ENTRIX
ENVIRONMENTAL CONSULTANTS

FINAL
REMEDIAL INVESTIGATION
FEASIBILITY STUDY
WORK PLAN
BRIGGS NURSERY, INC.
OLYMPIA, WASHINGTON

Prepared for:
Briggs Nursery, Inc.
4407 Henderson Boulevard
Olympia, Washington 98501

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1.0 INTRODUCTION

This report presents a work plan for the Remedial Investigation/Feasibility Study (RI/FS) at the Briggs Nursery Site (Site) located in Olympia, Washington. The RI/FS will be conducted in accordance with Washington Administrative Code (WAC) 173-340-350 and is submitted in compliance with Agreed Order 1315, Section IV, *Work to be Performed*, and Exhibit D of that Order, *Scope of Work and Schedule*.

1.1 SITE BACKGROUND

Briggs Nursery, Inc. (Briggs) is the current operator of the partially active wholesale nursery located on approximately 120 acres at 4407 Henderson Boulevard SE in Olympia, Washington. The Site is located at the intersection of Yelm Highway and Henderson Boulevard SE at Sections 35 and 36, Township 18 North, Range 2 West, latitude 47°00’19”N, longitude 122°53’06”W (Figure 1).

Briggs has operated at this location as a grower and wholesale landscape plant material vendor since 1912. As part of its nursery operations, Briggs historically applied pesticides and fertilizers to on-site plant inventory in accordance with manufacturer specifications. Pesticide and fertilizer chemicals were stored and mixed on site in structures used for these purposes in the Main Operations Area on the west side of Henderson Boulevard. Flat to gently sloped areas surrounding the Main Operations Area were used to store, grow, and retail plant inventory. The landscape plants were either set out in the open on plastic sheets for easy buyer access or retained in greenhouses.

Six bowl-shaped depressions or “kettles”, are either wholly or partially situated within the Briggs property (Figure 2). These kettles were created when stranded blocks of glacial ice gradually melted during the last glacial recession in the region. Over many years, stormwater and irrigation runoff from the Site and adjoining roads have been diverted into various kettles. Specific road runoff contributions to the kettles include:

- South Street runoff to the Central Kettle
- Pifer Road runoff to the Northwest Kettle
- Henderson Boulevard runoff to the Northeast Kettle
- Henderson Boulevard and Yelm Highway runoff to the Southeast Kettle, east of Henderson
- Runoff from Yelm Highway between the YMCA to approximately 0.5 mile west of the Site boundary diverted to the South Kettle prior to the recent installation of the City of Tumwater storm drain.

Nursery debris was disposed on Site from the late 1960’s to the late 1980’s in a depression on the east side of the Central Kettle. This debris fill area was listed by the Washington State Department of Ecology (Ecology) in 2002, cleaned up by Briggs in accordance with Agreed Order DE 02TCPSR-4593, and subsequently delisted by Ecology in 2004. Although the debris fill area is located within the Briggs Nursery property boundary, it is not included as an area of concern within the Site as defined in Draft Agreed Order 1315.

One product spill was documented near the chemical storage area in 1992. This spill was referenced in the Phillips Services Corporation Phase I Site Assessment but the quantity was not reported. Soil to a depth of two feet in the area of the spill was removed and the underlying soil designated as "clean" after soil testing for total petroleum hydrocarbons (TPH*)*. Additional sampling in this area is addressed in Section 2.3 regarding the contaminants of concern and Section 5.2 regarding sampling in the area of the fertilizer injector shed and chemical mixing area.

Ten underground storage tanks (USTs) are located on the Site, all within Work Area 2. These include:

- Four septic tanks;
- Four #2 fuel oil tanks (one 500-gallon; one 1,500-gallon; one 840-gallon; and one 1,200 gallon tank);
- One regular unleaded gasoline tank; and
- One diesel tank.

The 500-gallon steel diesel tank and the 1,000-gallon regular unleaded gasoline tank and associated delivery lines were tested using a volumetric tank test procedure in 1998. Results indicated these two USTs and associated delivery lines were "tight", within the limitations of the tank testing procedure. Size and material specifications are not known for the remaining eight on-site USTs.

All operations west of Henderson Boulevard have ceased, except for the business office. Briggs currently operates a plant tissue culture research laboratory on the east side of Henderson Boulevard. Other operations on the east side of the property include specialty grow sheds for plants produced in the research laboratory, as well as standard greenhouses for additional plant inventory.

1.2 PREVIOUS SITE WORK

Since 1996, a number of reports, sampling programs, and chemical analyses have addressed various locations at the Site. Other similar off-site work has been conducted since 1995. These data and reports in aggregate document low levels of pesticide contamination within the very near surface soils in the general nursery property. In a few instances, the concentration of the pesticide dieldrin in the near surface soil exceeds the 2001 Model Toxics Control Act (MTCA) Method B soil concentration for unrestricted land use, direct contact (ingestion only) and leaching pathway (carcinogen). In total, four samples (three on-site and one from the current YMCA property) exhibit dieldrin concentrations in excess of this Method B concentration limit.

Previous Site work also identified very low levels of chlorinated dibenzodioxin and furan compounds (CDD/Fs) in the water and sediments within several on-site kettles. As previously stated, these kettles have received runoff from both the Site and from nearby roads and highways over the years. Risk assessments performed to date, based on available analytical data, suggest that the additional carcinogenic risk associated with these kettles based on the presence of low levels of CDD/F does not exceed the MTCA risk standard under the trespassing child exposure scenario. A residential child exposure scenario was not included in this analysis.

Key reports from this time period are summarized below, with updates to 2001 MTCA standards as appropriate:

1996 On January 16, 1996, S. Chamberlain & Associates Inc. issued a letter report to Thurston County Health Department concerning sampling and analyses at the new YMCA property near the corner of Yelm Highway and Henderson Boulevard. Chemical analysis of one sample (#5) at a four-inch depth indicated dieldrin at a concentration (0.362 mg/kg) in excess of 2001 MTCA Method B levels for unrestricted land use direct contact pathway (0.0625 mg/kg carcinogen) and the calculated (following the Washington State Department of Ecology workbook *MTCASGL* for calculating cleanup levels) Method B Modified soil concentration deemed protective of ground water (0.173 mg/kg). Discrete depth sample analytical results indicated that the dieldrin concentration decreased rapidly.

1996 On October 10, 1996, Landau Associates, Inc. issued a letter report to Mr. Alexander Mackie, Esq. of Owens Davies Mackie. The report documented sampling and analytical data from the South, Central, and Northwest Kettles, and four soil samples from two locations in the western portion of the Briggs Nursery property. The kettle samples had very low concentrations of CDD/Fs in shallow kettle sediments. Concentrations of pesticides, herbicides, PCBs, and priority pollutant metals in the two soil samples in the western portion of the Site did not exceed MTCA 2001 Method A, Standard Method B, or background levels for Washington State, with the exception of thallium. Thallium was detected at 0.3[1] mg/kg, exceeding the level in soil considered protective of groundwater at that time, but below the level in soil considered protective of groundwater based on the calculated (i.e., following the Ecology *MTCASGL* workbook) 2001 Method B Modified soil concentration (0.327 mg/kg).

1998 On March 26, 1998, Phillips Services Corporation issued a *Limited Phase I Site Assessment for the Briggs Nursery Olympia Facility* to Owens Davies Mackie. The report provided descriptions and locations, with an abbreviated Site history, of 14 nursery facilities, features, and operational areas with a potential for contamination. . Five of the 14 features discussed were kettles (Central, South, Southeast, Northeast, and Northwest). The use of the kettles for Site drainage detention was noted. One of the 14 features identified and discussed was the Debris Pile on the eastern edge of the Central Kettle that has since been cleaned up and delisted and is not part of the Site under this Agreed Order. Eight of the features identified and discussed include the following Site facilities:

[1]Laboratory data results were reported to one significant digit.

- Shop;
- Fertilizer injector shed area;
- Pesticide chemical shed;
- Dry chemical fertilizer shed;
- Canning barn;
- Old barn and culvert
- Fumigation shed used for dry herbicide and pesticide storage;
- A small stormwater detention area just south of the Northeast Kettle; and
- Laboratory area to the east of Henderson Boulevard.

The report provides some information on surface drainage to the Central and Northeast Kettles and also provides estimates of the distribution of return flows from the pumped on-site well water and city irrigation water to the various on-site kettles. The report identifies two on-site underground storage tanks near the shop and provides volumetric tank tightness test results. The report documents a 1992 spill of copper chromium arsenical (CCA) wood preservative in the area around the pesticide chemical shed, the dry chemical fertilizer shed, and the fumigation shed. A contractor cleanup report indicates that approximately two vertical feet of contaminated soil was removed from the spill area and post-excavation soil samples were tested for TPH. The report includes a copy of the October 10, 1996 Landau report described above.

1998 On July 15, 1998, Phillips Services Corporation issued a *Phase II Executive Summary Report for the Briggs Nursery Olympia Facility*. Phillips collected twenty samples from various locations within the Site. Ten samples were concentrated in the Main Operations Area west of Henderson Boulevard. Ten additional samples randomly located around the Site area were collected. Two samples (301 and 1001) had analytical results (0.19 mg/kg and 0.13 mg/kg, respectively) indicating dieldrin concentrations in excess of the 2001 MTCA Standard Method B level for unrestricted land use direct contact pathway. Sample 301 is within the Main Operations Area. The exact location of sample 1001 is uncertain, although on a later map produced by L.C. Lee and Associates it is shown to the north of the Main Operations Area. A copy of the well log for the on-site groundwater irrigation well is included in the report, which indicates that the well was drilled in April 1986 to a depth of 534 feet below ground surface (bgs). At completion the well was screened from 230 to 319 feet bgs.

2000 On February 29, 2000, L.C. Lee & Associates issued to Owens Davies Mackie a letter report entitled *Briggs Village Thallium and Water Quality Sampling*. This report was a follow-up to the Landau 1996 report that reported thallium at a level in soil that was below the MTCA residential cleanup level based on direct contact but above the level for protection of groundwater. To address this issue, L.C. Lee collected discrete soil samples at one-foot intervals from the surface to six feet bgs at three sample locations. Thallium concentrations in all of these samples were below the *MTCASGL* workbook-calculated 2001 Method B Modified soil concentration (0.327 mg/kg) considered protective of groundwater. All sample concentrations were well below the 2001 MTCA Method B levels for unrestricted land use direct contact pathway. L.C. Lee also collected sediment samples from within and along the wetted perimeter of the Central, South, and Northeast Kettles. All sediment thallium concentrations were also below the 2001 MTCA Method B levels acceptable in soil.

2001 On January 18, 2001, L.C. Lee & Associates issued a letter report to Briggs entitled *Data Summary from the Additional Contaminant Sampling at the Briggs Nursery Site in Olympia, Washington*. L.C. Lee tested water from the on-site irrigation well for arsenic, beryllium, chromium, and thallium. None of these contaminants were detected in the well water sample. L.C. Lee conducted additional sampling and analysis in the following areas:

- The Fertilizer Injector Shed Area;
- A swale east of the Central Kettle and downgradient from the Fertilizer Injector Shed Area;
- A location east of the South Kettle;
- A location east of the Northwest Kettle;
- An area south of the Central Kettle previously sampled by Landau in 1996;
- The Northeast Kettle;
- The Central Kettle; and
- The Southeast Kettle.

The key results from the 2001 report were summarized and combined with data previously collected from these areas.

- Arsenic was reported at occurred at 8.0 mg/kg in a sample from the Central Kettle near the debris field and at 9.0 mg/kg in a sample from the Fertilizer Injector Shed Area. These values are slightly above the average background value for Puget Sound (7.0 mg/kg) but within the range of background values for the Puget Sound area. The values are also below the Method A cleanup level of 20.0 mg/kg.

- DDE and DDT were reported at concentrations of 0.08 mg/kg and 0.6 mg/kg, respectively in sample 301 from the Fertilizer Injector Shed area by Phillips in 1998 exceeded the Method B level in soil considered protective of groundwater at that date. However, these levels do not exceed the 2001 Standard Method B soil level for the direct contact pathway for unrestricted land use. The DDE concentration reported in sample 301 (0.79 mg/kg) does not exceed the *MTCASGL* workbook-calculated 2001 Modified Method B soil level protective of groundwater (0.787 mg/kg), and the DDT concentration does not exceed the Method A soil cleanup level of 3.0 mg/kg.

- DDE and DDT reported at 0.07 mg/kg and 0.05 mg/kg, respectively in sample 1001 in an uncertain location (mapped later as north of the Main Operations Area by L.C. Lee) by Phillips in 1998 exceeded the Method B level in soil considered protective of groundwater at that time. However, these levels do not exceed the 2001 Standard Method B soil level for the direct contact pathway for unrestricted land use. The DDE concentration reported in sample 301 (0.79 mg/kg) does not exceed the *MTCASGL* workbook-calculated 2001 Modified Method B soil level protective of groundwater (0.787 mg/kg), and the DDT concentration does not exceed the Method A soil cleanup level of 3.0 mg/kg.

- Aroclor 1254 reported at 0.059 mg/kg in one surficial sediment sample from the Southeastern Kettle is below the Method A cleanup level for PCB.

2003 On February 5, 2003, ENTRIX issued the closure report for the Briggs Nursery Debris Field. The extensive testing following debris excavation at the Debris Field Site on the east side of the Central Kettle showed that all contaminants of concern were below their detection limits.

2003 On September 30, 2003, ENTRIX issued a letter report to Perkins Coie entitled *Supplemental Letter Report In Response to Hearing Examiner Decision No. 97-0187 Briggs Urban Village (September 2003 Supplemental Report).* The report incorrectly reported dieldrin levels in sample 301 (Phillips 1998), 1001 (Phillips 1998), and FIS-4 (ENTRIX, 2003) as being below applicable 2001 MTCA soil standards. In fact, dieldrin concentrations in each of these samples exceed the 2001 Standard Method B soil level for the direct contact pathway for unrestricted land use due to carcinogenicity (0.062 mg/kg). Values of DDT, DDE, and dieldrin for sample 301 (collected at 3-ft bgs) should be corrected to 0.6 mg/kg, 0.08 mg/kg, and 0.19 mg/kg respectively. The workbook calculated values for 2001 MTCA Method B soil levels protective of groundwater for thallium, DDE, and dieldrin attached to this report are correct as presented. The key finding of this report as amended herein is that dieldrin concentrations found in three on-site samples (301, 1001, and FIS-4) are the only exceedances of relevant MTCA standards found to date on the Site.

2004 On January 22, 2004, ENTRIX issued a report entitled *Dioxin and Furan Sampling and Analysis and Human Health Risk Assessment Report for the Central Kettle Briggs Urban Village*. The key finding of this report is that the measured concentrations of PCDD/PCDF in sediment and water collected in 2000 and 2003 from the Central Kettle do not pose an unacceptable risk to on-site workers and “trespassing” children from dermal contact and ingestion. Overall incremental lifetime cancer risk for these populations resulting from dermal contact with and ingestion of Central Kettle sediments and water is below the MTCA cancer risk guidance value of 1 in 10^{-6}.

2004 ENTRIX work in progress shows that CDD/F compounds found in the Central and Southeast Kettles occur in homologue mixtures that resemble distributions reported in the literature as typical of urban street and highway runoff. The work in progress also shows that the mixtures in the Central and Southeast Kettles are not typical of mixtures reported in the literature that would result from operations that are known or believed to occur at the Site. A report presenting the results of this work is in progress.

2.0 WORK AREAS, CONTAMINANTS OF CONCERN, AND REMEDIAL INVESTIGATION OBJECTIVES

Consistent with the provisions of the draft Agreed Order, the Site is divided into three areas (Figure 2) for the purpose of both Site investigation and analysis and to facilitate early release of areas that are found to have contamination levels below applicable cleanup standards. Contaminants of concern (COC) are defined based on the results of the significant amount of work done to date on the Site. Remedial investigation objectives are defined based on an analysis of the Site history and the results of previous investigations addressing potential site contamination within the overall Site.

2.1 WORK AREAS 1, 2, AND 3

2.1.1 Work Area 1

Work Area 1 encompasses the northern and western portion of the Site. It includes the North, Northwest, Central and South Kettles. It excludes the Debris Field Site that has been cleaned up and delisted. The Site history indicates that this area was only used for greenhouses and general landscape plant storage over the operational life of Briggs Nursery. The kettles were used for on-site stormwater and irrigation return flow detention. The kettles also received street and highway runoff from Yelm Highway and from residential areas to the northwest of the Site.

2.1.2 Work Area 2

Work Area 2 encompasses the Main Operations Area of the Site west of Henderson Boulevard and the southeastern corner of the Site east of Henderson Boulevard and south of the Southeast Kettle. The portion of Work Area 2 to the west of Henderson Boulevard is the area where concentrated fertilizer and pesticide storage and chemical mixing occurred. It also includes the shop area where two fuel storage USTs are located and where vehicle maintenance occurred. Work Area 2 also contains four #2 fuel oil USTs and four septic tanks. It is presumed that the likelihood of any concentrated chemical contamination is highest in Work Area 2 because of the activities that occurred here and the more intensive usage than in other Site areas. Work Area 2 also includes the area of greenhouses to the east of Henderson Boulevard, south of the South Kettle and north of Yelm Highway.

2.1.3 Work Area 3

Work Area 3 comprises the northern portion of the Site to the east of Henderson Boulevard. It includes the Southeast Kettle and the Northeast Kettle. This area includes the actively operating portion of the Site, including the laboratory and specialty growth greenhouses for plants produced in the laboratory. It is presumed that any chemical contamination in this area would be associated with either laboratory activities or associated with plant care in the greenhouse area.

An additional objective for Work Area 3 is to determine whether Ward Lake has been impacted by nursery operations.

2.2 SITE HYDROGEOLOGY

2.2.1 Site Hydrostratigraphy

Well-log data from two wells (i.e., 35K03 at the old Olympia Brewery (Brewery Well), and 36D01 at the Site (Briggs Well)) drilled in the vicinity of the Site indicate that there are two main hydrostratigraphic units in the immediate area. Based on regional data and information (Ecology, 1995; Thurston County, 1992), it is evident that the two wells penetrate to undifferentiated formations that include the Quaternary Kitsap Formation (Qk), sea-level glacial deposits (Qc) and older undifferentiated Quaternary/Tertiary sediments (Tqu) at between 50 and 100 ft below mean sea level (msl). Above these units lies Quaternary Vashon recessional outwash (Qvr), which when deposited by the receding glacier and meltwater streams formed the primary landscape features that still dominate the area east of Tumwater and the Deschutes River valley, including Ward and Hewitt Lakes and the Site kettles. In places, the landforms of the recessional outwash have been somewhat denuded and are mantled by more recent alluvium, palustrine or lacustrine deposits, or have been deeply incised and filled with moderate thickness' of alluvium (i.e., the Deschutes River Valley).

Qvr is comprised of predominantly sands and gravels, with lenses of silty sand and, in places, clay lenses. To the east of Ward Lake, the thickness of Qvr ranges from 10 to 50 ft, but in the immediate area of the Site Qvr is much thicker, ranging from 100 to over 200 ft thick. The Qk consists predominantly of clay and silt with minor sand, gravel, peat, and wood. The Qk was deposited in shallow lakes and wetlands during an interglacial period. The thickness of the Qk unit typically ranges from 10 to 100 ft (Thurston County, 1992).

Below the Qk lies the sea level glacial deposit (Qc). This unit consists of coarse sand and gravel, and was deposited by glacial meltwater during a pre-Vashon glacial period. Also, based on well logs and interpretations of regional data, (Ecology, 1995) indicates that Vashon Till (Qvt) and Vashon Advance (Qva) deposits are likely not present below the Site. In other areas, the Qvt and Qva are typically found throughout the region forming an aquitard and aquifer, respectively.

2.2.2 Groundwater Occurrence

In the Site and surrounding area, the depth to groundwater varies due to the topographic irregularities of the recessional outwash and glacial deposits, and through flowing drainages. The elevation of the water table can be inferred from the water levels in the nearby Ward and Hewitt Lakes (i.e., water levels in Ward Lake fluctuate seasonally from 120 ft to over 126 ft msl, based on local and USGS topographic data), the Central Kettle and the off-site kettles located just off the Briggs property (117 ft to 125 ft msl) and the Deschutes River (which is around 100 ft msl). Except in the kettles, the surface elevation of the Site ranges from 170 ft to 202 ft msl. The kettle bottoms range from 117 ft msl in the off-site kettle to 149 ft msl in the Northeast Kettle. Thus, except in the kettles, the depth to groundwater ranges from approximately 45 to 80 ft below the ground surface.

Although, there are other main aquifers found throughout northern Thurston County (Ecology, 1995; Thurston County, 1992), based on the well logs and head data from the Brewery and Briggs wells, it is apparent that there are only three water-bearing units of concern beneath the Site and surrounding areas.

The upper unit is the unconfined aquifer that occurs within the Qvr deposits and is expressed by the water levels of surface water bodies. A second unit is suggested by the head data from the Briggs well, which was screened across the contact of the Qvr and underlying Qk/Qc deposits. Head data from the Briggs well indicates a static water level (i.e., approximately 108 ft msl) that is slightly lower than the water table inferred from the water levels in the nearby lakes and deeper kettles (i.e., ranging from 117 to 126 ft). In the Briggs well a clay seam was present at an approximate depth of 129 ft bgs (or 58 ft msl) and the well produces from a much deeper zone (i.e., from – 43 to – 132 ft msl). The clay lenses and silty sand portions that occur with the Qvr suggest that the Briggs well is producing from a deeper zone within the Qvr that is in a leaky-confined condition, and to a degree, isolated from the upper portions of the aquifer in contact with the lakes and kettles.

A third unit is indicated by head data in the Brewery Well, which has penetrated to a lower aquifer, most likely within the Qc deposits and/or coarser portions of the Qk deposits. Locally, fine-grained portions of the Qk unit (i.e., the silty clay layer) retard the movement of groundwater. At these locations the laterally continuous silty clay serves as a confining layer between aquifers that lie stratigraphically above and below it, causing substantial vertical head gradients to form. This vertical gradient is indicated by a relatively high head data (i.e., artesian conditions) in the Brewery Well (i.e., approximately 140 ft msl), depicted by the upward groundwater flow directions shown in Figure 3.

2.2.3 Groundwater Gradients and Flow Directions

Based on the available well log data, regional and local hydrostratigraphy, and local physiography, it can be inferred that water levels in the South and Central Kettles are controlled by a water table that is sloping gently in a westward direction towards the Deschutes River valley. Groundwater gradients between Ward Lake and the river valley, and the kettles and the river valley range from 0.006 to 0.010 ft/ft. This gradient fluctuates with the rising and falling water table associated with changes in recharge due to the wet or dry season.

The bottoms of the other kettles on the Site, however, are not in contact with the water table, as their bottom elevations are much higher. For example, the bottom elevations of the Southeast, Northeast, North, and Northwest Kettles are 148.5 ft, 149 ft, 143.2 ft, and 130 ft, respectively. Thus, the bases of these kettles lie within the unsaturated zone and lie approximately 28, 29, 23, and 10 ft above the water table. In these cases when precipitation, runoff, irrigation water, or stormwater enters the kettles, it infiltrates through kettle bottom sediments and then percolates within the unsaturated zone downward to the water table. In the Northeast Kettle, however, infiltration has been significantly retarded by a relatively thick accumulation of fine-grained silts, clays, and muck. Thus, the outlet pipes were constructed at the suggestion of Thurston County to convey the ponded drainage to Ward Lake. In the other kettles, infiltration rates are likely delayed somewhat by fine-grained kettle-bottom sediments (referred to as the "skin effect"), but not enough to cause significant ponding.

2.2.4 Effects of Pumping from Briggs Irrigation Well

The Briggs well was drilled and completed during March and April 1986 (State of Washington, 1986). This is the only well on the Site and, except for the Olympia Brewery wells to the west, provides the best depiction of the subsurface hydrogeologic and groundwater flow characteristics.

The potential effects of pumping from the Briggs well can be assessed in context with the available well completion and drawdown data (Robinson & Noble, 1986). The well boring was drilled to a total depth of 534 ft bgs (or –347 ft msl), and as noted above penetrated through Qvr, Qk, Qc and likely into Tqu. Based on insufficient well yield from the deeper zones, the well screen was completed over an interval comprised of predominantly sand to gravelly sand between 230 ft and 319 ft bgs (or –43 ft to –141 ft msl).

After completion of the well, step-drawdown and constant rate pumping tests were conducted. The step-drawdown test consisted of brief pumping rates of 230, 500, 760, and 1025 gallons per minute (gpm). The beginning static water level was 78.5 ft bgs (or approximately 108.5 ft msl). For each pumping rate the well's specific capacity was 25 to 26 gpm/ft of drawdown. The constant rate test was then run for 6 hours at a rate of 950 gpm. From a static water level of 78.5 ft the water level drew) to 117 ft (or 70 ft msl) at the end of 6 hours, for a maximum cone of depression of 38.5 ft. The well recovered approximately 96.4% to 79.9 ft bgs (or 107.1 ft msl) after 100 minutes. This quick recovery indicates that the radius of influence of the pumped well was likely relatively minor within the leaky confined portions of the lower Qvr. Further, because of the leaky confined nature of the screened zone, pumping does not likely affect water-bearing zones in the upper unconfined portions of the Qvr (i.e., the water levels in Ward Lake and Central Kettle).

Based on this data, Robinson & Noble (1986) calculated an aquifer transmissivity of 230,000 gpd/ft for the first 20 minutes of recovery and 420,000 gpd/ft after 20 minutes of recovery. Assuming the first 20 minutes were controlled by the transmissivity of immediate vicinity of the well bore, the formation transmissivity is better represented by the higher value.

Estimates of water withdrawals from the Briggs well for the existing nursery operation average approximately 320 ac-ft (or approximately 104 million gallons) per year (Adolfson Associates, 2003). This equates to an average pumping rate of just less than 200 gpm, which is substantially less than the design pump rate (i.e., 1,000 gpm) of the well. This indicates that the well is not pumped continuously, but only on demand. Demand is highest during the summer when conditions on the surface are drier and daily temperature maximums are highest. Thus, pumping frequency, overall pumped volumes and the zone of influence within the lower Qvr will be greater during these times.

2.3 POTENTIAL CONTAMINANTS OF CONCERN

Based on past investigations summarized in Section 1.2, and findings of the September 2003 Supplemental Report, the potential COCs are dieldrin in the fields and work areas and CDD/Fs in the kettles. Additional potential contaminants are discussed below.

2.3.1 Pesticides

Dieldrin is the only contaminant identified on-site fields and work areas that has exceeded any relevant 2001 MTCA standard (soil level for unrestricted land use based on dermal contact inhalation pathway). Because of detections of other pesticides in previous cleanup activities in other areas, all samples collected in this initial investigation phase will be analyzed for a full pesticide screen, including DDD/E/T. Also, sediment samples from the kettles will be analyzed for a full pesticide screening, including DDD/E/T.

In addition to the surficial soil grid sampling effort described in Sections 3.3, 4.1, 5.2, and 5.3, additional discretionary samples will be collected at the direction of Ecology during demotion activities. These samples will include samples from septic tanks and drainfields, wash basin drainage areas, catch basins and stormwater drainage outfalls.

2.3.2 PCBs

In a previous study, polychlorinated biphenyls (PCBs) were detected in a single sample from the southeast kettle. In light of this single detection, particular care will be taken during quality assurance of laboratory analyses to review interferences that could indicate PCBs at elevated levels in upland soils.

Briggs Nursery soil samples will be analyzed by U.S. EPA Method 8081A, which is used to analyze for chlorinated pesticides using an electron capture detector (ECD). The output of the ECD is a series of peaks on a chromatogram. Each of these peaks is associated with an individual pesticide, except for pesticides that occur as mixtures of compounds, such as chlordane and mirex.

The ECD is also sensitive to other chlorinated compounds such as PCBs, which are simultaneously detected when analyzing for chlorinated pesticides. PCBs occur as multi-component mixtures of compounds that produce patterns on the chromatogram potentially interfering with, or at least complicating, the detection of pesticides. Therefore, the potential co-occurrence of PCBs and pesticides needs to be taken into account whether analyzing solely for pesticides, solely for PCB, or analyzing for both compound classes.

Pesticide results will be carefully reviewed for interferences that could indicate PCBs at elevated concentrations.

2.3.3 CDD/Fs

CDD/Fs are a concern due to the potential of excess incremental cancer risk unless institutional controls remain in place relative to access. Previous investigations indicate that CDD/Fs are present in two of the kettles at concentrations above the MTCA unrestricted land use standards. CDD/Fs have also been linked to stormwater runoff from the roads. Sampling for CDD/Fs will be conducted in the surface water and sediments within the kettles.

2.3.4 Herbicides

The Lee and Associates report in 2001 reported one detection of the herbicide 2,4-D in the Southeast Kettle. Although the result (17 ppb) was well below the identified MTCA standard of 160 ppb, selected discretionary samples will be analyzed for herbicides at the request of Ecology.

2.3.5 Petroleum Hydrocarbons

Two underground storage tanks (USTs) located in Work Area 2 stored unleaded gasoline and diesel fuel. Four other underground tanks stored fuel oil No. 2. Therefore, in the UST area additional COCs include gasoline, diesel, and their individual components. The USTs are slated for decommissioning and removal during the demolition process. Sampling for TPH will be conducted during this process in accordance with the Washington State UST removal guidelines.

2.3.6 Metals

The metals tested historically are not of concern but copper may be a COC at some locations in Work Area 2.[2] Given the reported CCA release in area 2, chromium may also be a COC in some locations in Area 2. Selected samples will be analyzed for copper and chromium to ensure accurate characterization of metals contamination. The selected samples will focus on the areas of the highest potential for metals contamination, such as the fertilizer shed, the area of the 1992 spill and the chemical storage and mixing sheds.

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[2] Based on testing of three soil samples recently collected in July 2004 from the Fertilizer Injector Shed under the former tank crib liner, to be discussed with Ecology.

2.4 REMEDIAL INVESTIGATION OBJECTIVES

2.4.1 Work Area 1

In Work Area 1, the remedial investigation objective is to fully characterize, in a methodical way; any chemical contamination left behind by nursery practices. There is one sample of uncertain location (1001) within Work Area 1 that has exceeded the MTCA Method B standard (soil level for unrestricted land use based on dermal contact inhalation pathway) for dieldrin. For the most part, the area contained greenhouses and areas where growing plants in pots were placed in rows outside. Runoff from the Main Operations Area did not flow towards Work Area 1.

An additional remedial investigation objective for Work Area 1 is to determine in a methodical way the concentrations of CDD/Fs, in the water and sediments of the North, Northwestern, Central, and South Kettles to support a supplemental human health risk assessment that takes into account the future uses and institutional controls of the kettles.

2.4.2 Work Area 2

In Work Area 2, the remedial investigation objective is to assess in a methodical way the extent of contamination associated with concentrated nursery activities that exceeds relevant MTCA Method A and B cleanup standards. Work Area 2 includes the chemical storage and mixing areas where fertilizers and pesticides were prepared for use on landscape plants around the facility. Analyses of two samples in the area of the Fertilizer Injector Shed (301 and FIS-4) indicate dieldrin levels that exceed the MTCA Method B Standard for unrestricted land use based on dermal contact inhalation pathway.

In addition, Work Area 2 includes three septic tanks, four wash basins, which drained directly to the ground or into makeshift septic systems, and six petroleum USTs. An additional remedial investigation objective is to determine that the operation of the UST or drainage systems did not lead to subsurface contamination in the area.

2.4.3 Work Area 3

In Work Area 3, the remedial investigation objective is to fully characterize any contamination that has been left behind as a result of nursery operations. Limited sampling in the work areas of Work Area 3 has not identified any soils that exceed relevant MTCA standards. An additional remedial investigation objective for Work Area 3 is to determine the concentrations of CDD/Fs, in the water and sediments of the Northeast and Southeast Kettles to support a supplemental human health risk assessment that takes into account the future uses and institutional controls of the kettles.

An additional objective for Work Area 3 is to determine whether Ward Lake has been impacted by nursery operations.

3.0 SAMPLING METHODOLOGY, HANDLING, PRESERVATION, ANALYSIS, AND DERIVED WASTE

The sampling procedures for the RI/FS activities will be consistent for the objectives of this project. Each RI/FS activity provides the sampling procedures for all sampling activities to be conducted during the investigation, as well as the associated requirements for handling derived waste.

3.1 SURFICIAL SOIL SAMPLING

Based on information regarding past practices on-site, surficial soil samples in fields outside the Main Operations Area will be collected on a regular 200-foot grid that includes most of the Site with the exception of the kettles and kettle slopes and the areas identified as excluded from the Remedial Investigation (Figure 2). The Chemical Mixing Area in Area 2 is also excluded from the 200-foot grid sampling because a higher density 100-foot grid is recommended to more accurately assess the soil contamination in that area.

A licensed surveyor prior to sample collection will survey the sampling grid. Each grid line will be identified sequentially by a numbered pin flag. The numbers will correspond to the sample identifier.

Each sample will be a composite of five individual samples. At a given sampling location, a center grab sample will be collected. Four more grab samples will be collected on the four cardinal points of the compass (N, S, E, and W) approximately 2 feet from the center sample. The grab samples will be collected from zero to six inches in depth using a pre-cleaned shovel, trowel, or large stainless steel spoon to scoop and will be composited by homogenizing in a stainless steel mixing bowl. Rocks, vegetation, and debris will be removed from the homogenized samples.

Sample jars will be filled according to requirements listed in Section 3.6.

Additional grab samples will be collected at the discretion of the field scientist where evidence of contamination is observed. These samples will not be composited.

All sample locations will be recorded with a hand-held GPS unit. The locations will be reported in latitudes and longitudes to the hundredth. The North American datum 1983 (NAD83) will be used.

3.1.1 Further Delineation Sampling

Upon receiving results of the initial grid sampling analyses, further delineation of contaminated areas may be warranted. Additional soil samples will be collected in the vicinity of the grid node samples whose chemical concentrations exceed the MTCA cleanup standards.

Additional soil samples will be collected at 25 feet, 50 feet, 75 feet, 100 feet, and 150 feet in the four cardinal directions (based on grid north) from the grid nodes where soil exceeds MTCA standards. Soil samples may also be collected at approximately 142 feet and 213 feet in the appropriate diagonal directions (NE, SE, SW, and NW) from the grid nodes in exceedance of the dieldrin unrestricted land use standard. On the diagonals between two nodes on the 200-foot grid, 142 feet and 213 feet from a given node equal ½ and ¾ of the distance to the next grid node, respectively. These sampling regimes may be modified to account for property boundaries and impenetrable vegetation.

To assess the depth of soil that exceeds MTCA cleanup levels, subsurface samples will be collected at two grid nodes with higher of COCs. These grid nodes will be selected to provide an indication of the potential subsurface distribution of chemicals throughout the property.

A pit 24 inches in diameter and 30 inches deep will be dug at each grid node. Soil samples will be collected at five depths from within each pit at 6-inch intervals from zero to 30 inches below ground surface. Equal amounts of soil will be scraped from four sides of each pit to form a homogenized composite sample. Collection, handling, and decontamination methods will be consistent with those described in Sections 3.1, 3.5, 3.6, and 3.8.

3.2 SEDIMENT SAMPLING

Sediment samples will be collected from the six kettles within Work Areas 1 and 3. A small push corer or petite Ponar will be used and deployed either on foot or from a small boat for sample collection. A three-way anchor system may be employed in order to maintain a steady position while samples are collected, depending on water depth and conditions within each kettle. Care will be taken to ensure that the surface sediments are not disturbed before samples are collected.

The remaining sediments will be described as the sample is removed from the grab sampler and transferred to a stainless-steel bowl, noting any stratification that may be present. The color of the sediment (based on the Munsell soil color chart), grain sizes, approximate percentages of moisture content, organic and/or shell material, and any other noteworthy observations will be recorded in the field logbook. Prior to compositing the sediments in the stainless-steel bowl and subsequent collection of the remaining sub-samples for analyses, the sediments in the bowl will be photographed.

Sediments from the grab samples will then be composited to achieve a more representative sample of average surface sediment characteristics at that station. The sediment grab samples at each station will be composited in a stainless-steel bowl and covered with aluminum foil until a sufficient volume of sediment is collected. Sediment in the bowl will then be homogenized using a large stainless-steel spoon to achieve a uniform texture and color before sub-samples are taken and transferred to appropriate sample containers for the remaining analyses.

Sample jars will be filled according to requirements listed in Section 3.6.

Immediately after they are filled, all sample containers will be placed on ice in a cooler. Samples will be stored at four ± two degrees Centigrade. All samples that are to be analyzed upon receipt at the chemical testing laboratory will be maintained at four ± two degrees Centigrade. Sufficient headspace will be left in containers that are to be frozen (i.e., only archive samples) to accommodate expansion during freezing. Chain-of-custody forms will be completed and signed by the field team leader at the end of each day and shipped with the samples to the analytical laboratories.

All sample locations will be recorded with a hand-held GPS unit. The locations will be reported in latitudes and longitudes to the hundredth. NAD83 will be used.

3.3 SURFACE WATER SAMPLING

Composited surface water samples will be collected from each kettle. A minimum of three grab water samples will be collected from locations throughout the kettle for each composite. Additional grab samples will be collected in larger kettles. The kettle will be subdivided by inspection into sampling sections, and grab samples will then be composited within each section.

Samples will be collected with a sampler attached to a depth-marked hand line. The depth of the water will first be determined using a marked and weighted line. The amount of line that the sampler can be lowered to, within several feet of the bottom, will be measured and marked. The sampler will then be lowered at a constant rate to the marked depth and then raised at a constant rate. The rate of lowering and raising will be adjusted in order to allow the sample container to just fill as it is recovered from the water. Upon recovery, the water sample will be transferred to an appropriate sample container. This process will be repeated until the desired sample volume is collected.

Sample bottles will be filled according to requirements listed in Section 3.6.

3.4 GROUNDWATER SAMPLING

A total of six groundwater monitoring wells are anticipated to be installed on the Site. The proposed locations are identified on (Figure 5). The installation of these wells will provide a basis for assessing groundwater conditions and groundwater flow under the Site, and any impacts from contamination.

The locations and installation of groundwater monitoring wells is described in detail in Section 7.0 of this work plan. The groundwater sampling described in this section will occur upon completion and development of the monitoring wells described therein. A monitoring plan will be developed at a later date.

At least 24 hours after the wells have been installed and developed, a full round of water level measurements will be collected to establish the static water levels for the Site. These measurements will be to hundredth foot. Well purging will be conducted to remove stagnant water. Three successive well volumes will be purged either with the use of bailers or a peristaltic pump. Samples will be collected with minimal disturbance of sample chemistry and will be collected from the middle portion of the water column. No in-field filtration will be conducted.

Sample bottles will be filled according to requirements listed in Section 3.6.

The monitoring wells will be surveyed by a licensed surveyor. During initial field activities, sample locations will also be recorded with a hand-held GPS unit. The locations will be reported in latitudes and longitudes to the hundredth. NAD83 will be used.

3.5 SAMPLE CONTAINERS

The sample containers for the parameters identified in each RI/FS activity will be provided by the laboratory. These containers will be cleaned by the manufacturer to meet or exceed the analyte specifications established in the U.S. Environmental Protection Agency (EPA) “Specifications and Guidance for Obtaining Contaminant-Free Sample Containers”, April 1992.

The project laboratory will provide the appropriate sample containers. The required sample container type and volume, number of containers per analysis, preservation method, and maximum holding times are as follows:

- For **soil samples**, one 8-oz jar will be filled for TPH-Gx/Dx analyses. A second 8-oz jar will be filled for pesticide/herbicide and metals analyses. If a CDD/F analysis is to be conducted on a soil sample, a 4-oz jar will be filled. The holding time for refrigerated soils is 14 days for pesticides, herbicides, and NWTPH-Gx/Dx analyses, and 6 months for metals. The holding time for frozen soils is 1 year for CDD/F analysis.
- For **water samples**, two 1-L unpreserved amber bottles will be filled for the pesticides and herbicides analyses. The holding time for these analyses is 14 days (with the possible exception of heptachlor, which is not a pesticide of concern). Two 1-liter HCl-preserved amber bottles will be filled for NWTPH-Gx/Dx analyses, with a holding time of 14 days. A 500-mL HNO3 acid-preserved polycarbonate jar will be filled for metals analyses. The holding time for the metals analyses is 28 days.

3.6 SAMPLE HANDLING

The field sampler is personally responsible for the care and custody of the samples until they are transferred to another individual or secure area or properly dispatched to the laboratory. As few people as possible should handle the samples. The following sample handling procedures will be used to process samples after collection:

- Each sample jar will be labeled with indelible ink in accordance with the sample and station identification nomenclature, the Briggs RI/FS project name, sampling date and time, and primary sampler. Sample identifiers are unique and summarized in the following section (Section 3.8). No sample preservative will be added in the field.

- Labeled samples are sealed in individual Ziploc bags and placed in a cooler with sufficient bagged ice to maintain a 2 to 4 °C temperature.

- In addition to samples and ice, the cooler will be filled with inert cushioning material, such as bubble pack, or cardboard dividers to prevent the sample containers from sliding during shipment.

- Chain-of-custody forms will be completed to ensure that sample custody is documented, appropriate sample fractions have been collected, and scheduled analyses are properly assigned or samples are properly identified for archiving.

- Each cooler will contain chain-of-custody forms that list all samples within that cooler and no other cooler. Samples to be analyzed for TPH, pesticides/herbicides, and metals will be kept in separate coolers from any samples collected for potential CDD/F analyses. A Washington laboratory will analyze the former; the latter samples will be shipped to a specialty laboratory in California (see Section 8.1).

- An ENTRIX Contact will be listed on all chain-of-custody forms for communication with the laboratory

- The sampler shall place the completed chain-of-custody form in a laboratory-provided waterproof bag inside the cooler, on top of the cooler contents. The cooler lid will be secured with signed and dated custody seals placed in two locations across the opening of the cooler lid. All samples will be hand-delivered, picked-up by lab courier, or shipped by overnight express on ice to the appropriate laboratory.

- Upon receipt in the laboratory, the cooler will be opened and examined for evidence of proper cooling. The sample containers will be checked for breakage, leakage, or damage, and the contents and analytical requirements of the shipment will be verified against the chain-of-custody form. If this inspection reveals a problem, it will be documented on the chain-of-custody form and the Client Contact shall be notified at the time of receipt. Any shipping receipts will be attached to the chain-of-custody records and stored in the project file.

- Following receipt of the samples by the laboratory, ENTRIX will provide instructions for authorized analysis and required turn-around time for data reporting.

3.7 Sample Labeling

Each sample will be labeled with a unique sample number that will facilitate tracking and cross-referencing of sample information. The sample numbering system to be used is described as follows:

Example: GW-MMDDYY- 001

means

GW:	designates sample media
	(i.e., SW - surface water, SD - sediment, S - soil, GW - groundwater)
MMDDYY:	designates date of collection presented as month/day/year
001:	sequential number starting with 001 at the start of each project activity

Field blank and field duplicate samples also will be numbered with a unique sample number, consistent with the numbering system described above, to prevent laboratory bias of field QC samples.

3.8 Decontamination

All non-disposable sampling equipment will be decontaminated after each sample location.

Sampling equipment will be decontaminated between samples. The decontamination process will include scrubbing with Alconox® soap and rinsing with distilled water.

4.0 WORK AREA 1

All samples from Work Area 1 will be analyzed for pesticides, chromium, and copper. Samples from the kettles will be analyzed for CDD/Fs and pesticides.

4.1 OUTLYING PRODUCTION AREA SAMPLING GRID

Surficial soil samples will be collected from each cell of a grid imposed on the relatively flat topography in Work Area 1. The history of Work Area 1 gives no indication of potential spills or leaks and contamination if any in this area is likely associated with fertilizer or pesticide/herbicide application over relatively large areas. Therefore, each grid cell will be approximately 200 ft by 200 ft. A sample will be taken from the center of each grid cell. The sample will be composited from a center sample and four additional sub-samples, each sample at a 2-foot radius from the center and on a cardinal compass direction. Work Area 1 surficial soil samples will be collected from a 200-ft grid as described in Section 3.1. About 67 surficial soil samples will be collected in Work Area 1 and analyzed for pesticides, chromium, and copper. As noted in Section 2.3.2, pesticide results will be carefully reviewed for interferences that could indicate PCBs at elevated concentrations.

4.2 NORTH KETTLE

4.2.1 Sediment Samples

Ten to 12 sediment samples will be collected from the North Kettle. Sediment samples will be collected in accordance with sampling methods described in Section 3.2 of the work plan.

4.2.2 Surface Water Samples

Two composite surface water samples will be collected from the North Kettle from two separate locations. The surface water samples will be collected in accordance with sampling methods described in Section 3.3 of the work plan.

4.3 CENTRAL KETTLE

4.3.1 Sediment Samples

Ten to 12 sediment samples will be collected from the Central Kettle. Sediment samples will be collected using sampling methods described in Section 3.2 of the work plan.

4.3.2 Surface Water Samples

Two composite surface water samples will be collected from the Central Kettle from two separate locations. The surface water samples will be collected in accordance with sampling methods described in Section 3.3 of the work plan.

4.4 SOUTH KETTLE

4.4.1 Sediment Samples

Ten to 12 sediment samples will be collected from the South Kettle. Sediment samples will be collected using sampling methods described in Section 3.2 of the work plan.

4.4.2 Surface Water Samples

Two composite surface water samples will be collected from the South Kettle from two separate locations. The surface water samples will be collected in accordance with sampling methods described in Section 3.3 of the work plan.

4.5 NORTHWEST KETTLE

4.5.1 Sediment Samples

Ten to 12 sediment samples will be collected from the Northwest Kettle. Sediment samples will be collected using sampling methods described in Section 3.2 of the work plan. These samples will be analyzed for PCBs and CDD/Fs.

4.5.2 Surface Water Samples

Two composite surface water samples will be collected from the Northwest Kettle from two separate locations. The surface water samples will be collected in accordance with sampling methods described in Section 3.3 of the work plan.

5.0 WORK AREA 2

All grid samples from Work Area 2 will be analyzed for pesticides, chromium, copper, and screened for PCBs. . Within the Main Operations Area, additional samples will be collected and also tested for. Samples from the Shop and UST area will be analyzed only for petroleum hydrocarbons (NWTPH Gx/Dx).

5.1 SHOP AND UNDERGROUND STORAGE TANK AREA

Sampling in this area will aid in identifying the extent of potential contamination from historical releases and to confirm cleanup after demolition and tank removal activities.

5.1.1 Observation During Demolition

During demolition of the shop and underground storage tank area, an experienced environmental scientist will be on hand to visually inspect the condition of the shop foundation for any signs of compromised concrete or evidence of releases that may have reached the soils underneath.

5.1.2 Sampling Beneath Shop Foundation

Soil samples will be collected for any areas suspected of impact from releases. These soils will be analyzed only for petroleum hydrocarbons using NWTPH-Gx and NWTPH-Dx.

5.1.3 Tank Decommissioning and Disposal

Ten USTs (four septic tanks, four #2 fuel oil tanks, one regular unleaded gasoline tank and one diesel tank) are located on-site near the shop (Figure 4). A contractor to Briggs Nursery, Inc will handle decommissioning and disposal of the ten USTs. ENTRIX, Inc. will be on-site during tank decommissioning and disposal to address any potential contamination issues.

5.1.3.1 Tank Site Inspection Prior to Excavation

A Site inspection will be conducted prior to tank excavation. Current Site plans showing tank components and piping systems will be reviewed and verified prior to tank decommissioning activities. Prior to tank removal, the tank area will be inspected for signs of leaks or spills and to confirm the tank components and piping system. It is assumed that the tank sizes and utility locate information will be available in the Site plans.

In order to minimize risk of a spill during the tank excavation, the selected demolition contractor will ensure that the tanks are completely empty.

5.1.3.2 Observation and Analysis During Tank Excavation

A certified tank removal contractor will conduct the excavation under supervision of an ENTRIX environmental scientist. Care will be taken to ensure any remaining tank content will not be released during removal activities. Visual examination of soil will be performed during excavation to identify potential petroleum contamination. A Photo-Ionization Detector (PID) will be used to detect potential petroleum hydrocarbons in the soil.

If visible or olfactory evidence of contamination is observed during excavation, or if petroleum hydrocarbons are detected by use of the PID, soil samples will be collected during excavation activities and analyzed at an accredited laboratory in the State of Washington. In the event that soil contaminated above appropriate MTCA levels is encountered, the affected soil will be removed and transported off-site for reuse or disposal at an approved disposal facility. Confirmation soil samples would then be collected within the excavation area to ensure contaminated soils have been removed.

It is unlikely that groundwater will be encountered during decommissioning activities because groundwater is expected to be much deeper than the tank excavation. Should any perched water be encountered during the excavation, water samples will be collected and analyzed for evidence of hydrocarbon contamination. If contaminated groundwater is encountered, groundwater will be treated or disposed under an interim remedial action plan.

5.1.3.3 Post Excavation Confirmation Sampling

At the conclusion of the tank and soil (if any) excavations, at least two discrete confirmation soil samples will be collected for analysis from each wall and four samples from each excavation floor. If soil contaminated above appropriate MTCA levels is encountered, the affected soil will be removed and transported off-site for reuse or disposal at an approved disposal facility. Additional soil would be excavated until post-confirmation sample results indicate that the MTCA clean up levels have been achieved. The excavation pit will remain open until samples have been analyzed and it is determined that the soil contaminate levels do not exceed applicable MTCA cleanup standards.

5.1.3.4 Procedures If Interim Remedial Action Required

If contaminated soils are encountered in the excavation, stockpiles of excavated material will be separated between clean and potentially contaminated. Discrete samples will be collected at different depths from each segregated stock pile in accordance with *Guidance for Remediation of Petroleum Contaminated Soils*, Washington State Department of Ecology Toxics Cleanup Program, 91-30.

The samples will be analyzed only for petroleum hydrocarbons and byproducts using NWTPH-Gx and NWTPH-Dx. The clean stockpile may be used as backfill for the excavation. Any soil contaminated above MTCA cleanup standards will be transported off-site for disposal at an appropriate licensed and regulated facility.

5.2 FERTILIZER INJECTOR SHED/CHEMICAL MIXING AREA SAMPLING GRID

A higher density 100-foot sampling grid will be utilized for surficial soil sample collection in the Fertilizer Injector Shed (FIS) and Chemical Mixing Areas. Approximately 14 surficial soil samples will be collected. Samples will be collected as described in Section 3.1 and analyzed for pesticides. Some discretionary samples, in addition to the grid samples, will be collected within the fertilizer injector shed/chemical mixing shed area will be analyzed for pesticides, herbicides and metals.

5.2.1 Abandoned Sump Area

According to a recent disclosure by a former employee, an abandoned drainage sump is located behind the Chemical Mixing Shed. This sump may contain empty drums that were placed there for improved drainage and energy diffusion. According to the employee, the sump was filled and covered with asphalt. The estimated location of the abandoned sump has been identified and marked.

Following the underground storage tank removal (discussed in the following section), this sump and any remaining drums will be excavated and placed in overpack drums. The soil will then be sampled and analyzed prior to any further disturbance. The soils will be segregated and stockpiled. Samples will be collected from the walls and floor of the excavation as described in the UST sampling efforts. Samples will also be collected from the stockpile. These samples will be analyzed for pesticides, herbicides, and metals.

Any drums encountered during this excavation will be segregated, placed on an impermeable surface and any remaining liquid will be tested prior to disposal.

Should any perched groundwater be encountered, samples will be collected for analysis.

If warranted, additional subsurface investigations will be conducted in the vicinity of the Main Operations Area. Methods may include further exploratory excavation and ground penetrating radar.

5.3 PAD AND GREENHOUSE AREA SAMPLING GRID

Surficial soil samples will be collected from each cell of a grid imposed on the relatively flat topography in Work Area 2. Each grid cell will be approximately 100 ft by 100 ft. The sample will be composited from a center sample and four additional sub-samples, each sample at a 2-foot radius from the center and on a cardinal compass direction. Work Area 2 surficial soil samples will be collected from a 200-ft grid as described in Section 3.1.

6.0 WORK AREA 3

All samples from Work Area 3 will be analyzed for pesticides, chromium, and copper. Samples from the kettles will be analyzed for CDD/Fs and pesticides.

6.1 LABORATORY BUILDING AREA SAMPLING GRID

Surficial soil samples will be collected from each cell of a grid imposed on the relatively flat topography in Work Area 3. A higher density 100-foot sampling grid will be utilized for surficial soil sample collection in the laboratory building area for a total of about 43 samples. The sample will be composited from a center sample and four additional sub-samples, each sample at a 2-foot radius from the center and on a cardinal compass direction. Samples will be collected as described in Section 3.1.

6.2 OUTBUILDING AND FIELD AREA SAMPLING GRID

Surficial soil samples will be collected from each cell of a grid imposed on the relatively flat topography in Work Area 3. Each grid cell will be approximately 200 ft by 200 ft for a total of six samples. A sample will be taken from the center of each grid cell. The sample will be composited from a center sample and four additional sub-samples, each sample at a 2-foot radius from the center and on a cardinal compass direction. Work Area 3 surficial soil samples will be collected from a 200-ft grid as described in Section 3.1.

6.3 NORTHEAST KETTLE

6.3.1 Sediment Samples

Ten to 12 composite sediment samples will be collected from the Northeast Kettle. Sediment samples will be collected in accordance with sampling methods described in Section 3.2 of the work plan.

6.3.2 Surface Water Samples

Two composite surface water samples will be collected in the Northeast Kettle. Each of the samples will be collected at a unique location in the Northeast Kettle. Surface water samples will be collected using surface water sampling methods described in Section 3.3 of the work plan.

6.4 SOUTHEAST KETTLE

6.4.1 Sediment Samples

Ten to 12 composite sediment samples will be collected from the Southeast Kettle. Sediment samples will be collected in accordance with sampling methods described in Section 3.2 of the work plan.

6.4.2 Surface Water Samples

Two composite surface water samples will be collected from the Southeast Kettle. Both samples will be collected from a unique location. Surface water samples will be collected using sampling methods described in Section 3.3 of the work plan.

6.5 WARD LAKE

Based on the assessment of analytical results obtained during the RI described herein, Ward Lake sediments will be tested as necessary to measure contaminants attributable to nursery operations.

7.0 SITE GROUNDWATER INVESTIGATION PROGRAM

7.1 GOVERNING HYDROGEOLOGIC FACTORS

As described in Section 2.0, regional hydrogeologic information described in Section 2.0, borehole and test data from the Briggs irrigation well, and the two Olympia brewery wells located to the west, indicate that the Site is underlain by 100-200 ft of Qvr (or the recessional outwash). Qvr is comprised of predominantly sands and gravels, with lenses of silty sand and in places clay lenses. The clay lenses, if extensive, could create perching conditions.

Based on the topographic conditions and observations of groundwater lakes described in Section 2.0, groundwater is expected to flow westward from Ward Lake to the Deschutes River. Further, the depth to groundwater varies due to the topographic irregularities of the recessional outwash and glacial deposits, and through flowing drainages. Water levels may fluctuate up to 6 ft due to seasonal recharge (highest in spring and lowest in fall). Except in the kettles, the surface elevation of the Site ranges from 170 ft to 202 ft msl, while the water table is expected to range from 117 ft to 126 ft msl. Thus, except in the kettles, the depth to groundwater across the Site is expected to range from approximately 45 to 85 ft below the ground surface.

7.2 PROGRAM OBJECTIVES

The primary objective of the Site groundwater investigation program is to determine whether the shallow unconfined aquifer in the Qvr deposits has been impacted by Site activities. Additionally, it will be important to determine if any extensive perched water-bearing zone has been impacted. If groundwater quality has been impacted, then a second objective will be to assess groundwater flow directions, gradients, and possible migration pathways in the shallow Qvr aquifer and within any perched water-bearing zones.

7.3 DRILLING BOREHOLES AND INSTALLING MONITORING WELLS

Activities of concern that may have had the potential to affect soils and groundwater have occurred primarily in Work Area 2. Based on the assumed westward-flowing regional groundwater flow direction and the locations of activities of concern, six well locations are proposed in the following locations (Figure 5):

- An upgradient well location in Work Area 3 between the Southeast and Northeast Kettles;
- Two wells situated along the western arcuate boundary of Work Area 2 and immediately downgradient of the principal area of concern; and
- Three wells in Work Area 1 situated along the western and northern Briggs property boundary.

At each location, one or two wells may be installed depending on whether perched water-bearing zones are encountered. Based on the assumed elevation of the Qvr aquifer, and the approximate elevations of the well locations, all six drillholes are estimated to encounter groundwater at depths ranging from 60 to 75 ft.

Based on this assumed depth to groundwater, borings will be advanced to at least 70-85 ft below ground surface (bgs). Depending on subsurface conditions and after consultation with the driller, either a truck-mounted rotary rig (if predominantly sandy gravels with cobbles or coarser sediments are expected) or a hollow-stem auger rig (if predominantly sand size and finer sediments are expected) will be used. Split-spoon samples will be collected at 5-ft intervals and at the water table interface. Drill cuttings and split-spoon samples will be described and logged following standard United Soil Classification System (USCS). Borehole logs will be recorded following standard practices.

The presence of groundwater will be monitored during drilling. If a significant water-bearing zone is encountered in strata measurably above the projected groundwater surface elevation for that particular well location, then the borehole will be allowed to sit for 5-15 minutes, and then depth-to-water measurements will be made until the depth to water stabilizes. Continuous split-spoon samples will then be collected until a fine-grained layer (i.e., composed of silty clay, clayey silt, or clay) is encountered and perching conditions can be evaluated. If perching conditions are confirmed and there is at least one foot of water in the bottom of the borehole, then a monitoring well will be installed so that a 5- or 10-ft 10 or 20-slot screen extends about 1-ft below the upper surface of the confining layer. If perching conditions are not confirmed, then the borehole will be continued until either another perching condition is encountered or the shallow Qvr aquifer is reached. The borehole will penetrate to at least 6-ft but no more than 10-ft below the water table. At this time, the borehole will be allowed to sit for 15-30 minutes to allow the groundwater surface to stabilize, and provide data to help determine well screen depths.

If the first well at each well location is completed into a perching zone, then a second well will be located 3-5 ft from the first well, and advanced directly to the Qvr aquifer. The second well will be sampled and monitored the same as the first well, except that any observations of perching conditions will only be noted.

All Qvr aquifer wells will be set with 2-inch diameter PVC, using at least a 10-ft (because groundwater levels may fluctuate seasonally 6-8 ft) 10 or 20-slot screen (depending on borehole grain sizes). All wells will be constructed with sand filters that extend above the screen, and will be sealed with bentonite. Depending on ground surface conditions and facility requirements, the top of the well will either be completed as a stick-up well 2-3 ft above the ground surface, or be cement-mounted flush with the surface. All wells will have locking caps, and will be developed within 48 hours after well completion following standard well development techniques.

7.4 WELL SURVEY AND GROUNDWATER LEVEL MONITORING

Absolute elevations of the top-of-casing for each monitoring well will be surveyed by a licensed surveyor and recorded to the nearest hundredth of a foot using standard surveying techniques with reference to the appropriate local datum control (i.e., NAD 83). At least 24 hours after well development, groundwater levels below the top of casing in each well will be measured with a decontaminated electric water level indicator. The depth to groundwater in each monitoring well will be determined in accordance with American Society of Testing Materials Standard (ASTM) D4750-87 *Standard Test Method for Determining Subsurface Liquid Levels in a Borehole or Monitoring Well (Observation Well)* (ASTM, 1993).

7.5 GROUNDWATER SAMPLING

Following well development and just prior to well sampling, the groundwater level below the top of casing in each well will be measured with a decontaminated electric water level indicator and the volume of water in the borehole will be calculated. Groundwater samples from all monitoring wells will be collected in accordance with ASTM D 4448-85a *Standard Guide for Sampling Groundwater Monitoring Wells* (1992) to obtain valid, representative samples. A minimum of three (3) borehole volumes will be purged from each well prior to sampling. Well purging and sampling will be accomplished using a standard and appropriate method (e.g., hand pump, peristaltic pump, disposable polyethylene bailer, etc.). All equipment utilized will be either disposable or decontaminated using an Alconox soap wash followed by a distilled water rinse.

Groundwater samples will be collected into various appropriate laboratory-provided containers, depending on the type of analysis planned. Each water sample will be immediately cooled in an iced cooler for transportation to an approved laboratory. Chain of custody documentation will be maintained throughout the process.

8.0 ANALYTICAL PROCEDURES

8.1 LABORATORY SELECTION

Grid samples and selected discretionary samples collected during the demolition work activities will be analyzed for the parameters specified in Sections 4.0, 5.0 and 6.0 above by Analytical Resources, Inc. (ARI) located in Tukwila, Washington. The laboratory is Washington-certified.

High quality CDD/F analyses can only be obtained by a small number of laboratories. Selection of a CDD/F specialty laboratory will be made based on workload and pricing from two laboratories with a national reputation and recent confirmation of high quality analyses: Severn Trent Laboratory (STL) Sacramento, CA and ALTA Laboratories in El Dorado Hills, CA.

The petroleum hydrocarbon analyses required during the UST excavations will be conducted by Libby Environmental, Inc., in Olympia. Libby's proximity to the Site and ability to provide a mobile laboratory on the Site during the excavations will expedite the UST closure process. Libby will be able to provide same-day analyses to ensure the complete removal of petroleum contaminated soils.

8.2 LABORATORY ANALYTICAL METHODS

Some or all soil, sediment, and water samples collected under this Work Plan may be analyzed for pesticides, PCBs, herbicides, TPH-Gx/Dx, and CDD/Fs using the following procedures:

8.2.1 Chlorinated Pesticides

Chlorinated pesticides will be analyzed according to requirements of EPA method 9091a for sediment, soil, surface water, and groundwater matrices. Method detection limits (MDL) are specified in 8081a. Reporting limits in soil are 3.5 μg/Kg (parts per billion) for dieldrin, DDD, DDT, and DDE. Reporting limits in water are approximately 0.025 μg/L (parts per billion).

Should analyses for chlorinated herbicides be deemed necessary for selected samples, they will be conducted according to the requirements of EPA method 8151 for sediment, soil, surface water, and groundwater matrices. Reporting limits vary, for example, ranging from 8.7 ppb for 2,4,5-TP (Silvex), to 18 ppb (Dinoseb, Dicamba) to 35 ppb (2,4-D and Dichloroprop) to 18,000 ppb (MCPA) in soil. Reporting limits for the same herbicides in water range from approximately 0.1 to 10 ppb.

8.2.2 PCBs

The ECD method that will be used for analyzing pesticides is also sensitive to other chlorinated compounds such as PCBs, which are simultaneously detected when analyzing for chlorinated pesticides. PCBs occur as multi-component mixtures of compounds that produce patterns on the chromatogram potentially interfering with, or at least complicating, the detection of pesticides. Therefore, the potential co-occurrence of PCBs and pesticides needs to be taken into account whether analyzing solely for pesticides, solely for PCB, or analyzing for both compound classes.

Pesticide results will be carefully reviewed for interferences that could indicate PCBs at elevated concentrations.

8.2.3 Copper and Chromium

Copper and chromium will be analyzed according to the requirements of EPA method 6020 for sediment, soil, surface water, and groundwater matrices. The laboratory equipment will be calibrated so that additional metals can be reported in the future if deemed necessary. The reporting limit for copper is approximately 10 ppm in soil. The reporting limit for copper in water is approximately 0.01 ppm.

8.2.4 Petroleum Hydrocarbons:

Petroleum hydrocarbons will be analyzed according to the requirements of NWTPH-Gx (toluene through C_{12}) and NWTPH-Dx including diesel range (C_{12}-C_{24}), and heavy oil (C_{24}-C_{40}). Diesel reporting limits are 25 mg/Kg in soil and 0.25 mg/L in water. Heavy oil reporting limits are 100 mg/Kg in soil and 0.50 mg/L in water.

8.2.5 Chlorinated Dioxins and Furans:

CDD/Fs will be analyzed using the isotope dilution, multimedia EPA method 1613B for the seventeen 2,3,7,8-substituted tetra- through octa- CDDs) and dibenzofurans (CDFs) and for total tetra- through hepta- CDD and CDF homologues in surface water and sediment matrices only.

The lowest expected detection limit using this procedure for 2,3,7,8-tetra CDD/CDF is 1-10 pg/L (parts per quadrillion) for water /groundwater samples and 0.1 to one ng/Kg (parts per trillion) for soil samples. For penta- through hepta- CDD/CDF, the specified detection limit will be five times the achieved detection limit for the tetra-CDD/CDF. For octa-CDD/CDF (OCDD/OCDF), the detection limit will be 10 times that detection limit. These detection limits and associated quantitation limits (i.e., the value above which the results are no longer reported as estimates) are highly matrix-dependent and may not always be achievable.

8.2.6 Herbicides

Soil samples identified for herbicide analysis will be analyzed by EPA method 8151A using the standard detection limit ranges associated with the method. The detection limit for 2,4-D in particular is anticipated to be in the range of 35 to 50 μg/kg.

9.0 DATA MANAGEMENT AND QUALITY ASSURANCE REVIEW

This section provides project-specific objectives and intended data usage, measures that will be taken to assure the integrity of field sampling procedures, chain-of-custody, laboratory analyses, and quality assurance review of reported data.

9.1 QUALITY ASSURANCE OBJECTIVES FOR MEASUREMENT DATA

The overall quality assurance (QA) objective is to develop and implement procedures for field sampling, chain-of-custody, laboratory analyses, and reporting that will provide results that are legally defensible in a court of law and of sufficient quality to support risk assessment.

9.2 LEVEL OF QUALITY CONTROL EFFORT

Field blank, trip blank, method blank, field duplicate, laboratory duplicate, laboratory control sample, quality control (QC) check samples, and matrix spike samples will be analyzed to assess the quality of the data resulting from the field sampling and laboratory analytical programs.

Field and trip blanks will be submitted to the analytical laboratory to provide the means to assess the quality of the data resulting from the field sampling program. Field blank samples (equipment rinsate blanks) are analyzed to check for contamination introduced during sampling at the Facility which may cause sample contamination.

Trip blanks are used to assess the potential for contamination of samples due to contaminant migration during sample shipment and storage.

Method blank samples are generated within the laboratory and are used to assess contamination resulting from laboratory procedures. Field duplicate samples are analyzed to check for sampling and analytical reproducibility. Matrix spikes provide information about the effect of the sample matrix on the preparation and measurement methodology. Matrix spikes are performed in duplicate.

The general level of the QC effort will be one field blank and one field duplicate for every 10 or fewer investigative samples. Trip blank samples will remain unopened during the sampling event. One matrix spike/matrix duplicate (MS/MSD) will be collected/designated for every 20 or fewer investigative samples per sample matrix (i.e., groundwater, soil).

9.3 FIELD QUALITY CONTROL SAMPLE COLLECTION

9.3.1 Field Blank Sample Collection

Field blank samples will be collected when dedicated or disposable sampling equipment is not used to collect investigative samples. Field blanks consist of distilled water that has been routed through decontaminated sampling equipment and collected into the appropriate containers. The containers will be filled in order of decreasing analyte volatility.

9.3.2 MS/MSD Sample Collection

MS/MSD sample collection for organic parameters requires that double the volume of sample will be collected for aqueous samples.

9.3.3 Field Blank Samples

Field blank samples (rinsate blanks) will be collected in the field at a minimum frequency of one per every 10 or fewer investigative samples. Field blanks will be used to assess the efficiency of sampling equipment decontamination. The presence of analytes in the field blank samples will be indicative of potential cross contamination.

9.3.4 Trip Blank Samples

Trip blank samples, supplied by the laboratory with the sample containers, will be submitted with each shipping cooler containing aqueous VOC samples, if applicable. Trip blank samples are used to assess whether contamination of VOC samples has occurred due to contaminant migration during sample shipment and storage.

9.3.5 Field Duplicate Samples

Field duplicate samples are collected in a similar fashion to investigative samples at a minimum frequency of one duplicate per every 10 or fewer investigative samples by matrix. Field duplicate samples are analyzed by the laboratory to evaluate matrix, sample, and analytical reproducibility.

9.4 CUSTODY PROCEDURES

Custody is one of several factors that are necessary for the admissibility of environmental data as evidence in a court of law. Custody procedures help to satisfy the two major requirements for admissibility: relevance and authenticity. Sample custody is addressed in three parts: field sample collection, laboratory analysis, and final evidence files. Final evidence files, including all originals of laboratory reports, are maintained under document control in a secure area.

9.4.1 Field Custody Procedures

Field logbooks will provide the means of recording data collecting activities performed. As such, entries will be described in as much detail as possible so that persons going to the Facility could reconstruct a particular situation without reliance on memory. Field logbooks will be bound field survey books or notebooks. Logbooks will be assigned to field personnel and will be stored with the project files when not in use. Each logbook will be identified by the project number.

The title page of each logbook will contain the following:

i) Person to whom the logbook is assigned;

ii) Logbook number;

iii) Project name;

iv) Project start date; and

v) End date.

Entries into the logbook will contain a variety of information. At the beginning of each entry, the date, start time, weather, names of all sampling team members present, level of personal protection being used, and the signature of the person making the entry will be entered. The names of visitors to the Facility during activities and the purpose of their visit will also be recorded in the field logbook.

9.4.2 Laboratory Custody Procedures

Each laboratory will log samples in according to standard operating procedures for tracking samples. Final data reports will provide a copy of the completed chain-of-custody forms as well as forms showing the correlation between laboratory identification numbers and chain-of-custody identification numbers for each sample.

9.5 LABORATORY QUALITY CONTROL CHECKS

The laboratory has a QC program they use to ensure the reliability and validity of the analysis performed at the laboratory. The internal quality control checks may vary slightly for each individual procedure but in general will include the following QC requirements:

- Calibration Standards
- Instrument Performance Checks - Organics
- Initial and Continuing Calibration Checks
- Internal Standard Performance
- Method Blank Samples

  - Laboratory Control Samples and QC Check Samples
  - Matrix Spike/Matrix Spike Duplicates
  - Surrogates
  - ICP Interference Check Samples (ICS)
  - ICP Serial Dilution
  - Reagent Checks
- Blind Check Samples

All data will be properly recorded. The data package provided to ENTRIX will include a summary of QC data and all backup data, including calibration data for organic and metals analyses. Any samples analyzed in nonconformance with QC criteria will be re-analyzed by the laboratory, if sufficient volume is available.

9.6 DATA QUALITY ASSURANCE REVIEW

ENTRIX will conduct an independent data quality assurance (QA) review of all data reported by laboratories. The level-of-effort for these reviews will correspond to the level of detail that can be provided by the laboratory.

For organic compounds and metals (i.e., pesticides, CDD/Fs, copper) full data packages are requested and will be reviewed, including instrument calibration, which is equivalent to an EPA Level IV QA review. The findings will be summarized in a brief QA review report to document any appropriate qualification of the data values.

For TPH analyses, a more limited EPA Level II review will be conducted because those data packages are typically limited to a laboratory-provided summary of their own QC data without the ability to verify that summary from the original data. This QA review will also be summarized in a brief report that will document any appropriate qualification of the data values.

10.0 DRAFT AND FINAL RI REPORT

Draft and Final RI Reports for Work Areas 1, 2, and 3 will be prepared and submitted to Ecology. Depending on the Site demolition schedule, the reports will either be combined into one document for submittal or provided as individual documents. The RI Reports will describe sampling procedures, sampling locations, and ground water monitoring well construction details. Field observations including any field screening results will be summarized.

Analytical data will be presented in summary tables and the data validation results will be presented. Copies of laboratory data sheets will also be provided in appendices. The report will document areas, if any, where soil or sediment contaminant levels exceed MTCA guidelines. The report will also present a conceptual shallow groundwater model of the Site and provide information on ground water quality within the zone of exploration.

Laboratory analytical data will be shared with Ecology upon receipt and validation by ENTRIX.

Comments provided by Ecology on the Draft Report will be addressed in the Final Report. The Final Report will be submitted within three weeks of receipt of comments on the Draft Report from Ecology.

11.0 HUMAN HEALTH RISK ASSESSMENT ADDENDUM

Because of the unique nature of the kettles located on the Briggs property and the potential for a child exposure scenario, a human health risk assessment will be conducted on the kettles. The MTCA standards will be applied for all other areas.

A child resident risk scenario will be used to assess both baseline Site risks and risks after changes to kettle hydrology from the proposed project. In particular, several kettles will dry up since they will no longer receive irrigation return water and stormwater after site development. Additional risk scenarios will be assessed that incorporate engineering and institutional controls to inhibit access if any kettles appear problematic based on risk assessments that assume unrestricted access.

The exposure scenarios selected for the risk assessments will be discussed and approved by Ecology prior to initiating the risk analysis.

12.0 INTERIM RESPONSE ACTION PLANS

An objective of the RI stage of the Briggs Nursery project is to facilitate early release of Site areas to the extent feasible. Site history and previously conducted Site sampling and analyses suggest that areas of soils contaminated with COCs may exist within the larger Work Area 1, 2, and 3 boundaries. As the RI proceeds, these contaminated areas would be considered candidates for Interim Remedial Actions (IRAs). These IRAs could involve additional work to quickly assess and remediate the areas of contamination without the need for a formal Feasibility Study. Additional sampling and laboratory analysis will be conducted to determine the horizontal and vertical extent of the contaminated areas. Any proposed interim actions will be submitted in a written plan, and approved by Ecology prior to its implementation.

Once the contaminated zones are delineated and the soils are characterized, the following actions may be considered as part of the IRA.

- Uncontaminated soil will be left on the Site.

- Soils contaminated with chemicals at concentrations below what would be defined as a hazardous waste, but above the MTCA standards applicable to the future uses of the Site will be disposed of or reused off-site in a manner consistent with both MTCA and State and County solid waste guidelines.

- Soils with contamination that exceeds hazardous waste standards will be disposed of at a regulated commercial landfill approved for handling and disposal of such wastes.

- The underground storage tanks located in Work Area 2 and discussed in detail in Section 5.1 will be removed and disposed during the demolition process in Work Area 2. Any petroleum contaminated soils will be excavated and transported to a recycling facility for reuse. Confirmatory samples will be taken to ensure the extent of the contaminated soil has been adequately remediated.

Post-excavation sampling will be conducted to ensure that residual contaminants are below any relevant soil action levels. All work will be conducted in a manner consistent with all applicable State, local and Federal regulations.

13.0 FEASIBILITY STUDY

A Feasibility Study (FS) will be prepared consistent with MTCA guidelines to address potential approaches to the cleanup of any identified Site contamination not addressed in the IRA process discussed in Section 12.0. The FS will include a conceptual Site model that addresses potential exposure pathways. Cleanup alternatives will be developed and evaluated to address the potential exposure pathways. The cleanup alternatives will be evaluated in a manner consistent with relevant sections of WAC 173-340.

13.1 DEVELOPMENT OF CLEANUP LEVELS

Cleanup levels for soils, sediment, surface water, and groundwater will be derived from MTCA regulations. The cleanup levels for soils will assume unrestricted land use and will address the direct contact/ingestion pathway as well as the standard protective of groundwater derived standard. The groundwater cleanup standard will be based on protection of surface water given the likely interconnection between Ward Lake and the Deschutes River through the groundwater table below the Site.

13.2 DEVELOPMENT OF POINT OF COMPLIANCE

The Point of Compliance for the Site could be any location throughout the Site, based on analytical results from the RI described herein, and attributable to nursery operations.

13.3 DEVELOPMENT OF ALTERNATIVES

The FS will develop and evaluate a range of potential cleanup action alternatives in accordance with relevant sections of WAC 173-340. The FS will address only those volumes of contaminated media that have not been remediated through any IRA work conducted during the RI phase. Alternatives will be defined with a sufficient level of quantitative detail to allow differentiation among alternatives with respect to effectiveness, implementability, and cost.

13.4 TERRESTRIAL ECOLOGICAL RISKS AND NET ENVIRONMENTAL BENEFIT ANALYSIS (NEBA)

Of particular interest from an ecological viewpoint are the on-site kettles. Previous sampling within several kettles indicates low levels of CDD/F contamination in kettle surface water and sediment samples. If existing data and data gained from the proposed work predicts unacceptable incremental risk, a Net Environmental Benefit Analysis (NEBA) may be required. The purpose of the NEBA would be to assess whether the affected kettle under institutional control provided a sufficient level of environmental benefit to influence potential remedial alternatives. A NEBA may be advisable given the importance of relatively undisturbed kettle wetlands to regional and local ecological health in the Site area.

13.5 COMPARATIVE ANALYSIS OF ALTERNATIVES

A comparative analysis of the alternatives will be presented. The advantages and disadvantages of each alternative relative to other alternatives will be identified. A narrative discussion describing the advantages and disadvantages of the alternatives relative to each other and to the evaluation criteria will be presented. An assessment of how variations in key uncertainties could affect relative performance will be included.

13.6 DRAFT AND FINAL FS REPORTS

A Draft FS Report will be prepared and submitted to Ecology for its review. Comments received from Ecology on the Draft Report will be evaluated and the Final Report adjusted as appropriate based on the response to comments. The Final FS Report will be submitted within two weeks of receipt of a complete set of comments from Ecology.

14.0 REFERENCES

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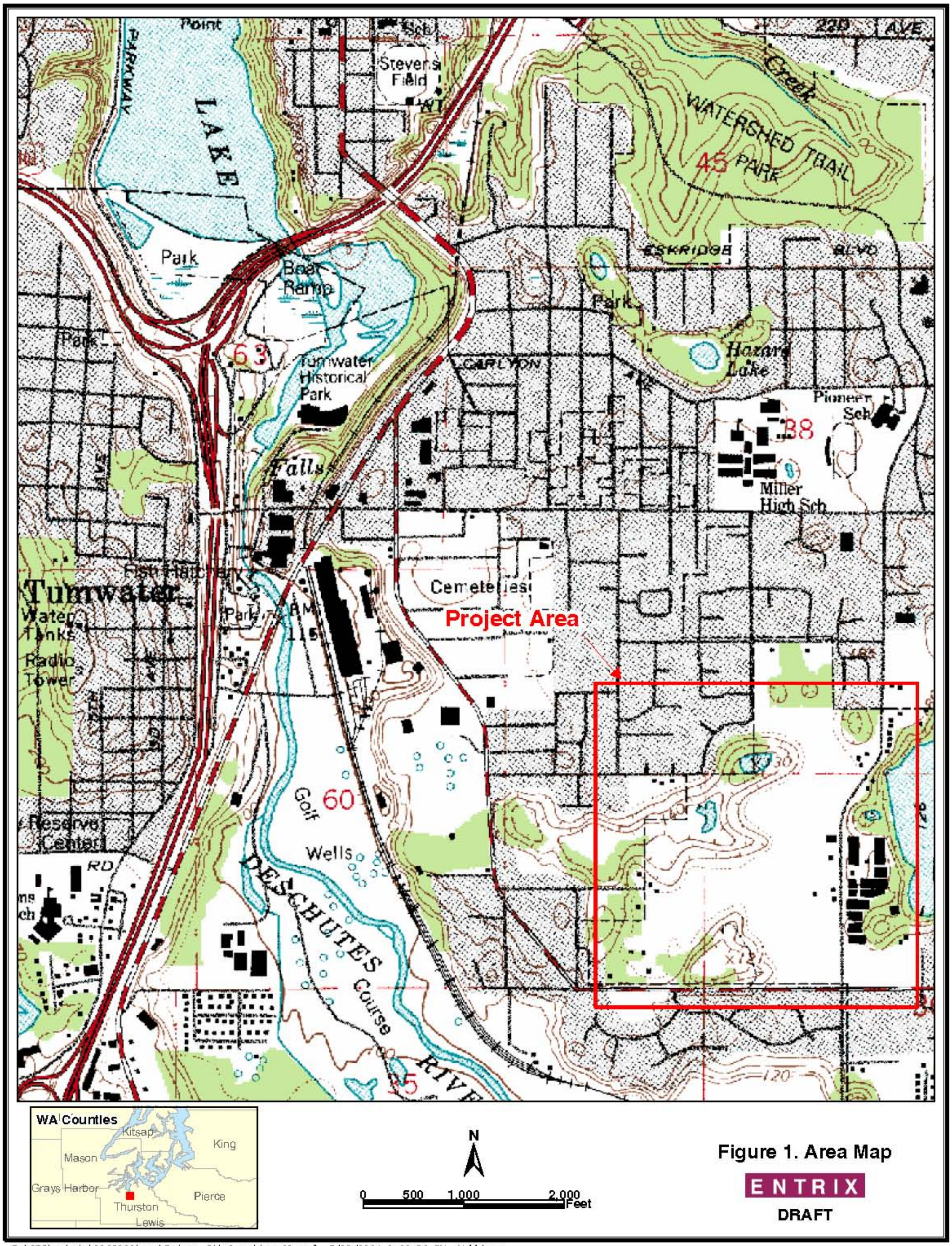

Figure 1. Area Map

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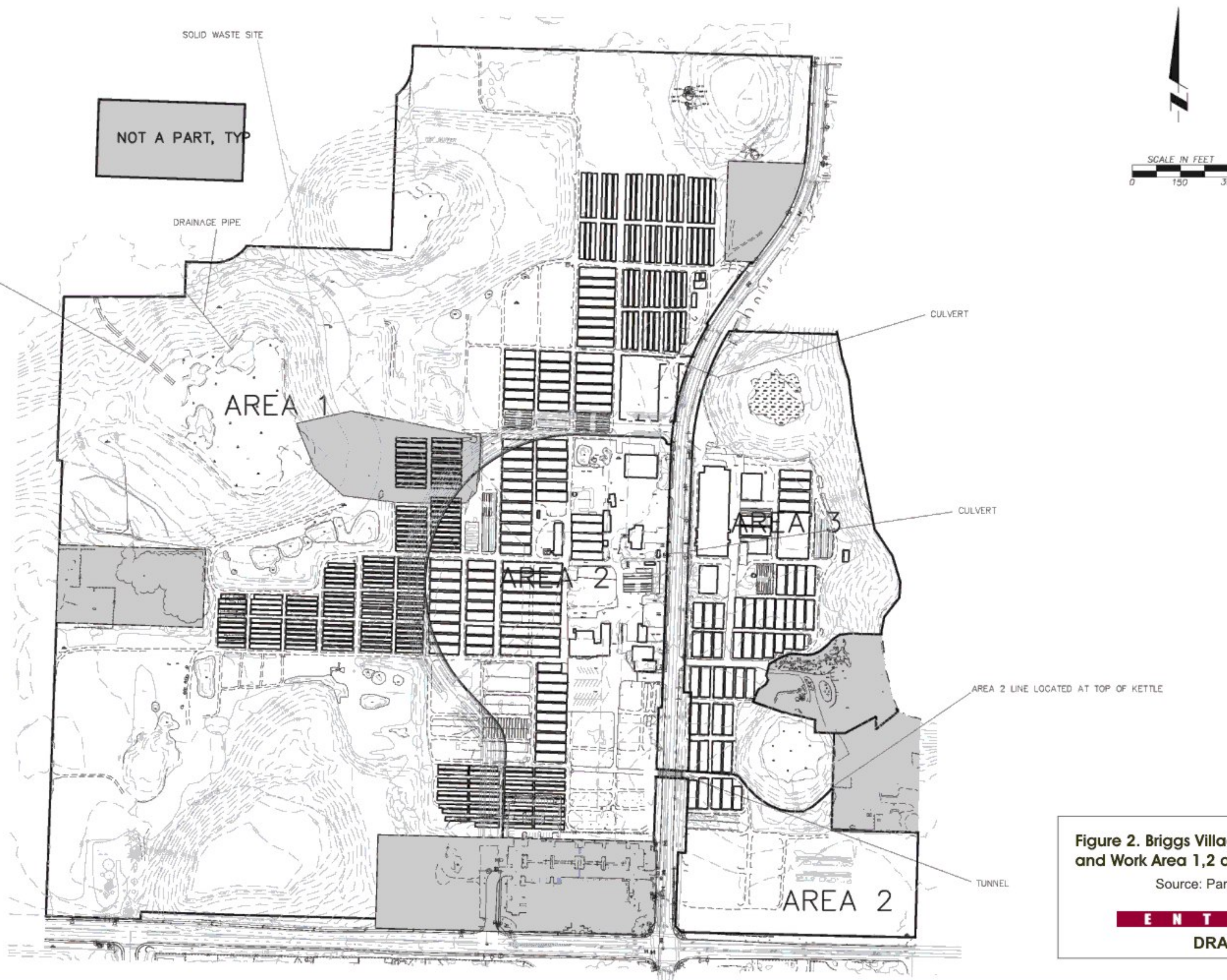

Figure 2. Briggs Village West Layout and Work Area 1,2 and 3 Locations

Source: Parametrix

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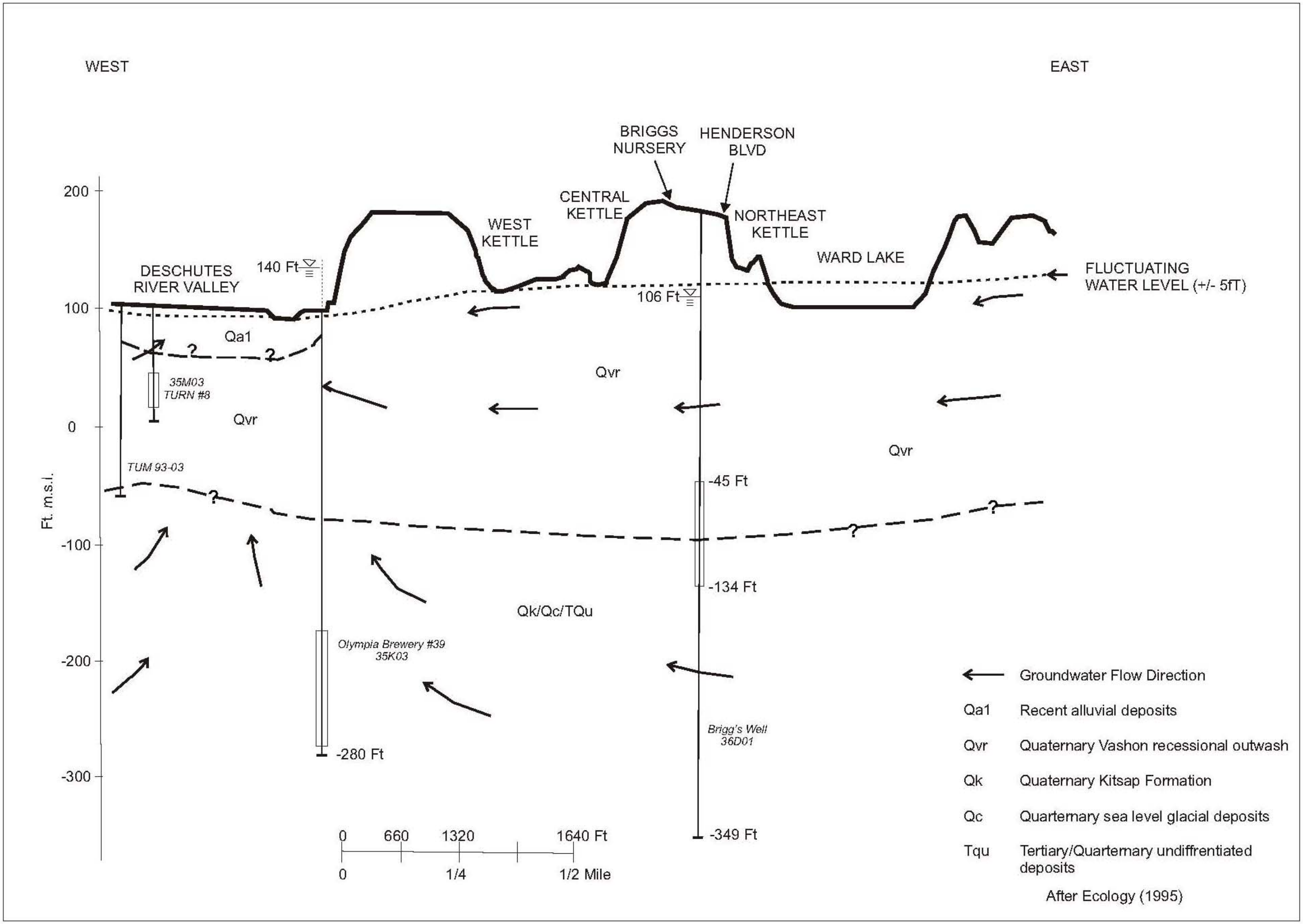

Figure 3. Conceptual Hydrogeologic Cross-Section for Briggs, Tumwater and Surrounding Areas

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Figure 4. UST Locations

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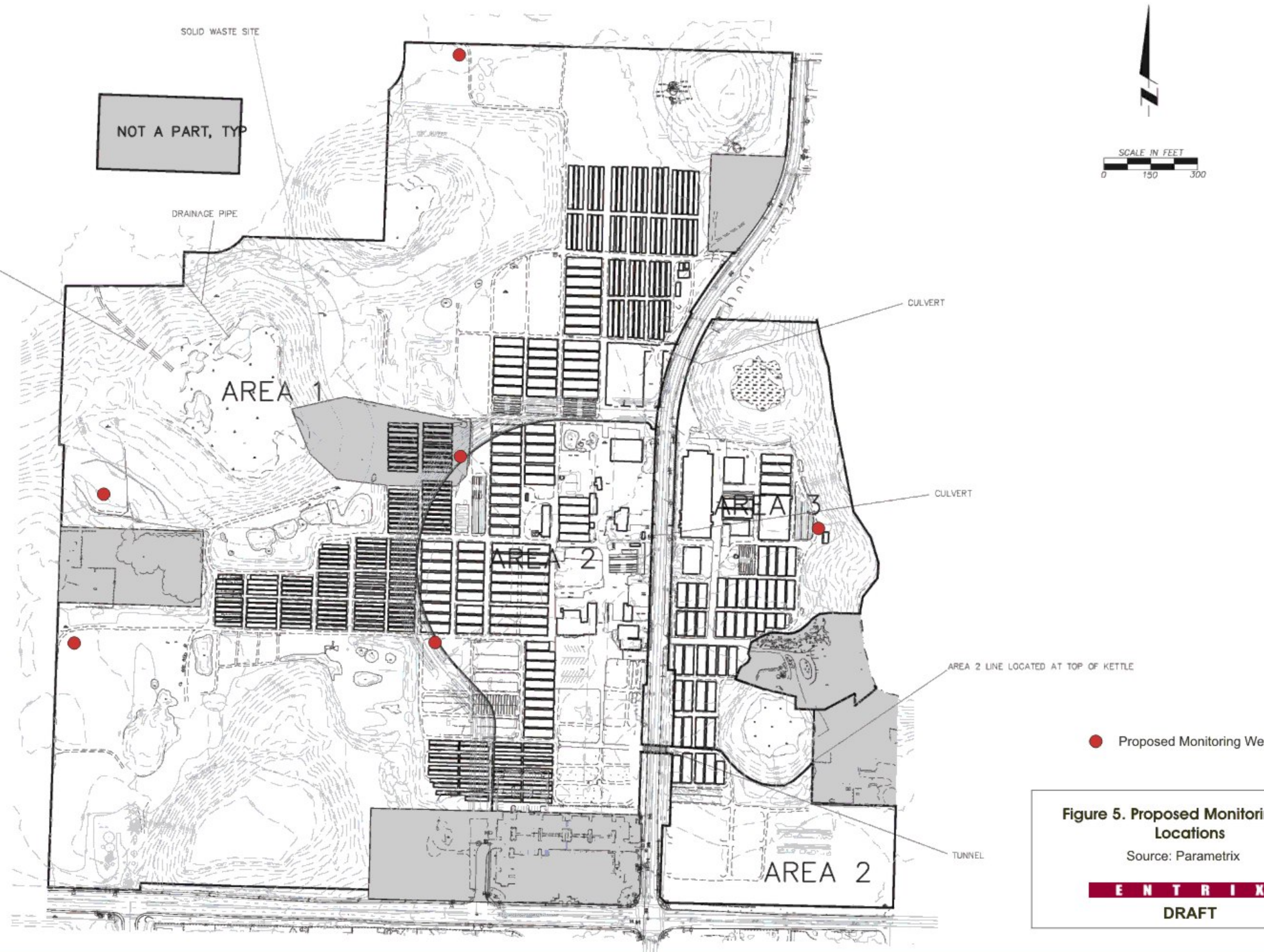

Figure 5. Proposed Monitoring Well Locations

Source: Parametrix

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