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TC-1874

WORK PLAN
PESTICIDE STORAGE WAREHOUSE
REMEDIAL INVESTIGATION/FEASIBILITY STUDY
WEBSTER NURSERY
OLYMPIA, WASHINGTON

Prepared for:

Washington State Department of Natural Resources
Engineering Division
Olympia, Washington

January 1999

Prepared by:

Tetra Tech, Inc.
One Union Square
600 University Street, Suite 800
Seattle, Washington 98101

TETRA TECH

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SECTION 1.0
INTRODUCTION

Tetra Tech, Inc., under contract to the Washington State Department of Natural Resources (DNR), has been requested to conduct a remedial investigation/feasibility study (RI/FS) of the pesticide storage warehouse facility, located at the Webster Nursery site in Thurston County, near Olympia, Washington (Figure 1-1). This document has been prepared pursuant to an Agreed Order issued by the Washington State Department of Ecology (Ecology), as dated 28 October 1998, and integrates the requisites of project sample and analysis and quality assurance/quality control (QA/QC) planning and documentation as established in the Washington State Model Toxics Control Act (MTCA) Cleanup Regulation [Chapter 173-340 of the Washington Administrative Code (WAC 173-340)].

This document serves as the Work Plan for the pesticide storage warehouse remedial investigation at the Webster Nursery site. This Work Plan has been prepared in accordance with applicable state and federal requirements and guidelines, and is intended to provide a detailed description of the site, including site history. This document also describes the work to be performed, explains project approach and scope, and presents the rationale and procedures for conducting project-specific activities. The primary purpose of the investigation is to evaluate the presence and extent of residual pesticide contamination in shallow subsoil adjacent to the location of a former underground storage tank (UST), assess groundwater quality in the vicinity of the former UST, and evaluate surficial soil quality along adjacent drainage pathway(s). An assessment of the subfloor drainage system has been recently conducted at the pesticide storage warehouse facility as discussed in Section 1.1.3 of this plan.

A Site Safety and Health Plan (SSHP) has also been prepared for the Webster Nursery site (Tetra Tech 1998a). The SSHP establishes policies and procedures for the prevention of accidents and to minimize environmental worker exposure from potential contaminants that may be present at the Webster Nursery site. The SSHP was prepared in accordance with the requirements set forth by the Occupational Safety and Health Administration (OSHA), Part 1910 of Title 29 (29 CFR 1910), and is provided under separate cover.

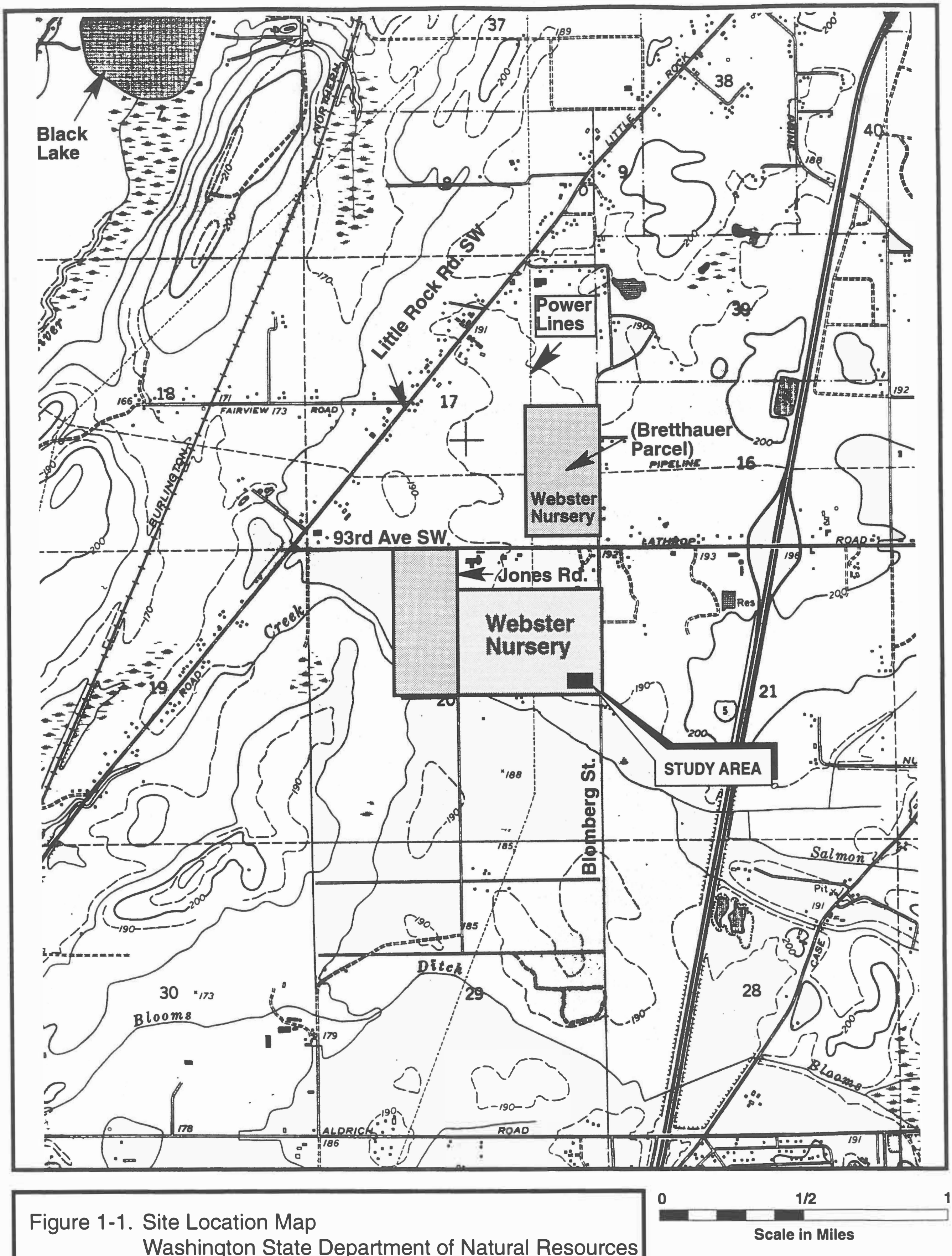


Figure 1-1. Site Location Map
Washington State Department of Natural Resources
Webster Nursery, Olympia, Washington
(Source: USGS Maytown Quadrangle)

1.1 SITE HISTORY AND OPERATION

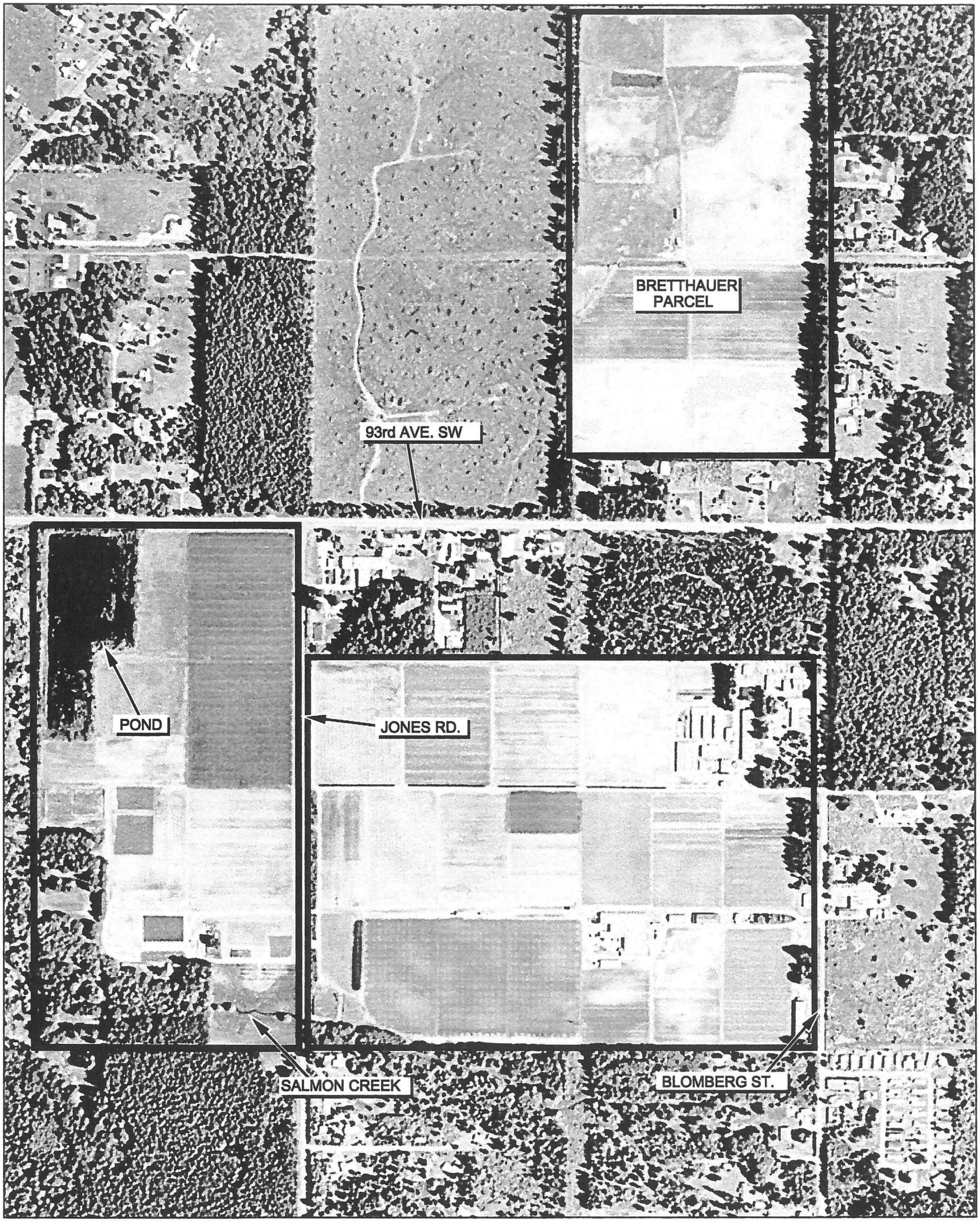
The L. T. "Mike" Webster Forest Nursery is the only state-owned forest nursery in Washington. Operated by DNR, it was established in 1957, replacing the Capitol Forest Nursery which had operated at the site since 1936. In the 1960s, the nursery became a self-funding program deriving all income from seedling sales. The approximately 300-acre nursery produces from 10 to 15 million seedlings per year on the 210 acres that are in production. The nursery also operates approximately 30,000 square feet of greenhouse space at the facility.

The Webster Nursery site was selected for its capability to sustain seasonal irrigation requirements and for its permeable subsurface soils, which allow good drainage. Currently, Webster Nursery sells approximately 50 percent of its seedling stock to private business. The remaining 50 percent is used for reforestation projects throughout the State of Washington. Douglas fir and cedar seedlings are grown for western Washington forests, and pine seedlings are grown for eastern Washington forests. Herbicides and fungicides are applied to soils and plants, respectively, in early spring,, summer, and early fall to control weeds and protect new seedlings from disease. No insecticides have reportedly been used at the nursery since the early 1990s (Tetra Tech 1995).

The Webster Nursery site comprises two noncontiguous parcels in Thurston County, near Olympia, Washington (Figure 1-2). The main nursery facility is located south of 93rd Avenue SW and comprises an office building, two warehouses, equipment storage, a cold storage building, three pumphouses, a gas house, a field kitchen, a pesticide storage warehouse, and a pesticide mixing shed. The adjacent greenhouse area consists of two shelters, greenhouses, a service building, cold storage, and an office and lunchroom (Tetra Tech 1995). The Webster Nursery is irrigated by 13 water supply wells, including seven wells located within the main parcel south of 93rd Avenue SW, three wells located on the nursery property west of Jones Road, and three wells located north of 93rd Avenue SW (refer to Figure 1-2).

1.1.1 Pesticide Storage Warehouse

The pesticide storage warehouse at the Webster Nursery facility was constructed in 1978, at which time the building floor drain systems were built and plumbed directly to a 750-gallon capacity pre-cast



NOTES:

APPROX PROPERTY BOUNDARY

0 310' 620'

APPROX SCALE 1" = 620'

N E S W

FIGURE 1-2

FACILITY OVERVIEW MAP, WEBSTER NURSERY, OLYMPIA, WASHINGTON.

(SOURCE: REPRODUCTION OF DNR 1993 AERIAL PHOTOGRAPH) concrete UST. The building is situated in the southeast corner of the Webster Nursery property, adjacent to Blomberg Street SW. The structure is oriented north/south, and measures 180 feet in length by 40 feet in width. As designed, the UST was installed approximately 8 feet south of the south end of the warehouse structure. Figure 1-3 illustrates the primary features associated with the pesticide storage warehouse facility.

The building was designed and constructed to house three discrete areas for specific purposes. A storage bay is located in the southern portion which is enclosed by concrete block walls on the north, south, and west sides; and with a chain-link fence securing the east side. The storage bay was constructed with two center floor drains which were connected by 3-inch metal piping directly to the former UST. This bay measures approximately 80 feet in length, and was designated for barrel, mulch, and peat storage (refer to Figure 1-3). Adjacent and north of the storage bay, the building houses the seed and fertilizer storage room. This room is approximately 60 feet in length, and also includes two floor drains through the center of the room which formerly connected directly to the storage bay and ultimately to the former UST. The third portion of the pesticide storage warehouse building is the northern-most section which was designed for use as the chemical storage area. This section of the building measures 40 feet in length, and includes two floor drains within the central sections of the floor. The chemical storage room also includes a floor drain for a shower and a service sink, both of which were previously plumbed to the sub-floor drainage system and the former UST (refer to Figure 1-3).

Based on available information, the warehouse structure was used primarily for material storage purposes. In addition to the Webster Nursery facility, the pesticide storage warehouse was used by various other DNR operations for material storage up to at least 1986. The non-nursery operations that utilized the warehouse for storage included the various DNR Regions for chemical applications for intermittent control of noxious weeds, the Roadsides group for weed control applications, and the Forest Resources group for specific applications at the various plantation sites throughout the state.

Chemical applications at the Webster Nursery site have reportedly been consistently conducted in accordance with the manufacturer's specifications in terms of mixing and application rates. A concerted effort has been made by DNR to search available and/or archived files for information regarding past material use, application, and handling practices at the nursery, as well as information

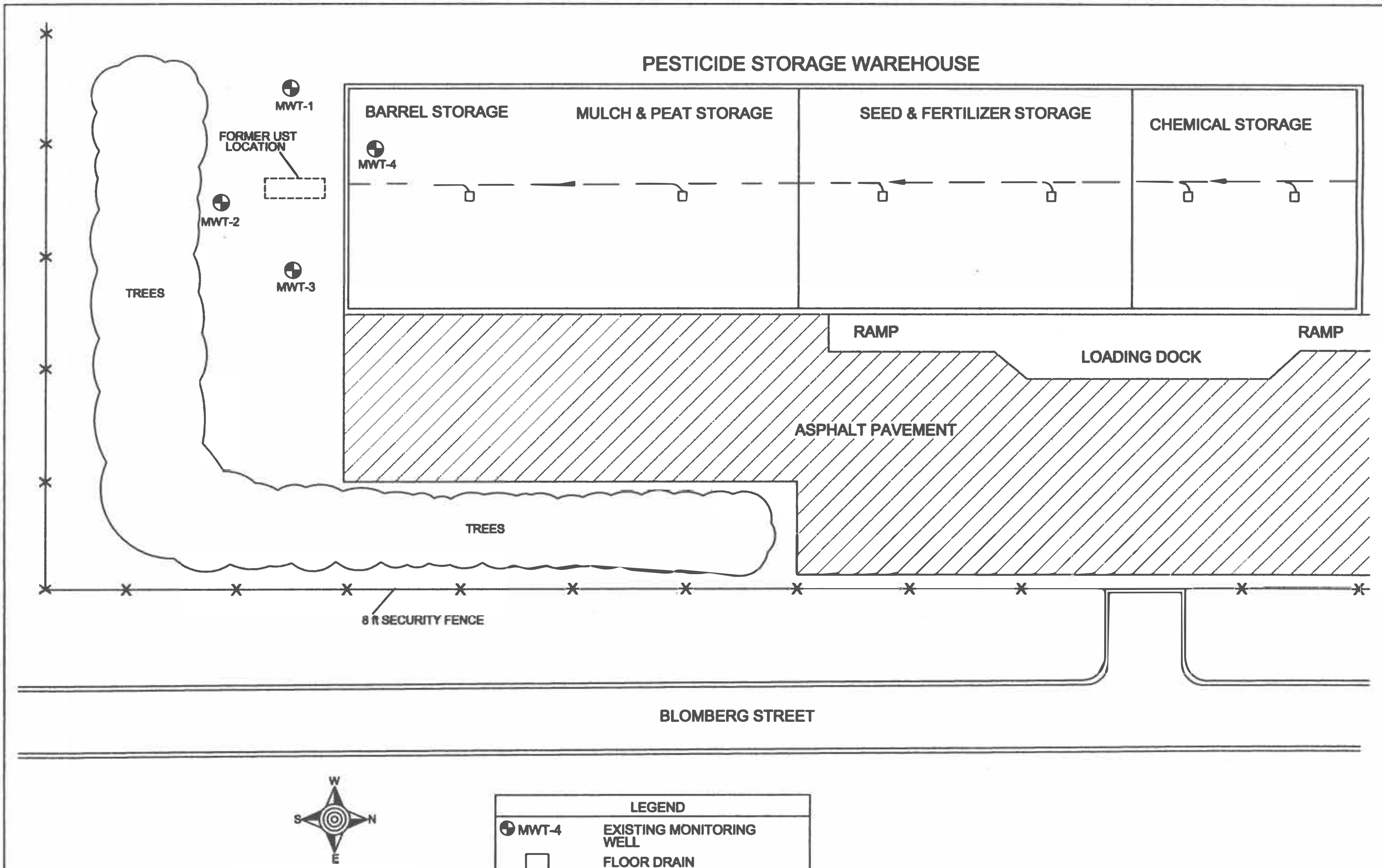


FIGURE 1-3
PESTICIDE STORAGE WAREHOUSE FACILITY, WEBSTER NURSERY, OLYMPIA, WASHINGTION

regarding past spill or material handling incidents. However, in accordance with the State general records retention schedule, records over 6 years old are not retained at either the facility or in agency archives. Based on an exhaustive records search that was completed, and information provided by DNR representatives knowledgeable with regard to past material storage practices at the site, Table A-1 in Appendix A has been compiled to provide a summary of materials known to have been used and/or stored at the site. This table includes the trade name of the product, the product manufacturer, and the identified primary active ingredient.

In 1995, DNR determined that it would be appropriate to conduct a materials inventory reduction program at the Webster Nursery site, including the removal and disposal of various products which were no longer being used at the site, or which had been in storage for an extended period and which were not likely to be used in the future. In conjunction with the Washington State Department of Agriculture, Waste Pesticide Program, DNR inventoried and compiled these materials from various areas at the nursery site in preparation for disposal and/or recycling. The material inventory sheets that were prepared pursuant to this effort are provided in Appendix B.

Inquiries regarding past spill incidents and associated releases directly to the floor drain system indicate that no such incidents have occurred based on the recollection of those queried. DNR personnel have suggested that some rinsing and washing activities may have been conducted in the storage area. Available information indicates that the sink and shower within the chemical storage portion of the structure were the most likely primary sources of the liquids which accumulated in the holding tank system. It has also been suggested that from 1978 when the building was constructed up until 1982, some mixing of pesticide solutions may have been conducted in this area as a part of routine agricultural product applications during the various seasonal nursery operations. In 1982, a separate chemical mix building was constructed on the north side of the pesticide storage warehouse. This structure was built as a self-contained unit by nursery personnel, and was not connected to the holding tank system installed with the warehouse structure. Subsequent to that time, the mixing and loading of agricultural chemicals for routine use at the Webster Nursery site has been conducted at the chemical mix building location.

As a part of the facility upgrades conducted in 1982, DNR elected to remove the concrete holding tank installed when the building was constructed and replace it with a single-walled steel UST. Planning was subsequently initiated in January 1996 to remove the single-walled steel UST system from the pesticide storage warehouse at the nursery and plug the floor drains within the structure. In July 1996 under contract to DNR, CEcon Corporation of Tacoma, Washington removed the UST.

Upon removal, the steel tank was observed to be in good condition, with no visual evidence of corrosion, leaks, or damage. However, soil sampling conducted at the time of the removal indicated the presence of residual pesticide compounds in the subsoils adjacent to the tank installation. Upon discovering the release, DNR implemented a soil over-excavation program which included the emergency removal of approximately 70 cubic yards of contaminated soil. This material was stockpiled on the property adjacent to the east side of the pesticide storage warehouse for subsequent treatment and/or disposal. The stockpiled soil was contained and secured within plastic sheeting material on an asphalt-covered portion of the driveway area. At that time, a meeting was held with Ecology and the Washington State Department of Health to advise them of the circumstances surrounding the tank removal effort.

1.1.2 UST Removal and Remedial Action

In 1996, when the steel UST was removed and the soil over-excavation activities were conducted at the Webster Nursery site, both the liquid tank contents and the stockpiled soil were characterized by DNR personnel. The sampling and analytical methods employed at the time were dependent on immediate information needs during the emergency removal, preliminary determinations regarding the constituents of concern in either the stockpile or holding tank, and requirements for subsequent onsite soil and water treatment efforts. The following sections provide an overview of the available analytical information regarding the contents of the UST upon removal, soil quality information for subsoil remaining in the tank vicinity, and characterization data (pre- and post-treatment efforts) for the stockpile soil.

1.1.2.1 Tank Contents Characterization. The liquid contents of the UST at the pesticide storage warehouse were initially sampled in April 1996 in preparation for the pending tank removal effort. When sampled, the tank was determined to be full, and the contents of the UST were pumped off during the tank removal effort and contained in a temporary storage tank at the site. Subsequent to the removal program and based on analytical information from the contents sampling, efforts were initiated to treat the water removed from the tank using a chemical oxidation process. These efforts were initiated in August 1996, and continued through the Spring of 1997. Subsequent to these efforts, the waste water from the former UST was accepted for disposal at a waste water treatment and recycling facility based on review of the most recent available analytical data. A summary of the analytical information derived from the tank content sampling efforts is provided in Table C-1 in Appendix C.

1.1.2.2 Tank Excavation Characterization. Soil over-excavation activities at the Webster Nursery site were completed in mid-June 1996 under the direction of DNR representatives. Although screening information indicated that not all impacted soil had been effectively removed from the former UST area, soil excavation activities were discontinued due to the presence of groundwater entering the bottom of the excavation, and DNR's concern that further excavation in the immediate vicinity of the pesticide storage warehouse would endanger the structural stability of the building.

Following the termination of excavation activities, soil samples were collected from the north, east, southeast, and south sidewalls, and from the bottom of the open excavation. These samples were analyzed using U.S. Environmental Protection Agency (EPA) Method 8150 and screening Method 1618. Those pesticide and herbicide compounds which were detected at concentrations above the laboratory reporting limits for these samples are provided on Table C-2 in Appendix C. As indicated, the highest concentrations of the compounds chlordane and heptachlor were found to remain within the bottom areas of the excavation.

1.1.2.3 Soil Stockpile Characterization. Concurrently with the collection of residual soil samples from the UST excavation area, DNR collected a total of four samples of the excavated material which had been stockpiled on the east side of the pesticide storage warehouse building. As was the case with the excavation soil samples, the stockpile samples were analyzed for herbicide compounds using EPA Method 8150 and for pesticides using screening Method 1618. As anticipated based on the results of the soil excavation samples, the stockpile soils were determined to contain concentrations of the pesticide compounds chlordane, heptachlor, and heptachlor epoxide above the cleanup levels established by MTCA (WAC 173-340-740).

In approximately October 1996, DNR in association with H&H Ecosystems, Inc. of North Bonneville, Washington; began an effort to treat the soil stockpile using a chemical oxidation and soil mixing process. The process was designed to use a hydrogen peroxide-based soil amendment in conjunction with homogenization and complete mixing of the stockpile materials to destroy pollutants in-place.

However, the onsite soil remediation process was unsuccessful in removing the identified pesticide and herbicide compounds to acceptable levels reportedly due to complications from wet weather and the inability to achieve an acceptable soil moisture content for the treatment process to be effective. The soil treatment efforts in this regard were conducted from approximately October 1996 to April 1997 when the contract with the soil treatment contractor was terminated. The results of the initial sampling of the stockpiled soil are provided in Table C-3 in Appendix C. Results of additional soil stockpile sampling conducted as a part of performance monitoring during the soil treatment effort are provided in Table C-4 and Table C-5 in Appendix C.

In preparation for the planned offsite disposal of the pesticide and herbicide containing soil stockpile at the Webster Nursery site, DNR commissioned the collection and analysis of an additional composite sample of the stockpile material. This sample was collected by representatives from DNR and a disposal contractor, and was submitted for analysis using EPA Method 8081 to assess the stockpile material for the presence of organochlorine pesticides. Prior to analysis and pursuant to the requirements of the Washington State Dangerous Waste Regulations (WAC 173-303-090) and the Resource Conservation and Recovery Act (RCRA) (40 CFR 261.24), the stockpile sample was extracted using the Toxicity Characteristic Leaching Procedure (TCLP) protocol as defined by EPA Method 1311. EPA Method 8081 was selected based on the listed compounds in the Washington State Toxicity Characteristics List (WAC 173-303-090), and prior analyses using EPA Method 8150 which determined that all method analyte concentrations were below the method reporting limits. The analytical data associated with the soil disposal sampling are provided in Appendix D. As indicated in Appendix D, no analytes were present at concentrations exceeding the laboratory reporting limits following the completion of the TCLP analyses.

A portion of the composite sample of the stockpile material was submitted for a 96-hour acute hazardous waste designation test in accordance with Ecology Dangerous Waste Regulations [Chapter 173-303-100(c) WAC], using fish bioassay testing Method 80-12. The fish bioassay results showed no mortality at either the 10 mg/L or 100 mg/L concentrations indicating that the stockpile soil material would not be classified as dangerous waste. A copy of the fish bioassay test results is provided in Appendix D.

1.1.2.4 Soil Stockpile Disposal. A summary of available background information regarding the stockpiled soil materials contained at the Webster Nursery facility was provided to Ecology for the determination of a proper waste designation (Sackett, J., 19 November 1997, personal communication). Specifically, DNR requested that a finding be provided as to whether the stockpiled soils at the Webster Nursery site are regarded as listed wastes pursuant to the discarded chemical products provisions of WAC 173-303-081 and 40 CFR 261.33. Based on a review of the information provided, Ecology concluded that the stockpiled soils would normally be considered a listed hazardous waste because they were derived from discarded chemical products. However, Ecology provided a "Contained In Determination" indicating that the soils in question no longer contain listed hazardous wastes based on: 1) a comparative review of detected pesticide concentrations with applicable MTCA standards, 2) the relatively low mobility of pesticide compounds in the environment, and 3) the analytical results associated with toxicity characteristics leaching procedure and fish bioassay analyses. The Contained In Determination provided by Ecology included a stipulation that the stockpiled soil material be disposed in a Subtitle C landfill facility.

On 28 May 1998, Cecon Corporation of Tacoma, Washington, under contract to DNR, removed all stockpiled soil material from the site. A total of approximately 132 tons of stockpiled soil material was removed by CEcon, Inc. and transported to the Chemical Waste Management Subtitle C Landfill facility located in Arlington, Oregon for disposal.

1.1.3 Subfloor Drainage Assessment

At the request of DNR, a subfloor drainage assessment associated with the pesticide storage warehouse facility was conducted by Tetra Tech in April 1998. The primary purpose of the investigation was to evaluate the potential for the floor drains and associated piping within the pesticide storage warehouse to have released contaminants in the areas beneath the building. The subfloor drainage assessment was conducted as part of the overall investigation of the pesticide storage warehouse and former underground storage tank site. It was necessary to expedite the subfloor drainage assessment activities due to proposed changes in building use which would restrict potential access to subflooring within the pesticide storage warehouse building.

A total of 12 subsoil samples, including one field duplicate sample, were collected and submitted for laboratory analyses, including organochlorine pesticide analysis by EPA Method SW 8081A and chlorinated herbicides by EPA Method SW 8151A. The subsoil samples were collected beneath the existing concrete and asphalt flooring at locations adjacent to and immediately beneath the floor drains (i.e., that are currently concrete filled) and associated piping. No pesticide compounds were detected in the subsoil samples submitted for analysis. Two chlorinated herbicide compounds, including dicamba and 2,4-D, were detected at a single subsoil sample station located north of and adjacent to the south end of the pesticide storage warehouse building. The concentration of dicamba and 2,4-D compounds detected in subsoil were well below the associated MTCA Method B soil cleanup levels for these compounds. A copy of the technical memorandum summarizing the subfloor drainage assessment findings is provided in Appendix E.

During the course of the subfloor drainage assessment, a round of water level measurements were taken from the eight shallow onsite monitoring wells, designated as SW-1 through SW-8, and from the four monitoring wells surrounding the former UST (i.e., wells MWT-1 through MWT-4) located adjacent to the pesticide storage warehouse. The water level measurements taken on 9 April 1998 were collected to provide information regarding general depth to groundwater and direction of groundwater flow of the water table aquifer underlying the Webster Nursery during the Spring season. Shallow groundwater was detected from approximately 3 to 7 feet BGS in the 12 wells monitored, with associated groundwater elevations ranging from approximately 178 to 189 feet above mean sea level. The general direction of groundwater flow in the water table aquifer underlying the subject area was west-northwest based on the 9 April 1998 water level measurement results.

1.2 PREVIOUS GROUNDWATER INVESTIGATION SUMMARY

Table 1-1 provides a summary of previous groundwater investigation activities conducted at the Webster Nursery site, including:

- A 1995 hydrogeologic investigation (Tetra Tech 1995);
- An annual groundwater monitoring event conducted in 1996 (Tetra Tech 1996a);
- An UST groundwater quality investigation also conducted in 1996 (Tetra Tech 1996b);

TABLE 1-1. SUMMARY OF GROUNDWATER QUALITY AND HYDROGEOLOGIC INVESTIGATION ACTIVITIES
WASHINGTON STATE DEPARTMENT OF NATURAL RESOURCES
WEBSTER NURSERY SITE, OLYMPIA, WASHINGTON

Event	Date	Purpose	Activities	Results
Hydrogeologic Investigation	July 1995	To assess groundwater quality in the vicinity of the Webster Nursery. Determine potential impacts of Nursery operations on adjacent properties, and evaluate potential impacts to the Nursery from off-site properties.	■ Evaluated historical and current chemical use and handling. ■ Installed eight shallow groundwater monitoring wells. ■ Measured water levels in 13 existing water supply wells and in 8 newly installed monitoring wells. ■ Surveyed well elevations and locations. ■ Collected groundwater samples from 8 monitoring wells and from 10 supply wells for laboratory analysis, including various pesticide compounds, nitrates, and total petroleum hydrocarbons (TPH).	■ Groundwater estimated to flow in a west to northwest direction. ■ A single pesticide compound, atrazine, was reported at the laboratory limit of detection in 1 of 18 wells sampled. ■ Nitrate was detected below applicable state groundwater quality criterion. ■ Diesel range TPH was detected in 3 of 8 shallow monitoring wells at relatively low concentrations.
Annual Groundwater Monitoring	August 1996	To assess groundwater quality in the vicinity of the Webster Nursery facility.	■ Collected groundwater samples from 8 shallow monitoring wells for laboratory analyses, including various pesticide and herbicide compounds, nitrates, and diesel and oil range TPH.	■ A single pesticide compound, bromacil, was detected in 1 of 8 monitoring wells at a concentration below applicable federal drinking water standards. ■ Nitrate was detected below applicable state groundwater quality criterion. ■ Diesel range TPH was detected in 3 of 8 shallow monitoring wells at relatively low concentrations.
UST Groundwater Quality Investigation	August 1996	To assess the potential impacts to groundwater quality resulting from the use of a former UST used to contain rinse/wash waters at the pesticide storage warehouse.	■ Installed 4 shallow monitoring wells around the former tank excavation area. ■ Collected groundwater samples from the 4 newly installed monitoring wells for laboratory analyses, including pesticide and herbicide compounds, nitrate, and diesel and oil range TPH analyses.	■ Three pesticide compounds, including chlordane, heptachlor, and heptachlor epoxide were detected in 2 of 4 monitoring wells at concentrations exceeding federal drinking water standards. ■ Nitrate was detected at concentrations below applicable state water quality criterion. ■ Diesel range TPH was detected in 1 of 4 samples at a relatively low concentration (i.e., slightly above the laboratory reporting limit).
Washington State Department of Health Groundwater Quality Assessment	April 1997	To assess groundwater quality in residential and public drinking water supply wells in the vicinity of the Webster Nursery facility.	■ Collected groundwater samples from 11 residential wells and 1 public drinking water supply well for laboratory analyses, including various pesticide and herbicide compounds, PAHs, and phthalates.	■ No pesticide or herbicide compounds were detected at or above the laboratory reporting limit.
Thurston County Public Health and Social Services Groundwater Quality Assessment	April 1997	To assess groundwater quality in residential wells and surface water quality in the vicinity of the Webster Nursery facility.	■ Collected groundwater samples from 13 residential wells and surface water samples from creek and pond locations for laboratory analyses, including pesticide and herbicide compounds, PAHs, and phthalates.	■ No compounds were detected at or above their respective laboratory reporting limits.
Comprehensive Groundwater Investigation	June 1997	To evaluate all available information regarding past material use, application, and handling practices at the nursery; as well as information regarding past spill or material handling incidents. To determine whether nursery operations have impacted area groundwater, specifically in nearby residential wells, as well as monitoring current groundwater quality in the vicinity of a former UST used to contain rinse/wash waters at the pesticide storage warehouse.	■ Developed an analytical program which identified a comprehensive list of pesticide-based target analytes using available facility-specific information. ■ Developed analytical protocols for four herbicide/fungicide compounds. ■ Collected water level data from 12 shallow onsite monitoring wells ■ Collected groundwater samples from a total of 12 residential wells, one public water supply well, and four onsite monitoring wells for a comprehensive suite of laboratory analyses.	■ The general direction of groundwater flow in the water table aquifer underlying the study area is toward the west-northwest. The estimated hydraulic gradient is approximately 0.003 feet per foot. ■ No target analytes were detected at or above their respective laboratory reporting limits in either the residential or water supply wells sampled. ■ Six chlorinated herbicide and four organochlorine pesticide compounds were detected in onsite monitoring wells. However only three pesticide compounds, including chlordane, heptachlor, and heptachlor epoxide were detected in 2 of 4 monitoring wells at concentrations exceeding federal drinking water standards.

- Two April 1997 groundwater quality assessments conducted by the Washington State Department of Health and the Thurston County Public Health and Social Services Department and;

- A comprehensive groundwater quality assessment conducted by the Washington State Department of Natural Resources in June 1997 (Tetra Tech 1998b).

SECTION 2.0
PROJECT DESCRIPTION

The following sections include a description of the project approach and scope of work, and details regarding project organization and responsibilities.

2.1 PROJECT APPROACH AND SCOPE OF WORK

The primary focus of the pesticide storage warehouse investigation is to 1) evaluate the extent of residual pesticide contamination in shallow subsoil adjacent to the location of the former UST, 2) evaluate the extent of impacted groundwater in the vicinity of the former UST, and 3) assess surficial soil quality along adjacent drainage pathway(s). The information obtained during the remedial investigation will be used to develop and identify appropriate cleanup actions, commensurate with the observed environmental conditions at the site. The following sections briefly summarize existing site conditions and identify the proposed field activities planned to meet site-specific objectives.

2.1.1 Soil Boring and Subsoil Quality Assessment

Subsoil quality in the vicinity of the former UST area was initially characterized during tank removal and associated over-excavation activities conducted in June 1996 (refer to Section 1.1.2, UST Removal and Remedial Action). Soil over-excavation activities surrounding the former tank area were discontinued due to the presence of groundwater entering the bottom of the excavation and concerns regarding the structural stability of the pesticide storage warehouse facility. Residual concentrations of pesticide-based compounds reportedly remain within subsoils adjacent to the former UST location. No soil sampling activities were conducted during the construction of the four groundwater monitoring wells installed in the immediate vicinity of the former UST. A subfloor drainage assessment recently conducted at the pesticide storage warehouse facility indicates that subsoils underlying the structure have not been adversely impacted (refer to Section 1.1.3, Subfloor Drainage Assessment).

2.1.1.1 Proposed Investigation Activities. Field activities proposed to determine the presence and extent of subsoil contamination in the vicinity of the former UST excavation area include the following:

- Drill up to 10 soil borings in the vicinity of the former UST using direct-push drilling techniques;
- Collect continuous soil samples for lithologic and field screening purposes; and
- Collect discrete subsoil samples at pre-determined depth intervals and/or based on field screening observations from each boring location for subsequent laboratory analysis.

2.1.2 Monitoring Well Installation and Groundwater Sampling

The results of recent groundwater quality assessments conducted in the vicinity of the Webster Nursery site indicate that groundwater quality adjacent to the Nursery has not been impacted by historical operations (refer to Table 1-1). However, shallow monitoring wells in the immediate vicinity of the former UST excavation area reveal elevated concentrations of some pesticide-based compounds.

2.1.2.1 Proposed Investigation Activities. The installation of at least four new groundwater monitoring wells is proposed to identify contaminant boundaries, to monitor groundwater quality at facility boundaries to ensure that no pesticide-based compounds are migrating off-site, and for subsequent use during the feasibility study phase of the project, as appropriate. Field activities proposed to meet this objective include the following:

- Install flush-mounted groundwater monitoring wells in a minimum of 4 of the 10 soil boring locations in accordance with the requirements of WAC 173-162;
- Develop each monitoring well as necessary to provide samples representative of groundwater conditions;

We'll have ~4½ days following development for wells to stabilize before sampling.

- Submit groundwater samples from each monitoring well for laboratory analysis; and
- Collect water level measurement and well elevation survey data to assess general aquifer characteristics (i.e., groundwater flow direction and hydraulic gradient).

2.1.3 Surface Drainage Assessment

No previous assessment of surface drainage has been conducted in the vicinity of the pesticide storage warehouse. Local surface drainage features in the vicinity of the pesticide storage warehouse include a slight depression (swale) located immediately east of the structure between the property boundary site fencing and Blomberg Street, and a swale feature located along the southeast property boundary (refer to Figure 1-3).

2.1.3.1 Proposed Investigation Activities. Up to five surface soil samples are proposed to be collected to assess surficial soil quality along the identified surface drainage pathways (refer to Section 7.3, Surface Drainage Sampling).

2.1.4 Subcontractors and Their Roles

To effectively perform the tasks outlined above, Tetra Tech will be supported by Cascade Drilling, Inc., of Woodinville, Washington for drilling and well installation services. Analytical services for this effort will be provided by North Creek Analytical of Bothell, Washington for soil analyses, and by Edge Analytical of Burlington, Washington for groundwater analyses.

2.2 PROJECT ORGANIZATION AND RESPONSIBILITIES

The organization, functional responsibilities of key staff, levels of authority among key participants, and lines of communications for activities affecting the Webster Nursery site investigation effort are presented on Figure 2-1, and their responsibilities are described in Table 2-1.

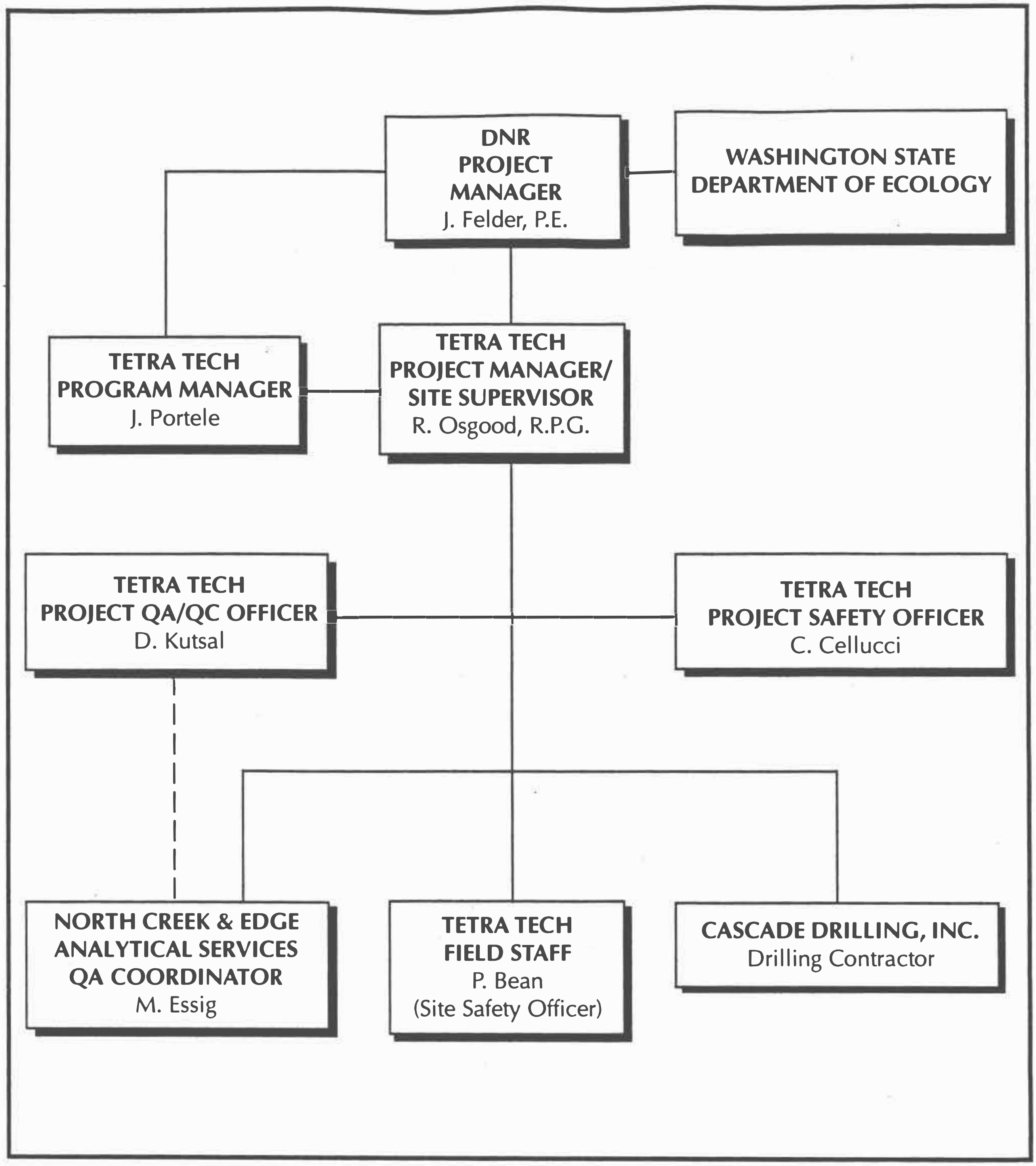


FIGURE 2-1. PROJECT ORGANIZATION AND RESPONSIBILITIES

TABLE 2-1. PERSONNEL RESPONSIBILITIES FOR QUALITY ASSURANCE PESTICIDE STORAGE WAREHOUSE REMEDIAL INVESTIGATION WEBSTER NURSERY SITE, OLYMPIA, WASHINGTON	
DNR Personnel	
Project Manager	Serves as liaison between the DNR and Tetra Tech. Provides project oversight, including review of site-specific management plans to ensure that compliance with DNR objectives for the site are met. Primary point-of-contact with Ecology regarding project activities.
Tetra Tech, Inc. Personnel	
Program Manager	Responsible for overall project direction, coordination, and technical consistency. Implements necessary action and adjustments to accomplish project objectives.
Project Manager/Site Supervisor	Ensures that project tasks are successfully completed within the projected budget and associated time periods. Provide senior technical review of all aspects of the Work Plan and Site Safety and Health Plan to ensure project objectives are met. Oversees field operations and sampling design. Provides onsite technical support. Supervises the implementation of standard operating procedures, project modifications, and corrective action during field operations.
Project QA/QC Officer	Review of site-specific management plans for technical aspects to ensure compliance with QA objectives. Provides technical QA assistance to accomplish project objectives including suggestions for corrective action during field operations. Oversee laboratory performance and adherence to Work Plan.
Project Health and Safety Officer	Prepares the Site Safety and Health Plan. Provides technical assistance as required to resolve onsite health and safety issues requiring corrective action.
Site Health and Safety Officer/ Safety QA	Ensures that health and safety guidelines are followed by field team members and any subcontractors onsite to avoid any compromise of sample integrity or worker health and safety. Conduct tailgate health and safety meetings and document any onsite health and safety issues.
Subcontractors	
North Creek Analytical Services (QA Coordinator) Edge Analytical (QA Coordinator)	Establishes QC procedures, oversees preparation of laboratory QA/QC plan. Monitors compliance with laboratory's QA/QC plan and serves as QA/QC point of contact. Monitors all required QC sample analyses including analytical duplicates, blanks. matrix spikes, performance evaluation samples, and standard reference materials. Initiates and documents required corrective action. Performs preliminary review of data for completeness and transcription or analytical error. Follows good laboratory practices and U.S. EPA guidelines.
Cascade Drilling, Inc. Services	Conducts all drilling and well installation services, including associated permitting requirements.

SECTION 3.0
ENVIRONMENTAL SETTING

The following section provides a description of the environmental setting, including physiography, climate, regional geology, surface water occurrence, and local hydrology associated with the Webster Nursery site.

3.1 PHYSIOGRAPHY

The Webster Nursery site is located in the Puget Lowland province, a depressed, partially submerged area where the primary topography and landforms have resulted from the Pleistocene glaciation. Unconsolidated glacial and glacially derived deposits range from very porous sands and gravels to relatively impermeable tills (Nobel and Wallace 1966).

The Webster Nursery site is located in Section 20, Township 17 North, Range 2 West, of the Willamette Meridian. Site elevation is approximately 190 feet above mean sea level (MSL). The site is included on the U.S. Geological Survey (USGS) Maytown, Washington quadrangle (USGS 1973). Topography in the immediate site vicinity generally dips to the west/northwest toward the Black River.

3.2 CLIMATE

The climate of Thurston County is influenced by moist Pacific air flows, which bring heavy rainfall between the months of October and March, and a relatively dry period between the months of June and August. Total annual precipitation is approximately 129.5 centimeters (cm) or 51 inches. The average seasonal snowfall is approximately 38.1 cm (15 inches). The average winter temperature is 3.8 degrees Centigrade (° C) or 39 degrees Fahrenheit (° F). The average summer temperature is 16.7° C (62° F). The prevailing wind direction is from the south/southwest, and the average windspeed is highest during the winter months at approximately 12.9 kilometers/hour (km/hr) or 8 miles per hour (mph) (USDA 1982).

3.3 REGIONAL GEOLOGY

The site lies in the Willamette-Puget structural basins of western Washington and Oregon. These basins are underlain by folded and faulted marine deposits. Basin deformations occurred mainly during the middle to late Tertiary period. However, some deformational events occurred as late as the late Pleistocene epoch of the Quaternary period and may be ongoing. More than 257 feet of glaciofluvial deposits overlie the marine deposits at the site. The glaciofluvial deposits consist of undifferentiated deposits of Vashon drift possibly overlying Salmon Springs drift and Pre-Salmon Springs deposits (Nobel and Wallace 1966).

The Vashon drift deposits at the site consist primarily of Vashon recessional sands, which are typically very fine to medium-grained sand with some silt and rarely any gravel. The recessional sands overlie Vashon recessional gravel, which consists of coarse gravel and sand. Some of the impermeable tills encountered at the site could be deposits of Vashon till, composed of directly-compacted clay to gravel-sized materials. The Salmon Springs drift is composed of stratified glaciofluvial sand and gravel. The Pre-Salmon Springs deposits are composed chiefly of fine-grained deposits of glacial and non-glacial origin lying uncomformably beneath the Salmon Springs drift (Nobel and Wallace 1966).

3.4 SURFACE WATER OCCURRENCE

There are four primary surface water bodies in the general vicinity of the Webster Nursery site, including Black Lake, the Black River, Salmon Creek, and a small onsite pond. The Black River flows in a northeasterly direction where it enters Black Lake approximately 2.5 miles northwest of the Webster Nursery site. The Black River exits Black Lake and continues to flow in a northeasterly direction where it discharges to Budd Inlet approximately 3.5 miles northeast of Black Lake. Salmon Creek flows in a northwesterly direction toward the Black River, and bisects the Webster Nursery in the southwest corner of the property adjacent to Jones Road (refer to Figure 1-2).

A ponded area is located in the northwest corner of the subject property adjacent to 93rd Avenue SW (refer to Figure 1-2). The pond is seasonally intermittent, and was reportedly created during the excavation of fill material used during the construction of the Nursery (Crockett, T., 9 June 1998, personal communication).

3.5 LOCAL HYDROLOGY

Thirteen water supply wells, designated as Well-1 through Well-13, have been installed at the site during the period from 1956 to 1990. The wells are drilled to depths as great as 257 feet below ground surface (BGS), but in general are screened over the interval between 39 and 137 feet BGS. Pumping rates for these wells range from 250 to 1,375 gallons per minute, and the static water level is generally about 11 feet BGS. Regional groundwater flow is estimated to be toward the northwest (Tetra Tech 1995). Groundwater flow in the shallow water bearing zones at the site appears to occur under unconfined conditions. Deeper water bearing zones may be semi-confined, but based on limited field testing there appears to be a hydraulic connection between the shallow (i.e., less than about 25 feet BGS) and deeper wells (i.e., approximately 50 to 115 feet BGS) at the site (Tetra Tech 1995).

Eight shallow groundwater monitoring wells, each installed to a total depth of approximately 20 feet BGS and designated as SW-1 through SW-8, were installed at Webster Nursery in July 1995 (Tetra Tech 1995). These wells were completed with 15-foot long screens constructed of 0.020-in slot IDT Schedule 40 PVC material installed over the interval from 5 to 20 feet BGS. These wells were distributed throughout the site to provide information regarding the quality of the groundwater entering and leaving the property. The water levels measured in these wells ranged from approximately 6.5 to 13 feet BGS with water level elevations ranging from 174.6 to 182.7 feet MSL in August 1995 (Tetra Tech 1995). In June 1997, measured water levels ranged from 3.5 to 8.0 feet BGS, with elevations ranging from 177.6 to 186.7 feet MSL. In April 1998, measured water levels ranged from 2.4 to 6.7 feet BGS, with elevations ranging from 178.1 to 188.1 feet MSL. The general groundwater flow direction determined from water levels within these wells trends toward the west/northwest, with an estimated hydraulic gradient of 0.003 feet per foot (Tetra Tech 1998b). Figure 3-1 shows the location of existing water supply and monitoring wells at the Webster Nursery site, and illustrates the groundwater elevation contour based on the June 1997 water level measurement data.

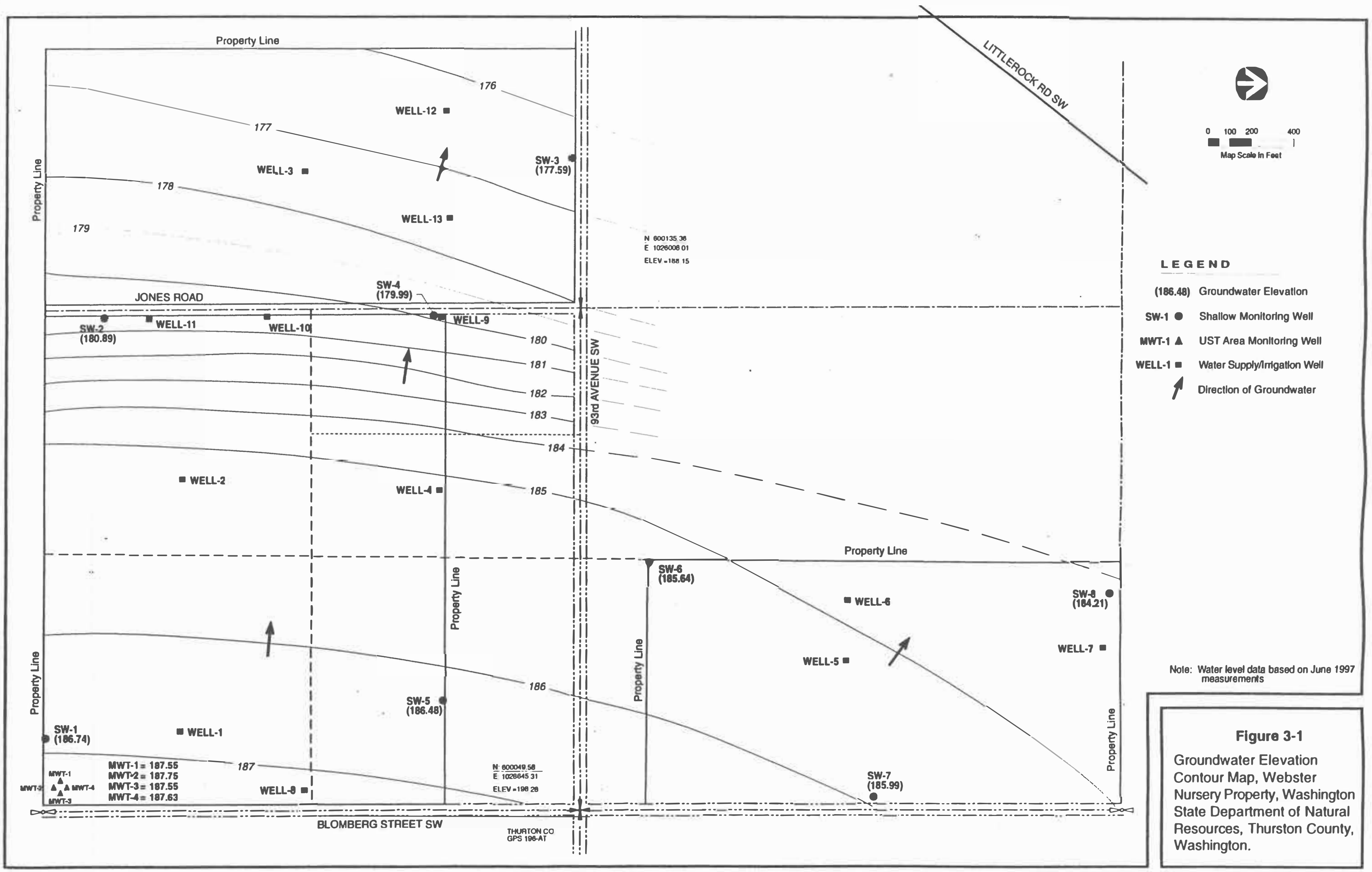


Figure 3-1

Groundwater Elevation Contour Map, Webster Nursery Property, Washington State Department of Natural Resources, Thurston County, Washington.

Four shallow monitoring wells, each installed to a total depth of approximately 15 feet BGS and designated as MWT-1 through MWT-4, were installed in August 1996 to evaluate water quality immediately adjacent to the former UST soil excavation located near the pesticide storage warehouse building (Tetra Tech 1996). These wells were completed with 100 feet of 0.020-inch screen installed in the intervals from 5 to 15 feet BGS using Schedule 40 PVC materials. The water levels measured in these wells in August 1996 ranged from approximately 7.7 feet BGS to 9.0 feet BGS, with elevations ranging from 184.37 to 184.44 feet MSL. In June 1997, measured water levels in these four wells ranged from 4.6 to 5.6 feet BGS with elevations ranging from 187.55 to 187.75 feet MSL. In April 1998, measured water levels in these four wells ranged from 3.8 to 4.9 feet BGS with elevations ranging from 188.80 to 189.02 feet MSL.

The shallow water table underlying the Webster Nursery site was observed to be approximately 3 to 7 feet higher in elevation in April 1998 relative to the water levels measured in August of 1995 and 1996. Available irrigation and well pumping information for the Webster Nursery indicated that no onsite wells were operating and that static groundwater conditions existed during the August 1995 and April 1998 monitoring events. Based on available groundwater pumping information, the observed variation in groundwater elevations of approximately 3 to 7 feet in individual wells at the Webster Nursery site is likely due to seasonal water table fluctuations.

SECTION 4.0
SITE CONCEPTUAL MODEL

The primary purpose of the site conceptual model is to integrate available site information, identify additional data needs, facilitate the selection of appropriate remedial alternatives, and guide the assessment of risk. The following sections discuss site contaminant identification, potential migration pathways, and potential receptors associated with the Webster Nursery facility. Figure 4-1 illustrates a conceptual exposure pathway model for the pesticide storage warehouse and former UST area based on the review of available site information and current understanding of the site.

4.1 SITE CONTAMINANT IDENTIFICATION

Chlorinated pesticide and herbicide compounds in subsurface soil and shallow groundwater linked to past Nursery operations and activities represents the primary environmental concern identified at the Webster Nursery site. In 1996, when the UST was removed and the soil over-excavation activities were conducted adjacent to the south end of the pesticide storage warehouse, both stockpiled soil and soils remaining within the tank excavation cavity were characterized (refer to Section 1.1.2, UST Removal and Remedial Action). Table 4-1 provides a summary of the maximum concentrations of pesticide and herbicide compounds detected in soils at the completion of tank removal and over-excavation activities.

Pesticide compounds; including chlordane, heptachlor, and heptachlor epoxide; were detected at concentrations which exceed their associated MTCA Method B soil cleanup levels (see Table 4-1). Chlorinated herbicides, including 2,4-D, Dalapon, 2,4,5-T, and 2,4,5-TP, were detected in soil at concentrations which were well below their respective MTCA Method B soil cleanup levels (see Table 4-1). No nitrogen or phosphorus pesticide compounds were detected in site soils at levels at or above their associated laboratory reporting limits during the UST assessment.

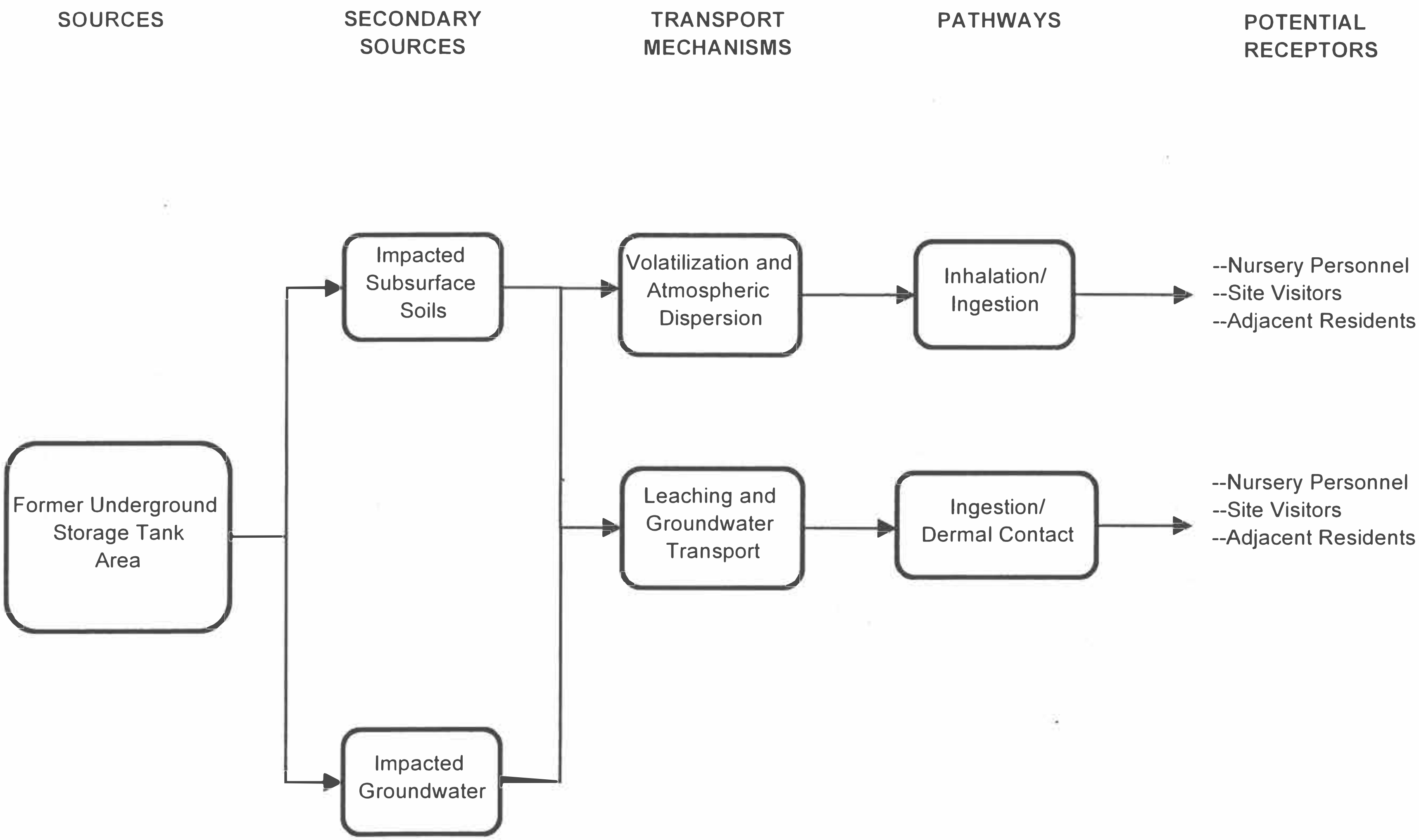


Figure 4-1. Conceptual Exposure Pathways for Pesticide Storage Warehouse and Former UST Area, Webster Nursery, Olympia, Washington.

TABLE 4-1. SUMMARY OF MAXIMUM DETECTED CONCENTRATIONS OF PESTICIDE AND HERBICIDE COMPOUNDS IN SOIL AT THE COMPLETION OF TANK REMOVAL AND OVER-EXCAVATION ACTIVITIES PESTICIDE STORAGE WAREHOUSE FACILITY WEBSTER NURSERY, OLYMPIA, WASHINGTON

Sample Location	Sample Date	Organochlorinated Pesticides (mg/kg)				Chlorinated Herbicides (mg/kg)			
		Chlordane							
		Cis	Trans	Heptachlor	Heptachlor epoxide	2,4-D	2,4,5-T	2,4,5-TP	Dalapon
UST Soil Stockpile	6/17/96	5.80	0.62	19.0	0.69	0.041	0.130	0.015	0.041
UST Excavation Soils	6/17/96	4.20	0.60	17.0	0.47	0.07	0.097	ND[a]	ND
MTCA Method B Residential Soil Cleanup Levels[b]		2.86[c]		0.222	0.110	800	800	640	2,400

a ND = Not detected at or above the laboratory reporting limit.

b The Model Toxics Control Act Cleanup Regulation [(Chapter 173-340-720(2)(b) WAC, as amended January 1996]; values based on MTCA Method B cleanup levels from the Cleanup Levels and Risk Calculations (CLARC II) update, February 1996; for those contaminants with both carcinogenic and noncarcinogenic state cleanup levels, the lowest value of the two is shown.

c Chlordane cleanup level based on change in chronic slope factor from 1.3 to 0.35 $(mg/kg\text{-}day)^{-1}$. On-line database search, EPA Integrated Risk Information System (IRIS), 11 June 1998.

Four groundwater monitoring wells, designated as wells MWT-1 through MWT-4, were installed and sampled in the immediate vicinity of the former UST in August 1996 (refer to Section 1.1.1, Pesticide Storage Warehouse; and Figure 1-3). Two additional groundwater monitoring events were conducted in these four wells in October 1996 and June 1997. Table 4-2 provides a current summary of the maximum detected concentrations of pesticide and herbicide compounds in groundwater samples collected from the tank excavation area monitoring wells. Six chlorinated herbicide compounds; including dicamba, 2,4-D, trichlopyr, 2,4,5-T, picloram, and 2,4,5-TP (silvex); were detected in the groundwater samples collected from the onsite monitoring wells surrounding the former UST area. However, the detected concentrations of these six compounds were well below established federal drinking water standards and applicable MTCA Method B groundwater cleanup levels (refer to Table 4-2).

Four chlorinated pesticide compounds, including heptachlor, heptachlor epoxide, alpha chlordane, and gamma chlordane were also detected in groundwater samples collected from the onsite tank excavation

TABLE 4-2. SUMMARY OF MAXIMUM DETECTED CONCENTRATIONS OF PESTICIDE AND HERBICIDE COMPOUNDS IN GROUNDWATER, TANK EXCAVATION AREA MONITORING WELLS
WEBSTER NURSERY, OLYMPIA, WASHINGTON

		Analytical Results (μg/L)			ARARs[a]	
Analytical Method	Detected Analyte	August 1996	October 1996	June 1997	Maximum Contaminant Levels[b] (μg/L)	MTCA Method B Groundwater Cleanup Levels[c] (μg/L)
Organochlorine Pesticides (EPA Method 508)	alpha-Chlordane	0.53	0.56	0.03	2.00	0.25[d]
	gamma-Chlordane	2.27	2.37	0.07		
	Heptachlor	1.39	0.35	0.29	0.40	0.019
	Heptachlor epoxide	2.64	2.45	1.38	0.20	0.009
Chlorinated Herbicides (EPA Method 515)	2,4,-D	ND[e] (0.50)	NA[f]	10.1	70.0	160
	2,4,5-T	NA	NA	75.0	NA	160
	2,4,5-TP	ND (1.00)	NA	7.19	50.0	128
	Dicamba	NA	NA	0.46	NA	480
	Picloram	ND (1.00)	NA	0.19	500	1,120
	Triclopyr	NA	NA	36.3	NA	NA
Nitrogen and Phosphorus Pesticides (EPA Method 507)	Atrazine	0.12	NA	ND (1.00)	3.00	0.398
	Simazine	0.28	NA	0.64 J[g]	4.00	0.729

a ARARs = Applicable or Relevant and Appropriate Requirements (chemical-specific).

b National Primary Drinking Water Regulations (40 CFR 141) – Values based on the EPA Drinking Water Regulations and Health Advisories maximum contaminant levels (MCLs), as published by the EPA Office of Water, October 1996.

c The Model Toxics Control Act Cleanup Regulation [(Chapter 173-340-720(2)(b) WAC, as amended January 1996]. Values based on MTCA Method B cleanup levels from the Cleanup Levels and Risk Calculations (CLARC II) update, February 1996. For those contaminants with both carcinogenic and noncarcinogenic state cleanup levels, the lowest of the two is shown.

d Chlordane cleanup level based on change in chronic slope factor from 1.3 to 0.35 $(mg/kg\text{-}day)^{-1}$. On-line database search, EPA Integrated Risk Information System (IRIS), 11 June 1998.

e ND = Not detected at or above the laboratory reporting limit (shown in parentheses).

f NA = Not analyzed.

g J = Indicates an estimated concentration detected below the laboratory reporting limit but above the associated method detection limit.

area monitoring wells. The detected concentrations of chlordane, heptachlor, and heptachlor epoxide compounds exceeded established federal drinking water standards and applicable MTCA Method B groundwater cleanup levels (refer to Table 4-2).

Privately-owned residential wells in the vicinity of the Webster Nursery site were sampled independently by the Washington State Department of Health and by the Thurston County Public Health and Social Services Department in April 1997 (refer to Section 1.2, Previous Groundwater Investigation Summary; and Table 1-1). The results of these groundwater quality assessments indicate no detectable concentrations of pesticide or herbicide compounds at or above the associated laboratory reporting limits. During the June 1997 comprehensive groundwater investigation conducted by DNR at the Webster Nursery site, a total of 12 privately-owned residential wells and one public water supply well were sampled for a comprehensive suite of pesticide/herbicide-based target analytes in the vicinity of the Nursery. No target analytes were detected in these wells at or above their respective laboratory reporting limits (refer to Table 1-1). No groundwater quality data was collected at the Webster Nursery site during 1998.

4.2 POTENTIAL MIGRATION PATHWAYS

This section discusses potential contaminant migration pathways associated with the pesticide storage warehouse and former UST area, including the air, surface water, and groundwater routes. Table 4-3 provides a summary of available physical and chemical characteristics associated with the primary pesticide and herbicide compounds previously detected at the Webster Nursery site. The characteristics presented in Table 4-3 include critical fate and transport data necessary to evaluate general contaminant behavior in the environment.

4.2.1 Air

Contaminant transport via the air pathway occurring as a result volatilization is not considered to be a significant exposure route at the Webster Nursery site due the relatively low vapor pressures exhibited by the pesticide-based compounds previously detected in the environment at the site (refer to Table 4-3).

TABLE 4-3. PHYSICAL AND CHEMICAL CHARACTERISTICS OF THE PRIMARY PESTICIDE AND HERBICIDE COMPOUNDS DETECTED IN SOIL AT WEBSTER NURSERY, OLYMPIA, WASHINGTON					
Chemical Compound	Water Solubility (mg/L)	Vapor Pressure (mm Hg)	Henry's Law Constant (atm-m^3/mol)	K_{oc}[a] (mL/g)	K_{ow}[b]
Chlordane	$5.60E^{-01}$	$1.00E^{-05}$	$9.63E^{-06}$	$1.40E^{+05}$	$2.01E^{+03}$
Heptachlor	$1.80E^{-01}$	$3.00E^{-04}$	$8.19E^{-04}$	$1.20E^{+04}$	$2.51E^{+04}$
Heptachlor epoxide	$3.50E^{-01}$	$3.00E^{-04}$	$4.39E^{-04}$	$2.20E^{+02}$	$5.01E^{+02}$
2,4-D	$6.20E^{+02}$	$4.00E^{-01}$	$1.88E^{-04}$	$2.00E^{+01}$	$6.46E^{+02}$

Source: U.S. EPA (1986). Superfund Public Health Evaluation Manual. Office of Emergency and Remedial Response, Washington, DC. EPA/540/1-86-060.

a K_{oc} = Adsorption coefficient.

b K_{ow} = Octanal/water partitioning coefficient.

Airborne particulates (dust) may provide a mechanism for contaminant transport via the air pathway at the Webster Nursery site. However, the area surrounding the former UST location is well protected by adjacent trees and the south side of the pesticide storage warehouse facility which limits the potential for dust transport (refer to Figure 1-3). Additionally, the eastern portion of the pesticide storage warehouse is paved with asphalt which further restricts potential dust generation at this site (refer to Figure 1-3). The top of the former UST was installed at a depth of approximately 2 to 3 feet BGS, and the associated pesticide contamination detected in adjacent soils has been identified in the subsurface and is not readily available to aeolian transport.

4.2.2 Surface Water

The occurrence of surface water associated with the Webster Nursery site and the surrounding area is discussed in Section 3.4, Surface Water Occurrence. The topography in the vicinity of the pesticide storage warehouse area is relatively flat. However, local surface drainage features in the vicinity of the pesticide storage warehouse include: 1) a low lying depression (swale) located immediately east of the facility between the security fencing at the site boundary and Blomberg Street, and 2) a swale feature located along the southern property boundary. These surface drainage features are proposed to be characterized during upcoming site investigation activities (refer to Section 7.3, Surface Drainage Sampling).

Salmon Creek is located approximately 0.15 miles to the south of the pesticide storage warehouse facility (refer to Figure 1-2). The potential for surface runoff from this area to impact Salmon Creek is considered low due to: 1) the absence of a direct surface drainage pathway, 2) the low water solubilities associated with pesticide-based compounds which reduce the potential for leaching into surface or pore waters, and 3) the affinity of pesticide-based compounds to adsorb to soil particles, as indicated by their high octanal/water partitioning coefficients (refer to Table 4-3).

The potential impact to Salmon Creek due to groundwater infiltration from the site is considered low. Groundwater flow in the shallow water table aquifer underlying the Webster Nursery site is reportedly toward the west/northwest and is off-gradient relative to Salmon Creek which flows in a northeasterly direction adjacent to the site No evidence of potential offsite migration of pesticide compounds has been identified during recent groundwater quality assessments conducted in the vicinity of the Nursery. It is presently not known whether Salmon Creek gains water from or loses water to the shallow water table aquifer adjacent to the Webster Nursery site.

The Thurston County Public Health and Social Services Department collected surface water samples from Salmon Creek and the onsite pond during an assessment conducted in April 1997. The surface water samples were analyzed for pesticide and herbicide compounds, polynuclear aromatic hydrocarbons, and phthalates. Results revealed that no compounds were detected at or above their respective laboratory reporting limits in samples submitted for laboratory analysis (refer to Section 1.2; Table 1-1).

4.2.3 Groundwater

A detailed discussion regarding the occurrence of groundwater at the Webster Nursery site is provided in Section 3.5, Local Hydrology. Groundwater flow in the shallow water bearing zones at the site appears to occur under unconfined conditions. Deeper water bearing zones reportedly may occur under semi-confined conditions, but there appears to be a hydraulic connection between shallow (i.e., less than approximately 25 feet BGS) and deeper wells (i.e., approximately 50 to 115 feet BGS) at the site (Tetra Tech 1995). The four shallow monitoring wells installed in the vicinity of the former UST excavation area were completed to a total depth of approximately 15 feet BGS. The primary subsoil lithology in the vicinity of the former UST area includes a loose, poorly-graded, fine silty sand which grades to a sandy silt at depths between 10 to 15 feet BGS based on review of available boring log information (Tetra Tech 1996a).

The general direction of groundwater flow in the water table aquifer underlying the Webster Nursery site is west/northwest with a relatively low hydraulic gradient estimated at approximately 0.003 feet per foot based on review of available hydraulic information. The observed variation in shallow groundwater elevations ranging from approximately 3 to 7 feet in individual wells at the Webster Nursery site is likely due to seasonal water table fluctuations (see Section 3.5, Local Hydrology).

A summary of groundwater quality information obtained from the former UST excavation area monitoring wells is provided in Table 4-2. The potential impacts to shallow groundwater at the site resulting from residual pesticide contamination in tank excavation soils is limited by the low water solubilities associated with pesticide-based compounds which significantly reduces the potential for contaminant leaching. The affinity of pesticide-based compounds to adsorb to soil particles, as indicated by their high octanal/water partitioning coefficients, also reduces the potential mobility of these compounds in the environment (refer to Table 4-3).

4.3 POTENTIAL RECEPTORS

Potential human receptors identified at the Webster Nursery facility are restricted to Nursery personnel and authorized site visitors, as the facility is gated and access is restricted. Local residents surrounding the Nursery are also identified as potential receptors, although the potential for impacts to nearby residents appear to be limited based on the assessment of the contaminant migration pathways associated with the Webster Nursery site (refer to Section 4.2, Potential Migration Pathways).

The Webster Nursery site employs 18 full-time personnel. An additional 75 to 100 seasonal workers are employed at the Nursery between the months of December and March dependent on the size of the estimated crop harvest. An estimated 100 to 150 visitors access the site on an annual basis (Crockett, T., 9 June 1998, personal communication). Residential housing is sparsely distributed in the vicinity of the Webster Nursery site.

SECTION 5.0
APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

The following section discusses applicable or relevant and appropriate requirements (ARARs) and the approach to development of site-specific soil cleanup levels for the Webster Nursery site.

5.1 REGULATORY FRAMEWORK

Following the receipt of analytical data, a comparative review of the findings of the pesticide storage warehouse investigation will be completed. This review will be conducted to assess the observed environmental conditions at the site relative to applicable regulatory standards and guidelines. In support of this effort, the following reference sources will be used for screening and review purposes:

- **Model Toxics Control Act (MTCA) Method B Groundwater and Soil Cleanup Levels (WAC 173-340-720/740, as amended January 1996).** Soil and groundwater analytical results will be reviewed against established MTCA Method B cleanup levels, as published in the Cleanup Levels and Risk Calculations (CLARC II) Update, February 1996. The development of site-specific soil cleanup levels for use at the Webster Nursery facility is discussed in Section 5.2, Site-Specific Soil Cleanup Levels.

- **National Primary Drinking Water Regulations, as defined in Part 141 of Title 40 of the Code of Federal Regulations (40 CFR 141).** Groundwater analytical results will be reviewed against established federal drinking water standards based on the EPA Drinking Water Regulations and Health Advisories Maximum Contaminant Levels (MCLs), as published by the EPA Office of Water (EPA 822-B-96-002), October 1996.

- **Toxicity Characteristics (TC) Assessment (Federal Register Vol. 53 No. 245, December 1988).** Analytical results will be assessed to determine if a sample would be anticipated to fail the toxicity characteristics leaching procedure (TCLP) or Washington State toxicity characteristic criteria. The protocol states that, if the total waste concentration is 20 times or less the maximum concentration of contaminants listed for the toxicity characteristic, the waste cannot be a characteristic hazardous waste and RCRA requirements would not be applicable.

- **The Resource Conservation and Recovery Act (RCRA), as defined in Part 261 of Title 40 of the Code of Federal Regulations (40 CFR 261).** The identification of a hazardous waste will be evaluated based on the characteristics of toxicity by performing TCLP testing by EPA Method 1311. TCLP information obtained during the investigation (if required) will be reviewed against the maximum concentration of contaminants for the toxicity characteristic as applicable to waste disposal and/or investigation derived waste management.

- **Dangerous Waste Regulations (WAC 173-303-090/100, as amended February 1998).** Dangerous waste characteristics for toxicity will be evaluated based on TCLP testing by EPA Method 1311. TCLP information obtained during the investigation (if required) will be reviewed against the maximum concentration of contaminants for the toxicity characteristic as applicable to waste disposal and/or investigation derived waste management. Dangerous waste criteria for toxicity will be evaluated by the book designation procedure, as applicable to waste disposal and/or investigation derived waste management.

A fish bioassay test may be used to establish the designation of waste if 1) the book designation procedure identifies a waste as potentially dangerous or 2) toxicological data is not available for a detected compound of concern as necessary to perform the book designation procedure.

The evaluation criteria described above include chemical-specific requirements that set concentration limits for an element or chemical compound in soil. As appropriate, the comparison of observed environmental conditions at the site with project-specific evaluation criteria will include consideration of site-specific factors (e.g., contaminant transport pathways and mechanisms and anticipated exposure and future land use scenarios).

5.2 SITE-SPECIFIC SOIL CLEANUP LEVELS

The approach to developing soil cleanup levels at the Webster Nursery site using the principles and technical basis set forth in MTCA is discussed in the following sections.

5.2.1 Use of MTCA Method B Residential Soil Cleanup Levels

The MTCA soil cleanup standards stipulate that contaminant concentrations detected in soil shall be protective of groundwater at the site. Specifically, the concentration of individual hazardous substances or mixtures shall be equal to or less than 100 hundred times the associated MTCA Method B groundwater cleanup level, unless it can be demonstrated that a higher soil concentration is protective of groundwater at the site [WAC 173-340-740 (3)(a)(ii)(A)]. The MTCA Method B 100 times groundwater cleanup level standard is considered overly conservative (i.e., too restrictive) for application at the Webster Nursery site based on several site-specific factors, including:

- The Webster Nursery is a commercial facility that restricts access with controlled points of entry;
- No adverse impacts to groundwater quality have been identified outside the area immediately adjacent to the former UST excavation area; and
- The pesticide-based contaminants detected in site soils exhibit low potential for leaching to groundwater based on their physical and chemical characteristics, including very low water solubilities and high affinity to adsorb to soil particles (refer to Section 5.0, Site Conceptual Model).

The use of MTCA Method B soil cleanup levels, as derived from the residential-use scenario and associated risk calculations (e.g., CLARC II Update, February 1996), are proposed for use as initial screening values for comparative review against the findings of the pesticide storage warehouse soil investigation. The use of alternative soil cleanup levels will be evaluated at the Webster Nursery site, as appropriate to the findings of the investigation and observed environmental conditions at the site.

The proposed approach to alternative soil cleanup level development is discussed in the following section.

5.2.2 Development of Alternative Soil Cleanup Levels

The migration of soil contaminants to the underlying water table aquifer is the primary pathway of concern identified in association with the pesticide storage warehouse and former UST area (refer to Section 5.0, Site Conceptual Model). However, several site-specific factors act to reduce the potential risk associated with the soil-to-groundwater pathway, including the low mobility of the identified pesticide-based compounds in the environment, the potentially limited extent of groundwater impacts, and the fact that access to the Webster Nursery is restricted and under the control of DNR.

Alternative site-specific soil cleanup levels will be evaluated for application at the Webster Nursery site based on information obtained during the pesticide storage warehouse investigation. The modification of MTCA risk-based exposure assumptions is proposed as the primary approach for calculating alternative site-specific soil cleanup levels at the Webster Nursery. Specifically, the risk-based exposure factors including target receptors, rates of ingestion, frequency of contact, and duration of contact will be considered relative to the site-specific conditions associated with the Nursery site. The use of fate and transport model(s) may also be employed to support the development of risk-based alternative soil cleanup levels at the site based on the identified chemical and physical characteristics of the former UST investigation area.

SECTION 6.0
EVALUATION OF REMEDIAL ALTERNATIVES

In accordance with MTCA guidance for the selection of cleanup actions [WAC 173-340-350(6)(e)], an evaluation of alternatives for applicable cleanup actions will be performed pursuant to the findings of the proposed pesticide storage warehouse remedial investigation. The remedial alternative evaluation will be summarized in the site investigation report, and will include the development of remedial action objectives that are protective of human health and the environment, and designed to address the identified nature and extent of contamination at the site. General response actions will be identified to satisfy all media-specific remedial objectives, including the identification and screening of associated technologies and process options. Remedial action alternatives will be developed and identified for each media of concern, as applicable. The identified alternatives will be screened based on three evaluation criteria: effectiveness, implementability, and cost. Alternatives with the most favorable composite evaluation of all factors will be retained for further consideration for a subsequent detailed analysis, if required.

The identification and selection of appropriate cleanup actions at the Webster Nursery site will be conducted in accordance WAC 173-340-360, which specifies the criteria for approving cleanup actions, the order of preference for implementation of cleanup technologies, policies for the application of permanent solutions, and the process for making these decisions.

SECTION 7.0
SAMPLING APPROACH AND OBJECTIVES

The overall sampling objectives of the Webster Nursery RI are to evaluate the extent of residual pesticide contamination in subsoil adjacent to the former UST excavation area located immediately south of the pesticide storage warehouse building, evaluate groundwater quality in the vicinity of the former UST, and assess surficial soil quality along adjacent drainage pathway(s). The following section describes sample strategies, including proposed sample locations and frequencies, that will be used during the pesticide storage warehouse remedial investigation. Figure 7-1 shows the proposed soil boring, monitoring well, and surface drainage sample station locations. Figure 7-1 also shows the previous subfloor drainage boring locations for reference; as these sample locations and associated results were incorporated in the development of the current proposed scope of work for this site.

7.1. SOIL BORING AND SUBSOIL SAMPLING

A total of six soil borings are proposed in the vicinity of the former UST excavation area (refer to Figure 7-1). Each soil boring will extend to an anticipated depth of approximately 10 feet BGS. The groundwater level in the vicinity of the former UST excavation area is anticipated to range seasonally from approximately 4 to 9 feet BGS based on previous water level measurement data collected at the site. Continuous subsoil sampling will be conducted at each boring location for lithologic and field screening (i.e., visual and olfactory observation) purposes. Subsoil samples will be collected for laboratory analysis from 2.5 feet BGS (i.e., the approximate depth of the tank fill piping and the top of the tank), 5 feet BGS (i.e., the approximate depth immediately underlying the former UST), and from 7.5 to 10 feet BGS at each of the six boring locations (refer to Figure 7-1). If visual or olfactory evidence of contamination is encountered during sampling this material will be specifically collected and submitted for laboratory analysis (refer to Section 9.0, Analytical Approach and Procedures).

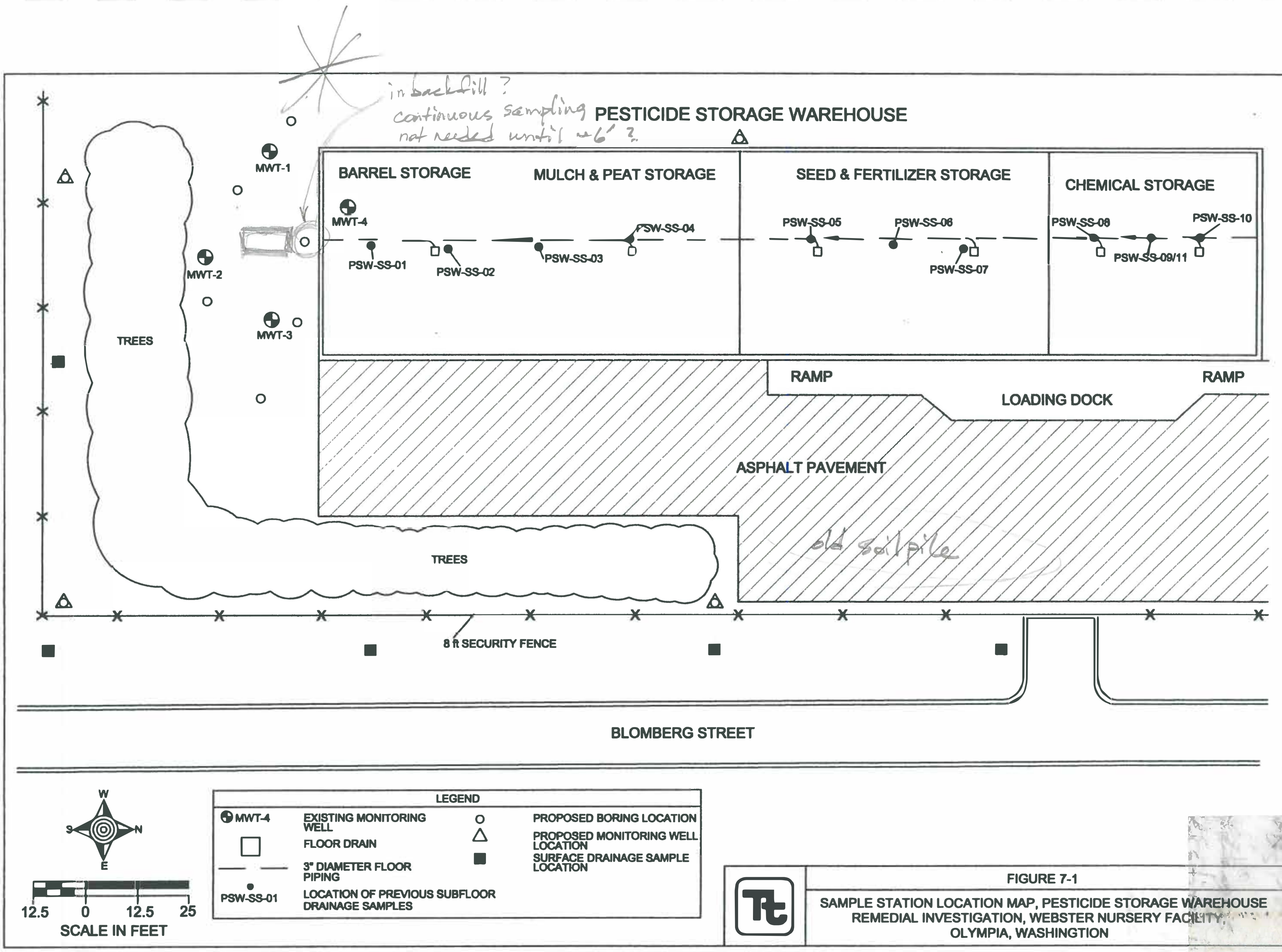


FIGURE 7-1

SAMPLE STATION LOCATION MAP, PESTICIDE STORAGE WAREHOUSE
REMEDIAL INVESTIGATION, WEBSTER NURSERY FACILITY,
OLYMPIA, WASHINGTON

One subsoil sample will also be collected for laboratory analysis from the soil/groundwater interface at each of the proposed newly installed monitoring well locations at the site (refer to Section 7.2, Monitoring Well Installation and Sampling).

7.2 MONITORING WELL INSTALLATION AND SAMPLING

The installation and sampling of up to four new groundwater monitoring wells is proposed to evaluate the extent of groundwater contamination in the vicinity of the former UST excavation area, and to ensure that no pesticide-based compounds are migrating off-site (refer to Figure 7-1). Three of the four proposed monitoring wells are located along adjacent property boundaries, including one well located approximately 65 feet south of the former UST location, one well placed at the southeast property boundary (i.e., approximately 110 feet southeast of the former UST location), and one well located approximately 135 feet northeast of the former UST location (refer to Figure 7-1). The proposed location of the fourth monitoring well is approximately 100 feet northwest of the former UST location and is placed in an assumed downgradient location.

Each monitoring well will be installed to an approximate depth of 20 feet BGS, and will include a 15 foot long screened interval (refer to Section 8.2, Soil Boring and Monitoring Well Installation). Each monitoring well will be appropriately developed and purged prior to groundwater sample collection. One groundwater sample will be collected from each well location and submitted for laboratory analysis (refer to Section 9.0, Analytical Approach and Procedures). In addition to sampling the newly installed monitoring wells, each of the four existing tank area monitoring wells (i.e., wells MWT-1 through MWT-4) in the vicinity of the former tank area have been proposed for sampling under separate contract to DNR. The newly installed monitoring well sampling effort will coincide with the sampling of the existing monitoring wells immediately adjacent to the UST excavation at the site.

7.3 SURFACE DRAINAGE SAMPLING

Up to five surficial soil samples are proposed to be collected and submitted for laboratory analysis along adjacent surface drainage pathways (refer to Figure 7-1). The proposed sample locations are distributed to provide adequate coverage of the drainage features identified at the site. Actual sample locations will specifically include lower lying areas where preferred drainage may occur, and at locations which may reveal signs of contamination based on field observations (e.g., soil staining, odor, etc.).

SECTION 8.0
FIELD INVESTIGATION PROCEDURES

The following section details the field activities and associated standard operating procedures (SOPs) to be implemented during the remedial investigation of the pesticide storage warehouse facility at the Webster Nursery site. The SOPs described below were developed by Tetra Tech to ensure that the samples collected are representative of field conditions, and that the field effort is completed in a standardized and reproducible manner and in accordance with applicable state and federal requirements and guidelines.

8.1 SITE INSPECTION

A site inspection of the pesticide storage warehouse and former UST area will be conducted prior to the start of field related investigation activities. The site inspection will include the following activities:

- Visual inspection of existing site conditions (e.g., ground surface conditions, potential restrictions to drill rig access);
- Selecting and marking soil boring and surface soil sample station locations. Sample station location maps will be revised, as necessary, to accurately identify all sample locations; and
- Establishment of staging area(s) for the management of investigation derived wastes.

No underground utilities are suspected in the vicinity of the proposed soil boring locations adjacent to the pesticide storage warehouse facility. However, required notification to Utilities Underground, a public utilities notification service, will be performed a minimum of two working days prior to the onset of drilling at the subject property, in accordance with Chapter 19.122 of the Revised Code of Washington (RCW 19.122). The utilities service will be requested to mark public utility lines on all easements and rights-of-way in the vicinity of the pesticide storage warehouse facility.

8.2 SOIL BORING AND MONITORING WELL INSTALLATION

A total of 10 soil borings, including four borings completed as groundwater monitoring wells, are proposed to be drilled by Cascade Drilling, Inc. of Woodinville, Washington, a Washington-licensed drilling company (refer to Figure 7-1). Cascade Drilling, Inc. will be responsible for obtaining all required permits and start cards prior to the start of drilling and well installation activities at the site.

Soil borings will be advanced using direct push techniques (i.e., a CME 45 truck-mounted geoprobe), and will be completed to the soil/water interface at each boring location. Four of the 10 soil boring locations will be completed as groundwater monitoring wells which will extend to an approximate depth of 20 feet BGS at each location. The monitoring wells will be installed using a CME 45 truck-mounted hollow-stem auger rig using standard drill and drive techniques. A professional geologist will supervise the drilling, and will prepare lithologic logs of borings using the Unified Soil Classification System (USCS). Subsoil sampling procedures are discussed in Section 8.3.2, Subsoil Sampling).

All groundwater monitoring wells will be constructed in accordance with Ecology's Minimum Standards for the Construction and Maintenance of Monitoring Wells, as specified in WAC 173-162. Each monitoring well will consist of 2-inch inside diameter, Schedule 40 polyvinyl chloride (PVC) material. The monitoring wells will be constructed using a 15-foot long screened interval consisting of 0.01-inch slot Schedule 40 PVC, which will be flush-threaded to Schedule 40 PVC blank casing sections, as needed. The screen and casing assemblies will be kept plumb and centered in the hollow-stem auger while being lowered. An artificial filter pack, consisting of clean 10/20 Colorado sand, will be carefully added to the borehole annulus to avoid bridging of the filter pack material. The filter pack material will extend a minimum of 2 feet above the top of the screened interval which will be placed approximately between 20 and 5 feet BGS at each proposed well location.

Following placement of the filter pack, a minimum of 2 feet of bentonite chip will be placed and hydrated to form a seal above the filter pack. This seal will be hydrated with potable water and allowed to expand for a minimum of 5 minutes prior to placement of the cement/bentonite grout. Cement/bentonite grout will be placed above the sanitary seal to the ground surface and a flush-

1999 Well Survey

mounted, traffic-rated water-tight protective casing will be installed at ground surface at each well location.

Soil boring cuttings and decontamination fluids generated during drilling activities will be handled as specified in Section 8.5, Investigation Derived Wastes. All soil borings not completed as monitoring wells will be immediately abandoned by filling the annular opening with hydrated bentonite from the base of the boring to the ground surface.

8.2.1 Well Development

Each newly installed monitoring well will be developed prior to groundwater sample collection to assure continuity between the well, well screen, and formation materials. Well development will be performed using a combination of bailing or pumping and surging with a surge block. No water, including recycled formation water, will be added to the well during development. Field parameters, including temperature, pH, conductivity, and turbidity will be routinely measured and recorded during well development to document the stabilization of formation groundwater.

Wells may be installed that, because of formation conditions, do not clean up after a number of rounds of bailing and surging. If the well does not clean up (i.e., suspended fine-grained material cannot be removed) after 25 casing volumes have been removed, well development may cease. The rate of groundwater drawdown and recharge will be recorded during well development activities. If the well is bailed dry during development, it will be allowed to recharge and development will continue. If the well is bailed dry a second time, well development may cease.

All well development equipment used will be dedicated and disposable; eliminating the need for decontamination between well locations. Wastewater generated during well development will be handled as detailed in Section 8.5, Investigation Derived Wastes.

8.2.2 Well Survey

Following completion and development, the monitoring wells will be surveyed by a certified land surveyor. The elevation of the newly installed wells will be surveyed to the nearest 0.01-foot at three locations, including the adjacent ground surface, the top of the flush-mount monument, and the north rim of the PVC well casing.

8.3 ENVIRONMENTAL SAMPLING PROCEDURES

The following sections describe procedures that will be followed to collect surface soil, subsoil, and groundwater samples at the Webster Nursery site. These procedures are designed to ensure that samples are representative of field conditions and that they are identified, handled, and transported properly to retain sample integrity.

8.3.1 Surface Soil Sampling

Surface drainage soil sample locations will specifically include lower lying areas where pathways and drainage accumulation may occur, and at locations which may reveal suspected signs of contamination (e.g., soil staining, odor, etc.). Surface soil sampling will be conducted using the following procedure:

1. Label the appropriate sample containers with all necessary information (refer to Section 8.9.1). Remove the vegetation layer and any surface debris (e.g., stones, twigs, leaves) from the specific sample location. Record surface conditions in log book.

2. Using a clean stainless steel sample spoon and/or trawl device remove approximately1 to 3 inches of surface soil from a 1-foot square area in preparation for sample collection.

3. Collect surface soil sample within the 1-foot square sample area using a clean stainless steel spoon. Place soil directly into appropriate, pre-labeled sample container(s) using the stainless steel sample spoon and securely fasten lids.

4. Immediately place the properly labeled sample containers in a cooler with ice and maintain at an optimal temperature of 4° C for the duration of sampling and transportation to the laboratory.

5. Record all sample collection information (e.g., location, sample identification, sample type, sample characteristics, etc.) in the field logbook.

6. Follow sample custody and handling procedures as described in Section 8.9.2

7. Decontaminate all soil sampling equipment between sample locations according to the procedures described in Section 8.4.

8.3.2 Subsoil Sampling

Up to 10 soil borings are proposed to be drilled in the vicinity of the pesticide storage warehouse and former UST area. Subsoil samples will be collected at each boring location using the following procedure:

1. Label the appropriate sample containers with all necessary information (refer to Section 8.9.1). Drive a clean, standard 24-inch long, stainless steel borehole sampler into the soil using direct push techniques.

2. Upon retrieval, the borehole sampler will be placed on a flat surface covered by clean plastic. Remove the plastic sample sleeve from the borehole sampler and immediately inspect the sample for visual and olfactory evidence of contamination. Record soil sample characteristics on the field boring log. Record all sample collection information (e.g., location, sample identification, sample type, depth collected, etc.) in the field logbook

3. Place soil directly from the borehole sample tube into appropriate, pre-labeled sample containers using a clean stainless steel spoon and securely fasten lids.

4. Immediately place the properly labeled sample containers in a cooler with ice and maintain at an optimal temperature of 4° C for the duration of sampling and transportation to the laboratory.

5. Follow sample custody and handling procedures as described in Section 8.9.

6. Decontaminate all soil sampling equipment between sample locations according to the procedures described in Section 8.4.

8.3.3 Groundwater Sampling

Monitoring wells will be completely developed and stabilized prior to sample collection. Groundwater samples will be collected from each newly installed temporary well a minimum of 24 hours following the completion of development. Groundwater purging and sample collection procedures are described in the following sections.

8.3.3.1 Groundwater Purging. The groundwater surface level and total well depth from the top of the well casing will be measured using a calibrated water level indicator. This information will be used to calculate the volume of water in the well casing. A peristaltic pump with dedicated tubing will be used to purge a minimum of three saturated casing volumes of groundwater from each well prior to sampling. Purged water will be placed in a graduated container to allow measurement of the volume of water removed from each well. The temperature, pH, and conductivity of the groundwater will be measured initially and between each casing volume purged, and these values will be recorded on a groundwater sampling log. If the temperature, pH, or conductivity of the purge water varies by greater that 10 percent between the last two consecutive casing volumes, additional casing volumes will be removed from the well until these parameters stabilize.

All purged groundwater will be contained in properly labeled, sealed drums and stored onsite pending disposal, as detailed in Section 8.5, Investigation Derived Wastes.

8.3.3.2 Groundwater Sample Collection. Groundwater samples will be collected from each of the four newly installed monitoring wells using a peristaltic pump equipped with dedicated tygon tubing to minimize potential sediment entrainment, and using the following procedure:

1. Label the appropriate sample bottles with all necessary information. Transfer groundwater directly from the pump tubing into appropriate, pre-labeled sample bottles.

2. Place the properly labeled and sealed sample containers in a cooler with ice in an effort to maintain an optimum temperature of at 4° C for the duration of the sampling and transportation period.

3. Record all sample collection information (e.g., location, sample identification, sample description, etc.) in the field logbook and/or on an associated groundwater sampling log.

4. Follow sample custody and handling procedures as described in Section 8.9, Documentation Procedures.

5. Contain all purged groundwater in properly labeled drums as discussed in Section 8.5, Investigation Derived Wastes.

8.3.4 Field Quality Control Sampling

Field quality control sampling is conducted to ensure the reliability of project samples and to verify the usefulness of the analytical data (refer to Section 10.0, Data Quality Objectives). Field quality control samples, including field duplicate and equipment rinse blank sampling will be collected in support of the pesticide storage warehouse and former UST area investigation effort (refer to Section 9.0, Analytical Approach and Procedures)..

Field duplicate samples will be collected from the same materials, and in the same manner, as the associated primary (field) sample. The field duplicate samples will be submitted to the laboratory for the same analyses as are specified for the associated field sample, but will be given a different (unique) sample number to avoid detection by the laboratory and to provide for an evaluation of the reproducibility of both field collection and laboratory analysis techniques.

One equipment rinse blank sample will be collected by pouring distilled water over the appropriate field sampling equipment (e.g., stainless steel borehole sampler, stainless steel sample spoon, etc.) and directly into the appropriate, laboratory-supplied sample container(s). Equipment rinse blank samples will be collected after the associated field sampling equipment has been subjected to standard decontamination procedures (refer to Section 8.4, Decontamination Procedures). This sample will be submitted to the laboratory and analyzed by the same analytical methods for which the associated field (primary) samples are analyzed. The equipment rinse blank sample will provide for an evaluation of sample accuracy and the effectiveness of decontamination procedures conducted following sample collection at each location.

8.4 DECONTAMINATION PROCEDURES

The following procedures will be used reduce the potential for sample exposure to contamination associated with the sampling equipment. Soil sampling equipment such as the stainless-steel sample sleeve and sampling spoon(s) will be decontaminated prior to each use following the four step sequence below:

1) Scrub each item with Alconox™ or an equivalent detergent;
2) Rinse with potable water;
3) Rinse with isopropyl alcohol; and
4) Final rinse with distilled water and allow to air dry

The decontamination procedure for sample handling equipment listed above includes an alcohol rinse to minimize potential organic compound cross-contamination.

8.5 INVESTIGATION DERIVED WASTES

The soil cuttings produced during drilling and fluids generated during groundwater development, purging, and sampling, and during the decontamination of equipment and personnel will be contained in 55-gallon Department of Transportation (DOT)-approved storage drums. A label will be attached to each drum, which will identify the site name, generator, date of waste generation, and type of waste. The containerized wastes will be stored on wooden pallets within the southern bay of the pesticide storage warehouse pending receipt of sampling analytical results. Based on corresponding analytical results, Tetra Tech will recommend appropriate disposal alternative(s) and will coordinate the disposal of the materials.

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8.6 FIELD MEASUREMENTS, INSTRUMENT CALIBRATION, AND MAINTENANCE

This section briefly describes the field measurements to be collected during the pesticide storage warehouse investigation, including instrument calibration and maintenance.

8.6.1 Temperature, pH, and Conductivity

Groundwater temperature, pH, and conductivity will be measured using a digital combination meter equipped with an automatic temperature compensator. The instrument will be calibrated according to manufacturer specifications each morning prior to use, and checked periodically using calibration standards to ensure that the accuracy of the instrument is maintained. A manufacturer's operation manual and the calibration log book will accompany the instrument onsite.

8.6.2 Water Level Indicator

A factory calibrated electronic water level indicator will be used to measure the depth to the groundwater surface in each monitoring well. Water levels will be measured relative to the surveyed reference point on the top of the well casing at all locations. The water level indicator probe and calibrated tape will be decontaminated prior to each use using the procedures described in Section 8.4.

8.7 SAMPLE CONTAINERS, PRESERVATION, AND HOLDING TIMES

Information regarding sample containers, preservation methods, and holding times is provided in Table 8-1. Preservation of samples is required to retain data integrity. The most common preservation techniques include pH adjustment and temperature control. Field personnel collecting environmental samples during the pesticide storage warehouse investigation effort will use EPA-recommended containers and adhere to EPA- recommended preservation techniques for the parameters of concern.

TABLE 8-1. RECOMMENDED SAMPLE CONTAINERS, PRESERVATION METHODS, AND HOLDING TIMES FOR SELECTED METHODS
PESTICIDE STORAGE WAREHOUSE INVESTIGATION
WEBSTER NURSERY
OLYMPIA, WASHINGTON

Parameter	Container[a]		Preservation[b]		Maximum Holding Times[c]
	Water	Soil	Water	Soil	
Chlorinated Pesticides (EPA 8081A)	NA	8 oz (G)	NA	Cool 4° C	14 days until extraction 40 days after extraction
Chlorinated Herbicides (EPA 8151A)	NA	8 oz (G)	NA	Cool 4° C	14 days until extraction 40 days after extraction
Organic Compounds (EPA 525.2)	2 X 1 liter (AG)	NA	Cool 4° C	NA	14 days until extraction 40 days after extraction
Chlorinated Acids (EPA 515.1)	1 liter (AG)	NA	Cool 4° C	NA	14 days until extraction 40 days after extraction
TCLP Herbicides/Pesticides (EPA 1311)	NA	8 oz (G)	NA	Cool 4° C	14 days until extraction 40 days after extraction
Total Organic Carbon (EPA 9060)	NA	4 oz (G)	NA	Cool 4° C	28 days

a Polyethylene (P), glass (G), or amber glass (AG).

b Where applicable, containers for all samples requiring preservation will be provided with preserving agent added by the laboratory.

c Samples should be analyzed as soon as possible after collection. The times listed are maximum times that samples may be held before analysis and still be considered valid.

Source: This table includes the requirements of the U.S. Environmental Protection Agency, as published in the Code of Federal Regulations, Volume 49, Number 205X.

8.8 SAMPLE STORAGE, PACKAGING, AND SHIPMENT

All samples will be packaged carefully to avoid breakage or contamination, and will be transported to the laboratory at proper temperature. The following sample packaging requirements will be followed:

- Sample bottle lids will not be mixed; all sample lids will stay with the original containers.
- All sample bottles will be wrapped in bubble pack or similar material and placed in plastic bags to minimize the potential for breakage or cross-contamination during shipment.
- All samples will be cooled unless "no cooling" has been specified. The sample containers will be packed in a chilled cooler. Empty space in the cooler will be filled with inert packing material.
- The Chain-of-Custody will be placed in a plastic bag and taped to the inside of the cooler lid.
- All coolers will be custody-sealed and taped with filament tape for shipment to the laboratory.

8.9 DOCUMENTATION PROCEDURES

The following sections describe the documentation procedures for field and sample analysis activities during the assessment of soil and groundwater at the pesticide storage warehouse area, including sample designation and labeling, sample custody in the field, daily field logs, and photographs.

8.9.1 Sample Designation and Labeling

Sample identification numbers will be designated using a four-part code identifying the site, sample type, sample location, and sample depth. An example of the sample designation is described as follows:

PSW-SB01-2.5

Where:

PSW	=	The abbreviated site designation (i.e., pesticide storage warehouse);
SB01	=	The sample type (e.g., subsoil) and the location (i.e., boring number); and
2.5	=	The depth (feet) at which the sample was taken

Sample designations will include the following sample type protocol:

SB	=	Subsoil
SD	=	Surface Drainage
GW	=	Groundwater

A single sample number will apply to as many sample containers as required for the specified analysis for a specific environmental sample sent to the contract laboratory. The sample number, along with the date and time the sample was obtained, will be recorded on the sampling record and written on the sample label. After collection and identification, the sample will be maintained under Chain-of-Custody procedures, as discussed in Section 8.9.2 of this document.

Duplicate samples will be labeled with a unique sample designation and sample time to avoid detection by the analytical laboratory. There should be nothing on the sample label or chain-of-custody that might alert the laboratory that the sample is a field duplicate. All information necessary to correlate and correctly identify and distinguish field QC samples will be recorded in the field logbook.

*8.9.1.1 **Sample Labels.*** The information recorded on individual sample labels includes the following:

- Project identifier and project number;
- Field identification sample number;
- Date and time of sample collection;
- Initials of the sampler;

- Analyses to be performed on the sample; and
- Preservative used and, in the case of water samples, whether the sample is filtered or unfiltered.

8.9.2 Sample Custody in the Field

Sample custody procedures will be based on EPA-recommended procedures (U.S. EPA 1992). As a result, emphasis is placed on careful documentation of sample collection and sample transfer. To ensure that all important information pertaining to each sample is recorded, the documentation procedures described in the following sections will be implemented during collection of environmental samples.

The criteria for proper sample custody are presented below. The documentation for sample custody and the protocols for custody transfer are also discussed.

8.9.2.1 Chain-of Custody. A Chain-of-Custody record is used to maintain sample custody and to document the transfer and possession of samples from the time of collection through receipt and analysis at the analytical laboratory. The custody record is completed by the individual collecting the samples. Chain-of-Custody records will be completed for all samples collected and submitted for chemical analysis, including any samples that may be held by the laboratory for subsequent analysis. A sample is considered to be in custody if it is:

- In the responsible party's physical possession;
- In the responsible party's immediate view;
- Within a locked or sealed container which is only accessible by authorized personnel; or
- In a secured area with access restricted to authorized personnel only.

Copies of the Chain-of-Custody record will be retained by the individual responsible for sample collection and transfer, and by the analytical laboratory. Project documentation will include the completed Chain-of-Custody record as part of the analytical data package.

8.9.2.2 ***Transfer of Custody.*** The field personnel who take the samples are responsible for the care and custody of the sample until it is properly transferred or delivered to the delivery agent. A Chain-of-Custody record will accompany all samples. When transferring the possession of samples, the individuals relinquishing and receiving the samples will sign, date, and note the time on the Chain-of-Custody form. The company relinquishing the sample, the company receiving the sample, and the reason for transfer, as stated previously, will be noted. This record documents the transfer of samples from the custody of the sampler to that of another person.

8.9.2.3 ***Daily Logs.*** All information pertinent to the field and/or sampling survey will be recorded on appropriate data sheets and in a project field logbook. Entries in the logbook will be made in waterproof ink and will include the following:

- Date of entry;
- Names and affiliations of personnel on the site;
- General description of each day's field activities;
- Documentation of weather conditions during sampling;
- Location of sampling (e.g., well or borehole number and proximity to nearest landmark or topographic point of reference);
- Observations of sample or collection environment;
- Identification of sampling device and all field measurements made;
- Sequence of collection of environmental samples;
- Type of sample matrix (e.g., soil, groundwater);
- Field sample identification number and date and time of environmental sample collection;

- Sample type (e.g., composite, normal, duplicate);

- Preservative used, if applicable, for the environmental sample.

The bottom of each page in the logbook will be signed or initialed by the person making the entries.

8.9.3 Corrections to the Logbook and Other Documents

All original data recorded in field logbooks, on sample tags, or in custody records; as well as other data sheet entries, will be written with waterproof ink. If an error is made on the document or in the logbook, corrections will be made simply by crossing a line through the error in such a manner that the original entry can still be read, and the correct information added as the change. All corrections will be initialed by the author and dated.

8.9.4 Photographs

Photographs, if taken, will be recorded in the appropriate logbook. Information to be recorded will include the following elements:

- Roll and frame number;

- Time and date;

- Photographer;

- Details for the location of the photograph;

- The subject of the photograph; and

- Any significant or relevant features to note in the photograph.

SECTION 9.0
ANALYTICAL APPROACH AND PROCEDURES

The analytical program for the pesticide storage warehouse remedial investigation was developed based on review of an extensive chemical inventory provided by DNR for the Nursery facility, and on analytical results from previous soil and groundwater sampling activities conducted at the site. The proposed analyses to be conducted on soil and groundwater samples in support of this investigation effort are discussed in the following sections. A summary of proposed sample analyses for the pesticide storage warehouse investigation is provided in Table 9-1. This table includes the estimated number of samples for each media, sample type, and the number of analyses and analytical methods for each sample. A section providing the estimated number of project samples by media and analysis is also included in Table 9-1.

9.1 SOIL SAMPLE ANALYSES

The proposed analyses to be conducted on all subsoil samples collected in support of this assessment include, organochlorine pesticides by EPA Method 8081A and chlorinated herbicides by EPA Method 8151A. To assess the potential for contaminants to leach from soil to groundwater, the toxicity characteristics leaching procedure (TCLP) is proposed for analysis on the soil which reveals the highest pesticide-based concentration(s) during the investigation. Additionally, the total organic carbon (TOC) content in selected soil samples will be determined to provide information regarding the adsorption potential of pesticides-based compounds in site soils. These standard analytical methods are referenced in the document entitled *Test Methods for Evaluating Solid Waste: Physical/Chemical Methods*, *SW-846,* 3rd Edition, U.S. EPA 1996.

The analysis of soil samples collected for the Webster Nursery site will be performed by North Creek Analytical of Bothell, Washington. The chosen laboratory has performed analytical services for the U.S. EPA Contract Laboratory Program (CLP) and has established protocols and QA procedures that conform with EPA guidelines and Washington State procedures. Routine analysis of the environmental soil samples will be performed using procedures based on the following EPA methods:

TABLE 9-1. SAMPLE ANALYTICAL SUMMARY
PESTICIDE STORAGE WAREHOUSE INVESTIGATION
WEBSTER NURSERY
OLYMPIA, WASHINGTON

Activity	Media	Estimated Number of Samples	Proposed Analysis[a]					
			Organochlorine Pesticides (EPA Method 8081A)	Chlorinated Herbicides (EPA Method 8151A)	TCLP (EPA Method 1311)	Total Organic Carbon (EPA Method 9060)	Chlorinated Acids (EPA Method 515.1)	Organic Compounds (EPA Method 525.2)
Subsoil Sampling	Soil	22	22	22	1	3	NA	NA
Surface Soil Sampling	Soil	5	5	5	NA	NA	NA	NA
Groundwater Sampling	Groundwater	4	NA	NA	NA	NA	4	4
Quality Assurance/Quality Control								
Equipment Rinsate Blank	Water	1	1	1	NA	NA	NA	NA
Duplicates	Soil	2	2	2	NA	NA	NA	NA
	Groundwater	1	NA	NA	NA	NA	1	1
Total Project Samples	Soil	29	29	29	1	3	0	0
	Water	6	1	1	0	0	5	5

a The standard analytical methods for soil analysis are referenced in the document entitled *Test Methods for Evaluating Solid Waste: Physical/Chemical Methods, SW-846*, 3rd Edition (U.S. EPA 1996). The standard analytical methods for groundwater analysis are referenced in the document entitled *Drinking Water Methods from Methods for the Determination of Organic Compounds in Drinking Water, EPA/600/4-88/039*, December 1988 (Revised July 1991), and Supplement II EPA/600/R-92/129, August 1992.

what about Las Cedros wells?
aren't we sampling all wells now?
Why sample just 4 now & others later?
→ because time is limited?!
because other areas of concern may prompt ∑ sampling! wells!
Order only requires the 4 for now
We don't know what DOE/Co. want at this time
if they will require anything?!

- U.S. EPA Method 8081A – Organochlorine pesticides by gas chromatography/electron capture detection (U.S. EPA 1996).

- U.S. EPA Method 8151A – Chlorinated herbicides by gas chromatography/electron capture detection (U.S. EPA 1996).

- U.S. EPA Method 1311 – Toxicity characteristic leaching procedure (TCLP) for pesticides and herbicides (U.S. EPA 1996).

- U.S. EPA Method 9060 – Total organic carbon determination by use of dohrmann analyzer (U.S. EPA 1996).

9.2 GROUNDWATER SAMPLE ANALYSES

The proposed drinking water analyses to be conducted on all groundwater samples collected in support of this assessment include, chlorinated acids by EPA Method 515.1 as referenced in the document entitled *Drinking Water Methods From Methods for The Determination of Organic Compounds in Drinking Water, EPA/600/4-88/039,* December 1988 (Revised July 1991), and the determination of organic compounds by EPA Method 525.2 as referenced in the document entitled *Drinking Water Methods From Methods for The Determination of Organic Compounds in Drinking Water Supplement II, EPA/600/R-92/129,* August 1992.

The analysis of groundwater samples collected for the Webster Nursery site will be performed by Edge Analytical of Burlington, Washington. The chosen laboratory has established protocols and QA procedures that conform with EPA guidelines and Washington State procedures, and is certified by the Washington State Department of Health to perform the analyses identified for use during this investigation. Routine analysis of the environmental groundwater samples will be performed using procedures based on the following EPA methods:

- U.S. EPA Method 515.1 – Chlorinated acids by gas chromatography with electron capture detector (U.S. EPA 1991).
- U.S. EPA Method 525.2 – Organic compounds by capillary column gas chromatography/ mass spectrometry (U.S. EPA 1992).

The proposed use of EPA's drinking water analytical methods to characterize groundwater quality at the Webster Nursery site is consistent with previous DNR groundwater sampling efforts at the facility; as well as previous groundwater quality assessments conducted by the Washington State Department of Health and the Thurston County Public Health and Social Services Department in the vicinity of the Nursery (refer to Section 1.2; Table 1-1).

Previous groundwater sampling efforts for the four monitoring wells installed immediately adjacent to the former UST area have routinely included the use of EPA Method 507 for the detection of nitrogen- and phosphorus-containing pesticides and EPA Method 508 for the determination of chlorinated pesticides in water. The proposed use of EPA Method 525.2 for the detection of organic compounds in drinking water includes those compounds previously reported by both EPA Methods 507 and 508, as well as several additional organic compounds. The use of EPA Method 525.2 was utilized by both the Washington State Department of Health and the Thurston County Public Health and Social Services Department during previous groundwater assessments conducted in the vicinity of the Nursery.

The reporting of polychlorinated biphenyls (PCBs), polynuclear aromatic hydrocarbons (PAHs), and phthalate compounds (i.e., a total of 26 compounds) associated with the EPA Method 525.2 drinking water analysis will not be requested. Reporting of these compounds is not deemed necessary based on the following:

- These compounds have not been identified as potential chemicals of concern at the site, and
- These compounds have not been detected during previous groundwater quality assessments in the vicinity of the site.

However, an extended list of pesticide and herbicide compounds, including a total of 51 additional compounds, will be added for routine quantification and reporting using the EPA Method 525.2 analysis (refer to Section 10, Data Quality Objectives).

SECTION 10.0
DATA QUALITY OBJECTIVES

The purpose of data quality objectives (DQOs) is to guide decisions and processes for the collection, analysis, and evaluation of data in an attempt to satisfy overall project objectives. It is the objective of this project to: 1) evaluate the extent of residual pesticide contamination in shallow subsoil adjacent to the location of the former UST, 2) evaluate the extent of impacted groundwater in the vicinity of the former UST, and 3) assess surficial soil quality along adjacent drainage pathway(s), as necessary to develop and identify appropriate cleanup actions commensurate with the observed environmental conditions at the site.

Data needs for the pesticide storage warehouse investigation effort include quantitative analytical data of sufficient quality to ensure the accurate assessment of the environmental conditions at the site. This information will also be used to ensure compliance with applicable Ecology and federal environmental cleanup and waste management regulations. Table 10-1 provides a summary of chemical-specific ARARs, general data needs, and associated data quality objectives which have been developed for the Webster Nursery site.

For data collected during the pesticide storage warehouse investigation work effort, primary analytical services will be performed at fixed-base laboratories at U.S. EPA Analytical Support Level III. Project goals for assessment criteria and measurement of data quality for this project are presented in detail in the following section.

10.1 GOALS FOR ASSESSMENT CRITERIA

Table 10-2 summarizes the objectives for measurement data established for the Webster Nursery site. The information provided in Table 10-2 includes project-specific objectives for measurement data by analytical method, including laboratory practical quantitation limits, and quality control limits established for matrix spike/matrix spike duplicate and for surrogate spike compounds. Chemical-

TABLE 10-1. SUMMARY OF APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS, GENERAL DATA NEEDS, AND DATA QUALITY OBJECTIVES
PESTICIDE STORAGE WAREHOUSE INVESTIGATION
WEBSTER NURSERY
OLYMPIA, WASHINGTON

Media	Applicable or Relevant and Appropriate Requirements					General Data Needs	Data Quality Objectives
	MTCA[a] Method B Soil Cleanup Levels	MTCA[b] Method B Groundwater Cleanup Levels	National[c] Primary Drinking Water Standards	Alternative[d] Soil Cleanup Levels	RCRA[e]		
Soil	X	NA[f]	NA	X	X	Determine the presence and extent of residual pesticide contamination in subsoil in the vicinity of the former UST. Assessment of surficial soil quality along adjacent drainage pathways	Establish compliance with chemical specific ARARs. Collect subsoil samples adjacent to the former UST area and surface soil samples along adjacent drainage pathways. Analyze these subsoil and surface soil samples, including associated QC samples for specified pesticide analyses.
Groundwater	NA	X	X	NA	NA	Determine the extent of pesticide-based contamination in shallow groundwater in the vicinity of the former UST.	Establish compliance with chemical specific ARARs. Collect groundwater samples from newly installed and existing monitoring wells adjacent to the former UST. Analyze these groundwater samples, including associated QC samples for specified pesticide analyses.

a Model Toxics Control Act (MTCA) Method B Soil Cleanup Levels [WAC 173-340-740(3)(a), as amended January 1996].

b Model Toxics Control Act (MTCA) Method B Groundwater Cleanup Levels [WAC 173-340-720(3)(a), as amended January 1996].

c Values based on EPA Drinking Water Regulations and Health Advisories Maximum Contaminant Levels (MCLs), as published by the EPA Office of Water, October 1996..

d Alternative site-specific soil cleanup levels to be evaluated based on results of investigation.

e Resource Conservation and Recovery Act (RCRA) 40 CFR Part 261.

f NA = Not Applicable.

TABLE 10-2. OBJECTIVES FOR SOIL AND GROUNDWATER MEASUREMENT DATA
PESTICIDE STORAGE WAREHOUSE INVESTIGATION
WEBSTER NURSERY
OLYMPIA, WASHINGTON

Parameter	Method Reference	Analytical Technique[a]	Matrix	Units	Quantitation Limit[b]	Quality Control Compound(s)	Accuracy[c]: Matrix Spike/Matrix Spike Duplicate (Percent Recovery)	Accuracy[c]: Surrogate Recovery	Precision (Relative Percent Difference)	Completeness (Percent)
Chlorinated Herbicides	EPA 8151A	GC/ECD	Soil	μg/kg	5-750	2,4-D	41-141	NA[d]	44	95
						2,4,5-TP	51-116	NA	27	
						2,4-DCAA	NA	31-136	NA	
Chlorinated Acids	EPA 515.1	GC/ECD	Ground-water	μg/L	0.08-2.0	All compounds	70-130	70-130	45	95
Organic Compounds	EPA 525.2	GC/MS	Ground-water	μg/L	0.02-2.0	All compounds	70-130	70-130	45	95
Organochlorine Pesticides	EPA 8081A	GC/ECD	Soil	μg/kg	0.5-50	Aldrin	35-138	NA	33	95
						Lindane	44-137	NA	35	
						Heptachlor	40-146	NA	32	
						TXC	NA	38-117	NA	
						Decachloro-biphenyl	NA	36-132	NA	

[a] Analytical Technique: (GC/ECD) = Gas Chromatography/Electron Capture Detection.
(GC/MS) = Gas chromatography/mass spectrometry.

[b] Quantitation limits are based on North Creek Analytical method reporting limits for soil and Edge Analytical method reporting limits for groundwater.

[c] Accuracy and precision control limits are based on North Creek Analytical method-specific values for soil and Edge Analytical for groundwater.

[d] NA = Not applicable.

specific ARAR action levels are identified, as appropriate, with associated method and laboratory reporting limits for the specified soil and groundwater sample analyses in Tables F-1 through F-4 in Appendix F.

10.2 MEASUREMENT OF DATA QUALITY

The following sections describe the methods used to assess data quality.

10.2.1 Accuracy

Accuracy is the degree of agreement of a measurement or average of measurements with an accepted reference or "true value", and is a measure of bias in the system. Field instruments have a potential accuracy which is specified by the manufacturer. The ability to obtain this level of accuracy depends on proper calibration. For the laboratory, results of method blank analysis, as well as reagent, matrix, and surrogate QC sample results, will be the primary indicators of accuracy. These results will be used to control accuracy within acceptable limits by requiring that they meet specific criteria. As these spiked QC samples are analyzed, spike recoveries will be calculated and compared to pre-established laboratory acceptance limits. The calculation formula for percent recovery is:

$$\%\ Spike\ Recovery = \left(\frac{[Value\ of\ Sample\ Plus\ Spike\ Added] - [Value\ of\ Unspiked\ Sample]}{[Value\ of\ Spike\ Added]} \right) X\ 100 \quad [1]$$

Acceptance criteria, also termed control limits, are based on previously established (i.e., historical) laboratory capabilities for similar samples using control chart techniques. In this approach, the control limits reflect the minimum and maximum recoveries expected for individual measurements for an in-control system. Recoveries outside the established control limits indicate some assignable cause, other than normal measurement error, and the possible need for corrective action. Corrective action could include recalibration of the instrument, reanalysis of the QC sample, reanalysis of the samples in the batch, or flagging the data as suspect if the problem cannot be resolved. These results will be reported to the DNR and Tetra Tech Project Manager(s).

10.2.2 Precision

Precision is defined as a measure of mutual agreement of a measurement or average of measurements with an accepted reference of "true" value. Based on these results, a measure of bias within the system can be estimated. The precision of the measurement data gathered during the work effort will be based on QC sample analyses (repeatability), replicate analyses (replicability), and the results obtained from duplicate/replicate field samples (sample replicability).

Precision is independent of the error (accuracy) of the analyses, and reflects only the degree to which the measurements agree with one another, not the degree to which they agree with the "true" value for the parameter measured. Precision is calculated in terms of Relative Percent Difference (RPD), which is expressed as follows:

$$RPD = \frac{[X_1 - X_2]}{[(X_1 + X_2)/2]} X\,100 \qquad [2]$$

where: X_1 and X_2 represent the individual values found for the target analyte in the two replicate analyses.

RPDs must be compared to the laboratory-established RPD for the analysis. For concentrations less than 10 times the detection limit, RPD criteria are not valid, and variations may be as great as 100 percent. The precision of duplicates may again depend on sample homogeneity. Initial spike concentrations will be greater than the detection limits and will have a range comparable to those stated in SW-846 (EPA 1996).

When RPDs exceed previously established control limits, the analyst or his/her supervisor must investigate why the data exceed stated acceptance limits and report these findings to the laboratory QA/QC Coordinator. RPDs outside the established control limits can indicate some assignable cause, other than normal measurement errors, and the need for corrective action. Follow-up action can include recalibration, reanalysis of the matrix spike/matrix spike duplicate (MS/MSD) QC sample, environmental sample reanalysis, or flagging the data as suspect if problems cannot be resolved.

Replicate analysis of control samples will be obtained when QC samples specific to the environmental samples are analyzed. Analytical precision will be evaluated from MS/MSD RPD analyses. Use of duplicate samples during analysis can also allow a measure of precision to be determined.

Field duplicates are defined as two samples collected independently at a single sampling location during a single act of sampling. Field duplicates will make up approximately 10 percent of the original sample number. Field duplicates will be collected for one soil and one groundwater sample, and analyzed for the same parameters as the primary samples. Field sample duplicates shall be used as a QC measure to monitor precision relative to sample collection activities. Analytical precision shall be evaluated using RPDs for MS/MSD, or duplicate samples.

10.2.3 Completeness

The target value for completeness of all parameters is 95 percent. Measurement data completeness is a measure of the extent that the database resulting from a specific measurement effort fulfills the objectives for the amount of data required. For this program, completeness will be defined as the valid data percentage of the total tests requested as follows:

$$Completeness\ (\%) = \frac{No.\ of\ Successful\ Analyses}{No.\ of\ Requested\ Analyses}\ X\ 100 \qquad [3]$$

Successful analyses are defined as those in which the sample arrived at the laboratory intact, properly preserved, in sufficient quantity to perform the requested analyses, and accompanied by a completed Chain-of-Custody form. Furthermore, the sample must be analyzed within the specified holding time and according to QC acceptance criteria.

Completeness for the entire project also involves elements specific to field and laboratory documentation of sample collection. This includes documentation detailing whether samples and analyses have been processed using the procedures outlined in this SAP and whether laboratory SOPs have been implemented.

10.2.4 Representativeness

Representativeness describes how well the data reflect site conditions in the vicinity of the data point at the time of collection. Representativeness may be maintained or attained by careful documentation of data collection procedures and adherence to standard data collection protocols.

The characteristics of representativeness are usually not quantifiable. Subjective factors to be taken into account are as follows:

- Degree of homogeneity of a site;
- Degree of homogeneity of a sample taken from one point in a site; and
- Available information on which a sample plan is based.

Field duplicates, as defined under precision, are also used to assess representativeness. Two samples which are collected at the same location and at the same time are considered to be equally representative of the site, at a given point in space and time. To maximize the representativeness of results, sampling techniques, sample size, sample locations, and depths will be carefully selected so they provide laboratory samples that are representative of the conditions in the area proximal to the pesticide storage warehouse area.

10.2.5 Comparability

Comparability is the degree to which data from separate data sets may be compared. For instance, sample data may be compared to data from background locations, to established criteria or guidance, or to data from earlier sampling events. Comparability is attained by careful adherence to standardized sampling procedures and rigorous documentation of sample locations (including depth, time, and date).

Data comparability will be achieved by using standard units of measure [i.e., milligrams per liter (mg/L)] for inorganics in water samples, micrograms per liter (μg/L) for organics in water, and milligrams per kilogram (mg/kg) (dry weight) for both inorganics and organics in soil samples].

The use of standardized methods to collect and analyze samples [in this case, American Society of Testing and Materials (ASTM), Ecology, and EPA methods], along with instruments calibrated against National Institute for Standards and Technology (NIST) and EPA-traceable standards, will also ensure comparability.

Comparability also depends on other data quality characteristics. Only when data are judged to be representative of the environmental conditions, and when precision and accuracy are known, can data sets be compared with confidence.

SECTION 11.0
DATA REDUCTION, VALIDATION, AND REPORTING

On behalf of DNR, Tetra Tech will ensure that the analytical laboratory(s) submit data supported by sufficient backup and QA information to permit an independent determination of data quality. Deliverables submitted by the laboratory will include the information described below.

1. Case narrative that includes a summary of any quality control, sample, shipment, or analytical problems, and documentation of all internal decisions. Problems will be outlined and final solutions documented. A copy of the signed chain-of-custody form for each group of samples will be included in the narrative packet.

2. Sample concentrations reported on standard data sheets in proper units and to the appropriate number of significant figures (i.e., one significant figure for concentrations less than 10 and two significant figures for concentrations greater than 10). For undetected values, the lower limit of detection of each compound will be reported separately for each sample. Date of sample analysis must be included.

3. Surrogate percent recovery summary for all organic analyses.

4. Matrix spike/matrix spike duplicate results.

5. Method blank summary.

Data will be compared to the project data quality objectives (refer to Table 10-1) to determine if the data are sufficient for project tasks.

Sample holding times will be calculated by comparing the date of sample collection, shown on the summary sampling logs, with the date of sample analysis (and extraction when appropriate), presented with the sample results.

The analytical laboratory will demonstrate its ability to produce acceptable results using the recommended methods (refer to Table 10-1) or their equivalent. Data will be evaluated based on the following criteria:

- Performance on method tests,
- Percent recovery of surrogate standards,
- Adequacy of detection limits obtained,
- Precision of replicate analyses,
- Comparison of the percentage of missing or undetected substances among replicate samples, and
- Percent recovery of spike compounds.

The two aspects of data quality of primary concern to Tetra Tech data review staff are precision and accuracy. Routine procedures for measuring precision and accuracy include use of replicate analyses, standard reference materials (SRMs), matrix spikes, and procedural blanks. Replicates, matrix spikes, and method blanks will be analyzed routinely by the laboratory. Additional spike and replicate analyses may be implemented.

SECTION 12.0
PERFORMANCE AND SYSTEM AUDITS

Performance and system audits for sampling and analysis operations consist of onsite review of field and laboratory QA systems; and onsite checks of equipment for sampling, calibration, and measurement. Environmental monitoring equipment will be serviced prior to the field investigation and calibrated during field use according to the instrument manufacturer's instructions and SOPs.

No audits of the laboratory are anticipated for this project. North Creek Analytical and Edge Analytical laboratories regularly undergo performance evaluation audits and are Washington State-certified analytical laboratories. The Tetra Tech Site Supervisor will be onsite during all field activities to ensure that the sampling protocols and procedures outlined in this Work Plan are followed.

SECTION 13.0
PREVENTIVE MAINTENANCE

Preventive maintenance of equipment is essential if project resources are to be used cost-effectively. Preventive maintenance will take two forms: 1) implementation of a schedule of preventive maintenance activities to minimize downtime and ensure the accuracy of individual measurement systems, and 2) availability of critical spare parts and backup systems and equipment. The preventive maintenance approach for specific pieces of equipment used in sampling, monitoring, and documentation will follow manufacturer's specifications. The overall performance of these maintenance procedures will be documented in field logbooks.

SECTION 14.0
CORRECTIVE ACTION

Corrective actions fall into two categories: 1) analytical or equipment malfunctions, and 2) nonconformance or noncompliance with QA requirements set forth for the project. During field operations and sampling procedures, the Site Supervisor and field team members will be responsible for correcting equipment malfunctions. All corrective measures implemented will be documented in the field logbook, including the rationale for implementing the corrective measure and the implications of associated malfunction.

Corrective actions required to conform to project specifications will be recorded by the Site Supervisor. Corrective actions will be documented in the field logbook and a corrective actions checklist will be completed. All corrective actions implemented will be noted in the site assessment report, including the basis for identifying the needed action.

The analytical laboratory will be required to adhere to U.S. EPA standard operating procedure guidelines and specifications. When instrument response, quality control sample (MS/MSD or duplicate) precision or accuracy, or blank analyses indicate exceedance of control limits, corrective actions must be initiated before continuing with sample analysis.

SECTION 15.0
QUALITY ASSURANCE REPORTS

Effective management of a field sampling and analytical effort requires timely assessment and review of field and laboratory activities. Such assessment and review will require effective interaction and feedback between Tetra Tech's field sampling team, the Project Manager, and the Laboratory QA/QC Coordinator, and effective communication with the DNR Project Manager. Sampling and analysis field operations will be reviewed by staff members responsible for the activity to determine if the sampling QC requirements are being fulfilled. The laboratory QA/QC Coordinator and the Site Supervisor are responsible for keeping Tetra Tech's Project Manager and the DNR Project Manager up to date regarding the status of their respective tasks. This procedure ensures that solutions are developed and implemented as quickly as possible.

SECTION 16.0
PROJECT SCHEDULE AND REPORTING

Figure 16-1 provides a timeline for the completion of the pesticide storage warehouse remedial investigation effort at the Webster Nursery site. The proposed project schedule is based on the effective date that the Agreed Order for the pesticide storage warehouse is issued to DNR by Ecology. The draft Agreed Order specifies that a draft investigation report will be submitted within 6 weeks following the completion of the field work. However, the proposed schedule allows 9 weeks for the draft report submittal as the analytical turnaround time for soil and groundwater analyses is estimated at three weeks.

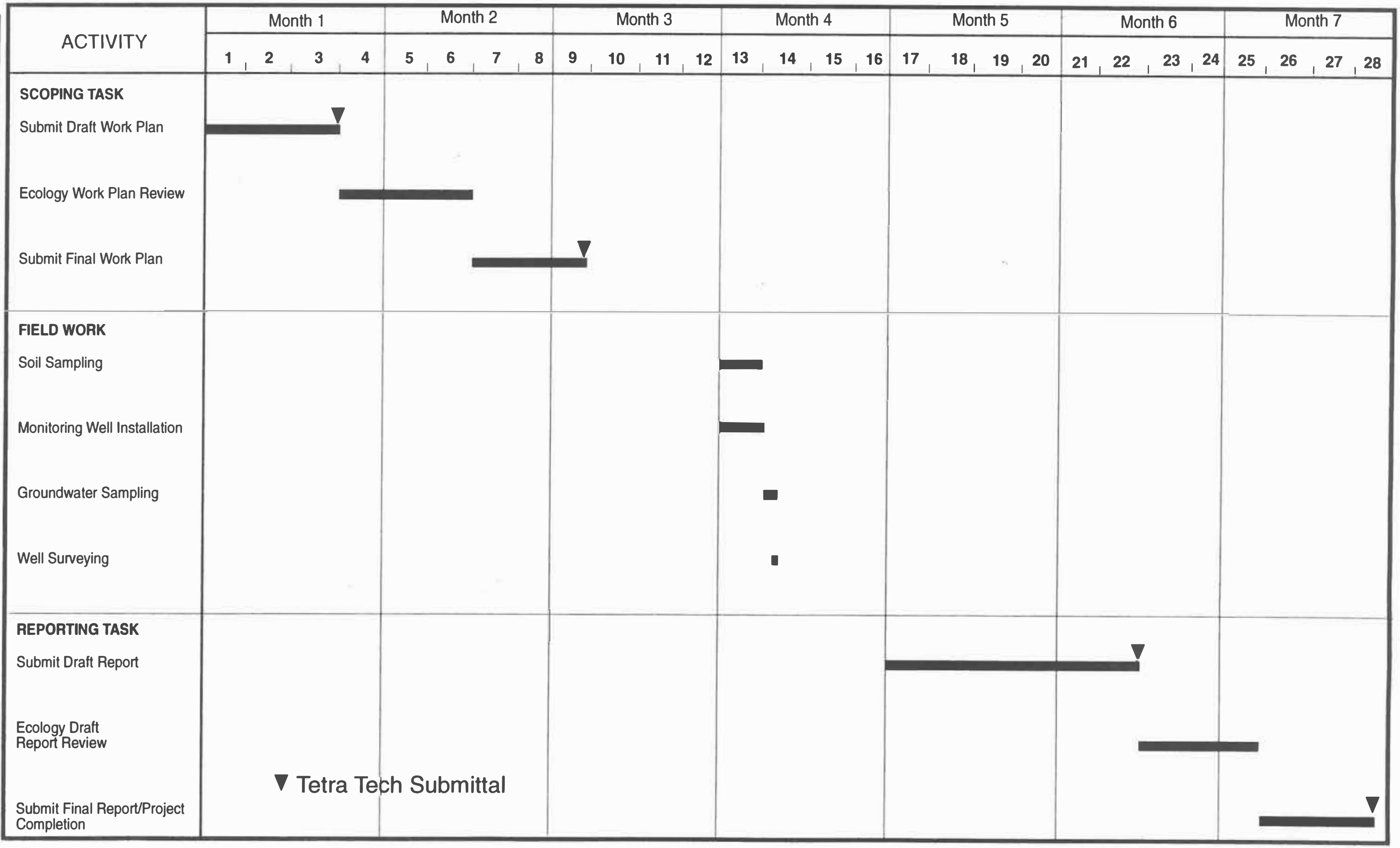

Figure 16-1. Schedule for Completion of the Pesticide Storage Warehouse Investigation, Webster Nursery, Olympia, Washington. (Schedule based on weeks following the effective date of the Agreed Order issued by Ecology)

SECTION 17.0
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APPENDIX A

PESTICIDE AND HERBICIDE PRODUCT SUMMARY

Table A-1

Pesticide and Herbicide Product Summary
Pesticide Storage Warehouse
Washington State Department of Natural Resources
Webster Nursery, Olympia, Washington

NAME OF PRODUCT	MANUFACTURER/BASIC PRODUCER	PRIMARY ACTIVE INGREDIENT
Herbicides		
2,4,5-T	unavailable	2,4,5-trichlorophenoxy-acetic acid
2,4-D	Advanced Chemicals Ltd.	2,4-dichlorophenoxyacetic acid
2,4-DP (Weedone) (2,4-DP) (Weedon-170)	BASF AG	(RS)-2-(2,4-dichlorophenoxy) propionic acid
AATREX (Atrazine)	Cornbelt Chemical Company	6-chloro-N2-ethyl-N4-isopropyl-1,3,5-triazine-2,4-diamine
Amitrole (Aminotrizole) (Amizole) (Amitrol -T)	CFPI Agro	1H-1,2,4,-triazol-3-amine
Amizine	discontinued by Rhone-Poulenc	unavailable
Arsenal (Chopper)	American Cyanamid Co.	Imazapyr
Asulam (Asulox)	Rhone-Poulenc	Asulam
Banvel (Dicamba)	Sandoz Agro, Inc.	Dicamba
Bifenox (Modown)	Rhone-Poulenc	Methyl 5-(2,4-dichlorophenoxy)-2-nitrobenzoate
Cacodylic Acid	Atomergic Chemetals Corp.	Hydroxydimethyl arsine oxide
Casaron (Norsac) (Dichlobenil)	Uniroyal Chemical Company, Inc:	2,6-dichlorobenzonitrile
Clopyralid (Stinger) (Transline)	DowElanco	3,6-dichoro-2-pyridinecarboxylic acid
Dalapon	Helm AG	2,2-dichloropropionic acid
Dinitro (Dinoseb) (DNBP)	discontinued by Cedar Chemical Corp.	2-(sec-butyl)-4,6-dinitrophenol
Diphenamid (Enide) (Dymid)	discontinued by NOR-AM	N,N-dimethyl-2,2-diphenylacetamide
Diquat	ZENECA	1,1'-ethylene-2,2'-bipyridyliamion
Dybar (Fenuron)	discontinued by DuPont Agricultural Products	unavailable
Escort	DuPont Agricultural Products	Metsulfuron-methyl
Fosamine-ammonium	DuPont Agricultural Products	Ammonium ethyl carbamoyl phosphonate
Garlon (Triclopyr)	DowElanco	(3,5,6-trichloro-2-pyridinyloxy) acetic acid
Glyphosate (Roundup) (Accord) (Rodeo)	Aimco Pesticides LTD.	Isopropylamine salt of N-(phosphonomethyl) glycine
Goal 2E (Oxyfluorfen)	Rohm and Haas Co.	2-chloro-1-(3-ethoxy-4-nitrophenoxy)-4-(trifluoromethylbenzene
Gramoxone (Paraquat)	Comlets Chemical Industrial Company	1,1'-dimethyl-4,4'-bipyridinium
Hexazinone (Velpar) (Pronone)	DuPont Agricultural Products	3-cyclohexyl-6-(dimethylamino)-1-methyl 1,3,5-triazine-2,4-(1H,3H) dione
Kerb (Pronamide)	Rohm and Haas Co.	3,5-dichloro-N-(1,1-dimethyl-2-propynyl) benzamide
Oust (sulfometuron-methyl)	DuPont Agricultural Products	Methyl 2[[[[(4,6-dimethyl-2-pyrimidinyl) amino]carbonyl]anino]sulfony]benzoate
Oxadiazon (Ronstar)	Rhone-Poulenc	5-tert-butyl-3-(2,4-dichloro-5-isopropoxyphenyl)-1,3,4-oxadiazol-2(3H)-one
Picloram (Tordon)	DowElanco	4-amino-3,5,6-trichloropicolinic acid
Princep (Simazine)	AAKO B.V.	2-chloro-4,6-bis-(ethylamino)-5-triazine
Silvex (Kuron) (2,4,5-TP)	discontinued by Dow Chemical Co.	(+/-)-2-(2,4,5-trichlorophenoxy)propionic acid
Curtail	DowElanco	Clopyralid + 2,4-D (both as alkanolamine salts)
Trans-Vert	discontinued by Union Carbide Corp.	unavailable
Ansar	Marman USA, Inc.	unavailable
Broadside	discontinued by Drexel Chemical Company	unavailable
Fungicides		
Azinphos-methyl (Guthion)	Bayer	0,0-dimethyl 5-[(4-oxo-1,2,3-benzotriazin-3(4H)-yl)methyl] phosphorodi
Benlate	DuPont Agricultural Products	Benomyl
Captan	AAKO B.V.	N-trichloromethylthio-4-cyclohexane-1,2-dicarboximide
Chloropicrin	Great Lakes Chemical Corp.	Trichloronitromethane
Clearys 3336 (Thiophanate)	unavailable	Diethyl [1,2-phenylenebis(iminocarbonothioyl)] bis[carbamate]

Table A-1

Pesticide and Herbicide Product Summary
Pesticide Storage Warehouse
Washington State Department of Natural Resources
Webster Nursery, Olympia, Washington

NAME OF PRODUCT	MANUFACTURER/BASIC PRODUCER	PRIMARY ACTIVE INGREDIENT
Dithane	Rohm and Haas	Salts of Dithiocarbamic Acid
Lesan	dicontinued by Bayer	Sodium [4-(dimethylamino)phenyl] diazenesulfonate
Methyl Bromide	Elf Atochem	Bromomethane
Subdue	Ciba	N-(2,6-dimethylphenyl)-N-(methoxyacetyl)-DL-alanine methyl ester
Truban (Etridiazole)	The Scotts Co.	5-ethoxy-3-trichloromethyl-1,2,4-thiaciazole
Vorlex	discontinued by NOR-AM	Methyl isothiocyanate, 1,3-dichloropropene and other chlorinated C3 hydrocarbons
Insecticides		
Chlordane	Velsicol Chemical Corp.	Tech chlordane; 4,7-methano-1H-indene-1,2,3,4,5,6,7,7a,8,8-octachloro-2,3,3a,4,7,7a-hexahydro-
Diazinon	AAKO B.V	O,O,-diethyl O-[6-methyl-2-(1-methylethyl)-4-pyrimidinyl] phosphorothioate
Endrin	unavailable	1,2,3,4,10,10-hexachloro-6,7-epoxy-1,4,4a,5,6,7,8,8a-octahydro-1,4-endo,endo-5,8-dimethanonaphthalene
Heptaclor	Velsicol Chemical Corp.	1,4,5,6,7,8,8-heptachloro-3a-,4,7,7a-tetrahydro-4,7-methaniondene
Lorsban (Chlorpyrifos)	DowElanco	O,O-dimethyl O-(3,5,6-trichloro-2-pyridinyl) phosphorothioate
Sevin (Carbaryl)	Rhone-Poulenc	1-naphthyl methylcarbamate
Thiodan (Endosulfan)	AAKO B.V	Endosulfan
Thuricide	Sandoz Agro, Inc.	Spores and crystalline delta-endotoxin as a.I. Which are produced by *Bacillus thuringiensis berliner* var. *kurstaki*
Pesticides		
Enide 50W	TUCO	Diphenamid
Aminotriazole	Aceto Chemical (Japan)	Aminotriazole
Princep 50W	Cibra-geigy	Simozine
Thiodan 50	FMC Corp.	Endosulfan
Captan Dust	FMC Corp.	Captan
Princep 4 G	Cibra-geigy	Simazine
Tok WP-50	Rohn & Haas	2-4 dichlorophenyl & p-nitrophenylether
Lasso 10	Monsanto	2-chloro-2-b-diethyl-n
Spergon	U.S. Rubber Co.	Tetrachloro-para-benzoquinane
Caddy	W.A. Cleary Corp.	Cadmium Chloride
Dexol	Dexol	1,1-bis-chlorophenyl-2
Isotox	Ortho	Lindane, Malathon,DDT & Tedion
Malathion 50	Ortho	Malathion 50
XXL	Agro	Vegetable oil, zylene range aromatic solvenx
Isotox	Ortho	Carbaryl
Dexon	Chremagro Mobay Chem.	Sodium 4-dimethylamino phenyl diazenesulfoznate
unknown	unavailable	Black Algatrine
Mesurol	Mobay Corp.	Methiocarb
Barrier 50W	Acme	Dichlobenil
Sevin 50W	Union Carbide	Carbaryl
Dacthal W-75	Fermenta	Dimethyl Tetrachloraterephthalate
Cobra	PPr Industries	Lactofen
Select 0.94 EC	Valent USA	Clethodim 13.3%
Ranstar	Chipeo	Oxadiaxon
XRM	DOW Chemical	3-6 Dichloro-2-Pyridinecarboxylic acid
Cinch	Shell	Cinmethylin

Table A-1

Pesticide and Herbicide Product Summary
Pesticide Storage Warehouse
Washington State Department of Natural Resources
Webster Nursery, Olympia, Washington

NAME OF PRODUCT	MANUFACTURER/BASIC PRODUCER	PRIMARY ACTIVE INGREDIENT
Gallery 75 DF	Dowelanco	Isoxaben
Pennant	Ciba-Geigy	Metolachlor
Tordan 10k	DOW Chemical	Picloram
Cupric Sulfate	Natural	Cupric Sulfate
Velpax WP	Dupont	Hexazione
Salvage Drum	unavailable	Floor Absorbant
Drum of floor sweepings/leaky container	unavailable	2,4-D & 2,4,-ST
Lindane	Pfizev	Benzene Hexachloride
Dowpan	DOW Chemical	Dalapan
Avitrol	Avitrol	FC Corn Chops-99S & 4-Amino Pyridine 0.03% A.I.
Glowan	Key Chemical	MSMS (organic arsenate) 6 lb. A.I.
Tevlar W.	Dupont	3-Chlozphenyl & 11-Dimethyl Urea 80% A.I.
Alar-85	UniRegal	Succinic Acid & 2,2-Dimethyl Hydrazide

APPENDIX B

WASTE PESTICIDE PROGRAM
MATERIAL INVENTORY SHEETS

PARTICIPANT INVENTORY FORM

WASTE PESTICIDE IDENTIFICATION AND DISPOSAL PROGRAM

p. 1 of 1

NAME: Washington State Dept. of Natural Resources

TELEPHONE NO.: 664-2174

MAILING ADDRESS: 9701 Blomberg St. SW
PO Box 47018
Olympia WA 98504-7018

COUNTY: Thurston

NAME OF PRODUCT	MANUFACTURER	ACTIVE INGREDIENT(S)	USDA NO. (or) EPA Reg No.	APPROX. AMOUNT	LIQUID	DRY	CONTAINER TYPE & SIZE
Enide 50W	TUCO	Diphenamid ✓	33594-NJ-1	132 lbs		✓	Paper 33 (4 lb) = 132
Aminotriazole	Aceto Chemical (Japan)	Aminotriazole = Amitrole ✓	274971	10 lbs		✓	paper round barrel (partial)
Princep 80W	Ciba-geigy	Simazine. ✓	100-437	50 lbs		✓	paper 10 (5 lbs) = 50
Thiodan 50	FMC Corp.	Endosulfan — not on any list to date 7-23-97	[illegible]	52 lbs.		✓	paper 13 [illegible]
Modown	Mobil	Bifenox ✓	2224-50	120 lbs.		✓	paper 12 (10 lb) = 120
Captan Dust	FMC	279-1634 Captan ✓	279-1634	100 lbs.		✓	paper 2 (50 lb) = 100

PLEASE MAIL TOP TWO COPIES TO THE ADDRESS BELOW
KEEP THE LAST COPY FOR YOUR RECORDS

QUESTIONS?: (206) [illegible]

MAIL TO:
Washington State Department of Agriculture
Waste Pesticide Program
P.O. Box 42589
Olympia, WA 98504-2589

AGR 4252 (7/94)

DEPARTMENT USE ONLY	
DS:	T: As of 7/20/95

✓ – Included in Tetra 6/97 Proposed Analytical Program table

WASTE PESTICIDE IDENTIFICATION AND DISPOSAL PROGRAM

NAME:	TELEPHONE NO.
Washington State Dept of Natural Resources	664-2174
MAILING ADDRESS: 1781 Blakely St SW PO Box 47018 Olympia, WA 98504-7018	COUNTY: Thurston

NAME OF PRODUCT	MANUFACTURER	ACTIVE INGREDIENT(S)	USDA NO. (or) EPA Reg No.	APPROX. AMOUNT	LIQUID	DRY	CONTAINER TYPE & SIZE
Princep 4 G	Geigy	Simazine ✓	100-435	50 lbs.		✓	paper 50 lbs.
Tok WP-50	Rohm & Haas	2-4 dichlorophenyl p-nitrophenylether	707-92	5 lbs.		✓	paper 5 lbs.
Lasso 10	Monsanto	2-Chloro-2-6-diethylen	unknown	25 lbs.		✓	paper 25
Spergon	US Rubber Co.	Tetrachloro-para-benzoquinone	unknown	1 lb.		✓	metal
Caddy	W.A. Cleary Corp	Cadmium Chloride	1001-10	2 lbs.	✓		glass ½ gal
unknown	unknown	unknown	unknown	1 lb.	✓		glass

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QUESTIONS?: (206) 902-2050

MAIL TO:
Washington State Department of Agriculture
Waste Pesticide Program
P.O. Box 42589
Olympia, WA 98504-2589

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AGR 4252 (7/94)

WASTE PESTICIDE IDENTIFICATION AND DISPOSAL PROGRAM

p. 3 of 1

NAME: Washington State Dept. Natural Resources	TELEPHONE NO. 664-2174
MAILING ADDRESS: 7701 Blomberg St. SW PO Box 47017 Olympia, WA 98504-7017	COUNTY: Thurston

NAME OF PRODUCT	MANUFACTURER	ACTIVE INGREDIENT(S)	USDA NO. (or) EPA Reg No.	APPROX. AMOUNT	LIQUID	DRY	CONTAINER TYPE & SIZE
Dexol	Dexol	11-bis chlorophenyl-2	192-122-AA	3 oz.	✓		plastic
Isotox	Ortho	Lindane, Malathon, DDT & Tedion	22922	3 oz.	✓		glass
Malathion 50	Ortho	Malathion 50	239-739-AA	4 oz.	✓		glass
XXL	Agro	Vegetable oil, xylene range aromatic solvent	005401-CA-01	6 oz	✓		glass
Isotox	Ortho	Carbaryl ✓	239-741	2 oz.	✓		glass
Unknown	unknown	unknown	unknown	8 oz	✓		plastic

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KEEP THE LAST COPY FOR YOUR RECORDS

QUESTIONS?: (206) 902-2050

MAIL TO:
Washington State Department of Agriculture
Waste Pesticide Program
P.O. Box 42589
Olympia, WA 98504-2589

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PARTICIPANT INVENTORY FORM
WASTE PESTICIDE IDENTIFICATION AND DISPOSAL PROGRAM

NAME: Washington State Dept Natural Resources

TELEPHONE NO.: 664-2174

MAILING ADDRESS: 9701 Blomberg St. SW
Po Box 47018
Olympia, WA 98504-7018

COUNTY: Thurston

NAME OF PRODUCT	MANUFACTURER	ACTIVE INGREDIENT(S)	USDA NO. (or) EPA Reg No.	APPROX. AMOUNT	LIQUID	DRY	CONTAINER TYPE & SIZE
Dexon ✓	Chemagro Mobay Chem.	Sodium 4-dimethylamino phenyl diazenesulfonate	3125-154-AA	1 lb.		✓	paper
Unknown	Unknown	Black Algatrine	unknown	2 oz.	✓		plastic
Mesurol	Mobay Corp.	Methiocarb	3125-288	2 lbs.		✓	paper
Barrier 50W	Acme	Dichlobenil	2217-KS-2	8 lbs.		✓	Paper 2 (4 lb)
Sevin ✓ 50W	Union Carbide	Carbaryl ✓	264-314	74 lbs.		✓	paper (5 lb) X 1[illegible] paper (2 lb) X 4 [illegible]
Dacthal W-75	Fermenta	Dimethyl Tetrachloraterephthalate	35982-TX-1	32 lbs.		✓	Paper (4 lb) X 8 = 32

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KEEP THE LAST COPY FOR YOUR RECORDS

QUESTIONS?: (206) [illegible]

MAIL TO:
Washington State Department of Agriculture
Waste Pesticide Program
P.O. Box 42589
Olympia, WA 98504-2589

AGR 4252 (7/94)

DEPARTMENT USE ONLY	
DS:	T:

WASTE PESTICIDE IDENTIFICATION AND DISPOSAL PROGRAM

NAME: Washington State Dept Natural Resources

TELEPHONE NO. 664-2174

MAILING ADDRESS: 9701 Blomberg St SW
PO Box 47014
Olympia WA 98504 7018

COUNTY: Thurston

NAME OF PRODUCT	MANUFACTURER	ACTIVE INGREDIENT(S)	USDA NO. (or) EPA Reg No.	APPROX. AMOUNT	LIQUID	DRY	CONTAINER TYPE & SIZE
Lindane	Riggs	Lindane	4062-X	40 oz		✓	Plastic (8oz) x 5 = 40
Cobra	PPG Industries	Lactofen	unknown	1 lb. (1 pt)	✓		Plastic
Select 0.94 EC	Valent USA	Clethodim 13.3%	59639-3	1 lb. (1 pt)	✓		Glass
Ronstar	Chipco	Oxadiaxon	359-714	1.5 lbs		✓	Paper
XRM	Dow Chemical	3-6 Dichloro-2-Pyridinecarboxylic Acid	464-NJ-1	2 lb. (2 pts)	✓		Glass
Cinch	Shell	Cinmethylin	unknown	1/4 pt.	✓		Glass

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Waste Pesticide Program
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Olympia, WA 98504-2589

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AGR 4252 (7/94)

WASTE PESTICIDE IDENTIFICATION AND DISPOSAL PROGRAM

NAME: Washington State Dept Natural Resources	TELEPHONE NO. 664-2174
MAILING ADDRESS: 9701 Blomberg St. SW PO Box 47018 Olympia, WA 98504-7018	COUNTY: Thurston

NAME OF PRODUCT	MANUFACTURER	ACTIVE INGREDIENT(S)	USDA NO. (or) EPA Reg No.	APPROX. AMOUNT	LIQUID	DRY	CONTAINER TYPE & SIZE
Gallery 75 DF	Dowelanco	Isoxaben	unknown	3 oz.		✓	Plastic [illegible]
Pennant	Ciba-Geigy	Metolachlor	unknown	1 oz	✓		Plastic
Tordon 10K	Dow	Picloram ✓	464320	200 lbs.		✓	Plastic (50 lbs.) [illegible] 200
Soil Sealer 13	unknown	unknown	unknown	300 lbs.	✓		Metal 55 gal
Atrazine	Clean Crop	Atrazine ✓	35982-[illegible]	30 lbs.		✓	Paper (5 lb) X [illegible]
Cupric Sulfate	Natural	Cupric Sulfate	unknown	5 lb (2 qts)		✓	Glass (2 1/2 lb) X [illegible]

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QUESTIONS?: (206) 902-2050

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WASTE PESTICIDE IDENTIFICATION AND DISPOSAL PROGRAM

NAME: Washington State Dept Natural Resources

TELEPHONE NO. 664-2174

MAILING ADDRESS: 9701 Blanken St. SW
PO Box 47018
Olympia, WA 98504-7018

COUNTY: Thurston

NAME OF PRODUCT	MANUFACTURER	ACTIVE INGREDIENT(S)	USDA NO. (or) EPA Reg No.	APPROX. AMOUNT	LIQUID	DRY	CONTAINER TYPE
Velpar WP	Dupont	Hexazione	unknown	1 lb. (1 gal)		✓	Plastic
Salvage Drum	unknown	Floor Absorbent	unknown	100 lbs.		✓	Metal 55 gal
Drum of Floor Sweepings / leaky container	unknown	2-4-D 2-4-5T	707-92	30 lbs.	✓	✓	Plastic
Krenite	Dupont	Fosamine	46376-SC-1	80 lbs.	✓		Metal 30 gal
Lindane	Pfizer	Benzene Hexachloride	1007-45	2 lbs (.75 gal)	✓		Metal

PLEASE MAIL TOP TWO COPIES TO THE ADDRESS BELOW
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QUESTIONS? (206) [illegible]

MAIL TO:
Washington State Department of Agriculture
Waste Pesticide Program
P.O. Box 42589
Olympia, WA 98504-2589

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Washington State Department of Agriculture
PARTICIPANT INVENTORY FORM
WASTE PESTICIDE IDENTIFICATION AND DISPOSAL PROGRAM

p. 8 of 8

NAME: Washington State Dept of Natural Resources	TELEPHONE NO. 664-2174
MAILING ADDRESS: 9701 Blomberg St. S.W. P.O. Box 47018 Olympia, WA 98504-7018	COUNTY: Thurston

NAME OF PRODUCT	MANUFACTURER	ACTIVE INGREDIENT(S)	USDA NO. (or) EPA Reg No.	APPROX. AMOUNT	LIQUID	DRY	CONTAINER TYPE & SIZE
Dowpon	Dow Chemical	Dalapon ✓	464-402	550 lbs.		X	Paper bags 11(50 lbs) = 550 lbs
Avitrol	Avitrol	FC Corn Chops-99S 4-Amino Pyridine 0.03% A.I.	11694-15	12 lbs.	X		plastic 2 gal.
Nalco-Trol II	Nalco Chemical	Polyvinyl Polymer	Calif 1706-5002-AA	230 lbs	X		Plastic 93 quarts
Glowon	Key Chemical	MSMA (organic arsenate) ✓ 6 lb. A.I.	USDA A592-1	170 lbs.	X		Metal 30 gal
Telvar W	Dupont	3 Chlorophenyl 11 Dimethyl Urea 80% A.I.	GC 16435 (P.A.) Lot No. C40524	12 lbs.		X	Paper
Alar-85	Uni Royal	Succinic Acid 2,2-Dimethyl Hydrazide	177500	5 lbs.		X	metal 8 (1 lb) 5 lb

PLEASE MAIL TOP TWO COPIES TO THE ADDRESS BELOW KEEP THE LAST COPY FOR YOUR RECORDS

QUESTIONS?: [illegible]

MAIL TO:
Washington State Department of Agriculture
Waste Pesticide Program
P.O. Box [illegible]
Olympia, WA [illegible]

DEPARTMENT USE ONLY	
DS:	T:

APPENDIX C

SUMMARY OF PREVIOUS UST EXCAVATION AND REMEDIAL ACTION RESULTS

Table C-1

Summary of Tank Contents Sample Results
Former Chemical Storage Area UST Treatement Assessement
Washington State Department of Natural Resources
Webster Nursery, Olympia, Washington

Analyte	Analytical Results (ug/L)						
	4/12/95[b]	11/21/96	12/3/96	12/31/96	1/20/97	3/5/97	
	EPA 1618[c]	EPA 8150	EPA 8150	EPA 8150	EPA 8150	EPA 8081[d]	EPA 8151
Dalapon	ND	ND	ND	ND	NA	NA	ND
Dicamba	4,700	37,000	42,000	170	NA	NA	ND
MCPP[e]	NA	ND	ND	ND	NA	NA	NA
MCPA[f]	NA	ND	ND	ND	NA	NA	NA
Dichloroprop	58	ND	ND	ND	NA	NA	ND
2,4-D	18,000	66,000	100,000	370	15	NA	160
Silvex (2,4,5-TP)	2,900	9,300	18,000	250	22	NA	293
2,4,5-T	15,000	33,000	58,000	300	33	NA	307
Dinoseb	ND	ND	ND	ND	NA	NA	ND
2,4-DB	ND	ND	ND	ND	NA	NA	ND
Pentachlorphenol	NA	NA	NA	NA	NA	NA	16.5
Chlordane	NA	NA	NA	NA	NA	ND	NA
Heptachlor	NA	NA	NA	NA	NA	ND	NA
Heptachlor Epoxide	NA	NA	NA	NA	NA	ND	NA

a Analytical results include all detected compounds and primary compounds found in adjacent soils
b Date of sample analysis
c U.S. EPA Analytical Method
d No pesticide compounds were detected using U.S. EPA Method 8081
e 4-(chloro-2-methylphenoxy) acetic acid
f 2-(4-chloro-2-methylphenoxy) propionic acid
NA Not Applicable
ND Not detected at or above the laboratory reporting limit

Table C-2

Summary of UST Excavation Soil Sample Results
Washington State Department of Natural Resources
Webster Nursery, Olympia, Washington

Sample Identification	Date Sampled	Location	Sample Depth (ft-BGS)[a]	Analytical Results[b] (mg/kg)					
				Herbicides[c]		Pesticides[d]			
				2,4,5,T	2,4,D	Chlordane(CIS)	Chlordane(Trans)	Heptachlor	Heptachlor Epoxide
NW2	6/17/96	North Face	3.5	0.018	ND	ND	ND	ND	ND
EW2	6/17/96	East Face	3.5	ND	0.014	ND	ND	0.370	ND
SEW1	6/17/96	Southeast Face	3.5	0.015	0.029	0.210	ND	ND	ND
SW2	6/17/96	South Face	3.5	0.013	ND	ND	ND	ND	ND
Bott1	6/17/96	Bottom 1	5.5	0.027	0.023	1.900	0.230	4.300	0.470
Bott2	6/17/96	Bottom 2	5.5	0.097	0.070	4.200	0.600	17.000	0.310

a (ft-BGS) = feet below ground surface
b Analytical results specifically include those compounds detected during analysis
c Analyis by U.S. EPA Method 8150
d Analysis by U.S. EPA Method 1618
ND Not detected at or above the laboratory reporting limit

Table C-3

Summary of UST Stockpiled Soil Sample Results
Washington State Department of Natural Resources
Webster Nursery, Olympia, Washington

		Analytical Results[a] (mg/kg)							
Sample	Date	Pesticides[b]				Herbicides[c]			
Identification	Sampled	Chlordane (CIS)	Chlordane (Trans)	Heptachlor	Heptachlor Epoxide	2,4,5,T	2,4,D	2,4,5,TP	Dalapon
SP1	6/17/96	4.300	0.580	18.000	0.350	ND	ND	ND	ND
SP2	6/17/96	2.200	0.240	7.700	0.440	ND	ND	ND	ND
SP3	6/17/96	5.200	0.710	19.000	0.490	0.054	0.018	ND	ND
SP4	6/17/96	5.800	0.620	13.000	0.690	0.130	0.041	0.015	0.041

a Analyitical results specifically include those compounds detected during analysis
a Analyis by U.S. EPA Method 1618
b Analysis by U.S. EPA Method 8150
ND Not detected at or above the laboratory reporting limit

Table C-4

Summary of Composite Soil Sample Results for Pesticides in Stockpiled Soils
Soil Treatment Assessment
Washington State Department of Natural Resources
Webster Nursery, Olympia, Washington

Analyte	Analytical Results[a] (mg/kg)				
	11/13/96[b]	11/21/96	12/12/96	1/15/97	1/31/97
	Pre-Treatment	First Treatment	Second Treatment	Third Treatment	Fourth Treatment
Aldrin #1[c]	0.012	0.021			
Aldrin #2	0.0058	0.004			
Alpha BHC #1	ND	ND			
Alpha BHC #2	ND	ND			
Beta BHC #1	0.0073	0.018			
Beta BHC #2	0.011	0.0081			
Delta BHC #1	ND	ND			
Delta BHC #2	ND	ND			
Gama BHC Lindane #1	ND	ND			
Gama BHC Lindane #2	ND	ND			
Chlordane Technical #1	19.000	18.000	–	–	6.200
Chlordane Technical #2	19.000	23.000			
alpha-Chlordane	–	–	1.200	0.870	1.300
gamma-Chlordane	–	–	5.600	4.100	6.10
4,4,DDD #1	ND	ND			
4,4,DDD #2	ND	ND			
4,4,DDE #1	ND	ND			
4,4,DDE #2	ND	ND			
4,4,DDT #1	ND	0.0031			
4,4,DDT #2	ND	0.0084			
Dieldrin #1	0.0038	0.0075			
Dieldrin #2	0.004	0.0035			
Endosulfin 1 #1	ND	ND			
Endosulfin 1 #2	ND	ND			
Endosulfan 2 #1	ND	ND			
Endosulfan 2 #2	ND	ND			
Endosulfan sulphate #1	ND	ND			
Endosulfan sulphate #2	ND	ND			
Endrin #1	0.03	ND			
Endrin #2	0.035	0.026			
Endrfin Aldehyde #1	ND	ND			
Endrfin Aldehyde #2	ND	ND			
Heptchlor #1	19.000	17.000	13.000	13.000	16.000
Heptchlor #2	15.000	19.000	–	–	–
Heptachlor epoxide #1	0.920	0.800	0.760	0.540	0.820
Heptachlor epoxide #2	0.980	1.1			
Methoxychlor #1	ND	ND			
Methoxychlor #2	ND	ND			
Endrin Ketone #1	ND	ND			
Endrin Ketone #2	ND	ND			
Toxaphene #1	ND	ND			
Toxaphene #2	ND	ND			

a Analysis of samples by U.S. EPA Method 8080
b Date of sample analysis
c #1 = Composite soil sample 60975-01
#2 = Composite soil sample 60975-02
ND Not detected at or above the laboratory reporting limit

Table C-5

Summary of Composite Soil Sample Results for Herbicides in Stockpiled Soils
Soil Treatment Assessment
Washington State Department of Natural Resources
Webster Nursery, Olympia, Washington

Analyte	Analytical Results[a] (mg/kg)	
	11/13/96[b]	11/21/96
Dalapon #1[c]	ND	ND
Dalapon #2	ND	ND
Dicamba #1	ND	ND
Dicamba #2	ND	ND
MCPP[d] #1	ND	ND
MCPP #2	ND	ND
MCPA[e] #1	ND	ND
MCPA #2	ND	ND
Dichloroprop #1	ND	ND
Dichloroprop #2	ND	ND
2,4D #1	ND	ND
2,4D #2	ND	ND
Silvex (2,4,5-TP) #1	ND	ND
Silvex (2,4,5-TP) #2	ND	ND
2,4,5-T #1	ND	ND
2,4,5-T #2	ND	ND
Dinoseb #1	ND	ND
Dinoseb #2	ND	ND
2,4DB #1	ND	ND
2,4DB #2	ND	ND

a Analysis of samples by U.S. EPA Method 8150
b Date of Sample Analysis
c #1 = Composite soil sample 60975-01
  #2 = Composite soil sample 60975-02
d 4-(chloro-2-methylphenoxy) acetic acid
e 2-(4-chloro-2-methylphenoxy) propionic acid
ND Not detected at or above the laboratory reporting limit

APPENDIX D

SUMMARY OF ANALYTICAL RESULTS (TCLP AND FISH BIOASSAY) FOR UST STOCKPILE SOIL DISPOSAL

SPECTRA Laboratories, Inc.

2221 Ross Way • Tacoma, WA 98421 • (253) 272-4850

October 22, 1997

Laidlaw Environmental, Inc.
117 Frontage Rd. No. #D-1
Pacific, WA 98047

Attn: Keith Gehring

Sample ID: #1
Project: DNR
Sample Matrix: TCLP Extract from soil
Date Sampled: 10-13-97
Date Received: 10-13-97
Date Extracted: 10-16-97
Date Analyzed: 10-20-97
Dilution Factor: 1
Spectra Project: S710-095
Spectra #4825

TCLP ORGANOCHLORINE PESTICIDES Method 8081

COMPOUNDS	RESULTS (ug/L)
gamma-BHC (Lindane)	<0.5
Chlordane (Tech)	<25.0
Endrin	<0.50
Heptachlor	<2.0
Heptachlor Epoxide	<2.0
Methoxychlor	<2.5
Toxaphene	<50.0

Fax

Surrogate Percent Recoveries:
Tetrachloro-m-xylene 40%

SPECTRA LABORATORIES, INC.

Steven G. Hibbs, Laboratory Manager

Webster Nursery

Parametrix, Inc.
Consultants in Engineering and Environmental Science
5808 Lake Washington Blvd. N.E. Kirkland, WA 98033-7350
425-822-8880 • Fax: 425-889-8808

Mr. John Felder
Department of Natural Resources
Engineering Division
P.O. Box 47030
Olympia, Washington 98504-7030

January 19, 1998
55-1795-13 (01)

SUBJECT: RESULTS OF HAZARDOUS WASTE DESIGNATION TEST

Dear Mr. Felder:

Please find enclosed the results of the 96-hour acute hazardous waste designation test using rainbow trout, *Oncorhynchus mykiss*, conducted on sample WN-SP-4 provided by the Washington Department of Natural Resources on 9 January 1998. Testing was initiated on 13 January 1998 in accordance with Washington State Department of Ecology Guidelines (Biological Testing Methods 80-12 for the Designation of Dangerous Waste). The bioassay was conducted at the 10 mg/L and 100 mg/L concentrations.

In summary, sample WN-SP-4 exhibited no mortality at either the 10 mg/L or 100 mg/L concentration and should not be considered extremely hazardous or dangerous waste. Testing was conducted concurrently with negative and positive control groups which met all acceptable test criteria. Copies of the raw data, reference toxicant results and chain-of-custody form are also enclosed in this data package.

If you have any questions regarding the results of this test, or are in need of further assistance, please contact either me or Ms. Dayle Ormerod at (425) 822-8880.

Thank you.

Sincerely,

PARAMETRIX, INC.

Anna Echter for

Paul Stenhouse
Project Manager, Environmental Toxicology Laboratory

cc: D. Ormerod DEO

Summary of test conditions for static acute definitive *O. mykiss* bioassay.

Job Name: Department of Natural Resources — Date: 13-17 January 1998

Test Protocol:	*Washington State Department of Ecology Biological Testing Methods, for the Designation of Dangerous Waste*, Publication # 80-12, revised August 1996.
Test Material:	Sample WN-SP-4
Test Organisms/Age:	*O. mykiss* (rainbow trout); 49 days from swim-up at test initiation
Source:	Mt. Lassen Trout Farm; Red Bluff, California
Loading Limit:	0.8 g (wet weight) per liter of test solution
Number/Container:	10
Volume/Container:	12 liters
Test Chambers:	20 L High-density linear polyethylene containers
Replicates:	Three
Test Concentration:	10 mg/L and 100 mg/L
Reference Toxicant:	Potassium chloride
Test Duration:	96 hours
Control:	Natural spring water from Gold Creek Trout Farm, Woodinville, WA
Lighting:	Fluorescent bulbs (50-100 foot candles)
Photoperiod:	16 hours light; 8 hours dark
Aeration:	None
Renewal:	None
Temperature:	12 ± 1° C
Chemical Data:	Dissolved oxygen, temperature and pH measured at initiation of test and every 24 hours; hardness, alkalinity and specific conductivity determined at each concentration
Effect Measured:	Mortality
Test Acceptability:	Control mortality ≤10%

Summary of Results:

	Percent Mortality		
Sample	Control - Spun	10 mg/L	100 mg/L
WN-SP-4	0	0	0
Reference Toxicant LC50 =		2.8 g/L	

APPENDIX E

TECHNICAL MEMORANDUM: SUMMARY OF SUBSOIL SAMPLE RESULTS FOR THE PESTICIDE STORAGE WAREHOUSE SUBFLOOR DRAINAGE ASSESSMENT, WEBSTER NURSERY SITE, OLYMPIA, WASHINGTON

TECHNICAL MEMORANDUM

TO: John Felder, P.E.
Environmental Engineer
Washington State Department of Natural Resources

DATE: 5 May 1998

FROM: Tetra Tech, Inc.

SUBJECT: Summary of Subsoil Sample Results for the Pesticide Storage Warehouse Subfloor Drainage Assessment, Webster Nursery Site, Olympia, Washington

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Tetra Tech, Inc., under contract to the Washington State Department of Natural Resources (DNR), has completed a subfloor drainage assessment at the Pesticide Storage Warehouse facility at the Webster Nursery site located in Thurston County, near Olympia, Washington. Prior to conducting the assessment, a detailed work plan, including sampling approach, procedures, and quality assurance objectives, was prepared and submitted for DNR and Washington State Department of Ecology (Ecology) review and approval. The subfloor drainage assessment is part of an overall investigation planned for the Pesticide Storage Warehouse and surrounding vicinity. The subfloor drainage assessment was completed at this time to facilitate a proposed change in use of the building by DNR.

A total of 12 subsoil samples, including one field duplicate sample, were collected and submitted for laboratory analysis on April 8th and 9th, 1998. Figure 1 (Attachment A) identifies the subsoil sample locations. The subsoil samples were collected beneath the existing concrete and asphalt flooring at locations adjacent and immediately beneath the floor drains (i.e., that are currently concrete filled) and associated piping. All samples were analyzed for organochlorine pesticides by U. S. Environmental Protection Agency (EPA) Method SW 8081A and for chlorinated herbicides by EPA Method SW 8151A. All samples were appropriately collected in accordance with the work plan specifications and protocols, and were received by North Creek Analytical of Bothell, Washington in good condition for analysis.

Tables 1 and 2 (Attachment B) provide a summary of organochlorine pesticide and chlorinated herbicide analytical results in soil, respectively. No pesticide compounds were detected in the subsoil samples submitted for analysis (see Table 1). Two chlorinated herbicide compounds, including dicamba and 2,4-D, were detected in subsoil at sample station location PSW-SS-01 at concentrations slightly exceeding the laboratory reporting limit (see Figure 1 and Table 2). Dicamba was detected in sample PSW-SS-01-2.0 at a concentration of 5.86 micrograms/kilogram (ug/kg) and 2,4-D was detected in sample PSW-SS-01-3.75 at a concentration of 22.8 ug/kg (see Table 2). Sample PSW-SS-01-3.75 feet was collected at the soil/groundwater interface, with shallow groundwater detected at approximately 4 feet below the asphalt surface at this location. The detected concentrations of chlorinated herbicide compounds in soil were well below Ecology's Model Toxics Control Act (MTCA) Cleanup Regulation Method B soil cleanup levels (i.e., 100 X groundwater cleanup value) which were used as conservative screening values to assess subsoil quality (see Table 2).

On 8 April 1998, the Thurston County Health Department collected a split sample concurrently with subsoil sample PSW-SS-01-2.0. The split soil sample was submitted independently by Thurston County to Sound Analytical Services, Inc. for analysis, including organochlorine pesticides by EPA Method SW 8081A and chlorinated herbicides by EPA Method SW 8151 Modified. No organochlorine pesticide or chlorinated herbicide compounds were detected in the split sample at or above the laboratory reporting limits. The laboratory reporting limit for the chlorinated herbicides dicamba and 2,4-D was 13 ug/kg, as compared to a reporting limit of 5.0 ug/kg for these compounds in project samples analyzed by North Creek Analytical (see Table 2).

The findings of the subfloor drainage assessment and data quality review will be incorporated in the Pesticide Storage Warehouse SITE CHARACTERIZATION REPORT to be prepared subsequent to completion of the additional site investigation activities planned at the facility.

ATTACHMENT A

Subsoil Sample Location Map

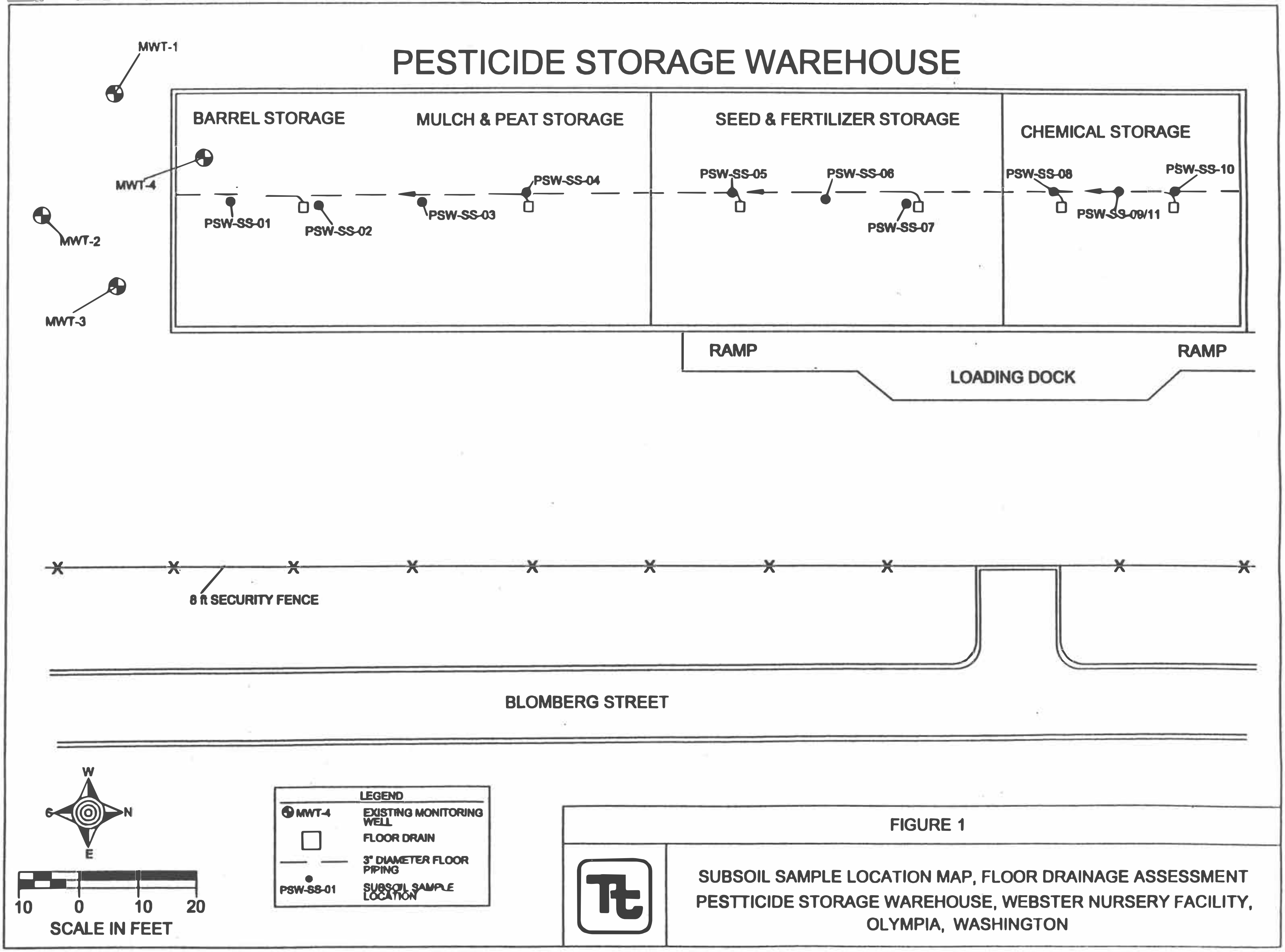

FIGURE 1

SUBSOIL SAMPLE LOCATION MAP, FLOOR DRAINAGE ASSESSMENT
PESTTICIDE STORAGE WAREHOUSE, WEBSTER NURSERY FACILITY,
OLYMPIA, WASHINGTON

ATTACHMENT B

SUMMARY OF ORGANOCHLORINATED PESTICIDES AND CHLORINATED HERBICIDES ANALYTICAL RESULTS IN SUBSOILS

Table 1. Summary of Organochlorine Pesticide Results in Subsoils
Pesticide Storage Warehouse Subfloor Drainage Assessment
Webster Nursery, Olympia, Washington
April 1998

Sample Identification [a]	Sample Results (ug/kg)																				
	Aldrin	alpha-BHC	beta-BHC	delta-BHC	gamma-BHC	Chlordane (Tech)	alpha-Chlordane	gamma-Chlordane	4,4'-DDD	4,4'-DDE	4,4'-DDT	Dieldrin	Endosulfan I	Endosulfan II	Endosulfan Sulfate	Endrin	Endrin aldehyde	Heptachlor	Heptachlor epoxide	Methoxychlor	Toxaphene
PSW-SS-01-2.0	ND[b]	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PSW-SS-01-3.75	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PSW-SS-02-2.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PSW-SS-03-2.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PSW-SS-04-2.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PSW-SS-05-2.5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PSW-SS-06-2.5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PSW-SS-07-2.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PSW-SS-08-1.5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PSW-SS-09-1.5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PSW-SS-10-1.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PSW-SS-11-1.5[c]	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PSW-Equipment Blank	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Laboratory Reporting Limit (µg/kg)	1.00	0.500	0.900	0.600	1.00	1.00	0.800	0.700	1.00	1.00	1.00	2.00	1.00	2.00	1.00	2.00	2.00	1.00	1.00	4.00	50.0
MTCA Method B Soil [d] Cleanup Level (ug/kg) (100 X Groundwater)	0.515	NA	NA	NA	6.73	6.73	6.73	6.73	36.5	25.7	25.7	0.547	9600	9600	NA	480	NA	1.94	0.962	8000	7.95

[a] Sample designation includes: PSW(Pesticide Storage Warehouse)-SS(Subsoil)-01(Sample Location)-2.0(Sample Depth in feet below base of concrete).

[b] ND = Not detected at or above the laboratory reporting limit.

[c] Sample PSW-SS-11-1.5 is a blind duplicate sample collected concurrently with sample PSW-SS-09-1.5.

[d] The Model Toxics Control Act Cleanup Regulation [(Chapter 173-340-740(3) WAC, as amended January 1996)]. Chemical-specific screening values based on MTCA Method B (100 X groundwater) criteria from the Cleanup Levels and Risk Calculations (CLARC II) Update, February 1996.

[e] NA = Not Available

Table 2. Summary of Chlorinated Herbicides Results in Subsoils
Pesticide Storage Warehouse Subfloor Drainage Assessment
Webster Nursery, Olympia, Washington
April 1998
Page 1 of 1

Sample Identification [a]	Sample Results (ug/kg)									
	2,4-D	2,4-DB	2,4,5-T	2,4,5-TP	Dalapon	Dicamba	Dichlorprop	Dinoseb	MCPA	MCPP
PSW-SS-01-2.0	ND[b]	ND	ND	ND	ND	**5.86**	ND	ND	ND	ND
PSW-SS-01-3.75	**22.8**	ND	ND	ND	ND	ND	ND	ND	ND	ND
PSW-SS-02-2.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PSW-SS-03-2.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PSW-SS-04-2.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PSW-SS-05-2.5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PSW-SS-06-2.5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PSW-SS-07-2.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PSW-SS-08-1.5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PSW-SS-09-1.5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PSW-SS-10-1.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PSW-SS-11-1.5[c]	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PSW-Equipment Blank	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Laboratory Reporting Limit (µg/kg)	5.00	20.0	20.0	20.0	50.0	5.00	15.0	10.0	750	750
MTCA Method B Soil [d] Cleanup Level (ug/kg) (100 X Groundwater)	16000	NA	16000	1280	48000	48000	NA[e]	1600	NA	NA

[a] Sample designation includes: PSW(Pesticide Storage Warehouse)-SS(Subsoil)-01(Sample Location)-2.0(Sample Depth in feet below base of concrete).

[b] ND = Not detected at or above the laboratory reporting limit.

[c] Sample PSW-SS-11-1.5 is a blind duplicate sample collected concurrently with sample PSW-SS-09-1.5.

[d] The Model Toxics Control Act Cleanup Regulation [(Chapter 173-340-740(3) WAC, as amended January 1996)]. Chemical-specific screening values based on MTCA Method B (100 X groundwater) criteria from the Cleanup Levels and Risk Calculations (CLARC II) Update, February 1996.

[e] NA = Not Available

APPENDIX F

LABORATORY REPORTING LIMITS AND ASSOCIATED SCREENING VALUES FOR PROPOSED PESTICIDE AND HERBICIDE ANALYSES

Table F-1. Laboratory Reporting Limit and Associated Screening Values
for Chlorinated Pesticides (EPA Method 8081A) in Subsoils
Webster Nursery, Olympia, Washington

Analytical Compound	Method Detection Limit (µg/kg)	Laboratory Reporting Limit (µg/kg)	MTCA Method B Soil Cleanup[a] Level (µg/kg)
Aldrin	0.09	1.00[b]	58.8
alpha-BHC	0.08	0.50	NA[b]
beta-BHC	0.17	0.90	NA
delta-BHC	0.12	0.60	NA
gamma-BHC (Lindane)	0.11	1.00	769
Chlordane (tech)	0.93	1.00	2,860
alpha-Chlordane	0.09	0.80	
gamma-Chlordane	0.07	0.70	2,860
4,4′-DDD	0.29	1.00	4,170
4,4′-DDE	0.04	1.00	2,940
4,4′-DDT	0.26	1.00	24.2
Dieldrin	0.25	2.00	62.5
Endosulfan I	0.10	1.00	480,000
Endosulfan II	0.20	2.00	480,000
Endosulfan sulfate	0.08	1.00	NA
Endrin	0.34	2.00	24,000
Endrin aldehyde	0.20	2.00	NA
Heptachlor	0.16	1.00	222
Heptachlor epoxide	0.09	1.00	110
Methoxychlor	3.23	4.00	400,000
Toxaphene	5.15	50.0	909
Atrazine	TBD[c]	TBD	4,550
Simazine	TBD	TBD	8,330

a The Model Toxics Control Act Cleanup Regulation [(Chapter 173-340-740(3)(a) WAC, as amended January 1996)]. Chemical-specific reference values in µg/kg based on MTCA Method B from the Cleanup Levels and Risk Calculations (CLARC II) Update, February 1996. For those contaminants with both carcinogen and noncarcinogen state cleanup levels, the carcinogenic value has been applied.

b NA = Not Available

c TBD = To be determined. Analytical laboratory to conduct a method detection limit study for specified compounds by EPA Method 8081A.

Table F-2. Laboratory Reporting Limits and Associated Screening Values
for Chlorinated Herbicides (EPA Method 8151A) in Subsoils
Webster Nursery, Olympia, Washington

Analytical Compound	Method Detection Limit (µg/kg)	Laboratory Reporting Limit (µg/kg)	MTCA Method B Soil Cleanup[a] Level (µg kg)
2,4-D	0.63	5.00	800,000
2,4-DB	2.17	20.0	NA [b]
2,4,5-T	2.11	20.0	800,000
2,4,5-TP (Silvex)	1.84	20.0	640,000
Dalapon	2.23	5.00	2,400,000
Dicamba	0.51	5.00	2,400,000
Dichlorprop	1.45	15.0	NA
Dinoseb	1.14	10.0	80,000
MCPA	39.5	750	NA
MCPP	33.3	750	NA

a The Model Toxics Control Act Cleanup Regulation [(Chapter 173-340-740(3)(a) WAC, as amended January 1996)]. Chemical-specific reference values in µg/kg based on MTCA Method B from the Cleanup Levels and Risk Calculations (CLARC II) Update, February 1996. For those contaminants with both carcinogen and noncarcinogen state cleanup levels, the carcinogenic value has been applied.

b NA = Not Available.

Table F-3. Laboratory Reporting Limit and Associated Screening Values for Chlorophenoxy Herbicides (EPA Method 515.1) in Groundwater, Webster Nursery, Olympia, Washington

Analytical Compound	Method Detection Limit (ug/L)	Laboratory Reporting Limit (ug/L)	Chemical-Specific ARARs[a]	
			Maximum Contaminant Levels (ug/L)[b]	MTCA Method B Groundwater Cleanup Levels (ug/L)[c]
2,4 - D	0.02	0.20	70.00	160.00
2,4,5 - TP (SILVEX)	0.02	0.40	NA[d]	128.00
PENTACHLOROPHENOL	0.02	0.08	1.00	0.73
DALAPON	0.30	2.00	200.00	480.00
DINOSEB	0.20	0.40	7.00	16.00
PICLORAM	0.06	0.20	500.00	1123.00
DICAMBA	0.02	0.20	NA	480.00
2,4 DB	0.02	1.00	NA	NA
2,4,5 T	0.03	0.40	NA	160.00
BENTAZON	0.05	0.50	NA	40.00
DICHLORPROP	0.06	0.50	NA	NA
ACTIFLORFIN	0.10	2.00	NA	211.00
DACTHAL (DCPA)	0.20	0.10	NA	160.00
3,5 - DICHLOROBENZOIC ACID	0.03	0.50	NA	NA

[a] ARAR = Applicable or Relevant and Appropriate Requirements

[b] National Primary Drinking Water Regulations (40 CFR 141) - Values based on the EPA Drinking Water Regulations and Health Advisories maximum contaminant levels (MCLs), as published by the EPA Office of Water, October 1996.

[c] The Model Toxics Control Act (MTCA Cleanup Regulation [(Chapter 173-340-720(2)(b) WAC, as amended January 1996]. Values based on MTCA Method B grounwater cleanup levels from the Cleanup Levels and Risk Calculations (CLARC II) Update, February 1996. For those contaminants with both carcinogen and noncarcinogenic state cleanup levels, the lowest of the two is shown.

[d] NA = Not Available

Table F-4. Laboratory Reporting Limits and Associated Screening Values for Organic Compounds (EPA Method 525.2) in Groundwater, Webster Nursery, Olympia, Washington

Page 1 of 2

Analytical Compound	Method Detection Limit (ug/L)	Laboratory Reporting Limit (ug/L)	Chemical-Specific ARARs[a] Maximum Contaminant Levels (ug/L)[b]	MTCA Method B Groundwater Cleanup Levels (ug/L)[c]
ENDRIN	0.022	0.02	2	4.8
LINDANE (BHC - GAMMA)	0.042	0.04	0.2	**0.0673**
METHOXYCHLOR	0.048	0.2	40	80
TOXAPHENE	0.1	2	3	**0.0795**
ALACHLOR	0.035	0.4	2	1.08
ATRAZINE	0.040	0.2	3	0.398
BENZO(A)PYRENE	0.026	0.04	0.2	**0.012**
CHLORDANE	0.444	0.4	2	**0.0673**
DI(ETHYLHEXYL)-ADIPATE	0.208	1.3	400	72.9
DI(ETHYLHEXYL)-PHTHALATE	0.922	1.3	6	12,800
HEPTACHLOR	0.074	0.08	0.4	**0.0194**
HEPTACHLOR EPOXIDE (A&B)	0.041	0.04	0.2	**0.00962**
HEXACHLOROBENZENE	0.039	0.2	1	**0.0547**
HEXACHLOROCYCLO-PENTADIENE	0.034	0.2	50	112
SIMAZINE	0.028	0.15	4	0.729
PENTACHLOROPHENOL	0.085	0.08	1	0.729
ALDRIN	0.068	0.2	NA[d]	**0.00515**
BUTACHLOR	0.024	0.4	NA	NA
DIELDRIN	0.047	0.2	NA	**0.00547**
METOLACHLOR	0.025	1.0	NA	NA
METRIBUZIN	0.024	0.2	NA	400
PROPACHLOR	0.015	0.2	NA	208
BROMACIL	0.031	0.2	NA	NA
PROMETON	0.030	0.2	NA	240
TERBACIL	0.038	0.2	NA	208
DIAZINON	0.035	0.2	NA	14.1
EPTC	0.012	0.3	NA	NA
4,4-DDD	0.121	0.2	NA	0.365
4,4-DDE	0.046	0.2	NA	0.257
4,4-DDT	0.042	0.2	NA	0.257
CYANAZINE	0.049	0.2	NA	**0.104**
MALATHION	0.03	0.2	NA	320
PARATHION	0.1	0.2	NA	96
TRIFLURALIN	0.028	0.2	NA	11.4
EXTENDED ANALYTE LIST				
1,3 - DICHLOROBENZENE	0.1	0.1	NA	1.82
CARBOFURAN	0.1	0.1	40	80
CARBARYL	0.1	0.1	NA	1600
DISULFOTON	0.076	0.1	NA	0.64
TERBUFOS	0.1	0.1	NA	0.4
ENDOSULFAN I	0.068	0.1	NA	96
1,4 - DICHLOROBENZENE	0.1	0.1	NA	1.82
1,2 - DICHLOROBENZENE	0.1	0.1	NA	720
ISOPHORONE	0.1	0.1	NA	92.1
DICHLORVOS	0.1	0.1	NA	0.301
MEVINPHOS	0.1	0.1	NA	4
PEBULATE	0.1	0.1	NA	800
ETRADIAZOLE	0.1	0.1	NA	NA
BUTYLATE	0.1	0.1	NA	800
VERNOLATE	0.1	0.1	NA	NA

Table F-4. Laboratory Reporting Limits and Associated Screening Values for Organic Compounds (EPA Method 525.2) in Groundwater, Webster Nursery, Olympia, Washington

Page 2 of 2

Analytical Compound	Method Detection Limit (ug/L)	Laboratory Reporting Limit (ug/L)	Chemical-Specific ARARs[a] Maximum Contaminant Levels (ug/L)[b]	MTCA Method B Groundwater Cleanup Levels (ug/L)[c]
EXTENDED ANALYTE LIST (CONTINUED)				
CHLORONEB	0.1	0.1	NA[d]	NA
MOLINATE	0.1	0.1	NA	32
ETHOPROP	0.1	0.1	NA	NA
CYCLOATE	0.1	0.1	NA	NA
CHLORPROPHAM	0.1	0.1	NA	3200
ATRATON	0.1	0.1	NA	NA
BHC, ALPHA -	0.1	0.1	NA	NA
PROPAZINE	0.1	0.1	NA	320
BHC, BETA -	0.1	0.1	NA	NA
PRONAMIDE	0.1	0.1	NA	1200
CHLOROTHALONIL	0.1	0.1	NA	7.95
BHC, DELTA -	0.1	0.1	NA	NA
DINOSEB	0.012	0.1	7	16
SIMETRYN	0.1	0.1	NA	NA
PROMETRYN	0.1	0.1	NA	64
AMETRYN	0.1	0.1	NA	144
CHLORPYRIFOS	0.1	0.1	NA	48
TRIADIMEFON	0.1	0.1	NA	NA
DACTHAL (DCPA)	0.1	0.1	NA	160
DIPHENAMIDE	0.1	0.1	NA	480
MGK-264	0.1	0.1	NA	NA
STIROFOS	0.1	0.1	NA	NA
NAPROPAMIDE	0.1	0.1	NA	1600
TRICYCLAZOLE	0.1	0.1	NA	NA
CHLOROBENZILATE	0.1	0.1	NA	0.324
ENDOSULFAN II	0.1	0.1	NA	96
ENDRIN ALDEHYDE	0.1	0.1	NA	NA
ENDOSULFAN SULFATE	0.1	0.1	NA	NA
NORFLURAZON	0.024	0.1	NA	640
HEXAZINONE	0.044	0.1	NA	528
FENARIMOL	0.1	0.1	NA	NA
PERMETHRIN, CIS-	0.1	0.1	NA	800
PERMETHRIN, TRANS-	0.1	0.1	NA	800
TERBUTRYN	0.1	0.1	NA	16
DEET	0.1	0.1	NA	NA
FENAMIPHOS	0.1	0.1	NA	4

a ARAR = Applicable or Relevant and Appropriate Requirements

b National Primary Drinking Water Regulations (40 CFR 141) - Values based on the EPA Drinking Water Regulations and Health Advisories maximum contaminant levels (MCLs), as published by the EPA Office of Water, October 1996.

c The Model Toxics Control Act (MTCA) Cleanup Regulation [(Chapter 173-340-720(2)(b) WAC, as amended January 1996]. Values based on MTCA Method B grounwater cleanup levels from the Cleanup Levels and Risk Calculations (CLARC II) Update, February 1996. For those contaminants with both carcinogen and noncarcinogenic state cleanup levels, the lowest of the two is shown.

d NA = Not Available

Bold = Indicates the associated ARAR is below the specified analytical laboratory reporting limit