

9 October 2019

Mr. Kenneth Thiessen
Oregon Department of Environmental Quality
700 NE Multnomah St., Suite #600
Portland, Oregon 97232

Subject: Well Decommissioning Work Plan
East Multnomah County Troutdale Sandstone Aquifer Remedy
Fairview, Oregon
ECSI No. 1479

Dear Ken:

Geosyntec Consultants (Geosyntec) and Landau Associates (LAI) have prepared this Work Plan for well decommissioning as part of the East Multnomah County (EMC) Troutdale Sandstone Aquifer (TSA) remedy being conducted jointly by Cascade Corporation (Cascade) and The Boeing Company (Boeing). The TSA remedy is being implemented under the Oregon State Department of Environmental Quality (DEQ) Consent Order No. WMCSR-NWR-96-08 (DEQ, 1997). This Work Plan provides the procedures and schedule to decommission four groundwater monitoring wells [BOP-22R(ds), BOP-60R(ds), CMW-8(dg), and CMW-10(dg)]. The locations of the wells are shown on Figure 1.

Decommissioning of these wells was recommended in the *2018 TSA Annual Report* (Geosyntec, LAI, SSPA, 2019), which was approved by DEQ on 3 July 2019 (DEQ, 2019). Decommissioning was recommended for these wells because concentrations of volatile organic compounds (VOCs) met the TSA criteria for well decommissioning over multiple rounds of sampling. Trichloroethene (TCE) is the dominant VOC by mass and continues to be used to evaluate the performance of the remedy. Water quality restoration has been achieved in the vicinity of these wells.

WELL DESCRIPTIONS

Well construction details, including well location coordinates, screened aquifer units, ground surface elevations, well screen elevations, and total boring depths, are provided in Table 1. Well location and construction information are summarized below, and boring and well construction logs are provided in Attachment 1. Surveyed elevations datum and projection are North American Datum of 1983 (NAD83), Oregon State Plane-North Zone.

- **BOP-22R(ds):** Monitoring well BOP-22R(ds) is located along the western property boundary of the Boeing facility and south of NE Sandy Boulevard. The well was installed in 2008 as a replacement to well BOP-22(ds), which had evidence of a possible leaking well seal. Replacement well BOP-22R(ds) is a flush-mount well and is constructed with 2-inch diameter, schedule 80 (SCH 80) PVC with a screen installed in the Upper TSA from 243 to 263 feet below ground surface (ft bgs). The total depth of the boring is 310 ft bgs, with the interval below the screen being backfilled with bentonite grout.
- **BOP-60R(ds):** Monitoring well BOP-60R(ds) is located on the Boeing facility property near the southwestern corner of Building 85-001 and was installed in 2010 as a replacement well to BOP-60(ds), which had evidence of possible leakage through the well seal. Replacement well BOP-60R(ds) is installed with a flush-mount protective casing and is constructed of 2-inch diameter SCH 80 PVC piping with a screened interval in the Upper TSA from 155 to 165 ft bgs. The total depth of the boring is 165.5 ft bgs.
- **CMW-8(dg):** Monitoring well CMW-8(dg) is located south of and adjacent to Interstate 84 (I-84) on Union Pacific Railroad Company property. Monitoring well CMW-8(dg) was installed in 1990 and has a flush grade protective well vault with a locking cap with 12-inch steel outer casing that extends from 2 to 60 ft bgs. Well casing is 4-inch SCH 80 PVC screened from 178 to 193 ft bgs in the Lower TSA with a 3-foot sump. The total depth of the boring is 199.1 ft bgs.
- **CMW-10(dg):** Monitoring well CMW-10(dg) is located south of and adjacent to I-84 on Union Pacific Railroad Company property, approximately 530 ft. east of CMW-8(dg). Monitoring well CMW-10(dg) was installed in 1990 and has a flush grade protective well vault with a locking cap with 10-inch outer casing that extends from 2 to 60 ft bgs. Well casing is 2.5-inch SCH 80 PVC screened from 189 to 204 ft bgs in the Lower TSA with a 2.5-foot sump. The total depth of the boring is 210 ft. bgs.

Groundwater samples were last collected in 2017 from wells BOP-22R(ds), BOP-60R(ds), and CMW-8(dg), and in 1999 from CMW-10(dg). TCE concentrations have been consistently below the laboratory reporting limit at BOP-22R(ds) since December 2009 and at CMW-8(dg) since August 2007. TCE concentrations at CMW-10(dg) have been below the cleanup level (5 micrograms per liter [$\mu\text{g/L}$]) in four of the five last monitoring events (1997-1999), while TCE concentrations at BOP-60R(ds) have consistently been below the cleanup level since sampling began in 2010. The historical VOC concentrations from the groundwater monitoring wells are summarized in Table 2.

METHODOLOGY

The Oregon Water Resources Department (OWRD) provided approval for the special standard requests to backfill in place for the four wells. The OWRD approvals are presented in Attachment 2.

Prior to decommissioning activities, the following activities will be performed:

- Perform underground utility locate survey to determine the potential presence and location of buried utilities in the well vicinity. The utility location survey will include UPRR specific requirements for notification and locating potential underground fiber optic cables for wells CMW-8(dg) and CMW-10(dg).
- Submit a well decommissioning start card, as required by OAR 690-240-0385.
- Measure the depth to water and the total depth of the well.
- Provide notification to DEQ of the schedule for field activities.

Well decommissioning procedures will be conducted in accordance with applicable Oregon Administrative Rules (OARs) outlined in OAR 690-240 using an Oregon Licensed Driller, as summarized in the following section.

Decommissioned in Place

The four groundwater monitoring wells [BOP-22R(ds), BOP-60R(ds), CMW-8(dg), and CMW-10(dg)] will be decommissioned in place by backfilling with bentonite grout. Decommissioning methods will be conducted in accordance with OAR 690-240-0510(2) and will follow the general steps outlined below:

- The monument, concrete pad, steel vault, and other surface items (e.g. bollards, if present) will be removed using an excavator or similar heavy equipment.
- The well will be decommissioned by filling the well from the bottom up with a bentonite grout slurry that meets the requirements of OAR 690-240-0475.
- The well casing will then be cut below grade, as compatible with the local site conditions and land practices.
- The holes/excavations at the ground surface (former monument area) will be backfilled with gravel or as determined by the property owner, and the ground surface will be finished to match surrounding areas.
- Upon completion of the well decommissioning, the decommissioning materials and debris will be removed and disposed at a permitted landfill.

SITE CLEANUP AND WASTE MANAGEMENT

Metal and concrete removed from the well will be disposed of or recycled at an appropriate solid waste or recycling facility. Displaced water or decontamination water collected and/or generated during decommissioning will be temporarily stored in 55-gallon drums or water storage totes. Solids in the water will be allowed to settle out, and the water will be transferred to the appropriate groundwater treatment systems under existing National Pollutant Discharge Elimination System permits. Water from wells BOP-22R(ds) and BOP-60R(ds) will be routed to the Boeing groundwater treatment system, while water generated from wells CMW-8(dg) and CMW-10(dg) will be routed to the TSA central treatment system. Remaining solids will remain in soil drums, characterized for disposal, and once approved transported off-site for disposal at a permitted landfill.

NOTIFICATION AND SCHEDULE

DEQ will be notified via email prior to, and upon the completion of, the well decommissioning; however, decommissioning is currently slated for early November 2019 and are anticipated to require two to three days to complete. Notification information will include the following, in accordance with OAR 690-240-0510(6) (notification requirements):

- Well identification information;
- Decommissioning methodology;
- Amount and type of sealant/backfill material (i.e. bentonite grout) used; and
- Other information required by the DEQ.

Well decommissioning activities will also be reported in the 2019 TSA Annual Report. The completion notification email will be sent to DEQ within two weeks after decommissioning activities are completed.

Mr. Ken Thiessen
9 October 2019
Page 5

CLOSURE

We look forward to your review and approval of this Work Plan. Please contact us with any questions regarding this Work Plan or if you need additional information.

Sincerely,



Cindy Bartlett, R.G.
Geosyntec Consultants



Brent Miller, P.E.
Geosyntec Consultants



Christine Kimmel, L.G.
Landau Associates

Cc: Jason Hegdahl, Cascade Corporation
Debbie Taege, The Boeing Company

Mr. Ken Thiessen
9 October 2019
Page 6

References:

Geosyntec Consultants, Landau Associates, SSPA, 2019. Annual Performance Report, 1 January 2017 – 31 December 2018, East Multnomah County Troutdale Sandstone Aquifer Remediation, 31 May 2019.

Oregon Department of Environmental Quality (DEQ), 2019. Email from K. Thiessen RE: East Multnomah Co, TSA, 2018 Annual Report Approval. 3 July 2019.

Oregon Department of Environmental Quality (DEQ), 1997. TSA Remedy Order on Consent, WMCSR-NWR-96-08, 14 February 1997.

Oregon Water Resources Department (OWRD), 2019. Letter to Don Larson, Yellow Jacket Drilling Services, Final Order—Special Standards Approval, 10 September 2019.

Attachments:

Table 1	Well Construction Summary
Table 2	Groundwater VOC Results Summary
Figure 1	TSA Monitoring Wells to be decommissioned
Attachment 1	Well Boring and Exploration Logs
Attachment 2	OWRD Special Standard Letters

Tables

Table 1
Well Construction Summary
Monitoring Well Decommissioning Work Plan
East Multnomah County TSA Remedy

Well Name	Well Type	Well Tag	Stratigraphic Unit	Survey Data Easting (ft)	Survey Data Northing (ft)	Ground Surface (ft MSL)	Measuring Point (ft MSL)	Screen Top (ft bgs)	Screen Bottom (ft bgs)	Screen Top Elev (ft MSL)	Screen Bottom Elev (ft MSL)	Screen Length (ft)	Well Diameter (inches)	Well Material	Well Depth (ft bgs)	Boring Depth (ft bgs)	Boring Diameter	Casing Material	Date Completed	Property Owner	Section, Township, & Range	Notes	Analytical Summary
BOP-22R(ds)	Monitoring Well	no tag	Upper TSA	7697050.528	691019.5093	84.2	82.91	243	263	-158.8	-178.8	20	2	PVC	265	310	12" (185 ft) 6" (310 ft)	?	10/14/2008	The Boeing Company	S29 T1N R3E	Modified from above grade to flush mount in 01/2009 and re-surveyed; prior measuring point elev of 86.19 updated to 82.91. Replacement well for BOP-22ds.	TCE (& other VOCs) <0.50 µg/L in 34 of 36 samples from 2008-2018; TCE ranged from 30 µg/l in 2008 up to 0.20 µg/l in 2018, and was below detection limits (0.5, 1.0) from 2009-2018.
BOP-60R(ds)	Monitoring Well	L102850	Upper TSA	7697726.613	690503.5041	83.16	82.8	155	165	-71.84	-81.84	10	2	S80 PVC	165	165.5	8" (103 ft) 6" (165.5 ft)	?	3/3/2010		S29 T1N R3E	Replacement well for BOP-60ds	TCE (& other VOCs) <0.50 µg/L in 12 of 28 samples from 2010-2017; TCE ranged from 2.5 µg/l in 2011 up to 0.20 µg/l in 2017, and was below detection limits (0.5, 1.0) from 2012-2017.
CMW-8(dg)	Monitoring Well	no tag	Lower TSA	7700075.66	689028.28	137	136.21	178	193	-41	-56	15	4	S80 PVC	196	199.1	16" (50 ft) 12" (141 ft) 10" (199.1 ft)	Steel	4/2/1990	Union Pacific Railroad Contact: Gary Honeyman, Manager Environmental Site Remediation Phone: (307) 745-6532	S29 T1N R3E	Well is located on Union Pacific Railroad property, adjacent to I-84 eastbound lanes.	TCE (& other VOCs) <0.50 µg/L in 8 of 53 samples from 1990-2017; TCE ranged from 6.0 µg/l in 1990 up to 80 µg/l in 1997, and was below detection limits (0.5, 1.0) from 2007-2017.
CMW-10(dg)	Monitoring Well	no tag	Lower TSA	7700589.45	688923.88	135.3	135.05	189	204	-53.7	-68.7	15	2.5	S80 PVC	206.5	210	10" (68 ft) 8" (167 ft) 6" (210 ft)	?	5/14/1990		S29 T1N R3E	Well is located on Union Pacific Railroad property, adjacent to I-84 eastbound lanes.	TCE (& other VOCs) <0.50 µg/L in 2 of 24 samples from 1990 to 1999. TCE ranged from 25 µg/l in 1990 up to 61 µg/l in 1996. TCE concentrations were 1.6 and 1.9 µg/l in 1998 and 1999, the last two years this well was sampled.

Notes:

Survey Data coordinates are NAD83, Oregon State Plane-North Zone
TSA = Troutdale Sandstone Aquifer
bgs = below ground surface
ft = feet
PVC = polyvinyl chloride
MSL = mean sea level

Table 2
Groundwater VOC Results Summary
Monitoring Well Decommissioning Work Plan
East Multnomah County TSA Remedy

Aquifer Zone	Monitoring Well ID	Date Sampled	Trichloro ethene (TCE)	Tetrachloro ethene (PCE)	cis-1,2-Dichloro ethene	1,1-Dichloro ethene	Vinyl Chloride	Sample ID	Notes
Upper	BOP-22Rds	10/27/2008	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	BOP-22Rds;BOP22R(ds)-102708;20081027	
Upper	BOP-22Rds	11/14/2008	30	0.40	2.7	1.0	< 2.0	BOP-22Rds;BOP-22RDS-1108;20081114	VP
Upper	BOP-22Rds	11/14/2008	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	BOP-22Rds;BOP22Rds-246;20081114	VP
Upper	BOP-22Rds	11/14/2008	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	BOP-22Rds;BOP22Rds-251;20081114	VP
Upper	BOP-22Rds	11/14/2008	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	BOP-22Rds;BOP22Rds-255;20081114	VP
Upper	BOP-22Rds	11/14/2008	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	BOP-22Rds;BOP22Rds-260;20081114	VP
Upper	BOP-22Rds	11/14/2008	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	BOP-22Rds;BOP22Rds-264;20081114	VP
Upper	BOP-22Rds	12/3/2008	0.20	< 2.0	< 2.0	< 2.0	< 2.0	BOP-22Rds;BOP22R(ds)081203;20081203	
Upper	BOP-22Rds	12/11/2008	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	BOP-22Rds;BOP-22R(ds);20081211	
Upper	BOP-22Rds	3/17/2009	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	BOP-22Rds;BOP-22Rds;20090317	
Upper	BOP-22Rds	5/8/2009	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	BOP-22Rds;BOPTSA3-0509;20090508	
Upper	BOP-22Rds	8/7/2009	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	BOP-22Rds;BOPTSA6-0809;20090807	
Upper	BOP-22Rds	11/12/2009	1.8	< 2.0	< 2.0	< 2.0	< 2.0	BOP-22Rds;BOPTSA5-1109;20091112	
Upper	BOP-22Rds	12/30/2009	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	BOP-22Rds;BOP22Rds;20091230	
Upper	BOP-22Rds	2/4/2010	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	BOP-22Rds;BOPTSA2-0210;20100204	
Upper	BOP-22Rds	2/4/2010	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	BOP-22Rds;BOPTSA12-0210;20100204	1
Upper	BOP-22Rds	5/5/2010	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	BOP-22Rds;BOPTSA3-0510;20100505	
Upper	BOP-22Rds	8/18/2010	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	BOP-22Rds;BOPTSA6-0810;20100818	
Upper	BOP-22Rds	11/11/2010	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	BOP-22Rds;BOPTSA3-1110;20101111	
Upper	BOP-22Rds	2/8/2011	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	BOP-22Rds;BOPTSA2-0211;20110208	
Upper	BOP-22Rds	5/5/2011	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	BOP-22Rds;BOPTSA3-0511;20110505	
Upper	BOP-22Rds	8/4/2011	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	BOP-22Rds;BOPTSA6-0811;20110804	
Upper	BOP-22Rds	11/2/2011	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	BOP-22Rds;BOPTSA3-1111;20111102	
Upper	BOP-22Rds	2/22/2012	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	BOP-22Rds;BOP TSA2-0212;20120222	
Upper	BOP-22Rds	5/4/2012	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	BOP-22Rds;BOPTSA3-0512;20120504	
Upper	BOP-22Rds	8/3/2012	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	BOP-22Rds;BOPTSA6-0812;20120803	
Upper	BOP-22Rds	2/5/2013	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	BOP-22Rds;BOP-22R(ds)-0213;20130205	
Upper	BOP-22Rds	8/5/2013	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	BOP-22Rds;BOP-22Rds-0813;20130805	
Upper	BOP-22Rds	8/6/2014	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	BOP-22Rds;BOP-22R(ds)-0814;20140806	
Upper	BOP-22Rds	8/6/2015	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	BOP-22Rds;BOP-22R(ds)-0815;20150806	
Upper	BOP-22Rds	11/5/2015	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	BOP-22Rds;BOP-22Rds-1115;20151105	
Upper	BOP-22Rds	8/8/2016	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	BOP-22RDS;BOP-22RDS-0816;20160808	
Upper	BOP-22Rds	3/13/2017	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	BOP-22RDS-0317	
Upper	BOP-22Rds	8/7/2017	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	BOP-22RDS-0817	
Upper	BOP-60Rds	3/24/2010	0.90	< 2.0	< 2.0	< 2.0	< 2.0	BOP-60Rds;BOP-60R(ds)(155);20100324	VP
Upper	BOP-60Rds	3/24/2010	0.80	< 2.0	< 2.0	< 2.0	< 2.0	BOP-60Rds;BOP-60R(ds)(159);20100324	VP
Upper	BOP-60Rds	3/24/2010	0.80	< 2.0	< 2.0	< 2.0	< 2.0	BOP-60Rds;BOP-60R(ds)(163);20100324	VP
Upper	BOP-60Rds	5/5/2010	1.1	< 2.0	< 2.0	< 2.0	< 2.0	BOP-60Rds;BOPTSA4-0510 155;20100505	VP
Upper	BOP-60Rds	5/5/2010	0.90	< 2.0	< 2.0	< 2.0	< 2.0	BOP-60Rds;BOPTSA4-0510 159;20100505	VP
Upper	BOP-60Rds	5/5/2010	0.80	< 2.0	< 2.0	< 2.0	< 2.0	BOP-60Rds;BOPTSA4-0510 163;20100505	VP
Upper	BOP-60Rds	8/19/2010	2.2	< 2.0	0.30	< 2.0	< 2.0	BOP-60Rds;BOPTSA14-0810-155;20100819	VP
Upper	BOP-60Rds	8/19/2010	0.80	< 2.0	< 2.0	< 2.0	< 2.0	BOP-60Rds;BOPTSA14-0810-159;20100819	VP
Upper	BOP-60Rds	8/19/2010	0.80	< 2.0	< 2.0	< 2.0	< 2.0	BOP-60Rds;BOPTSA14-0810-163;20100819	VP
Upper	BOP-60Rds	11/11/2010	0.90	< 2.0	< 2.0	< 2.0	< 2.0	BOP-60Rds;BOPTSA4-1110(155);20101111	VP
Upper	BOP-60Rds	11/11/2010	0.30	< 2.0	< 2.0	< 2.0	< 2.0	BOP-60Rds;BOPTSA4-1110(159);20101111	VP
Upper	BOP-60Rds	11/11/2010	0.70	< 2.0	< 2.0	< 2.0	< 2.0	BOP-60Rds;BOPTSA4-1110(163);20101111	VP
Upper	BOP-60Rds	2/8/2011	2.3	< 2.0	0.30	< 2.0	< 2.0	BOP-60Rds;BOPTSA5-0211(155);20110208	VP
Upper	BOP-60Rds	2/8/2011	2.5	< 2.0	0.30	< 2.0	< 2.0	BOP-60Rds;BOPTSA5-0211(159);20110208	VP
Upper	BOP-60Rds	2/8/2011	2.4	< 2.0	0.30	< 2.0	< 2.0	BOP-60Rds;BOPTSA5-0211(163);20110208	VP
Upper	BOP-60Rds	5/5/2011	0.80	< 2.0	< 2.0	< 2.0	< 2.0	BOP-60Rds;BOPTSA4-0511(155);20110505	VP
Upper	BOP-60Rds	5/5/2011	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	BOP-60Rds;BOPTSA4-0511(159);20110505	VP
Upper	BOP-60Rds	5/5/2011	0.30	< 2.0	< 2.0	< 2.0	< 2.0	BOP-60Rds;BOPTSA4-0511(163);20110505	VP
Upper	BOP-60Rds	8/4/2011	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	BOP-60Rds;BOPTSA13-0811;20110804	
Upper	BOP-60Rds	11/3/2011	0.50	< 2.0	< 2.0	< 2.0	< 2.0	BOP-60Rds;BOPTSA4-1111;20111103	
Upper	BOP-60Rds	2/22/2012	1.2	< 2.0	< 2.0	< 2.0	< 2.0	BOP-60Rds;BOP TSA5-0212;20120222	
Upper	BOP-60Rds	5/4/2012	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	BOP-60Rds;BOPTSA4-0512;20120504	
Upper	BOP-60Rds	8/3/2012	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	BOP-60Rds;BOPTSA13-0812;20120803	
Upper	BOP-60Rds	2/5/2013	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	BOP-60Rds;BOP-60Rds-0213;20130205	
Upper	BOP-60Rds	8/5/2013	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	BOP-60Rds;BOP-60Rds-0813;20130805	
Upper	BOP-60Rds	8/12/2014	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	BOP-60Rds;BOP-60R(ds)-0814;20140812	
Upper	BOP-60Rds	8/6/2015	0.40	< 2.0	< 2.0	< 2.0	< 2.0	BOP-60Rds;BOP-60R(ds)-0815;20150806	
Upper	BOP-60Rds	8/7/2017	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	BOP-60RDS-0817	
Upper	BOP-60Rds	8/7/2017	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	BOP-Y-0817	1
Lower	CMW-8dg	3/30/1990	6.0					CMW-8dg;IB-8d;19900330	
Lower	CMW-8dg	6/27/1990	12					CMW-8dg;;19900627	
Lower	CMW-8dg	4/2/1991	14	< 0.50	< 0.50	< 0.50	< 0.50	CMW-8dg;;19910402	
Lower	CMW-8dg	2/15/1992	29	0.50	< 0.50	< 0.50	< 0.50	CMW-8dg;;19920215	
Lower	CMW-8dg	5/27/1992	29	1.2	0.80	< 0.50	< 0.50	CMW-8dg;;19920527	
Lower	CMW-8dg	9/1/1992	31 J	< 0.50 J	< 0.50 J	< 0.50 J	< 0.50 J	CMW-8dg;;19920901	
Lower	CMW-8dg	11/18/1992	24	< 0.50	< 0.50	< 0.50	< 0.50	CMW-8dg;;19921118	
Lower	CMW-8dg	2/23/1993	43	1.1	< 0.50	< 0.50	< 0.50	CMW-8dg;;19930223	
Lower	CMW-8dg	5/20/1993	35	3.4	< 0.50	< 0.50	< 0.50	CMW-8dg;;19930520	
Lower	CMW-8dg	8/23/1993	25	0.60	< 0.50	< 0.50	< 0.50	CMW-8dg;;19930823	
Lower	CMW-8dg	11/9/1993	34	1.5	0.70	< 0.50	< 0.50	CMW-8dg;;19931109	
Lower	CMW-8dg	2/14/1994	37	1.6	1.0	< 1.0	< 0.50	CMW-8dg;;19940214	
Lower	CMW-8dg	5/25/1994	32	1.0	1.0	< 1.0	< 0.50	CMW-8dg;;19940525	
Lower	CMW-8dg	8/15/1994	43	2.0	1.3	< 1.0	< 0.50	CMW-8dg;;19940815	
Lower	CMW-8dg	12/2/1994	36	1.4	1.3	< 0.50	< 0.50	CMW-8dg;;19941202	
Lower	CMW-8dg	2/21/1995	15	< 0.50	0.90	< 0.50	< 0.50	CMW-8dg;;19950221	
Lower	CMW-8dg	5/15/1995	43	1.9	1.8	< 0.50	< 0.50	CMW-8dg;;19950515	1
Lower	CMW-8dg	5/15/1995	45	2.1	1.9	< 0.50	< 0.50	CMW-8dg;;19950515	
Lower	CMW-8dg	8/22/1995	54	2.3	2.2	< 0.50	< 0.50	CMW-8dg;;19950822	
Lower	CMW-8dg	8/22/1995	55	1.7	1.7	< 1.0	< 2.0	CMW-8dg;Split Sample;19950822	1
Lower	CMW-8dg	11/20/1995	50	1.8	2.1	< 0.50	< 0.50	CMW-8dg;;19951120	
Lower	CMW-8dg	2/20/1996	53	2.0	2.4	< 0.50	< 0.50	CMW-8dg;;19960220	
Lower	CMW-8dg	8/12/1996	69	2.6	2.8	< 0.50	< 0.50	CMW-8dg;;19960812	

Table 2
Groundwater VOC Results Summary
Monitoring Well Decommissioning Work Plan
East Multnomah County TSA Remedy

Aquifer Zone	Monitoring Well ID	Date Sampled	Trichloro ethene (TCE)	Tetrachloro ethene (PCE)	cis-1,2-Dichloro ethene	1,1-Dichloro ethene	Vinyl Chloride	Sample ID	Notes
Lower	CMW-8dg	5/22/1997	80	3.3	4.3	< 0.50	< 0.50	CMW-8dg;;19970522	
Lower	CMW-8dg	8/19/1997	60	2.1	3.8	< 0.50	< 0.50	CMW-8dg;;19970819	
Lower	CMW-8dg	2/26/1998	40	1.7	1.6	< 0.50	< 0.50	CMW-8dg;;19980226	
Lower	CMW-8dg	8/24/1998	30	0.90	1.1	< 0.50	< 0.50	CMW-8dg;;19980824	
Lower	CMW-8dg	2/26/1999	24	0.90	0.90	< 0.50	< 0.50	CMW-8dg;;19990226	
Lower	CMW-8dg	8/20/1999	13	< 0.50	< 0.50	< 0.50		CMW-8dg;;19990820	
Lower	CMW-8dg	8/20/1999	12	< 0.50	< 0.50	< 0.50		CMW-8dg;;19990820	1
Lower	CMW-8dg	2/8/2000	8.0	< 0.50	< 0.50	< 0.50		CMW-8dg;;20000208	
Lower	CMW-8dg	2/8/2000	7.9	< 0.50	< 0.50	< 0.50		CMW-8dg;;20000208	1
Lower	CMW-8dg	8/7/2000	9.6	< 0.50	< 0.50	< 0.50		CMW-8dg;;20000807	
Lower	CMW-8dg	8/7/2000	9.7	< 0.50	< 0.50	< 0.50		CMW-8dg;;20000807	1
Lower	CMW-8dg	2/12/2001	20	1.3	0.70	< 0.50	< 0.50	CMW-8dg;MW-8(dg);20010212	
Lower	CMW-8dg	2/12/2001	20	1.3	0.70	< 0.50	< 0.50	CMW-8dg;MW-8(dg)-Dup;20010212	1
Lower	CMW-8dg	5/7/2001	23	1.3	0.85	< 0.50	< 0.50	CMW-8dg;MW-8(dg);20010507	
Lower	CMW-8dg	8/8/2001	29	1.5	0.78	< 0.50	< 0.50	CMW-8dg;MW-8(dg);20010808	
Lower	CMW-8dg	8/8/2001	29	1.4	0.76	< 0.50	< 0.50	CMW-8dg;MW-8(dg)-Dup;20010808	1
Lower	CMW-8dg	11/13/2001	19	1.0	0.62	< 0.50	< 0.50	CMW-8dg;MW-8(dg);20011113	
Lower	CMW-8dg	2/14/2002	26	1.3	0.69	< 0.50	< 0.50	CMW-8dg;MW-8(dg);20020214	
Lower	CMW-8dg	2/14/2002	24	1.1	0.58	< 0.50	< 0.50	CMW-8dg;MW-8(dg)-Dup;20020214	1
Lower	CMW-8dg	5/6/2002	21	1.2	0.65	< 0.50	< 0.50	CMW-8dg;MW-8(dg);20020506	
Lower	CMW-8dg	8/14/2002	11	0.67	< 0.50	< 0.50	< 0.50	CMW-8dg;MW-8(dg);20020814	
Lower	CMW-8dg	8/14/2002	12	0.64	< 0.50	< 0.50	< 0.50	CMW-8dg;MW-8(dg)-Dup;20020814	1
Lower	CMW-8dg	2/19/2003	2.5	< 0.50	< 0.50	< 0.50	< 0.50	CMW-8dg;MW-8(dg);20030219	
Lower	CMW-8dg	2/19/2003	2.7	< 0.50	< 0.50	< 0.50	< 0.50	CMW-8dg;MW-8(dg)-Dup;20030219	1
Lower	CMW-8dg	8/14/2003	1.5	< 0.50	< 0.50	< 0.50	< 0.50	CMW-8dg;MW-8(dg);20030814	
Lower	CMW-8dg	8/14/2003	1.5	< 0.50	< 0.50	< 0.50	< 0.50	CMW-8dg;MW-8(dg)-Dup;20030814	1
Lower	CMW-8dg	2/17/2004	6.9	< 0.50	< 0.50	< 0.50	< 0.50	CMW-8dg;MW-8(dg);20040217	
Lower	CMW-8dg	2/17/2004	7.1	< 0.50	< 0.50	< 0.50	< 0.50	CMW-8dg;MW-8(dg)-Dup;20040217	1
Lower	CMW-8dg	8/12/2004	8.9	0.50	< 0.50	< 0.50	< 0.50	CMW-8dg;MW-8(dg);20040812	
Lower	CMW-8dg	8/12/2004	9.0	0.52	< 0.50	< 0.50	< 0.50	CMW-8dg;MW-8(dg)-Dup;20040812	1
Lower	CMW-8dg	2/9/2005	7.4	< 0.50	< 0.50	< 0.50	< 0.50	CMW-8dg;MW-8(dg);20050209	
Lower	CMW-8dg	8/17/2005	4.1	< 0.50	< 0.50	< 0.50	< 0.50	CMW-8dg;MW-8(dg);20050817	
Lower	CMW-8dg	8/17/2005	4.1	< 0.50	< 0.50	< 0.50	< 0.50	CMW-8dg;MW-8(dg)-Dup;20050817	1
Lower	CMW-8dg	2/7/2006	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	CMW-8dg;MW-8(dg);20060207	
Lower	CMW-8dg	2/7/2006	0.82	< 0.50	< 0.50	< 0.50	< 0.50	CMW-8dg;MW-8(dg);20060207	1
Lower	CMW-8dg	5/10/2006	1.2	< 0.50	< 0.50	< 0.50	< 0.50	CMW-8dg;MW-8(dg);20060510	
Lower	CMW-8dg	5/10/2006	1.4	< 0.50	< 0.50	< 0.50	< 0.50	CMW-8dg;MW-8(dg);20060510	1
Lower	CMW-8dg	8/14/2006	1.2	< 0.50	< 0.50	< 0.50	< 0.50	CMW-8dg;MW-8(dg);20060814	
Lower	CMW-8dg	8/14/2006	1.2	< 0.50	< 0.50	< 0.50	< 0.50	CMW-8dg;MW-8(dg)-Dup;20060814	1
Lower	CMW-8dg	2/12/2007	0.64	< 0.50	0.59	< 0.50	< 0.50	CMW-8dg;MW-8(dg);20070212	
Lower	CMW-8dg	8/15/2007	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	CMW-8dg;MW-8(dg);20070815	
Lower	CMW-8dg	8/12/2008	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	CMW-8dg;MW-8(dg);20080812	
Lower	CMW-8dg	8/18/2009	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	CMW-8dg;MW-8(dg);20090818	
Lower	CMW-8dg	8/10/2011	< 0.50	< 0.50	0.72	< 0.50	< 0.50	CMW-8dg;MW-8dg;20110810	
Lower	CMW-8dg	8/20/2013	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	MW8DG-082013	
Lower	CMW-8dg	8/5/2015	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	MW-8DG-080515	
Lower	CMW-8dg	8/7/2017	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	CMW8DG-080717	
Lower	CMW-10dg	6/1/1990	25					CMW-10dg;IB-10d;19900601	
Lower	CMW-10dg	7/6/1990	11					CMW-10dg;;19900706	
Lower	CMW-10dg	4/4/1991	15	< 0.50	< 0.50	< 0.50	< 0.50	CMW-10dg;;19910404	
Lower	CMW-10dg	2/15/1992	14	< 0.50	< 0.50	< 0.50	< 0.50	CMW-10dg;;19920215	
Lower	CMW-10dg	5/27/1992	25	1.0	0.90	< 0.50	< 0.50	CMW-10dg;;19920527	
Lower	CMW-10dg	8/27/1992	15	< 0.50	< 0.50	< 0.50	< 0.50	CMW-10dg;;19920827	
Lower	CMW-10dg	11/13/1992	25	< 0.50	< 0.50	< 0.50	< 0.50	CMW-10dg;;19921113	
Lower	CMW-10dg	2/12/1993	40	< 0.50	< 0.50	< 0.50	< 0.50	CMW-10dg;;19930212	
Lower	CMW-10dg	5/21/1993	40	< 0.50	< 0.50	< 0.50	< 0.50	CMW-10dg;;19930521	
Lower	CMW-10dg	8/24/1993	33	0.60	1.0	< 0.50	< 0.50	CMW-10dg;;19930824	
Lower	CMW-10dg	11/23/1993	19	0.70	0.60	< 0.50	< 0.50	CMW-10dg;;19931123	
Lower	CMW-10dg	11/23/1993	21 J	0.70 J	0.60 J	< 0.50 J	< 0.50 J	CMW-10dg;;19931123	1
Lower	CMW-10dg	2/16/1994	35	1.1	1.2	< 1.0	< 0.50	CMW-10dg;;19940216	
Lower	CMW-10dg	2/16/1994	35	1.1	1.2	< 1.0	< 0.50	CMW-10dg;;19940216	1
Lower	CMW-10dg	5/25/1994	30	0.70	0.60	< 1.0	< 0.50	CMW-10dg;;19940525	
Lower	CMW-10dg	8/16/1994	35	0.90	1.1	< 1.0	< 0.50	CMW-10dg;;19940816	
Lower	CMW-10dg	8/16/1994	41	1.1	1.4	< 1.0	< 0.50	CMW-10dg;;19940816	1
Lower	CMW-10dg	12/1/1994	47	1.3	1.7	< 0.50	< 0.50	CMW-10dg;;19941201	
Lower	CMW-10dg	2/21/1995	44	1.4	1.6	< 0.50	< 0.50	CMW-10dg;;19950221	
Lower	CMW-10dg	8/23/1995	58	2.0	2.1	< 0.50	< 0.50	CMW-10dg;;19950823	
Lower	CMW-10dg	2/20/1996	19	0.50	0.70	< 0.50	< 0.50	CMW-10dg;;19960220	
Lower	CMW-10dg	8/12/1996	61	1.7	2.1	< 0.50	< 0.50	CMW-10dg;;19960812	
Lower	CMW-10dg	5/20/1997	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	CMW-10dg;;19970520	
Lower	CMW-10dg	8/19/1997	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	CMW-10dg;;19970819	
Lower	CMW-10dg	2/26/1998	15	< 0.50	1.1	< 0.50	< 0.50	CMW-10dg;;19980226	
Lower	CMW-10dg	8/24/1998	1.9	< 0.50	< 0.50	< 0.50	< 0.50	CMW-10dg;;19980824	
Lower	CMW-10dg	3/5/1999	2.5	< 0.50	< 0.50	< 0.50	< 0.50	CMW-10dg;;19990305	
Lower	CMW-10dg	8/20/1999	1.2	< 0.50	< 0.50	< 0.50	< 0.50	CMW-10dg;;19990820	
Lower	CMW-10dg	2/9/2000	0.80	< 0.50	< 0.50	< 0.50	< 0.50	CMW-10dg;;20000209	
Lower	CMW-10dg	8/7/2000	1.5	< 0.50	< 0.50	< 0.50	< 0.50	CMW-10dg;;20000807	
Lower	CMW-10dg	2/12/2001	1.1	< 0.50	< 0.50	< 0.50	< 0.50	CMW-10dg;MW-10(dg);20010212	
Lower	CMW-10dg	8/9/2001	0.51	< 0.50	< 0.50	< 0.50	< 0.50	CMW-10dg;MW-10(dg);20010809	
Lower	CMW-10dg	2/11/2002	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	CMW-10dg;MW-10(dg);20020211	
Lower	CMW-10dg	8/14/2002	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	CMW-10dg;MW-10(dg);20020814	
Lower	CMW-10dg	2/19/2003	0.59	< 0.50	< 0.50	< 0.50	< 0.50	CMW-10dg;MW-10(dg);20030219	
Lower	CMW-10dg	8/14/2003	0.66	< 0.50	< 0.50	< 0.50	< 0.50	CMW-10dg;MW-10(dg);20030814	
Lower	CMW-10dg	2/17/2004	0.82	< 0.50	< 0.50	< 0.50	< 0.50	CMW-10dg;MW-10(dg);20040217	
Lower	CMW-10dg	8/17/2004	0.81	< 0.50	< 0.50	< 0.50	< 0.50	CMW-10dg;MW-10(dg);20040817	
Lower	CMW-10dg	8/17/2005	1.4	< 0.50	< 0.50	< 0.50	< 0.50	CMW-10dg;MW-10(dg);20050817	
Lower	CMW-10dg	8/14/2006	0.51	< 0.50	< 0.50	< 0.50	< 0.50	CMW-10dg;MW-10(dg);20060814	

Table 2
 Groundwater VOC Results Summary
 Monitoring Well Decommissioning Work Plan
 East Multnomah County TSA Remedy

Aquifer Zone	Monitoring Well ID	Date Sampled	Trichloro ethene (TCE)	Tetrachloro ethene (PCE)	cis-1,2-Dichloro ethene	1,1-Dichloro ethene	Vinyl Chloride	Sample ID	Notes
Lower	CMW-10dg	8/15/2007	0.82	< 0.50	< 0.50	< 0.50	< 0.50	CMW-10dg;MW-10(dg);20070815	
Lower	CMW-10dg	8/12/2008	0.71	< 0.50	< 0.50	< 0.50	< 0.50	CMW-10dg;MW-10(dg);20080812	
Lower	CMW-10dg	8/18/2009	0.69	< 0.50	< 0.50	< 0.50	< 0.50	CMW-10dg;MW-10(dg);20090818	
Lower	CMW-10dg	8/6/2010	0.65	< 0.50	< 0.50	< 0.50	< 0.50	CMW-10dg;MW-10(dg);20100806	
Lower	CMW-10dg	8/10/2011	0.53	< 0.50	< 0.50	< 0.50	< 0.50	CMW-10dg;MW-10dg;20110810	
Lower	CMW-10dg	7/31/2012	0.55	< 0.50	< 0.50	< 0.50	< 0.50	CMW-10dg;MW-10dg;20120731	
Lower	CMW-10dg	8/20/2013	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	MW10DG-082013	
Lower	CMW-10dg	8/5/2014	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	CMW10DG-080514	
Lower	CMW-10dg	8/5/2015	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	MW-10DG-080515	
Lower	CMW-10dg	8/4/2016	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	CMW10DG-080416	
Lower	CMW-10dg	8/7/2017	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	CMW10DG-080717	

Notes

Results are presented in micrograms per liter (µg/L).

-- = not analyzed

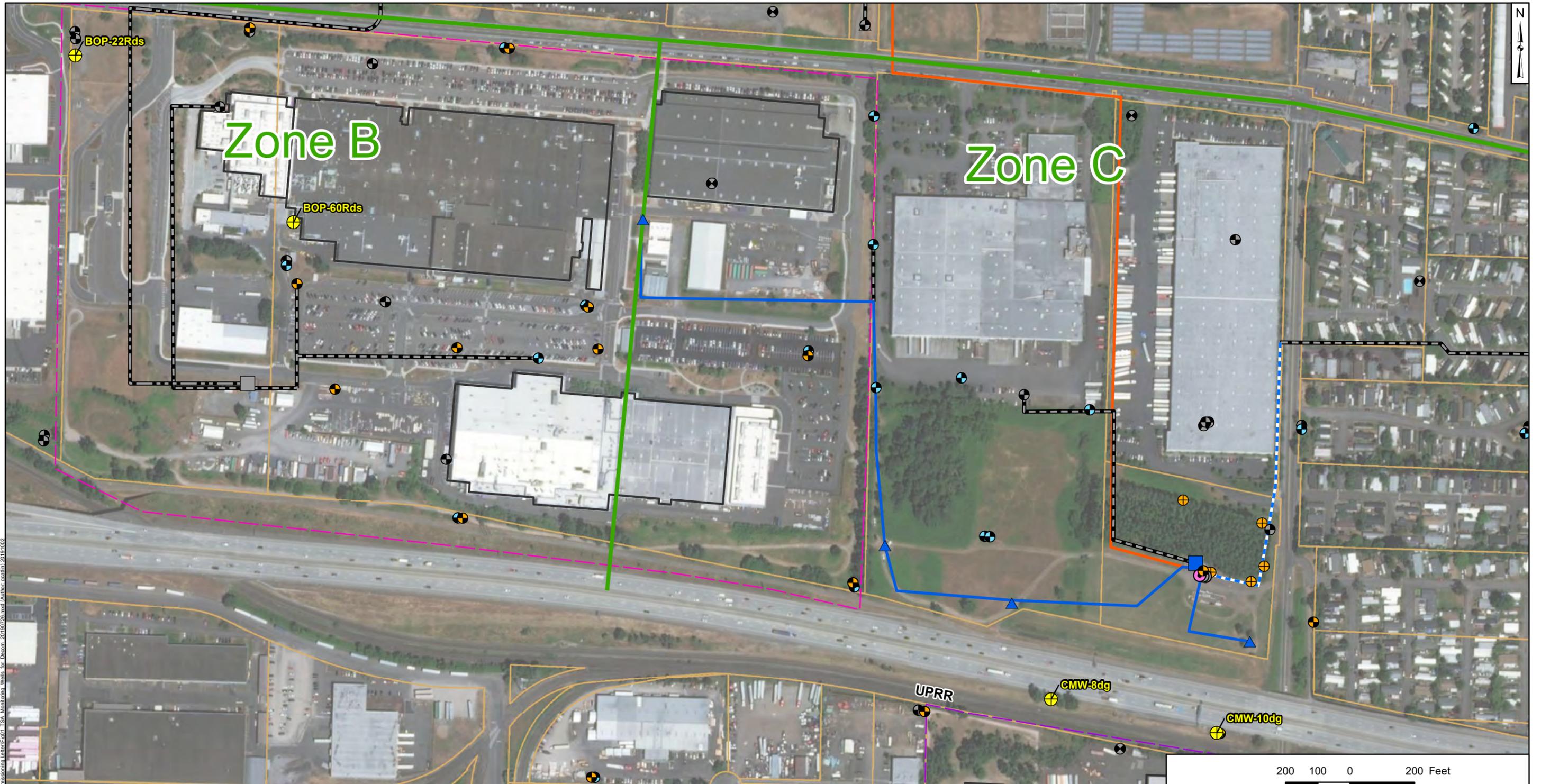
< 0.50 indicates not detected at reporting limit shown

J = estimated value

Field duplicate samples are indicated with a "1"; blank cells indicate primary sample.

VP = vertical profile samples from discrete depth intervals collected after well installation.

Figure



Legend

Well to be Decommissioned	Decommissioned Soil Vapor Monitoring Well	Taxlots
Upper & Lower TSA Monitoring Well	Soil Vapor Extraction Well	Soil Vapor Extraction Trench, Active
Upper TSA Monitoring Well	Lower TSA Extraction Well	Approximate Extracted Groundwater Conveyance Pipeline, Active
Lower TSA Monitoring Well	Decommissioned Extraction Well	Approximate Extracted Groundwater Conveyance Pipeline, No Longer in Use
SGA Monitoring Wells	Groundwater Treatment System	Approximate Treated Groundwater Discharge Pipeline, Active
CU1 Monitoring Well	Decommissioned Groundwater Treatment System	Approximate Treated Groundwater Discharge Pipeline, Decommissioned
Decommissioned Upper TSA Monitoring Well	Structure	Zone Boundary
Decommissioned Lower TSA Monitoring Well	Boeing Property Boundary	Notes
Decommissioned or No Longer Monitored Monitoring Well	Cascade Corporation Property Boundary	UPRR: Union Pacific Rail Road

200 100 0 200 Feet

TSA Monitoring Wells to be Decommissioned
East Multnomah County

Geosyntec
consultants

PNG0564S October 2019

Figure 1

C:\Users\jgibson\OneDrive\Documents\Projects\001\001\Well Decommissioning Letter\001 TSA Monitoring Wells for Decommissioning.mxd (Author: jgibson) 20191002

Attachment 1

Well Boring and Exploration Logs



GSI Water Solutions, Inc.
 55 SW Yamhill Avenue
 Suite 400
 Portland, Oregon 97204

Log of Borehole: BOP-22R(ds)

Project No.: 170.002

Project: Upper TSA Monitoring Well Installation

Client: Cascade

Logged By: Ken Trotman / Matt Kohlbecker

Location: Boeing Facility

Project Manager: Ken Trotman

SUBSURFACE PROFILE				SAMPLE			Geologic Unit	Sample Type
Depth	Symbol	Soil Name, USCS Group Symbol, Color, Moisture Content, Relative Density or Consistency, Soil Structure, Mineralogy	Depth	% Gravel	% Sand	% Fines (Silt and Clay)		
Ground Surface								
0		SILT (ML), light brown, low plasticity, with trace gravel and trace sand	0.0	5%	5%	90%	OB	<p>12-inch Diameter Borehole</p> <p>8-inch Diameter Conductor Casing</p> <p>Bentonite Cement Grout</p> <p>High Solids Bentonite Grout Seal</p>
5		Silty GRAVEL (GM), light brown, well graded, rounded to subrounded, coarse to fine gravel	5.0					
10				65%	10%	25%		
15		SILT (ML), light brown, low plasticity, with trace sand	15.0	0%	5%	95%		
20		Silty GRAVEL with sand (GM), light brown, well graded, rounded to subrounded, coarse gravel with cobbles, with trace clay	20.0	55%	30%	15%		
25		Well graded GRAVEL with silt and sand (GW-GM), light gray, rounded to subangular, fine to coarse gravel with cobbles, sand is fine to coarse, trace clay	25.0				TG	
30				50%	40%	10%		
35								
40		Silty GRAVEL (GM), olive gray, well graded, rounded to subrounded, fine to coarse gravel with cobbles	40.0					
45				60%	10%	30%		
50			50.0					

Drilled By: Boart Longyear

Hole Size: 12" / 6"

Drill Method: Dual Rotary (0' to 165' bgs) and Rotosonic (165' to 310' bgs)

Datum:

Drill Date: September 16, 2008, to October 14, 2008

Sheet: 1 of 7



GSI Water Solutions, Inc
 55 SW Yamhill Avenue
 Suite 400
 Portland, Oregon 97204

Log of Borehole: BOP-22R(ds)

Project No.: 170.002

Project: Upper TSA Monitoring Well Installation

Client: Cascade

Logged By: Ken Trotman / Matt Kohlbecker

Location: Boeing Facility

Project Manager: Ken Trotman

SUBSURFACE PROFILE				SAMPLE				
Depth	Symbol	Soil Name, USCS Group Symbol, Color, Moisture Content, Relative Density or Consistency, Soil Structure, Mineralogy	Depth	% Gravel	% Sand	% Fines (Silt and Clay)	Geologic Unit	Sample Type
55		Silty GRAVEL with sand (GM), light gray, rounded to subangular, cobbles to fine gravel, trace clay						
60				45%	40%	15%		
65		Poorly graded GRAVEL with sand (GP), light gray, rounded to subangular, coarse gravel with cobbles, trace silt	65.0					
70								
75								
80				70%	25%	5%		
85								
90								
95		Poorly graded GRAVEL with silt and sand (GP-GM), olive gray, rounded to subrounded, coarse gravel with cobbles, trace clay	95.0					
100				65%	25%	10%		

Drilled By: Boart Longyear

Hole Size: 12" / 6"

Drill Method: Dual Rotary (0' to 165' bgs) and Rotasonic (165' to 310' bgs)

Datum:

Drill Date: September 16, 2008, to October 14, 2008

Sheet: 2 of 7



GSI Water Solutions, Inc
 55 SW Yamhill Avenue
 Suite 400
 Portland, Oregon 97204

Log of Borehole: BOP-22R(ds)

Project No.: 170.002

Project: Upper TSA Monitoring Well Installation

Client: Cascade

Logged By: Ken Trotman / Matt Kohlbecker

Location: Boeing Facility

Project Manager: Ken Trotman

SUBSURFACE PROFILE			SAMPLE					
Depth	Symbol	Soil Name, USCS Group Symbol, Color, Moisture Content, Relative Density or Consistency, Soil Structure, Mineralogy	Depth	% Gravel	% Sand	% Fines (Silt and Clay)	Geologic Unit	Sample Type
105		Poorly graded GRAVEL with silt and sand (GP-GM), olive gray, rounded to subrounded, coarse gravel with cobbles, trace clay (same as above)						
110								
115								
120								
125								
130								
135								
140								
145								
150					150.0	40%	35%	25%

Drilled By: Boart Longyear

Hole Size: 12" / 6"

Drill Method: Dual Rotary (0' to 165' bgs) and Rotasonic (165' to 310' bgs)

Datum:

Drill Date: September 16, 2008, to October 14, 2008

Sheet: 3 of 7



GSI Water Solutions, Inc
 55 SW Yamhill Avenue
 Suite 400
 Portland, Oregon 97204

Log of Borehole: BOP-22R(ds)

Project No.: 170.002

Project: Upper TSA Monitoring Well Installation

Client: Cascade

Logged By: Ken Trotman / Matt Kohlbecker

Location: Boeing Facility

Project Manager: Ken Trotman

SUBSURFACE PROFILE				SAMPLE				
Depth	Symbol	Soil Name, USCS Group Symbol, Color, Moisture Content, Relative Density or Consistency, Soil Structure, Mineralogy	Depth	% Gravel	% Sand	% Fines (Silt and Clay)	Geologic Unit	Sample Type
155		Silty GRAVEL with sand (GM), light gray, subrounded to subangular, coarse gravel with cobbles						
160								
165		SILT (ML), light brown, dry, low plasticity, hard, trace sand (contact depth based on change in drilling rate @ 161 feet bgs)	161.0	0%	5%	95%	SU1A	
170								
175		Poorly graded SAND (SP), light brown, wet, sand is fine to medium, subangular to angular, trace silt and trace gravel	172.0	5%	90%	5%		
180		SILT (ML), light brown, dry, low plasticity, hard, with trace sand	175.0	0%	5%	95%		
185		Poorly graded SAND (SP), light brown, wet, sand is fine to medium, subangular to angular, trace silt	178.5	5%	90%	5%		
190		SILT (ML), light brown, dry, low plasticity, hard, with trace sand	181.0	0%	5%	95%	SU1B	
195		SILT (ML), dark gray, moist, low plasticity		0%	10%	90%		
200		No Recovery	190.0					
205		SILT (ML), dark brown, moist, low plasticity, with black laminations of organic matter	195.5	0%	10%	90%		
210			200.5					

6-inch Diameter Borehole

185

Drilled By: Boart Longyear

Hole Size: 12" / 6"

Drill Method: Dual Rotary (0' to 165' bgs) and Rotosonic (165' to 310' bgs)

Datum:

Drill Date: September 16, 2008, to October 14, 2008

Sheet: 4 of 7



GSI Water Solutions, Inc.
 55 SW Yamhill Avenue
 Suite 400
 Portland, Oregon 97204

Log of Borehole: BOP-22R(ds)

Project No.: 170.002

Project: Upper TSA Monitoring Well Installation

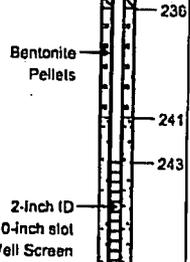
Client: Cascade

Logged By: Ken Trotman / Matt Kohlbecker

Location: Boeing Facility

Project Manager: Ken Trotman

SUBSURFACE PROFILE				SAMPLE			Geologic Unit	Sample Type
Depth	Symbol	Soil Name, USCS Group Symbol, Color, Moisture Content, Relative Density or Consistency, Soil Structure, Mineralogy	Depth	% Gravel	% Sand	% Fines (Silt and Clay)		
205		Silty SAND to sandy SILT (SM/ML), olive gray, moist		0%	55%	45%	SU1C	
		Sandy SILT (ML), dark gray, moist	204.0	0%	45%	55%		
		Silty SAND to sandy SILT (SM/ML), olive gray, moist		0%	55%	45%		
210		Silty SAND (SM), dark gray, moist, sand is fine	209.0	0%	60%	40%	SU1D	
215		SILT (ML), greenish gray, moist, low plasticity, with trace fine sand	212.0	0%	60%	40%		
		SILT (ML), dark gray, moist, low plasticity, with trace fine sand	215.0	0%	5%	95%		
225		Sandy SILT to silty SAND (ML/SM), dark gray, moist, low plasticity	222.0	0%	40%	60%		
230		No Recovery	229.0				TS	
240		Poorly graded SAND (SP), dark gray to black, wet, vitric, with indurated sandstone laminae, sand is medium, trace silt	238.0					
245				0%	90%	10%		
250								



Drilled By: Boart Longyear

Hole Size: 12" / 6"

Drill Method: Dual Rotary (0' to 165' bgs) and Rotosonic (165' to 310' bgs)

Datum:

Drill Date: September 16, 2008, to October 14, 2008

Sheet: 5 of 7



GSI Water Solutions, Inc
 55 SW Yamhill Avenue
 Suite 400
 Portland, Oregon 97204

Log of Borehole: BOP-22R(ds)

Project No.: 170.002

Project: Upper TSA Monitoring Well Installation

Client: Cascade

Logged By: Ken Trotman / Matt Kohlbecker

Location: Boeing Facility

Project Manager: Ken Trotman

SUBSURFACE PROFILE				SAMPLE			Geologic Unit	Sample Type
Depth	Symbol	Soil Name, USCS Group Symbol, Color, Moisture Content, Relative Density or Consistency, Soil Structure, Mineralogy	Depth	% Gravel	% Sand	% Fines (Silt and Clay)		
255		Silty SAND (SM), dark gray to greenish gray, moist	252.0	15%	55%	30%	10/20 Silica Sand Filter Pack	
		Poorly graded SAND (SP), dark gray, wet, vitric, with indurated sandstone laminae, sand is medium		0%	90%	10%		
260		No Recovery	258.0				263 265	
265		Poorly graded SAND (SP), dark gray, wet, vitric, with indurated sandstone laminae and layers, sand is predominately medium, with trace gravel at 260'		<5%	90%	5%		
270		Silty SAND (SM), greenish gray, wet	269.5	0%	60%	40%	Bentonite Pellets	
		No Recovery						
275		Sandy SILT (ML), greenish gray, wet, low plasticity, sand is fine to coarse	275.0	5%	40%	55%		
		Well graded SAND (SW), dark gray, wet, vitric, with indurated sandstone laminae and layers, trace gravel	278.0	10%	85%	5%		
280		Poorly graded SAND (SP), dark gray, wet, vitric, predominantly fine sand, with sandstone laminae		0%	95%	5%		
285		Well graded SAND to SANDSTONE (SW/SNS), dark gray, vitric, with occasional horizons of gravel in the sand						
		Silty SAND (SM), dark gray, vitric, wet, with sandstone layers	285.0					
290		Poorly graded SAND (SP), dark gray, wet, vitric, sand is predominantly medium, with indurated sandstone layers and trace gravel						
300			300.0					

Drilled By: Boart Longyear

Hole Size: 12" / 6"

Drill Method: Dual Rotary (0' to 165' bgs) and Rotasonic (165' to 310' bgs)

Datum:

Drill Date: September 16, 2008, to October 14, 2008

Sheet: 6 of 7



GSI Water Solutions, Inc
 55 SW Yamhill Avenue
 Suite 400
 Portland, Oregon 97204

Log of Borehole: BOP-22R(ds)

Project No.: 170.002

Project: Upper TSA Monitoring Well Installation

Client: Cascade

Logged By: Ken Trotman / Matt Kohlbecker

Location: Boeing Facility

Project Manager: Ken Trotman

SUBSURFACE PROFILE			SAMPLE					
Depth	Symbol	Soil Name, USCS Group Symbol, Color, Moisture Content, Relative Density or Consistency, Soil Structure, Mineralogy	Depth	% Gravel	% Sand	% Fines (Silt and Clay)	Geologic Unit	Sample Type
305		Sandstone (SNS), dark gray to greenish gray, wet to moist, vitric, slightly to moderately cemented						
305.5		Conglomerate (CGT), gray to dark gray, with fine to coarse sand and interbedded sandstone layers, gravel is up to 3 inches in diameter	305.5	50%	40%	10%	TC	
310		Poorly graded SAND (SP), dark gray, moist, vitric, sand is predominantly fine		0%	100%	0%		
310		Conglomerate (CGT), gray to dark gray		75%	15%	10%		
315								
320								
325								
330								
335								
340								
345								
350								

GEOLOGIC UNIT CODES:
 OB = Overbank Deposits
 TG = Troutdale Gravel
 SU1A = Siltstone Unit 1 - subunit 1A
 SU1B = Siltstone Unit 1 - subunit 1B
 SU1C = Siltstone Unit 1 - subunit 1C
 SU1D = Siltstone Unit 1 - subunit 1D
 TS = Troutdale Sand
 TC = Troutdale Conglomerate

WELL COORDINATES
 N: 691063.9
 E: 1495261.6
 Oregon State Plane North NAD 83

Drilled By: Boart Longyear

Hole Size: 12" / 6"

Drill Method: Dual Rotary (0' to 165' bgs) and Rotasonic (165' to 310' bgs)

Datum:

Drill Date: September 16, 2008, to October 14, 2008

Sheet: 7 of 7

BOP-60R(ds)

SAMPLE DATA				SOIL PROFILE			GROUNDWATER	
Depth (ft)	Sample Number & Interval	Sampler Type	Blows/Foot	PID (ppm)	Graphic Symbol	USCS Symbol	Monitoring Well Detail	
							Water Level	
							Drilling Method: <u>Rotosonic</u> Ground Elevation (ft): <u>83.16</u> Drilled By: <u>Cascade Drilling Inc.</u>	
30	S-17	d4		0.4	[Symbol]	GM	<p style="text-align: right;">2-inch diameter, Schedule 80, PVC well casing</p> <p style="text-align: right;">Bentonite grout</p> <p style="text-align: center;">▽ ATD</p>	
	S-18	d4		0.0	[Symbol]			
35	S-19	d4		0.0	[Symbol]			
	S-20	d4		0.0	[Symbol]	GM		
	S-21	d4		0.0	[Symbol]	GM		
40	S-22	d4		0.0	[Symbol]			
	S-23	d4		0.0	[Symbol]			
45	S-24	d4		0.0	[Symbol]			
	S-25	d4		1.7	[Symbol]			
50	S-26	d4		0.0	[Symbol]			
	S-27	d4		0.9	[Symbol]			
55	S-28	d4		0.0	[Symbol]			
60								

- 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.

25116 6/17/10 N:\PROJECTS\025116_BOP-60R(DS).GPJ WELL LOG



TSA Remedy
Portland, Oregon

Log of Monitoring Well BOP-60R(ds)

Figure
A-2
(2 of 6)

BOP-60R(ds)

SAMPLE DATA					SOIL PROFILE			GROUNDWATER	
Depth (ft)	Sample Number & Interval	Sampler Type	Blows/Foot	PID (ppm)	Graphic Symbol	USCS Symbol	Monitoring Well Detail		
							Water Level		
							Drilling Method: <u>Rotosonic</u> Ground Elevation (ft): <u>83.16</u> Drilled By: <u>Cascade Drilling Inc.</u>		
60	S-29	d4		0.0	(Graphic symbol: vertical line with small circles)	GM	<p style="text-align: right;">2-inch diameter, Schedule 80, PVC well casing</p> <p style="text-align: right;">Bentonite grout</p>		
	S-30	d4		0.0	(Graphic symbol: vertical line with small circles)				
65	S-31	d4		0.0	(Graphic symbol: vertical line with small circles)				
	S-32	d4		0.0	(Graphic symbol: vertical line with small circles)	GP	<p style="text-align: right;">2-inch diameter, Schedule 80, PVC well casing</p> <p style="text-align: right;">Bentonite grout</p>		
	S-33	d4		0.0	(Graphic symbol: vertical line with small circles)	GM			
70	S-34	d4		0.0	(Graphic symbol: vertical line with small circles)				
	S-35	d4		0.0	(Graphic symbol: vertical line with small circles)	SP	<p style="text-align: right;">2-inch diameter, Schedule 80, PVC well casing</p> <p style="text-align: right;">Bentonite grout</p>		
	S-36	d4		0.0	(Graphic symbol: vertical line with small circles)	GM			
75	S-37	d4		0.0	(Graphic symbol: vertical line with small circles)	SP			
					(Graphic symbol: vertical line with small circles)		<p style="text-align: right;">2-inch diameter, Schedule 80, PVC well casing</p> <p style="text-align: right;">Bentonite grout</p>		
					(Graphic symbol: vertical line with small circles)				
80					(Graphic symbol: vertical line with small circles)				
					(Graphic symbol: vertical line with small circles)		<p style="text-align: right;">2-inch diameter, Schedule 80, PVC well casing</p> <p style="text-align: right;">Bentonite grout</p>		
					(Graphic symbol: vertical line with small circles)				
85					(Graphic symbol: vertical line with small circles)				
					(Graphic symbol: vertical line with small circles)		<p style="text-align: right;">2-inch diameter, Schedule 80, PVC well casing</p> <p style="text-align: right;">Bentonite grout</p>		
					(Graphic symbol: vertical line with small circles)				
90					(Graphic symbol: vertical line with small circles)				

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25116 6/17/10 N\PROJECTS\025116 BOP-60R(DS)\GPJ WELL LOG



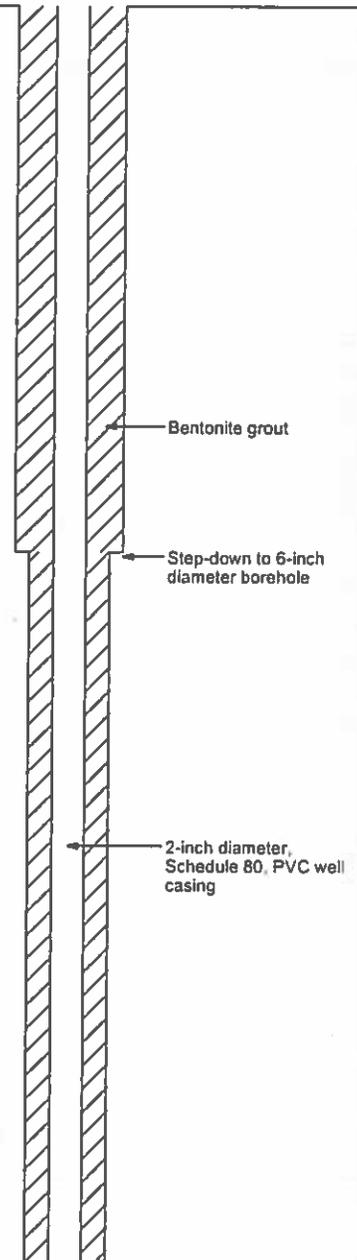
TSA Remedy
Portland, Oregon

Log of Monitoring Well BOP-60R(ds)

Figure
A-2
(3 of 6)

BOP-60R(ds)

SAMPLE DATA				SOIL PROFILE			GROUNDWATER	
Depth (ft)	Sample Number & Interval	Sampler Type	Blows/Foot	PID (ppm)	Graphic Symbol	USCS Symbol	Monitoring Well Detail	
							Drilling Method: <u>Rotosonic</u>	Ground Elevation (ft): <u>83.16</u>
90						SP		
90-95	S-38	d4		0.0	GM	GM		
Light brown, silty fine SANDSTONE with silt, weakly cemented; no odor, no sheen (Siltstone Unit - SU1A)								
95-100	S-39	d4		0.0				
100-105	S-40	d4		0.0		SNS		
Brown silty, SANDSTONE, strong cementation, weathered; no odor, no sheen								
105-110	S-41	d4		0.0		SLS		
Green gray, silty clay to clayey SILTSTONE (Siltstone Unit - SU1B)								
110-115				0.0		SLS		
Green gray, clayey SILTSTONE, weak cementation, weathered; no odor, no sheen (damp, very soft)								
115-120	S-42	d4		0.0		SLS		
Brown to green gray, clayey SILTSTONE with trace fine sand, weak cementation, weathered; no odor, no sheen (damp, very soft) -Decrease in sand content								
120-125	S-43	d4		0.0		SNS		
Dark gray, silty, SANDSTONE; slightly micaceous, moderately cemented, moderately weathered; no odor, no sheen (moist, hard) (Siltstone Unit - SU1C)								
125-130				0.0		SNS		
Dark gray, silty SANDSTONE, strong cementation; no odor, no sheen (damp, hard)								
130-135				0.0		SLS		
(Soil description continues from previous section)								



25116 6/17/10 N:\PROJECTS\025116_BOP-60R(DS).GPI WELL LOG

- Notes:
1. Stratigraphic contacts are based on field interpretations and are approximate.
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 3. Refer to "Soil Classification System and Key" figure for explanation of graphics and symbols.



TSA Remedy
Portland, Oregon

Log of Monitoring Well BOP-60R(ds)

Figure
A-2
(4 of 6)

BOP-60R(ds)

SAMPLE DATA					SOIL PROFILE			GROUNDWATER			
Depth (ft)	Sample Number & Interval	Sampler Type	Blows/Foot	PID (ppm)	Graphic Symbol	USCS Symbol	Drilling Method: <u>Rotosonic</u>	Ground Elevation (ft): <u>83.16</u>	Drilled By: <u>Cascade Drilling Inc.</u>	Water Level	Monitoring Well Detail
120	S-44	d4		0.0		SLS	Gray, sandy, SILTSTONE, with fine to medium angular gravels; slightly micaceous, weakly cemented, moderately weathered, no odor, no sheen (wet, hard)				
					SLS	Medium gray, sandy, SILTSTONE; moderately weathered, no odor, no sheen (moist, soft)					
					SLS	Light brown to red, clayey, SILTSTONE, slightly micaceous, strong cementation, moderately weathered, no odor, no sheen (moist, hard) (Siltstone Unit - SU/D)					
125	S-45	d4		0.0		SLS	Gray to dark brown, clayey SILTSTONE with trace fine to medium angular gravel; weak cementation, moderately weathered; no odor, no sheen (moist, hard)				
					SLS	-3 inch layer of fine sand.					
					SLS	Dark red brown to light gray, clayey SILTSTONE; moderately weathered, no odor, no sheen (moist, soft)					
					SLS	Brown, sandy SILTSTONE slightly micaceous, weak cementation, moderately weathered, no odor, no sheen (damp, hard)					
135	S-46	d4		0.0		SNS	Brown to olive gray, silty, fine SANDSTONE, slightly weathered, strong cementation, no odor, no sheen (damp, hard)				
					SLS	Green, clayey SILTSTONE; moderately weathered, no odor, no sheen (moist, hard)					
					GW/GM	Dark green, silty, sandy fine to medium GRAVEL; no odor, no sheen (wet, loose)					
140	S-46	d4		0.0		SLS	Dark olive, sandy SILTSTONE, with trace 3 to 4 inch cobbles; no odor, no sheen (moist, medium hard)				
					SNS	Dark olive gray, silty fine to medium SANDSTONE, slightly weathered, moderate cementation; no odor, no sheen (moist, hard)					
					SNS	Brown, silty fine SANDSTONE; moderate cementation; no odor, no sheen (moist, medium hard)					
					SNS	-Grades wet, no more silt at 147 ft.					
145	S-46	d4		0.0		SNS					
150											

- Notes:
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 3. Refer to "Soil Classification System and Key" figure for explanation of graphics and symbols.

25116_6/17/10_N\PROJECTS\025116_BOP-60R(DS).GPI WELL LOG



TSA Remedy
Portland, Oregon

Log of Monitoring Well BOP-60R(ds)

Figure
A-2
(5 of 6)

BOP-60R(ds)

SAMPLE DATA				SOIL PROFILE			GROUNDWATER				
Depth (ft)	Sample Number & Interval	Sampler Type	Blows/Foot	PID (ppm)	Graphic Symbol	USCS Symbol	Drilling Method	Ground Elevation (ft)	Drilled By	Water Level	Monitoring Well Detail
150	S-47	d4		0.0		SNS	Rotasonic	83.16	Cascade Drilling Inc.		<p>Bentonite chips</p> <p>2-inch diameter, Schedule 80, PVC well casing</p> <p>8/12 Colorado sand pack</p> <p>2-inch diameter, Schedule 80, PVC screen (0.020-inch slot size)</p> <p>Threaded end cap</p>
155						SNS					
160	S-48	d4		0.0							
165											

Boring Completed 02/23/10
Total Depth of Boring = 165.5 ft.

Monitoring Well Completed 03/03/10
Total Depth of Monitoring Well = 165.5 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.

25116_6/17/10 N\PROJECTS\025116_BOP-60R(DS)\GPI WELL LOG



TSA Remedy
Portland, Oregon

Log of Monitoring Well BOP-60R(ds)

Figure
A-2
(6 of 6)

Project CASCADE - RI/FS PHASE I
 Location Portland, OR
 Job Number 4008900401
 Geologist/Engineer Rick Malin
 Drilling Subcontractor Staco / Cable tool
 Surface Elevation 136.879 msl

Boring Number IB-80
 Well Number MW-80
 Depth of Boring 199.10 feet
 Top of Casing Elevation 136.553 msl
 Date Started 3/1/90
 Date Completed 4/2/90

DEPTH IN FEET	N-VALUE	SAMPLE	LITHOLOGY	DESCRIPTION	WELL CONSTRUCTION DETAIL
0			SM	<u>SILTY SAND</u> - with coarse sand and gravel, brown, poorly graded, damp, organic fragments.	
5				← increasing gravel, decrease in silt, fine to coarse sand, 15% silt, moderately well-graded.	
10			GM	<u>SANDY GRAVEL</u> - with some silt, medium greenish black sand, 5% silt, organic fragments, no cementation, basalt and granitic material.	
15			GP	<u>SANDY GRAVEL</u> - greenish black sand, fine to medium, loose, poorly-graded.	
20			SW	<u>GRAVELLY SAND</u> - greenish black sand, very fine to medium, % silt, well-graded.	
25					
30					

DEPTH IN FEET	N-VALUE	SAMPLE	LITHOLOGY	DESCRIPTION	WELL CONSTRUCTION DETAIL
30			SW	← decrease in gravel size, very fine to coarse sand, traces of mica and quartz in sand, well-graded.	
35			GM/SM	<u>SANDY GRAVEL</u> - with silt, greenish black sand, fine to medium, approaching a silty gravel.	
40			GW	<u>SILTY GRAVEL</u> - with sand, black, fine to coarse sands, well-graded, medium density, loose.	
45			SM	<u>SAND</u> - with tannish cemented silty sand, brownish silt. ← increasing silt	
50	11 50 70		SC	<u>CLAYEY SAND</u> - brown, coarse to medium black sand intermixed with yellowish brown silts and clays, damp.	
55			CL/ML	<u>CLAYEY SILT</u> - with sand, blue-green, some degree of intermixing with a brown clayey silt, dry, dense, mica flakes in sand. ← dark green clayey silt with sand, intermixing with bluish green clayey silt with sand, coarsening of sand.	
60					

DEPTH IN FEET	N-VALUE	SAMPLE	LITHOLOGY	DESCRIPTION	WELL CONSTRUCTION DETAIL
60	17		CL/ML	blackish green to black silty sand with minor amounts of clay, slightly damp, partially indurated, PID: 0 ppm.	
67	67		SM/ML	<u>SILTY SAND</u> - very fine sands, trending towards a silt. increasing blackish sand, dense, partially indurated.	
70	58		ML	<u>CLAYEY SILT</u> - with sand, greenish black, increase in silt, slightly plastic.	
75			SM	<u>SILTY SAND</u> - brown, dense, partially cemented. drilling easy	
80			ML/SM	<u>SANDY SILT</u> - with chunks of more indurated silt, dark greenish brown. sand to clay ratio varying.	
85	20			varying from a silty clay to a silty clay with very fine sand, dark grey brown to a greenish blue, very dense, dry. 1-91.0	
90	90			<u>SANDY SILT</u> - with traces of coarse sand to fine black gravel, brown silts.	

DEPTH IN FEET	N-VALUE	SAMPLE	LITHOLOGY	DESCRIPTION	WELL CONSTRUCTION DETAIL
90			ML/SM		
			SM	SANDY SILT - with traces of coarse sand to fine black gravel, brown silts.	
95				← increasing sand, decreasing silt.	
			SW/SS	SAND - with traces of fine gravel, greenish black and yellow grain sand, partially cemented, yellowish orange cementing matrix, dense to very dense, fairly well-graded.	
100	74				
105				← increasing gravel.	
				← slow drilling.	
110				← medium to coarse sand, greenish black to orange yellow.	
115				← drilling easy	
120					

VOLCLAY GROUT
173 to 18.0 feet

DEPTH IN FEET	N-VALUE	SAMPLE	LITHOLOGY	DESCRIPTION	WELL CONSTRUCTION DETAIL
120			SW/SS	← increasing grain size.	
125				← coarse sand and gravels, loose.	
				← decreasing grain size.	
130				← fine to medium sands, loose, partial cementation, PID: 0 ppm.	
135	nc			← increase in gravel and cementation.	
140			CO	<u>CONGLOMERATE</u> - gravel and cobbles in a green and yellow medium sand matrix, cementation coating on clasts, variety of clast material, rounded clasts.	
145			SW	<u>GRAVELLY SAND</u> - black, well-graded, clean material, loose, PID: 0 ppm.	
150				← blackish green sand, loose, well-graded, occasional cobble with little indication of cementation, slow drilling, PID: 0 ppm.	

DEPTH IN FEET	N-VALUE	SAMPLE	LITHOLOGY	DESCRIPTION	WELL CONSTRUCTION DETAIL
150			SW	← increasing gravels	
155				← gravelly sand, increase in silt, little indication of cementation, PID: 0 ppm.	
160			GP	<u>CONGLOMERATE</u> - silty sand with quartz, increase cementation, casing driving hard, PID: 1.3 ppm.	
165			SS/SW	<u>SANDSTONE</u> - black with traces of gravels, occasional cobble, slightly silty, some granitic material, PID: 1.3 ppm. ← trace of clay/silt intermixed with gravelly sandstone. ← increase in cementation, PID: 0 ppm.	
170			GM	<u>SILTY GRAVEL</u> - with some cobbles, loose, greyish silt, sand containing quartz and mica, no cementation on clasts, dense, PID: 0 ppm.	
175			GP	<u>SANDY GRAVEL</u> - with some cobbles, little indication of cementation, <5% silt, dense, PID: 0.3 ppm.	
180					

DEPTH IN FEET	N-VALUE	SAMPLE	LITHOLOGY	DESCRIPTION	WELL CONSTRUCTION DETAIL
180			GP	<p>← increasing cementation.</p> <p>← increase in sand.</p> <p>← material consists of 80% gravels and cobbles, 20% fine to medium sand with mica, slightly cemented, PID: 0 ppm.</p>	
185		SS	GRAVELLY SAND - with silt, tannish grey sand, very fine to coarse, micaceous, well-graded, brownish grey silt, PID: 0 ppm.		
190		CL	SILTY CLAY - with fine to coarse sand, bluish green, medium stiffness, slightly damp.		
195				Bottom of boring at 199.1 feet.	<p>3 FT. SUMP 205.5 to 204.0 feet</p>
200					
205					<p>CENTRALIZERS AT: 110. 177.5. 185.5. 193.5 FEET</p>
210					

**CENTURY WEST
ENGINEERING**

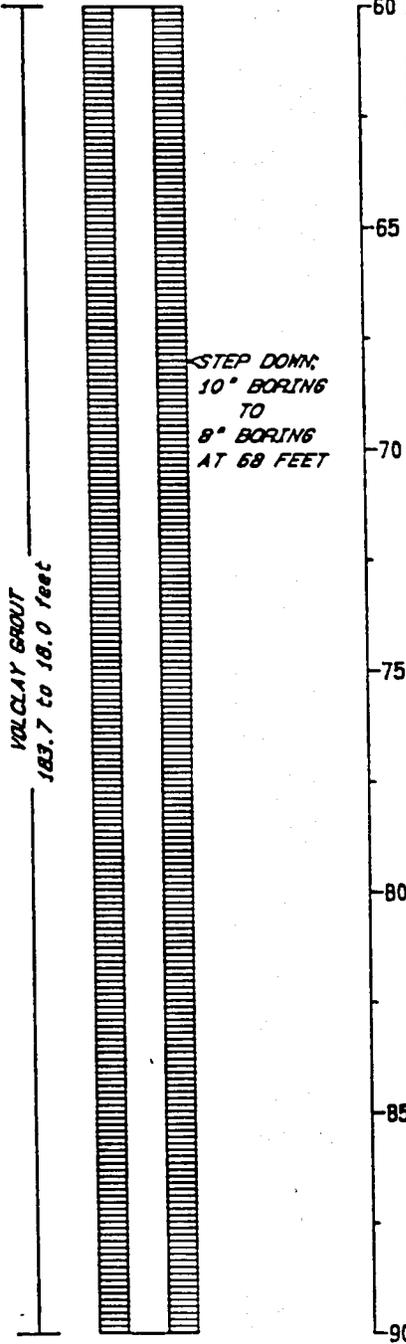
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EXPLORATION
LOG**

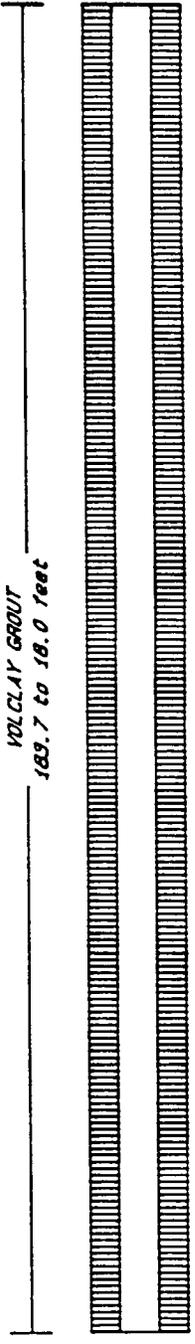
IB-100
Page 1 of 7

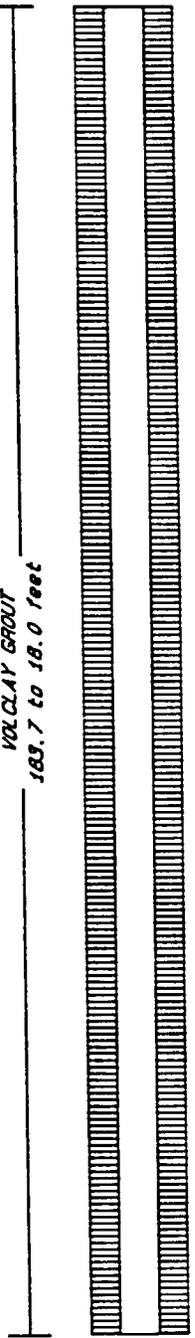
Project <u>CASCADE - RI/FS PHASE I</u>	Boring Number <u>IB-100</u>
Location <u>Portland, OR</u>	Well Number <u>MW-10DG</u>
Job Number <u>4008900401</u>	Depth of Boring <u>210.0 feet</u>
Geologist/Engineer <u>Rick Malin</u>	Top of Casing Elevation <u>134.949 msl</u>
Drilling Subcontractor <u>Staco / Cable tool</u>	Date Started <u>5/9/90</u>
Surface Elevation <u>135.321 msl</u>	Date Completed <u>5/14/90</u>

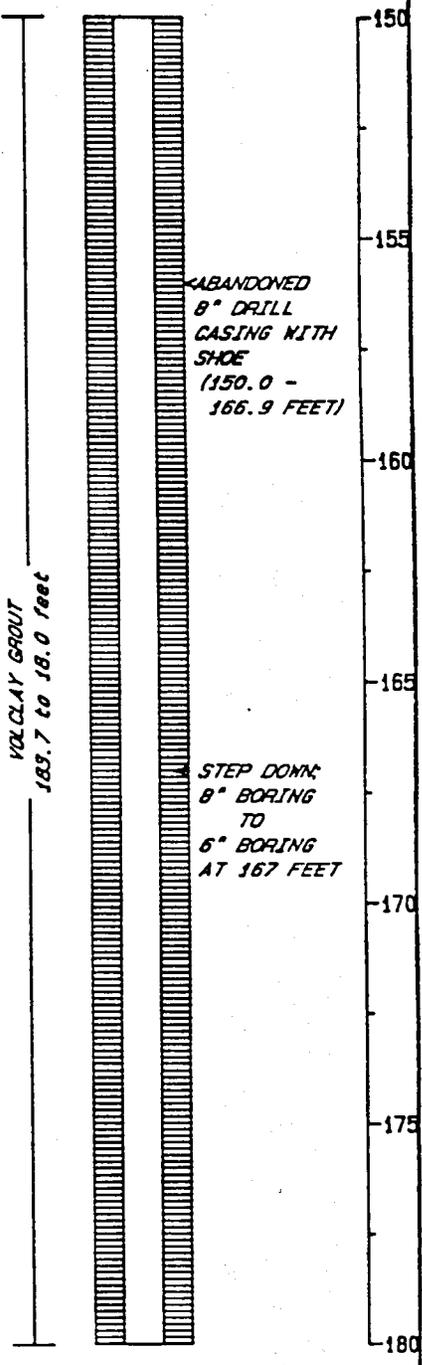
DEPTH IN FEET	N-VALUE	SAMPLE	LITHOLOGY	DESCRIPTION	WELL CONSTRUCTION DETAIL
0			GM/SM	<u>GRAVELLY SAND</u> - with basaltic and granitic cobbles, andesitic boulders in the upper five feet.	<p>PROTECTIVE FLUSH GRADE WELL VAULT WITH LOCKING CAP</p> <p>BLANK CASING Schedule 80 2.5" PVC</p> <p>PERMANENT 10" DRILL CASING 2 TO 60 FEET</p> <p>CEMENT GROUT 18.0 to 2.0 feet</p> <p>VOLCLAY GROUT 183.7 to 18.0 feet</p>
5			GM/GW	<u>SANDY GRAVEL</u> - with some silt, brownish grey, greenish black sand with mica, very fine to medium grained, cobbles of basalt and granitic material, moderately graded.	
15			GW	<u>SANDY GRAVEL</u> - gravels and cobbles in a sand matrix, tan-nish sand with mica cementation indicated on clasts, rounded clasts, mediumn graded PID: 0.3 ppm.	
20				← indications of cementation, traces of clayey silt. PID: 0 ppm.	
25					
30					

DEPTH IN FEET	N-VALUE	SAMPLE	LITHOLOGY	DESCRIPTION	WELL CONSTRUCTION DETAIL
30			GW	<p>PID: 0 ppm.</p> <p>← decreasing clast size.</p> <p>← increasing sand, trending towards a gravelly sand.</p>	
35					
40			SW/SS	<p>SANDSTONE - light brown, slightly friable, medium grained sand, 5-10% silt, well-graded.</p> <p>← increasing silt/clay.</p>	
45					
50	13 47 38		ML	<p>CLAY - grey, slightly plastic, some clumps of a darker bluish green silty clay, some intermixing of fine gravel in clay.</p> <p>← clayey silt with sand, bluish green, very fine sand with mica, dense, slightly damp, low plasticity.</p> <p>← clayey silt with fine sand, bluish green, intermixing with greyish clayey material, sticky, plastic, slightly damp, bright.</p> <p>← greenish brown, no blue material.</p>	
55					
60					

DEPTH IN FEET	N-VALUE	SAMPLE	LITHOLOGY	DESCRIPTION	WELL CONSTRUCTION DETAIL
60			ML	siltstone, dark green, gritty, appears to contain some fine sand, cemented.	 <p>STEP DOWN, 10" BORING TO 8" BORING AT 68 FEET</p> <p>VOLCLAY GROUT 183.7 to 18.0 feet</p>
65	5	12		sandy silt with clay, brown, very fine to medium grained sand, variable cementation, moist, friable, lacks plasticity, PID: 0 ppm.	
70	25			slight plasticity, moist, PID: 0 ppm.	
75				clayey silt, sticky, moist, low plasticity, no sand observed.	
80				increasing sand, very fine.	
85				grey and orange clayey silt with sand, sticky, low plasticity, moist, PID: 0 ppm.	
90	13	45		sandy siltstone, dark green, cemented, some clay, very fine sand.	
	30				

DEPTH IN FEET	N-VALUE	SAMPLE	LITHOLOGY	DESCRIPTION	WELL CONSTRUCTION DETAIL
90			SM	<u>SILTY SANDSTONE</u> - greyish green to orange yellow, sand fine to very fine, blackish green sand, weathering to orange yellow color.	
95				← sandstone with traces of gravel, brown to orange yellow.	
100	100		SS	<u>SANDSTONE</u> - black to yellow, cemented, fine to medium basaltic sand with palagonite, well sorted, poorly graded, dense.	
105				← increasing coarseness.	
110				← sandstone, black to olive green to orange brown, ranging from very fine to coarse, white cementing matrix, well cemented, traces of gravel, PID: 0 ppm.	
115			SW	<u>SAND</u> - greenish black to yellowish very fine sand, loose, well graded, dominantly basalt, clean material, no silts, PID: 0 ppm.	
120					

DEPTH IN FEET	N-VALUE	SAMPLE	LITHOLOGY	DESCRIPTION	WELL CONSTRUCTION DETAIL
120			SW	← PID: 0 ppm.	
125				← increasing gravels, PID: 0 ppm.	
130				← gravelly sands, no indication of cementation, dense, PID: 0 ppm.	
135			CO/GW	<u>CONGLOMERATE</u> - rounded gravels and cobbles with fine to coarse black sands, cementation on about 50% of clasts, yellowish tan sand with mica cemented on clasts, granitic and basaltic material, PID: 0.6 ppm.	
140				← increasing clasts size, ← looser material, increasing sand, possible sand lense, PID: 0 ppm.	
145				← nonbasaltic gravels, clasts indicate cementation, PID: 0 ppm. ← PID: 0.3 ppm.	
150					

DEPTH IN FEET	N-VALUE	SAMPLE	LITHOLOGY	DESCRIPTION	WELL CONSTRUCTION DETAIL
150			CO/SW	sandy gravel, black, most gravels lack signs of cementation, very fine to coarse, black to yellowish tan sand with mica, tannish cementing material, < 5% silt, PID: 0 ppm.	
155				← decrease in clast size.	
160				← gravel and cobbles with sand, mostly basaltic material, loose, some indications of cementation, sand very fine to coarse, greenish black, some tan, well graded.	
165			GM/SM	<u>GRAVELLY SAND</u> - with silt, light brown silt intermixed with gravels, loose, PID: 0 ppm.	
170			SW	<u>GRAVELLY SAND</u> - medium grain sand with mica, indication of cementation, wide variety of material, increase in quartz mostly fine gravels, fairly well-graded, PID: 0 ppm.	STEP DOWN: 8" BORING TO 6" BORING AT 167 FEET
175				← decrease in gravel, increase in finer sand, loose, dense, PID: 0 ppm.	
180				← sand, loose, black to green with quartz and mica, PID: 0 ppm.	

DEPTH IN FEET	N-VALUE	SAMPLE	LITHOLOGY	DESCRIPTION	WELL CONSTRUCTION DETAIL
180			SW	<p>← sand with gravel, poorly graded, dense to medium dense, cementation on some gravels, little or no silt.</p>	<p>1/2" BENTONITE PELLETS 187.0 to 189.7 feet</p> <p>CSS1 8-12 SILICA SAND 210.0 to 187.0 feet</p> <p>SCREENED INTERVAL 0.020 SLOT SCH. 80, 2.5" DIA. PVC 204.0 to 189.0 feet</p> <p>SUMP 206.5 to 204.0 feet</p>
185			<p>← increase in gravel, moderately graded, PID: 0 ppm.</p>		
190			<p>← decrease in gravel, increase in fines, well graded, dense, loose, no indication of cementation, PID: 0 ppm.</p>		
195			<p>← increase in gravels, PID: 0.4 ppm.</p>		
200			<p>← decrease in gravels, well graded, dense, no indication of cementation, PID: 0 ppm.</p>		
205			<p>← increase in gravel size, signs of cementation, dense, slow drilling, PID: 0 ppm.</p>		
210			<p>← black sand with some gravels, poorly graded, dense, not cemented, very fine to medium sand, PID: 0 ppm.</p> <p>← very fine to coarse black sand, loose, dense.</p>		
180-210	11 15 30		ML	<p><u>CLAYEY SILT</u> - with micaceous sand, light greyish blue, moist, tends to crumble apart, low plasticity.</p>	

Attachment 2
OWRD Special Standard Letters



Oregon

Kate Brown, Governor

Water Resources Department

North Mall Office Building
725 Summer St NE, Ste A
Salem, OR 97301
Phone: 503-986-0900
Fax: 503-986-0904
www.Oregon.gov/OWRD

July 23, 2019

PETER S. LARSEN MWC# 10408
CASCADE DRILLING LP
13600 SE AMBLER ROAD
CLACKAMAS, OREGON 97015

FINAL ORDER

Dear Mr. Larsen:

The Special Standards Request Form you submitted for owner: Boeing Company, Start Card number 1043362 is hereby approved for the following: you may decommission this monitoring well in-place as outlined on your Special Standards Request Form. *A stipulation of this Special Standards Request Approval is that cement grout, placed using a tremie pipe, be used to fill the casing and screened interval.* All other monitoring well decommissioning standards must be adhered to. A copy of your Special Standards Request Form is attached.

If you have any questions regarding this letter, I may be contacted at (503) 986-0852, or by e-mail at Joel.W.Jeffery@oregon.gov.

Sincerely,

Joel Jeffery, Coordinator
Well Construction Program
Well Construction and Compliance Section

enclosure

cc: Northwest Region
File

This is a final order in other than contested case. This order is subject to judicial review under ORS 183.484. Any petition for judicial review must be filed within the 60 day time period specified by ORS 183.484(2). Pursuant to ORS 536.075 and OAR 137-004-0080 you may either petition for judicial review or petition the Director for reconsideration of this order. A petition for reconsideration may be granted or denied by the director, and if no action is taken within 60 days following the date the petition was filed, the petition shall be deemed denied.



Oregon Water Resources Department
 725 Summer Street NE, Suite A
 Salem Oregon 97301-1266
 (503) 986-0900
 www.wrd.state.or.us

Special Standards Request Form

REQUEST FOR WRITTEN APPROVAL TO USE CONSTRUCTION METHODS NOT INCLUDED IN OREGON ADMINISTRATIVE RULES 690-200 THROUGH 690-240

Before the request can be considered, this form must be completed. Requests shall be submitted to the Well Construction Program Coordinator, Water Resources Department, 725 Summer Street NE, Suite A, Salem OR 97301-1266. Requests may also be considered by the appropriate Regional Manager.

Date of request: 6/26/19 Oral approval date (if applicable): _____

Bonded Well Constructor (name, license #, and mailing address): Pete Larsen - 10408

13600 SE Ambler Rd. Clackamas, OR 97015

(1) Location of Well: NW 1/4 NW 1/4 Tax lot 01400 Section 29,
 Township 1 N, Range 3 E, Multnomah County

Address at well site: NE 185th Dr and NE Sandy Blvd, Portland, OR 97230
Gresham, OR 97030

(2) Start Card Number(s)(for work to be done): 1043362

(3) Name and Address of Land Owner: Boeing Company

19000 NE Sandy Blvd, Gresham, OR 97030

(4) Distance to the nearest septic tank, drainfield, closed sewage line (if water supply well)

Unknown

(5) The unusual site conditions which necessitate this request: Client requests permission to

abandon monitoring wells in place based on analytical data.

(6) The proposed construction methods that the bonded well constructor believes will be adequate for this well: (attach additional pages if needed)

Abandon well in place using OWRD approved methods. Remove monument and upper portion

of the monitoring well. Repair and restore surface to grade.

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JUL 02 2019

101-15-0004
OWRD

(7) Diagram showing the pertinent features of the proposed well design and construction:
(attach additional pages if needed)

Well # | Orig Start # | Depth (ft)

BOP-22-Rds | 4009299 | 165-ft
1004908 264

Mult 97158



PLEASE NOTE:

- (1) The Well Construction Standards serve to protect ground water resources. By approving and issuing this special construction standard the Oregon Water Resources Department is not representing that a well constructed in accordance with this condition will maintain structural integrity or that it meets engineering standards. The well constructor/landowner is responsible for ensuring that a well is constructed in a manner that protects ground water resources as required under Oregon Administrative Rules 690-200 through 690-240.
- (2) If it should be determined at some future date that the well, due to its construction, is allowing ground water contamination, waste or loss of artesian pressure, the undersigned shall return to the site and rectify the problem.
- (3) If oral approval was granted, a written request must be submitted to the Department either within three (3) working days of the date of oral approval or prior to the completion of the associated well work. Failure to submit a written request as described above may void prior oral approval.

I have read and understand the above information. I further attest that the information provided is accurate to the best of my knowledge.

Bonded Constructor Signature: _____

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JUL 02 2009

OWRD



Oregon

Kate Brown, Governor

Water Resources Department

North Mall Office Building

725 Summer St NE, Ste A

Salem, OR 97301

Phone: 503-986-0900

Fax: 503-986-0904

www.Oregon.gov/OWRD

July 23, 2019

PETER S. LARSEN MWC# 10408
CASCADE DRILLING LP
13600 SE AMBLER ROAD
CLACKAMAS, OREGON 97015

FINAL ORDER

Dear Mr. Larsen:

The Special Standards Request Form you submitted for owner: Boeing Company, Start Card number 1043361 is hereby approved for the following: you may decommission this monitoring well in-place as outlined on your Special Standards Request Form. *A stipulation of this Special Standards Request Approval is that cement grout, placed using a tremie pipe, be used to fill the casing and screened interval.* All other monitoring well decommissioning standards must be adhered to. A copy of your Special Standards Request Form is attached.

If you have any questions regarding this letter, I may be contacted at (503) 986-0852, or by e-mail at Joel.W.Jeffery@oregon.gov.

Sincerely,

Joel Jeffery, Coordinator
Well Construction Program
Well Construction and Compliance Section

enclosure

cc: Northwest Region
File

This is a final order in other than contested case. This order is subject to judicial review under ORS 183.484. Any petition for judicial review must be filed within the 60 day time period specified by ORS 183.484(2). Pursuant to ORS 536.075 and OAR 137-004-0080 you may either petition for judicial review or petition the Director for reconsideration of this order. A petition for reconsideration may be granted or denied by the director, and if no action is taken within 60 days following the date the petition was filed, the petition shall be deemed denied.



Oregon Water Resources Department
 725 Summer Street NE, Suite A
 Salem Oregon 97301-1266
 (503) 986-0900
 www.wrd.state.or.us

Special Standards Request Form

REQUEST FOR WRITTEN APPROVAL TO USE CONSTRUCTION METHODS NOT INCLUDED IN OREGON ADMINISTRATIVE RULES 690-200 THROUGH 690-240

Before the request can be considered, this form must be completed. Requests shall be submitted to the Well Construction Program Coordinator, Water Resources Department, 725 Summer Street NE, Suite A, Salem OR 97301-1266. Requests may also be considered by the appropriate Regional Manager.

Date of request: 6/26/19 Oral approval date (if applicable): _____

Bonded Well Constructor (name, license #, and mailing address): Pete Larsen - 10408

13600 SE Ambler Rd, Clackamas, OR 97015

(1) Location of Well: SW 1/4 SW 1/4 Tax lot 500 Section 29
 Township 1 N, Range 3 E Multnomah County
 Address at well site: 19000 NE Sandy Blvd

Gresham, OR 97030

(2) Start Card Number(s)(for work to be done): 1043361

(3) Name and Address of Land Owner: Boeing Company

19000 NE Sandy Blvd, Gresham, OR 97030

(4) Distance to the nearest septic tank, drainfield, closed sewage line (if water supply well)

Unknown

(5) The unusual site conditions which necessitate this request: Client requests permission to

abandon monitoring wells in place based on analytical data.

(6) The proposed construction methods that the bonded well constructor believes will be adequate for this well: (attach additional pages if needed)

Abandon well in place using OWRD approved methods. Remove monument and upper portion

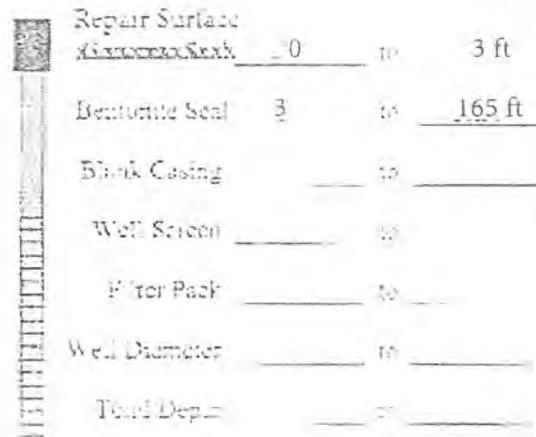
of the monitoring well. Repair and restore surface to grade.

- (7) Diagram showing the pertinent features of the proposed well design and construction (attach additional pages if needed)

Well # | Orig Start # | Depth (ft)

BOP-60-Rds | 1009299 | 165 ft

Mult 102296



PLEASE NOTE:

- (1) The Well Construction Standards serve to protect ground water resources. By approving and issuing this special construction standard the Oregon Water Resources Department is not representing that a well constructed in accordance with this condition will maintain structural integrity or that it meets engineering standards. The well constructor or landowner is responsible for ensuring that a well is constructed in a manner that protects ground water resources as required under Oregon Administrative Rules 690-210 through 690-240.
- (2) If it should be determined at some future date that the well, due to its construction, is allowing ground water contamination, waste or loss of artesian pressure, the undersigned shall return to the site and rectify the problem.
- (3) If oral approval was granted, a written request must be submitted to the Department either within three (3) working days of the date of oral approval or prior to the completion of the associated well work. Failure to submit a written request as described above may void prior oral approval.

I have read and understand the above information. I further attest that the information provided is accurate to the best of my knowledge.

Bonded Constructor Signature _____

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Oregon

Kate Brown, Governor

Water Resources Department

North Mall Office Building

725 Summer St NE, Ste A

Salem, OR 97301

Phone: 503-986-0900

Fax: 503-986-0904

www.Oregon.gov/OWRD

September 10, 2019

DONALD LARSON, MWC #10432
YELLOW JACKET DRILLING SERVICES, LLC
16765 SE 362ND DRIVE
SANDY, OREGON 97055

FINAL ORDER

Dear Mr. Larson:

The Special Standards Request Form you submitted for owner: Union Pacific Rail Road, Start Card numbers: 1044350 through 1044351 is hereby approved for the following: You may decommission these monitoring wells in-place using cement grout as outlined on your Special Standards Request Form dated August 15, 2019. All other monitoring well decommissioning standards must be adhered to. A copy of your Special Standards Request Form is enclosed.

Verbal approval of this Special Standards Request was provided on September 10, 2019.

If you have any questions regarding this letter, I may be contacted at (503) 986-0852, or by e-mail at Joel.W.Jeffery@oregon.gov.

Sincerely,

Joel Jeffery, Coordinator
Well Construction Program
Well Construction and Compliance Section

cc: Northwest Region
File

This is a final order in other than contested case. This order is subject to judicial review under ORS 183.484. Any petition for judicial review must be filed within the 60 day time period specified by ORS 183.484(2). Pursuant to ORS 536.075 and OAR 137-004-0080 you may either petition for judicial review or petition the Director for reconsideration of this order. A petition for reconsideration may be granted or denied by the director, and if no action is taken within 60 days following the date the petition was filed, the petition shall be deemed denied.





Oregon Water Resources Department
 725 Summer Street NE, Suite A
 Salem Oregon 97301-1266
 (503) 986-6900
 www.wrd.state.or.us

Special Standards Request Form

REQUEST FOR WRITTEN APPROVAL TO USE CONSTRUCTION METHODS NOT INCLUDED IN OREGON ADMINISTRATIVE RULES 690-200 THROUGH 690-240

Before the request can be considered, this form must be completed. Requests shall be submitted to the Well Construction Program Coordinator, Water Resources Department, 725 Summer Street NE, Suite A, Salem OR 97301-1266. Requests may also be considered by the appropriate Regional Manager.

Date of request: 8/15/2019 Oral approval date (if applicable): 9-10-19

Bonded Well Constructor (name, license #, and mailing address): Don Larson

Lic # 10432, 16765 SE 362nd Drive, Sandy OR 97055

(1) Location of Well N1 1/4 N1 1/4 Tax lot _____ Section 29,
 Township 1 N Range 3 E, Multnomah County
 Address at well site _____ Railroad Right of Way _____

(2) Start Card Number(s)(for work to be done): 1044350 & 1044351

(3) Name and Address of Land Owner Union Pacific Railroad
1400 Douglas Street, Omaha, NE 68179

(4) Distance to the nearest septic tank, drainfield, closed sewage line (if water supply well)
Unknown

(5) The unusual site conditions which necessitate this request: Monitoring well abandonment
by grout in-place method for 2 monitoring wells, based on well construction details and
water quality data enclosed with this request (Table 2)

(6) The proposed construction methods that the bonded well constructor believes will be adequate for this well (attach additional pages if needed)
Pressure grout from bottom to top of monitoring wells, remove well monument and patch surface.

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AUG 19 2019

OWRD

- (7) Diagram showing the pertinent features of the proposed well design and construction (attach additional pages if needed)

PLEASE NOTE

- (1) The Well Construction Standards serve to protect ground water resources. By approving and issuing this special construction standard the Oregon Water Resources Department is not representing that a well constructed in accordance with this condition will maintain structural integrity or that it meets engineering standards. The well constructor/or landowner is responsible for ensuring that a well is constructed in a manner that protects ground water resources as required under Oregon Administrative Rules 690-200 through 690-240
- (2) If it should be determined at some future date that the well, due to its construction, is allowing ground water contamination, waste or loss of artesian pressure, the undersigned shall return to the site and rectify the problem.
- (3) If oral approval was granted, a written request must be submitted to the Department either within three (3) working days of the date of oral approval or prior to the completion of the associated well work. Failure to submit a written request as described above may void prior oral approval.

I have read and understand the above information. I further attest that the information provided is accurate to the best of my knowledge.

Bonded Constructor Signature _____

Don Larson

RECEIVED

AUG 19 2019