MW-8, MW-21 and MW-22), then the ground surface was also surveyed. The flush mount monument for well MW-14 was obliterated; therefore the ground surface at this well was also surveyed. Survey data is presented in Table 3.

A comparison was made between the new survey and the former survey. With the exception of well MW-7R, the original top of monitoring well survey was within -0.04 ft and +0.03 ft for all wells after adjusting for the different datum. The current survey for well MW-7R differed from the original survey by -0.85 ft.[5] The original survey data is included in Table 3.

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[5] Survey comparisons were made by adding 310.55 ft (the median difference between the original and professional surveys) to each original survey value.

3.1.2 WELL RECONNAISSANCE

On November 4, 2010 Landau Associates performed an initial assessment of all site monitoring wells. All wells were located except MW-3 (north of Area A) and MW-13 (east of Area F). These two wells were located on December 6, 2010. MW-13 was located with a metal detector under about 4 or 5 inches of gravel. The initial reconnaissance included depth sounding and water level measurement at each well. These data are included in Table 4.

The initial reconnaissance data also included an evaluation of the presence of odor, sheen and floating product. Odor and sheen observations were also made during the initial groundwater sampling event in December 2010. An odor or sheen was observed in three (MW-1, MW-4 and MW-5) of the six shallow wells surrounding Area A. All five deep wells (MW-7R, MW-17, MW-18, MW-19 and MW-20) located in or adjacent to Area A also detected an odor. All of these wells except MW-19 detected a sheen. A thin layer of floating product was noted at well MW-18. A slight odor was noted at shallow well MW-10 located east of Area B. A strong odor and floating product was noted at shallow well MW-15 located east of Area G. A summary of field observations of odor, sheen and floating product is included in Table 4.

3.2 GROUNDWATER QUALITY

In December 2010 groundwater samples were collected for gasoline and diesel range TPH and BTEX. Twenty wells were sampled. Wells MW-14 and MW-16 were not sampled because there was not enough groundwater in the wells to collect a sample. Wells were sampled with either a 2-inch Grundfos submersible pump, a Waterra inertial pump (i.e. foot valve) or a disposable bailer. The Waterra foot valves are dedicated whereas the Grundfos required decontamination between wells. At the PFF site, dedicated or disposable sampling equipment is important due to the presence of product or sheen at some wells. Consequently, it was determined that the use of Waterra foot valves for pumping was the most appropriate sampling technique.

3.2.1 TPH AND BTEX

The results of the December 2010 sampling event indicated that TPH and BTEX concentrations had declined at all wells. To verify this trend, three Area A wells (shallow well MW-4; deep wells MW-17 and MW-19) were resampled on February 1, 2011. The February 2011 resampling indicated appreciably higher concentrations than the December 2010 sampling event but lower than the historical maximum value. Groundwater quality data collected by Landau Associates in December 2010 and February 2011 is summarized in Appendix A. A comparison between maximum and most recent TPH and BTEX groundwater quality data for shallow wells is presented in Figures 16 and 17 respectively. A comparison between maximum and most recent TPH and BTEX groundwater quality data for deep wells is presented in Figures 18 and 19 respectively.

Based on the most recent sampling data, the only shallow zone exceedances of TPH MTCA Method A cleanup levels were at Area A well MW-4 and Area G well MW-15; there were no shallow zone exceedances for BTEX. All of the deep aquifer wells around Area A that exhibited an odor or sheen also had an exceedance of MTCA Method A cleanup levels. However, given the variability observed between the December 2010 and February 2011 sampling results, it is difficult to draw conclusions about the nature and extent of groundwater quality without additional data to characterize concentration variability.

3.2.2 MNA PARAMETERS

MNA parameters were analyzed at wells during the initial sampling. Field parameters were collected at all locations where there was adequate groundwater. Ferrous iron was also measured in the field. During the February 2011 sampling event, nitrate and sulfate were also sampled at MW-4, MW-17 and MW-19. Most of the wells in the vicinity of Area A had detectable levels of ferrous iron indicating slightly to moderately reducing conditions. The sulfate concentration at well MW-19 appeared to be low (2.8 mg/L) indicating relatively strong reducing conditions at this location. MNA parameters and field parameter data from the December 2010 and February 2011 sampling events are presented in Appendix A.

3.2.3 OTHER PARAMETERS

Fuel additives are required to be sampled for gasoline releases (WAC 173-340-900 Table 830-1). Fuel additives 1,2-dibromoethane (EDB), 1,2-dichloroethane (EDC), methyl t-butyl ether (MTBE) and lead were sampled on a limited basis at select shallow wells by EPI (EPI 2003a). EDB was sampled for once at MW-11 (Area F) and MW-15 (Area G) and was not detected. EDC was sampled for once at each of the four gasoline UST areas (Areas A, B, F and G); it was only detected at MW-8 at 8 µg/L, slightly above the MTCA Method B cleanup level of 5 µg/L. A total of seven MTBE samples were collected at the four gasoline UST areas; it was not detected. Lead was sampled for once at Area B, Area F and Area G and was not detected.

Naphthalenes are also required to be sampled for gasoline and diesel releases. Naphthalenes were sampled for once at well MW-8 (Area B) (EPI 2003a). 2-methylnaphtalene was detected at 2 µg/L.

4.0 REMEDIAL INVESTIGATION

Additional remedial investigation activities are proposed to provide adequate information to identify and select a cleanup action for the site. The objective of proposed activities is to address data gaps in the existing site characterization to adequately define the nature and extent of TPH related contamination in soil and groundwater. Additional objectives are to verify and refine the hydrogeological conceptual model of the site discussed in Section 2.2 and abandon unnecessary or improperly installed wells.

Groundwater and soil sampling will be conducted in accordance with the sampling and analysis plan (SAP) presented in Appendix B. A quality assurance project plan (QAPP) has been prepared (Appendix C) to ensure data quality objectives for this project are met. Quality assurance/quality control (QA/QC) procedures are included for sample documentation, field quality checks, chain-of-custody procedures, laboratory quality control, and data validation. All field activities will be conducted in accordance with the site health and safety plan (HASP), which is included in Appendix D.

4.1 WELL ABANDONMENT

A number of wells at the site are recommended for abandonment for a variety of reasons. In general, the well locations are appropriate for site characterization but the well installation compromises data quality. The following wells have been identified for abandonment:

- Wells MW-17 and MW-18 have long screens that extend from the Area A excavation into the top of the deep aquifer (e.g., see Figure 10). These wells are potential conduits for shallow zone contamination to travel to the deep aquifer.
- Wells MW-9, MW-12, MW-13, MW-14 and MW-16 all have limited water (see Table 2) or are often dry. Consequently they are difficult to sample. These wells also have long screens that extend upward from near the base of the till or top of the deep aquifer. Consequently it is difficult to interpret the data from these wells (i.e., whether the results reflect the shallow zone or deep aquifer).
- Well MW-21 appears to be damaged. Though the well is reportedly screened within the deep aquifer, water levels are unusual. Water levels are inconsistent (see Table 2) between measurement events and are not consistent with nearby (i.e., well MW-22) groundwater levels.

Wells MW-9, MW-12, MW-13, MW-14, MW-16, MW-17, MW-18, and MW-21 will be abandoned in accordance with the *Minimum Standards for Construction and Maintenance of Wells* [Washington Administrative Code (WAC) Chapter 173-160]. Each well will be over-drilled and grouted by a licensed well driller to ensure an adequately sealed borehole to prevent potential vertical migration of contaminants. The locations of wells identified for abandonment are shown on Figure 20.

4.2 UTILITY LOCATE

Prior to drilling, the public one-call utility location and notification service will be contacted to locate public utilities on and adjacent to the site. A private locating company will also be subcontracted to identify subsurface conductible utilities.

4.3 AREA D AND AREA E EXISTING UST INVESTIGATION

A ground penetrating radar (GPR) survey will be used to identify the location of the Area E abandoned 8,000-gal diesel UST in the main processing building on Parcel 1 and the Area D 500-gallon heating oil UST on the east side of the residential building on Parcel 2. If the GPR survey is unsuccessful, a magnetometer may be used to define tank locations.

Once the tanks have been located, field investigations will be conducted to evaluate the potential for an UST release. At Area D, a single boring will be drilled adjacent to the tank. Soil samples will be collected to determine if a release has occurred. At Area E, the existing concrete slab will be cored on either side of the tank. A limited access rig (e.g., a Bobcat™ mounted hollow stem auger) will be used to drill two borings to collect soil samples. Soil sampling will be conducted according to the SAP. Preliminary soil sampling depths are presented in Table 5. Sample analyses are listed in Table 6.

Tank locations and soil sampling data will be used to determine final disposition of the tanks. If the tanks can be removed without damaging the structural integrity of the buildings, Landau Associates will arrange for an UST contractor to remove the tanks. If a release from the tanks is confirmed, Landau Associates will report the release to Ecology within 24 hours (WAC 173-360-720). Prior to final decommissioning, Landau Associate will obtain necessary permits from the Fire Marshall and the TPCHD. A UST 30-day notice will also be filed with Ecology prior to UST decommissioning. If the tanks cannot be removed, Landau Associates will develop a plan to submit to Ecology and the TPCHD for approval to abandon the tanks in place (i.e., fill them with foam or grout).

4.4 SOIL INVESTIGATION

Soil sampling will be conducted to determine the nature and extent of TPH related soil contamination within and above the till.[6] Sampling will be conducted at each of the UST areas. The scope of investigation is intended to supplement existing information collected during previous investigations summarized in Section 2.1. Soil sampling will be conducted according to the SAP. Soil boring locations are shown on Figure 23. Soil borings that will be converted to wells are shown on Figures 21 (shallow) and Figure 22 (deep). A summary of soil sampling depths at all borings is presented in Table 5. The soil sampling depth interval was specified as 5 ft. The maximum depth of sampling at each UST area was determined to be 5 ft below the maximum depth of residual soil contamination observed at that UST area based on previous investigations (Section 2). The overall maximum soil sampling depth is specified as 45 ft BGS (i.e., about Elevation 360 ft). This depth is within about 5 ft of the bottom of the glacial till layer (see geologic cross sections on Figures 10 and 11) and should be adequate to characterize the extent of soil contamination within the till. The final sampling interval and boring depth may be modified in the field by the field geologist in consultation with the Landau Associates project manager based on field screening and observed conditions during drilling. Field screening includes visual observation of staining or discoloration, odor, sheen (from a sheen test), and photoionization detector readings. Field screening results will be recorded on the boring log at a minimum of 5 ft intervals. Additional details on field screening are presented in the SAP.

Samples will be collected in soil borings and borings for wells. Borings less than 15 ft may be drilled with a direct-push probe. Borings less than 35 ft may be drilled with a hollow stem auger or a sonic drill rig. Borings deeper than 35 ft will be drilled with a sonic rig. Sonic samples 20 ft or less will be collected directly from the soil core. Sonic samples deeper than 20 ft will be collected from a driven sampler to avoid overheating the sample. In addition to sampling at specific UST areas, soil sampling will be conducted at locations where the soil stockpile was located (see Figure 5).

4.4.1 SOIL STOCKPILE SAMPLING

A soil stockpile from Area B and C UST excavations was located on Parcel 2. The location of the soil stockpile is shown on Figure 5. Four soil samples will be collected to verify that residual soil contamination is not associated with the stockpile. Each sample will be collected from 0 to 3 inches BGS after first removing grass or gravel. Samples will be analyzed for diesel range TPH and cPAHs. Soil

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[6] The extent of TPH impacts in soil beneath the till will be inferred from the groundwater investigation since the soil deposits are assumed to be saturated at least part of the year.

sample locations will be determined in the field using a GPS and predetermined sample coordinates. Sample locations will be specified to achieve geographic coverage of the sample area.

4.4.2 Area A

Soil sampling will be conducted from five soil borings and borings for four new wells. Three borings (A-4, MW-26s and MW-25d) will be drilled within the existing backfilled Area A excavation to characterize residual soil conditions in the excavation. The remaining borings will be located outside the perimeter of the excavation to determine if contamination has migrated laterally and vertically from the excavation. Boring A-5 will be drilled inside the adjacent former storage building to determine if contamination is present beneath the building. The location of borings was based on confirmation soil sampling results presented in Section 2.1.1.

4.4.3 Area B

Soil sampling will be conducted from two soil borings. These borings are located in the vicinity of the former pump island where residual soil contamination was left in place. Boring B-1 will be drilled inside the adjacent building to determine if there is significant contamination under the building slab.

4.4.4 Area C

Soil sampling will be conducted from one soil boring and borings from two wells. These borings are situated to characterize residual soil contamination left beneath the building slab and residual soil inside and outside the Area C excavation.

4.4.5 Area D

Soil sampling will be conducted from one soil boring (see Section 4.3). The boring is situated to characterize soil contamination at the northeastern edge of the underground storage tank (UST) within Area D. The soil sampling results may require subsequent soil borings.

4.4.6 Area E

Soil sampling will be conducted from two soil borings (see Section 4.3). The borings are situated to characterize soil contamination at the eastern and western sides of the UST within Area E. The soil sampling results may require subsequent soil borings.

4.4.7 AREA F

Soil sampling will be conducted from three borings and borings from two wells. These borings are situated to characterize residual soil contamination left beneath the building slab and residual soil inside and outside the Area F excavation.

4.4.8 AREA G

Soil sampling will be conducted from two borings and borings from two wells. These borings are situated to characterize residual soil inside and outside the Area G excavation.

4.5 SOIL SAMPLING ANALYSES

Soil sampling analyses are specified to characterize TPH and TPH-related constituents consistent with MTCA requirements (WAC 173-340-900 Table 830-1). Soil from boring locations at former gasoline USTS are being analyzed for gasoline and diesel range hydrocarbons. BTEX and lead analysis is also specified for select samples to estimate the extent of BTEX constituents associated with gasoline impacts. Select cPAH and PCB analyses are specified for diesel and waste oil UST locations. Soil sample analyses are summarized in Table 6.

4.6 GROUNDWATER INVESTIGATION

The purpose of the groundwater investigation is to determine the nature and extent of groundwater contamination associated with UST areas where a documented release has been confirmed. The scope of groundwater investigation includes installation of four shallow wells and nine deep wells, and groundwater level monitoring and groundwater quality sampling. Shallow well locations are shown on Figure 21. Deep well locations are shown on Figure 22. Preliminary well screen depth intervals are presented on Table 5. All deep wells are intended to be screened wholly within advance outwash deposits below the Vashon glacial till. Consequently, screen interval depths listed in Table 5 are rough estimates. Final screen intervals will be determined by field geologist or engineer in consultation with the Landau Associates project manager based on boring specific geologic conditions. It is anticipated that soil sampling will identify the till-advance outwash geologic contact. The boring will extend at least 10 ft below this contact with the top of the deep well screen corresponding to the identified geologic contact. In all cases, the bottom of the screen interval for all deep wells will extend to at least Elevation 342 ft (approximate depth of 63 ft BGS). This should increase the likelihood that these wells will remain saturated annually based on existing water level information for deep aquifer wells (see Figure 14).

Shallow well installations were identified to locate at least one well within or near each existing UST area excavation. A second shallow well (MW-33s) is located near Area G because existing well MW-15 indicates the presence of shallow zone groundwater contamination beyond the UST excavation.

Deep well installations were identified to locate wells downgradient of each existing UST area excavation. A number of wells were identified to replace wells that will be abandoned. One well, MW-27d, is located upgradient of the Area A excavation. This well will help characterize the upgradient water quality and provide a data point for determining groundwater flow direction. One well, MW-32d, is situated upgradient of all the UST areas except Area D. This well will provide important water level information to calculate groundwater flow direction.

4.6.1 WELL INSTALLATION

Except for well MW-25d, all wells will be constructed of 2-inch diameter schedule 40 PVC well casing. Well MW-25d will be constructed of 4-inch diameter PVC to facilitate floating product removal pilot testing (Section 5.1.2). Each well will be fitted with 10 ft of 0.010-inch slot size well screen. A sand pack (10/20 Colorado sand or equivalent) will extend at least 2 ft above the screen. The sand pack will be surged during placement to prevent settling during development. Onsite wells will be completed with a traffic-rated, flush-mounted monument (8-inch diameter) set in concrete. Offsite wells MW-23d and MW-24d will be installed with stickup monuments. Well names and the identification numbers assigned by Ecology will be marked on the well identification tags supplied by Ecology and will be attached to each well casing following well installation.

New monitoring wells will be developed by over-pumping; air lift will not be used. Development water will be contained onsite in 55-gallon drums and disposed of properly pending the outcome of sampling.

4.6.2 GROUNDWATER SAMPLING

Groundwater sampling will be conducted at all new monitoring wells and existing monitoring wells that are not abandoned. With the exception of upgradient wells, all new wells will be sampled quarterly to characterize temporal water quality trends. New upgradient wells will be sampled once (MW-32d) or semiannually (MW-27d). Existing wells will be sampled semiannually to supplement the existing data at these wells and for data comparability with new wells. The groundwater sampling schedule is presented in Table 7.

4.6.3 GROUNDWATER ANALYSES

Groundwater analyses are specified to characterize TPH and TPH-related constituents consistent with MTCA requirements (WAC 173-340-900 Table 830-1). Groundwater from wells at former gasoline USTs will be analyzed for gasoline and diesel range hydrocarbons. BTEX analysis is also specified for select samples to estimate the extent of BTEX constituents associated with gasoline impacts. Limited lead, naphthalene and fuel additive sampling is also specified to evaluate if these constituents are a concern. Similarly, select cPAH analyses are specified for diesel and waste oil UST locations. MNA parameters will also be analyzed at all wells to provide data to support the feasibility study. Groundwater sample analyses are summarized in Table 7. Groundwater sampling and quality control procedures are presented in the SAP and QAPP.

4.6.4 GROUNDWATER LEVEL MONITORING

Each month, including prior to each quarterly groundwater sampling event (see Section 3.2.3 below), the depth to water measurements from the top of the well casing will be collected with an oil-water interface probe. Depth to groundwater, and LNAPL petroleum (if present), will be measured and recorded. Groundwater elevations will be calculated and used for determination of groundwater flow direction and gradient. Data logger/pressure transducers will be installed at two glacial till wells and one Qva aquifer well to refine the conceptual model.

4.7 SURVEYING

Once all wells are completed, Landau Associates will arrange for a professional land surveyor to survey the location and top of the well steel monument and well PVC casings. Ground surface will also be surveyed for stickup monuments. Outside borings will be surveyed for location using a map-grade GPS system. Inside boring locations will be surveyed by a professional land surveyor. Site datum will be consistent with datum listed in Table 3.

4.8 ABANDONMENT PROCEDURE AND WASTE DISPOSAL

Following sampling at each soil boring location, the direct-push borings will be abandoned with hydrated bentonite chips. Quick set concrete will be used to patch each hole drilled through cement. Asphalt patch will be used to patch holes drilled through asphalt. Equipment will be decontaminated prior to leaving the site.

Investigative-derived waste (IDW) soil cuttings, purge water, and/or decon water will be temporarily stored in Department of Transportation-approved 55-gallon drums prior to disposition. IDW will be handled in accordance with applicable regulations. Landau Associates will arrange for appropriate disposal of IDW upon receipt of laboratory analytical results. This may be performed in batches if multiple investigation events are scheduled within a given 90-day (or less) period.

4.9 DATA MANAGEMENT

All water level, soil quality and water quality data will be entered into the project Access database after quality assurance (QAPP) has been completed. All original laboratory data will be uploaded to the project SharePoint site within two weeks of receiving data from the analytical laboratory. All final quality assured data will be entered on the project SharePoint site in Excel format on a monthly basis. The project database will be submitted to Ecology via Ecology's electronic information management (EIM) system format at the end of the RI/FS and after cleanup action is complete.

4.10 DATA EVALUATION AND REPORTING

Once the RI field work is complete and there is an agreement with Ecology and TPCHD that sufficient characterization has been completed, an RI/FS report will be prepared. The report will outline the results of the current and previous RI field investigations, present a detailed conceptual site model, an assessment of applicable cleanup regulations and standards, an ecological evaluation, and the findings and an assessment of the pilot study results as they relate to feasibility of remedial options for the site.

5.0 FEASIBILITY STUDY

A feasibility study will be conducted consistent with MTCA regulations to evaluate and select a feasible cleanup alternative or alternatives for the PFF property. As part of the FS, a number of pilot tests will be performed to evaluate the applicability of specific technologies.

5.1 PILOT TESTING

Based on review of existing site data, Landau Associates has identified several preliminary remedial options. The following sections identify these preliminary remedial options and associated pilot testing.

5.1.1 MONITORED NATURAL ATTENUATION (MNA)

Monitored natural attenuation (MNA) has wide applicability to TPH impacted sites. The evaluation of MNA will focus on whether or not evidence exists demonstrating that active MNA processes (e.g., biodegradation) are ongoing at the site and whether MNA can effectively achieve remedial action objectives within a reasonable timeframe and meet the MTCA expectations for MNA described in WAC 173-340-370(7).

MNA parameters will be analyzed during groundwater monitoring events and evaluated in accordance with Ecology's *Guidance on Remediation of Petroleum-Contaminated Ground Water by Natural Attenuation* (Ecology 2005) to assess MNA potential. The evaluation will commence after well abandonment and installation of new monitoring wells so that post well decommissioning trends in the deep aquifer groundwater quality may be observed and incorporated into the MNA evaluation.

MNA parameters will be collected from each existing well on one occasion. Additionally, MNA parameters from select monitoring wells will be collected for four consecutive quarters in conjunction with the quarterly groundwater sampling. MNA parameters are nitrate and sulfate and field measured parameters ferrous iron, dissolved oxygen and oxygen-reduction potential (ORP).

Soluble manganese (Mn^{+2}), methane (CH_4), and alkalinity data can also be valuable information under certain conditions. Also, total organic carbon (TOC) analysis may aid in evaluating whether oxidative processes can be effectively used to degrade the petroleum hydrocarbons and other fuel-related constituents at the site. Consequently, these additional constituents will be analyzed for the first quarterly sampling event from wells MW-27d, MW-25d, MW-26s, MW-4, MW-19, and MW-15. The MNA parameter sampling schedule is presented in Table 7. Sampling and quality control procedures are documented in the SAP and QAPP.

5.1.2 ENHANCED PASSIVE BIOREMEDIATION

Enhance passive bioremediation (EPB) is a potential remedial option within and downgradient of residual petroleum source areas. EPB may be conducted independently or in conjunction with MNA. Depending on aquifer redox conditions and the evaluation of MNA parameters, either aerobic or anaerobic bioremediation may be applicable. If MNA and redox parameters indicate that naturally occurring oxidizing conditions exist, the application would likely consist of injecting a commercially available dissolved oxygen electron acceptor [e.g., oxygen releasing compound (ORC)]. If naturally occurring reducing conditions exist within petroleum contaminated areas, the application would likely consist of injecting an electron acceptor such as a sulfate or nitrate solution within the backfilled excavation to stimulate sulfate or nitrate reducing conditions and anaerobic biodegradation of residual petroleum within adjacent soils and underlying groundwater. Anaerobic biodegradation may be preferred over aerobic degradation where naturally reducing conditions prevail due to the ease in maintaining these conditions over a longer time period relative to trying to convert to and maintain aerobic conditions with a dissolved oxygen electron acceptor.

The feasibility of enhanced passive bioremediation is greatly impacted by the ability to inject electron acceptor solution into the aquifer. The pilot study will, therefore, include conducting an injection test using clean water to evaluate the feasibility of this remedial option. Injection test will be performed at three separate wells (MW-25d and MW-26s in the Area A source area and MW-15 in the Area G source area) to evaluate injection capacity in different locations. Injection of clean water will require an Underground Injection Control (UIC) Permit; therefore, this task will include preparation of necessary permit application materials to obtain approval from Ecology.

Clean water, likely from a municipal drinking water source, would be delivered to the site and injected into existing monitoring wells within the former excavation areas. The pilot test would focus on estimating the rate at which water can be injected into the impacted areas and the feasibility of using the backfilled excavation areas as pseudo infiltration galleries. The specific procedures for this pilot test are as follows:

Injection testing will utilize up to 1,500 gallons of potable water per well. Potable water delivered to the site or obtained from an onsite hose bib will be used to fill temporary tote tanks. The water will be dechlorinated by adding a pond dechlorinator product (sodium thiosulfite), per product directions, to each tote tank prior to injection. This injection test volume is needed to observe the steady-state injection rate and potential leaks in the well seal that could develop over time with higher injection volumes.

Water tanks and the injection pump will be staged near the pilot test injection well (i.e., MW-25d). Three 630-gallon tote tanks and a 3-inch, gasoline-powered, centrifugal pump used for injection will also be staged in this area. A 3-inch diameter injection hose will be extended from the tote tank and pump location to the well. Injection hose cam-lock connections will be wired closed and the hose run will be monitored for leaks constantly during active injection. The well seal and surrounding ground surface will be monitored for potential water discharge indicative of injection short circuiting to the surface.

Various measurements will be made and recorded during injection testing. The injection rate will be calculated from the water level drop in the tanks and elapsed time of injection. Injection pressure will be measured at the top of each injection well using a pressure gauge and the maximum applied pressure will be 40 pounds per square inch (psi).

It is anticipated that injection testing will be performed in three steps using increasing injection flow rates and pressures. Injection rates will be regulated, as needed, using the pump throttle and a valve located at the well head. Each injection step will be either 20 minutes of injection or 500-gallons of injection volume, whichever is reached first. The three anticipated injection steps are as follows:

1. Gravity feed: The initial step will consist of gravity feed without operation of the injection pump. Elapsed time and water level measurements will begin approximately one minute after the hose has filled with water between the tanks and the well, to avoid counting the volume of the hose, well casing, and filter pack in the flow rate estimation.
2. Pump operation – 20 psi: The pump will be operated to achieve a pressure of approximately 20 psi at the well head.
3. Pump operation – 30 to 40 psi: The pump will be operated to achieve a pressure of approximately 30 to 40 psi at the well head.

The data collected during the tests will be evaluated to determine whether adequate volumes of electron acceptor solution can be delivered into the subsurface to perform enhanced passive bioremediation, as described above.

5.1.3 FREE PRODUCT RECOVERY

MTCA requires conducting free product removal to the maximum extent practicable [WAC 173-340-450(4)]. Pilot testing during the RI will consist of operating a vacuum-enhanced free product recovery well for up to four weeks within the tank farm excavation area (Area A) to assess the practicability of free product recovery. The specific procedures for this pilot test are described in the following paragraphs.

The pilot test will be performed in MW-25d, which will be installed with 4-inch diameter casing to allow for this type of testing. The vacuum enhanced groundwater extraction system will consist of a submersible groundwater pump and a vacuum extraction system.

The groundwater extraction portion of the system will include a submersible pump installed in the well, with the pump motor and intake below the perched groundwater table. The pump will be equipped with an internal or external level switch or dry-run shutoff. Water and product will be pumped from the well to a temporary holding tank (i.e., baffled frac tank) for product separation and later disposal.

For the vacuum portion of the system, the well head will be plumbed and valved to allow attachment of a vacuum system. The vacuum system is intended to pull product toward the well, thus potentially increasing the amount of product available for extraction in the well. A temporary trailer- or skid-mounted vacuum system will be installed that consist of an extraction manifold with pressure gauge, regenerative blower, and discharge stack. This pilot study is expected to generate and discharge less than one pound of benzene to the atmosphere; therefore, air discharge treatment (e.g., activated carbon) is not required for this pilot study[7].

The test will be run for up to four weeks if the well yields sufficient sustained or intermittent flow. Drawdown in the recovery well and nearby monitoring wells (MW-7R, MW-19, MW-20, and MW-27d) will be monitored every 15 minutes for the first hour and hourly for the first 6 hours of system operation. The monitoring frequency will then be decreased throughout the remainder of the pilot test accordingly depending on the response of the groundwater table. If the recovery well is pumped dry and does not recover within a reasonable timeframe (e.g., 24 hours), the pilot test will be terminated. Extremely slow or limited groundwater recovery also yields useful information about the ability to recover groundwater and product at the site.

The total volume of water and product extracted, the estimated extraction rate, and groundwater table drawdown will be measured or calculated as part of this pilot test and the results evaluated for feasibility of implementing of a full scale product recovery system.

5.2 EVALUATION OF REMEDIAL ALTERNATIVES

The pilot tests described above will be the first step in the evaluation of potential remedial options for site cleanup. The results of these tests along with evaluation of other data collected during the RI will be used to identify and screen potentially applicable and viable remedial alternatives for further evaluation. This evaluation, and selection of a preferred remedial alternative, will be performed and

[7] Per Puget Sound Clean Air Agency, Regulation I, Section 6.03: (c) **Exemptions**. A Notice of Construction application and Order of Approval are not required for the following new sources, provided that sufficient records are kept to document the exemption: (94) Soil and groundwater remediation systems involving <15 pounds per year of benzene or vinyl chloride, <500 pounds per year of perchloroethylene, and <1,000 pounds per year of toxic air contaminants.

documented through a feasibility study and associated disproportionate cost analysis as described under WAC 173-340-350 and WAC 173-340-360.

6.0 SCHEDULE

A preliminary RI work plan schedule is presented on Figure 24. This schedule assumes approval of the work plan scope by March 14, 2011.

7.0 USE OF THIS REPORT

This work plan has been prepared for the exclusive use of Ecology for specific application to the Pederson's Fryer Farms remedial investigation and feasibility study. No other party is entitled to rely on the information, conclusions, and recommendations included in this document without the express written consent of Landau Associates. Further, the reuse of information, conclusions, and recommendations provided herein for extensions of the project or for any other project, without review and authorization by Landau Associates, shall be at the user's sole risk. Landau Associates warrants that within the limitations of scope, schedule, and budget, our services have been provided in a manner consistent with that level of care and skill ordinarily exercised by members of the profession currently practicing in the same locality under similar conditions as this project. We make no other warranty, either express or implied.

This document has been prepared under the supervision and direction of the following key staff. Environmental

LANDAU ASSOCIATES, INC.

Eric F. Weber, L.G.
Principal

Jennifer Wynkoop
Senior Environmental Scientist

EFW/JWW/jas

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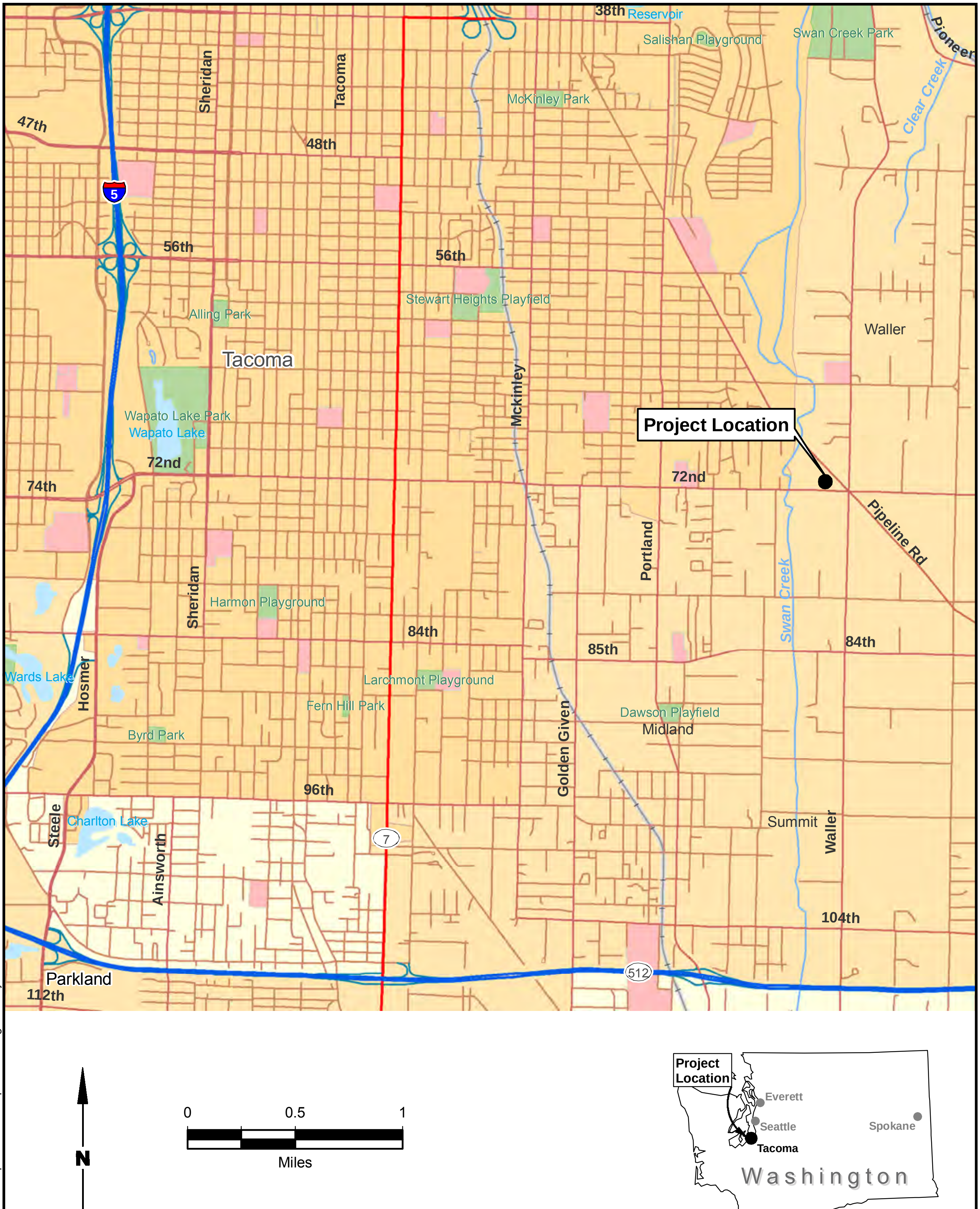

Data Source: ESRI 2008

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Pederson's Fryer Farms Pierce County, Washington	**Vicinity Map**	Figure 1

Y:\Projects\136006\MapDocs\RI Workplan\Final\Fig2-Property.mxd 3/25/2011 NAD 1983 StatePlane Washington South FIPS 4602 Feet

Legend

① Property Numbering ID

- - - - Tax Parcel

Data Source: Pierce County GIS; I3 Imagery

Note

1. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

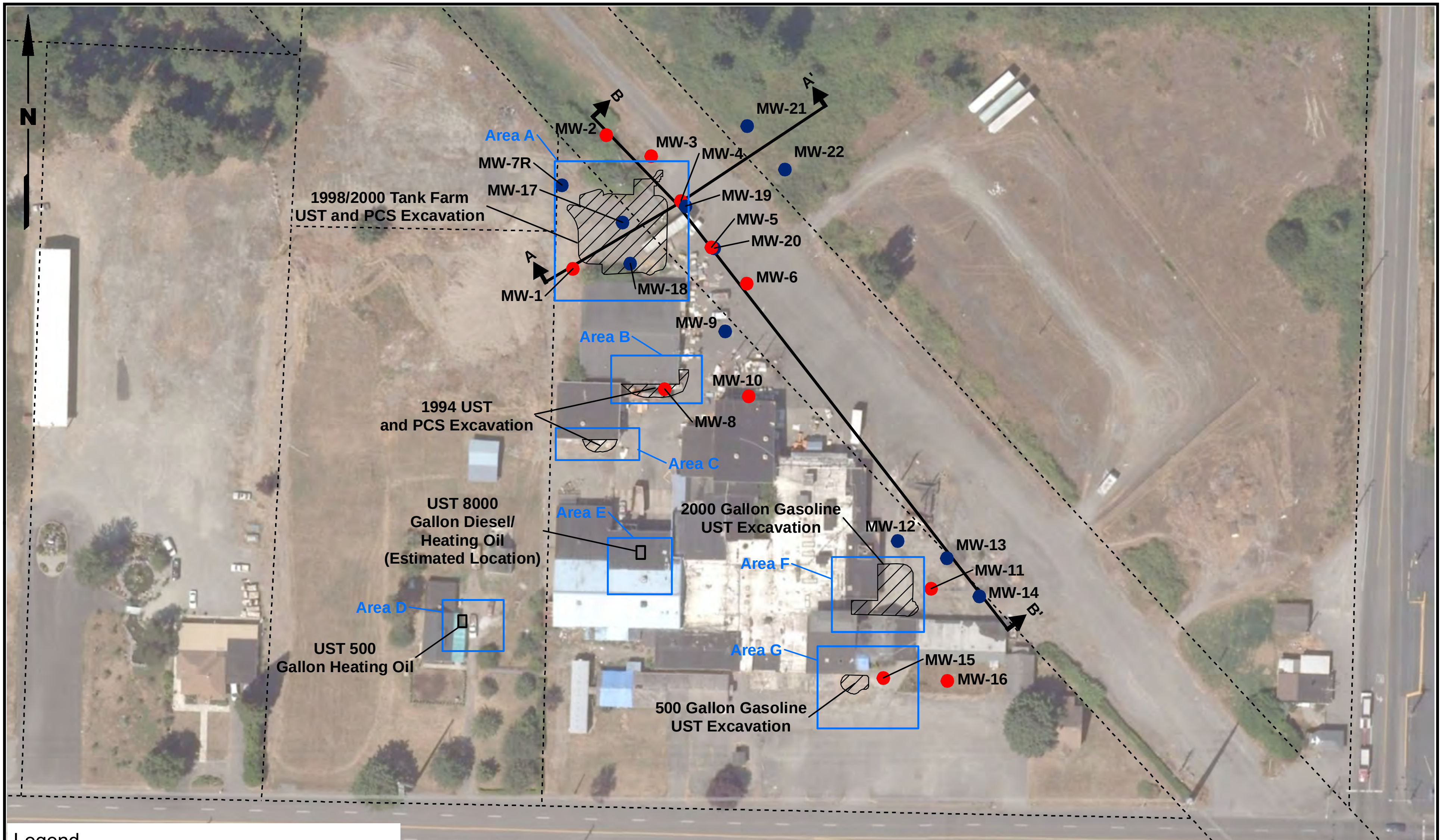
Landau Associates

0 150 300

Scale in Feet

Pederson's Fryer Farms Pierce County, Washington	**Property Boundaries and Ownership**	Figure 2

Y:\Projects\136006\MapDocs\RI Workplan\Final\Fig3-Site Features.mxd 3/25/2011 NAD 1983 StatePlane Washington South FIPS 4602 Feet



Legend

- Deep Wells
- Shallow Wells
- Tax Parcel
- A A' Cross Section Location
- Area of Concern
- Former Excavation Area

0 120 240

Scale in Feet

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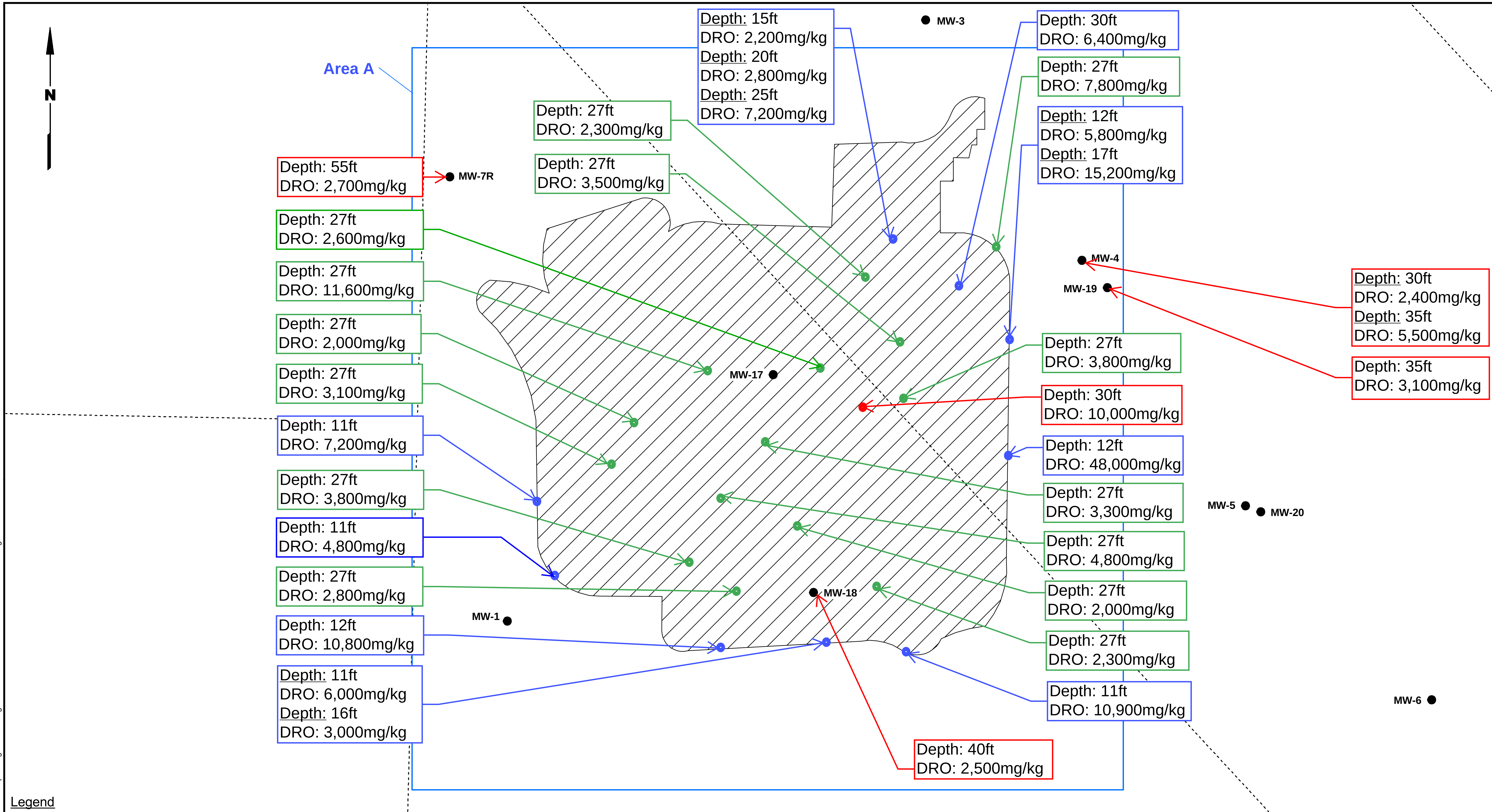
Data Source: Pierce County GIS; Bing Maps Aerial

Notes

1. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.
2. Area E was GPR surveyed on 3/22/11 and the UST was not located. It may be further north as shown.

Pederson's Fryer Farms Pierce County, Washington	**Site Features**	Figure 3



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Legend

- Monitoring Well
- Tax Parcel
- Area of Concern
- Former Excavation Area

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Note

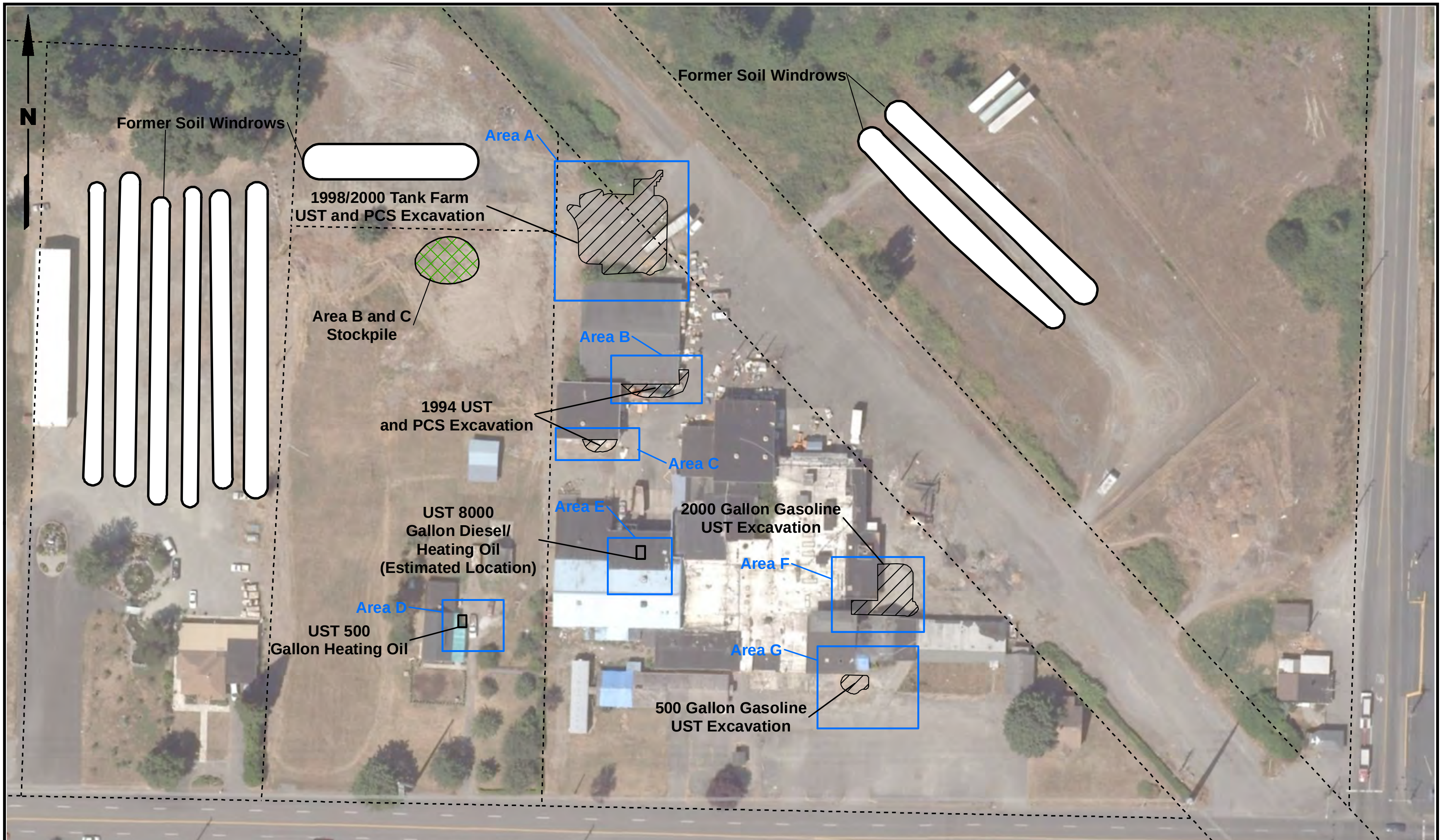
1. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.
2. All northern tank farm excavation and adjacent monitoring well installation soil samples with concentrations ≥ 2000mg/kg are shown. To see all samples results, see EPIs reports "Interim Remedial Action and Site Investigation Report – Volume I" (Figure 8) and "Additional Subsurface Investigation Report" (Figure 7).
3. DRO - Diesel Range Organics
4. Monitoring well soil samples are from June/July 2004. All other samples were taken during excavation in August-October 2000.

0 15 30
Scale in Feet

Data Source: Pierce County GIS

Pederson's Fryer Farms Pierce County, Washington	**Soil Confirmation Soil Samples: Area A**	Figure 4

Y:\Projects\136006\MapDocs\RI Workplan\Final\Fig5-Bioremediation Windrow Locations.mxd 3/25/2011 NAD 1983 StatePlane Washington South FIPS 4602 Feet



Legend

- - - - Tax Parcel
Former Excavation Area
Area of Concern

0 120 240
Scale in Feet

Data Source: Pierce County GIS;
Bing Maps Aerial

Note
1. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.
2. Soil windrows contained soil from Areas A, F, and G.

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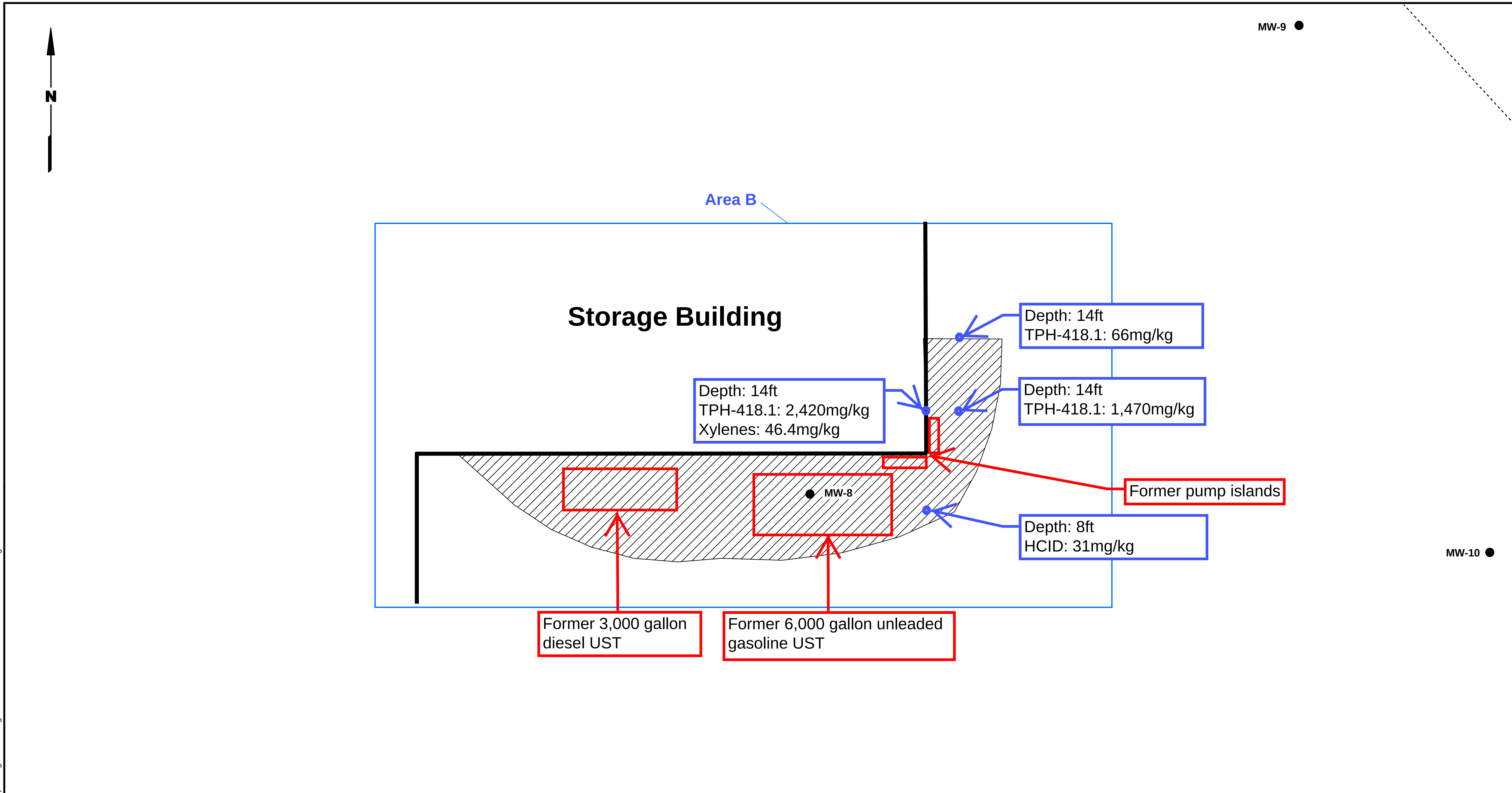
Pederson's Fryer Farms
Pierce County, Washington

Former Bioremediation Windrow Locations

Figure 5



Legend

- ● Monitoring Well
- ------ Tax Parcel
- Area of Concern
- Former Excavation Area

Note
1. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.
2. All historical data concentrations that exceed current applicable MTCA Method A Soil CULs are shown and have units mg/kg. To see all sample locations and concentrations see EPI's IRA Report Volume II Appendix A and Volume III Appendix Q.
3. Method TPH-418.1 was used to identify total recoverable petroleum hydrocarbons (could include diesel, oil, and/or gasoline).
4. Method HCID used to identify the type of TPH present in sample.
5. DRO-diesel range organics; ORO-oil range organics.
6. Monitoring well soil samples are from April 2001. All other samples were taken during excavation in 1994.

0 10 20
Scale in Feet

Data Source: Pierce County GIS

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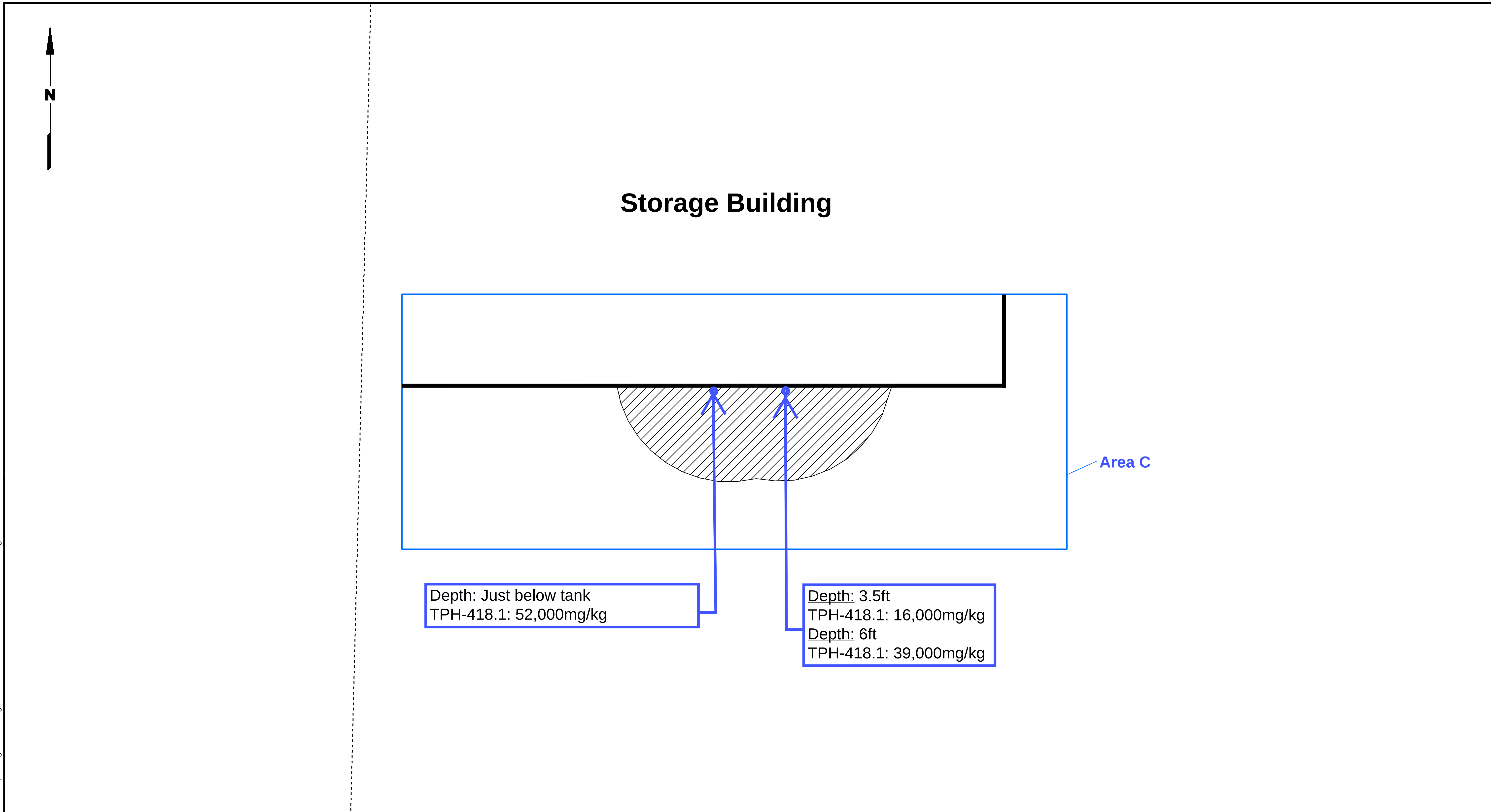
Pederson's Fryer Farms Pierce County, Washington	**Soil Confirmation** **Soil Samples: Area B**	Figure 6

Y:\Projects\136006\MapDocs\RI Workplan\Fig6-AreaBLarge.mxd 3/4/2011 NAD 1983 StatePlane Washington South FIPS 4602 Feet



Legend

- Tax Parcel
- Area of Concern
- Former Excavation Area

Note

1. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.
2. All historical detected data concentrations that exceed current applicable MTCA Method A Soil CULs are shown and have units mg/kg. To see all sample locations and concentrations see EPI's IRA Report Volume II Appendix A.
3. Method TPH-418.1 was used to identify total recoverable petroleum hydrocarbons (could include diesel, oil, and/or gasoline).
4. All samples were taken during excavation in 1994.

0 10 20

Scale in Feet

Data Source: Pierce County GIS

LANDAU ASSOCIATES

Pederson's Fryer Farms Pierce County, Washington	**Soil Confirmation** **Soil Samples: Area C**	Figure 7

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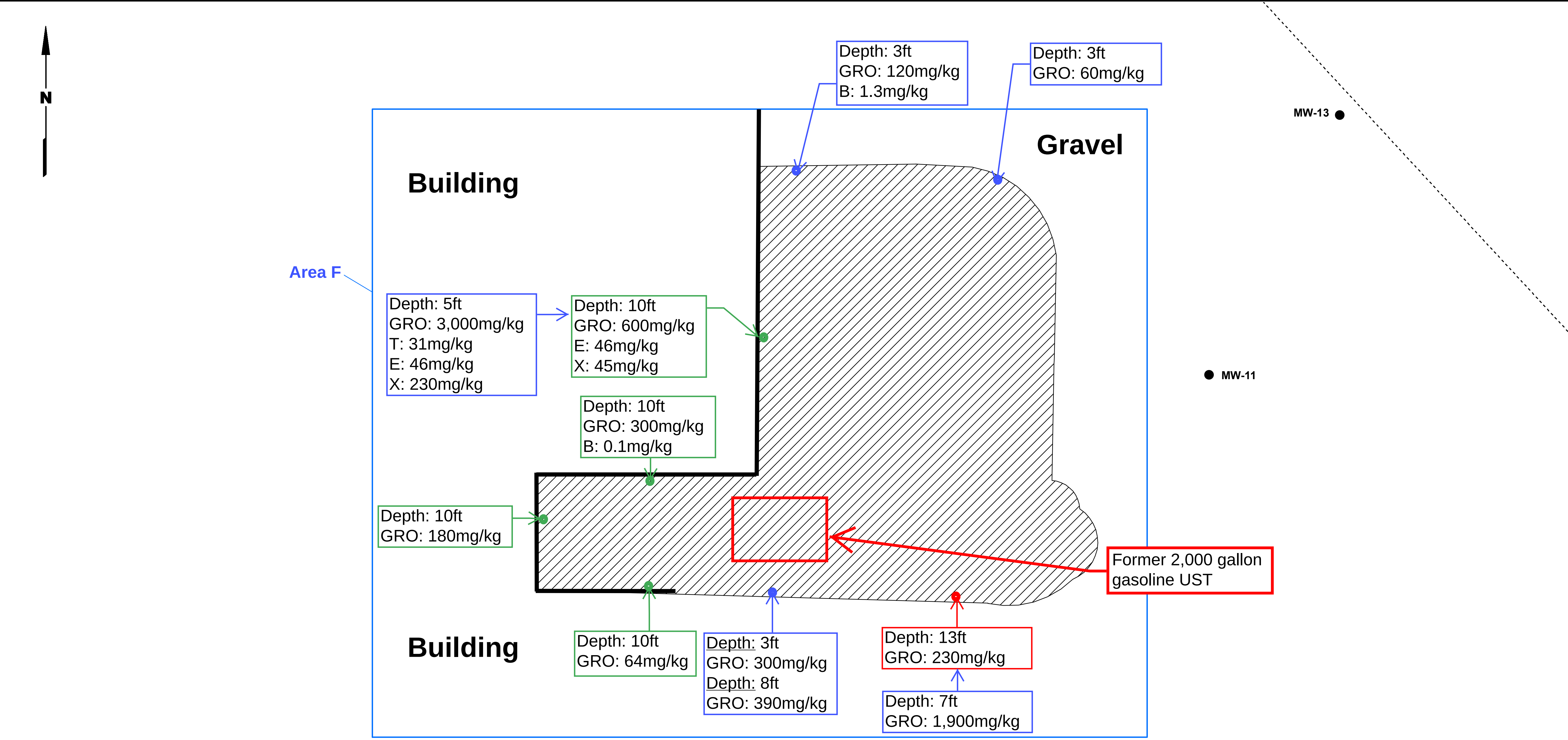


Legend

- Monitoring Well
- Tax Parcel
- Area of Concern
- Former Excavation Area

LANDAU ASSOCIATES

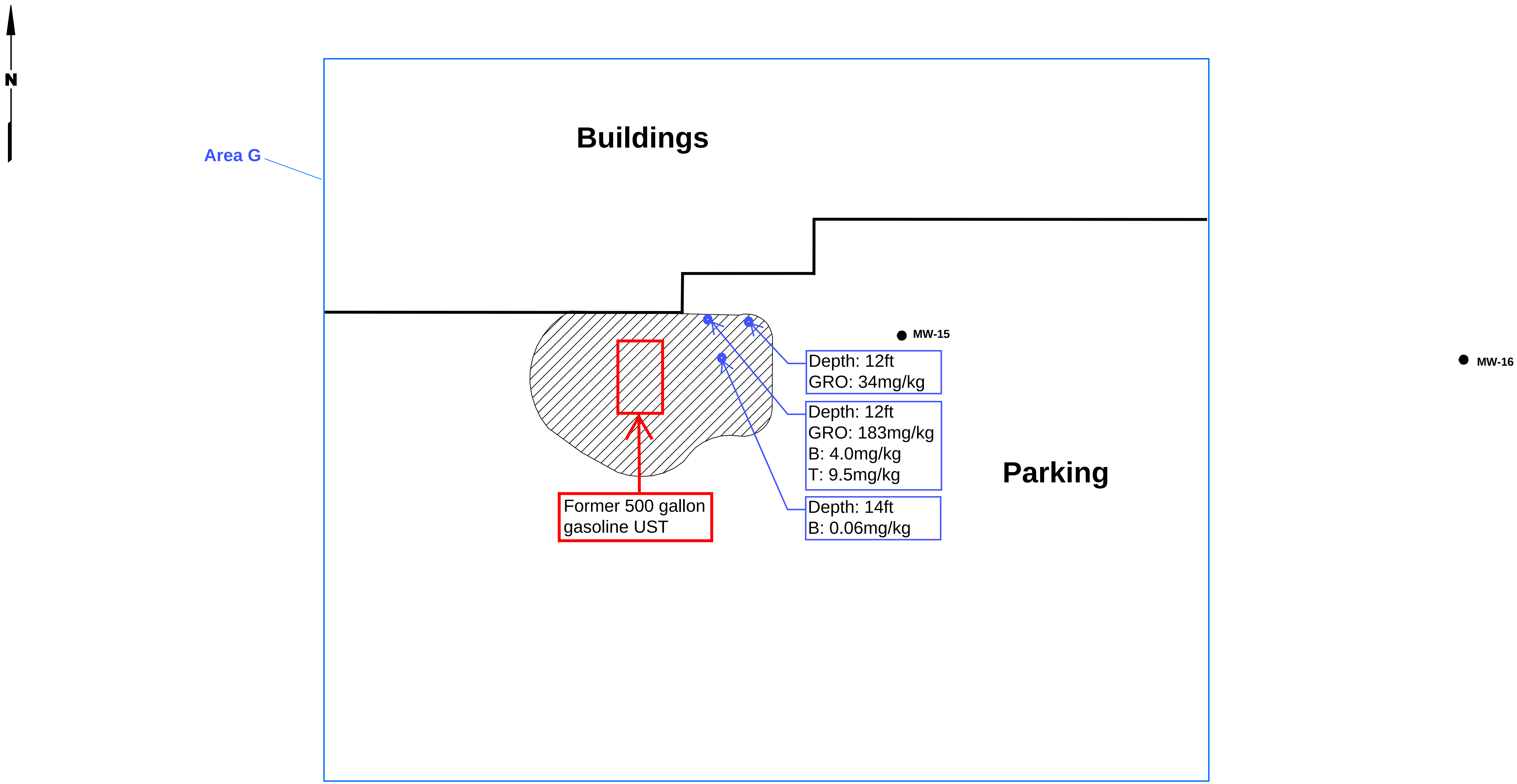
Note

1. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.
2. GRO - Gasoline Range Organics, B - Benzene, T - Toluene, E - Ethylbenzene, X - Total Xylene
2. All 2,000 gallon gasoline UST excavation and adjacent monitoring well installation soil samples with GRO and BTEX concentrations at or exceeding current MTCA Method A Soil CULs for Unrestricted Land Uses are shown; CULs are 30mg/kg for GRO and 0.03, 7.0, 6.0, and 9.0mg/kg for BTEX, respectively. To see all sample locations and concentrations, see EPI's IRA Report Volume I Figure 6 and Volume II Appendix E.
4. Monitoring well soil samples are from May 2001. All other samples were taken during excavation in August-October 2000.

0 10 20
Scale in Feet

Data Source: Pierce County GIS

Pederson's Fryer Farms Pierce County, Washington	**Soil Confirmation** **Soil Samples: Area F**	Figure 8



Legend

- ● Monitoring Well
- ----- Tax Parcel
- Area of Concern
- Former Excavation Area

Note

1. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.
2. GRO - Gasoline Range Organics, B - Benzene, T - Toluene, E - Ethylbenzene, X - Total Xylene
3. All 500 gallon gasoline UST excavation and adjacent monitoring well installation soil samples with GRO and BTEX concentrations at or exceeding current MTCA Method A Soil CULs for Unrestricted Land Uses are shown; 30mg/kg for GRO and 0.03, 7.0, 6.0, and 9.0mg/kg for BTEX, respectively. To see all sample locations and concentrations, see EPI's IRA Report Volume I Figure 6 and Volume II Appendix E.
4. Monitoring well soil samples are from May 2001. All other samples were taken during excavation in August-October 2000.

Data Source: Pierce County GIS

0 10 20

Scale in Feet

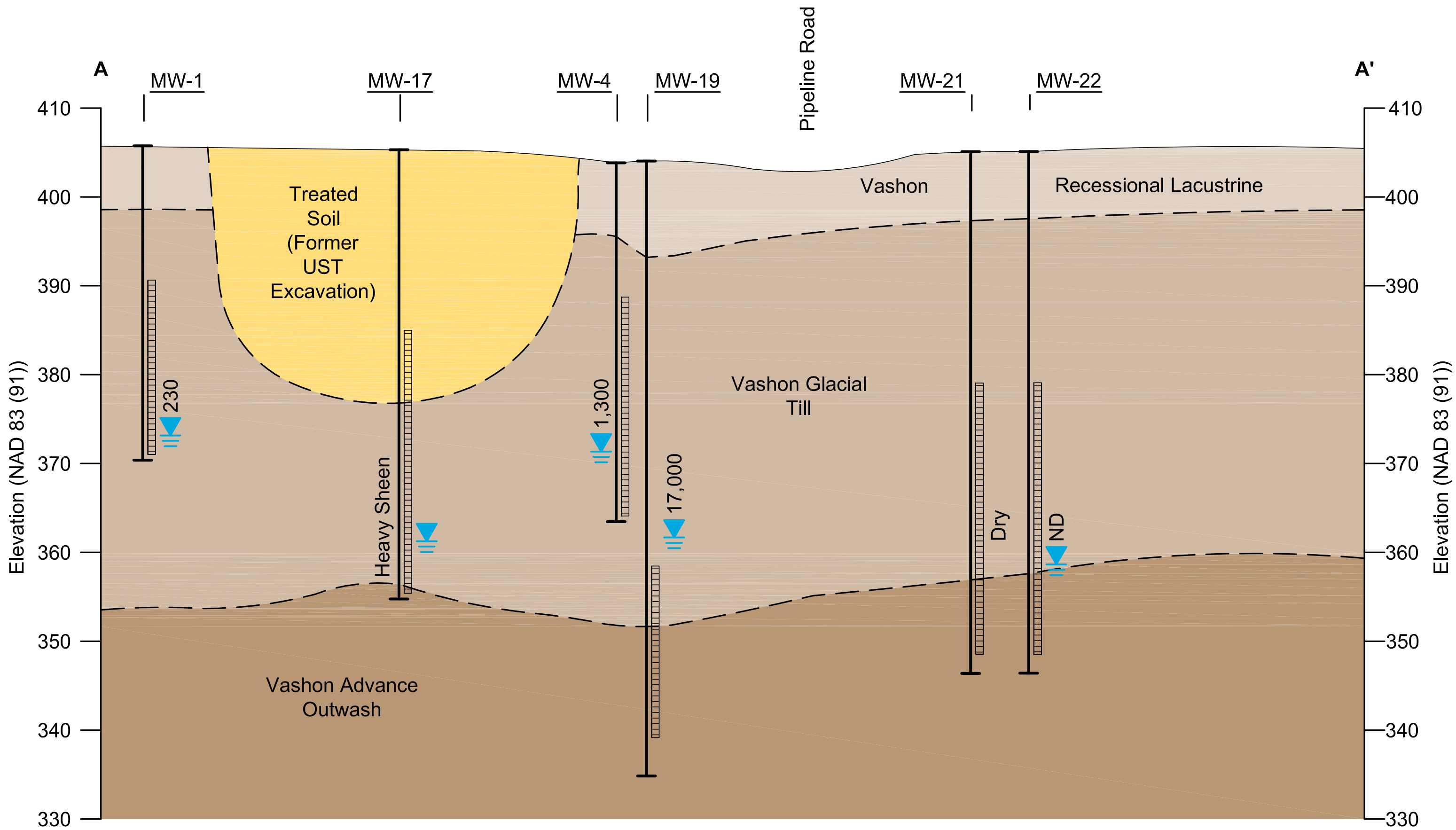
Landau Associates

Pederson's Fryer Farms
Pierce County, Washington

Soil Confirmation
Soil Samples: Area G

Figure 9

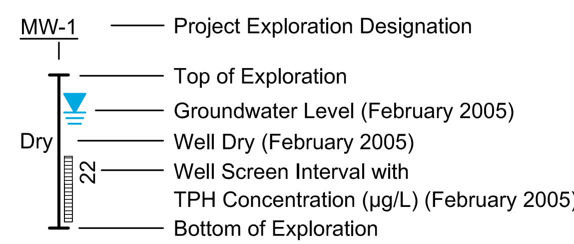
Y:\Projects\136006\MapDocs\RI Workplan\Fig9-AreaGLarge.mxd 3/4/2011 NAD 1983 StatePlane Washington South FIPS 4602 Feet



Note

1. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

Legend



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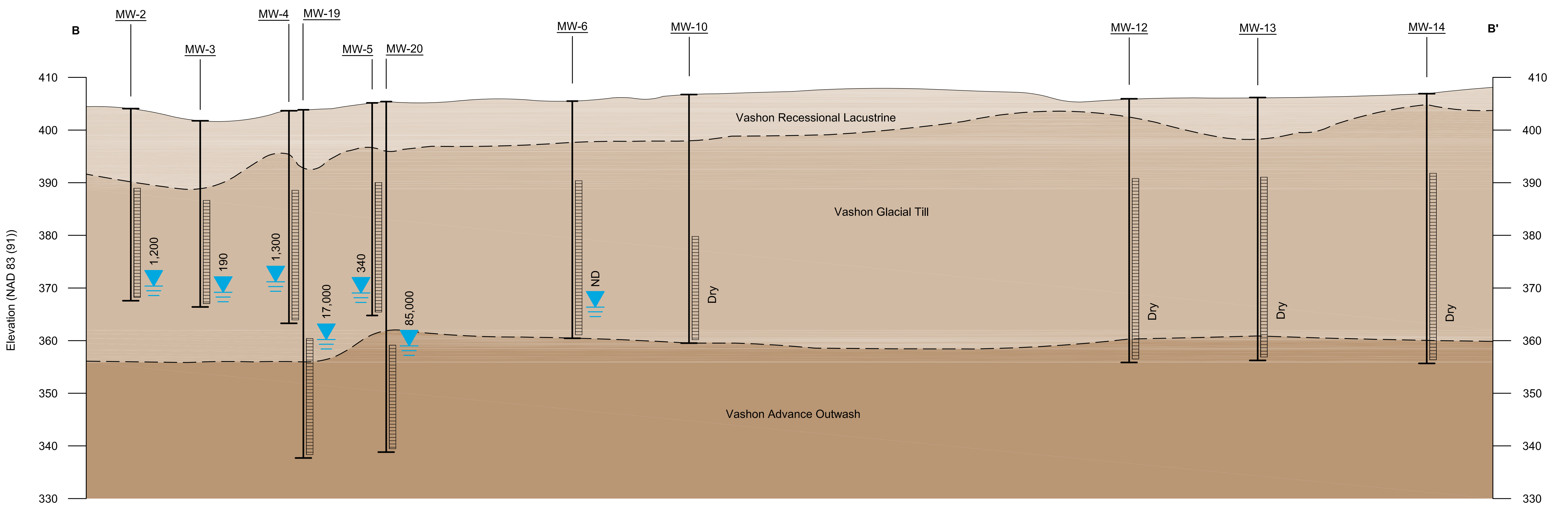
0 40 80

Horizontal Scale 1" = 40'
Vertical Scale 1" = 20'

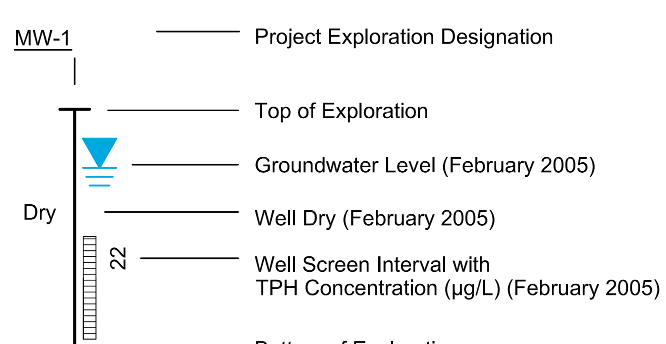
Pederson's Fryer Farms
Pierce County, Washington

Geologic Cross Section A-A'

Figure 10

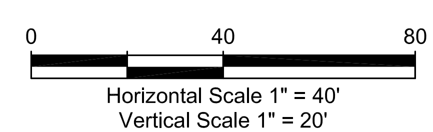


Legend



Note

1. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.



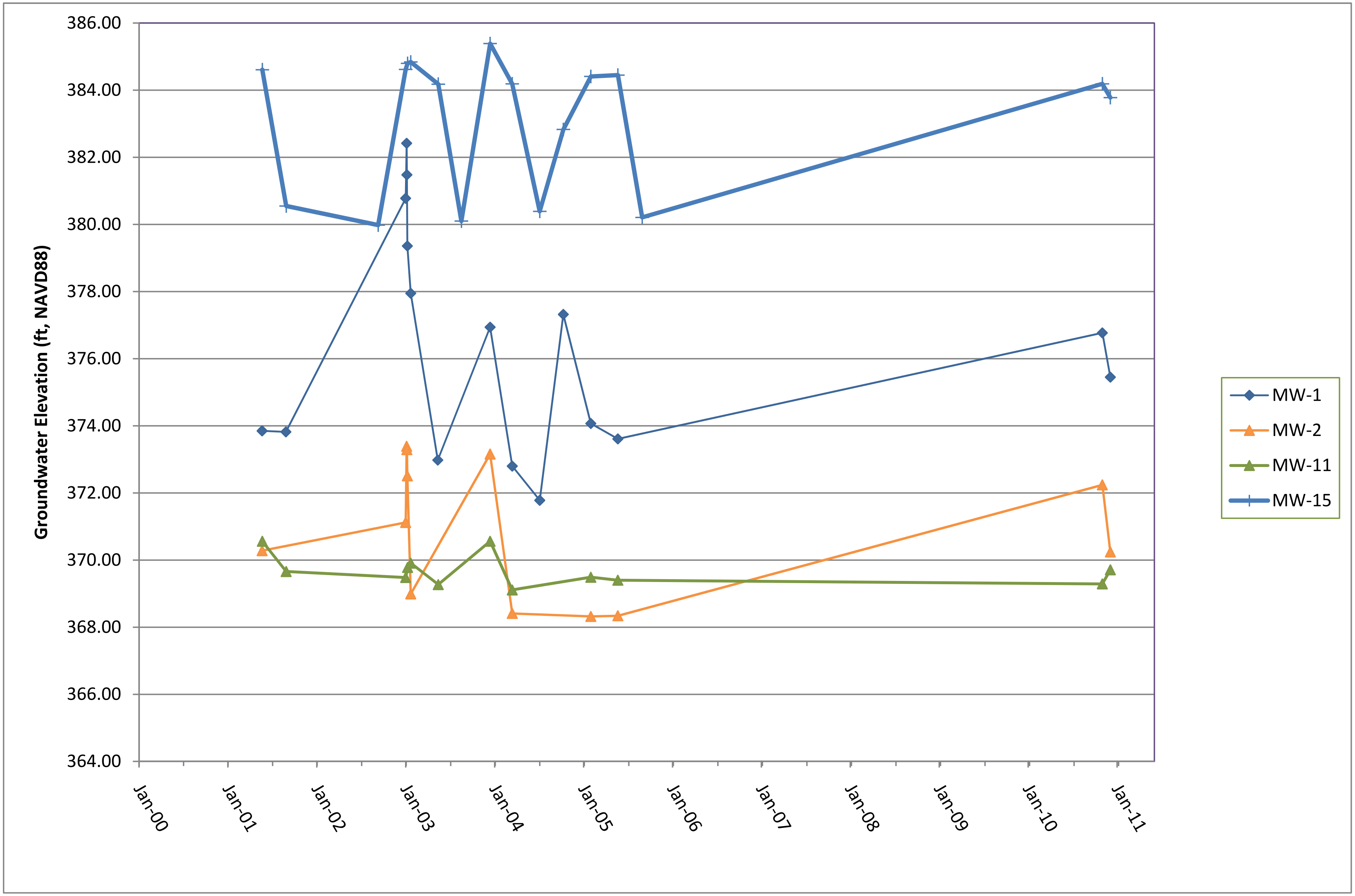
Pederson's Fryer Farms Pierce County, Washington

Geologic Cross Section B-B'

Figure 11

Landau Associates

Pederson's Fryer Farms | \\tacoma1\data\DATA\PROJECT\136\006\R\RI Work Plan\Figures\Old\Figs for KMH_2-17-11\Sections.dwg (A) "Figure 11" 3/24/2011



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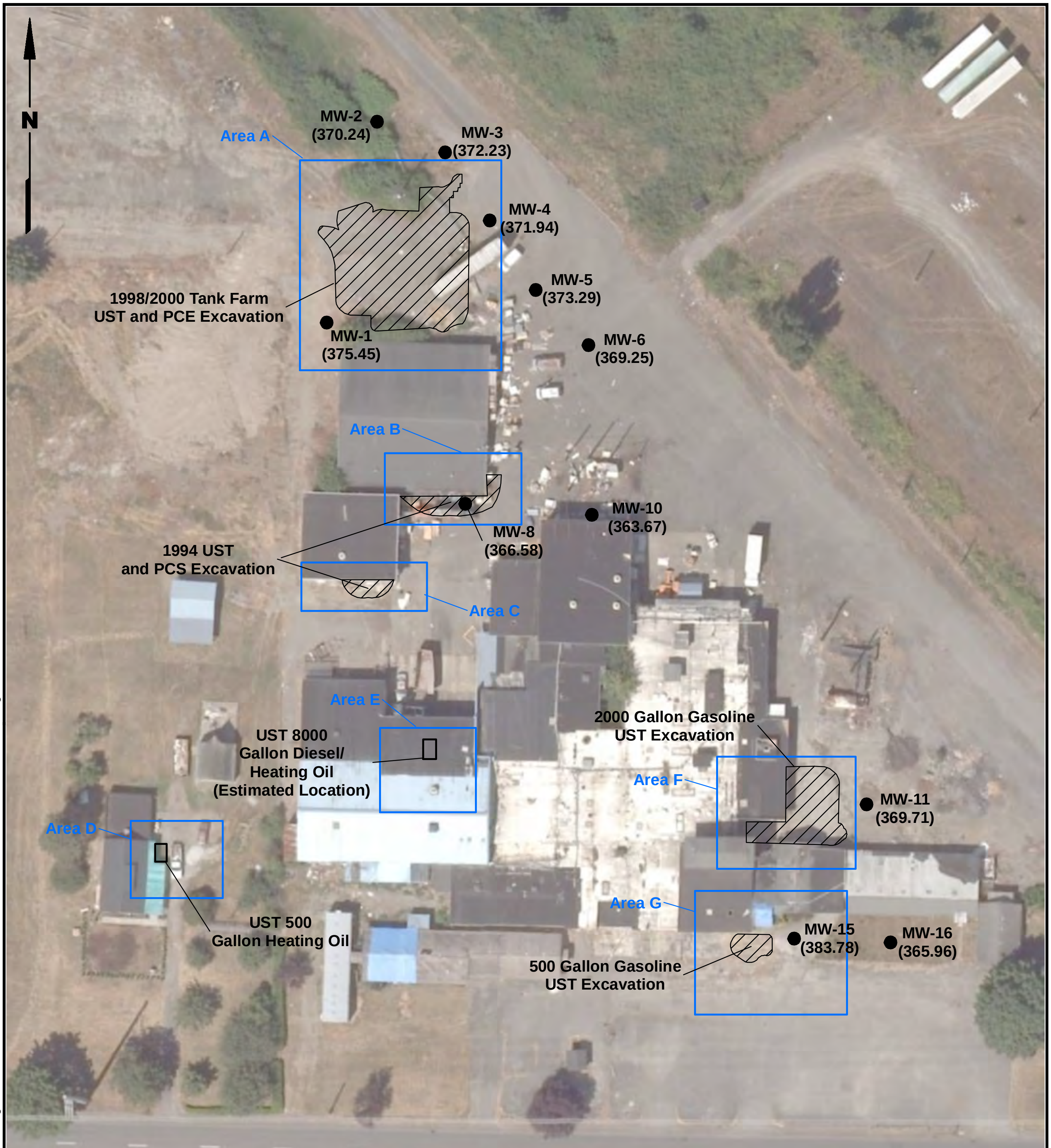
Pederson's Fryer Farms
Pierce County, Washington

Shallow Zone Groundwater Elevations Hydrographs

Figure
12



Legend

● Monitoring Well

(366.58) Groundwater Elevation (ft, NAVD88)

Area of Concern

Former Excavation Area

Note

1. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

0 80 160

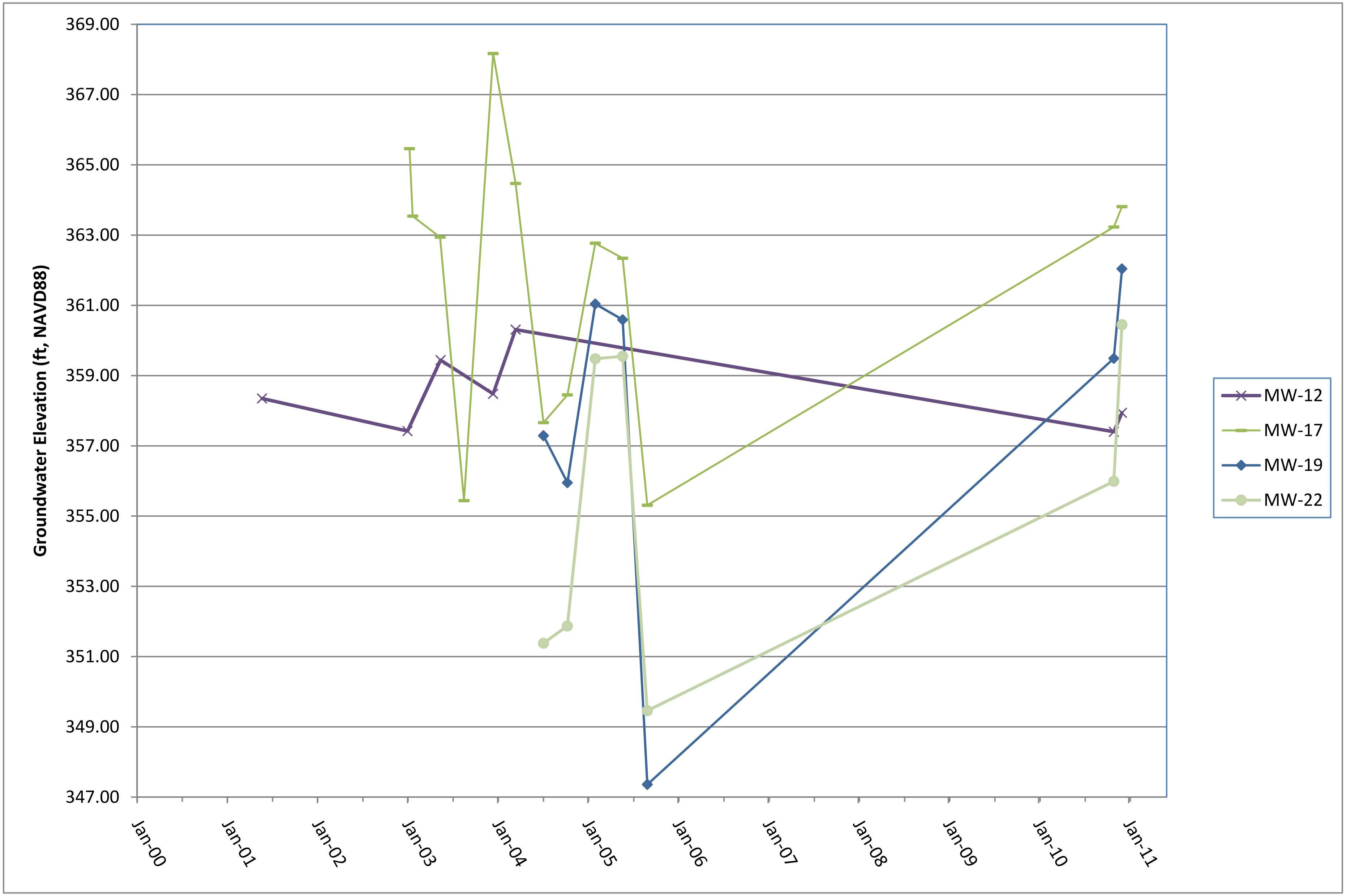
Scale in Feet

Data Source: Pierce County GIS; Bing Maps Aerial

Y:\Projects\136006\MapDocs\RI Workplan\Final\Fig13-Groundwater-ShallowWells.mxd 3/25/2011 NAD 1983 StatePlane Washington South FIPS 4602 Feet

Landau Associates

Pederson's Fryer Farms Pierce County, Washington	**Groundwater Elevations - Shallow Wells December 2010**	Figure 13



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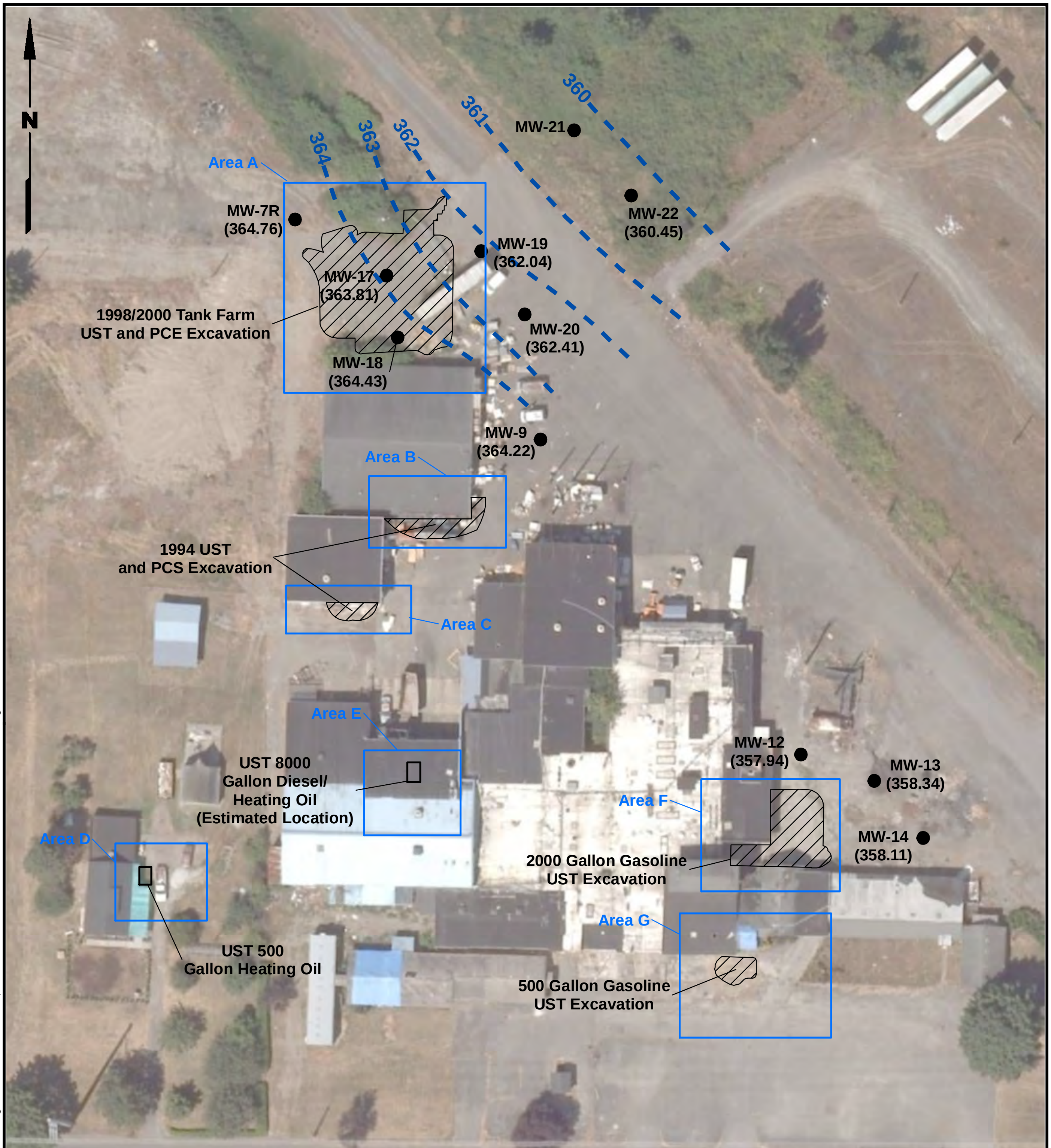
Pederson's Fryer Farms
Pierce County, Washington

Deep Zone Groundwater Elevations Hydrographs

Figure
14



Legend

- ● Monitoring Well
- Area of Concern
- Former Excavation Area
- (364.22) Groundwater Elevation (ft, NAVD88)
- 361 – – Groundwater Elevation Contour

Note
1. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

0 80 160

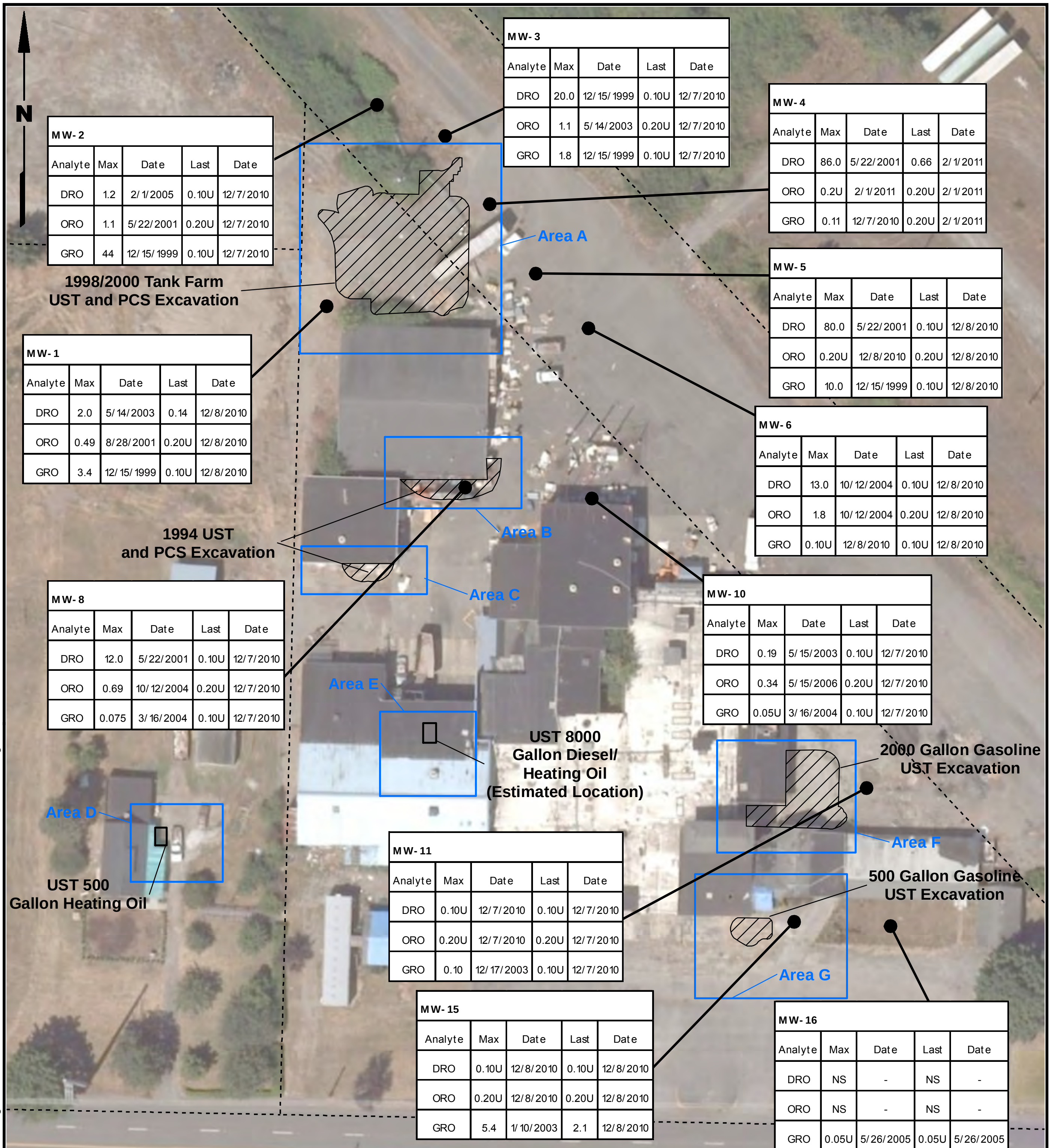
Scale in Feet

Data Source: Pierce County GIS; Bing Maps Aerial

Y:\Projects\136006\MapDocs\RI Workplan\Final\Fig15-Groundwater-DeepWells.mxd 3/25/2011 NAD 1983 StatePlane Washington South FIPS 4602 Feet

LANDAU ASSOCIATES

Pederson's Fryer Farms Pierce County, Washington	**Groundwater Elevations - Deep Wells December 2010**	Figure 15



MW-3

Analyte	Max	Date	Last	Date
DRO	20.0	12/15/1999	0.10U	12/7/2010
ORO	1.1	5/14/2003	0.20U	12/7/2010
GRO	1.8	12/15/1999	0.10U	12/7/2010

MW-4

Analyte	Max	Date	Last	Date
DRO	86.0	5/22/2001	0.66	2/1/2011
ORO	0.2U	2/1/2011	0.20U	2/1/2011
GRO	0.11	12/7/2010	0.20U	2/1/2011

MW-2

Analyte	Max	Date	Last	Date
DRO	1.2	2/1/2005	0.10U	12/7/2010
ORO	1.1	5/22/2001	0.20U	12/7/2010
GRO	44	12/15/1999	0.10U	12/7/2010

MW-5

Analyte	Max	Date	Last	Date
DRO	80.0	5/22/2001	0.10U	12/8/2010
ORO	0.20U	12/8/2010	0.20U	12/8/2010
GRO	10.0	12/15/1999	0.10U	12/8/2010

MW-1

Analyte	Max	Date	Last	Date
DRO	2.0	5/14/2003	0.14	12/8/2010
ORO	0.49	8/28/2001	0.20U	12/8/2010
GRO	3.4	12/15/1999	0.10U	12/8/2010

MW-6

Analyte	Max	Date	Last	Date
DRO	13.0	10/12/2004	0.10U	12/8/2010
ORO	1.8	10/12/2004	0.20U	12/8/2010
GRO	0.10U	12/8/2010	0.10U	12/8/2010

MW-8

Analyte	Max	Date	Last	Date
DRO	12.0	5/22/2001	0.10U	12/7/2010
ORO	0.69	10/12/2004	0.20U	12/7/2010
GRO	0.075	3/16/2004	0.10U	12/7/2010

MW-10

Analyte	Max	Date	Last	Date
DRO	0.19	5/15/2003	0.10U	12/7/2010
ORO	0.34	5/15/2006	0.20U	12/7/2010
GRO	0.05U	3/16/2004	0.10U	12/7/2010

MW-11

Analyte	Max	Date	Last	Date
DRO	0.10U	12/7/2010	0.10U	12/7/2010
ORO	0.20U	12/7/2010	0.20U	12/7/2010
GRO	0.10	12/17/2003	0.10U	12/7/2010

MW-15

Analyte	Max	Date	Last	Date
DRO	0.10U	12/8/2010	0.10U	12/8/2010
ORO	0.20U	12/8/2010	0.20U	12/8/2010
GRO	5.4	1/10/2003	2.1	12/8/2010

MW-16

Analyte	Max	Date	Last	Date
DRO	NS	-	NS	-
ORO	NS	-	NS	-
GRO	0.05U	5/26/2005	0.05U	5/26/2005

Notes
1. All results reported in mg/L.
2. DRO - Diesel Range Organics
ORO - Oil Range Organics
GRO - Gasoline Range Organics
NS - Not Sampled
3. ORO product has been identified as "Lube Oil Range" in associated lab reports.
4. U indicates non-detect.
5. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

Legend
- Monitoring Well
- Tax Parcel
- Area of Concern
- Former Excavation Area

0 80 160
Scale in Feet

Data Source: Pierce County GIS; Bing Maps Aerial

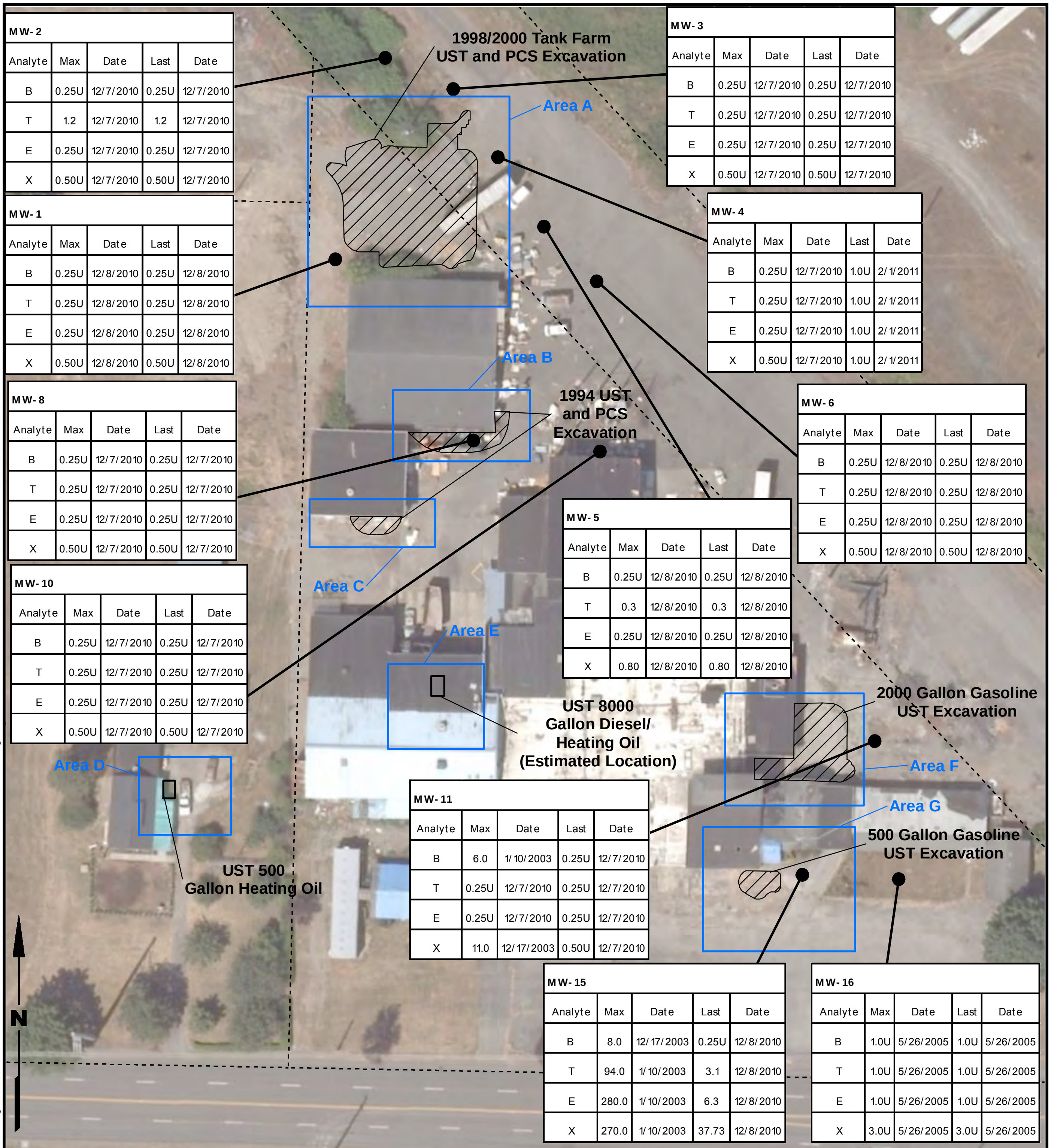
Y:\Projects\136006\MapDocs\RI Workplan\Final\Fig16-ShallowZoneTPH.mxd 3/25/2011 NAD 1983 StatePlane Washington South FIPS 4602 Feet

LANDAU ASSOCIATES

Pederson's Fryer Farms
Pierce County, Washington

Shallow Zone TPH Concentrations: Maximum and Most Recent

Figure 16



MW-2

Analyte	Max	Date	Last	Date
B	0.25U	12/7/2010	0.25U	12/7/2010
T	1.2	12/7/2010	1.2	12/7/2010
E	0.25U	12/7/2010	0.25U	12/7/2010
X	0.50U	12/7/2010	0.50U	12/7/2010

MW-3

Analyte	Max	Date	Last	Date
B	0.25U	12/7/2010	0.25U	12/7/2010
T	0.25U	12/7/2010	0.25U	12/7/2010
E	0.25U	12/7/2010	0.25U	12/7/2010
X	0.50U	12/7/2010	0.50U	12/7/2010

MW-1

Analyte	Max	Date	Last	Date
B	0.25U	12/8/2010	0.25U	12/8/2010
T	0.25U	12/8/2010	0.25U	12/8/2010
E	0.25U	12/8/2010	0.25U	12/8/2010
X	0.50U	12/8/2010	0.50U	12/8/2010

MW-4

Analyte	Max	Date	Last	Date
B	0.25U	12/7/2010	1.0U	2/1/2011
T	0.25U	12/7/2010	1.0U	2/1/2011
E	0.25U	12/7/2010	1.0U	2/1/2011
X	0.50U	12/7/2010	1.0U	2/1/2011

MW-8

Analyte	Max	Date	Last	Date
B	0.25U	12/7/2010	0.25U	12/7/2010
T	0.25U	12/7/2010	0.25U	12/7/2010
E	0.25U	12/7/2010	0.25U	12/7/2010
X	0.50U	12/7/2010	0.50U	12/7/2010

MW-6

Analyte	Max	Date	Last	Date
B	0.25U	12/8/2010	0.25U	12/8/2010
T	0.25U	12/8/2010	0.25U	12/8/2010
E	0.25U	12/8/2010	0.25U	12/8/2010
X	0.50U	12/8/2010	0.50U	12/8/2010

MW-10

Analyte	Max	Date	Last	Date
B	0.25U	12/7/2010	0.25U	12/7/2010
T	0.25U	12/7/2010	0.25U	12/7/2010
E	0.25U	12/7/2010	0.25U	12/7/2010
X	0.50U	12/7/2010	0.50U	12/7/2010

MW-5

Analyte	Max	Date	Last	Date
B	0.25U	12/8/2010	0.25U	12/8/2010
T	0.3	12/8/2010	0.3	12/8/2010
E	0.25U	12/8/2010	0.25U	12/8/2010
X	0.80	12/8/2010	0.80	12/8/2010

MW-11

Analyte	Max	Date	Last	Date
B	6.0	1/10/2003	0.25U	12/7/2010
T	0.25U	12/7/2010	0.25U	12/7/2010
E	0.25U	12/7/2010	0.25U	12/7/2010
X	11.0	12/17/2003	0.50U	12/7/2010

MW-15

Analyte	Max	Date	Last	Date
B	8.0	12/17/2003	0.25U	12/8/2010
T	94.0	1/10/2003	3.1	12/8/2010
E	280.0	1/10/2003	6.3	12/8/2010
X	270.0	1/10/2003	37.73	12/8/2010

MW-16

Analyte	Max	Date	Last	Date
B	1.0U	5/26/2005	1.0U	5/26/2005
T	1.0U	5/26/2005	1.0U	5/26/2005
E	1.0U	5/26/2005	1.0U	5/26/2005
X	3.0U	5/26/2005	3.0U	5/26/2005

Notes

1. All results reported in μg/L.
2. B - Benzene, T - Toluene, E - Ethylbenzene, X - Total Xylene
3. U indicates non-detect.
4. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

Legend

- ● Monitoring Well
- ----- Tax Parcel
- Area of Concern
- Former Excavation Area

0 80 160

Scale in Feet

Data Source: Pierce County GIS; Bing Maps Aerial

Y:\Projects\136006\MapDocs\RI Workplan\Final\Fig17-ShallowZoneBTEX.mxd 3/25/2011 NAD 1983 StatePlane Washington South FIPS 4602 Feet

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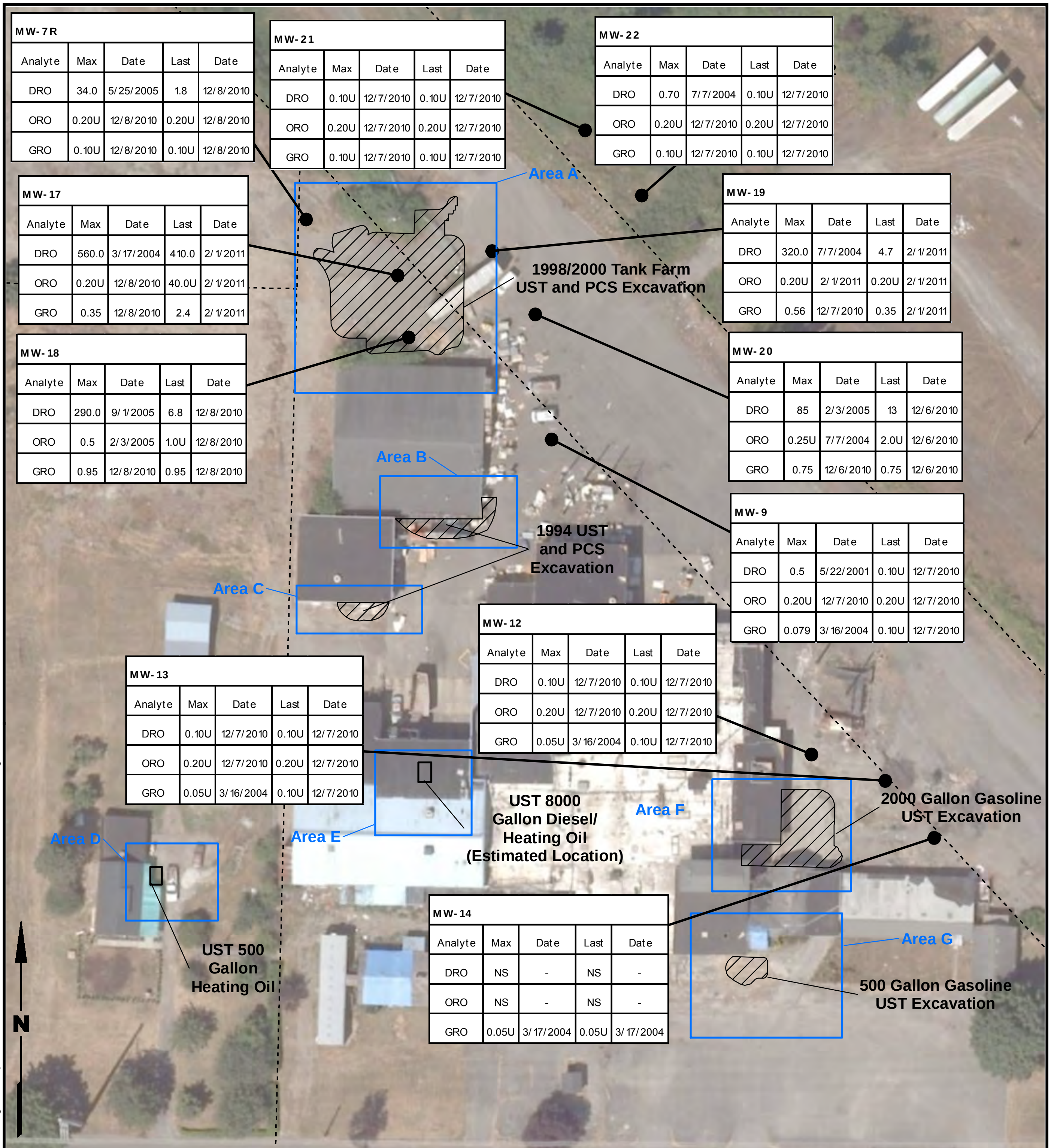
Pederson's Fryer Farms
Pierce County, Washington

Shallow Zone BTEX Concentrations: Maximum and Most Recent

Figure 17



MW-7R

Analyte	Max	Date	Last	Date
DRO	34.0	5/25/2005	1.8	12/8/2010
ORO	0.20U	12/8/2010	0.20U	12/8/2010
GRO	0.10U	12/8/2010	0.10U	12/8/2010

MW-21

Analyte	Max	Date	Last	Date
DRO	0.10U	12/7/2010	0.10U	12/7/2010
ORO	0.20U	12/7/2010	0.20U	12/7/2010
GRO	0.10U	12/7/2010	0.10U	12/7/2010

MW-22

Analyte	Max	Date	Last	Date
DRO	0.70	7/7/2004	0.10U	12/7/2010
ORO	0.20U	12/7/2010	0.20U	12/7/2010
GRO	0.10U	12/7/2010	0.10U	12/7/2010

MW-17

Analyte	Max	Date	Last	Date
DRO	560.0	3/17/2004	410.0	2/1/2011
ORO	0.20U	12/8/2010	40.0U	2/1/2011
GRO	0.35	12/8/2010	2.4	2/1/2011

MW-19

Analyte	Max	Date	Last	Date
DRO	320.0	7/7/2004	4.7	2/1/2011
ORO	0.20U	2/1/2011	0.20U	2/1/2011
GRO	0.56	12/7/2010	0.35	2/1/2011

MW-18

Analyte	Max	Date	Last	Date
DRO	290.0	9/1/2005	6.8	12/8/2010
ORO	0.5	2/3/2005	1.0U	12/8/2010
GRO	0.95	12/8/2010	0.95	12/8/2010

MW-20

Analyte	Max	Date	Last	Date
DRO	85	2/3/2005	13	12/6/2010
ORO	0.25U	7/7/2004	2.0U	12/6/2010
GRO	0.75	12/6/2010	0.75	12/6/2010

MW-9

Analyte	Max	Date	Last	Date
DRO	0.5	5/22/2001	0.10U	12/7/2010
ORO	0.20U	12/7/2010	0.20U	12/7/2010
GRO	0.079	3/16/2004	0.10U	12/7/2010

MW-12

Analyte	Max	Date	Last	Date
DRO	0.10U	12/7/2010	0.10U	12/7/2010
ORO	0.20U	12/7/2010	0.20U	12/7/2010
GRO	0.05U	3/16/2004	0.10U	12/7/2010

MW-13

Analyte	Max	Date	Last	Date
DRO	0.10U	12/7/2010	0.10U	12/7/2010
ORO	0.20U	12/7/2010	0.20U	12/7/2010
GRO	0.05U	3/16/2004	0.10U	12/7/2010

MW-14

Analyte	Max	Date	Last	Date
DRO	NS	-	NS	-
ORO	NS	-	NS	-
GRO	0.05U	3/17/2004	0.05U	3/17/2004

Notes

1. All results reported in mg/L.
2. DRO - Diesel Range Organics
   ORO - Oil Range Organics
   GRO - Gasoline Range Organics
   NS - Not Sampled
3. ORO product has been identified as "Lube Oil Range" in associated lab reports.
4. U indicates non-detect.
5. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

Legend

- ● Monitoring Well
- Area of Concern
- ---- Tax Parcel
- Former Excavation Area

0 80 160

Scale in Feet

Data Source: Pierce County GIS; Bing Maps Aerial

Y:\Projects\136006\MapDocs\RI Workplan\Final\Fig18-DeepZoneTPH.mxd 3/25/2011 NAD 1983 StatePlane Washington South FIPS 4602 Feet

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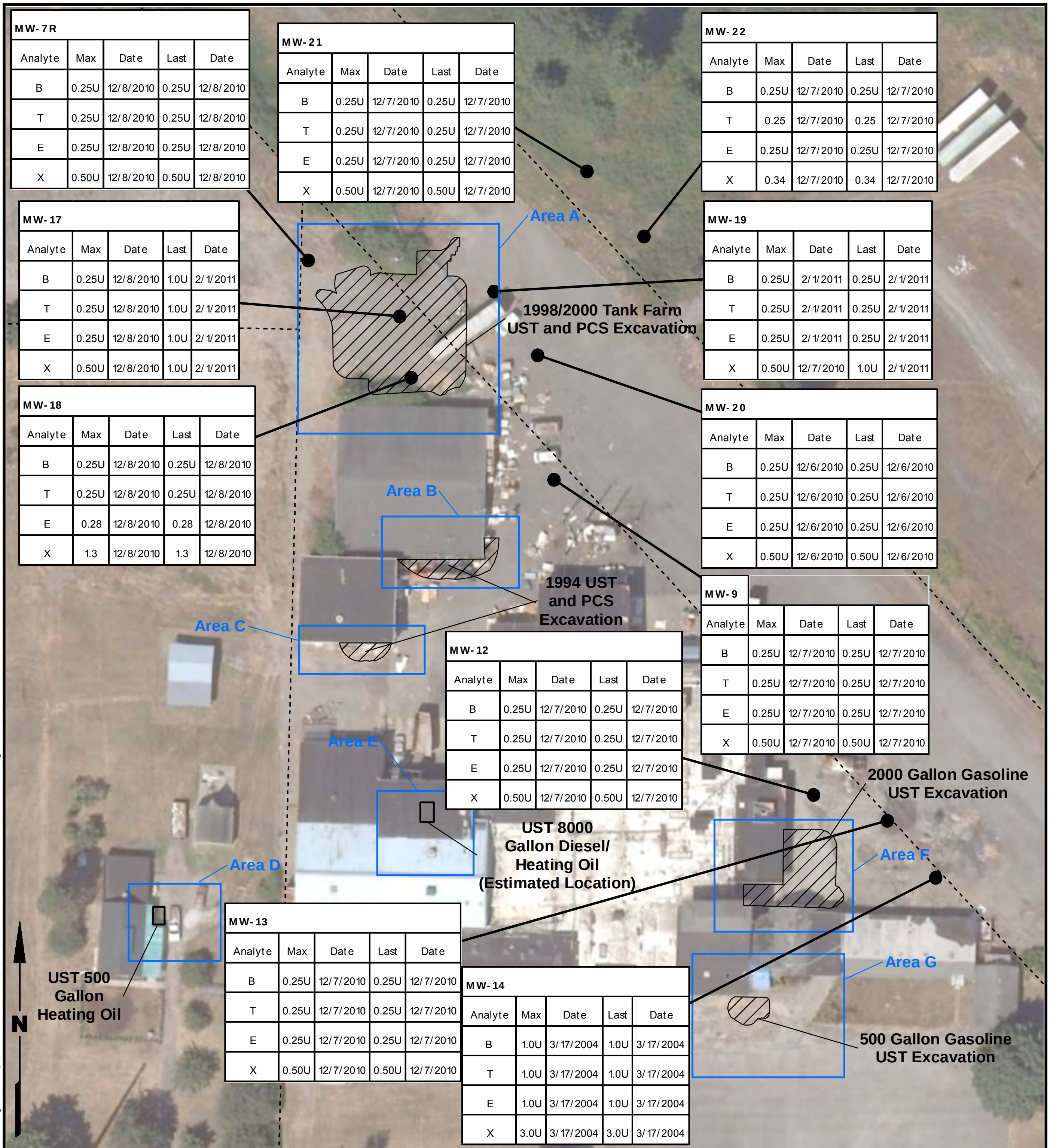
Pederson's Fryer Farms
Pierce County, Washington

Deep Zone TPH Concentrations: Maximum and Most Recent

Figure 18



MW-7R

Analyte	Max	Date	Last	Date
B	0.25U	12/8/2010	0.25U	12/8/2010
T	0.25U	12/8/2010	0.25U	12/8/2010
E	0.25U	12/8/2010	0.25U	12/8/2010
X	0.50U	12/8/2010	0.50U	12/8/2010

MW-21

Analyte	Max	Date	Last	Date
B	0.25U	12/7/2010	0.25U	12/7/2010
T	0.25U	12/7/2010	0.25U	12/7/2010
E	0.25U	12/7/2010	0.25U	12/7/2010
X	0.50U	12/7/2010	0.50U	12/7/2010

MW-22

Analyte	Max	Date	Last	Date
B	0.25U	12/7/2010	0.25U	12/7/2010
T	0.25	12/7/2010	0.25	12/7/2010
E	0.25U	12/7/2010	0.25U	12/7/2010
X	0.34	12/7/2010	0.34	12/7/2010

MW-17

Analyte	Max	Date	Last	Date
B	0.25U	12/8/2010	1.0U	2/1/2011
T	0.25U	12/8/2010	1.0U	2/1/2011
E	0.25U	12/8/2010	1.0U	2/1/2011
X	0.50U	12/8/2010	1.0U	2/1/2011

MW-19

Analyte	Max	Date	Last	Date
B	0.25U	2/1/2011	0.25U	2/1/2011
T	0.25U	2/1/2011	0.25U	2/1/2011
E	0.25U	2/1/2011	0.25U	2/1/2011
X	0.50U	12/7/2010	1.0U	2/1/2011

MW-18

Analyte	Max	Date	Last	Date
B	0.25U	12/8/2010	0.25U	12/8/2010
T	0.25U	12/8/2010	0.25U	12/8/2010
E	0.28	12/8/2010	0.28	12/8/2010
X	1.3	12/8/2010	1.3	12/8/2010

MW-20

Analyte	Max	Date	Last	Date
B	0.25U	12/6/2010	0.25U	12/6/2010
T	0.25U	12/6/2010	0.25U	12/6/2010
E	0.25U	12/6/2010	0.25U	12/6/2010
X	0.50U	12/6/2010	0.50U	12/6/2010

MW-9

Analyte	Max	Date	Last	Date
B	0.25U	12/7/2010	0.25U	12/7/2010
T	0.25U	12/7/2010	0.25U	12/7/2010
E	0.25U	12/7/2010	0.25U	12/7/2010
X	0.50U	12/7/2010	0.50U	12/7/2010

MW-12

Analyte	Max	Date	Last	Date
B	0.25U	12/7/2010	0.25U	12/7/2010
T	0.25U	12/7/2010	0.25U	12/7/2010
E	0.25U	12/7/2010	0.25U	12/7/2010
X	0.50U	12/7/2010	0.50U	12/7/2010

MW-13

Analyte	Max	Date	Last	Date
B	0.25U	12/7/2010	0.25U	12/7/2010
T	0.25U	12/7/2010	0.25U	12/7/2010
E	0.25U	12/7/2010	0.25U	12/7/2010
X	0.50U	12/7/2010	0.50U	12/7/2010

MW-14

Analyte	Max	Date	Last	Date
B	1.0U	3/17/2004	1.0U	3/17/2004
T	1.0U	3/17/2004	1.0U	3/17/2004
E	1.0U	3/17/2004	1.0U	3/17/2004
X	3.0U	3/17/2004	3.0U	3/17/2004

Note

1. All results reported in µg/L.
2. B - Benzene, T - Toluene
   E - Ethylbenzene, X - Total Xylene
3. U indicates non-detect.
4. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

Legend

- Monitoring Well
- Tax Parcel
- Area of Concern
- Former Excavation Area

0 80 160

Scale in Feet

Data Source: Pierce County GIS; Bing Maps Aerial

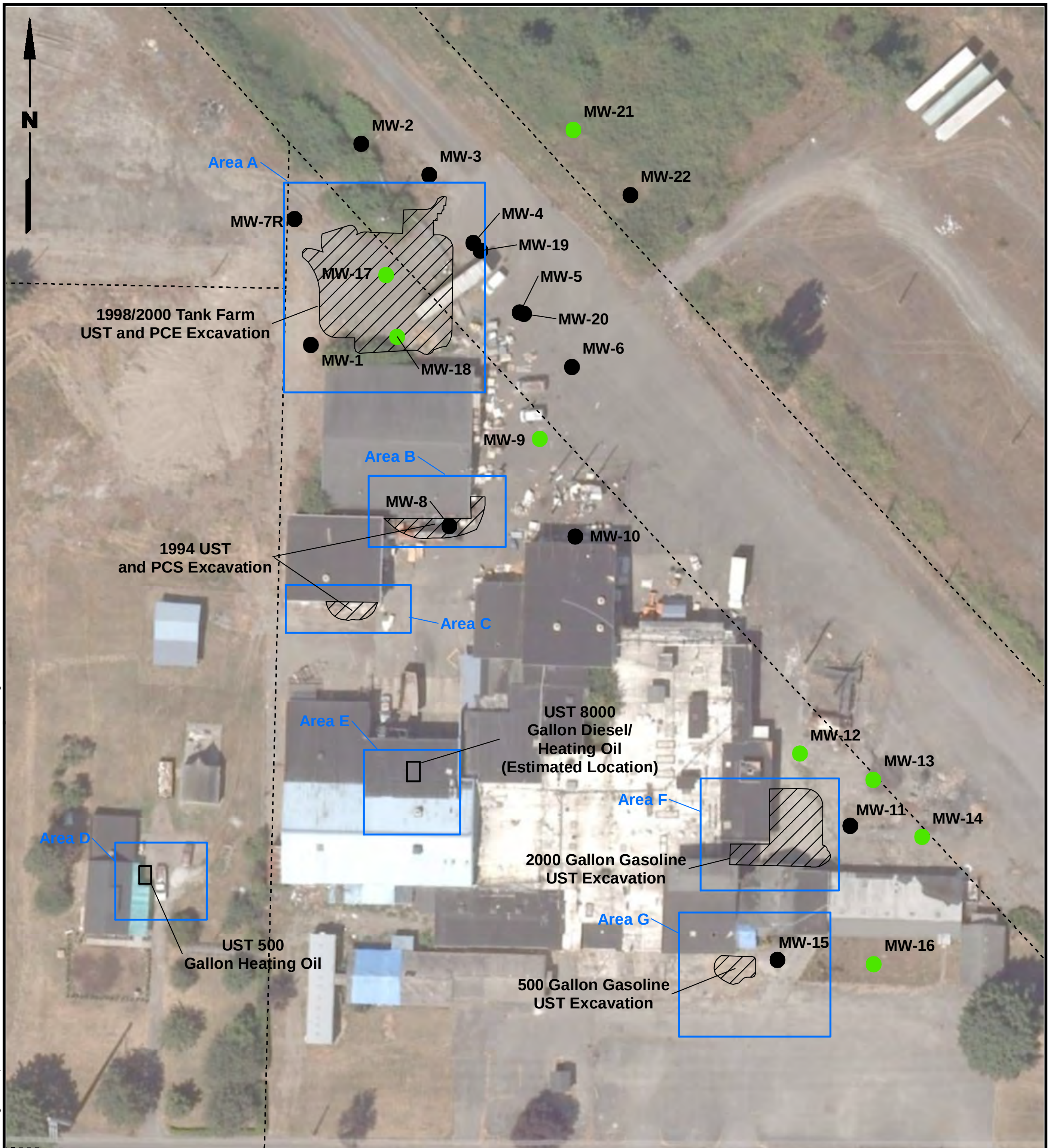
Y:\Projects\136006\MapDocs\RI Workplan\Final\Fig19-DeepZoneBTEX.mxd 3/25/2011 NAD 1983 StatePlane Washington South FIPS 4602 Feet

Landau Associates

Pederson's Fryer Farms
Pierce County, Washington

Deep Zone BTEX Concentrations: Maximum and Most Recent

Figure 19



Legend

- Existing Monitoring Well
- Existing Monitoring Well to be Abandoned
- Tax Parcel
- Area of Concern
- Former Excavation Area

Note

1. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

0 80 160

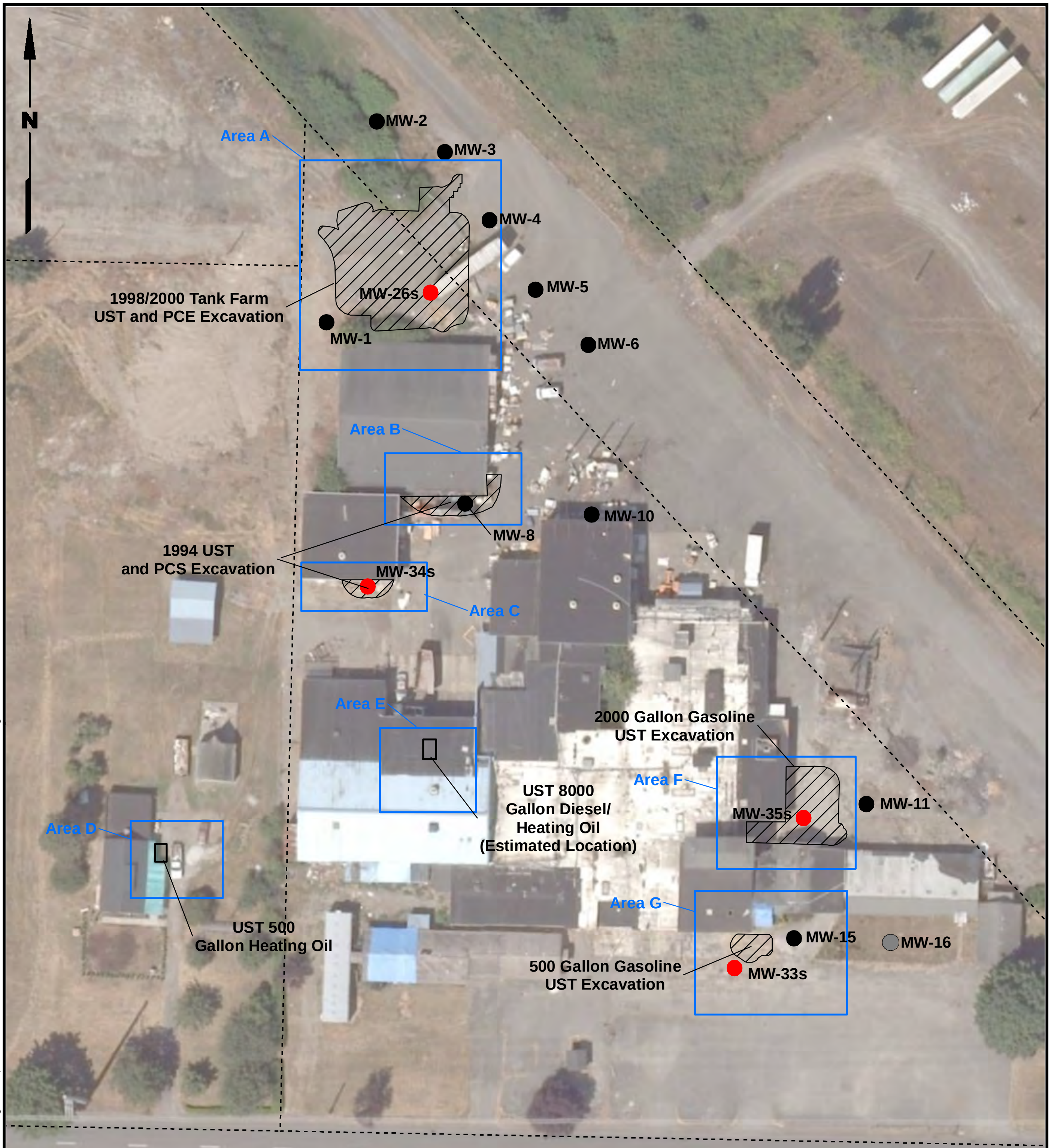
Scale in Feet

Data Source: Pierce County GIS; Bing Maps Aerial

Y:\Projects\136006\MapDocs\RI Workplan\Final\Fig20-ProposedWellAbandonments.mxd 3/25/2011 NAD 1983 StatePlane Washington South FIPS 4602 Feet

LANDAU ASSOCIATES

Pederson's Fryer Farms Pierce County, Washington	**Proposed Well Abandonments**	Figure 20



Legend

- Shallow Well to be Abandoned
- Proposed Shallow Monitoring Well
- Existing Monitoring Well; MW-11
- Tax Parcel
- Area of Concern
- Former Excavation Area

Note
1. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

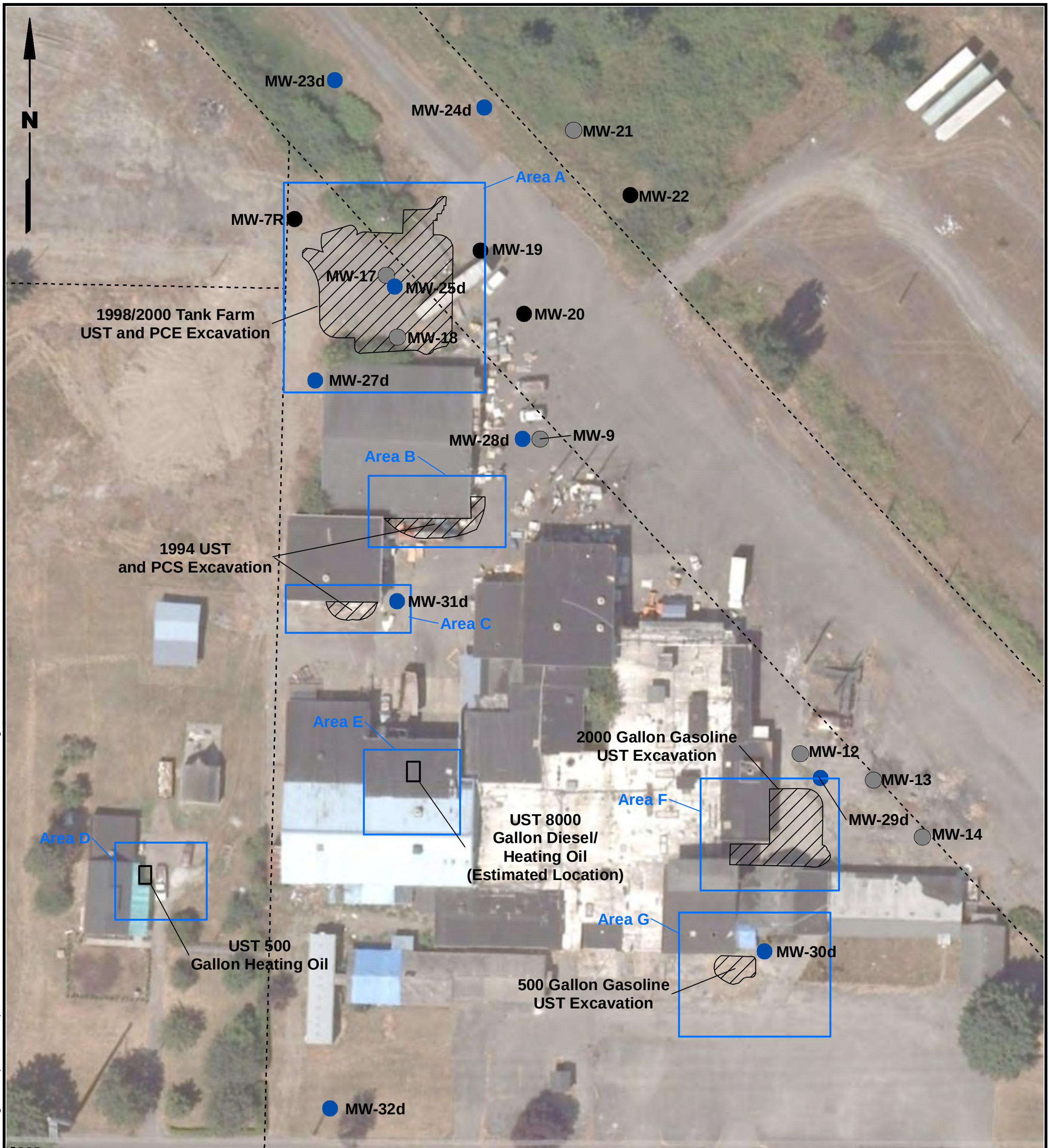
0 80 160
Scale in Feet

Data Source: Pierce County GIS; Bing Maps Aerial

Y:\Projects\136006\MapDocs\RI Workplan\Final\Fig21-ProposedShallowWells.mxd 3/25/2011 NAD 1983 StatePlane Washington South FIPS 4602 Feet

Landau Associates

Pederson's Fryer Farms Pierce County, Washington	**Proposed Shallow Well Locations**	Figure 21



Legend

- Deep Well to be Abandoned
- Existing Deep Monitoring Well
- Proposed Deep Monitoring Well
- Tax Parcel
- Area of Concern
- Former Excavation Area

Note

1. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

0 80 160

Scale in Feet

Data Source: Pierce County GIS; Bing Maps Aerial

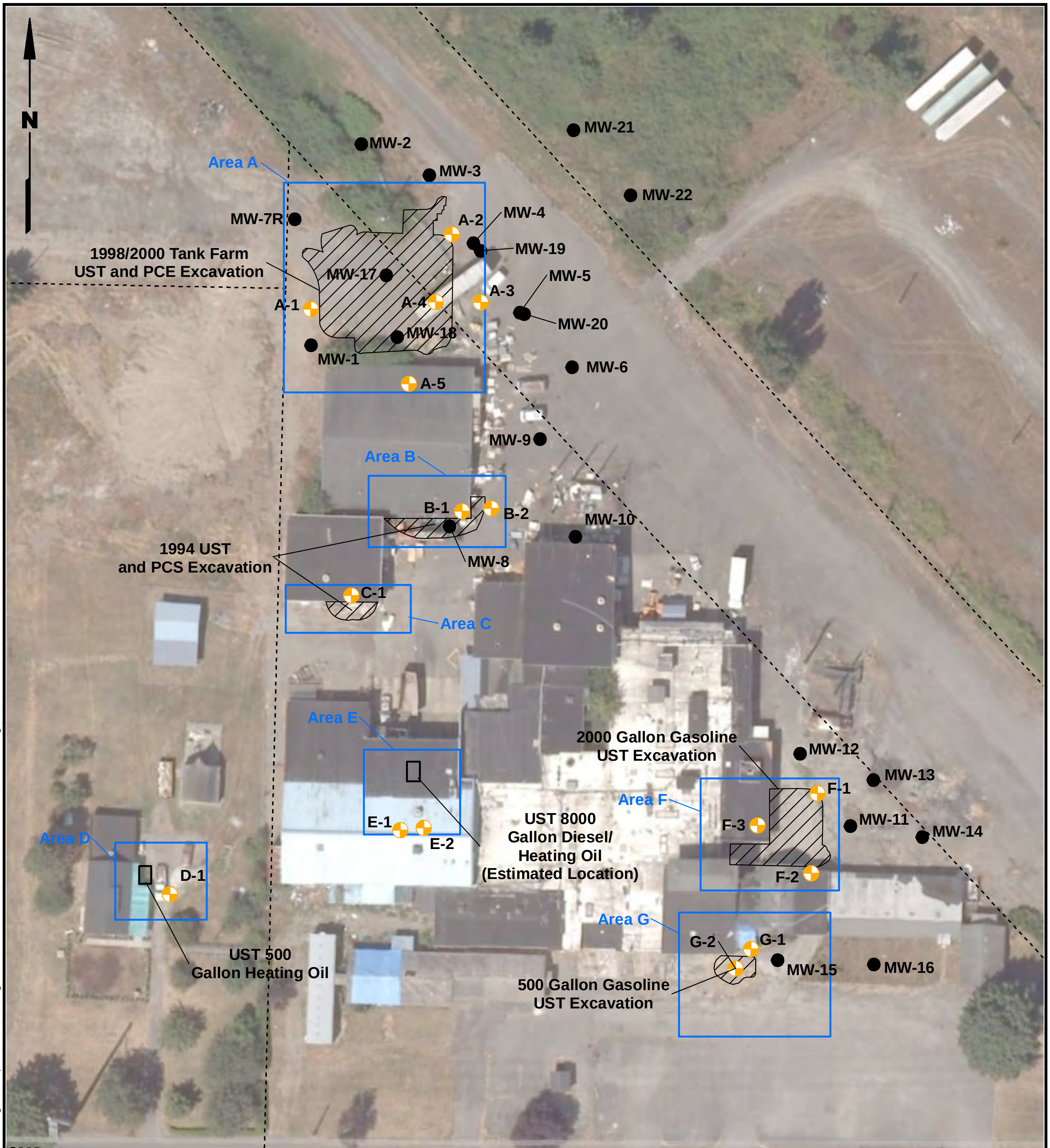
Y:\Projects\136006\MapDocs\RI Workplan\Final\Fig22-ProposedDeepWells.mxd 3/25/2011 NAD 1983 StatePlane Washington South FIPS 4602 Feet

Landau Associates

Pederson's Fryer Farms
Pierce County, Washington

Proposed Deep Well Locations

Figure 22



Legend

- Existing Monitoring Well
- Proposed Boring
- Tax Parcel
- Area of Concern
- Former Excavation Area

Note

1. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

0 80 160

Scale in Feet

Data Source: Pierce County GIS; Bing Maps Aerial

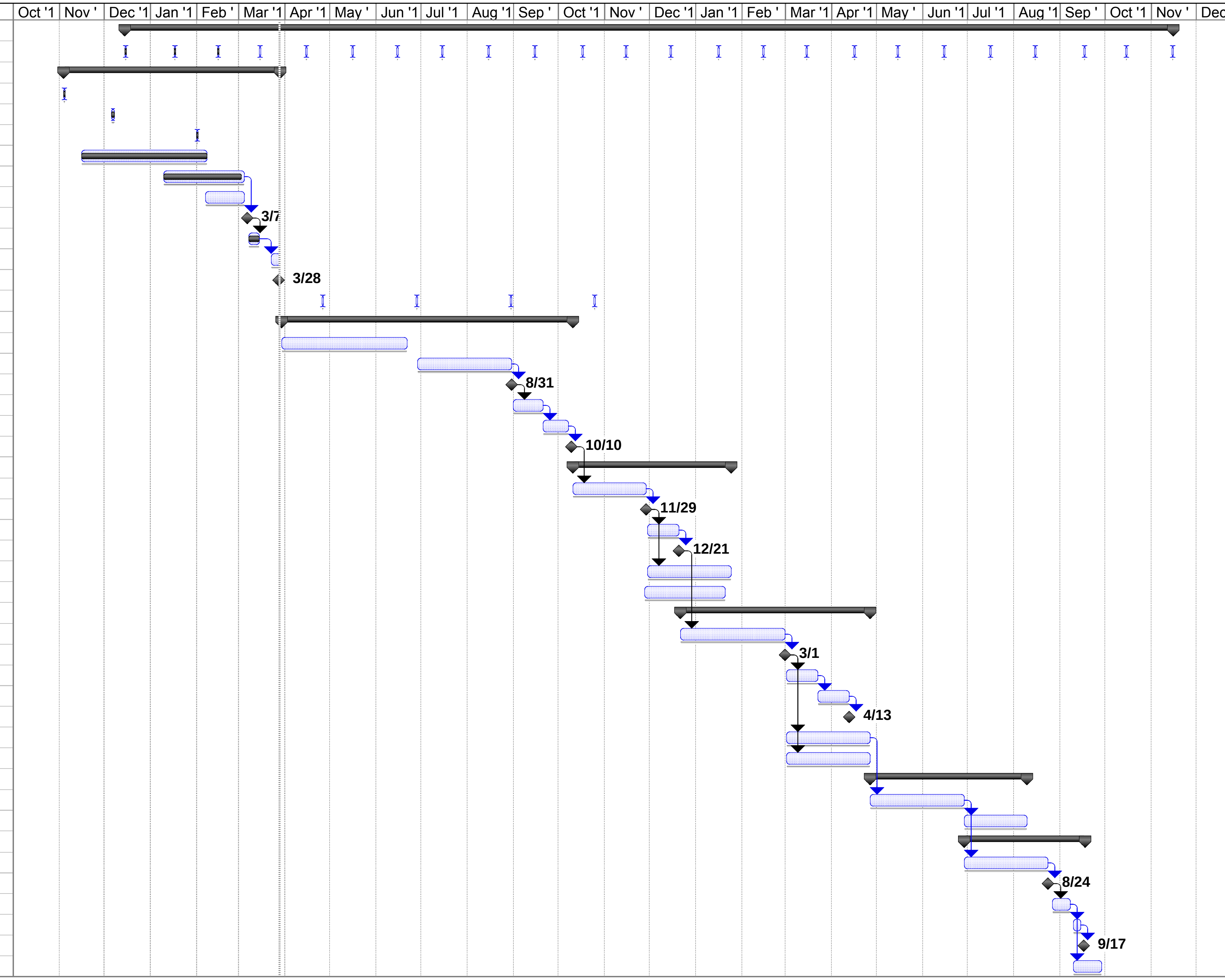
Y:\Projects\136006\MapDocs\RI Workplan\Final\Fig23-ProposedSoilBorings.mxd 3/25/2011 NAD 1983 StatePlane Washington South FIPS 4602 Feet

Landau Associates

Pederson's Fryer Farms Pierce County, Washington	**Proposed Soil Boring Locations**	Figure 23

FIGURE 24
RI/FS SCHEDULE
PEDERSON'S FRYER FARMS

ID	Task Name	Duration	Start	Finish	Predecessors
1	**Project Management**	**502 days**	**Wed 12/15/10**	**Thu 11/15/12**	
2	**Progress Reports**	**502 days**	**Wed 12/15/10**	**Thu 11/15/12**	
27	**RI/FS Work Plan**	**103 days**	**Thu 11/4/10**	**Mon 3/28/11**	
28	Initial Well Inspection	1 day	Thu 11/4/10	Thu 11/4/10	
29	Initial GW Sampling Event	2 days	Mon 12/6/10	Tue 12/7/10	
30	Additional Well Sampling	1 day	Tue 2/1/11	Tue 2/1/11	
31	Historic Data Review	12 wks	Tue 11/16/10	Mon 2/7/11	
32	Draft Work Plan	8 wks	Mon 1/10/11	Fri 3/4/11	
33	HASP and QAPP	4 wks	Mon 2/7/11	Fri 3/4/11	
34	Draft Work Plan to Ecology	1 day	Mon 3/7/11	Mon 3/7/11	32
35	Ecology Review of Work Plan	1 wk	Tue 3/8/11	Mon 3/14/11	34
36	Incorporate Ecology Comments	4 days	Wed 3/23/11	Mon 3/28/11	35
37	Publish Work Plan	1 day	Mon 3/28/11	Mon 3/28/11	
38	**Groundwater Sampling**	**131 days**	**Tue 4/26/11**	**Tue 10/25/11**	
43	**RI/FS**	**139 days**	**Wed 3/30/11**	**Mon 10/10/11**	
44	RI Field Work	3 mons	Wed 3/30/11	Tue 6/21/11	
45	Draft RI/FS Report	9 wks	Wed 6/29/11	Tue 8/30/11	40
46	Draft RI/FS to Ecology	1 day	Wed 8/31/11	Wed 8/31/11	45
47	Ecology Review and Comment	14 days	Thu 9/1/11	Tue 9/20/11	46
48	Incorporate Ecology Comments	13 days	Wed 9/21/11	Fri 10/7/11	47
49	Publish Final RI/FS	1 day	Mon 10/10/11	Mon 10/10/11	48
50	**Cleanup Action Plan**	**76 days**	**Tue 10/11/11**	**Tue 1/24/12**	
51	Draft CAP Report	7 wks	Tue 10/11/11	Mon 11/28/11	49
52	Draft CAP Report to Ecology	1 day	Tue 11/29/11	Tue 11/29/11	51
53	Ecology Review and Comment	3 wks	Wed 11/30/11	Tue 12/20/11	52
54	Publish Final CAP	1 day	Wed 12/21/11	Wed 12/21/11	53
55	Develop Public Outreach Plan	8 wks	Wed 11/30/11	Tue 1/24/12	52
56	Develop SEPA Documents	2 mons	Mon 11/28/11	Fri 1/20/12	
57	**Engineering Design Report**	**91 days**	**Thu 12/22/11**	**Thu 4/26/12**	
58	Prepare Draft ED Report	10 wks	Thu 12/22/11	Wed 2/29/12	54
59	Draft ED Repor to Ecology	1 day	Thu 3/1/12	Thu 3/1/12	58
60	Ecology Review and Comment	3 wks	Fri 3/2/12	Thu 3/22/12	59
61	Incorporate Ecology Comments	3 wks	Fri 3/23/12	Thu 4/12/12	60
62	Publish ED Report	1 day	Fri 4/13/12	Fri 4/13/12	61
63	Prepare Construction Plans and Specs	8 wks	Fri 3/2/12	Thu 4/26/12	59
64	Obtain State and Local Permits	8 wks	Fri 3/2/12	Thu 4/26/12	59
65	**Engineering Oversight**	**75 days**	**Fri 4/27/12**	**Thu 8/9/12**	
66	Engineering Oversight During Remedial Action	9 wks	Fri 4/27/12	Thu 6/28/12	63
67	Prepare As-built Drawings/Documents	6 wks	Fri 6/29/12	Thu 8/9/12	66
68	**Remedial Action Report**	**57 days**	**Fri 6/29/12**	**Mon 9/17/12**	
69	Prepare Draft RA Report	8 wks	Fri 6/29/12	Thu 8/23/12	66
70	Provide Draft RA Report to Ecology	1 day	Fri 8/24/12	Fri 8/24/12	69
71	Ecology Review and Comment	2 wks	Mon 8/27/12	Fri 9/7/12	70
72	Incorporate Ecology Comments	1 wk	Mon 9/10/12	Fri 9/14/12	71
73	Publish RA Report	1 day	Mon 9/17/12	Mon 9/17/12	72
74	Provide Project Documentation Files to Ecology	3 wks	Mon 9/10/12	Fri 9/28/12	71



Task | Progress | Summary | External Tasks | Deadline
Split | Milestone | Project Summary | External Milestone

TABLE 1
SUMMARY OF AREAS OF CONCERN
PEDERSON'S FRYER FARMS

Area of Concern	Tank History	Tank Status	Residual Soil Contamination
Area A	Northern Tank Farm: - 12,000 gal diesel tank - 8,000 gal gasoline tank - 6,000 gal diesel tank - 550 gal new oil tank	All four tanks closed in place in January 1997. All four tanks removed in March 1998.	Residual soil impacts along the NE corner, east sidewall, south sidewall, SW corner, and throughout the bottom of the excavation.
Area B	- 3,000 gal diesel tank - 6,000 gal unleaded gasoline tank - two pump islands	Tanks and pump islands removed in 1994	3,000 gal tank excavation had clean confirmation samples. 6,000 gal tank had remaining contamination on east sidewall but low concentrations (21 and 31 mg/kg gas); Pump islands had remaining contamination on west sidewall extending beneath building and base of excavation (14 ft BGS) (2,420 and 1,470 mg/kg gasoline). Area of remaining contamination is at SE corner of building on east side.
Area C	300 gal waste oil tank	Tank removed in 1994	Contaminated soil remained along the north wall (against building) from 4 to 8 ft BGS
Area D	500 gal heating oil tank	Closed in place in January 1997. Still exists on site.	Unknown
Area E	8,000 gal diesel/heating oil tank	Closed in place January 1997. Still exists on site.	Unknown
Area F	2,000 gal gasoline UST	Closed in place January 1997. Removed August 2000.	Contamination remained at the limits of excavation all the way around the SW finger of the excavation and south sidewall (under buildings).
Area G	500 gal gasoline UST	Closed in place January 1997. Removed August 2000.	Contamination remained in the sidewall at the NE corner (near MW-15, partially under building and landscaping).

TABLE 2
SITE MONITORING WELLS
PEDERSON'S FRYER FARMS

		Depth to Water (ft)			Measured Well Depth (ft)				
	Aquifer Designation	Mar-10	Nov-10	Dec-10	Nov-10	Dec-10	Computed Thickness of Water Column in Well (Dec 2010) (ft)	Well Construction Depth (ft)	Screen Length (ft)
MW-1	S	29.97	28.89	30.21	34.80	34.9	4.69	35	20
MW-2	S	34.36	31.95	33.95	38.70	38.16	4.21	35	20
MW-3	S	30.50	--	29.59	--	34.35	4.76	35	20
MW-4	S	33.21	32.90	31.84	37.95	38.15	6.31	40	25
MW-5	S	43.00	30.98	32.02	40.66	39.6	7.58	40	25
MW-6	S	37.45	36.07	36.41	44.25	44.3	7.89	45	30
MW-8	S	43.47	43.05	43.32	47.87	47.9	4.58	45	30
MW-10	S	43.09	43.15	42.28	44.68	44.7	2.42	45	30
MW-11	S	--	37.70	37.28	38.85	38.9	1.62	40	25
MW-15	S	24.80	24.87	25.28	29.81	29.9	4.62	30	15
MW-16	S	40.99	42.88	43.03	44.29	43.55	0.52	45	30
MW-7R	D	39.76	41.04	40.06	55.35	55.3	15.24	55	30
MW-9	D	41.40	47.07	42.58	49.05	49.1	6.52	50	35
MW-12	D	--	48.71	48.17	49.45	49.45	1.28	50	35
MW-13	D	--	--	48.02	--	49.35	1.33	50	35
MW-14	D	--	48.98	49.00	49.53	49.6	0.60	50	35
MW-17	D	40.92	41.99	41.41	52.10	52.1	10.69	50	30
MW-18	D	41.71	41.63	41.68	54.90	55.1	13.42	55	30
MW-19	D	41.46	44.48	41.93	60.10	60.19	18.26	65	20
MW-20	D	31.61	45.76	43.16	61.80	61.85	18.69	65	20
MW-21	D	--	38.37	56.81	59.52	58.74	1.93	55	30
MW-22	D	45.09	49.04	44.58	57.79	56.6	12.02	55	30

-- = Not Measured

Yellow highlighting indicates suspect measurement

TABLE 3
MONITORING WELL SURVEY
PEDERSON'S FRYER FARMS

	December 2010					Pre 2005 Survey
Well Name	Northing	Easting	Well Monument Rim Elevation	Top of 2" PVC Elevation	Ground Elevation	Top of 2" PVC Elevation
MW-1	683836.91	1170109.24	406.03	405.66		95.11
MW-2	683948.81	1170137.22	404.60	404.19	401.53	93.62
MW-3	683931.57	1170175.11	402.27	401.82		91.24
MW-4	683893.73	1170199.69	404.13	403.78		93.23
MW-5	683855.05	1170225.46	405.74	405.31		94.76
MW-6	683824.50	1170254.79	406.00	405.66		95.12
MW-7R	683906.90	1170100.17	405.13	404.82		95.12
MW-8	683736.04	1170186.29	410.21	409.90	406.90	99.39
MW-9	683784.55	1170236.91	407.09	406.80		96.23
MW-10	683730.00	1170256.64	407.31	406.95		96.38
MW-11	683568.83	1170409.54	407.51	406.99		96.47
MW-12	683609.10	1170381.54	406.37	406.11		95.56
MW-13	683594.68	1170422.54	406.65	406.36		95.78
MW-14	683562.80	1170449.64	Obliterated	407.11	407.50	96.56
MW-15	683494.22	1170369.24	409.43	409.06		98.50
MW-16	683491.91	1170422.82	409.48	408.99		98.44
MW-17	683875.71	1170151.09	405.53	405.22		94.67
MW-18	683841.41	1170157.43	406.32	406.11		95.58
MW-19	683889.41	1170203.71	404.30	403.97		93.41
MW-20	683854.11	1170227.87	405.78	405.57		95.02
MW-21	683956.51	1170255.41	405.38	405.00	401.48	94.44
MW-22	683920.24	1170287.10	405.79	405.03	402.53	94.47

a) December 2010 Survey: Coordinate System and Zone: Washington State Plane, South Zone Coordinates.
Horizontal Datum: NAD 83(91), South Zone, US FEET. Vertical Datum: NAVD88, US FEET.
b) Pre 2005 Survey: Vertical Datum based on arbitrary site datum
c) Ground elevation only surveyed for above-ground monuments and MW-14. MW-14 was originally a flush mount monument but was obliterated so it could not be surveyed.
d) All units in feet.

TABLE 4
WELL INSPECTION NOTES
PEDERSON'S FRYER FARMS

Well ID		December 2010 Inspection DTW (ft)	December 2010 Inspection Measured Well Depth	December 2010 Inspection Comments/ Observations	November 2010 Inspection DTW (ft)	November 2010 Inspection Measured Well Depth	November 2010 Inspection Comments/ Observations
MW-1	S	30.21	34.9	small brown particles, turbid, diesel odor, light sheen	28.89	34.80	slight odor, no oil
MW-2	S	33.95	38.16	clear, no odor or sheen	31.95	38.70	no odor, no oil
MW-3	S	29.59	34.35	no notes taken	--	--	could not find well
MW-4	S	31.84	38.15	red/brown, ferrous flocs, low odor, no sheen	32.90	37.95	no odor, no oil
MW-5	S	32.02	31.6	clear, no odor or sheen	30.98	40.66	slight odor, no oil
MW-6	S	36.41	44.3	clear, no odor or sheen	36.07	44.25	no odor, no oil
MW-7R	D	40.06	55.3	clear, light sheen and light diesel odor	41.04	55.35	no odor, no oil
MW-8	S	43.32	47.9	clear, brown floating particles, no odor or sheen	43.05	47.87	no odor, no oil, sediment on probe
MW-9	D	42.58	49.1	clear, brown floating particles, no odor or sheen	47.07	49.05	no odor, no oil, all three bolts missing
MW-10	S	42.28	44.7	clear, brown particles, no sheen, diesel odor	43.15	44.68	
MW-11	S	37.28	38.9	clear, small white particles, no odor, slight sheen	37.70	38.85	well was buried under gravel in parking lot
MW-12	D	48.17	49.45	clear, no odor or sheen	48.71	49.45	well was buried under gravel in parking lot, needs new monument
MW-13	D	48.02	49.35	brown, some floating debris, no odor or sheen	--	--	well buried under gravel parking lot, could not find well
MW-14	D	49	49.6	no water taken; insufficient amount for sample	48.98	49.53	well buried under gravel parking lot, needs new cap and monument
MW-15	S	25.28	29.9	cloudy, very strong diesel odor, sheen	24.87	29.81	potentially up to 0.02 ft of product, but layer was too thin to get conclusive reading from probe, strong petroleum odor
MW-16	S	43.03	43.55	no water taken; insufficient amount for sample	42.88	44.29	no odor, no sheen
MW-17	D	41.41	52.1	clear, light sheen, diesel odor	41.99	52.10	petroleum odor, no oil
MW-18	D	41.68	55.1	clear, light sheen, diesel odor	41.63	54.90	potentially up to 0.02 ft of product, but layer was too thin to get conclusive reading from probe, moderate petroleum odor
MW-19	D	41.93	60.19	clear, no odor or sheen	44.48	60.10	slight odor, no oil
MW-20	D	43.16	61.85	clear, diesel odor, light sheen	45.76	61.80	no odor, no oil
MW-21	D	56.81	58.74	clear, no odor or sheen	38.37	59.52	no odor, no sheen, difficulty getting water level due to inconsistent beeping on probe
MW-22	D	44.58	56.6	clear, no odor or sheen	49.04	57.79	no odor, no oil

Aquifer designation: S = Shallow; D = Deep

DTW = Depth to Water

TABLE 5
SOIL SAMPLING DEPTHS
PEDERSON'S FRYER FARMS

	Location	Boring Depth (ft)	Soil Quality Sampling Depth (ft)	Well Screen Interval Depth (ft)
Area A	Well			
	MW-23d	60	20, 30, 40	50 to 60
	MW-24d	60	None	50 to 60
	MW-25d	60	10, 15, 20, 25, 30, 35, 40, 45	50 to 60
	MW-26s	32	5,10, 15, 20, 25, 30	22 to 32
	MW-27d	60	20, 30, 40	50 to 60
	Boring			
	A-1	40	10, 15, 20, 25, 30, 35, 40, 45	
	A-2	40	10, 15, 20, 25, 30, 35, 40, 45	
	A-3	40	10, 15, 20, 25, 30, 35, 40, 45	
	A-4	40	5, 10, 15, 20, 25, 30, 35, 40, 45	
	A-5	40	10, 15, 20, 25, 30, 35, 40, 45	
Area B	Well			
	MW-28d	60	None	50 to 60
	Boring			
	B-1	15	5, 10, 15, 20	
	B-2	20	5, 10, 15, 20	
Area C	Well			
	MW-31d	60	10, 15	50 to 60
	MW-34s	15	5, 10, 15	5 to 15
	Boring			
	C-1	20	5, 10, 15	
Area D	Boring			
	D-1	15	8, 13	
Area E	Boring			
	E-1	15	8, 13	
	E-2	15	8, 13	
Area F	Well			
	MW-29d	60	5, 10, 20	50 to 60
	MW-35s	20	5,10,15, 20	10 to 20
	Boring			
	F-1	25	5, 10, 15, 20, 25	
	F-2	25	5, 10, 15, 20, 25	
	F-3	20	5, 10, 15, 20, 25	
Area G	Well			
	MW-30d	60	10, 20, 30	50 to 60
	MW-33s	30	5, 10, 15, 20,30	15 to 30
	Boring			
	G-1	15	5,10, 15, 20	
	G-2	20	5,10, 15, 20	
Other	Well			
	MW-32d	60	None	50 to 60

TABLE 6
SOIL SAMPLING MATRIX
PEDERSON'S FRYER FARMS

	Location	Boring Depth (ft)	Soil Quality Sampling Depth (ft)	Soil Analysis: NWTPH-Gx	NWTPH-Dx	BTEX	Lead	cPAHs	PCBs
Area A	Well								
	MW-23d	60	20, 30	A	A				
	MW-25d	60	10, 15, 20, 25, 30, 35, 40, 45	A	A	1			
	MW-26s	32	5,10, 15, 20, 25, 30	A	A	1	2		
	MW-27d	60	20, 30	A	A				
	Boring								
	A-1	40	10, 15, 20, 25, 30, 35, 40	A	A	1			
	A-2	40	10, 15, 20, 25, 30, 35, 40	A	A	1			
	A-3	40	10, 15, 20, 25, 30, 35, 40	A	A	1			
	A-4	40	5, 10, 15, 20, 25, 30, 35, 40	A	A	2	2	2	2
	A-5	40	10, 15, 20, 25, 30, 35, 40	A	A	1			
Area B	Well								
	MW-28d	60	None						
	Boring								
	B-1	15	5, 10, 15	A	A	1	1	1	
	B-2	20	5, 10, 15	A	A	1		1	
Area C	Well								
	MW-31d	60	10		A			1	
	MW-34s	15	5,10,15		A			2	
	Boring								
	C-1	20	5, 10, 15		A			1	1
Area D	Boring								
	D-1	15	8, 13		A			1	
Area E	Boring								
	E-1	15	8, 13		A			1	
	E-2	15	8, 13		A			1	
Area F	Well								
	MW-29d	60	10, 15, 20, 25	A	A	1			
	MW-35s	20	5,10,15,20, 25	A	A	1			
	Boring								
	F-1	25	10, 15, 20, 25	A	A				
	F-2	25	10, 15, 20, 25	A	A				
	F-3	20	5, 10, 15, 20	A	A	2	1		
Area G	Well								
	MW-30d	60	10, 20, 30	A	A	1			
	MW-33s	30	5, 10, 15, 20,30	A	A	1			
	Boring								
	G-1	15	5,10, 15	A	A	1			
	G-2	20	5,10,15,20	A	A	2	1		

A = All samples analyzed.

1 = One sample analyzed. Sample selected at the discretion of field geologist

2 = Two samples analyzed. Samples selected at the discretion of the field geologist.

Note: Soil contamination is not anticipated at monitoring wells MW-24d, MW-28d, and MW-32d.
Therefore, no planned soil samples will be collected unless staining and/or odors are observed.
Any collected samples would be analyzed for NWTPH-Gx, NWTPH-Dx, and BTEX

TABLE 7
GROUNDWATER SAMPLING MATRIX
PEDERSON'S FRYER FARMS

	Location	NWTPH-Gx	NWTPH-Dx	BTEX	Other	Naphthalenes	cPAHs	MNA1	MNA2	Lead
Area A										
	New									
	MW-23d	Q	Q	1				1		
	MW-24d	Q	Q	1				1	1	
	MW-25d	Q	Q	Q	1	1	1	Q	1	1
	MW-26s	Q	Q	Q				Q		1
	MW-27d	S	S	1				1	1	
	Existing									
	MW-7R	S	S	1				1		
	MW-19	S	S	1				1		
	MW-20	S	S	1				1		
	MW-22	S	S	2				1		
	MW-1	S	S	1				1		
	MW-2	S	S	1				1		
	MW-3	S	S					1	1	
	MW-4	S	S					1		
	MW-5	S	S							
	MW-6	S	S	1						
Area B										
	New									
	MW-28d	Q	Q	Q	1	1		Q		
	Existing									
	MW-8	S	S	1			1	1		
	MW-10	S	S	1			1	1		
Area C										
	New									
	MW-31d	Q	Q				1	1		
	MW-34s	Q	Q				1	1		
Area F										
	New									
	MW-35s	Q	Q	Q				Q		
	MW-29d	Q	Q	Q	1	1		Q		
	Existing									
	MW-11	S	S	1				1		
Area G										
	New									
	MW-30d	Q	Q	Q				Q		
	MW-33s	Q	Q	Q				Q		
	Existing									
	MW-15	S	S	S	1	1		1	1	
Background	New									
	MW-32d	1	1					1		

Other Constituents: MTBE; 1,2-dichloroethane; EDB

Q= quarterly sampling

S = Semi annual sampling

1 = 1st quarter sampling only

MNA 1 Parameters: Sulfate, nitrate. Ferrous iron by field HACH kit.

MNA 2 Parameters: Methane, alkalinity, manganese, total organic carbon.

APPENDIX A

December 2010 and February 2011 Groundwater Quality Results

APPENDIX A
DECEMBER 2010 AND FEBRUARY 2011 GROUNDWATER QUALITY RESULTS
PEDERSON'S FRYER FARMS

	MTCA Method A Cleanup Level for Groundwater (a)	MW-01 RZ78C 12/08/2010	MW-02 RZ78Q 12/07/2010	MW-03 RZ78R 12/07/2010	MW-04 RZ79B 12/07/2010	MW-04 SH05B 2/01/2011	MW-05 RZ78G 12/08/2010	MW-06 RZ78H 12/08/2010	MW-07R RZ78A 12/08/2010	MW-08 RZ78K 12/07/2010
TOTAL PETROLEUM HYDROCARBONS (mg/L)										
NWTPH-Dx										
Diesel Range Organics	0.5	**0.14**	0.10 U	0.10 U	**0.31**	**0.66**	0.10 U	0.10 U	**1.8**	0.10 U
Lube Oil	0.5	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
NWTPH-Gx										
Gasoline Range Organics	0.8/1.0 (b)	0.10 U	0.10 U	0.10 U	**0.11**	0.25 U	0.10 U	0.10 U	0.10 U	0.10 U
BTEX (µg/L)										
Method SW8021B										
Benzene	5	0.25 U	0.25 U	0.25 U	0.25 U	1.0 U	0.25 U	0.25 U	0.25 U	0.25 U
Toluene	1000	0.25 U	**1.2**	0.25 U	0.25 U	1.0 U	**0.30**	0.25 U	0.25 U	0.25 U
Ethylbenzene	700	0.25 U	0.25 U	0.25 U	0.25 U	1.0 U	0.25 U	0.25 U	0.25 U	0.25 U
m, p-Xylene	1000 (c)	0.50 U	0.50 U	0.50 U	0.50 U	1.0 U	**0.50**	0.50 U	0.50 U	0.50 U
o-Xylene	1000 (c)	0.25 U	0.25 U	0.25 U	0.25 U	1.0 U	**0.30**	0.25 U	0.25 U	0.25 U
CONVENTIONALS (mg/L)										
EPA Method 300.0										
Nitrate	10					**1.2**				
Sulfate	250					**6.1**				
FIELD PARAMETERS										
Conductivity (µS/cm)		124	120	NS	NS	95	227	159	243	NS
Dissolved Oxygen (mg/L)		EE	2.26	NS	NS	0.50	0.46	0.43	EE	NS
pH		6.38	5.81	NS	NS	6.01	6.05	5.88	6.31	NS
ORP (mV)		88.9	195.6	NS	NS	52.4	230.7	297.9	90.8	NS
Ferrous Iron (mg/L)		1.0	0.0	0.0	4.8	0.9	0.0	NS	1.2	0.0

APPENDIX A
DECEMBER 2010 AND FEBRUARY 2011 GROUNDWATER QUALITY RESULTS
PEDERSON'S FRYER FARMS

	MTCA Method A Cleanup Level for Groundwater (a)	MW-09 RZ78M 12/07/2010	MW-10 RZ78O 12/07/2010	MW-11 RZ78J 12/07/2010	MW-12 RZ78L 12/07/2010	MW-13 RZ78I 12/07/2010	MW-15 RZ78B 12/08/2010	MW-17 RZ78E 12/08/2010	MW-17 SH05C 2/01/2011	MW-18 RZ78F 12/08/2010
TOTAL PETROLEUM HYDROCARBONS (mg/L)										
NWTPH-Dx										
Diesel Range Organics	0.5	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	**2.5**	**410**	**6.8**
Lube Oil	0.5	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	40 U	1.0 U
NWTPH-Gx										
Gasoline Range Organics	0.8/1.0 (b)	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	**2.1**	**0.35**	**2.4** J	**0.95**
BTEX (µg/L)										
Method SW8021B										
Benzene	5	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	1.0 UJ	0.25 U
Toluene	1000	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	**3.1**	0.25 U	1.0 UJ	0.25 U
Ethylbenzene	700	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	**6.3**	0.25 U	1.0 UJ	**0.28**
m, p-Xylene	1000 (c)	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	**37**	0.50 U	1.0 UJ	**1.3**
o-Xylene	1000 (c)	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	**0.73**	0.25 U	1.0 UJ	0.25 U
CONVENTIONALS (mg/L)										
EPA Method 300.0										
Nitrate	10								0.1 U	
Sulfate	250								**6.8**	
FIELD PARAMETERS										
Conductivity (µS/cm)		NS	NS	NS	NS	NS	130	205	168	182
Dissolved Oxygen (mg/L)		NS	NS	NS	NS	NS	EE	0.31	0.12	1.78
pH		NS	NS	NS	NS	NS	6.49	6.22	6.26	6.21
ORP (mV)		NS	NS	NS	NS	NS	-89.9	-78.9	-62.5	-78
Ferrous Iron (mg/L)		0.0	0.0	0.0	0.0	0.0	2.0	2.8	1.6	2.0

APPENDIX A
DECEMBER 2010 AND FEBRUARY 2011 GROUNDWATER QUALITY RESULTS
PEDERSON'S FRYER FARMS

	MTCA Method A Cleanup Level for Groundwater (a)	MW-19 RZ79A 12/07/2010	Dup of MW-19 MW-99 RZ79C 12/07/2010	MW-19 SH05A 2/01/2011	MW-20 RZ78N 12/06/2010	MW-21 RZ78D 12/07/2010	MW-22 RZ78P 12/07/2010
TOTAL PETROLEUM HYDROCARBONS (mg/L)							
NWTPH-Dx							
Diesel Range Organics	0.5	**0.17**	**0.18**	**4.7**	**13**	0.10 U	0.10 U
Lube Oil	0.5	0.20 U	0.20 U	0.20 U	2.0 U	0.20 U	0.20 U
NWTPH-Gx							
Gasoline Range Organics	0.8/1.0 (b)	**0.56**	**0.54**	**0.35**	**0.75**	0.10 U	0.10 U
BTEX (µg/L)							
Method SW8021B							
Benzene	5	0.25 U	0.25 U	1.0 U	0.25 U	0.25 U	0.25 U
Toluene	1000	0.25 U	0.25 U	1.0 U	0.25 U	0.25 U	**0.25**
Ethylbenzene	700	0.25 U	0.25 U	1.0 U	0.25 U	0.25 U	0.25 U
m, p-Xylene	1000 (c)	0.50 U	0.50 U	1.0 U	0.50 U	0.50 U	0.50 U
o-Xylene	1000 (c)	0.25 U	0.25 U	1.0 U	0.25 U	0.25 U	**0.34**
CONVENTIONALS (mg/L)							
EPA Method 300.0							
Nitrate	10			0.1 U			
Sulfate	250			**2.8**			
FIELD PARAMETERS							
Conductivity (µS/cm)		199	200	168	214	NS	99
Dissolved Oxygen (mg/L)		0.61	0.69	0.13	EE	NS	0.62
pH		6.31	6.31	6.21	6.22	NS	5.98
ORP (mV)		-98.2	-98.4	-89.1	-101.2	NS	294.9
Ferrous Iron (mg/L)		2.8	2.8	3.0	3.6	0.0	0.0

J = Indicates the analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample
UJ = The analyte was not detected in the sample; the reported sample reporting limit is an estimate
Bold = Detected compound.
NS = Not sampled due to inefficient water levels.
EE = Displayed parameter value at time of sampling was innacurate due to equipment error
Box = Exceedance of cleanup level.
-- = A cleanup level is not available for the individual constituent.
(a) All cleanup levels are MTCA Method A except for Conventionals nitrate and sulfate, which are preliminary Method B cleanu
levels derived from ARARs and WA State Board of Health MCLs.
(b) MTCA Method A cleanup level is 0.8 ug/L if benzene is present and 1.0 ug/L if benzene is not present.
Benzene was not detected in any sample during this event, but has been detected at MW-15 during previous sampling events
(c) Cleanup level cannot be exceeded by the sum of individual xylene concentrations

APPENDIX B

Sampling and Analysis Plan (SAP)

SAP
Remedial Investigation/Feasibility Study
Pederson's Fryer Farms
Pierce County, Washington

March 28, 2011

Prepared for

Washington State Department of Ecology

LANDAU ASSOCIATES
950 Pacific Avenue, Suite 515
Tacoma, WA 98402
(253) 926-2493

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TABLES

1.0 INTRODUCTION

This sampling and analysis plan (SAP) describes the procedures for conducting field activities during the remedial investigation (RI) and feasibility study (FS) at the former Pederson's Fryer Farms (PFF) property (the site) located at 2901 72nd Street East, in Tacoma, Washington. This SAP is an appendix to, and is intended to be used in conjunction with, the Site *Work Plan, Remedial Investigation and Feasibility Study, Pederson's Fryer Farms, Tacoma, Washington* (Work Plan). The primary objective of this SAP is to document sampling and analysis procedures and methodologies that will result in data of sufficient quality to characterize the nature and extent of contamination and provide a basis for developing and selecting cleanup actions. This SAP was prepared consistent with the requirements of WAC 173-340-820.

2.0 FIELD INVESTIGATION PROCEDURES

Planned field investigations associated with the RI/FS include the following:

- Drilling borings and collecting soil samples for chemical analysis at 16 subsurface borings and 10 monitoring well borings[1].
- Installation of four permanent shallow monitoring wells.
- Installation of nine permanent deep monitoring wells.
- Collection of surface soil samples from a former soil stockpile area.
- Collection of groundwater grab samples at boring locations for chemical analysis if groundwater is encountered and the Landau Associates field representative determines that sample collection is warranted.
- Collection of groundwater samples from new and existing groundwater monitoring wells for chemical analysis.
- Abandonment of eight existing wells.

This section describes the field procedures to be employed during the RI/FS field investigations.

2.1 SOIL INVESTIGATION

The soil investigation will consist of collecting and analyzing soil samples from 16 subsurface borings and 10 well borings. Boring locations are shown on Figure 23 of the Work Plan and proposed monitoring well locations are shown on Figures 21 and 22 of the Work Plan. Current Site features are shown on Figure 3 of the Work Plan. The actual location of each soil boring will be surveyed using a map grade global positioning system (GPS). Monitoring wells will be surveyed by a certified professional surveyor as described in Section 4.7 of the Work Plan.

2.1.1 SHALLOW SOIL SAMPLING

Shallow soil samples will be collected from the former soil stockpile location to verify that there is no associated residual soil contamination. The former location of the stockpile is shown on Figure 5 of the Work Plan. Specific sampling locations will be specified to achieve geographic coverage of the sample area.

Soil samples will be tested for diesel- and motor oil-range petroleum hydrocarbons and carcinogenic polycyclic aromatic hydrocarbons (cPAHs). Samples will be collected using the following method:

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[1] Soil contamination is not anticipated at monitoring wells MW-24d, MW-28d, and MW-32d. Therefore, no planned soil samples will be collected unless staining and/or odors are observed. Any collected samples would be analyzed for NWTPH-Gx, NWTPH-Dx, and BTEX.

- Remove grass, organic material, rock, or gravel from the soil surface.
- Using a clean shovel, dig approximately 5 to 6 inches below ground surface (BGS).
- Using a clean stainless steel spoon or trowel, scrape the sidewall of the hole to expose a fresh sampling surface.
- Using the stainless steel spool or trowel, collect soil from 0 to 3 inches BGS of the sidewall and place in a stainless steel bowl.
- Homogenize the soil in the bowl using the stainless-steel spoon or trowel.
- Transfer the homogenized soil into the appropriate laboratory supplied sample container.

Each sample will be properly labeled and documented on the chain-of-custody (COC) and soil collection field forms. Samples will be labeled as SS (for soil sample) and then numerically (i.e., SS-01 through SS-04). Equipment decontamination procedures are described in Section 2.7 and laboratory analysis procedures for soil are described in Sections 2.1.3 of this SAP.

2.1.2 BOREHOLE SAMPLING

Boreholes for well installation will be drilled using a hollow stem auger, sonic drill rig, or direct-push probe. All borings will be completed by a driller licensed in the state of Washington and will be monitored by a Landau Associates field representative. Before and between drilling of each boring and at completion of the project all downhole drilling equipment will be cleaned using a high-pressure hot water or steam washer as described in Section 2.7 of this SAP.

During drilling, continuous soil samples will be collected at each soil boring location if using sonic drilling or direct-push boring methods. Sample recovery is anticipated to be in 3-ft- to 5-ft-long sections for sonic drilling and a maximum of 4-ft-long sections for direct-push boring. Driven samples will be collected every 5 ft if using a hollow stem auger. Maximum sample recovery is 1.5 ft using a 3-inch diameter split-spoon sampler for the hollow-stem auger. Soil lithology will be field-classified and recorded in accordance with the Uniform Soil Classification System (ASTM 1998). A record of the soil and groundwater conditions observed during drilling will be recorded on a Log of Exploration Form. The log will also show soil types, evidence of contamination based on field screening, and other pertinent information.

Retained soil from the borings will be field-screened for evidence of environmental impact. Field-screening will be conducted by visually inspecting the soil for staining and other evidence of environmental impact, performing a sheen test on samples, and monitoring soil vapors for volatile organic compounds (VOCs) using a portable photoionization detector (PID). All field screening notes will be added to the boring logs.

Sheen testing will be conducted during drilling for samples taken at a minimum of 5 ft intervals. Each sample will be handled with a clean pair of nitrile gloves and will be placed in a clean plastic pan. Water will be added to the pan and the contents will be mixed. Visual evidence of sheen on the water surface will be recorded on the boring log at the associated sample interval depth.

PID readings will be recorded on the boring log in units parts per million (PPM). The portion of the recovered sample with the highest PID detection will be retained and submitted for laboratory analysis for each soil quality sampling depth range identified on Table 6 of the Work Plan. If there is no indication of a PID detection, the portion of the sample selected for analysis will be based on the judgment of the Landau Associates field representative. The final sampling interval and boring depth may be modified in the field by the field geologist or engineer in consultation with the Landau Associates project manager based on observed conditions during drilling.

Soil samples collected for analysis of gasoline-range petroleum hydrocarbons and VOCs will be collected in accordance with U.S. Environmental Protection Agency (EPA) Method 5035A. The EPA 5035A soil sampling method is intended to reduce volatilization and biodegradation of samples. The EPA 5035A procedure for soil sample collection is as follows:

- Collect soil "cores" from the sampler using coring devices (i.e., EnCore® sampler, EasyDraw Syringe®, or a Terra Core™ sampling device). Each "core" will consist of approximately 5 grams of soil. Collect three discrete "cores" from each sampling location. One EasyDraw Syringe® or Terra Core™ device will be used to collect the three discrete "cores"; however, if the EnCore® samplers are used, then three sampling devices are required.
- Remove excess soil from coring device. If EasyDraw Syringe® or Terra Core™ sampling device are used for sample collection then place the "cored" soil directly into three preserved 40 milliliter (ml) vials with a stirbar. Vials will be preserved as indicated in Table B-1. If the EnCore® sampler is used, then close the sampler for transport to the laboratory.
- Collect one 2-ounce (oz) soil jar of representative soil for moisture content and laboratory screening purposes. Fill the jar to minimize headspace.

Soil samples to be tested for non-volatile parameters [e.g., total metals (lead), diesel- and motor-oil range petroleum hydrocarbons, cPAHs, and polychlorinated biphenyls (PCBs)] will be collected from the identified soil sampling interval using the following methods:

- Scrape the outside of the soil core to expose a fresh sampling surface using a clean stainless-steel spoon.
- Homogenize the soil in a stainless-steel bowl using the stainless-steel spoon.
- Transfer the homogenized soil into the appropriate laboratory supplied sample container.

Each sample will be properly labeled and documented on the COC and boring logs. Labeling of the soil samples will consist of the following:

- Boring name: each soil sample will be identified by the boring name or the well name if the sample was collected from a boring that will be converted to a well.

- The depth range of the sample interval: in feet from the shallowest to deepest depth.
- Date of sample collection.

An example sample number is A2(13-14)20110421 which is a sample from boring A-2 collected at a depth of 13 to 14 ft BGS on April 21, 2011. Another example sample number is MW25d(35-36) 20110421 which is a sample collected from the installation of monitoring well MW-25d at a depth of 35 to 36 ft BGS on April 21, 2011.

2.1.3 LABORATORY ANALYSIS

Soil samples will be analyzed in accordance with the soil sampling matrix presented in Table 6 of the Work Plan for each of the soil borings. Samples will be tested for gasoline-, diesel-, and motor oil-range petroleum hydrocarbons; total metals (lead); cPAHs; and PCBs depending on the boring location (Table 6 of the Work Plan). An acid/silica gel cleanup will be applied to all soil samples analyzed for diesel-range and oil-range petroleum hydrocarbons. The methods for analysis of the above compounds, as well as containers and holding times are summarized in Table B-1.

2.2 GROUNDWATER INVESTIGATION

The groundwater investigation will consist of installing 13 additional monitoring wells, collecting groundwater samples from each of the new and existing monitoring wells and from the 16 proposed soil borings (if groundwater is encountered), laboratory analysis of the groundwater samples, and groundwater level monitoring. Proposed locations for installation of new permanent monitoring wells are shown on Figures 21 and 22 of the Work Plan and existing monitoring wells are shown on Figure 3 of the Work Plan. Proposed locations for the soil borings are located on Figure 23 of the Work Plan.

2.2.1 SOIL BORING GROUNDWATER GRAB SAMPLING

If groundwater is encountered in the till (i.e., less than 45 ft BGS), groundwater samples may be collected from soil borings at the discretion of the Landau Associates field representative. The groundwater samples will be collected using a groundwater sampler consisting of a 4-ft-long, wire-wrapped, stainless-steel screen (0.010-inch slot size) with a retractable protective steel sheath. The groundwater sampler will be advanced to the sample depth and the protective sheath will be retracted to expose the stainless-steel screen to the formation. Low-flow purging will be performed for 10 minutes or until the purge water is clear using a peristaltic pump with disposable 3/8-inch polyethylene tubing or disposable 5/8-inch polyethylene tubing with a Waterra foot valve if the water level is greater than 20 ft BGS. A peristaltic pump will be used if the groundwater level is less than 20 ft BGS.

Borehole groundwater samples will be collected as described in Section 2.2.2.3 of this SAP. It is anticipated that borehole groundwater samples will be analyzed only for gasoline-, diesel-, and oil-range petroleum hydrocarbons.

2.2.2 MONITORING WELL GROUNDWATER SAMPLING

Groundwater samples will be collected from new and existing monitoring wells in accordance with Section 4.6.2 of the Work Plan. Procedures for installing and developing the new wells and collecting groundwater samples from new and existing monitoring wells and the planned laboratory analyses are described below.

2.2.2.1 Installation and Construction of Monitoring Wells

Boreholes for groundwater monitoring wells will be drilled in accordance with Section 2.1.2 of this SAP. Depending on the depth-to-water at each monitoring well location, the borings will be advanced until the target interval is reached. Monitoring wells will be installed as described in Section 4.6.1 of the Work Plan. Monitoring wells will be constructed by a licensed drilling contractor in the state of Washington, in accordance with the *Minimum Standards for Construction and Maintenance of Wells* (Chapter 173-160 WAC; Ecology 2008). Oversight of drilling and well installation activities will be performed by a Landau Associates field representative experienced with environmental sampling and construction of resource protection wells.

2.2.2.2 Well Development

The monitoring wells will be developed after construction to remove formation material from the well borehole and the filter pack prior to groundwater level measurement and sampling. Development will be achieved by repeatedly surging the well with a surge block and purging the well until the water runs clear; at least five well casing volumes will be removed. During development, the purged groundwater will be monitored for the following field parameters:

- pH
- Specific conductance
- Temperature
- Dissolved oxygen
- Turbidity.

The wells will be developed until the turbidity of the purged groundwater decreases to 5 Nephelometric turbidity units (NTUs), if practicable. Field parameters will not be collected if free-product is identified in the groundwater to prevent equipment contamination. If the well dewaters during the initial surging and purging effort, one final well casing volume will be removed after the well has fully recharged, if practicable. Well development activities will be recorded on a Well Development form.

2.2.2.3 Groundwater Sample Collection

The groundwater samples will be collected no earlier than 2 days after well development. Collection of groundwater samples at each new monitoring well and each existing monitoring well will be completed using low-flow sampling techniques per the following procedures:

- Immediately following removal of each well monument cover, the well head will be observed for damage, leakage, and staining. Additionally, immediately following removal of the well head cap, any odors will be recorded and the condition of the well opening will be observed. Any damage, leakage, or staining to the well head or well opening will be recorded.
- Prior to sampling, each well will be purged using a pump that is attached to dedicated purge and sample collection tubing. A peristaltic pump will be used for wells with a groundwater depth less than 20 ft BGS and a waterra foot valve attached to 5/8-inch tubing will be used on wells with a groundwater level greater than 20 ft. Purging will begin with a low pumping rate. The pumping rate will be maintained at less than 1 liter per minute and with drawdown of less than 1 ft during purging. Purging will continue until specific conductance, pH, temperature, ORP, and dissolved oxygen (field parameters) have stabilized.
- Field parameters, including pH, temperature, specific conductance, dissolved oxygen, and turbidity, will be continuously monitored during purging using a flow cell. Purging of the well will be considered to be complete when all field parameters become stable for three successive readings. The successive readings should be within +/- 0.1 pH units for pH, +/- 3% for conductivity, and +/- 10% for dissolved oxygen and turbidity. Parameters will not be collected if free-product is identified in the groundwater to prevent equipment contamination.
- Purge data will be recorded on a Groundwater Sample Collection form including purge volume; time of commencement and termination of purging; any observations regarding color, turbidity, or other factors that may have been important in evaluation of sample quality; and field measurements of pH, specific conductance, temperature, dissolved oxygen, and turbidity.
- Following the stabilization of field parameters, the flow cell will be disconnected and groundwater samples will be collected. Sample data will be recorded on a Groundwater Sample Collection form, including sample number and time collected; the observed physical characteristics of the sample (e.g., color, turbidity, etc.); and field parameters (pH, specific conductance, temperature, dissolved oxygen, and turbidity).
- Any problems or significant observations will be noted in the “comments” section of the Groundwater Sample Collection form.
- Groundwater samples will be collected directly into the appropriate sample containers using a waterra foot-valve attached to 5/8-inch tubing. To prevent degassing during sampling for gasoline-range petroleum hydrocarbons and benzene, toluene, ethylbenzene, and xylenes (BTEX), a pumping rate will be maintained below about 100 milliliters per minute (ml/min). The gasoline-range petroleum hydrocarbons and BTEX containers will be filled completely

so that no head space remains. Samples will be chilled to 4°C immediately after collection. Clean nitrile gloves will be worn when collecting each sample.

- For select wells (identified in Table 7 of the Work Plan), a groundwater sample will be collected and analyzed for ferrous iron in the field using a HACH kit.
- Groundwater for dissolved metals (lead) analyses will be collected last and field-filtered through a 0.45 micron, in-line disposable filter. Dissolved metal samples will be preserved, as specified in Table B-1. A note will be made on the sample label, sample collection form, and COC to indicate the sample has been field filtered and preserved.

Each sample will be properly labeled and documented on the COC and the Groundwater Sample Collection form. Procedures for labeling groundwater samples are as follows:

- Well or boring name: each soil sample will be identified by the boring name or well name the groundwater sample was collected from.
- Date: each sample name will include the date the sample was collected (year, month, date).

An example sample number is A2-20110420 (groundwater sample from boring A-2 collected on April 20, 2011) and MW25d-20110420 (groundwater sample from monitoring well MW-25d collected on April 20, 2011).

2.2.3 LABORATORY ANALYSIS

Groundwater analyses for each new and existing well is shown in Table 7 of the Work Plan and described in Section 4.6.3 of the Work Plan. Based on location, groundwater samples will be analyzed for gasoline-, diesel-, and oil-range petroleum hydrocarbons; BTEX; methyl t-butyl ether (MTBE); 1,2-dichloroethane; 1,2-dibromoethane; naphthalenes; cPAHs; and/or dissolved lead. Select samples (identified in Table 7 of the Work Plan) will also receive laboratory analysis for sulfate, nitrate, methane, alkalinity, and total organic carbon (TOC) for the monitored natural attenuation (MNA) parameters. The methods for analysis of the above compounds, as well as containers and holding times, are summarized in Table B-1.

2.2.4 GROUNDWATER FLOW MONITORING

To evaluate groundwater flow direction, depth to groundwater will be measured at each new and existing well during each sampling event. Procedures for monitoring groundwater flow are discussed below.

2.2.4.1 Water Level Measurements

Water level measurements will be obtained at each monitoring well prior to purging and sample collection. All water levels will be measured using an electronic water level indicator or oil-water interface probe and will be recorded to the nearest 0.01 ft. Measurements will be taken from the top of the well casing. Decontamination procedures for the indicator and probe are described in Section 2.7.1 of this SAP.

2.2.5 WELL ABANDONMENT

Eight wells (MW-9, MW-12, MW-13, MW-14, MW-16, MW-17, MW-18, and MW-21) will be abandoned. Well locations are shown on Figure 20 of the Work Plan. Well abandonment will be conducted in accordance with the requirements set forth in WAC 173-160-420 and WAC 173-160-460. Prior to the start of decommissioning activities, a Notice of Intent to Decommission Wells and as-built well logs for each well will be submitted to the Washington State Department of Ecology (Ecology) within a minimum of 72 hours prior to the start of abandonment activities. The wells will be abandoned by backfilling the well screens and casings with bentonite chips. Well monuments at each well will be removed and the ground surface compacted and existing asphalt pavement patched. Upon completion of the well abandonment, a Water Well Report accompanied by as-built well decommissioning logs, and a copy of the original Resource Protection Well Report forms will be submitted to Ecology.

2.3 QUALITY ASSURANCE AND QUALITY CONTROL

Analytical samples collected during the RI/FS will follow Quality Assurance/Quality Control (QA/QC) procedures and standards outlined in the Quality Assurance Project Plan (QAPP; Appendix C of the Work Plan). Field QA/QC includes the collection of quality control samples, including blind field duplicate samples, matrix spike and matrix spike duplicate samples, and trip blanks. The procedures for collection of the quality control samples are provided in the QAPP.

2.4 SAMPLE CONTAINERS, PRESERVATION, AND STORAGE

Soil and groundwater samples submitted to the analytical laboratory for analysis will be collected in the appropriate sample container provided by the analytical laboratory. The samples will be preserved by cooling to a temperature of 4°C and as required by the analytical method. Maximum holding and extraction times until analysis is performed will be strictly adhered to by field personnel and the analytical laboratory. Sample containers, preservatives, and holding times for each chemical analysis are presented in Table B-1.

2.5 SAMPLE TRANSPORTATION AND HANDLING

The transportation and handling of groundwater samples will be accomplished in a manner that not only protects the integrity of the sample, but also prevents any detrimental effects due to release of samples. Samples will be logged on a COC form and will be kept on ice in secured coolers under the custody of field personnel or an authorized courier until delivery to the analytical laboratory. The COC will accompany each shipment of samples to the laboratory.

2.6 SAMPLE CUSTODY

The primary objective of sample custody is to create an accurate, written record that can be used to trace the possession and handling of samples so that their quality and integrity can be maintained from collection until completion of all required analyses. Adequate sample custody will be achieved by means of approved field and analytical documentation. Such documentation includes the COC record that is initially completed by the sampler and is, thereafter, signed by those individuals who accept custody of the sample. A sample is in custody if at least one of the following is true:

- It is in someone's physical possession.
- It is in someone's view.
- It is secured in a locked container or otherwise sealed so that tampering will be evident.
- It is kept in a secured area, restricted to authorized personnel only.

Sample control and COC in the field and during transportation to the laboratory will be conducted in general conformance with the procedures described below:

- As few people as possible will handle samples.
- Sample containers will be obtained new or pre-cleaned from the laboratory performing the analyses.
- The sample collector will be personally responsible for the completion of the COC record and the care and custody of samples collected until they are transferred to another person or dispatched properly under COC rules.
- The cooler in which the samples are shipped will be accompanied by the COC record identifying its contents. The original record and laboratory copy will accompany the shipment (sealed inside the shipping container). The other copy will be forwarded to Landau Associates along with sample collection forms.
- Coolers will be sealed with strapping tape and custody seals for shipment to the laboratory. The method of shipment, name of courier, and other pertinent information will be entered in the "remarks" section of the COC record and traffic report.

When samples are transferred, the individuals relinquishing and receiving the samples will sign the COC form and record the date and time of transfer. The sample collector will sign the form in the first signature space. Each person taking custody will observe whether the shipping container is correctly sealed and in the same condition as noted by the previous custodian (if applicable); deviations will be noted on the appropriate section of the COC record.

A designated sample custodian at the laboratory will accept custody of the shipped samples, verify the integrity of the custody seals, and certify that the sample identification numbers match those on the COC record. The custodian will then enter sample identification number data into a bound logbook, which is arranged by a project code and station number. If containers arrive with broken custody seals, the laboratory will note this on the COC record and will immediately notify the sampler and Landau Associates.

2.7 EQUIPMENT DECONTAMINATION

The decontamination procedures described below are to be used by field personnel to clean drilling, sampling, and related field equipment. Deviation from these procedures must be documented in field records.

2.7.1 WATER LEVEL INDICATOR

The tape from the water level indicator or oil-water interface probe will be washed with alconox soap and rinsed with potable water between each well measurement. If the water level indicator or oil-water interface probe is exposed to free-product, the indicator/probe and tape will be cleaned as follows:

1. Equipment will be wiped down with paper towels to remove gross material.
2. Rinse with hexane.
3. Scrub surfaces of equipment with brushes using an Alconox solution.
4. Rinse and scrub equipment with clean tap water.

2.7.2 SAMPLING EQUIPMENT

All sampling equipment used (e.g., stainless-steel bowls, stainless-steel spoons, stainless-steel trowels, shovels, soil split-spoon samplers, etc.) will be cleaned using a three-step process, as follows:

1. Scrub surfaces of equipment that would be in contact with the sample with brushes using an Alconox solution.
2. Rinse and scrub equipment with clean tap water.
3. Rinse equipment a final time with deionized water to remove tap water impurities.

If sampling equipment is exposed to free product, non-dedicated equipment will be cleaned as follows:

1. Equipment will be wiped down with paper towels to remove gross material.
2. Rinse with hexane.
3. Scrub surfaces of equipment with brushes using an Alconox solution.
4. Rinse and scrub equipment with clean tap water.

5. Rinse equipment a final time with deionized water to remove tap water impurities.

Decontamination of the reusable sampling devices will occur between sample collections at each well/boring.

2.7.3 HEAVY EQUIPMENT

Heavy equipment (e.g., the drilling rigs and drilling equipment that is used downhole, or that contacts material and equipment going downhole) will be cleansed by a hot water, high pressure wash before each use and at completion of the project. Potable tap water will be used as the cleansing agent.

2.8 RESIDUAL WASTE MANAGEMENT

Soil cuttings generated during boring advancement will be temporarily stored on site in 55-gallon drums. Disposal methods for soil stored in 55-gallon drums will be determined based on the analytical results for the soil.

Water generated during well development, purging, and decontamination will be temporarily stored on site in 55-gallon drums. Disposal methods for groundwater stored in drums will be determined based on the analytical results for the groundwater samples.

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This document has been prepared under the supervision and direction of the following key staff:

LANDAU ASSOCIATES, INC.

Jessica Stone
Project Scientist

Stacy J. Lane, L.G.
Senior Geologist

JCS/SJL/kes

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TABLE B-1
SAMPLE CONTAINERS, PRESERVATIVES, AND HOLDING TIMES
PEDERSON'S FRYER FARMS

Matrix / Analysis	Analytical Method	Container	Preservation	Maximum Holding Time (Days)
Soil:				
Diesel-Range Motor Oil-Range Petroleum Hydrocarbons	NWTPH-Dx	8-oz. jar - glass	Store cool at 6°C	14
Gasoline-Range Petroleum Hydrocarbons, BTEX	NWTPH-GX, EPA Method 8021	2 x 40-ml vial - glass (1) 1 2-oz jar - glass	Add MeOH Store cool at 6°C 2-oz jar - no headspace	14
Lead	EPA Method 6010	8-oz. jar - glass	Store cool at 6°C	180
PAHs	EPA Method 8270	8-oz. jar - glass	Store cool at 6°C	14
PCBs	EPA Method 8081	8-oz. jar - glass	Store cool at 6°C	14
Water:				
Gasoline-Range Petroleum Hydrocarbons, BTEX, MTBE	NWTPH-GX, EPA Method 8021	2 x 40-ml vials - glass (1)	Add HCl to pH<2; Store cool at 6°C	14
Diesel-Range Motor Oil-Range Petroleum Hydrocarbons	NWTPH-Dx	2 x 500-mL amber glass	Store cool at 6°C	7
VOCs (EDC, BTEX, MTBE)	EPA Method 8260	3 x 40-ml vials - glass (1)	Add HCl to pH<2; Store cool at 6°C	14
1,2-Dibromomethane (EDB)	EPA Method 8011	2 x 60-ml vials - glass (1)	Store cool at 6°C	14
Dissolved Metals	EPA Method 200.8	500-mL polyethylene (1)	Add $HN0_3$; Store cool at 6°C	180
PAHs	EPA Method 8270 (SIM)	2 x 500-mL amber glass	Store cool at 6°C	7
Alkalinity	Standard Method 2320	500-mL polyethylene	Store cool at 6°C	14
Nitrate	EPA Method 300.0	500-mL polyethylene	Store cool at 6°C	48 hours
Sulfate	EPA Method 300.0	Combine with Nitrate	Store cool at 6°C	28
Methane	RSK 175	2 x 40-ml vials - glass (1)	Store cool at 6°C	14
TOC	EPA Method 415.1	250-mL amber glass	Add 2 mL 9N H_2SO_4 pH<2; Store cool at 6°C	28

(1) No headspace.
BTEX = Benzene, Toluene, Ethylbenzene, Xylenes
VOCs = Volatile Organic Compounds
EDC = 1,2-Dichloroethane
MTBE = Methyl tertiary-butyl ether
PCBs = Polychlorinated Biphenyls
SIM = Selected ion monitoring
PAHs = Polycyclic Aromatic Hydrocarbons
TOC = Total Organic Carbon

APPENDIX C

Quality Assurance Project Plan (QAPP)

QAPP
Remedial Investigation/Feasibility Study
Pederson's Fryer Farms
Pierce County, Washington

March 28, 2011

Prepared for

Washington State Department of Ecology

Landau Associates
950 Pacific Avenue, Suite 515
Tacoma, WA 98402
(253) 926-2493

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TABLES

1.0 INTRODUCTION

This quality assurance project plan (QAPP) establishes the quality assurance/quality control (QA/QC) procedures to be used in support of the remedial investigation (RI) and feasibility study (FS) at the former Pederson's Fryer Farms (PFF) property (the site) located at 2901 72nd Street East, in Tacoma, Washington. This QAPP is an appendix to the site *Work Plan, Remedial Investigation and Feasibility Study, Pederson's Fryer Farms, Tacoma, Washington* (Work Plan). This QAPP was prepared using the Washington State Department of Ecology (Ecology) *Guidelines for Preparing Quality Assurance Project Plans for Environmental* Studies (Ecology 2004).

The planned scope of the RI, as described in the Work Plan, includes collection of soil and groundwater samples and submittal of the samples to a laboratory for analysis. This QAPP presents the project quality objectives, laboratory methods, QA/QC requirements, corrective actions, and data management procedures for the RI.

2.0 QUALITY ASSURANCE OBJECTIVES

The QA objectives for this project are to develop and implement procedures that will ensure collection of representative data of known, acceptable, and defensible quality. The data quality parameters used to assess the acceptability of the data are precision, accuracy, representativeness, comparability, and completeness. These parameters are discussed in the following sections.

2.1 DECISION QUALITY OBJECTIVES

The decision quality objectives (DQOs) specify how good the project decisions must be to accomplish the overall project goal. The RI/FS is intended to provide sufficient data, analysis, and evaluations to develop a cleanup action for the site.

The decisions required to meet this goal include:

- The number of samples to collect and the locations of the samples that will be considered sufficient for evaluating cleanup action alternatives
- The analytical methods required to evaluate the data against screening criteria protective of human health and the environment
- The type of media (e.g., soil and groundwater) and site locations that may require cleanup.

To achieve the overall project goal, the DQOs will be to obtain data that are representative of site conditions and that are comparable to selected screening criteria, as described below.

2.2 REPRESENTATIVENESS

Representativeness expresses the degree to which data accurately and precisely represent an actual condition or characteristic of a population. Representativeness can be evaluated using replicate samples, representative sampling locations, and blanks. Representativeness for the RI sampling will be accomplished using appropriate selection of sampling locations for each medium of potential concern (groundwater and soil). A detailed description is provided in the Work Plan and Appendix B [Sampling and Analysis Plan (SAP)] to the Work Plan. A general description of the sampling plan for each medium of concern is described below. To determine that the analytical results are representative of the sampled item and not influenced by cross-contamination, method blanks will be included with each analysis as described in Section 4.5.6.

2.3 COMPARABILITY

Comparability expresses the confidence with which one data set can be evaluated in relation to another data set. For this work, comparability of data will be established through the use of standard analytical methodologies with reporting limits that can meet screening level criteria to the extent practicable, standard reporting formats, and common traceable calibration and reference materials. Methods to be used for analysis of soil and groundwater are discussed in Section 3.0.

2.4 MEASUREMENT QUALITY OBJECTIVES

The measurement quality objectives (MQOs) for the project specify how good the data must be in order to meet the objectives of the project and are based on precision and accuracy, as described in this section.

2.4.1 PRECISION

Precision measures the reproducibility of measurements under a given set of conditions. Specifically, it is a quantitative measure of the variability of a group of measurements compared to their average values. Analytical precision is measured through matrix spike/matrix spike duplicate (MS/MSD) samples for organic analysis and through laboratory duplicate samples for inorganic analyses.

Analytical precision measurements will be carried out on project-specific samples at a minimum frequency of 1 per sample analysis group or 1 in 20 samples, whichever is more frequent per matrix analyzed, as practical. Laboratory precision will be evaluated against quantitative relative percent difference (RPD) performance criteria provided by the laboratory.

Field precision will be evaluated by the collection of groundwater blind field duplicates at a minimum frequency of 1 per sampling event or 1 in 20 samples. No field duplicates will be collected for soil due to the inherent heterogeneity of the medium. Control limits for the groundwater field duplicates and replicates will be 20 percent unless the duplicate sample values are within five times the reporting limit, in which case the control limit interval will be plus or minus the reporting limit.

Precision measurements can be affected by the nearness of a chemical concentration to the method detection limit (MDL), where the percent error (expressed as RPD) increases. The equation used to express precision is as follows:

$$RPD = \left| \frac{C_1 - C_2}{(C_1 + C_2)/2} \right| x\, 100$$

where: C_1 = first sample value

C_2 = second sample value (duplicate)

RPD = relative percent difference.

2.4.2 ACCURACY

Accuracy is an expression of the degree to which a measured or computed value represents the true value. Field accuracy is controlled by adherence to sample collection procedures as outlined in the SAP.

Analytical accuracy may be assessed by analyzing "spiked" samples with known standards (surrogates, laboratory control samples, and/or matrix spike) and measuring the percent recovery. Accuracy measurements on matrix spike samples will be carried out at a minimum frequency of 1 per laboratory analysis group or 1 in 20 samples per matrix analyzed. Because MS/MSDs measure the effects of potential matrix interferences of a specific matrix, the laboratory will perform MS/MSDs only on samples from this investigation and not from other projects. Surrogate recoveries will be determined for every sample analyzed for organics.

Laboratory accuracy will be evaluated against quantitative matrix spike and surrogate spike recovery performance criteria provided by the laboratory. Accuracy can be expressed as a percentage of the true or reference value, or as a percent recovery in those analyses where reference materials are not available and spiked samples are analyzed. The equation used to express accuracy is as follows:

$$\begin{matrix}\textit{Percent}\\ \textit{Recovery}\end{matrix} = \frac{\textit{(Spiked Sample Result - Unspiked Sample Result)}}{\textit{Amount of Spike Added}} \; x \; 100$$

Control limits for percent recovery for soil and groundwater samples will be laboratory acceptance limits generated according to U.S. Environmental Protection Agency (EPA) guidelines.

2.4.3 BIAS

Bias is the systematic or persistent distortion of a measured process that causes errors in one direction. Bias of the laboratory results will be evaluated based on analysis of method blanks and matrix spike samples as described in Section 3.0.

2.4.4 SENSITIVITY

Sensitivity is the ability to discern the difference between very small amounts of a substance. For the purposes of this project, sensitivity is the lowest concentration that can be accurately detected by the analytical method. The analytical method will be considered sufficiently sensitive if the reporting limits are below project screening levels. Proposed method and target reporting limits are discussed in Section 3.0.

2.4.5 COMPLETENESS

Completeness is a measure of the proportion of data obtained from a task sampling plan that is determined to be valid. It is calculated as the number of valid data points divided by the total number of data points requested. The QA objective for completeness during this project will be 95 percent. Completeness will be routinely determined and compared to this control criterion.

3.0 LABORATORY METHODS

Soil samples will be analyzed for the following:

- Diesel-range and motor oil-range petroleum hydrocarbons using Ecology Method NWTPH-Dx with an acid silica gel cleanup
- Gasoline-range petroleum hydrocarbons using Ecology Method NWTPH-G
- Benzene, toluene, ethylbenzene, xylenes (BTEX) using EPA Method 8021
- Carcinogenic polycyclic aromatic hydrocarbons (cPAHs) using EPA Method 8270 with an acid silica gel cleanup
- Lead using EPA Method 6010
- Polychlorinated biphenyls (PCBs) using EPA Method 8081.

Groundwater samples will be analyzed for the following:

- Diesel-range and motor oil-range petroleum hydrocarbons using Ecology Method NWTPH-Dx with an acid silica gel cleanup
- Gasoline- range petroleum hydrocarbons using Ecology Method NWTPH-G
- BTEX and methyl tertiary-butyl ether (MTBE) using EPA Method 8021 and EPA Method 8260
- 1,2-Dibromoethane (EDB) using EPA Method 8011
- 1,2-Dichloroethane (EDC) using EPA Method 8260
- cPAHs and naphthalenes (naphthalene, 1-methylnaphthalene, and 2-methylnaphthylene) using EPA Method 8270 with selected ion monitoring (SIM) and an acid silica gel cleanup
- Lead and manganese using EPA Method 200.8
- Sulfate and nitrate using EPA Method 300
- Alkalinity using Standard Method 2320
- Methane using Method RSK 175
- Total organic carbons using EPA Method 415.1.

Laboratory methods and target reporting limits for the analysis of each of the above constituents in soil and groundwater are summarized in Tables C-1 and C-2. For all groundwater analyses, any suspended material in the sample will be allowed to settle and the sample will not be agitated prior to analysis of the supernatant.

Sample containers, preservation, and holding times are provided in the SAP (Appendix B of the Work Plan).

4.0 QUALITY ASSURANCE/QUALITY CONTROL REQUIREMENTS

This section describes the procedures that will be implemented to: 1) ensure sample integrity from the time of sample collection to the time of analysis in the laboratory, 2) obtain the appropriate chemical and physical data, 3) collect field and laboratory quality control samples, 4) monitor performance of the laboratory and field measurement systems, 5) correct any deviations from the methods or QA requirements established in this QAPP, and 6) report and validate the data.

4.1 LABORATORY INSTRUMENT CALIBRATION

The analytical laboratory project manager is responsible for maintaining laboratory instruments in proper working order including routine maintenance and calibration, and training of personnel in maintenance and calibration procedures. Laboratory instruments will be properly calibrated with appropriate check standards and calibration blanks for each parameter before beginning each analysis. Instrument performance check standards, where required, and calibration blank results will be recorded in a laboratory logbook dedicated to each instrument. At a minimum, the preventive maintenance schedules contained in the EPA methods and in the equipment manufacturer's instructions will be followed. Laboratory calibration procedures and schedules will be as described in the laboratory QAPP.

4.2 FIELD EQUIPMENT CALIBRATION

Field meters, including pH, conductivity, dissolved oxygen (DO), temperature probes, turbidity, and photoionization detector (PID), will be calibrated and maintained in accordance with the manufacturer's specifications. All routine maintenance and calibrations will be recorded in the field sampling logs.

4.3 FIELD DOCUMENTATION

A complete record of all field activities will be maintained for the duration of the field phase of the work. Documentation will include the following:

- Daily recordkeeping by field personnel of all field activities
- Recordkeeping of all samples collected for analysis (field sampling forms)
- Use of sample labels and tracking forms for all samples collected for analysis.

The field logs will provide a description of all sampling activities, sampling personnel, weather conditions, and a record of all modifications to the procedures and plans identified in the SAP. The field logs are intended to provide sufficient data and observations to enable participants to reconstruct events that occurred during the sampling period.

Sample possession and handling will also be documented so that it is traceable from the time of sample collection to the laboratory and data analysis. Sample chain-of-custody forms and procedures are described in the SAP.

4.4 SAMPLE HANDLING PROCEDURES AND TRANSFER OF CUSTODY

Samples submitted to the analytical laboratory will be collected in the appropriate sample containers and preserved as specified in Table B-1 of the SAP. The storage temperatures and maximum holding times for physical/chemical analyses are also provided in Table B-1 of the SAP.

The transportation and handling of samples will be accomplished in a manner that not only protects the integrity of the sample, but also prevents any detrimental effects due to the release of samples. Samples will be logged on a chain-of-custody form and will be kept in coolers on ice until delivery to the analytical laboratory. The chain-of-custody form will accompany each shipment of samples to the laboratory. Procedures for sample transportation and handling are described in Section 2.6 of the SAP.

4.5 FIELD AND LABORATORY QUALITY CONTROL SAMPLES

Field and analytical laboratory control samples will be collected to evaluate data precision, accuracy, representativeness, completeness, and comparability of the analytical results for this investigation. Soil and groundwater quality control samples are described below. The frequency at which they will be collected and/or analyzed is also described.

4.5.1 BLIND FIELD DUPLICATES

A blind field duplicate will be collected at a frequency of at least 1 per 20 groundwater samples per chemical analysis, not including QC samples, but not less than one field duplicate per sampling event (any continuous sampling period not interrupted by more than 2 days). The blind field duplicate will consist of a split sample collected at a single sample location. No soil blind field duplicate samples will be collected due to the inherent heterogeneity of the samples. Groundwater blind field duplicates will be collected by alternately filling sample containers for both the original and the corresponding duplicate sample at the same location to decrease variability between the duplicates. Blind field duplicate sample results will be used to evaluate data precision.

4.5.2 FIELD TRIP BLANKS

Field trip blanks will consist of de-ionized or distilled water sealed in a sample container provided by the analytical laboratory. The trip blank will accompany samples collected for the analysis of gasoline-range petroleum hydrocarbons and BTEX during transportation to and from the field, and then will be returned to the laboratory with each shipment. The trip blank will remain unopened until submitted to the laboratory for analysis. One trip blank per cooler containing groundwater and soil samples for gasoline-range petroleum hydrocarbons and BTEX analyses will be evaluated to determine possible sample contamination during transport.

4.5.3 LABORATORY MATRIX SPIKE

A minimum of 1 laboratory MS per 20 samples, or 1 MS sample per batch of samples if fewer than 20 samples are obtained in a sample event, will be included for all organic and inorganic analyses. The matrix spikes will be performed using site samples. These analyses will be performed to provide information on accuracy and to verify that extraction and concentration levels are acceptable. The laboratory spikes will follow EPA guidance for matrix and blank spikes.

4.5.4 LABORATORY MATRIX SPIKE DUPLICATE

A minimum of 1 laboratory MSD per 20 samples, or 1 MSD sample per batch of samples if fewer than 20 samples are obtained in a sample event, will be included for all organic analyses. The analysis of MSD samples will be performed to provide information on the precision of chemical analyses. The laboratory spikes will follow EPA guidance for matrix and blank spike duplicates.

4.5.5 LABORATORY DUPLICATES

A minimum of 1 laboratory duplicate per 20 samples, or 1 laboratory duplicate sample per batch of samples if fewer than 20 samples are obtained in a sample event, will be analyzed for metals. These analyses will be performed to provide information on the precision of chemical analyses. The laboratory duplicate will follow EPA guidance in the method.

4.5.6 LABORATORY METHOD BLANKS

A minimum of 1 laboratory method blank per 20 samples, one every 12 hours, or 1 per batch of samples analyzed (if fewer than 20 samples are analyzed in a sample event), will be analyzed for all parameters to assess possible laboratory contamination. Dilution water will be used whenever possible. Method blanks will contain all reagents used for analysis. The generation and analysis of additional method, reagent, and glassware blanks may be necessary to verify that laboratory procedures do not contaminate samples.

4.5.7 LABORATORY CONTROL SAMPLE

A minimum of 1 laboratory control sample per 20 samples, or 1 laboratory control sample per sample batch if fewer than 20 samples are obtained in a sample event, will be analyzed for all parameters.

4.5.8 SURROGATE SPIKES

All project samples analyzed for organic compounds will be spiked with appropriate surrogate compounds as defined by the analytical methods.

4.6 LABORATORY QUALITY ASSURANCE/QUALITY CONTROL FOR CHEMICAL AND CONVENTIONAL ANALYSES

QA/QC for chemical testing includes laboratory instrument and analytical method QA/QC. Instrument QA/QC monitors the performance of the instrument and method QA/QC monitors the performance of sample preparation procedures. The analytical laboratory will be responsible for instrument and method QA/QC. QA/QC procedures to be performed by the laboratory for analysis of soil and groundwater samples will be in accordance with methods specified in Tables C-1 and C-2.

When an instrument or method control limit is exceeded, the laboratory will contact the project manager immediately. The laboratory will be responsible for correcting the problem and will reanalyze the samples within the sample holding time if sample reanalysis is appropriate. Corrective actions are described further in Section 5.0.

5.0 CORRECTIVE ACTIONS

Corrective actions will be needed for two categories of nonconformance:

- Deviations from the methods or QA requirements established in this QAPP
- Equipment or analytical malfunctions.

Corrective action procedures to be implemented based on detection of unacceptable data are developed on a case-by-case basis. Such actions may include one or more of the following:

- Altering procedures in the field
- Using a different batch of sample containers
- Performing an audit of field or laboratory procedures
- Reanalyzing samples (if holding times allow)
- Resampling and analyzing
- Evaluating sampling and analytical procedures to determine possible causes of the discrepancies
- Accepting the data without action, acknowledging the level of uncertainty
- Rejecting the data as unusable.

During field operations and sampling procedures, the field personnel will be responsible for conducting and reporting required corrective actions. A description of any action taken will be entered in the field sample collection forms. The project manager will be consulted immediately if field conditions are such that conformance with this QAPP is not possible. The field coordinator will consult with the Landau Associates project manager, who may authorize changes or exceptions to the QA/QC portion of the QAPP, as necessary and appropriate.

During laboratory analysis, the laboratory QA officer will be responsible for taking required corrective actions in response to equipment malfunctions. If an analysis does not meet DQOs outlined in this QAPP, corrective action will follow the guidelines in the noted EPA analytical methods and the EPA guidelines for data validation for organic and inorganic analyses (EPA 2008, 2010). At a minimum, the laboratory will be responsible for monitoring the following:

- Calibration check compounds must be within performance criteria specified in the EPA method or corrective action must be taken prior to initiation of sample analysis. No analyses may be performed until these criteria are met.
- Before processing any samples, the analyst should demonstrate, through analysis of a reagent blank, that interferences from the analytical system, glassware, and reagents are within acceptable limits. Each time a set of samples is extracted or there is a change in reagents, a reagent blank should be processed as a safeguard against chronic laboratory contamination. The blank samples should be carried through all stages of the sample preparation and measurement steps.
- Method blanks should, in general, be below instrument detection limits. If contaminants are present, then the source of contamination must be investigated, corrective action taken and

documented, and all samples associated with a contaminated blank reanalyzed. If, upon reanalysis, blanks do not meet these requirements, Landau Associates will be notified immediately to discuss whether analyses may proceed.

- Surrogate spike analysis must be within the specified range for recovery limits for each analytical method used or corrective action must be taken and documented. Corrective action includes: 1) reviewing calculations, 2) checking surrogate solutions, 3) checking internal standards, and 4) checking instrument performance. Subsequent action could include recalculating the data and/or reanalyzing the sample if any of the above checks reveal a problem. If the problem is determined to be caused by matrix interference, reanalysis may be waived if so directed following consultation with Landau Associates. If the problem cannot be corrected through reanalysis, the laboratory will notify Landau Associates prior to data submittal so that additional corrective action can be taken, if appropriate.
- If the recovery of a surrogate compound in the method blank is outside the recovery limits, the blank will be reanalyzed along with all samples associated with that blank. If the surrogate recovery is still outside the limits, Landau Associates will be notified immediately to discuss whether analyses may proceed.
- If quantitation limits or matrix spike control limits cannot be met for a sample, Landau Associates will be notified immediately to discuss corrective action required.
- If holding times are exceeded, all positive and undetected results may need to be qualified as estimated concentrations. If holding times are grossly exceeded, Landau Associates may determine the data to be unusable.

If analytical conditions are such that nonconformance with this QAPP is indicated, Landau Associates will be notified as soon as possible so that any additional corrective actions can be taken. The laboratory project manager will then document the corrective action by a memorandum submitted to Landau Associates. A narrative describing the anomaly, the steps taken to identify and correct the anomaly, and any recalculation, reanalyses, or re-extractions will be submitted with the data package in the form of a cover letter.

5.1 DATA VERIFICATION AND VALIDATION

Prior to submitting a laboratory report, the laboratory will verify that all the data are consistent, correct, and complete, with no errors or omissions. Following receipt of the laboratory report, a Stage 2A verification and validation check, as defined in EPA's *Guidance for Labeling Externally Validated Laboratory Analytical Data for Superfund Use* (EPA 2009), will be conducted to determine if the analytical results are acceptable and meet the quality objectives described in Section 2.1. The Stage 2A verification and validation check for each laboratory data package will include the following:

- Verification that the laboratory data package contains all necessary documentation (including chain-of-custody records; identification of samples received by the laboratory; date and time of receipt of the samples at the laboratory; sample conditions upon receipt at the laboratory; date and time of sample analysis; and, if applicable, date of extraction, definition of laboratory data qualifiers, all sample-related quality control data, and quality control acceptance criteria).

- Verification that all requested analyses, special cleanups, and special handling methods were performed.
- Verification that quality control samples are performed as specified in this QAPP.
- Evaluation of sample holding times.
- Evaluation of quality control data compared to acceptance criteria, including method blanks, surrogate recoveries, matrix spike and matrix spike duplicate results, laboratory duplicate and/or replicate results, laboratory control sample results, and blind field duplicate results.
- Evaluation of reporting limits compared to target reporting limits specified in this QAPP.
- The data validation will be accomplished according to applicable portions of the National Functional Guidelines for Superfund Organic Methods Data Review (EPA 2008) and the National Functional Guidelines for Inorganic Superfund Data Review (EPA 2010).

In the event that a portion of the data is outside the DQO limits or the limits specified in the EPA guidance documents, or sample collection and/or documentation practices are deficient, corrective action(s) will be initiated. Corrective action, as described in Section 5.0, will be determined by the field coordinator and Landau Associates' QA officer in consultation with the Landau Associates project/task manager and may include any of the following:

- Rejection of the data and resampling
- Qualification of the data
- Modified field and/or laboratory procedures.

Data qualification arising from data validation activities will be described in the data validation technical memorandum, rather than in individual corrective action reports.

6.0 DATA MANAGEMENT PROCEDURES

All laboratory analytical results, including QC data, will be submitted in hard copy and electronically to Landau Associates. The electronic format will include comma separated value (CSV) files that will be downloaded directly to an Excel spreadsheet. Following validation of the data, any qualifiers will be added to the Excel spreadsheets. All survey data will be provided electronically in a format that can be downloaded into an Excel spreadsheet. All field data (groundwater field parameter data and water level measurements) will be entered into an Excel spreadsheet and verified to determine all entered data are correct and without omissions and errors. Following receipt of all RI data and all survey data, water level measurements, field parameters, and analytical results will be formatted electronically and downloaded to Ecology's Environmental Information Management (EIM) system.

* * * * * * * * * *

This document has been prepared under the supervision and direction of the following key staff:

LANDAU ASSOCIATES, INC.

Jessica Stone
Project Scientist

Stacy J. Lane, L.G.
Senior Geologist

JCS/SJL/ccy

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TABLE C-1
SOIL ANALYTICAL METHODS AND TARGET REPORTING LIMITS
PEDERSON'S FRYER FARMS

Analyte	Analytical Method (a)	Target Reporting Limits (b)
PAHs		
Naphthalene	EPA Method 8270 (c)	0.067 mg/kg
1-Methylnaphthalene	EPA Method 8270 (c)	0.067 mg/kg
2-Methylnaphthalene	EPA Method 8270 (c)	0.067 mg/kg
Acenaphthylene	EPA Method 8270 (c)	0.067 mg/kg
Acenaphthene	EPA Method 8270 (c)	0.067 mg/kg
Dibenzofuran	EPA Method 8270 (c)	0.067 mg/kg
Fluorene	EPA Method 8270 (c)	0.067 mg/kg
Phenanthrene	EPA Method 8270 (c)	0.067 mg/kg
Anthracene	EPA Method 8270 (c)	0.067 mg/kg
Fluoranthene	EPA Method 8270 (c)	0.067 mg/kg
Pyrene	EPA Method 8270 (c)	0.067 mg/kg
Benzo(a)anthracene	EPA Method 8270 (c)	0.067 mg/kg
Chrysene	EPA Method 8270 (c)	0.067 mg/kg
Benzo(b)fluoranthene	EPA Method 8270 (c)	0.067 mg/kg
Benzo(k)fluoranthene	EPA Method 8270 (c)	0.067 mg/kg
Benzo(a)pyrene	EPA Method 8270 (c)	0.067 mg/kg
Indeno(1,2,3-cd)pyrene	EPA Method 8270 (c)	0.067 mg/kg
Dibenz(a,h)anthracene	EPA Method 8270 (c)	0.067 mg/kg
Benzo(g,h,i)perylene	EPA Method 8270 (c)	0.067 mg/kg
VOLATILE ORGANIC COMPOUNDS		
Benzene	EPA Method 8021	0.025 mg/kg
Toluene	EPA Method 8021	0.025 mg/kg
Ethylbenzene	EPA Method 8021	0.025 mg/kg
m,p-Xylene	EPA Method 8021	0.050 mg/kg
o-Xylene	EPA Method 8021	0.025 mg/kg
METALS		
Lead	EPA Method 6010	2.0 mg/kg
PCBs		
Aroclor 1016	EPA Method 8082	0.033 mg/kg
Aroclor 1242	EPA Method 8082	0.033 mg/kg
Aroclor 1248	EPA Method 8082	0.033 mg/kg
Aroclor 1254	EPA Method 8082	0.033 mg/kg
Aroclor 1260	EPA Method 8082	0.033 mg/kg
Aroclor 1221	EPA Method 8082	0.033 mg/kg
Aroclor 1232	EPA Method 8082	0.033 mg/kg
Total Petroleum Hydrocarbons		
Gasoline-Range Petroleum Hydrocarbons	NWTPH-Gx (d)	5 mg/kg
Diesel-Range Petroleum Hydrocarbons	NWTPH-Dx (c,d)	5 mg/kg
Motor Oil-Range Petroleum Hydrocarbons	NWTPH-Dx (c,d)	10 mg/kg

(a) Analytical methods are from SW-846 (EPA 1986) and upddates.
(b) Reporting limit goals are based on current laboratory data and may be modified during the investigation process as methodology is refined. Laboratory reporting will be based on the lowest standard on the calibration curve. Instances may arise where high sample concentrations, nonhomogeneity of samples, or matrix interferences preclude achieving the desired reporting limits.
(c) An acid silica gel cleanup will be applied.
(d) Methods NWTPH-G and NWTPH-Dx as described in *Analytical Methods for Petroleum Hydrocarbons* (Ecology 1997).

TABLE C-2
GROUNDWATER ANALYTICAL METHODS AND TARGET REPORTING LIMITS
PEDERSON'S FRYER FARMS

Analyte	Analytical Method (a)	Target Reporting Limits (b)
PAHs		
Naphthalene	EPA Method 8270 SIM (c)	0.1 µg/L
1-Methylnaphthalene	EPA Method 8270 SIM (c)	5.0 µg/L
2-Methylnaphthalene	EPA Method 8270 SIM (c)	5.0 µg/L
Acenaphthylene	EPA Method 8270 SIM (c)	0.1 µg/L
Acenaphthene	EPA Method 8270 SIM (c)	0.1 µg/L
Dibenzofuran	EPA Method 8270 SIM (c)	0.1 µg/L
Fluorene	EPA Method 8270 SIM (c)	0.1 µg/L
Phenanthrene	EPA Method 8270 SIM (c)	0.1 µg/L
Anthracene	EPA Method 8270 SIM (c)	0.1 µg/L
Fluoranthene	EPA Method 8270 SIM (c)	0.1 µg/L
Pyrene	EPA Method 8270 SIM (c)	0.1 µg/L
Benzo(a)anthracene	EPA Method 8270 SIM (c)	0.1 µg/L
Chrysene	EPA Method 8270 SIM (c)	0.1 µg/L
Benzo(b)fluoranthene	EPA Method 8270 SIM (c)	0.1 µg/L
Benzo(k)fluoranthene	EPA Method 8270 SIM (c)	0.1 µg/L
Benzo(a)pyrene	EPA Method 8270 SIM (c)	0.1 µg/L
Indeno(1,2,3-cd)pyrene	EPA Method 8270 SIM (c)	0.1 µg/L
Dibenz(a,h)anthracene	EPA Method 8270 SIM (c)	0.1 µg/L
Benzo(g,h,i)perylene	EPA Method 8270 SIM (c)	0.1 µg/L
VOLATILES		
1,2-Dichloroethane (EDC)	EPA Method 8260	0.2 µg/L
Benzene	EPA Methods 8021 and 8260	0.25 / 0.2 µg/L
Toluene	EPA Methods 8021 and 8260	0.25 / 0.2 µg/L
Ethylbenzene	EPA Methods 8021 and 8260	0.25 / 0.2 µg/L
m,p-Xylene	EPA Methods 8021 and 8260	0.50 / 0.4 µg/L
o-Xylene	EPA Methods 8021 and 8260	0.25 / 0.2 µg/L
1,2-Dibromomethane (EDB)	EPA Method 8011	0.01 µg/L
Methyl tertiary-butyl ether	EPA Methods 8021 and 8260	0.50 / 0.50 µg/L
DISSOLVED METALS		
Lead	EPA Method 200.8	1.0 µg/L
Manganese	EPA Method 200.8	0.5 µg/L
Total Petroleum Hydrocarbons		
Gasoline-Range Petroleum Hydrocarbons	NWTPH-Gx (c,d)	0.25 mg/L
Diesel-Range Petroleum Hydrocarbons	NWTPH-Dx (c,d)	0.25 mg/L
Motor Oil-Range Petroleum Hydrocarbons	NWTPH-Dx (c,d)	0.5 mg/L
CONVENTIONALS		
Alkalinity	Standard Method 2320	1.0 mg/L
Nitrate	EPA Method 300.0	0.0 mg/L
Sulfate	EPA Method 300.0	2.0 mg/L
Methane	RSK 175	0.7 mg/L
Total Organic Carbon	EPA Method 415.1	1.5 mg/L

SIM = Selected ion monitoring

(a) Analytical methods are from SW-846 (EPA 1986) and updates.
(b) Reporting limits goals are based on current laboratory data and may be modified during the investigation process as methodology is refined. Laboratory reporting will be based on the lowest standard on the calibration curve. Instances may arise where high sample concentrations, nonhomogeneity of samples, or matrix interferences preclude achieving the desired reporting limits.
(c) An acid silica gel cleanup will be applied.
(d) Methods NWTPH-G and NWTPH-Dx as described in *Analytical Methods for Petroleum Hydrocarbons* (Ecology 1997).

APPENDIX D

Health and Safety Plan (HASP)

HASP
Remedial Investigation/Feasibility Study
Pederson's Fryer Farms
Pierce County, Washington

March 28, 2011

Prepared for

Washington State Department of Ecology

LANDAU ASSOCIATES
950 Pacific Avenue, Suite 515
Tacoma, WA 98402
(253) 926-2493

LANDAU ASSOCIATES
ENVIRONMENTAL | GEOTECHNICAL | NATURAL RESOURCES

WORK LOCATION PERSONNEL PROTECTION AND SAFETY EVALUATION FORM

Attach Pertinent Documents/Data
Fill in Blanks As Appropriate

Job No.:	0136006.010		
Prepared by:	Jessica Stone	Reviewed by:	Christine Kimmel
Date:	March 28, 2011	Date:	March 5, 2011

A. WORK LOCATION DESCRIPTION

1. **Project Name:** Pederson's Fryer Farm RI/FS
2. **Location:** 2901 72nd Street East, Tacoma, Washington
3. **Anticipated Activities:** Well installation, well decommissioning, groundwater and soil sampling, groundwater injection.
4. **Size:** Approximately 10 acres
5. **Surrounding Population:** Rural, with some residential and commercial
6. **Buildings/Homes/Industry:** Vacant, undeveloped land to the north; commercial retail (smoke shop/trading post) to the east; Mount Rainier Lutheran School campus to the south; Vietnamese Buddhist community of Tacoma facility to the west.
7. **Topography:** Flat
8. **Anticipated Weather:** 45 to 60 degrees, potential rain
9. **Unusual Features:** Site contains buildings in moderate to poor condition, old vehicles, equipment and materials from previous site operations (poultry processing facility).
10. **Site History:** Pederson's Fryer Farms operated as a poultry processing facility from 1948 to 1998. The property is primarily vacant, but is occasionally used as a warehouse and for distribution for a floral company (plants, flowers, and Christmas trees). Eleven underground storage tanks (USTs) containing gasoline, diesel, and/or heavy oil were historically located on site. All but two of the tanks have been removed; the two remaining tanks have been closed in place due to interference from structures that prevent their removal. The site has soil and groundwater contaminated with petroleum hydrocarbons. Previous investigations from 1999 through 2010 indicate diesel-range petroleum hydrocarbons concentrations up to 48,000 mg/kg in soil and 560 mg/L in groundwater; and gasoline-range petroleum hydrocarbons up to 3,000 mg/kg in the soil and 44 mg/L in groundwater. Groundwater samples also indicate historical benzene concentrations up to 8 μg/L, toluene up to 94 μg/L, xylene up to 270 μg/L, and ethylbenzene concentrations up to 280 μg/L. Concentrations of these constituents in groundwater are currently lower. Benzene was not detected

during the last sampling event and maximum concentrations of ethylbenzene, toluene and xylene were 6.3 µg/L, 3.1 µg/L, and 37 µg/L respectively. Lead has been sampled in soil at the site with the highest concentration at 6 mg/kg, well below background soil lead concentrations.

B. HAZARD DESCRIPTION

1. Background Review: ☒ Complete ☐ Partial

If partial, why?

2. Hazardous Level: ☐ B ☐ C ☒ D ☐ Unknown

Justification: Limited exposure during sampling activities. Petroleum hydrocarbons, lead, BTEX, and cPAH possible.

3. Types of Hazards: (Attach additional sheets as necessary)

A. ☒ Chemical ☒ Inhalation ☒ Explosive
☐ Biological ☒ Ingestion ☐ O2 Def. ☒ Skin Contact

Describe: Exposure to chemical hazards from gasoline, diesel, and heavy oil products. Nitrile gloves will be worn, tyvex chemical resistant suite will be available and worn if petroleum free product phase is known or suspected to be present and there is risk of contaminating clothing. Incidental inhalation and ingestion possible from sampling process. Respirator will be worn if vapor levels warrant. Vapor levels may result in explosive conditions, site activities to be monitored with explosive meter.

B. ☒ Physical ☒ Cold Stress ☒ Noise ☐ Heat Stress ☐ Other

Describe: Physical hazards from equipment and overhead obstacles (e.g., overhead power lines, or overhead objects inside building) may be encountered during exploration activities. Noise hazards may be associated with exploration equipment. Ear protection will be used. Steel-toe boots will be worn at all times due to heavy object hazards. Potential trip and fall hazards associated with exploration equipment will be minimized by keeping the work area clean and organized. Due to the cold temperatures, warm clothing and rain gear (if needed) will be worn.

C. ☐ Radiation

Describe:

4. Nature of Hazards:

☒ Air — Describe: Potential vapors of petroleum hydrocarbon constituents.

☒ Soil — Describe: Potential exposure to contaminated soil containing petroleum hydrocarbons, toluene, xylene, and ethylbenzene constituents. Historically, cPAH contaminated soil has also been encountered at the site. PCBs have not been found at the site but could potentially be present along with petroleum contamination.

☐ Surface Water — Describe:

☒ Groundwater — Describe: Potential exposure to contaminated groundwater containing petroleum hydrocarbons, benzene, toluene, xylene, and ethylbenzene constituents. Historically, one groundwater sample from the site at MW-8 also contained 1,2-dichloroethane.

☐ Other — Describe:

5. Chemical Contaminants of Concern ☐ N/A

Contaminant	PEL (ppm unless stated)	IDLH (ppm)	Source/Quantity Characteristics	Route of Exposure	Symptoms of Acute Exposure	Instruments Used to Monitor Contaminant
Diesel- and Heavy Oil-Range Petroleum Hydrocarbons	100 (as petroleum distillates; naphtha) *source: WA State*	400 (as petroleum distillates; naphtha) *source: NIOSH*	Soil concentrations up to 48,000 mg/kg; groundwater concentrations up to 560 mg/L	Inhalation, ingestion, dermal contact, eye contact	Irritation of eyes, nose, throat, nausea, dizziness, headache, dry cracked skin	Olfactory, visual, PID
Gasoline-Range Petroleum Hydrocarbons	100 (as petroleum distillates; naphtha) *source: WA State*	400 (as petroleum distillates; naphtha) *source: NIOSH*	Soil concentrations up to 3,000 mg/kg; groundwater concentrations up to 44 mg/L	Inhalation, ingestion, dermal contact, eye contact	Nervous excitation, insomnia gastrointestinal symptoms, encephalopathy, anxiety, delirium, delusions, convulsions, and acute psychosis	Olfactory, visual, PID
Hexane	TWA 100 ppm *source: NIOSH*	Not determined *source: NIOSH*	Used a cleaning agent for equipment	Inhalation, ingestion, dermal contact, eye contact	Irritation of eyes, skin, nose, throat, nausea, headache, vomiting	Non-applicable
cPAH (Polycyclic Aromatic Hydrocarbons) (Coal tar pitch volatiles)	Ca, TWA 0.1 mg/m^3 *source: NIOSH*	0.1 mg/m^3 *source: NIOSH*	Soil and groundwater at unknown concentrations	Skin absorption or contact, inhalation	Dermatitis, bronchitis, affects respiration system, skin, bladder and kidneys	Non-applicable
PCBs	1 mg/m^3 (skin) *source: NIOSH*	Carcinogen (5 mg/m^3) *source: NIOSH*	Soil and groundwater at unknown concentrations	Skin absorption or contact, inhalation	Eye irritant, chloracne, liver damage (carcinogenic)	Non-applicable
Benzene	0.1 ppm	500/5.0 (WA STEL)	Soil at unknown concentrations; groundwater concentrations up to 8.0 µg/L	Inhalation, ingestion, absorption, and skin or eye contact.	Irritated eyes, skin, nose, and respiratory system, giddiness, headache, nausea, staggered gait, dermatitis, fatigue, anorexia, lassitude, bone marrow depressant. (carcinogenic)	PID meter

Contaminant	PEL (ppm unless stated)	IDLH (ppm)	Source/Quantity Characteristics	Route of Exposure	Symptoms of Acute Exposure	Instruments Used to Monitor Contaminant
Toluene	100 ppm	500/150(WA STEL)	Soil at unknown concentrations; groundwater concentrations up to 94 µg/L	Inhalation, ingestion, percutaneous absorption, and skin & eye contact.	Headache, dizziness, drowsiness, coordination problems, & coma	PID monitoring
Xylene	100 ppm	900/150 (WA STEL)	Soil at unknown concentrations; groundwater concentrations up to270 µg/L	Inhalation, ingestion, percutaneous absorption, and skin & eye contact.	Nervous system depression, liver and kidney damage.	PID monitoring
Ethylbenzene	100 ppm	800/125 (WA STEL)	Soil at unknown concentrations; groundwater at concentrations up to 280 µg/L	Inhalation, ingestion, percutaneous absorption, and skin & eye contact.	Nervous system depression, headaches, dizziness, nausea, convulsions, & coma	PID monitoring
1,2-Dichloroethane	Ca, TWA 4 mg/m^3 *source: NIOSH*	50 ppm *source: NIOSH*	Soil and groundwater at unknown concentrations	Inhalation, ingestion, absorption, and skin or eye contact.	Eye irritant, corneal opacity, nervous system depression, vomiting	PID monitoring

Notes:

PEL Permissible Exposure Limits
IDLH Immediately Dangerous to Life or Health
STEL Washington State Short Term Exposure Limit

Source/Quantity Characteristics are based on maximum concentrations detected on site between 1999 to 2011

6. Physical Hazards of Concern ☐ N/A

Hazard	Description	Location	Procedures Used to Monitor Hazard
Slip/trip	Wet or uneven ground, equipment, tubing, hoses	Throughout area	Visual and area awareness, keep work area clean and organized
Overhead utilities	Drill rig connecting with overhead utilities	Drill locations	Coordination with drillers and care when selecting drill locations
Heavy lifting	Moving or lifting heavy objects	Throughout area	Visual and area awareness
Pinch points	Contact with equipment and heavy objects	Throughout area	Visual and area awareness

7. Work Location Instrument Readings ☐ N/A

Location: ____________________

Percent O_2: ____________________ Percent LEL: ____________________

Radioactivity: ____________________ PID: ____________________

FID: ____________________ Other: ____________________

Other: ____________________ Other: ____________________

Other: ____________________ Other: ____________________

Location: ____________________

Percent O_2: ____________________ Percent LEL: ____________________

Radioactivity: ____________________ PID: ____________________

FID: ____________________ Other: ____________________

Other: ____________________ Other: ____________________

Other: ____________________ Other: ____________________

Location: ____________________

Percent O_2: ____________________ Percent LEL: ____________________

Radioactivity: ____________________ PID: ____________________

FID: ____________________ Other: ____________________

Other: ____________________ Other: ____________________

Other: ____________________ Other: ____________________

Location: ____________________

Percent O_2: ____________________ Percent LEL: ____________________

Radioactivity: ____________________ PID: ____________________

FID: ____________________ Other: ____________________

Other: ____________________ Other: ____________________

Other: ____________________ Other: ____________________

8. Hazards Expected In Preparation For Work Assignment ☐ N/A

Describe:

C. PERSONAL PROTECTIVE EQUIPMENT

1. Level of Protection

☐ A ☐ B ☐ C ☒ D

Location/Activity: Monitoring well installation and soil borings, groundwater injection. If conditions warrant, upgrade to Level C PPE. Modified level D includes use of Tyvek coveralls to protect skin and clothing from contaminated soil or groundwater.

☐ A ☐ B ☒ C ☐ D

Location/Activity: If action levels are exceeded during drilling or sampling activities. Modified C in area with known or suspected petroleum free product.

2. Protective Equipment (specify probable quantity required)

Respirator ☐ N/A

☐ SCBA, Airline
☐ Full-Face Respirator
☒ Half-Face Respirator (Cart. organic vapor) (Only if upgrade to Level C)
☐ Escape mask
☐ None
☐ Other:
☐ Other:

Clothing ☐ N/A

☐ Fully Encapsulating Suit
☐ Chemically Resistant Splash Suit
☐ Apron, Specify:
☒ Tyvek Coverall (only if upgrade to Modified D)
☐ Saranex Coverall
☐ Coverall, Specify
☒ Other: long sleeves and pants, reflective vest

Head & Eye ☐ N/A

☒ Hard Hat
☐ Goggles
☐ Face Shield
☒ Safety Eyeglasses
☐ Other:

Hand Protection ☐ N/A

☒ Undergloves; Type: Nitrile (only if upgrade to Modified D or Level C)
☒ Gloves; Type: Nitrile
☒ Overgloves; Type: Neoprene (only if upgrade to Modified D or Level C)
☐ None
☐ Other:

Foot Protection ☐ N/A

☐ Neoprene Safety Boots with Steel Toe/Shank
☐ Disposable Overboots
☒ Other: Steel toe boots

3. Monitoring Equipment ☐ N/A

☒ CGI	☒ PID
☐ O^2 Meter	☐ FID
☐ Rad Survey	☐ HAM particulate meter (if visible dust is present)
☐ Detector Tubes (optional)	

Type:

D. DECONTAMINATION

PERSONAL DECONTAMINATION

☒ Required ☐ Not Required

If required, describe:

Wash face/hands before breaks and lunch. Disposable PPE will be removed and stored in plastic bag for disposal as solid waste.

EQUIPMENT DECONTAMINATION (ATTACH DIAGRAM)

☒ Required ☐ Not Required

If required, describe and list equipment:

All non-dedicated equipment will be decontaminated between explorations and soil sampling intervals, and at the end of the day. Nondedicated sampling equipment will be decontaminated with alconox soap (or equivalent) and a tap water solution followed by a tap water rinse and a distilled water rinse. If free-product is encountered, non-dedicated equipment will first be wiped down with paper towels to remove gross material, followed by a rinse with hexane, and then decontaminated using alconox soap (or equivalent) and tap water solution wash followed by a tap water rinse and a distilled water rinse.

Down hole drilling equipment will be decontaminated between borings and sampling intervals using a high-pressure, hot-water or steam cleaner.

E. PERSONNEL

	Name	Work Location Title/Task	Medical Current	Fit Test Current
1.	**Jennifer Wynkoop**	**Assistant Project Manager**	☒	☒
2.	**Lauren McIntire**	**Senior Staff Engineer**	☒	☒
3.	**Dylan Frazer**	**Senior Staff Geologist**	☒	☒
4.	**Paul Raymaker**	**Senior Staff Geologist**	☒	☒
5.	**Toni Smith**	**Staff Hydrogeologist**	☒	☒
6.			☐	☐
7.			☐	☐
8.			☐	☐
9.			☐	☐
10.			☐	☐

Site Safety Coordinator: **Lauren McIntire**

F. ACTIVITIES COVERED UNDER THIS PLAN

Task No.	Description	Preliminary Schedule
	Monitoring Well Installation	April 2011
	Soil Boring Explorations	April 2011
	Groundwater Sampling	2011
	Groundwater Injection	April/May 2011

G. SUBCONTRACTOR'S HEALTH AND SAFETY PROGRAM EVALUATION

☐ N/A

Name and Address of Subcontractor: To be determined prior to mobilization to conduct described activities.

EVALUATION CRITERIA

Item	Adequate	Inadequate	Comments
Medical Surveillance Program	☐	☐	
Personal Protective Equipment Availability	☐	☐	
Onsite Monitoring Equipment Availability	☐	☐	
Safe Working Procedures Specification	☐	☐	
Training Protocols	☐	☐	
Ancillary Support Procedures (if any)	☐	☐	
Emergency Procedures	☐	☐	
Evacuation Procedures Contingency Plan	☐	☐	
Decontamination Procedures Equipment	☐	☐	
Decontamination Procedures Personnel	☐	☐	

GENERAL HEALTH AND SAFETY PROGRAM EVALUATION: ☐ Adequate ☐ Inadequate

Additional Comments:

Evaluation Conducted By: ______________________________ Date: ______________

EMERGENCY FACILITIES AND NUMBERS

Hospital: Good Samaritan Hospital
407 14th Avenue Southeast, Puyallup, WA

Directions: Head east on 72nd Street East towards Waller Road
72nd Street East will turn into Pioneer Way East and then into West Pioneer Avenue
Turn right at South Meridian
Turn left at 14th Ave SE
Arrive at 407 Ave SE

Telephone: (253) 697-4000

Emergency Transportation Systems (Fire, Police, Ambulance) – 911

Emergency Routes – Map (Attachment B)

Emergency Contacts:

	Offsite	Onsite
Jennifer Wynkoop	253-284-4879	206-617-3117
Christine Kimmel	425-778-0907	206-786-3801

In the event of an emergency, do the following:

1. Call for help as soon as possible. Call 911. Give the following information:
   - WHERE the emergency is – use cross streets or landmarks
   - PHONE NUMBER you are calling from
   - WHAT HAPPENED – type of injury
   - WHAT is being done for the victim(s)
   - YOU HANG UP LAST – let the person you called hang up first.

2. If the victim can be moved, paramedics will transport to the hospital. If the injury or exposure is not life-threatening, decontaminate the individual first. If decontamination is not feasible, wrap the individual in a blanket or sheet of plastic prior to transport.

HEALTH AND SAFETY PLAN
APPROVAL/SIGN OFF FORMAT

I have read, understood, and agreed with the information set forth in this Health and Safety Plan (and attachments) and discussed in the Personnel Health and Safety briefing.

Name	Signature	Date
Name	Signature	Date
Name	Signature	Date
Name	Signature	Date
Name	Signature	Date
Lauren McIntire Site Safety Coordinator	Signature	Date
Christine Kimmel Landau Health and Safety Manager	Signature	Date
Project Manager	Signature	Date

Personnel Health and Safety Briefing Conducted By:

Name	Signature	Date

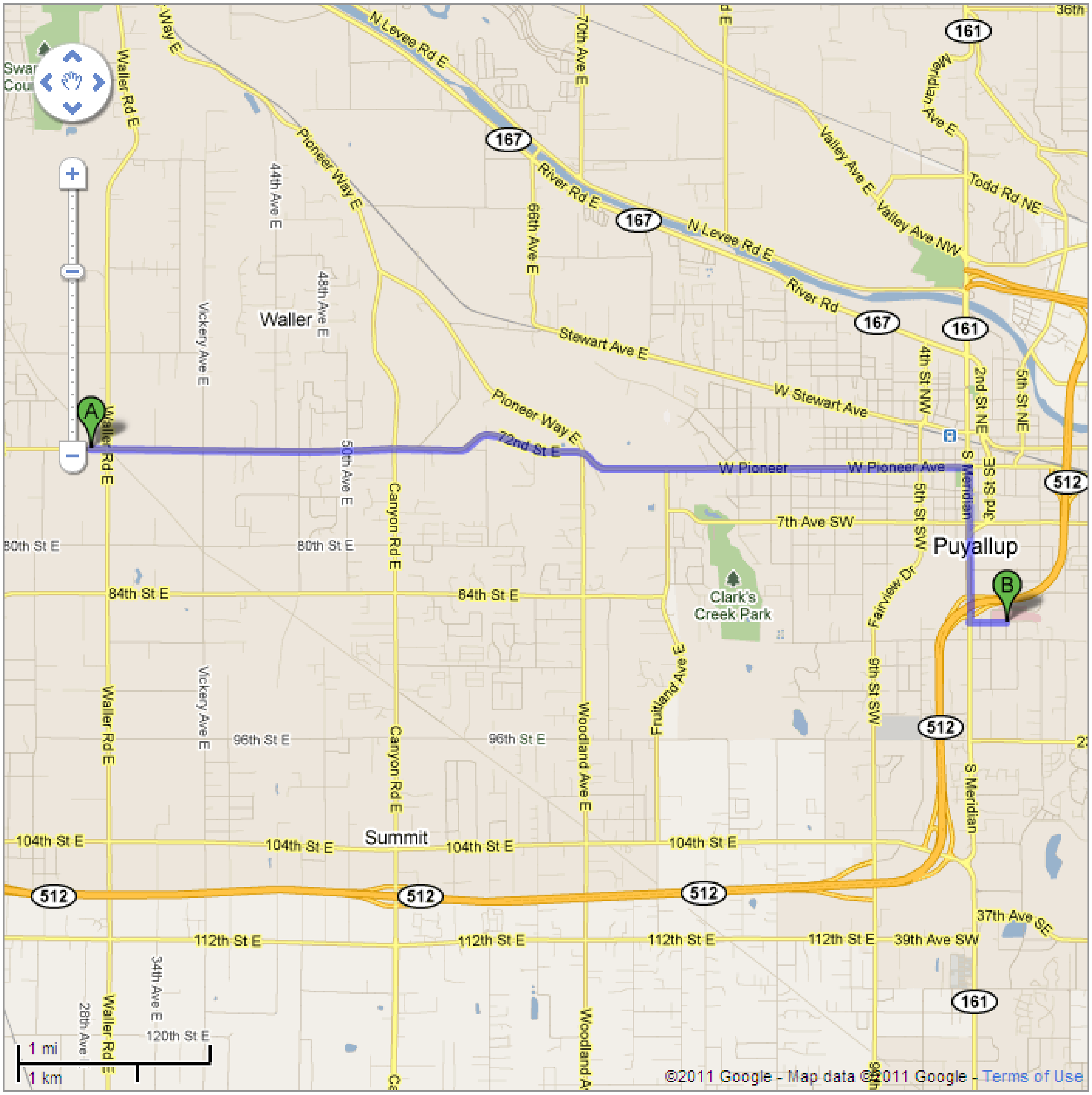
ATTACHMENT A

ACTION LEVELS FOR RESPIRATORY PROTECTION

Monitoring Parameter	Reading	Level of Protection
Organic Vapors	PID Reading >5 ppm in breathing zone for more than 15 minutes or >25 ppm for momentary peak	Upgrade to Level C – half-face respirator with organic vapor/HEPA combination cartridges
	PID Reading >25 ppm in breathing zone from more than 15 minutes or >50 ppm for momentary peak	Stop work, evacuate area and contact H&S Manager
Contaminated Particulate	0.025 mg/m^3 (lead)	Stop work and control dust with water, resume work. If dust persists, upgrade to Level C – half-face respirator with organic vapor/HEPA combination cartridges
Explosive Vapors	>10 %LEL	Discontinue work immediately and allow vapors to reduce prior to resuming work.
Oxygen	<19.5% or >22%	Stop Work, contact H&S Manager

ATTACHMENT B

MAP TO HOSPITAL



A 2901 72nd St E, Tacoma, WA 98404

	1. Head **east** on **72nd St E** toward **Pipeline Rd E** About 5 mins	go 2.6 mi total 2.6 mi
	2. Continue onto **Pioneer Way E** About 4 mins	go 2.0 mi total 4.6 mi
↱	3. Turn right at **S Meridian** About 2 mins	go 0.8 mi total 5.5 mi
↰	4. Turn left at **14th Ave SE** Destination will be on the left About 2 mins	go 0.2 mi total 5.6 mi

B 407 14th Ave SE, Puyallup, WA 98372

These directions are for planning purposes only. You may find that construction projects, traffic, weather, or other events may cause conditions to differ from the map results, and you should plan your route accordingly. You must obey all signs or notices regarding your route.

Map data ©2011 Google

Directions weren't right? Please find your route on maps.google.com and click "Report a problem" at the bottom left.