LANDAU ASSOCIATES

TECHNICAL MEMORANDUM

TO: Steve Teel, Washington State Department of Ecology

CC: Amy Sikora, Washington State Department of Natural Resources

FROM: Katie Gauglitz, LG, and Sierra Mott

DATE: April 14, 2023

RE: Compliance Monitoring Plan
Webster Nursery Site, Site Identification 3380
Tumwater, Washington
Project No. 0774006.040.047

INTRODUCTION

This technical memorandum presents the Compliance Monitoring Plan (CMP) for the Washington State Department of Natural Resources (DNR) Webster Nursery Site, a former pesticide-storage warehouse in Tumwater, Washington (Site; Figure 1). The Site is associated with past releases of organochlorine pesticides and consists of an area of contaminated soil and groundwater at the nursery that has been locally affected by a release of organochlorine pesticides from an underground storage tank (UST) formerly located south of the pesticide storage warehouse. Constituents of concern include the organochlorine pesticides heptachlor, heptachlor epoxide (HE; breakdown product of heptachlor), and technical chlordane.

Remedial action excavation and disposal of HE-contaminated soil was completed in August 2018. A summary of the remedial action is provided in a Cleanup Action Completion Report (Landau 2020). As of August 2022, DNR has completed the seventeenth quarterly groundwater performance monitoring event following the remedial action (Landau 2022); a minimum of four events were required per the Cleanup Action Plan (Landau 2016) and as described in the CACR. However, additional performance monitoring is warranted. A summary of the current groundwater monitoring plan, a review of groundwater and soil compliance requirements, DNR's understanding of how to obtain Site closure, and a compliance schedule are presented in this technical memorandum.

SUMMARY OF GROUNDWATER MONITORING

Since completion of the remedial action, groundwater performance monitoring has been conducted in accordance with the framework established by Washington State Department of Ecology (Ecology) Agreed Order (AO) Number DE 00TCP-SR295, the Remedial Action Work Plan (Landau 2017), and the CACR (Landau 2020). Revisions to the monitoring plan were approved by Ecology in August 2019 (Morris 2019) and are summarized as follows:

- Continue quarterly groundwater monitoring at SW-10R and SW-11R until at least four consecutive quarters of data are below cleanup levels (CULs)
- Suspend groundwater monitoring at SW-9R, SW-14, SW-15, and SW-16 (HE has never been detected at a concentration exceeding the CUL at any of these wells)
- Discontinue collecting groundwater elevation measurements at all wells (except for SW-10R and SW-11R per low-flow sampling requirements) and discontinue presenting quarterly groundwater elevation contours.

The groundwater monitoring network is shown on Figure 2. A concentration time series plot for SW-10R and SW-11R is shown on Figure 3. Results indicate that concentration of HE had consistently exceeded cleanup levels (CULs) at one well, SW-10R, but have been decreasing over time. Historically, concentrations of HE have also periodically exceeded the CUL at SW-11R (most recently August 2021).

COMPLIANCE MONITORING

There are three types of compliance monitoring required per the Model Toxics Control Act (MTCA) (Washington Administrative Code [WAC] 173-340-410), which are listed below:

- **Protection monitoring:** ensure protection of human health and the environment during construction, operation, and maintenance through the remedial action period (WAC 173-340-410[1][a])
- **Performance monitoring:** confirm through monitoring that cleanup standards have been met following the remedial action (WAC 173-340-410[1][b])
- **Confirmational monitoring:** confirm the long-term effectiveness of the remedial action once cleanup standards have been met (WAC 173-340-410[1][c]).

A description of the monitoring plan for Site groundwater and soil is described in the sections below.

Performance Monitoring

Soil Monitoring

Soil performance samples were collected from the 2018 remedial excavation and compared to MTCA Method B CULs for protection of groundwater (Landau 2020). Results indicated that soil with concentrations of technical chlordane, heptachlor, and HE above the groundwater protection CULs remained in place. Groundwater monitoring will be conducted at SW-10R and SW-11R until Ecology agrees that it has been empirically demonstrated that residual soil concentrations in the remedial excavation area will not cause an exceedance of the applicable groundwater CUL. Soil results compared to both protection of groundwater and direct contact CULs are presented in Table 1. As shown in Table 1, no performance monitoring soil sample results exceed the direct contact CULs for any analyte in any sample.

Groundwater Confirmational Monitoring

Performance groundwater monitoring conducted after the completion of the remedial excavation indicated that longer-term confirmation monitoring was required. Confirmational monitoring is currently being performed and will continue until it has been confirmed that cleanup standards have been met in both groundwater and soil. Groundwater monitoring will be conducted in accordance with the Site sampling and analysis plan, which is included as Attachment 2. Confirmational groundwater monitoring shall be performed at SW-10R and SW-11R. Groundwater confirmational monitoring data will be evaluated to determine compliance using the following statistical approach:

- Trend and/or regression analysis on the groundwater data collected since the 2018 remedial action shows a stable and decreasing trend using a statistical method approved by Ecology (e.g., Mann-Kendall trend analysis).
- The final four (4) sample results do not exceed the cleanup level and are not highly variable (e.g., the highest concentration above the laboratory reporting limit is no more than three (3) times the lowest concentration above the laboratory reporting limit).
- Three of the final four samples must be collected during a time when the water-level elevation in SW-10R is relatively low (comparable to typical August water-level elevations and less than or equal to an elevation of 183.7 feet). This is necessary because the concentrations of heptachlor epoxide tend to be highest when the water-table elevation is relatively low.

COMPLIANCE SCHEDULE

Groundwater confirmational monitoring is ongoing. A total of eighteen groundwater monitoring events have occurred since completion of the remedial action; most recent results indicate that SW-10R and SW-11R have met CULs, however concentrations of HE at SW-10R and SW-11R have shown some variability within an overall decreasing trend (Landau 2022). Beginning with the August 2023 monitoring event, additional annual performance monitoring will be required until concentrations at both wells have met CULs as outlined in the above statistical approach.

Due to the requirement for ongoing confirmational monitoring, the quarterly events were renamed, beginning with the August 2019 event, using the following convention: 3Q19. DNR will continue to submit groundwater monitoring data to Ecology within 30 days of receipt of validated data, and no later than 90 days from the groundwater sampling date. Environmental Information Management submittals are required and will also be completed annually.

CONCLUSIONS AND NEXT STEPS

The next groundwater monitoring event will occur in August 2023 and annually thereafter until Ecology concurs that groundwater CULs have been met. Once the groundwater cleanup is complete, DNR will request that Ecology initiate actions for termination of the environmental covenant. As such, DNR anticipates requesting Ecology evaluate the overall success of the cleanup and, at its discretion, issue a letter indicating AO requirements are satisfied and that the cleanup is complete. All groundwater monitoring wells associated with the remedial action would be decommissioned at that time.

USE OF THIS TECHNICAL MEMORANDUM

This technical memorandum has been prepared for the exclusive use of Washington State Department of Natural Resources for specific application to the Webster Nursery Site. No other party is entitled to rely on the information, conclusions, and recommendations included in this document without the express written consent of Landau Associates. Further, the reuse of information, conclusions, and recommendations provided herein for extensions of the project or for any other project, without review and authorization by Landau Associates, shall be at the user's sole risk. Landau Associates warrants that within the limitations of scope, schedule, and budget, our services have been provided in a manner consistent with that level of care and skill ordinarily exercised by members of the profession currently practicing in the same locality under similar conditions as this project. Landau makes no other warranty, either express or implied.

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

LANDAU ASSOCIATES, INC.

Katie Gauglitz, LG
Senior Geologist

Sierra Mott
Senior Scientist

KMG/SMM/kjg
[Y:\774\006 WEBSTER\R\COMPLIANCE MONITORING PLAN\CMP 2023 REV\WEBSTER NURSERY CMP TM 04.14.2023]

ATTACHMENTS:

Figure 1.	Vicinity Map
Figure 2.	Groundwater Monitoring Network
Figure 3.	Heptachlor Epoxide Time Series Concentrations for SW-10(R) and SW-11(R)
Table 1.	Performance Monitoring Soil Sample Analytical Results
Attachment 1:	Health and Safety Plan
Attachment 2:	Sampling and Analysis Plan

REFERENCES

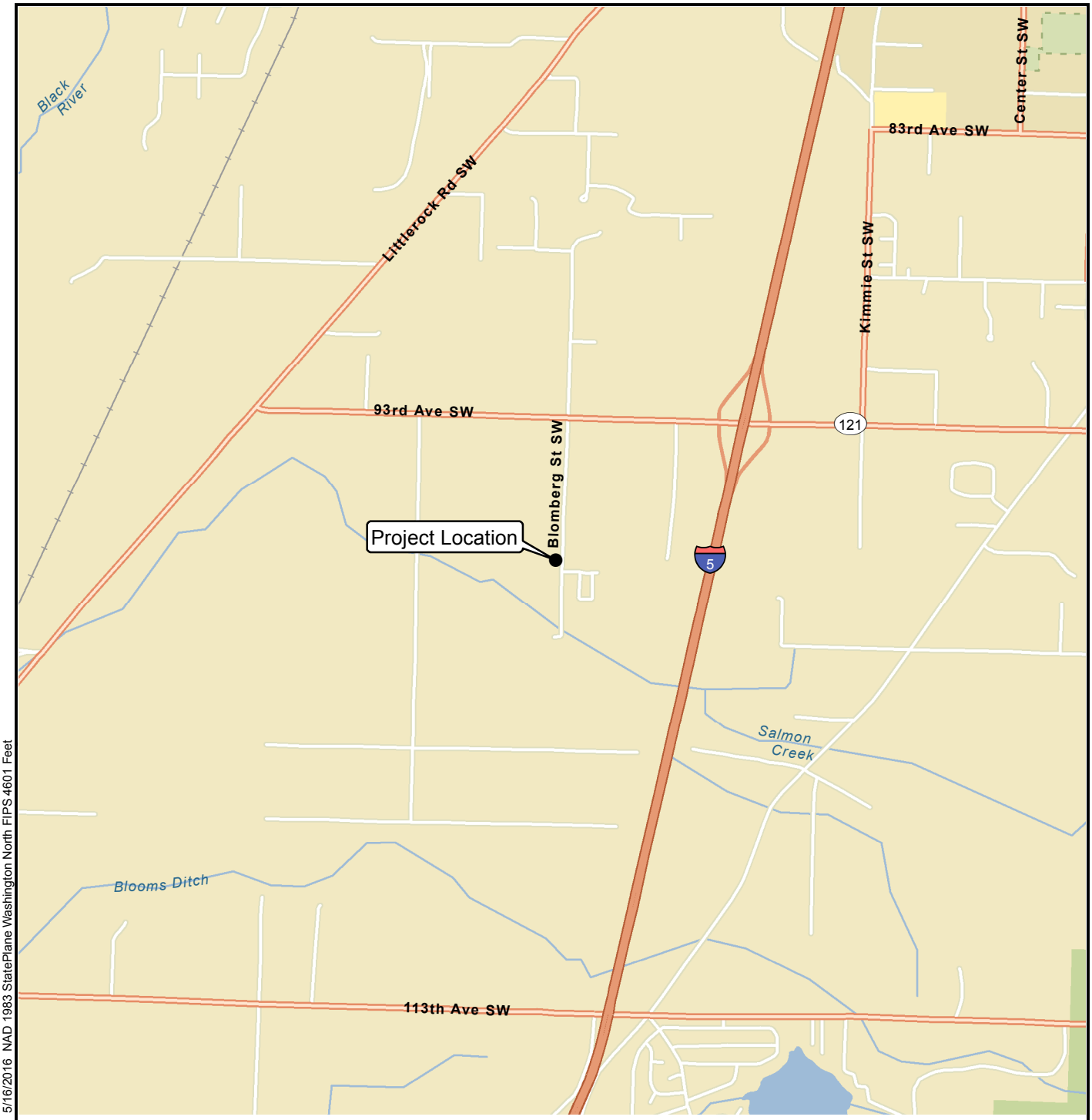
Landau. 2016. Draft: Cleanup Action Plan, Webster Nursery, Site ID 3380, Tumwater Washington. Landau Associates, Inc. June.

Landau. 2017. Remedial Action Work Plan, Webster Nursery, 9805 Blomberg Street SW, Tumwater, Washington. Landau Associates, Inc. October 31.

Landau. 2020. Final: Cleanup Action Completion Report, Washington State Department of Natural Resources Webster Nursery, Tumwater, Washington. Landau Associates, Inc. May 29.

Landau. 2022. Final Technical Memorandum: Third Quarter 2022 Groundwater Monitoring Results; Webster Nursery Site, Site Identification 3380; Tumwater, Washington. Landau Associates. October 12.

Morris, Matthew. 2019. Email message from Matthew Morris, Cleanup Project Manager, Washington State Department of Ecology Toxics Cleanup Program, to Sierra Mott and Eric Weber, Landau Associates, Inc. and Amy Sikora, Washington Department of Natural Resources, Re: Webster Nursery Compliance Plan. August 23.



N

0 0.5 1

Miles

Data Source: Esri 2012

G:\Projects\774\006\020\026\FSIF01 VicinityMap.mxd 5/16/2016 NAD 1983 StatePlane Washington North FIPS 4601 Feet

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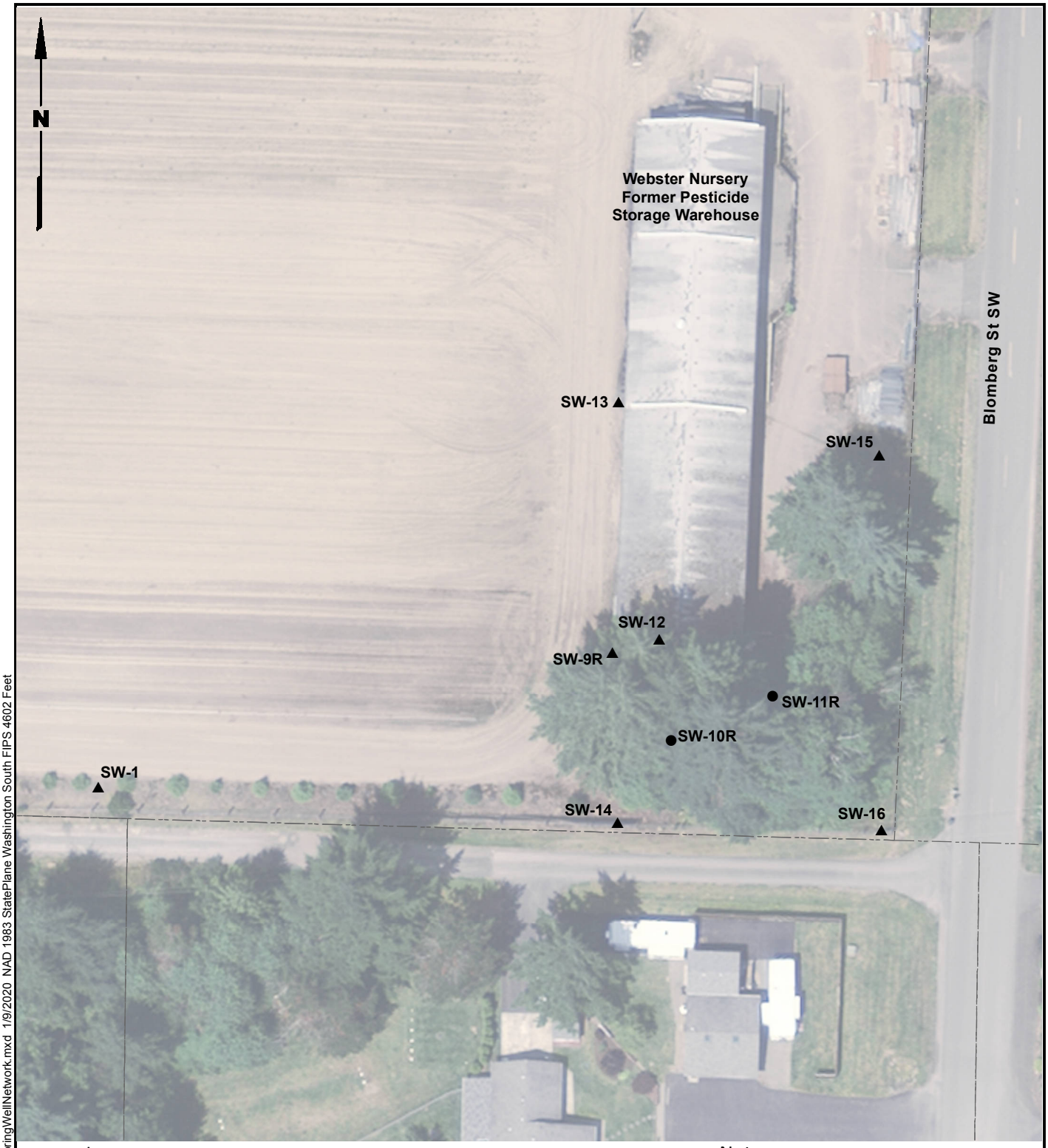
Webster Nursery Site Tumwater, Washington	**Vicinity Map**	Figure 1



G:\Projects\774\006\040\045\F02MonitoringWellNetwork.mxd 1/9/2020 NAD 1983 StatePlane Washington South FIPS 4602 Feet

Legend

- ● Pesticide Monitoring Well
- ▲ Other Monitoring Well
- Tax Parcels

0 50 100

Scale in Feet

Notes

1. SW-9R, SW-10R, and SW-11R are new (replacement) wells.
2. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

Data Sources: Thurston County GIS; WA DNR Survey, 2018.

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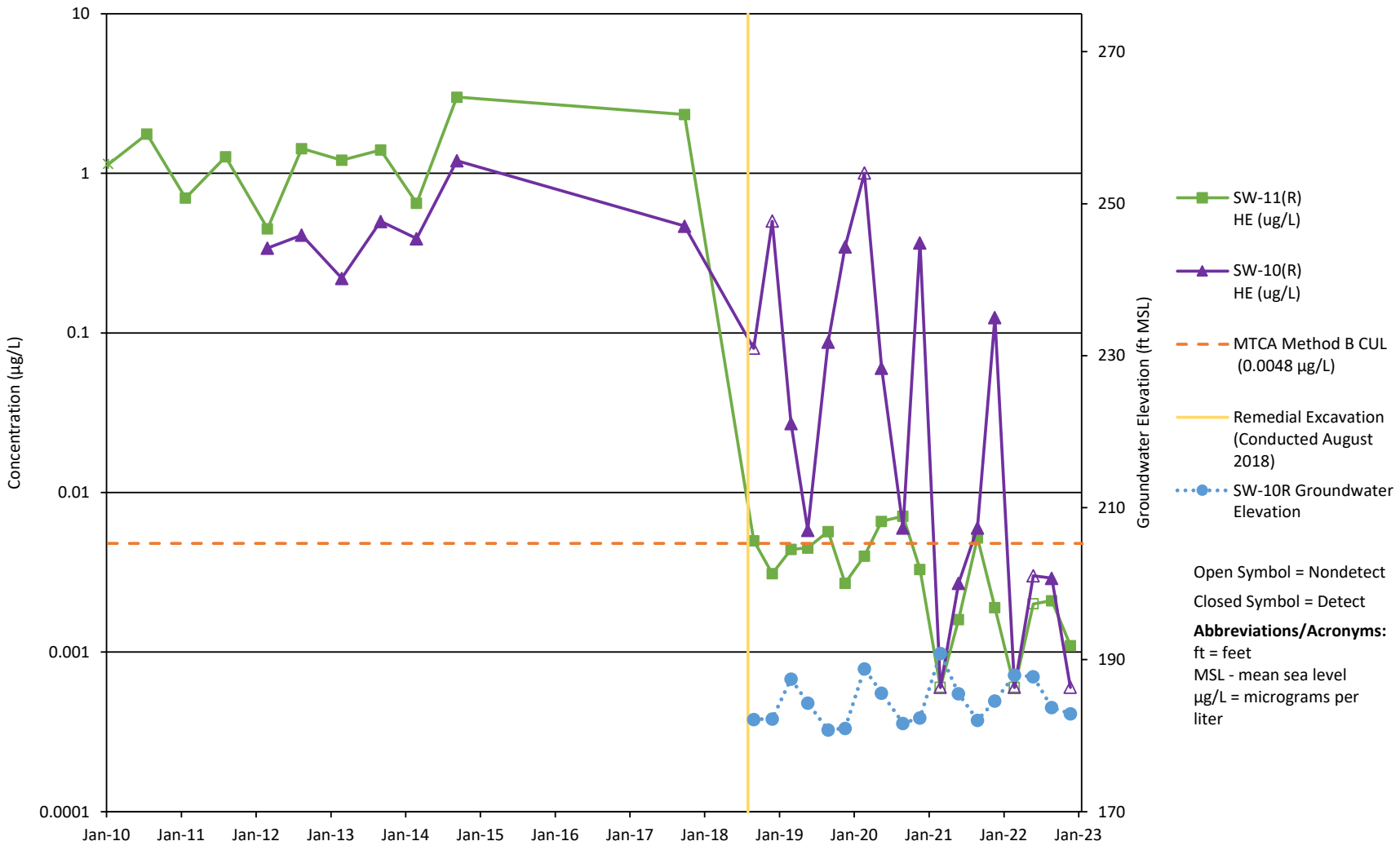
Webster Nursery Site Tumwater, Washington	**Monitoring Well Network**	Figure 2

Y:\774\006 Webster\R\Quarterly GW Monitoring Reports\2022_11_4Q22\Figures\F03_HE and GWE Timeseries 3Q



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Webster Nursery Site
Tumwater, Washington

Heptachlor Epoxide and Groundwater Elevation Time Series SW-10(R) and SW-11(R)

Figure
3

Table 1
Excavation Soil Sample Analytical Results
Webster Nursery – Tumwater, Washington

Analyte	Soil Direct Contact MTCA Method B Cancer	Soil Protective of Groundwater Saturated	Sample Location, Sample Depth (bgs), Laboratory SDG, Sample Date									
			B1-E 15 ft 580-79307-1 8/2/2018	B2-A 10.5 ft 580-79307-1 8/2/2018	B3-F 10.5 ft 580-79307-1 8/2/2018	B4-A 10.5 ft 580-79307-1 8/2/2018	SW1-E 8 ft 580-79307-1 8/2/2018	SW2-S 8 ft 580-79307-1 8/2/2018	SW3-N 6.5 ft 580-79307-1 8/2/2018	SW4-S 5.5 ft 580-79508-1 8/8/2018	SW5-W 6.5 ft 580-79307-1 8/2/2018	SW9-S 5.5 ft 580-79508-1 8/8/2018
Pesticides (µg/kg; SW-846 8081B)												
4,4'-DDD	--	--	2.7 U	2.8 U	2.9 U	2.4 U	2.8 U	2.7 U	2.6 U	2.4 U	2.4 U	2.4 U
4,4'-DDE	--	--	2.7 U	2.8 U	2.9 U	2.4 U	2.8 U	2.7 U	2.6 U	2.4 U	2.4 U	2.4 U
4,4'-DDT	--	--	2.7 U	2.8 U	2.9 U	2.4 U	2.8 U	2.7 U	2.6 U	2.4 UJ	2.4 U	2.4 UJ
Aldrin	--	--	4.1 U	4.1 U	4.3 U	3.6 U	4.3 U	4.1 U	4.0 U	3.6 U	3.5 U	3.6 U
alpha-BHC	--	--	2.7 U	2.8 U	2.9 U	2.4 U	2.8 U	2.7 U	2.6 U	2.4 U	2.4 U	2.4 U
beta-BHC	--	--	6.8 U	6.9 U	7.2 U	6.1 U	7.1 U	6.8 U	6.6 U	6.0 U	5.9 U	6.1 U
Chlordane, Technical	2,860	103	14 U	**330**	**2300**	12 U	14 U	14 U	13 U	12 U	12 U	12 U
cis-Chlordane	--	--	2.7 U	**26**	**140**	2.4 U	2.8 U	2.7 U	2.6 U	2.4 U	2.4 U	2.4 U
delta-BHC	--	--	4.1 U	4.1 U	4.3 U	3.6 U	4.3 U	4.1 U	4.0 U	3.6 U	3.5 U	3.6 U
Dieldrin	--	--	2.7 U	2.8 U	2.9 U	2.4 U	2.8 U	2.7 U	2.6 U	2.4 U	2.4 U	2.4 U
Endosulfan I	--	--	2.7 U	2.8 U	2.9 U	2.4 U	2.8 U	2.7 U	2.6 U	2.4 U	2.4 U	2.4 U
Endosulfan II	--	--	2.7 U	2.8 U	2.9 U	2.4 U	2.8 U	2.7 U	2.6 U	2.4 U	2.4 U	2.4 U
Endosulfan Sulfate	--	--	2.7 U	2.8 U	2.9 U	2.4 U	2.8 U	2.7 U	2.6 U	2.4 UJ	2.4 U	2.4 U
Endrin	--	--	2.7 U	2.8 U	2.9 U	2.4 U	2.8 U	2.7 U	2.6 U	2.4 U	2.4 U	2.4 U
Endrin Aldehyde	--	--	27 UJ	28 UJ	29 UJ	24 UJ	28 UJ	27 UJ	26 UJ	24 U	24 UJ	24 U
Endrin Ketone	--	--	2.7 U	2.8 U	2.9 U	2.4 U	2.8 U	2.7 U	2.6 U	2.4 U	2.4 U	2.4 U
gamma-BHC	--	--	2.7 U	2.8 U	2.9 U	2.4 U	2.8 U	2.7 U	2.6 U	2.4 U	2.4 U	2.4 U
Heptachlor	222	1.9	4.1 U	4.1 U	**4.9**	3.6 U	4.3 U	4.1 U	4.0 U	3.6 UJ	3.5 U	3.6 U
Heptachlor Epoxide	110	4.02	**11**	**16**	**49**	3.6 U	4.3 U	**11**	4.0 U	3.6 U	3.5 U	3.6 U
Methoxychlor	--	--	14 U	14 U	14 U	12 U	14 U	14 U	13 U	12 U	12 U	12 U
Toxaphene	--	--	140 U	140 U	140 U	120 U	140 U	140 U	130 U	120 U	120 U	120 U
trans-Chlordane	--	--	**15**	**130**	**730**	3.6 U	4.3 U	4.1 U	4.0 U	3.6 U	3.5 U	3.6 U

Notes:

U = The analyte was analyzed for, but was not detected above the level of the reported sample quantitation limit.

UJ = The analyte was analyzed for, but was not detected. The reported quantitation limit is approximate and may be inaccurate or imprecise.

Bold = detected compound

Box = detected concentration is greater than the cleanup level for protection of groundwater

Green Box = detected concentration is greater than the cleanup level for direct contact

-- = not available

Abbreviations and Acronyms:

µg/kg = micrograms per kilogram

bgs = below ground surface

ft = feet

MTCA = Model Toxics Control Act

SDG = sample delivery group

ATTACHMENT 1

Health and Safety Plan

Work Location Personnel Protection and Safety Evaluation Form

Project Number:	0774006.020.024	Reviewed by:	Ken Reid
Prepared by:	Sierra Mott	Date:	August 4, 2016
Date:	July 21, 2016		

A. Work Location Description

1.	**Project Name:**	Washington State Department of Natural Resources (DNR) Webster Nursery Cleanup Action
2.	**Location:**	Tumwater, Washington
3.	**Anticipated Activities**	Excavation and disposal of approximately 145 cubic yards of soil contaminated with heptachlor epoxide (HE); confirmation soil sampling; decommissioning two groundwater monitoring wells; installation of two replacement monitoring wells using direct-push drilling method; collection of groundwater samples.
4.	**Size:**	Property is 4 acres; project area is less than 1 acre
5.	**Surrounding Population:**	Residential/Agricultural
6.	**Buildings/Homes/Industry:**	Current DNR tree seedling nursery; equipment storage, warehouse
7.	**Topography:**	Flat
8.	**Anticipated Weather:**	Sun or rain; 30 to 80 degrees Fahrenheit
9.	**Unusual Features:**	None.
10.	**Site History:**	From 1978 until the mid-1990s, organochlorine pesticides were stored in an underground storage tank (UST) located south of the nursery's pesticide storage warehouse. Pesticide containers were rinsed in this building and diluted pesticide wash water leaked over time from the UST. Upon final removal of the UST in 1996, pesticide residues were found in surrounding subsurface soil adjacent to the UST. Contaminated soil was removed and disposed of, but field screening indicated that soil contamination was left in place. Monitoring wells were installed immediately surrounding the former UST location. Subsequently, Ecology issued an Agreed Order to DNR. Additional wells were installed for long-term groundwater monitoring. Recent groundwater and subsurface soil sampling results indicate that HE exceeds applicable MTCA Method B soil and groundwater cleanup levels near the zone of seasonal water table fluctuation in the immediate vicinity of the former UST. Other contaminants at the Site (below cleanup levels) include parent compound heptachlor and alpha- and gamma-chlordane (chlordanes). The proposed cleanup action consists of decommissioning two monitoring wells located inside the excavation area, removal and offsite disposal of contaminated soil located

between 3 ft bgs and 10.5 ft bgs, Site restoration, and installation of two replacement monitoring wells. Periodic groundwater sampling will be performed subsequent to the cleanup action.

B. Hazard Description

1. Background Review: ☒ Complete ☐ Partial
If partial, why? Click here to enter text.

2. Hazardous Level: ☐ B ☐ C ☒ D (Modified) ☐ Unknown
Justification: Existing data regarding site conditions and limited exposure based on field activities and equipment to be used.

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

A. ☒ Chemical ☒ Inhalation ☐ Explosive
☐ Biological ☒ Ingestion ☐ O_2 Def. ☒ Skin Contact

Describe: Contact with soil or groundwater impact by HE.

B. ☒ Physical ☐ Cold Stress ☒ Noise ☐ Heat Stress ☒ Other
Describe: Physical hazards associated with drilling, excavations and confirmation soil sampling, and groundwater sampling.

C. ☐ Radiation
Describe: Click here to enter text.

4. Nature of Hazards:

☒ Air Describe: Potential for airborne dust and contamination.

☒ Soil Describe: Potential for contact with or ingestion of contaminated sediment during drilling and sampling.

☐ Surface Water Describe: Click here to enter text.

☒ Groundwater Describe: Potential for contact with or ingestion of contaminated groundwater during drilling and sampling.

☐ Other Describe: Click here to enter text.

5. Chemical Contaminants of Concern ☐ N/A

Contaminant	PEL (ppm)	IDLH (ppm)	Source/Quantity Characteristics	Route of Exposure	Symptoms of Acute Exposure	Instruments Used to Monitor Contaminant
Heptachlor	0.5 mg/m^3	35 mg/m^3	May be present in soil.	Inhalation, absorption, ingestion, dermal contact.	Tremors, convulsion, liver damage (carcinogen).	Dust Control
Heptachlor Epoxide (HE)	0.5 mg/m^3	Not available	Present in groundwater and soil.	Inhalation, absorption, ingestion, dermal contact.	Tremors, convulsion, liver damage (carcinogen)	Dust Control
Chlordane	0.5 mg/m^3	100 mg/m^3	Present in groundwater.	Inhalation, absorption, ingestion, dermal contact.	Blurred vision, delirium, cough, abdominal pain, nausea, vomiting, diarrhea (carcinogen).	Dust Control

Notes: Heptachlor changes to HE once mixed with water (including in the body).
PEL is the Permissible Exposure Limit for an 8 hour day.
mg/m^3 = milligrams per cubic meter

6. Physical Hazards of Concern ☐ N/A

Hazard	Description	Location	Procedures Used to Minimize Hazard
Drill rig, fork lift, and support vehicles	Moving parts of drill rig, forklift, and the support vehicles can be locations of falling and flying objects and pinch/crush points	Near drill rig for drilling and installation of two monitoring wells	Alert observation of surroundings; minimize time spent near drill rig and get driller's attention before approaching drill rig, forklift, or any vehicle; no loose clothing.
Open excavation	Excavations greater than 4 ft deep pose a hazard of falls and sidewall collapse	Around excavations	Personnel will not be allowed to enter excavations greater that 4 ft deep without shoring. Confirmation soil samples will be collected using an excavator bucket. While in an excavation less than 4 ft deep, workers' heads must not be allowed to break the plane of the top of the excavation so that in the case of a sidewall collapse, the worker's head and upper body are not buried.
Weather stress	Exposure to hot or cold temperatures, wind, and or rain	All areas of the site	Have drinking water accessible, wear appropriate clothing (light for heat, warm for cold), wear sunscreen protection, avoid caffeine, work in the shade when possible, and take short breaks in the shade as needed.
Slips, trips, and falls	Uneven terrain and drilling equipment	All areas of the site	Visual observations of terrain and hazards. Keep work area clear of debris.
Overhead and underground utilities	Damage to utilities through drilling and excavations	Around work area	Client to provide utility maps and a public utility locating service will be utilized. No raised drill rig towers within 20 ft of overhead power lines.
Travel to and from site	Operating motor vehicle in traffic on highways and rural roads.	Route to and from site from Landau Associates office	Operate motor vehicle while well rested and physically able to drive safely. Conduct pre-trip vehicle inspection, all vehicles to be maintained and in good working order. Obey all traffic laws including no cell phone use while driving. Secure all cargo properly to avoid shifting. Allow sufficient time for travel to site at safe speeds. Engage emergency brake when parking vehicles. Establish a planned route prior to departure. Be observant of unsafe road conditions and erratic/dangerous drivers.

7. Work Location Instrument Readings ☐ N/A

Location:	
Percent O_2:	Percent LEL:
Radioactivity:	PID:
FID:	Other:
Other:	Other:
Other:	Other:

Location:	
Percent O_2:	Percent LEL:
Radioactivity:	PID:
FID:	Other:
Other:	Other:
Other:	Other:

Location:	
Percent O_2:	Percent LEL:
Radioactivity:	PID:
FID:	Other:
Other:	Other:
Other:	Other:

Location:	
Percent O_2:	Percent LEL:
Radioactivity:	PID:
FID:	Other:
Other:	Other:
Other:	Other:

8. Hazards Expected in Preparation for Work Assignment ☒ N/A

Describe: Click here to enter text.

C. Personal Protective Equipment

1. Level of Protection

☐ A ☐ B ☐ C ☒ D (Modified)

Location/Activity: All

☐ A ☐ B ☒ C ☐ D

Location/Activity: If action levels (Attachment A) are exceeded.

2. Protective Equipment (specify probable quantity required)

Respirator ☐ N/A

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

Clothing ☐ N/A

- ☐ Fully Encapsulating Suit
- ☐ Chemically Resistant Splash Suit
- ☐ Apron, Specify:
- ☒ Tyvek Coverall
- ☐ Saranex Coverall
- ☐ Coverall, Specify
- ☒ Other: Dedicated field clothing, highly visible safety vest

Head & Eye ☐ N/A

- ☒ Hard Hat
- ☐ Goggles
- ☐ Face Shield
- ☒ Safety Eyeglasses
- ☒ Other: Hearing protection

Hand Protection ☐ N/A

- ☒ Undergloves; Type: Nitrile
- ☐ Gloves; Type:
- ☐ Overgloves; Type:
- ☐ None
- ☐ Other:

Foot Protection ☐ N/A

- ☐ Neoprene Safety Boots with Steel Toe/Shank
- ☒ Disposable Overboots
- ☒ Other: Chemical Resistant Steel-Toe

Work Boots

3. Monitoring Equipment ☐ N/A

- 0 CGI
- 0 O2 Meter
- 0 Rad Survey
- 0 Detector Tubes (optional)

Type:

- 0 PID
- 0 FID
- 0 Other

D. Decontamination

Personal Decontamination ☒ Required ☐ Not Required

If required, describe: Decontaminate exposed skin before each break in the work shift and before eating or drinking using hot water and soap. Use disposable PPE and discard as solid waste. Avoid hand to mouth contact.

Equipment Decontamination ☒ Required ☐ Not Required

If required, describe: Decontamination of non-dedicated sampling equipment soil and groundwater sampling equipment with dry methods (brushing, scrubbing) and/or Alconox/tap water solution followed by tap water rinse. Field staff will be prepared to set up a wash sink on site. All contaminated water will be stored onsite.

E. Activities Covered Under This Plan

Task No.	Description	Preliminary Schedule
1	Monitoring well decommissioning and replacement; well development; initial sampling	September through October 2018
2	Excavation and disposal of contaminated soil; confirmation soil sampling	September through October 2018
3	Groundwater sampling	October 2018

Emergency Facilities and Numbers

Hospital: Capital Medical Center, 3900 Capital Mall Drive SW, Olympia, Washington 98502
Telephone: 360-754-5858
Directions: Attachment B

Urgent Care Clinic: Urgent Care South, 6981 Littlerock Road SW #101, Olympia Washington ,
Telephone: 360-943-3633
Directions: Attachment C

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

Emergency Routes – Maps (Attachment B and C)

Emergency Contacts:

Name	Offsite	Onsite
Toni Smith	253-926-2493	208-275-9785
Eric Weber	253-926-2493	206-940-2406
Christine Kimmel	425-778-0907	206-786-3801

In the event of an emergency, do the following:

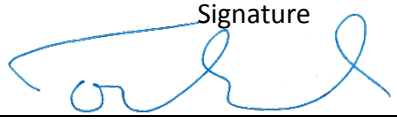
1. Call for help as soon as possible. Call 911. Give the following information:
    a. WHERE the emergency is – use cross streets or landmarks
    b. PHONE NUMBER you are calling from
    c. WHAT HAPPENED – type of injury
    d. WHAT is being done for the victim(s)
    e. YOU HANG UP LAST – let the person you called hang up first.
2. If the victim can be moved, paramedics will transport to the hospital. If the injury or exposure is not life-threatening, decontaminate the individual first. If decontamination is not feasible, wrap the individual in a blanket or sheet of plastic (avoiding the head and face) prior to transport.

In the event of a non-emergency injury, do the following:

1. Ask the injured person if you can help them.
2. Administer first aid to the skill level for which you have been trained and feel comfortable performing. If you are unsure if the emergency is life threatening or not, immediately call 911 and follow the steps above.
3. If the injury is minor, but some medical attention beyond the skills of site workers is required after administering first aid, the victim can be transported to the hospital following decontamination, if necessary. The directions to the nearest *Urgent Care Clinic* is provided in Attachment C.

Health and Safety Plan
Approval/Sign Off Form

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

Name	Signature	Date
Click here to enter text.		Click here to enter text.
Click here to enter text.		Click here to enter text.
Click here to enter text.		Click here to enter text.
Click here to enter text.		Click here to enter text.
Toni Smith Task Manager		January 19, 2017
Sierra Mott Site Safety Coordinator		January 19, 2017
Christine Kimmel LAI Health and Safety Manager		January 19, 2017
Eric Weber Project Manager		January 19, 2017

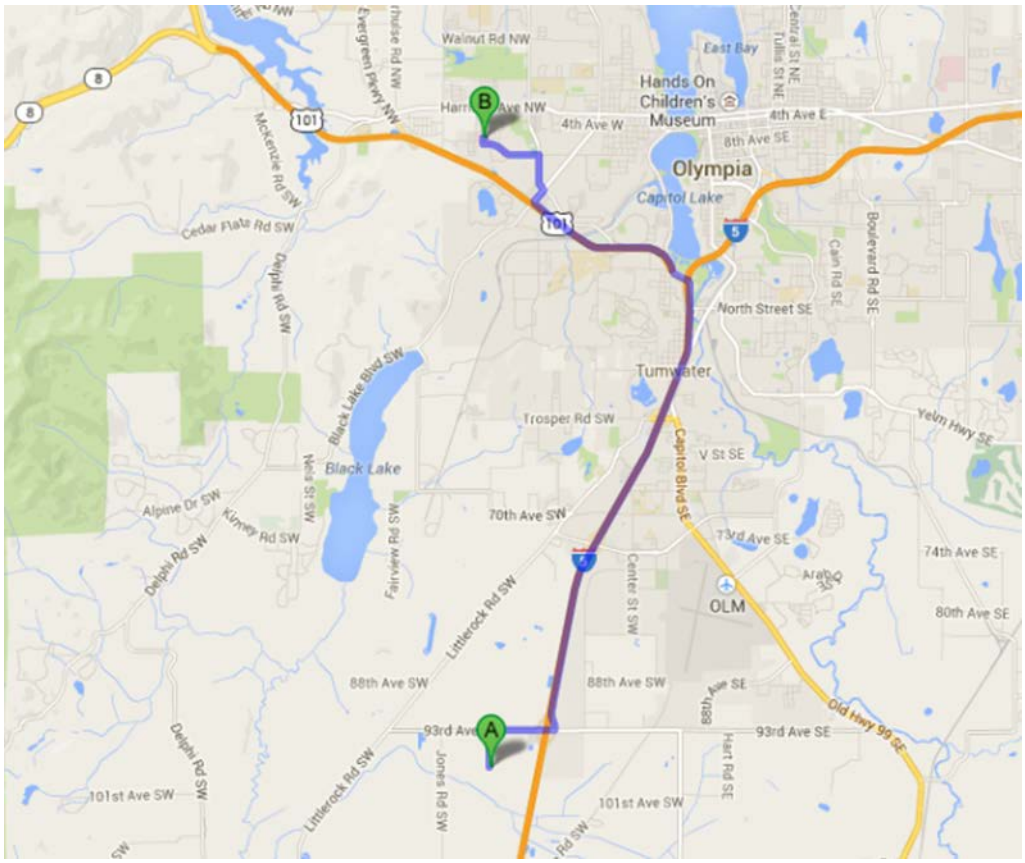
Personnel Health and Safety Briefing Conducted by:

Name	Signature	Date
Sierra Mott		Click here to enter text.

Attachment A
Action Levels for Respiratory Protection

Monitoring Parameter	Reading	Level of Protection
Dust	Visible Dust	Apply moisture to soil, if dust persists then upgrade to Modified Level D PPE and monitor dust level at work perimeter

Attachment B
Directions to Hospital

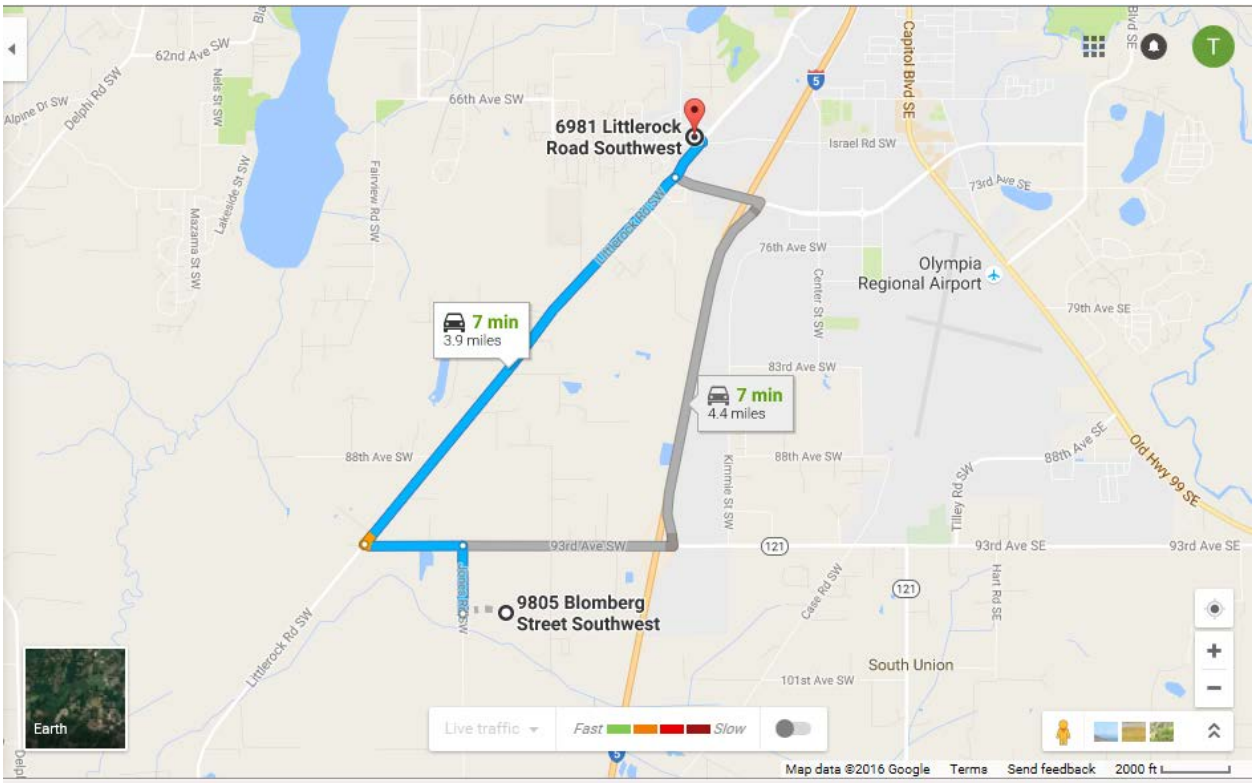


A 9805 Blomberg St SW, Olympia, WA 98512

	1. Head **north** on **Blomberg St SW** toward **93rd Ave SW** About 54 secs	go 0.4 mi total 0.4 mi
↱	2. Take the 1st right onto **93rd Ave SW** About 2 mins	go 0.7 mi total 1.1 mi
5	3. Turn left to merge onto **I-5 N** About 5 mins	go 4.8 mi total 5.8 mi
101	4. Take exit **104** to merge onto **US-101 N** toward **Aberdeen/Port Angeles** About 2 mins	go 1.7 mi total 7.6 mi
↗	5. Take the **Black Lake Blvd** exit toward **W Olympia**	go 0.4 mi total 8.0 mi
↱	6. Keep right at the fork, follow signs for **West Olympia** and merge onto **Black Lake Blvd SW**	go 0.2 mi total 8.1 mi
↰	7. Turn left onto **Cooper Point Rd SW** About 52 secs	go 0.4 mi total 8.5 mi
↰	8. Turn left onto **Capital Mall Dr SW** About 2 mins	go 0.6 mi total 9.1 mi
↱	9. Turn right	go 312 ft total 9.2 mi
↰	10. Turn left Destination will be on the right	go 75 ft total 9.2 mi

B **Capital Medical Center**
3900 Capitol Mall Dr SW, Olympia, WA 98502

Attachment C
Directions to Urgent Care Center



9805 Blomberg Street Southwest

Olympia, WA 98512

1. Head north on Jones Rd SW toward 93rd Ave SW
2. Turn left onto 93rd Ave SW
3. Turn right onto Littlerock Rd SW
4. At the traffic circle, take the 2nd exit and stay on Littlerock Rd SW
5. At the traffic circle, take the 3rd exit onto 70th Ave SW
   Destination will be on the right

6981 Littlerock Road Southwest

Tumwater, WA 98512

ATTACHMENT 2

Sampling and Analysis Plan

LANDAU ASSOCIATES

SAMPLING AND ANALYSIS PLAN / QUALITY ASSURANCE PROJECT PLAN

Webster Nursery
Tumwater, Washington

April 14, 2023

Prepared for

Washington State Department of Natural Resources
9805 Blomberg Street Southwest
Olympia, Washington

TACOMA
2107 South C Street, Tacoma, WA 98402 T 253.926-2493

landauinc.com

Sampling and Analysis Plan/Quality Assurance Project Plan
Webster Nursery
9805 Blomberg Street Southwest
Tumwater, Washington

This document was prepared by, or under the direct supervision of, the technical professionals noted below.

Document prepared by: Sierra Mott — Primary Author — Sierra Mott

Document reviewed by: Katie M. Gauglitz — Quality Reviewer — Katie Gauglitz, LG

Date:	April 14, 2023
Project No.:	0774006.040
File path:	Document4
Project Coordinator:	KJG

LANDAU ASSOCIATES

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TABLE OF CONTENTS

TABLES

APPENDICES

LIST OF ABBREVIATIONS AND ACRONYMS

AR ..... Analytical Resources, LLC
CACR ..... Cleanup Action Completion Report
CAP ..... Cleanup Action Plan
CLP ..... Contract Laboratory Program
CMP ..... Compliance Monitoring Plan
COC ..... chain-of-custody
CUL ..... cleanup level
DQI ..... data quality indicator
DQO ..... data quality objective
Ecology ..... Washington State Department of Ecology
EDD ..... electronic data deliverable
EIM ..... Environmental Information Management
ELAP ..... Environmental Laboratory Accredited Program
EPA ..... US Environmental Protection Agency
HASP ..... Health and Safety Plan
HE ..... heptachlor epoxide
Landau ..... Landau Associates, Inc.
LCS ..... laboratory control sample
LCSD ..... laboratory control sample duplicate
LL ..... low-level
µg/L ..... micrograms per liter
MQO ..... measurement quality objective
MS ..... matrix spike
MSD ..... matrix spike duplicate
MTCA ..... Model Toxics Control Act
QA ..... quality assurance
QAPP ..... quality assurance project plan
QC ..... quality control
RAWP ..... remedial action work plan
RPD ..... relative percent difference
Site ..... Webster Nursery site
SAP ..... sampling and analysis plan
SOP ..... standard operating procedure
SQL ..... structure query language
WAC ..... Washington Administration Code

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1.0 INTRODUCTION

This Sample and Analysis Plan/Quality Assurance Project Plan (SAP/QAPP) describes field sampling and laboratory analytical procedures that will be followed during completion of confirmational monitoring at the Webster Nursery site (Site) located south of Tumwater, Washington. Soil and groundwater at the Site have been affected by a historical release of organochlorine pesticides from an underground storage tank. The remedial action completed in 2018 consisted of soil removal and confirmation soil sampling; groundwater sampling is ongoing. A detailed description of the Site and cleanup is provided in the Cleanup Action Completion Report (CACR; Landau 2020).

The purpose of this plan is to provide sampling and analysis methodologies consistent with accepted procedures that will maintain accuracy, reproducibility, and comparability of data during ongoing groundwater sampling events. Ongoing groundwater monitoring is presented in the Compliance Monitoring Plan (CMP; Landau 2023). This SAP/QAPP has been prepared in accordance with the requirements of Washington Administrative Code (WAC) 173-340-820 to support the tasks specified in the Washington State Department of Ecology (Ecology) Webster Nursery Cleanup Action Plan (CAP; Ecology 2016). This SAP/QAPP also references the Site Health and Safety Plan (HASP) presented in Attachment 1 of the CMP.

2.0 PROJECT ORGANIZATION AND RESPONSIBILITY

The responsibilities of key project personnel are defined below.

2.1 Management Responsibilities

Katie Gauglitz, Landau Associates, Inc. (Landau) Project Manager

The project manager will have overall responsibility for project implementation consistent with the approved remedial action work plan (RAWP) (Landau 2017) and will be responsible for maintaining quality assurance (QA). Tasks include:

- Prepare and review the CMP, SAP/QAPP, and other key project plans
- Coordinate field activities
- Monitor project activity and quality
- Provide regulatory and technical consulting.

2.2 Quality Assurance Responsibilities

Danille Jorgensen and Kristi Schultz, Landau Data Specialists

The data specialists will be responsible for the management and integrity of analytical and field data generated for this project. Tasks include the following:

- Laboratory coordination and oversight
- Verification and validation of analytical data in accordance with this SAP/QAPP, Landau standard operating procedures (SOPs,) and US Environmental Protection Agency (EPA) Contract Laboratory Program (CLP) guidelines as applicable
- Management and maintenance of the project's structure query language (SQL) server database, which uses the EarthSoft EQuIS™ data management system
- Data queries and reporting from the EQuIS database
- Submittals to Ecology's Environmental Information Management (EIM) database
- Advising on data corrective action procedures.

2.3 Laboratory Responsibilities

Analytical Resources, LLC (AR) laboratory in Tukwila, Washington, is an Ecology-accredited laboratory and will perform groundwater analyses and related analytical services in support of cleanup activities described herein. In order to identify detections above the groundwater cleanup level (CUL; 0.00481 micrograms per liter [µg/L]), groundwater monitoring analyses will be performed using the EPA 8081B low-level (LL) method.

2.4 Field Responsibilities

Samantha Lindstrom, Landau Field Lead

The field lead will be responsible for leading and coordinating field activities including documentation, sampling, and sample handling. The field lead will report directly to the Landau project manager. Tasks include the following:

- Coordinating with the Landau project manager
- Coordinating and managing field and laboratory activities, including sampling
- Documenting and reviewing field data including field measurements and monitoring
- Following the schedule of work
- Coordinating and overseeing subcontractors.

3.0 QUALITY ASSURANCE

This section presents the QA and quality control (QC) objectives and processes including data quality objectives (DQOs), measurement quality objectives (MQOs), data quality indicators (DQI), and QC procedures for field and laboratory work.

3.1 Data Quality Objectives

DQOs specify the environmental decisions that the data will support, and the corresponding level of datum quality required to ensure decisions are based on sound scientific data. The DQOs for this project are to collect data in support of the selected remedial action as detailed in the 2016 CAP, which is being implemented to remove heptachlor epoxide (HE) concentrations in shallow water following excavation of HE-affected soil near the seasonal water table. While HE is the primary chemical of concern at the Site, groundwater samples will be analyzed for organochlorine pesticides by EPA Method 8081B LL. Data will be compared to the Model Toxics Control Act (MTCA) Method B CULs, as listed in Table 1 of this plan.

3.2 Data Quality Indicators

DQIs are used to establish quality objectives and are discussed in detail below. A summary of DQIs and their associated MQOs is presented in Table 2.

3.2.1 Precision

Precision is a measure of variability in the results of replicate measurements due to random error (Ecology 2004). Precision is best expressed in terms of the standard deviation or relative percent difference (RPD). QC sample types that can be used to evaluate precision include field and laboratory duplicates, matrix spike duplicates (MSD), and laboratory control sample duplicates (LCSD). The precision of duplicate measurements will be expressed as an RPD, which is calculated by dividing the absolute value of the difference of the two measurements by the average of the two measurements and expressing as a percentage. The formula for RPD calculation is shown below:

$$\mathrm{RPD} = \left[\frac{|\mathrm{D1} - \mathrm{D2}|}{[(\mathrm{D1} + \mathrm{D2}) \div 2]}\right] \times 100\%$$

Where:
D1 = first measurement value and
D2 = second measurement value (duplicate)

3.2.2 Accuracy

Accuracy is a combination of precision and bias, in that it represents the degree to which a measured value represents the known value (Ecology 2004). Accuracy is expressed as the percent recovery of spiked samples (matrix spike [MS], laboratory control sample [LCS], and surrogate spike). The general formula used to calculate percent recovery is shown below; for MS/MSD percent recovery the result from the unspiked sample is taken into account in the formula:

$$\%R = \left[\frac{SSR}{C_s}\right] \times 100\%$$

Where:
%R = Percent Recovery
SSR = Spiked Sample Result
C_s = Concentration of the Spike Added

3.2.3 Representativeness

Representativeness is an indicator of how accurately a result reflects the desired characteristic(s) of a defined population, accounting for both temporal and spatial variability (Ecology 2004). Representativeness qualitatively describes how well the analytical data characterize an area of concern. Representativeness is largely determined by the sampling design; analytical parameters for use in its evaluation include method-specified holding times and preservation requirements, and matrix heterogeneity. The sampling design for this project is discussed in Section 7.2.

3.2.4 Comparability

Comparability is the "degree of confidence with which one data set can be compared to another" (EPA 2004). QC procedures and MQOs as stated in this plan will provide for measurements that are consistent and representative of the media and conditions measured.

3.2.5 Completeness

Completeness is a measure of "the amount of valid data obtained from a measurement system compared to the amount that could be expected to be obtained under normal conditions" (EPA 1988). Field completeness is calculated as the number of actual samples collected divided by the number of planned samples. Analytical completeness is calculated as the number of valid data points divided by the total number of data points requested. Data points are considered invalid if they are rejected during data validation. The data validation approach for this project is provided in Section 5.0.

3.3 Quality Control Procedures

This section describes QC procedures, which will be implemented in the field and in the laboratory.

3.3.1 Field Quality Control Procedures

QC procedures to be implemented in the field include preventative maintenance/calibration of field instruments, sampling, documentation, and custody procedures.

3.3.1.1 Preventative Maintenance/Calibration Procedures

Field instruments will be properly operated, calibrated, and maintained by qualified personnel according to the manufacturer's guidelines and recommendations. Periodic schedules for preventive maintenance of any field instruments used during the project, including equipment testing, parts replacement, and general cleaning will be followed according to the manufacturer's instructions. Field equipment

performance will be evaluated against check standards and calibration blanks, as appropriate, for each parameter before use and at least once during a sampling day or when meter drift is suspected.

Documentation of routine and special preventive maintenance and calibration information will be maintained in a field or laboratory logbook or reference file and will be available upon request. Each maintenance and calibration logbook entry will include the date and initials of the individual performing the activity.

3.3.1.2 Sampling, Documentation, and Custody Procedures

Groundwater samples submitted to the analytical laboratory for analysis will be collected in the appropriate sample containers provided by the laboratory. The samples will be preserved by cooling to a temperature of less than 6 degrees Celsius and, as required, by the analytical method. Sample extraction and analysis will be performed by the analytical laboratory within the recommended holding times. Sample containers, preservatives, and holding times for each chemical analysis are presented in Table 3.

3.3.2 Laboratory Quality Control Procedures

Laboratory analyses for all constituents will be conducted by a laboratory that is certified through the Environmental Laboratory Accreditation Program (ELAP). The laboratory is required to maintain current certification through the duration of time they are performing analytical work for this project. This section describes the QC procedures to be implemented by AR in Tukwila, which is the selected analytical laboratory.

3.3.2.1 Analytical Methods and Reporting Limits

Groundwater samples collected during confirmational monitoring events will be analyzed for organochlorine pesticides by EPA Method 8081B LL. The laboratory shall be qualified to perform the analyses using standard, documented laboratory analytical procedures. All analytical work shall be performed in accordance with this plan, and AR's Quality System Manual.

Reporting limit goals and CULs for each constituent are identified for each analysis. These are only goals because instances may arise where high sample concentrations, non-homogeneity of samples, or matrix interferences preclude achieving the desired reporting limits and associated QC criteria. If this occurs, the laboratory will report the reason(s) for deviations from these reporting limits or non-compliance with QC criteria.

3.3.2.2 Instrument Calibration and Maintenance

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

schedules contained in the EPA methods and in the equipment manufacturer's instructions will be followed.

3.3.2.3 Documentation

Analytical data will be provided by the laboratory in an electronic (Adobe® PDF) report format and an electronic data deliverable (EDD). Both laboratory deliverables will be saved in the project folder, which is on a secure server that is routinely backed up. Landau uses EQuIS environmental data management software for querying and reporting analytical data. Project EDDs will be reviewed and compared to the laboratory report for QA/QC and completeness and then loaded to the project's EQuIS database. Laboratory data reports for this project will be an EPA Tier II equivalent and, at a minimum, will include the following:

- Both field and laboratory sample identification number
- Case narrative, including adherence to prescribed protocols, non-conformity events, corrective measures, and/or data deficiencies
- Sample analytical results
- The sample date, the date it was received at the laboratory, and the date that it was extracted and/or analyzed
- The quantified concentration
- The method reporting limit
- Units for reporting
- Laboratory QC sample results (including date and time of analysis, method, and acceptability criteria), such as:
  - Data qualifiers assigned by the laboratory, with definitions presented in each report
  - Surrogate recoveries
  - MS/MSD results
  - LCS/LCSD results
  - Laboratory duplicate results
  - Blank results
- Sample custody (including signed, original chain-of-custody [COC] records, and documentation of condition of custody seals)
- ELAP certification number and method listing.

Upon receipt of laboratory data, the Landau data specialist and project manager will review the data for completeness and format. If any error is noted in the laboratory report, the laboratory will be informed and appropriate corrective action will be performed, including review of raw data, assigning a data qualifier to the sample result, and/or reanalysis of the sample. For minor corrections (such as misspelled sample names), the individual making the correction shall cross a line through the error, enter the correct information, and initial and date the correction.

4.0 SAMPLE HANDLING, DOCUMENTATION, AND CUSTODY PROCEDURES

Sample handling and documentation procedures are summarized in this section. These procedures and protocols for sampling activities were developed to meet the DQOs of the CAP and are based on proven and acceptable sampling methods as established by EPA guidance documents, Washington State regulations, and professional judgment. Sample preservation and storage requirements are provided in Table 3.

4.1 Sample Handling and Transport

Sample collection procedures and protocols for each sampling activity are described in detail in Section 7.2 of this SAP/QAPP. Sample containers, preservatives, and holding times (Table 3) will vary according to the type of sample collected and the analytical method to be used. Strict precautions will be taken to adhere to maximum sample holding times. Each sample will be documented, labeled, and identified as noted below.

4.1.1 Sample Packaging and Shipping

The following procedures will be followed:

- Samples will be packaged and transported in a manner that protects the integrity of the sample and prevents detrimental effects due to the possible hazardous nature of samples.
- Samples will be placed on sealed ice that is double-bagged using Ziploc® bags in coolers, immediately after collection. At the end of each day, samples will be inventoried and sent to the analytical laboratory in a lined cooler containing ice.
- Samples will be packaged carefully to avoid breakage or cross contamination using sufficient packing material. The COC forms accompanying the samples to the laboratory will be placed inside a separate plastic Ziploc bag and taped inside the cooler lid.
- The samples will generally be delivered to the laboratory in person or shipped by a commercial overnight carrier. If shipped using an overnight carrier, the shipping container will be taped shut with strapping tape and custody seals.

4.2 Sample Custody and Documentation

Sample documentation includes field notes, field sampling forms, field photographs, and container labels. Sample custody procedures include field, shipment, transfer, and laboratory custody procedures.

4.2.1 Documentation

Documentation necessary to meet the field QA objectives for this project includes:

- Field notebooks (logbooks) in which general field observations and activities are recorded
- Field sampling forms specific to sampling (COC, etc.)
- Sample container labels.

If an error is made on any field documentation, corrections will be made by drawing a single line through the error and entering the correct information. Whenever possible, errors will be corrected by the person who made the entry. Corrections will be initialed, dated, and, if necessary, a footnote explaining the correction will be included. The erroneous information will not be discarded. All field documentation and project records will be filed to prevent loss, damage, or alteration. Access to any archived project files or laboratory data will be controlled to maintain integrity of the documentation.

4.2.1.1 Field Notebook

Daily field documentation of individual field tasks will be recorded to provide sufficient data and observations to enable participants to reconstruct events that occurred during the project and to refresh the memory of the field personnel if called upon to give testimony during legal proceedings. Corrections will be made as explained above. Information documented on field sampling forms need not be repeated in the field notes; however, reference must be made in the field notes to the field forms.

4.2.1.2 Field Sampling Forms

To aid in achieving complete data, field-sampling forms (e.g., COC record, sample collection form, etc.) will be used to document sampling activities.

4.2.1.3 Photographs

Photographs may be taken in the field to document sampling locations and conditions. When taken, the time and date of photographs will be recorded in field notes and the photograph archived as an electronic file for future use.

4.2.2 Sample Custody

The primary objective of sample custody is to create an accurate record that can be used to trace the possession and handling of samples so their quality and integrity can be documented and maintained from collection until completion of all required analyses. Adequate documentation of sample custody will be achieved by means of the COC record initially completed by the sampler, and thereafter signed by each individual who accepts custody of the sample. A sample will be considered to be in custody under the following conditions:

- The handler has the sample in physical possession
- The handler has the sample in view
- The sample is locked or secured in a locked container or otherwise sealed so that tampering will be evident
- The sample is kept in a secured area, restricted to authorized personnel only.

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

4.2.2.1 Field Custody Procedures

The following field custody procedures will be followed:

- As few persons as possible will handle samples
- Sample bottles will be obtained new or pre-cleaned from the laboratory performing the analyses
- The person collecting the sample will be responsible for completing the COC record and for the care and custody of collected samples until they are transferred to another person under standard COC procedures
- The Landau field representative will oversee field custody procedures during the fieldwork and in the event of non-compliance, will determine if corrective action is required.

4.2.2.2 Sample Shipment Custody Procedures

The following sample shipment custody procedures will be followed:

- The coolers in which the samples are shipped will be accompanied by the COC record identifying their contents. The original record and laboratory copy will accompany the shipment (sealed inside the shipping container). The other copy will be distributed, as appropriate, to the Landau project manager.
- If the samples are to be shipped via a commercial carrier, shipping containers will be sealed with custody seals for shipment to the laboratory. The method of shipment, name of courier, and other pertinent information will be entered in the remarks section of the COC record.

4.2.2.3 Transfer of Custody

When samples are transferred, the individual(s) relinquishing and receiving the samples will sign the COC record and document the date and time of transfer. The person who collected the sample(s) will sign the form in the first signature space. If the samples are shipped via commercial carriers, the COC records will be sealed inside the sample container before delivery and the custody signature will be from the person who receives the samples from the carrier at its final destination. Each person taking custody will evaluate the integrity of the shipping container seal and note any observations on the COC record. Project documentation of sample custody will be verified during regular review of the laboratory data package(s).

4.2.2.4 Laboratory Custody Procedures

A designated sample custodian at the laboratory will accept custody of the shipped samples and certify that the sample identification numbers match those on the COC record. The custodian will log the sample identification numbers and requested analyses in accordance with laboratory QA/QC protocols. The laboratory will maintain sample security and custody throughout the analytical process.

5.0 DATA REDUCTION, VALIDATION, AND REPORTING

Analytical reports from the laboratory for this project will be accompanied by QC results and any other necessary analytical information to enable reviewers to determine the quality of the data. The Landau quality reviewer for this project is responsible to the Landau project manager for conducting checks for internal consistency, transmittal errors, laboratory protocols, and for complete adherence to the QC elements in this SAP/QAPP. The Landau data specialist will be responsible for conducting checks for adherence to the QC elements specified in this SAP/QAPP and for performing an EPA-equivalent Level IIA validation, the components of which are listed below. Level IIA validation is performed primarily from information contained on sample result forms and sample related QC summary forms; raw data is not reviewed during this process:

- Case Narrative
- COC documentation
- Sample receipt and condition documentation
- Sample summary or equivalent
- Method summary or equivalent
- Sample results with date, units, and reporting limits
- Laboratory data qualifier definitions
- CLP equivalent forms
- Method/laboratory blank results
- Sample surrogate results
- Field QC results
- LCS/LCSD results
- MS/MSD results
- Lab duplicate results.

Data validation will be performed in accordance with applicable sections of the EPA CLP *National Functional Guidelines for Organic Data Review* (EPA 2014), analytical methods, Landau data validation SOPs, and this SAP/QAPP. If significant non-conformities are found, additional laboratory data may be evaluated. Corrective action, as described in Section 6.0, will be determined by the Landau project manager, and may include any of the following responses:

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

Data qualification arising from data validation activities will be described in the reports summarizing the results of the supplemental investigation and compliance monitoring.

6.0 CORRECTIVE ACTIONS

Corrective action will be required if there are deviations from the methods or QA requirements established in this SAP/QAPP or if there are equipment or analytical malfunctions. Corrective action procedures will be implemented based on the type of unacceptable data and will be developed on a case-by-case basis. The following corrective actions may be included:

- Altering procedures in the field
- Using a different batch of sample containers
- Performing an audit of field or laboratory procedures
- Reanalyzing samples (if holding times allow)
- Resampling
- Evaluating sampling and analytical procedures to determine possible causes of the discrepancies
- Accepting the data with no action, acknowledging the level of uncertainty
- Qualification of the data
- Rejecting the data as unusable.

During field operations and sampling procedures, the field personnel will be responsible for conducting and reporting required corrective action. A description of any corrective action taken will be entered in the daily field notebook. If field conditions do not allow for conformance with this SAP/QAPP, the Landau project manager will be consulted immediately. For any corrective action or field condition resulting in a revision of this SAP/QAPP, the Landau project manager will authorize changes or exceptions to the SAP/QAPP, as necessary and appropriate.

During laboratory analysis, the laboratory QA officer will be responsible for taking required corrective actions in response to equipment malfunctions. If an analysis does not meet data quality goals outlined in this SAP/QAPP, corrective action generally will follow the guidelines in the EPA analytical methods noted in this SAP/QAPP and the EPA guidelines for data validation (EPA 1999; 2004, respectively). If analytical conditions are such that non-conformance with this SAP/QAPP is indicated, the Landau project manager will be notified as soon as possible so that any additional corrective actions can be taken.

The Landau project manager ultimately is responsible for implementation of appropriate corrective action and maintenance of a complete record of QC issues and corrective actions.

7.0 FIELD INVESTIGATION PROCEDURES

Field activities are expected to include groundwater sampling. Procedures for sampling, sample handling, and documentation are described below.

7.1 Monitoring Wells

Current monitoring locations include wells SW-10R and SW-11R. Well and boring logs for SW-10R and SW-11R are included in Appendix A.

7.1.1 Well Decommissioning

In the future, site wells (SW-1, SW-9R, SW-10R, SW-11R, SW-12, SW-13, SW-14, SW-15, and SW-16) may be decommissioned according to regulation (WAC 173-160-460) following Ecology confirming the cleanup is complete. Wells will be decommissioned by pressure grouting or filling with bentonite chips.

7.1.2 Well Redevelopment

In the event of observed damage to a well, elevated turbidity, or at the discretion of Ecology or the Landau project manager, a well may be redeveloped using the following procedures:

1. The depth to the bottom of the well shall be measured prior to beginning development.
2. Use a weighted 1.5-inch-diameter polyvinyl chloride or stainless-steel bailer with a ceramic-ball check valve (or equivalent) to remove sand and fines from the bottom of the well casing. Carefully lower the bailer to the bottom of the well and gently raise and lower it to suspend the fines in the water column. Withdraw the bailer from the well and pour out (rinse if necessary) the fines and purged water. Repeat until no more sediment is retrieved from the bottom of the well.
3. Surge the well screen interval with the bailer or a surge block several times.
4. Pump water from the well using a centrifugal pump or airlift. Raise the pump intake incrementally to remove turbidity through the entire screened interval. Periodically record the pumping rate and the turbidity of discharged water. Continue pumping water from the well until the turbidity is significantly reduced.
5. Again, surge the well with the bailer or a surge block.
6. Measure and record the total depth of the well. Evaluate whether fines are present in the bottom of the casing.
7. Pump again and continue pumping until the well yields water with a turbidity of 10 nephelometric turbidity units or less, unless Ecology agrees that it is not practical to continue development to reach this criterion. If water was added to the well during drilling, a minimum of 200 percent of the volume of water added to the well must be purged during development. Record the final turbidity on the well development log.

Purge water shall be contained on-site and handled as described in Section 3.2.1.7 of the RAWP.

7.1.3 Well Development Logs

Well development logs will contain the following information:

- Well location and designation
- Screened interval and casing diameter
- Date and time of development
- Weather conditions
- Static water levels measured before and after development
- Total depth of well before and after development
- Volume of water in the well casing
- Descriptions of development equipment (pumps, surge blocks, hose/tubing diameter, etc.)
- Equipment calibration data
- A record showing water volumes purged from the well, purge rates, water quality parameter measurements (turbidity), and presence of fines in the bottom of the well.

7.2 Sampling

This section documents field procedures that will be used to collect confirmational groundwater samples. Any variation or modification to these procedures that may become necessary will be coordinated with Ecology and documented in field records.

7.2.1 Groundwater Monitoring

The existing Site groundwater monitoring well network includes nine wells. Of the nine wells, two (SW-10R and SW-11R) will be sampled as part of the confirmational groundwater quality monitoring program for pesticides. Groundwater quality samples are collected using a peristaltic pump with dedicated tubing stationed at each well. Field parameters are collected while the well is being purged using a YSI multi-parameter probe. Purge water from sampling is collected in a 5-gallon bucket and is transported to and contained in onsite drums provided by Washington State Department of Natural Resources.

Groundwater data are screened using the current MTCA Method B groundwater CUL for applicable constituents. The primary constituent of concern at the Site is HE. Groundwater samples will be analyzed for organochlorine pesticides by EPA Method 8081B LL in order to achieve reporting limits at the HE CUL of 0.0048 µg/L. It is anticipated that groundwater monitoring samples will be analyzed by AR.

7.2.2 Sampling Designation and Labeling

7.2.2.1 Groundwater Sample Designation

Each groundwater sample collected during groundwater monitoring will be identified by a unique sample designation, which will include the well name followed by the date of collection. For example, sample designation SW-10R-20230607 identifies a groundwater sample collected from well SW-10R on June 7, 2023.

7.2.2.2 Sample Container Labels

Each sample container will be labeled and sealed immediately after the sample is placed in the container. Sample container labels will be filled out using waterproof ink and will be firmly affixed to the sample containers. The sample container label will contain the following information:

- Monitoring well designation
- Project name
- Date and time of collection
- Name of sampler(s)
- Preservation (if applicable).

Additional identifiers may be added, as necessary, based on the specific sampling activity. Other identification information will be recorded in the field notes and on appropriate sample collection forms. Field QC samples (blind duplicates) will be coded as individual samples and identified in the field notes and on sample collection forms.

7.3 Decontamination Procedures

Decontamination procedures are designed to remove trace-level contaminants from sampling equipment and prevent cross-contamination between samples. Sampling equipment will be decontaminated before collecting each sample to avoid cross-contamination. Decontaminated sampling equipment will be handled in a manner that minimizes contact with potentially contaminated surfaces. Nitrile gloves will be worn when handling groundwater samples. New disposable gloves will be used for collecting each sample.

7.3.1 Sampling Equipment

Decontamination procedures for sampling equipment will be used to minimize the possibility of cross-contamination. Sampling equipment that comes in contact with potentially contaminated material will be decontaminated before and after each use. Decontamination of sampling equipment will consist of the following steps and will be documented on the sample collection form:

1. Initial tap water rinse to remove large particles, if applicable
2. Alconox® and tap water wash
3. Tap water rinse

4. Deionized or distilled water rinse.

7.3.2 Personnel

Personnel decontamination procedures depend on the level of protection specified for a given activity. The HASP (Appendix B of the RAWP) identifies the appropriate level of protection for each type of fieldwork involved in the project, as well as appropriate decontamination procedures.

SMM/KMG/kjg
[\\TACOMA3\PROJECT\774\006 WEBSTER\R\SAP-QAPP\2023_APRIL\LANDAU_ WEBSTER SAPQAPP]

8.0 REFERENCES

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Ecology. 2016. Agreed Order No. DE 13181 In the Matter of Remedial Action by Washington State Department of Natural Resources. Washington State Department of Ecology. August 9.

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Table 1
Reporting Limit Goals
Sampling and Analysis Plan/Quality Assurance Project Plan
Webster Nursery
Tumwater, Washington

Analyte	CAS RN	Groundwater	
		CUL (µg/L)	RL (a) (µg/L)
4,4'-DDD	72-54-8	--	0.00125
4,4'-DDE	72-55-9	--	0.00125
4,4'-DDT	50-29-3	--	0.00125
Aldrin	309-00-2	--	0.000625
alpha-BHC	319-84-6	--	0.000625
alpha-Chlordane	5103-71-9	--	0.000625
beta-BHC	319-85-7	--	0.000625
beta-Chlordane	5103-74-2	--	0.000625
Chlordane	57-74-9	0.25	0.00500
delta-BHC	319-86-8	--	0.000625
Dieldrin	60-57-1	--	0.00125
Endosulfan I	959-98-8	--	0.000625
Endosulfan II	33213-65-9	--	0.00125
Endosulfan Sulfate	1031-07-8	--	0.00125
Endrin	72-20-8	--	0.00125
Endrin Aldehyde	7421-93-4	--	0.00125
Endrin Ketone	53494-70-5	--	0.00125
gamma-BHC (Lindane)	58-89-9	--	0.000625
Heptachlor	76-44-8	0.0194	0.000625
Heptachlor Epoxide	1024-57-3	0.00481	0.000625
Methoxychlor	72-43-5	--	0.00625
Toxaphene	8001-35-2	--	0.0625

Notes:

1. CULs are based on MTCA Method B cleanup levels.

(a) Groundwater samples are to be analyzed by AR using EPA Method 8081B LL.

Acronyms/Abbreviations:

-- = CUL is not applicable
AR = Analytical Resources, LLC in Tukwila, WA
CAS RN = chemical abstracts service registry number
CUL = MTCA Method B cleanup Level
EPA = US Environmental Protection Agency
LL = low-level
µg/L = micrograms per liter
MTCA = Model Toxics Control Act
RL = reporting limit

Table 2
Measurement Quality Objectives
Sampling and Analysis Plan/Quality Assurance Project Plan
Webster Nursery
Tumwater, Washington

DQI	QC Sample or Activity Used to Assess MQO	MQO	Sampling or Analytical DQI
Groundwater Samples Analyzed for Organochlorine Pesticides by EPA Method 8081B Low Level (AR)			
Representativeness	Cooler Temperature	< 6°C	S
Bias	Surrogates	Recoveries within laboratory-specified control limits	A
Accuracy	LCS/LCSD	Recoveries within laboratory-specified control limits	A
Method performance for matrix, bias	MS/MSD	Recoveries within laboratory-specified control limits	S&A
Precision	LCS/LCSD and MS/MSD	RPDs within laboratory-specified control limits	A
Precision	Field Duplicates	RPD <25%	S&A
Bias/Contamination	Method Blank	Target analytes not detected at concentrations > 1/2 the RL	S&A
Analytical Completeness	Number of usable (not rejected) results out of total number of results	90%	S&A
Field Completeness	Number of samples collected out of planned samples	95%	S

Abbreviations/Acronyms:

% = percent
A = analytical
AR = Analytical Resources, LLC in Tukwila, WA
°C = degrees Celsius
DQI = data quality indicator
EPA = US Environmental Protection Agency
LCS = laboratory control spike
LCSD = laboratory control spike duplicate
MQO = measurement quality objective
MS = matrix spike
MSD = matrix spike duplicate
QC = quality control
RL = reporting limit
RPD = relative percent difference
S = sampling

Table 3
Sample Containers, Preservatives, and Holding Times
Sampling and Analysis Plan/Quality Assurance Project Plan
Webster Nursery
Tumwater, Washington

Matrix	Method	Container	Preservative	Holding Time (a)	Minimum Mass/Volume	Laboratory Performing Analyses
Groundwater	Pesticides by EPA 8081B LL	1-L amber glass	<6°C, $Na_2S_2O_3$	7 days/40 days	1 L	AR

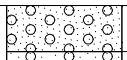
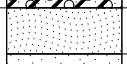
Note:
(a) Time from sample collection to extraction/Time from sample extraction to analysis.

Acronyms/Abbreviations:
AR = Analytical Resources, LLC
°C = degrees Celsius
EPA = United States Environmental Protection Agency
g = grams
L = liter
LL = low level

APPENDIX A

SW-9R, SW-10R, and SW-11R Well Logs

Soil Classification System

MAJOR DIVISIONS			GRAPHIC SYMBOL	USCS LETTER SYMBOL[1]	TYPICAL DESCRIPTIONS [2][3]
COARSE-GRAINED SOIL (More than 50% of material is larger than No. 200 sieve size)	GRAVEL AND GRAVELLY SOIL (More than 50% of coarse fraction retained on No. 4 sieve)	CLEAN GRAVEL (Little or no fines)		**GW**	Well-graded gravel; gravel/sand mixture(s); little or no fines
				**GP**	Poorly graded gravel; gravel/sand mixture(s); little or no fines
		GRAVEL WITH FINES (Appreciable amount of fines)		**GM**	Silty gravel; gravel/sand/silt mixture(s)
				**GC**	Clayey gravel; gravel/sand/clay mixture(s)
	SAND AND SANDY SOIL (More than 50% of coarse fraction passed through No. 4 sieve)	CLEAN SAND (Little or no fines)		**SW**	Well-graded sand; gravelly sand; little or no fines
				**SP**	Poorly graded sand; gravelly sand; little or no fines
		SAND WITH FINES (Appreciable amount of fines)		**SM**	Silty sand; sand/silt mixture(s)
				**SC**	Clayey sand; sand/clay mixture(s)
FINE-GRAINED SOIL (More than 50% of material is smaller than No. 200 sieve size)	SILT AND CLAY (Liquid limit less than 50)			**ML**	Inorganic silt and very fine sand; rock flour; silty or clayey fine sand or clayey silt with slight plasticity
				**CL**	Inorganic clay of low to medium plasticity; gravelly clay; sandy clay; silty clay; lean clay
				**OL**	Organic silt; organic, silty clay of low plasticity
	SILT AND CLAY (Liquid limit greater than 50)			**MH**	Inorganic silt; micaceous or diatomaceous fine sand
				**CH**	Inorganic clay of high plasticity; fat clay
				**OH**	Organic clay of medium to high plasticity; organic silt
	HIGHLY ORGANIC SOIL			**PT**	Peat; humus; swamp soil with high organic content

OTHER MATERIALS	GRAPHIC SYMBOL	LETTER SYMBOL	TYPICAL DESCRIPTIONS
PAVEMENT		**AC** or **PC**	Asphalt concrete pavement or Portland cement pavement
ROCK		**RK**	Rock (See Rock Classification)
WOOD		**WD**	Wood, lumber, wood chips
DEBRIS		**DB**	Construction debris, garbage

NOTES:

1. USCS letter symbols correspond to symbols used by the Unified Soil Classification System and ASTM classification methods. Dual letter symbols (e.g., SP-SM for sand or gravel) indicate soil with an estimated 5-15% fines. Multiple letter symbols (e.g., ML/CL) indicate borderline or multiple soil classifications.
2. Soil descriptions are based on the general approach presented in the *Standard Practice for Description and Identification of Soils (Visual-Manual Procedure)*, outlined in ASTM D 2488. Where laboratory index testing has been conducted, soil classifications are based on the *Standard Test Method for Classification of Soils for Engineering Purposes*, as outlined in ASTM D 2487.
3. Soil description terminology is based on visual estimates (in the absence of laboratory test data) of the percentages of each soil type and is defined as follows:

Primary Constituent:	> 50%	- "GRAVEL," "SAND," "SILT," "CLAY," etc.
Secondary Constituents:	> 30% and ≤ 50%	- "very gravelly," "very sandy," "very silty," etc.
	> 15% and ≤ 30%	- "gravelly," "sandy," "silty," etc.
Additional Constituents:	> 5% and ≤ 15%	- "with gravel," "with sand," "with silt," etc.
	≤ 5%	- "trace gravel," "trace sand," "trace silt," etc., or not noted.

LANDAU ASSOCIATES

Webster Nursery
Olympia, Washington

Soil Classification System and Key

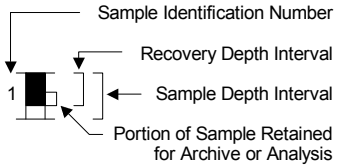
Figure
B-1
(1 of 2)

Drilling and Sampling Key

SAMPLER TYPE

Code	Description
a	3.25-inch O.D., 2.42-inch I.D. Split Spoon
b	2.00-inch O.D., 1.50-inch I.D. Split Spoon
c	Shelby Tube
d	Grab Sample
e	Single-Tube Core Barrel
f	Double-Tube Core Barrel
g	Other - See text if applicable
1	300-lb Hammer, 30-inch Drop
2	140-lb Hammer, 30-inch Drop
3	Pushed
4	Rotosonic
5	Air Rotary (Rock)
6	Wash Rotary (Rock)
7	Other - See text if applicable

SAMPLE NUMBER & INTERVAL



Field and Lab Test Data

Code	Description
PP = 1.0	Pocket Penetrometer, tsf
TV = 0.5	Torvane, tsf
PID = 100	Photoionization Detector VOC screening, ppm
W = 10	Moisture Content, %
D = 120	Dry Density, pcf
-200 = 60	Material smaller than No. 200 sieve, %
GS	Grain Size - See separate figure for data
AL	Atterberg Limits - See separate figure for data
VST	Vane Shear Test
GT	Other Geotechnical Testing
CA	Chemical Analysis

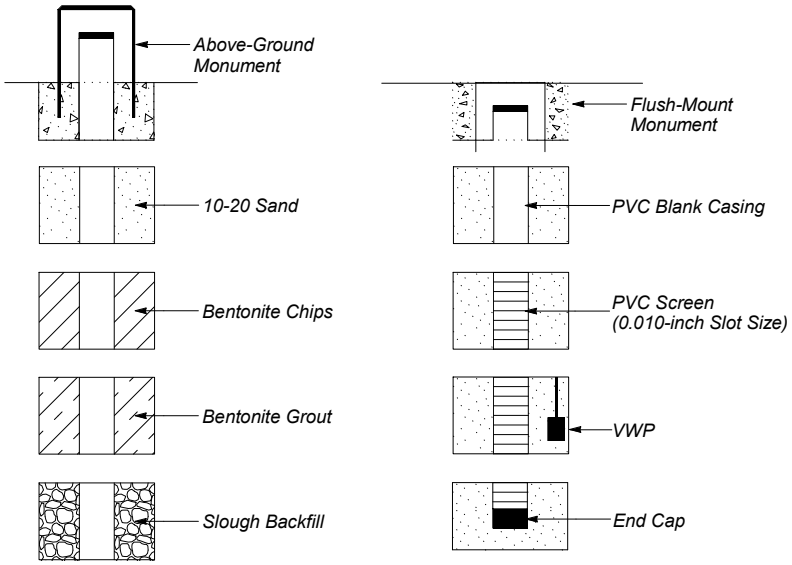
Groundwater

▽ Approximate water elevation at time of drilling (ATD).

▼ Approximate water elevation at other time(s). When multiple water levels are obtained other than ATD, only a representative range is shown. See text for additional information.

Note: Groundwater levels can fluctuate due to precipitation, seasonal conditions, and other factors.

Well Log Graphics



LANDAU ASSOCIATES

Webster Nursery
Olympia, Washington

Soil Classification System and Key

Figure B-1 (2 of 2)

SW-9R

SAMPLE DATA

SOIL PROFILE

GROUNDWATER

Drilling Method: Direct-Push

Ground Elevation (ft): Not Measured

Drilled By: Cascade Drilling Inc.

Monitoring Well Detail
(DOE#: BKR472)

Depth (ft)	Sample Number & Interval	Sampler Type	Blows/Foot	Test Data	Graphic Symbol	USCS Symbol	Soil Description	Water Level
0		d5				SM	Light brown, silty, fine to coarse SAND with gravel; no odor, no sheen (loose, moist) **(RECESSIONAL OUTWASH)**	
2		d3						
4						SP-SM	Light brown, fine to medium SAND with silt; no odor, no sheen (medium dense, moist)	
6								
8		d3				SM	Gray, silty, fine to medium SAND with occassional silt layers; no odor, no sheen; no odor, no sheen (medium dense, wet)	ATD
10							-Slightly mottled from 10.0 - 14.9 ft	
12		d3						
14								
16						ML	Gray, sandy, SILT; no odor, no sheen (medium stiff, wet)	
18								

Flush-mounted monument with locking cap

Bentonite chips

Granular bentonite

2-inch diameter, Schedule 40, PVC well casing

2-inch diameter, Schedule 40, PVC pre-packed screen (0.010-inch slot size) with 10/20 Colorado sand pack and 20/40 stainless steel mesh

Boring Completed 08/16/18
Total Depth of Boring = 16.0 ft.

Monitoring Well Completed 08/16/18
Total Depth of Monitoring Well = 15.9 ft.

Notes:
1. Stratigraphic contacts are based on field interpretations and are approximate.
2. Reference to the text of this report is necessary for a proper understanding of subsurface conditions.
3. Refer to "Soil Classification System and Key" figure for explanation of graphics and symbols.

774006.01 9/5/18 N:\PROJECTS\0774006.010.013.GPJ WELL LOG

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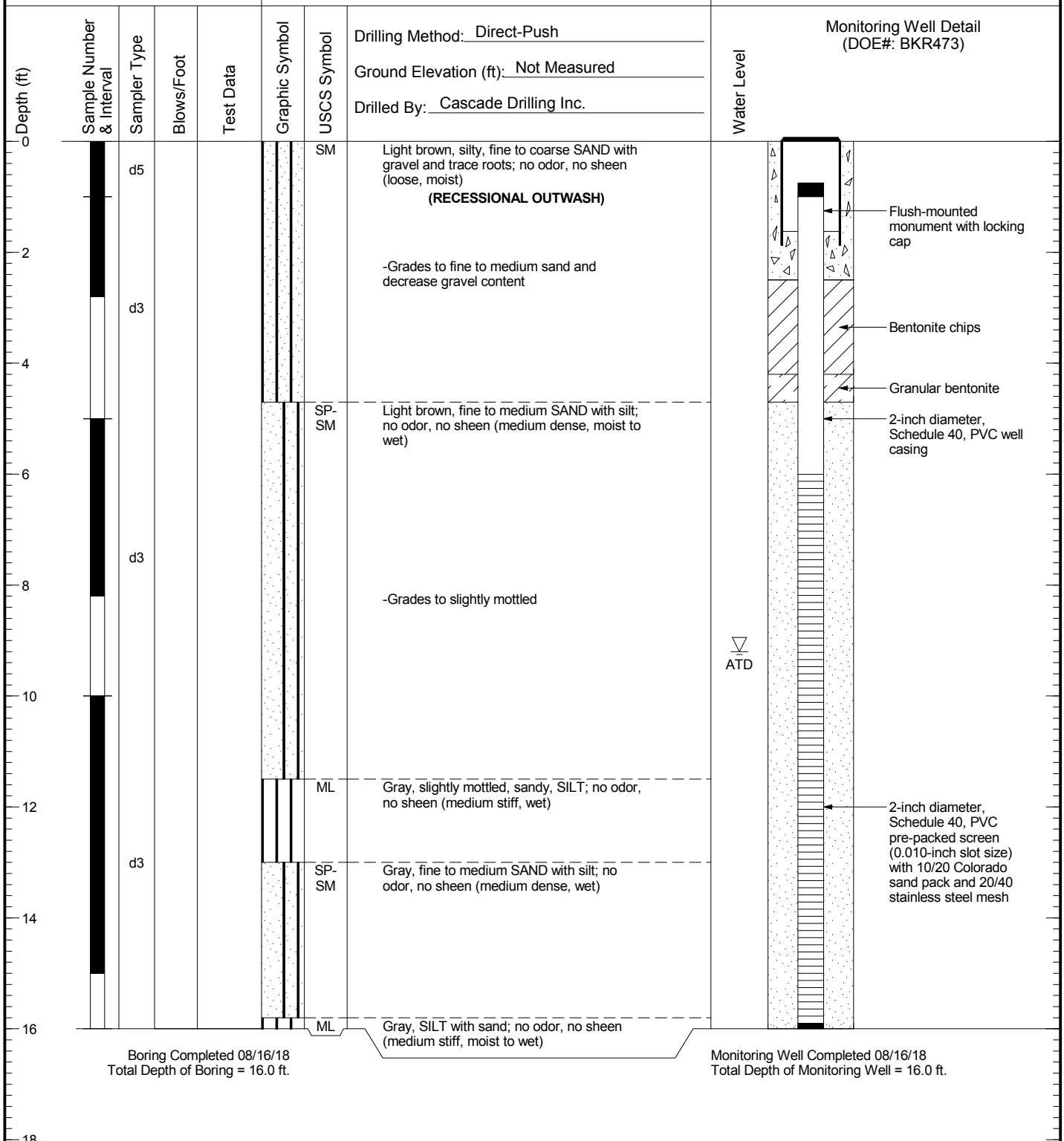
Webster Nursery
Olympia, Washington

Log of Monitoring Well SW-9R

Figure
B-

SW-10R



Boring Completed 08/16/18
Total Depth of Boring = 16.0 ft.

Monitoring Well Completed 08/16/18
Total Depth of Monitoring Well = 16.0 ft.

Notes:
1. Stratigraphic contacts are based on field interpretations and are approximate.
2. Reference to the text of this report is necessary for a proper understanding of subsurface conditions.
3. Refer to "Soil Classification System and Key" figure for explanation of graphics and symbols.

774006.01 9/5/18 N:\PROJECTS\0774006.010.013.GPJ WELL LOG

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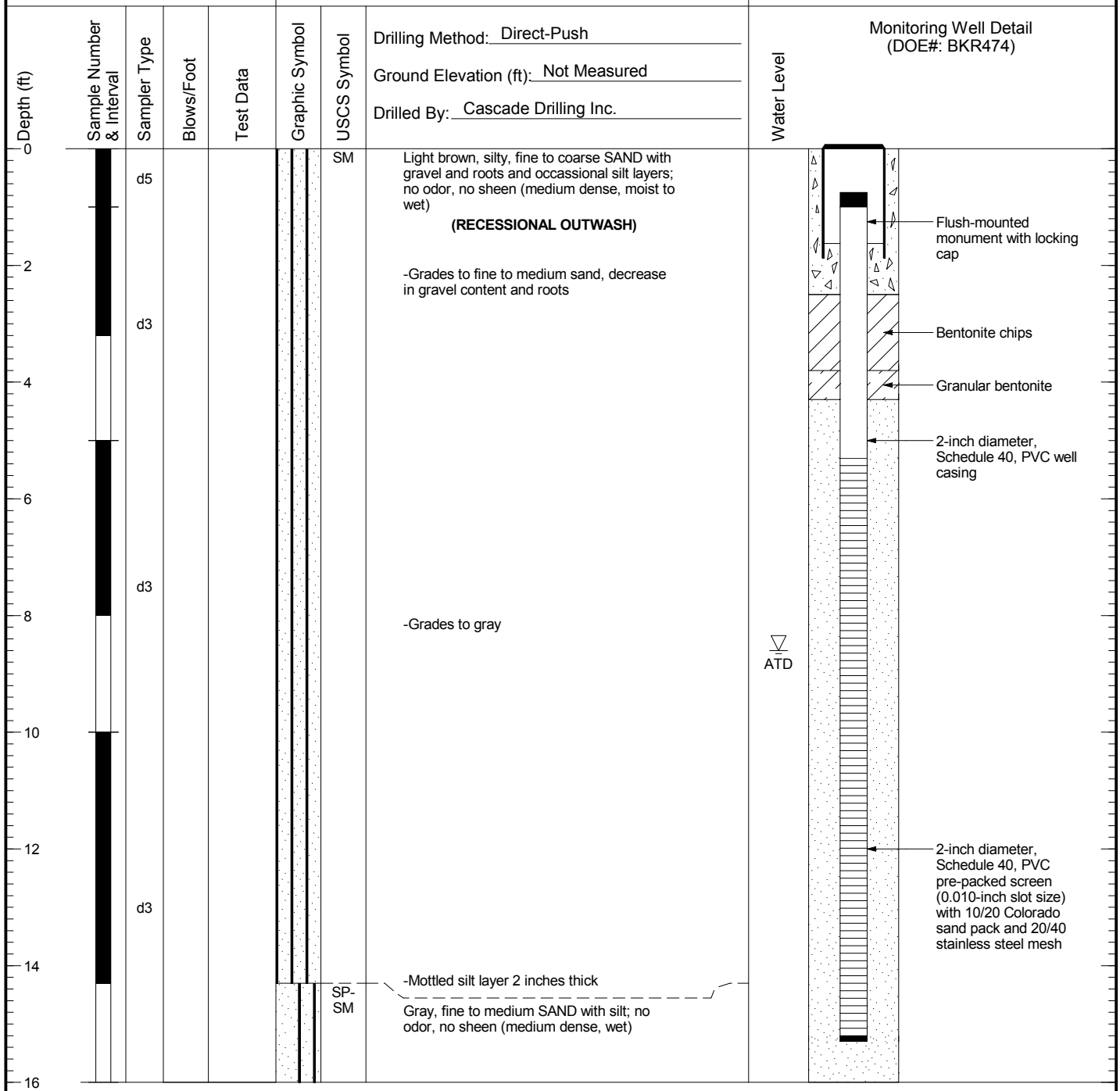
Webster Nursery
Olympia, Washington

Log of Monitoring Well SW-10R

Figure
B-

SW-11R



Boring Completed 08/16/18
Total Depth of Boring = 16.0 ft.

Monitoring Well Completed 08/16/18
Total Depth of Monitoring Well = 15.3 ft.

Notes:
1. Stratigraphic contacts are based on field interpretations and are approximate.
2. Reference to the text of this report is necessary for a proper understanding of subsurface conditions.
3. Refer to "Soil Classification System and Key" figure for explanation of graphics and symbols.

774006.01 9/5/18 N:\PROJECTS\0774006.010.013.GPJ WELL LOG

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Webster Nursery
Olympia, Washington

Log of Monitoring Well SW-11R

Figure
B-