LANDAU ASSOCIATES

September 14, 2016

Oregon Department of Environmental Quality
Northwest Region Portland Office
2010 SE 4th Ave., Suite 400
Portland, OR 97201

Attn: Mr. Bob Williams

Transmitted via email to: *Robert.k.williams@state.or.us*

Re: Work Plan
BOP-22(dg), BOP-70(ds), BOP-71(ds), and EMC-2(usg) Well Decommissioning
East Multnomah County Remedy
Gresham, Oregon
ECSI No. 1479

Dear Bob:

Landau Associates has prepared this work plan for well decommissioning as part of the East Multnomah County Troutdale Sandstone Aquifer (TSA) remedy project being conducted jointly between The Boeing Company (Boeing) and Cascade Corporation (Cascade). The TSA remedy is being implemented under the Oregon State Department of Environmental Quality (ODEQ) Consent Order No. WMCSR-NWR-96-08. This work plan provides the procedures to decommission four groundwater monitoring wells [BOP-22(dg), BOP-70(ds), BOP-71(ds), and EMC-2(usg)]. The locations of the wells are shown on Figure 1. DEQ approved removal of these wells from the monitoring program on May 26, 2016 (Williams 2016).

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. The exploration logs and as-builts are provided in Attachment 1. Historical concentrations of the chemicals of potential concern (COPCs) for the East Multnomah Count Remedy project (trichloroethene [TCE]; tetrachloroethene; cis-1,2-dichloroethene; 1,1-dichloroethene; and vinyl chloride) are summarized in Table 2.

Groundwater monitoring well BOP-22(dg) is located near the northwestern property boundary of the Boeing site, as shown on Figure 1, and is screened from -239 to -259 feet mean sea level (ft MSL) elevation in the lower portion of the TSA unit. The well was installed in 1989 to monitor groundwater quality along the western portion of the remedy area. Analytical results for the project COPCs at this well are all below the respective laboratory reporting limits with the one-time exception of TCE, which was reported at a concentration of 0.4 micrograms per liter (µg/L) during the initial sampling in 1989. The single detection of TCE was well below the cleanup level (5 µg/L).

Monitoring wells BOP-70(ds) and BOP-71(ds) are located within the City of Gresham right-of-ways for NE 185th Avenue and NE Sandy Boulevard, as shown on Figure 1. BOP-70(ds) is a flush-mount well located in NE 185th Avenue roadway near the eastern curb; BOP-71(ds) is an above-grade well located in an unpaved right-of-way on the north side of Sandy Blvd. Monitoring well BOP-71(ds) is screened from elevation -185 to -205 ft MSL, which correlates to the upper portion of the TSA unit. Well BOP-70(ds) has three screened intervals; however, only the intermediate screen was utilized for groundwater monitoring:

- A shallow screen from elevation -144.51 to -154.51 ft MSL, which correlates to the lower unit of the confining layer between the Troutdale Gravel Aquifer (TGA) and the underlying TSA.

- An intermediate screen from elevation -174.51 to -184.51 ft MSL, which correlates to the upper portion of the TSA unit.
- A lower screen from elevation -204.51 to -214.51 ft MSL, which correlates to the base of the TSA unit.

Historical COPCs analytical results for BOP-70(ds) and BOP-71(ds) indicate all COPCs have been below the respective laboratory reporting limits with the exception of two low-level (0.5 and 0.62 µg/L) TCE concentrations at BOP-70(ds) in 2007, which were below the cleanup level.

Well EMC-2(usg) is a flush-mount well within a vault located near Fairview Lake in an open utility landscape space (City of Fairview right-of-way) north of the railroad tracks, as shown on Figure 1. EMC-2(usg) is screened within the Sand and Gravel Aquifer (SGA), which underlies the TSA. Well EMC-2(usg) was installed in 1997 with a screened interval from -104 to -114 ft MSL elevation. COPC concentrations have consistently been below the respective laboratory reporting limits, and the well was removed from the project monitoring program in August 2013, although maintained for Portland Water Bureau monitoring through 2015.

Methodology

Well decommissioning will follow applicable Oregon Administrative Rules (OARs) outlined in OAR 690-240 using an Oregon Certified Driller. 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.
- 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.

Over-Drilling

Wells BOP-22(dg), BOP-70(ds), BOP-71(ds), and EMC-2(usg) will be decommissioned by over-drilling using a rotosonic drill rig. Decommissioning methods will be conducted in accordance with OAR 690-240-0510(1) and will follow these general steps:

- The concrete pad, steel vault and/or protective casing, and other surface items (e.g., bollards) will be removed using an excavator or similar heavy equipment.
- The PVC casing and screen, and well seal materials (e.g., filter pack sand, bentonite), will be removed using the drilling rig by over-drilling the well from ground surface to total depth of the well [BOP-22(dg) is 338 ft deep; BOP-70(ds) is 285 ft deep; BOP-71(ds) is 295 ft deep; and EMC-2(usg) is 171 ft deep]. Stepdown in drill casings were observed at BOP-22(dg) at 171 ft below ground surface (bgs) and BOP-71(ds) at 195 ft bgs. A minimum drill bit equal to the outside-diameter of the boring will be used to over-drill the wells.
- The drill cuttings, sand filter pack, and other debris will be removed from the boring.
- The boring will be backfilled with bentonite grout slurry from the bottom of the boring to approximately 5 bgs. The bentonite grout slurry will meet the requirements of OAR 690-240-0475 for backfill materials. Hydrated bentonite chips will be used to backfill the boring to 1 ft bgs. Soil or concrete will be used to backfill the boring to the surface.
- The work area will be cleaned up, decommissioning materials and debris removed, and the ground surface restored to match surrounding terrain.

Site Cleanup and Waste Management

Solid wastes and soil cuttings (investigation derived waste [IDW]) generated during decommissioning will be contained in 10- to 20-cubic yard containers and placed into temporary storage pending characterization, permitting, and transport to the proper disposal facility. Based on previous ODEQ procedures, the IDW from the wells will be field-screened for the possible presence of contamination using visual signs of soil staining or

sheen, and vapor head-space measurements with a portable photoionization detector meter. One composite sample from each IDW storage container will be collected and analyzed for the disposal facility requested analyte suite. If field screening results and/or analytical results indicate the presence of contamination, ODEQ will be consulted for a "No Longer Contains" determination. Upon receipt of the No Longer Contains determination (if needed), the IDW will be transported offsite for disposal. The metal protective monuments removed from the well will be decontaminated and recycled at the appropriate facility.

Wastewater collected will be temporarily stored in a holding tank and decanted into the existing TSA central treatment system (CTS) for BOP-70(ds), BOP-71(ds), and EMC-2(usg), and at the Boeing Groundwater Treatment System (GWTS) for BOP-22(dg).

Notification and Schedule

ODEQ will be notified via email prior to and upon the completion of the well decommissioning. Notification information will include the following, in accordance with OAR 690-240-0510(6) (notification requirements):

1. Well identification information
2. Decommissioning methodology
3. Amount and type of sealant/backfill material (i.e., bentonite grout) used
4. Any other information required by the ODEQ.

Well decommissioning activities will also be reported in the pending TSA 2016 annual report. Well decommissioning activities are scheduled to begin mid to late October and are expected to require approximately 10 days per well to complete

The completion notification email will be sent to ODEQ within 2 weeks after decommissioning activities are completed.

LANDAU ASSOCIATES, INC.

Christina Kimmel

Chris Kimmel, LG
Associate Geologist

Brett Borgeson

Brett Borgeson
Project Scientist

CBK/BHB/tam
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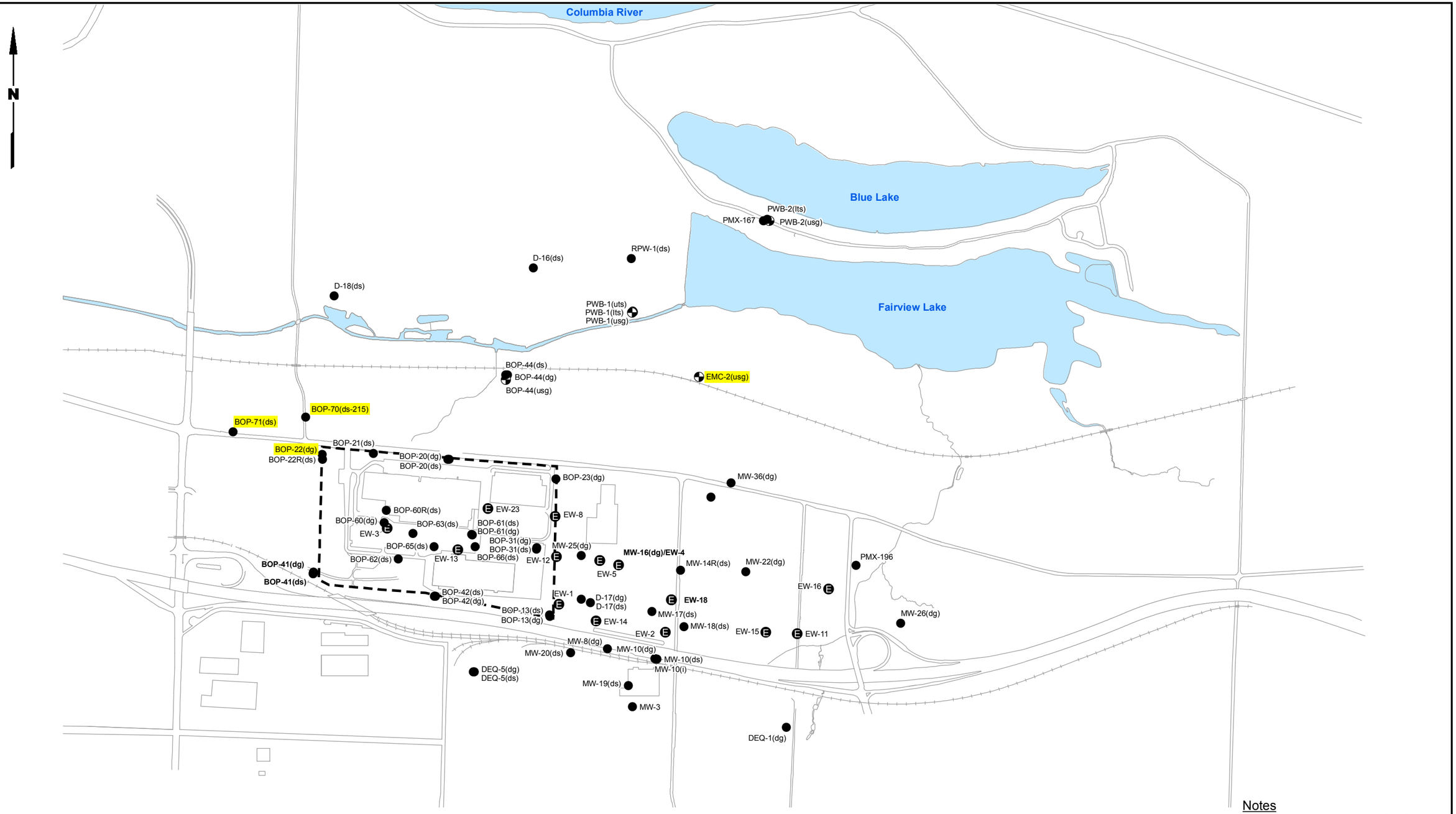
Attachments

Figure 1	TSA Remedy Well Locations
Table 1	Selected Well Construction Data
Table 2	Historical Analytical Results – Selected TSA Wells
Attachment 1:	Exploration Logs and As-builts

References

Williams, R. 2016. "Re: Cascade Boeing TSA 2015 Annual Report." Robert K. Williams, Oregon Department of Environmental Quality. May 26.



Notes
1. Blue colored wells are identified for decommissioning.
2. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

Legend
- SGA Monitoring Wells
- TSA Monitoring Wells
- TSA Extraction Wells
- Subject Property

0 1,000 2,000
Scale in Feet

LANDAU ASSOCIATES

Boeing Portland Gresham, Oregon	**TSA Remedy Well Locations**	Figure 1

TABLE 1
SELECTED WELL CONSTRUCTION DATA
EAST MULTNOMAH COUNTY TSA REMEDY

Well				Elevations, ft MSL					
	Aquifer Screened	X Coordinate	Y Coordinate	Ground Surface	Measuring Point	Top of Screen	Bottom of Screen	Depth of Boring (ft)	Boring Outside Diameter (inches)
BOP-22(dg)	Lower TSA	1495260.1	691137.8	81.3	81.05	-239	-259	338	8
BOP-70(ds)	Upper TSA	1495082.9	691532.8	65.5	65.15	-144.6	-154.6	285	12
BOP-71(ds)	Upper TSA	1494310.3	691381.3	85.6	87.88	-185	-205	308	12
EMC-2(usg)	SGA	1499258.5	691965.1	52.9	47.15	-104	-114	175	10

MSL = mean sea level
ft = feet
TSA = Troutdale Sandstone Aquifer
SGA = Sand and Gravel Aquifer

TABLE 2
HISTORICAL ANALYTICAL RESULTS
SELECTED TSA WELLS
EAST MULTNOMAH COUNTY TSA REMEDY

Sample Location	Sample Date	TCE	1,1-DCE	cis-1,2-DCE	PCE	VC
	MCL Cleanup Level:	**5**	**7**	**70**	**5**	**2**
BOP-22dg	4/17/1989	**0.4** J	NA	NA	NA	NA
BOP-22dg	2/13/1991	1.0 U	1.0 U	1.0 U	1.0 U	3.0 U
BOP-22dg	5/14/1991	1.0 U	1.0 U	1.0 U	1.0 U	2.0 U
BOP-22dg	8/14/1991	1.0 U	1.0 U	1.0 U	1.0 U	2.0 U
BOP-22dg	1/29/1992	1.0 U	1.0 U	1.0 U	1.0 U	3.0 U
BOP-22dg	7/10/1992	1.0 U	1.0 U	1.0 U	1.0 U	2.0 U
BOP-22dg	10/28/1992	1.0 U	1.0 U	1.0 U	1.0 U	2.0 U
BOP-22dg	2/11/1993	1.0 U	1.0 U	1.0 U	1.0 U	2.0 U
BOP-22dg	7/23/1993	1.0 U	1.0 U	1.0 U	1.0 U	2.0 U
BOP-22dg	2/14/1994	1.0 U	1.0 U	1.0 U	1.0 U	2.0 U
BOP-22dg	8/17/1994	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
BOP-22dg	2/20/1995	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
BOP-22dg	8/28/1995	1.0 U	1.0 U	1.0 U	1.0 U	2.0 U
BOP-22dg	2/14/1996	1.0 U	1.0 U	1.0 U	1.0 U	2.0 U
BOP-22dg	8/7/1996	1.0 U	1.0 U	1.0 U	1.0 U	2.0 U
BOP-22dg	10/18/1996	1.0 U	1.0 U	1.0 U	1.0 U	2.0 U
BOP-22dg	10/25/1996	1.0 U	1.0 U	1.0 U	1.0 U	2.0 U
BOP-22dg	2/18/1997	1.0 U	1.0 U	1.0 U	1.0 U	2.0 U
BOP-22dg	2/20/1998	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
BOP-22dg	8/13/1998	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
BOP-22dg	9/3/1999	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
BOP-22dg	1/11/2000	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
BOP-22dg	8/15/2000	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
BOP-22dg	10/12/2000	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
BOP-22dg	8/13/2001	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
BOP-22dg	8/9/2002	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
BOP-22dg	8/7/2003	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
BOP-22dg	9/23/2003	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
BOP-22dg	8/6/2004	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
BOP-22dg	8/4/2005	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
BOP-22dg	8/11/2006	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
BOP-22dg	11/28/2006	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
BOP-22dg	8/17/2007	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
BOP-22dg	8/13/2008	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
BOP-22dg	8/7/2009	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
BOP-22dg	8/18/2010	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
BOP-22dg	8/4/2011	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
BOP-22dg	8/6/2014	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
BOP-22dg	8/28/2015	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
BOP-70ds (215)	4/18/2007	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
BOP-70ds (215)	4/18/2007	**0.50**	0.5 U	0.5 U	0.5 U	0.5 U
BOP-70ds (215)	5/15/2007	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
BOP-70ds (215)	8/6/2007	**0.62**	0.5 U	0.5 U	0.5 U	0.5 U
BOP-70ds (215)	11/7/2007	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
BOP-70ds (215)	2/7/2008	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
BOP-70ds (215)	5/7/2008	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
BOP-70ds (215)	8/12/2008	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
BOP-70ds (215)	11/11/2008	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U

TABLE 2
HISTORICAL ANALYTICAL RESULTS
SELECTED TSA WELLS
EAST MULTNOMAH COUNTY TSA REMEDY

Sample Location	Sample Date	TCE	1,1-DCE	cis-1,2-DCE	PCE	VC
	MCL Cleanup Level:	**5**	**7**	**70**	**5**	**2**
BOP-70ds (215)	2/9/2009	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
BOP-70ds (215)	5/13/2009	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
BOP-70ds (215)	8/13/2009	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
BOP-70ds (215)	2/10/2010	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
BOP-70ds (215)	8/10/2010	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
BOP-70ds (215)	2/8/2011	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
BOP-70ds (215)	8/8/2011	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
BOP-70ds (215)	2/22/2012	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
BOP-70ds (215)	7/30/2012	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
BOP-70ds (215)	2/13/2013	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
BOP-70ds (215)	8/20/2013	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
BOP-70ds (215)	2/5/2014	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
BOP-70ds (215)	8/5/2014	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
BOP-71ds	4/17/2007	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
BOP-71ds	5/15/2007	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
BOP-71ds	8/6/2007	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
BOP-71ds	11/7/2007	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
BOP-71ds	2/7/2008	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
BOP-71ds	5/7/2008	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
BOP-71ds	8/12/2008	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
BOP-71ds	11/11/2008	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
BOP-71ds	2/9/2009	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
BOP-71ds	5/13/2009	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
BOP-71ds	8/13/2009	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
BOP-71ds	2/10/2010	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
BOP-71ds	8/10/2010	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
BOP-71ds	2/8/2011	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
BOP-71ds	8/8/2011	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
BOP-71ds	2/22/2012	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
BOP-71ds	7/30/2012	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
BOP-71ds	2/13/2013	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
BOP-71ds	8/20/2013	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
BOP-71ds	2/5/2014	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
BOP-71ds	8/5/2014	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
EMC-2usg	9/6/1997	0.5 U	0.5 U	0.5 U	1 U	0.5 U
EMC-2usg	9/15/1997	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
EMC-2usg	11/12/1997	0.5 U	0.5 U	0.5 U	0.5 U	NA
EMC-2usg	2/25/1998	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
EMC-2usg	5/22/1998	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
EMC-2usg	8/26/1998	0.5 U	0.5 U	0.5 U	0.5 U	NA
EMC-2usg	2/27/1999	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
EMC-2usg	8/18/1999	0.5 U	0.5 U	0.5 U	0.5 U	NA
EMC-2usg	2/9/2000	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
EMC-2usg	8/9/2000	0.5 U	0.5 U	0.5 U	0.5 U	NA
EMC-2usg	10/11/2000	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
EMC-2usg	2/13/2001	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
EMC-2usg	8/6/2001	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
EMC-2usg	2/11/2002	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U

TABLE 2
HISTORICAL ANALYTICAL RESULTS
SELECTED TSA WELLS
EAST MULTNOMAH COUNTY TSA REMEDY

Sample Location	Sample Date	TCE	1,1-DCE	cis-1,2-DCE	PCE	VC
	MCL Cleanup Level:	**5**	**7**	**70**	**5**	**2**
EMC-2usg	8/13/2002	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
EMC-2usg	2/18/2003	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
EMC-2usg	8/13/2003	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
EMC-2usg	9/25/2003	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
EMC-2usg	2/16/2004	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
EMC-2usg	8/17/2004	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
EMC-2usg	2/10/2005	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
EMC-2usg	8/8/2005	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
EMC-2usg	2/14/2006	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
EMC-2usg	8/14/2006	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
EMC-2usg	11/6/2006	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
EMC-2usg	8/6/2007	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
EMC-2usg	8/12/2008	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
EMC-2usg	8/13/2009	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
EMC-2usg	8/10/2011	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
EMC-2usg	8/20/2013	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U

MCL = maximum contaminant level
NA = not analyzed.
TCE = trichloroethene
1,1,-DCE = 1,1-dichloroethene
cis-1,2-DCE = cis-1,2-dichloroethene
PCE = tetrachloroethene
VC = vinyl chloride

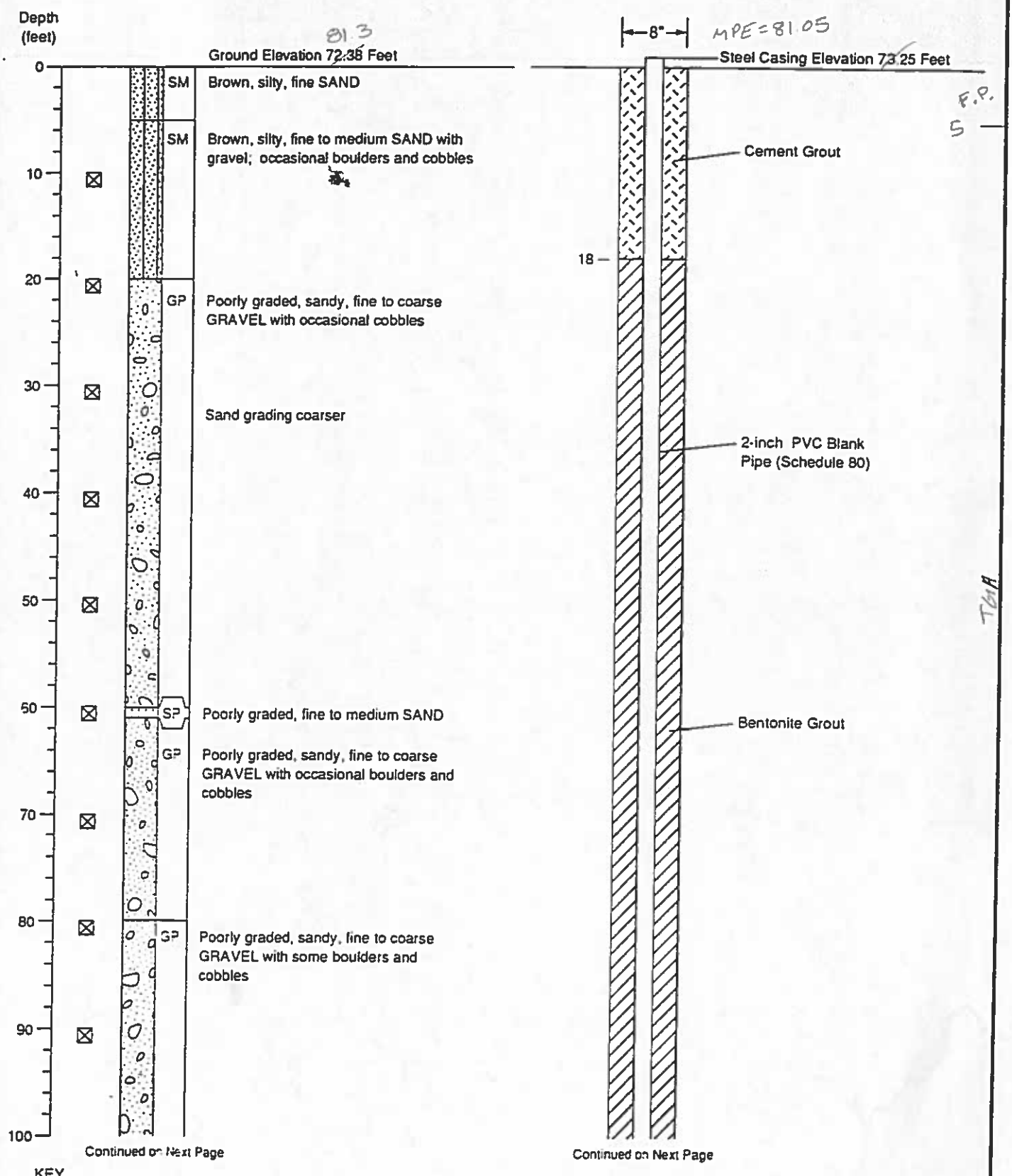
U = Indicates compound was analyzed for, but was not detected at the given reporting limit.

Note: Results reported in micrograms per liter (µg/L).

ATTACHMENT 1

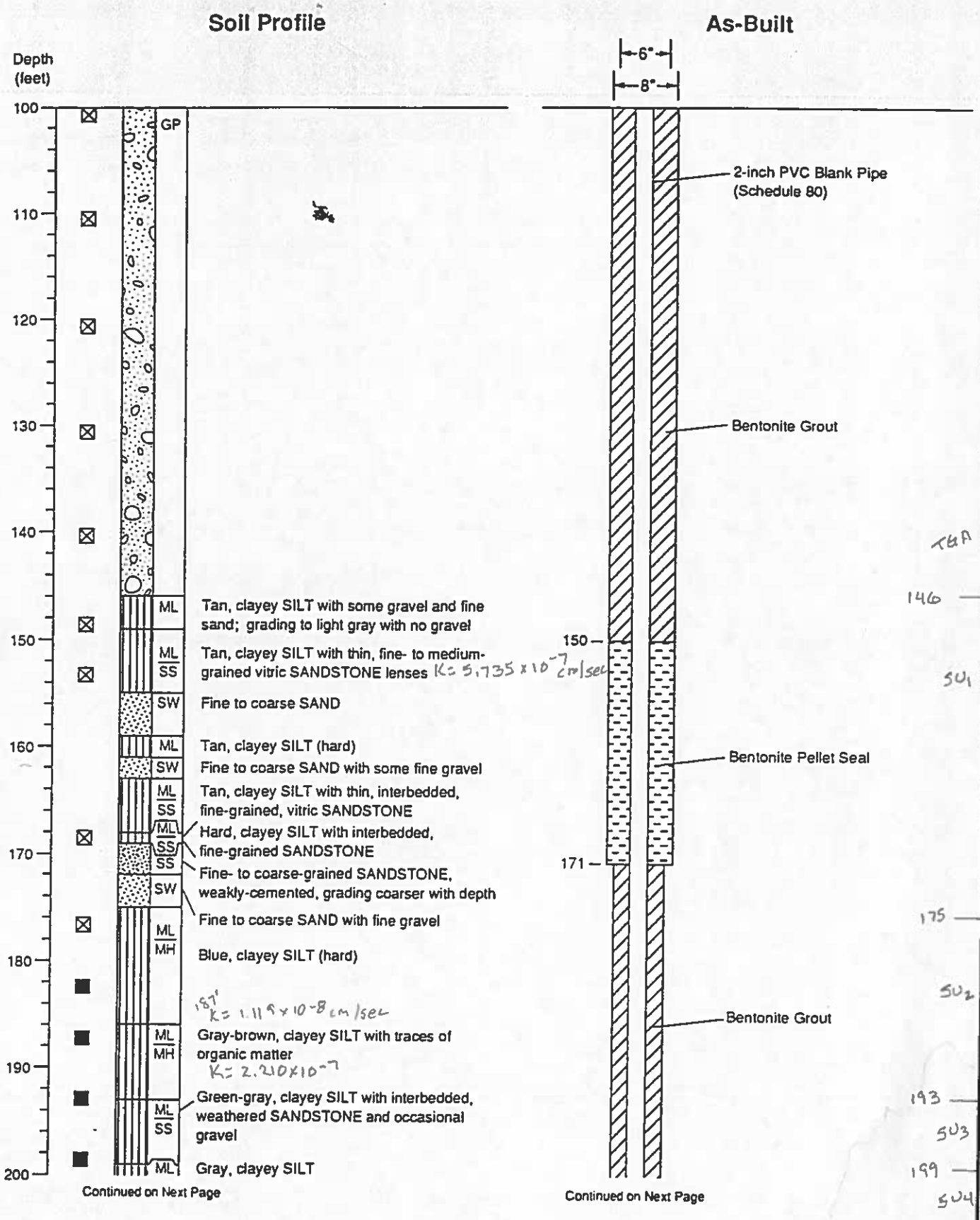
Exploration Logs and As-Builts

Well BOP-22(dg)



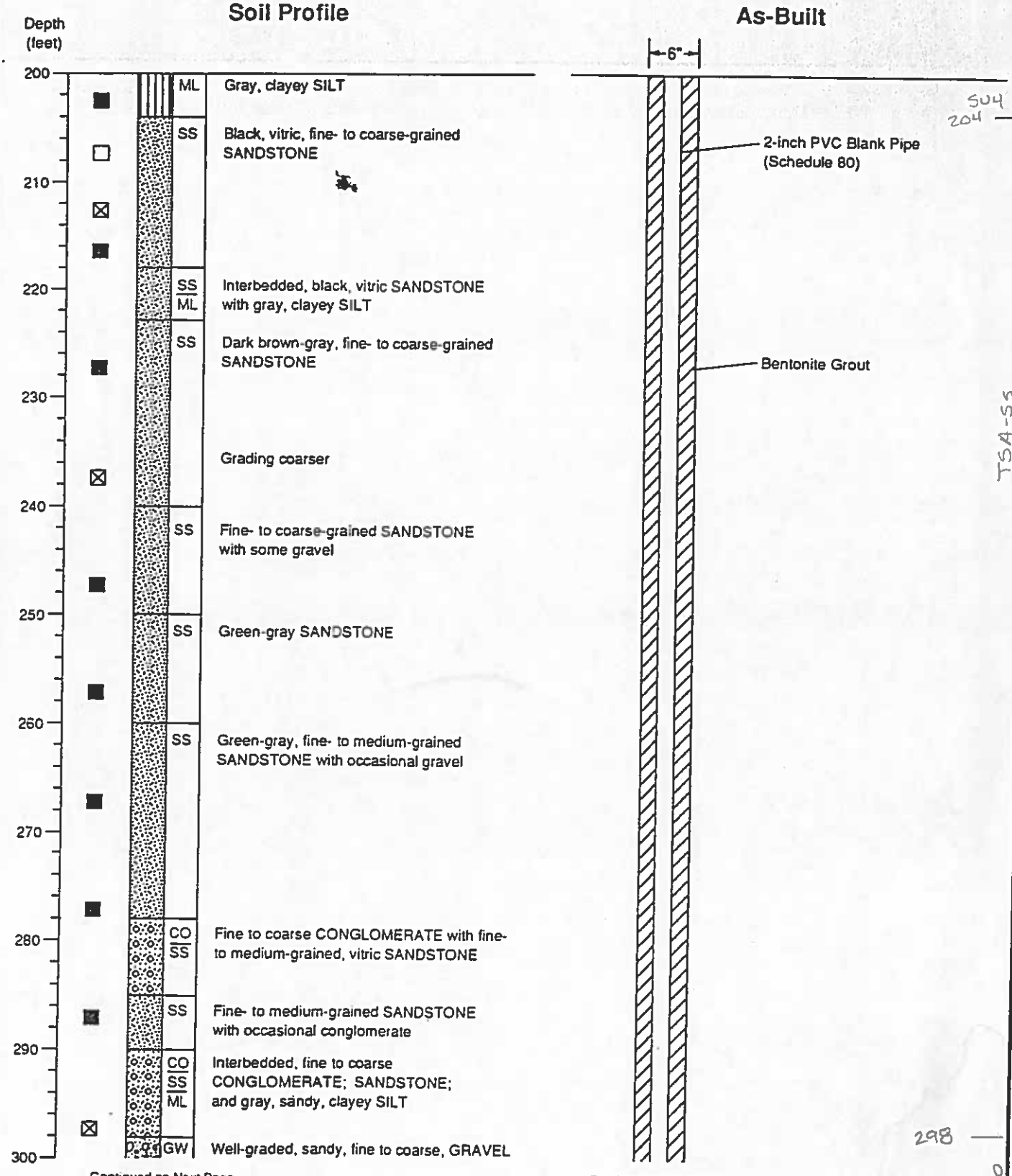
LANDAU ASSOCIATES, INC.	Soil Profile and Well Log for Well BOP-22(dg)

Well BOP-22(dg) (Continued)



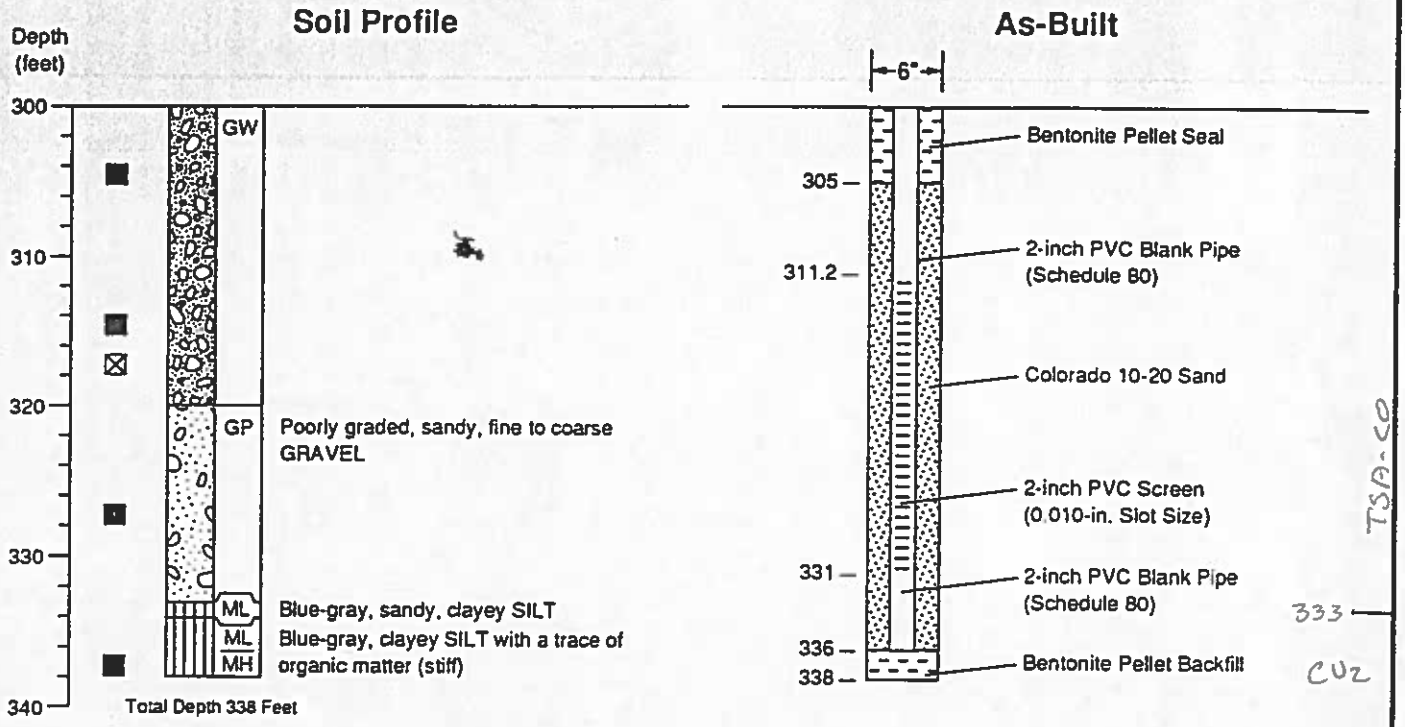
LANDAU ASSOCIATES, INC.	Soil Profile and Well Log for Well BOP-22(dg)

Well BOP-22(dg) (Continued)



LANDAU ASSOCIATES, INC.	Soil Profile and Well Log for Well BOP-22(dg)

Well BOP-22(dg) (Continued)



LANDAU ASSOCIATES, INC.	Soil Profile and Well Log for Well BOP-22(dg)

Figure A-7 (4 of 4)

Geologic Log

0'–0.66' CONCRETE SLAB

BROWN SANDY SILT, DAMP (3')

BROWN SANDY, GRAVELLY SILT, DAMP (6')

6'–7' GRAY SILTY, SANDY GRAVEL, DAMP

7'–8' COBBLES AND BOULDERS

GRAY SILTY, SANDY GRAVEL WITH LENSES OF INCREASED SAND AND SILT, DENSE AND DAMP

97'

BROWN SILTY, SANDY BLACK AND TAN GRAVEL, WET

115'

BROWN SILTY, SANDY MULT–COLORED GRAVEL, WET

135'

GRAY–BROWN SANDY GRAVEL, CEMENTED IN CLAY WITH DEPTH

163'–164' TAN SILTSTONE

164'–165' GRAY SILTSTONE

165'–167' GRAY SANDSTONE

BLACK AND BROWN SAND AND SANDSTONE MIX WITH GRAVEL, DENSE AND WET

198'

203'

BLACK AND BROWN SANDY GRAVEL, WITH SOFT BLUE/GRAY SILTSTONE

BLACK SAND WITH PIECES OF SANDSTONE, TRACE OF GRAVEL WITH DEPTH

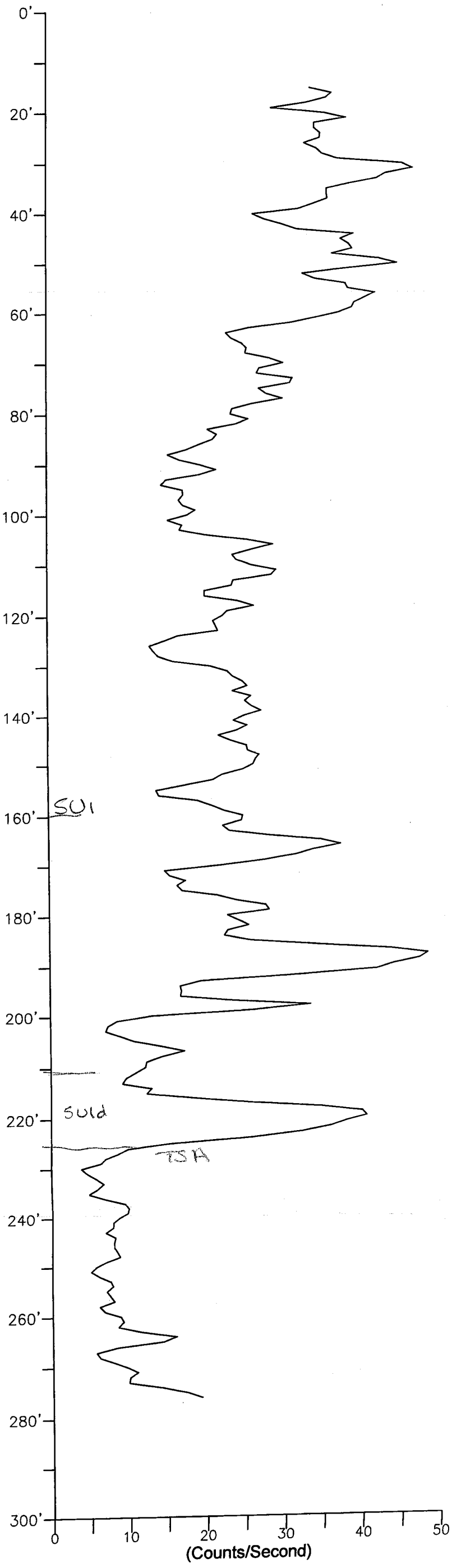
280'

283'

BLACK SANDY GRAVEL, WET

BOTTOM OF HOLE AT 283'

Natural Gamma Log



NOTE:
GEOLOGIC LOG NOMENCLATURE PROVIDED BY LANDAU ASSOCIATES, INC.

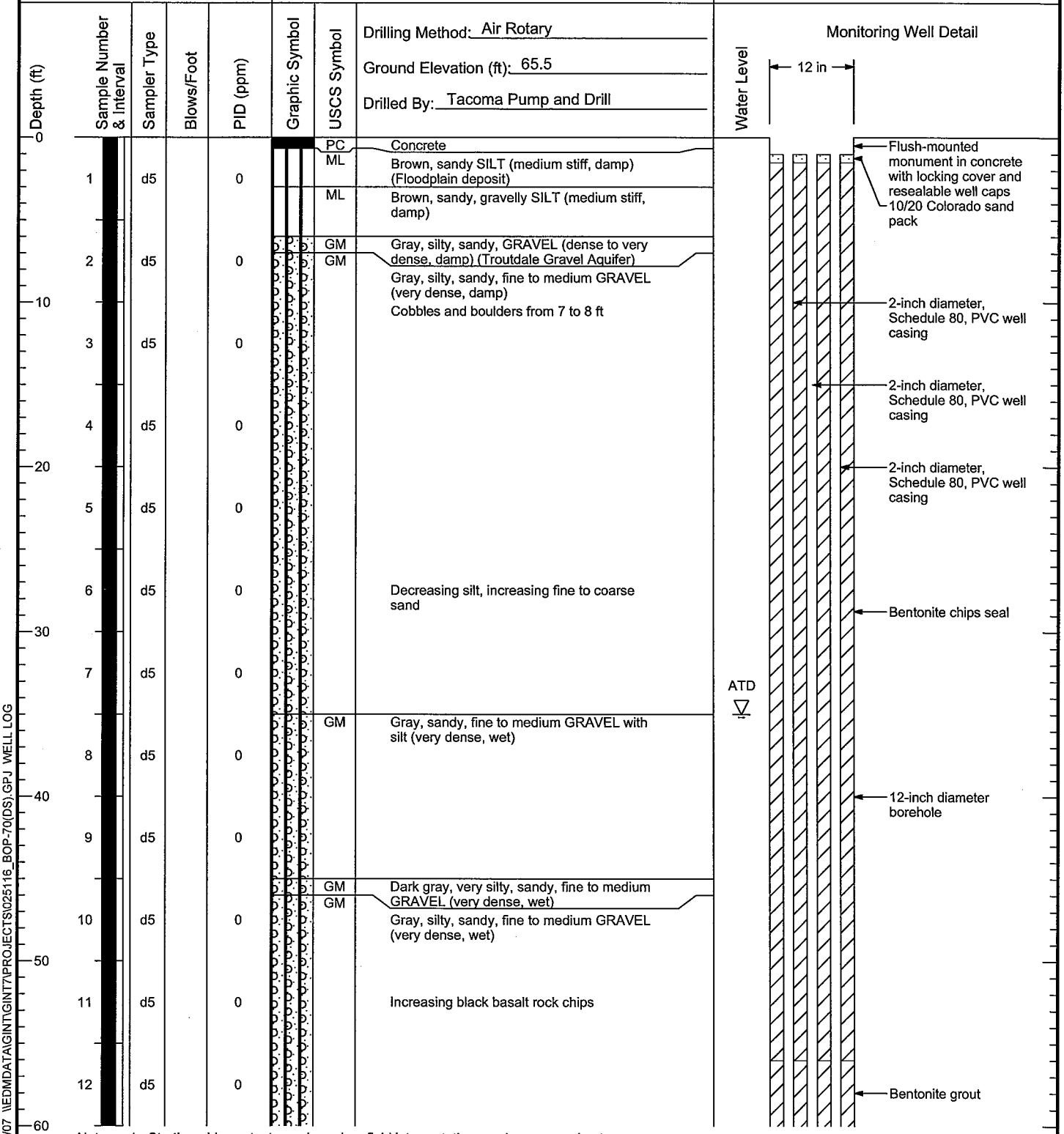
ROBINSON NOBLE SALTBUSH INC.	PM: SAM	Multnomah County, Oregon
	March 2007	T 01 N/R 03 E - 20

Figure 2

Boeing-Cascade Corp. Well BOP-70 (DS) Natural Gamma Log

Tacoma Pump & Drilling Company, Inc.

BOP-70 (ds)



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. 9/4/07 \\EDMDATA\GINT\GINT7\PROJECTS\025116_BOP-70(DS).GPJ WELL LOG

LANDAU ASSOCIATES

TSA Remedy Portland, Oregon	Log of Monitoring Well BOP-70 (ds)	Figure A-2 (1 of 5)

BOP-70 (ds)

SAMPLE DATA				SOIL PROFILE			GROUNDWATER	
Depth (ft)	Sample Number & Interval	Sampler Type	Blows/Foot	PID (ppm)	Graphic Symbol	USCS Symbol	Drilling Method: Air Rotary Ground Elevation (ft): 65.5 Drilled By: Tacoma Pump and Drill	Water Level / Monitoring Well Detail
60						GM	Gray, silty, sandy, fine to medium GRAVEL (very dense, wet)	
	13	d5		0				2-inch diameter, Schedule 80, PVC well casing
	14	d5		0				
70								2-inch diameter, Schedule 80, PVC well casing
	15	d5		0				
	16	d5		0			Some quartzite rock	2-inch diameter, Schedule 80, PVC well casing
80								
	17	d5		0				
							Some tan rock	Bentonite grout
	18	d5		0				
90								
	NR							
						GM	Brown to gray, silty, sandy fine to medium GRAVEL (dense, wet)	12-inch diameter borehole
	19	d5		0				
100							Gravel consists of black fine grained rock and quartzose sandstone	
	20	d5		0			Increasing brown silt	
	NR	d5						
110								
	21	d5		0				
						GM	Brown, silty, sandy fine to medium GRAVEL with multicolored rock (dense, wet)	
	22	d5		0				
120								

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

25116. 9/4/07 \\EDMDATA\GINT\GINT7\PROJECTS\025116_BOP-70(DS).GPJ WELL LOG

LANDAU ASSOCIATES

TSA Remedy Portland, Oregon	Log of Monitoring Well BOP-70 (ds)	Figure A-2 (2 of 5)

BOP-70 (ds)

Drilling Method: Air Rotary
Ground Elevation (ft): 65.5
Drilled By: Tacoma Pump and Drill

Depth (ft)	Sample Number & Interval	Sampler Type	Blows/Foot	PID (ppm)	Graphic Symbol	USCS Symbol	Soil Profile	Water Level	Monitoring Well Detail
120						GM	Brown, silty, sandy fine to medium GRAVEL with multicolored rock (dense, wet)		
	23	d5		0					
	24	d5		0					
130									BOP-70 (ds) Shallow: 2-inch diameter, Schedule 80, PVC well casing
	25	d5		0					
						GP	Gray to brown, sandy fine to medium GRAVEL (dense, wet)		BOP-70 (ds) Intermediate: 2-inch diameter, Schedule 80, PVC well casing
	26	b5		0					
140									BOP-70 (ds) Deep: 2-inch diameter, Schedule 80, PVC well casing
	27	d5		0					
	28	d5		0			Some cemented gravel, increasing sand content		
150									Bentonite grout
	29	d5		0					
						GP	Gray to brown, sandy GRAVEL some gravel cemented with clay (dense, wet)		
	30	d5		0					
160									12-inch diameter borehole (nominal)
	31	d5		0					
						SLS	Tan, SILTSTONE (Confining Unit 1)		
						SLS	Gray, SILTSTONE		
						SNS	Gray, SANDSTONE		
	32	d5		0		SNS	Dark brown to black, SANDSTONE (very dense, wet)		
170						SNS	Dark brown, SANDSTONE with interbedded black and brown sand (very dense, wet)		
	33	d5		0					
						SNS	Brown and dark brown, SANDSTONE with sand (very dense, wet)		
						SNS	Brown to black, fine to medium SANDSTONE (very dense, wet)		
	34	d5		0					
180									

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. 9/4/07 \\EDMDATA\GINT\GINT7\PROJECTS\025116_BOP-70(DS).GPJ WELL LOG

LANDAU ASSOCIATES

TSA Remedy Portland, Oregon	Log of Monitoring Well BOP-70 (ds)	Figure A-2 (3 of 5)

BOP-70 (ds)

Drilling Method: Air Rotary
Ground Elevation (ft): 65.5
Drilled By: Tacoma Pump and Drill

Depth (ft)	Sample Number & Interval	Sampler Type	Blows/Foot	PID (ppm)	Graphic Symbol	USCS Symbol	Soil Profile	Water Level	Monitoring Well Detail
180						SNS	Brown and dark brown, SANDSTONE with sand and interbeds of dark gray siltstone		Bentonite grout
	35	d5		0		SNS	Black SANDSTONE and GRAVEL mix (very dense, wet)		2-inch diameter, Schedule 80, PVC well casing
	36	d5		0		SNS	Gray SILTSTONE and GRAVEL and some black SANDSTONE (dense, wet) Increasing siltstone		
190	37	d5		0		SNS	Brown and black, fine to medium SANDSTONE and GRAVEL with interbeds of soft blue-gray siltstone (medium dense, wet)		2-inch diameter, Schedule 80, PVC well casing
	38	d5		0					2-inch diameter, Schedule 80, PVC well casing
200	39	d5		0					12-inch diameter borehole
	40	d5		0		SNS	Black and tan, SANDSTONE and some gravels with pieces of light gray sandstone (dense to very dense, wet) (Troutdale Sandstone Unit).		Bentonite pellets seal
210	41	d5		0					10/20 Colorado sand pack
	NR	d5				SNS	Black and brown, SANDSTONE (dense, wet)		BOP-70 (ds-215): 2-inch diameter, Schedule 80, PVC screen (0.010-inch slot size)
	NR	d5							
220	NR	d5							Threaded end cap
	NR	d5							
230	42	d5		0					Bentonite pellets seal
	43	d5		0					10/20 Colorado sand pack
240									

Gamma SUIT

Gamma TSA

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. 9/4/07 \\EDMDATA\GINT\GINT7\PROJECTS\025116_BOP-70(DS).GPJ WELL LOG

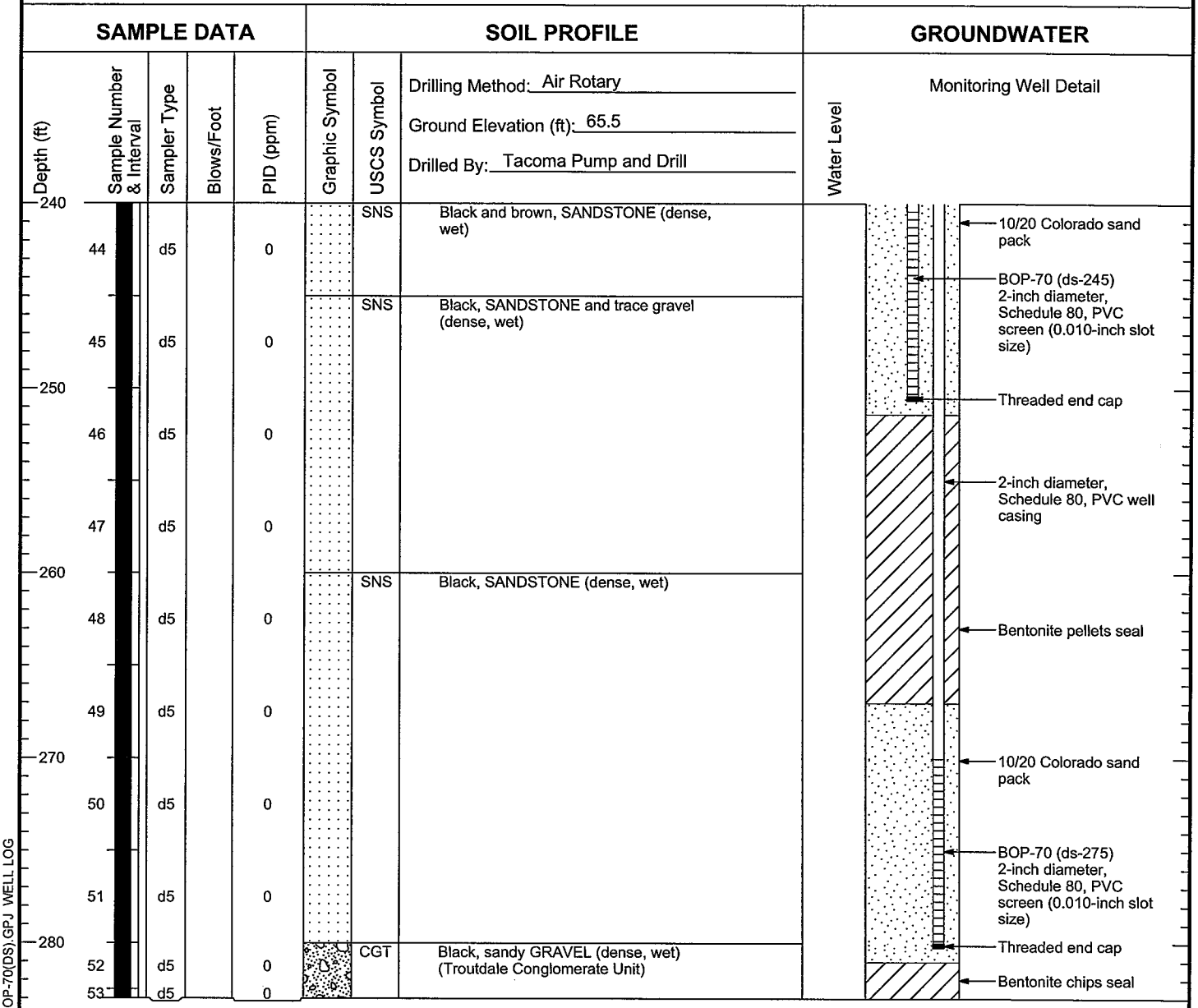
LANDAU ASSOCIATES

TSA Remedy
Portland, Oregon

Log of Monitoring Well BOP-70 (ds)

Figure
A-2
(4 of 5)

BOP-70 (ds)



Boring Completed 03/21/07
Total Depth of Boring = 283.0 ft.

Point located at State Plane Coordinates:
North: 691532.75
East: 1495082.90

Monitoring Well Completed 03/29/07
Elevation at Top of Monitoring Well Casing =
65.15 ft (Shallow);
65.13 ft (Intermediate);
65.12 ft (Deep)
Total Depth of Monitoring Well = 283.0 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.

25116. 9/4/07 \\EDMDATA\GINT\GINT7\PROJECTS\025116_BOP-70(DS).GPJ WELL LOG

LANDAU ASSOCIATES

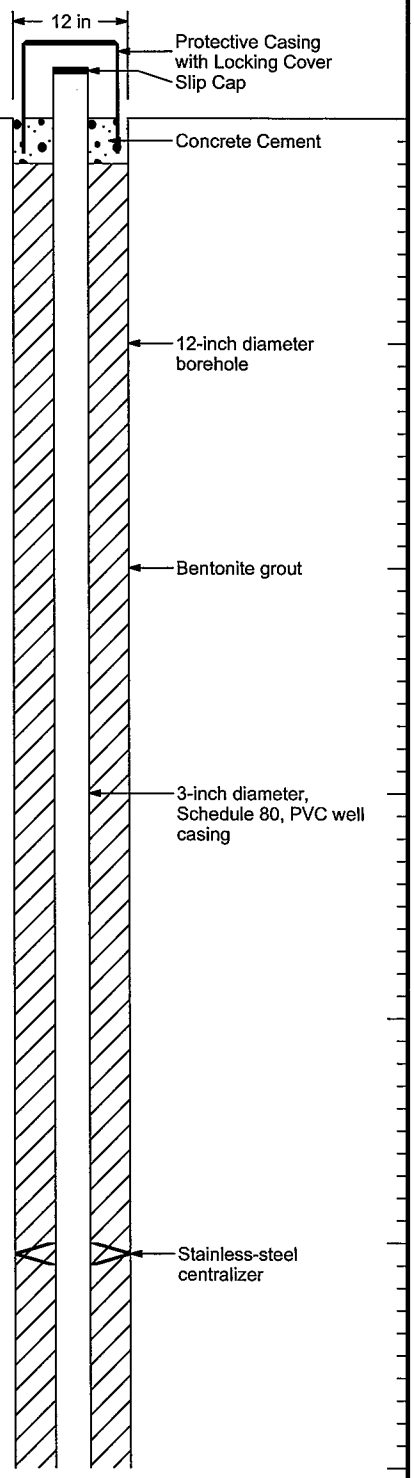
TSA Remedy Portland, Oregon	Log of Monitoring Well BOP-70 (ds)	Figure A-2 (5 of 5)

BOP-71 (ds)

SAMPLE DATA				SOIL PROFILE			GROUNDWATER
Depth (ft)	Sample Number & Interval	Sampler Type	Blows/Foot	PID (ppm)	Graphic Symbol	USCS Symbol	Drilling Method: Air Rotary Ground Elevation (ft): 85.6 Drilled By: Tacoma Pump and Drill
0						ML	Brown, sandy SILT (medium stiff, damp) (Floodplain deposit)
1		d5		0			
						ML	Light brown to gray, sandy SILT with trace gravels (medium stiff, damp)
2		d5		0			
10							
3		d5		0			Increasing sand
						GM	Brown, silty, sandy fine to medium GRAVEL with boulders and cobbles (dense, damp) (Troutdale Gravel Aquifer)
4		d5		0			
5		d5		0			
20							
6		d5		0			
7		d5		0			
30							
8		d5		0			
						GM	Brown, silty, sandy fine to medium GRAVEL with cobbles (medium dense, wet)
9		d5		0			
40							
						GM	Brown to gray, silty, sandy fine to medium GRAVEL (dense, wet)
10		d5		0			
11		d5		0			
50							
12		d5		0			
13		d5		0			
60							

Water Level: ATD ▽

Monitoring Well Detail



Notes:
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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. 9/4/07 \\EDMDATA\GINT\GINT7\PROJECTS\025116_BOP-71 (DS).GPJ WELL LOG

LANDAU ASSOCIATES

TSA Remedy Portland, Oregon	Log of Monitoring Well BOP-71 (ds)	Figure A-3 (1 of 6)

BOP-71 (ds)

SAMPLE DATA				SOIL PROFILE			GROUNDWATER
Depth (ft)	Sample Number & Interval	Sampler Type	Blows/Foot	PID (ppm)	Graphic Symbol	USCS Symbol	Drilling Method: Air Rotary Ground Elevation (ft): 85.6 Drilled By: Tacoma Pump and Drill	Water Level / Monitoring Well Detail
60						GM	Dark brown, sandy fine to medium angular GRAVEL with silt (dense, wet)	
	14	d5		0				
	15	d5		0				
70						GP	Dark brown-black, fine to medium GRAVEL (dense, wet) with very angular basalt chips	
	16	d5		0				
	17	d5		0				
80								
	18	d5		0				
	19	d5		0				
90						ML	Dark brown, very fine to medium gravelly SILT interbed with rounded and subrounded gravels and boulders (very dense, wet)	
	20	d5		0				
						GP	Gray, sandy fine to medium GRAVEL with black and tan cobbles and boulders (dense to very dense, wet)	
	21	d5		0				
100								
	22	d5		0				
	23	d5		0				
110								
	24	d5		0				
						GM	Gray-brown, silty, sandy fine to medium GRAVEL (dense, wet)	
	25	d5		0				
120								

12-inch diameter borehole

Bentonite grout

3-inch diameter, Schedule 80, PVC well casing

Stainless-steel centralizer

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. 9/4/07 \\EDMDATA\GINT\GINT7\PROJECTS\025116_BOP-71 (DS).GPJ WELL LOG

LANDAU ASSOCIATES

TSA Remedy
Portland, Oregon

Log of Monitoring Well BOP-71 (ds)

Figure
A-3
(2 of 6)

BOP-71 (ds)

Drilling Method: Air Rotary
Ground Elevation (ft): 85.6
Drilled By: Tacoma Pump and Drill

Depth (ft)	Sample Number & Interval	Sampler Type	Blows/Foot	PID (ppm)	Graphic Symbol	USCS Symbol	Soil Profile	Water Level	Monitoring Well Detail
120						GP	Black to tan, sandy, GRAVEL (dense, wet)		
	26	d5		0					
	27	d5		0			gravel fragments are white and tan and have a sandy matrix Increasing quartzite and chert		
130									12-inch diameter borehole (nominal)
	28	d5		0					
	29	d5		0					
	30	d5		0					
140						GP	Gray-brown, sandy, medium to coarse, very micaceous GRAVEL with some fine sand		Bentonite grout
	31	d5		0					
	32	d5		0					
150						GP	Gray-black, sandy, medium to coarse GRAVEL with multi-colored rock chips (dense, wet)		3-inch diameter, Schedule 80, PVC well casing
	33	d5		0					
	34	d5		0					
160									
	35	d5		0					
	36	d5		0					
170									Stainless-steel centralizer
	37	d5		0					
	38	d5		0					
180									

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

25116. 9/4/07 \\EDMDATA\GINT\GINT7\PROJECTS\025116_BOP-71 (DS).GPJ WELL LOG

LANDAU ASSOCIATES

TSA Remedy
Portland, Oregon

Log of Monitoring Well BOP-71 (ds)

Figure
A-3
(3 of 6)

BOP-71 (ds)

Drilling Method: Air Rotary
Ground Elevation (ft): 85.6
Drilled By: Tacoma Pump and Drill

Depth (ft)	Sample Number & Interval	Sampler Type	Blows/Foot	PID (ppm)	Graphic Symbol	USCS Symbol	Soil Profile
180	39	d5		0		GP	Gray-black, sandy, medium to coarse GRAVEL with multi-colored rock chips (dense, wet)
	40	d5		0			
190	41	d5		0		GP	Gray to black, sandy GRAVEL with occassional siltstone (medium dense, wet)
	42	d5		0		SLS	Blue-gray, SILTSTONE (medium stiff, wet) (Confining Unit 1)
	43	d5		0			
	44	d5		0		SLS	Light brown, SILTSTONE (medium stiff, wet)
	45	d5		0		SNS	Light brownwith black, SANDSTONE with black specs (dense, wet)
200	46	d5		0			
	47	d5		0		SNS	Gray, silty SANDSTONE (dense, wet)
	NR	d5					
210	NR	d5					
	48	d5		0		SNS	Gray, silty SANDSTONE (dense, wet)
220	49	d5		0		SNS	Gray, silty SANDSTONE (dense)
	50	d5		0		SLS	Gray, SILTSTONE (medium stiff, moist-wet)
	51	d5		0			
230	52	d5		0		SP	Black and white, SAND with pumice and wood (loose, wet)
						SNS	Black, SANDSTONE (dense, wet)
	53	d5		0			
240						SLS	Blue-Gray, SILTSTONE with trace sand (medium stiff, wet)

Groundwater

Water Level

Monitoring Well Detail

- 12-inch diameter borehole
- Step-down to 8-inch diameter borehole
- Bentonite grout
- 8-inch diameter borehole
- Stainless-steel centralizer
- 3-inch diameter, Schedule 80, PVC well casing

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. 9/4/07 \\EDMDATA\GINT\GINT7\PROJECTS\025116_BOP-71 (DS).GPJ WELL LOG

LANDAU ASSOCIATES

TSA Remedy
Portland, Oregon

Log of Monitoring Well BOP-71 (ds)

Figure
A-3
(4 of 6)

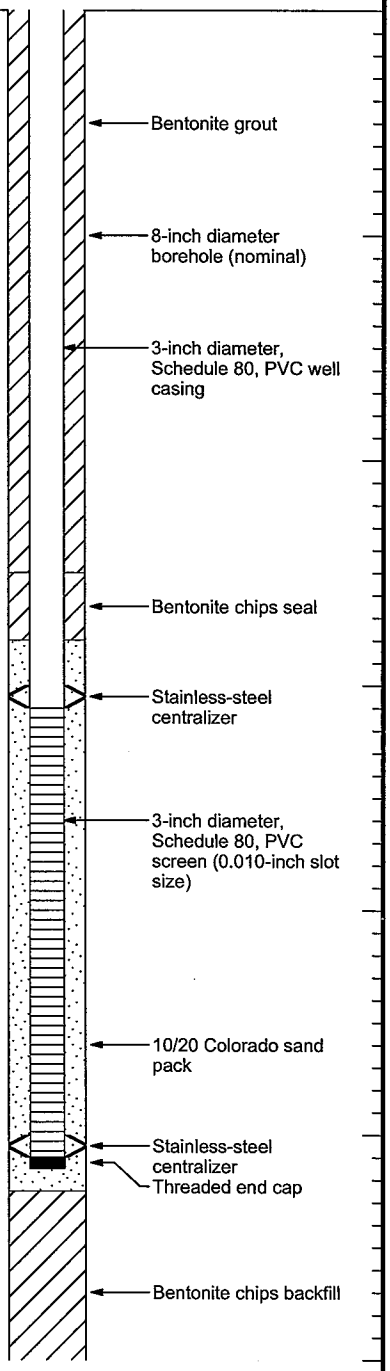
BOP-71 (ds)

Drilling Method: Air Rotary
Ground Elevation (ft): 85.6
Drilled By: Tacoma Pump and Drill

Depth (ft)	Sample Number & Interval	Sampler Type	Blows/Foot	PID (ppm)	Graphic Symbol	USCS Symbol	Soil Profile
240						SLS	Blue-Gray, SILTSTONE with trace sand (medium stiff, wet)
	54	d5		0		SNS	Gray-Black SANDSTONE (dense, wet)
	55	d5		0		SNS	Gray-green, very silty SANDSTONE (dense, wet)
250	56	d5		0			
	57	d5		0			
260	58	d5		0		SNS	Blue-Gray, silty SANDSTONE (dense, wet)
	59	d5		0		SNS	Black, highly fractured SANDSTONE (dense, wet) (Troutdale Sandstone Unit) Increase in formation water production
270	60	d5		0			
	61	d5		0		SNS	Brown and black, SANDSTONE (dense, wet)
	62	d5		0			
280	63	d5		0		SNS	Black, medium to coarse SANDSTONE (medium dense, wet)
	64	d5		0		SNS	Black and brown, fine to medium SANDSTONE (medium dense, wet)
290	65	d5		0		SNS	Blue-black, fine to medium SANDSTONE (dense, wet)
	66	d5		0			
	67	d5		0			
300							

Water Level

Monitoring Well Detail



Notes:
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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. 9/4/07 \\EDMDATA\GINT\GINT7\PROJECTS\025116_BOP-71 (DS).GPJ WELL LOG

LANDAU ASSOCIATES

TSA Remedy
Portland, Oregon

Log of Monitoring Well BOP-71 (ds)

Figure
A-3
(5 of 6)

BOP-71 (ds)

SAMPLE DATA				SOIL PROFILE			GROUNDWATER	
Depth (ft)	Sample Number & Interval	Sampler Type	Blows/Foot	PID (ppm)	Graphic Symbol	USCS Symbol	Drilling Method: Air Rotary Ground Elevation (ft): 85.6 Drilled By: Tacoma Pump and Drill	Water Level	Monitoring Well Detail
300									
	68	d5		0		SNS	Blue-black SANDSTONE with some chert gravels (dense, wet) (TSA Sandstone)		
	69	d5		0			Increasing green and white rocks		
						CGT	Black, some multicolor GRAVELS (very dense, wet) (TSA Conglomerate)		
310									
320									
330									
340									
350									
360									

Boring Completed 02/20/07
Total Depth of Boring = 308.0 ft.

Point located at State Plane Coordinates:
North: 691381.33
East: 1494310.26

Monitoring Well Completed 03/01/07
Elevation at Top of Monitoring Well Casing = 87.88 ft.
Total Depth of Monitoring Well = 291.5 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. 9/4/07 \\EDMDATA\GINT\GINT7\PROJECTS\025116_BOP-71 (DS).GPJ WELL LOG

LANDAU ASSOCIATES

TSA Remedy Portland, Oregon	Log of Monitoring Well BOP-71 (ds)	Figure A-3 (6 of 6)

LOG OF EXPLORATORY BORING

PROJECT NAME	Cascade Corporation	BORING NO.	EMC-2(usg)
LOCATION	Troutdale, Oregon	PAGE	1 OF 5
DRILLED BY	Staco Well Services	GROUND ELEV.	52.9'
DRILL METHOD	Air Rotary	TOTAL DEPTH	175.00'
LOGGED BY	Bob Williams	DATE COMPLETED	09/11/97

SAMPLE NUMBER	SAMPLE TYPE	GROUND WATER LEVELS	DEPTH IN FEET	SAMPLES	WELL DETAILS	LITHOLOGIC COLUMN	LITHOLOGIC DESCRIPTION
1	C						**0 to 19.0 feet: SILT (ML),** light brown with orange mottling, nonplastic, micaceous, trace rounded, medium to coarse, well-graded basaltic sand, damp. (ALLUVIUM)
2	C		5				
3	C		10				
			15				
4	C		20				**19.0 to 49.0 feet: SAND (SW),** black, basaltic clasts, fine to coarse, well graded, rounded grains with quartz and red basalt clasts, poorly to well cemented with light brown to yellow-green palagonitic cement; moist to wet. (TROUTDALE SANDSTONE AQUIFER - SANDSTONE)
5	C		25				@ 25.0 feet: becomes well cemented.
6	C		30				@ 30.0 feet: becomes poorly cemented.
7	C	▽ 8/29/97	35				@ 34.0 feet: becomes well cemented.
			40				

REMARKS

(1) C = cutting sample collected with fine-mesh sieve. (2) Water samples collected at 157 feet and 175 feet. (3) Open triangle = approximate depth at which water was encountered during drilling. Black triangle = water level in completed well. (4) Borehole was drilled with an air rotary rig; 10-inch bit, threaded casing to 155 feet, open hole to 175 feet.

LOG OF EXPLORATORY BORING

PROJECT NAME	Cascade Corporation	BORING NO.	EMC-2(usg)
LOCATION	Troutdale, Oregon	PAGE	2 OF 5
DRILLED BY	Staco Well Services	GROUND ELEV.	52.9'
DRILL METHOD	Air Rotary	TOTAL DEPTH	175.00'
LOGGED BY	Bob Williams	DATE COMPLETED	09/11/97

SAMPLE NUMBER	SAMPLE TYPE	GROUND WATER LEVELS	DEPTH IN FEET	SAMPLES	WELL DETAILS	LITHOLOGIC COLUMN	LITHOLOGIC DESCRIPTION
8	C	▼ 9/11/97					19.0 to 49.0 feet: **SAND (SW)**, continued.
9	C		45				
10	C		50				**49.0 to 130.0 feet; SANDY GRAVEL (GW)**, black, basaltic, white to light yellowish brown and red quartzitic, fine to coarse, well graded, rounded, some vesicular clasts with black, basaltic sand and light yellowish brown quartzitic, and micaceous sand, fine to coarse, subrounded to rounded, moderately to well cemented with palagonite cement, trace silt; wet. (TROUTDALE SANDSTONE AQUIFER - CONGLOMERATE)
11	C		55				@ 55.0 feet: sandstone decreasing.
12	C		60				
13	C		65				@ 65.0 feet: borehole stays open - formation well cemented.
14	C		70				@ 68.0 feet: increasing brown silt content.
15	C		75				@ 70.0 to 75.0 feet: becomes moderately cemented, increased black, fine to coarse sand and brown silt.
			80				

REMARKS

(1) C = cutting sample collected with fine-mesh sieve. (2) Water samples collected at 157 feet and 175 feet. (3) Open triangle = approximate depth at which water was encountered during drilling. Black triangle = water level in completed well. (4) Borehole was drilled with an air rotary rig; 10-inch bit, threaded casing to 155 feet, open hole to 175 feet.

LOG OF EXPLORATORY BORING

PROJECT NAME	Cascade Corporation	BORING NO.	EMC-2(usg)
LOCATION	Troutdale, Oregon	PAGE	3 OF 5
DRILLED BY	Staco Well Services	GROUND ELEV.	52.9'
DRILL METHOD	Air Rotary	TOTAL DEPTH	175.00'
LOGGED BY	Bob Williams	DATE COMPLETED	09/11/97

SAMPLE NUMBER	SAMPLE TYPE	DEPTH IN FEET	LITHOLOGIC DESCRIPTION
16	C		**49.0 to 130.0 feet; SANDY GRAVEL (GW)**, continued.
			@ 80.0 feet: becomes well cemented.
17	C	85	
18	C	90	@ 90.0 feet: becomes moderately cemented.
			@ 93.0 feet: water production is approximately 10 gpm.
19	C	95	
20	C	100	
21	C	105	
22	C	110	
			@ 113.0 to 130.0 feet: increasing black, basaltic, and light yellowish brown quartzitic sand, fine to coarse, well graded.
23	C	115	
		120	

REMARKS

(1) C = cutting sample collected with fine-mesh sieve. (2) Water samples collected at 157 feet and 175 feet. (3) Open triangle = approximate depth at which water was encountered during drilling. Black triangle = water level in completed well. (4) Borehole was drilled with an air rotary rig; 10-inch bit, threaded casing to 155 feet, open hole to 175 feet.

LOG OF EXPLORATORY BORING

PROJECT NAME	Cascade Corporation	BORING NO.	EMC-2(usg)
LOCATION	Troutdale, Oregon	PAGE	4 OF 5
DRILLED BY	Staco Well Services	GROUND ELEV.	52.9'
DRILL METHOD	Air Rotary	TOTAL DEPTH	175.00'
LOGGED BY	Bob Williams	DATE COMPLETED	09/11/97

SAMPLE NUMBER	SAMPLE TYPE	GROUND WATER LEVELS	DEPTH IN FEET	SAMPLES	WELL DETAILS	LITHOLOGIC COLUMN	LITHOLOGIC DESCRIPTION
24	C						**49.0 to 130.0 feet; SANDY GRAVEL (GW),** continued.
25	C		125				
26	C		130				**130.0 to 148.5 feet: INTERBEDDED SILTSTONE, SANDSTONE, and CONGLOMERATE (ML/SW/GW),** clayey siltstone is light brown to gray; black basaltic to yellowish-white quartzitic, micaceous sand, very fine to coarse-grained, subangular to rounded grains; gravel has clasts of dark basalt and white to yellow quartz, subrounded to rounded. (CONFINING UNIT 2 EQUIVALENT)
27	C						@ 130.0 feet: primarily light brown siltstone (80 percent fines, 10 percent sand, 10 percent gravel).
28	C		135				@ 132.0 feet: conglomerate and sand increase as siltstone decreases; siltstone changes color from light brown to light gray (5 percent fines, 40 percent sand, 50 percent gravel).
29	C						@ 135.0 feet: increase in percentage of light gray siltstone and clayey, silty, very fine-grained and micaceous sandstone (10 percent fines, 20 percent sand, 70 percent gravel).
30	C		140				@ 137.5 feet: decrease in very fine sandstone and increase in coarse sand; primarily gravel; water production at 50 gpm (10 percent fines, 20 percent sand, 70 percent gravel).
31	C						@ 140.0 to 143.0 feet: primarily gravel and fine to coarse sand with trace fine grained silty sandstone (50 percent sand, 50 percent gravel).
32	C		145				@ 144.0 feet: percentage of fine sandstone increases; light gray (10 percent fines, 40 percent sand, 50 percent gravel).
33	C						@ 147.0 feet: fine sandstone becomes more indurated, light brown to yellowish green (50 percent sand, 50 percent gravel).
34	C						@ 148.0 feet: thin zone of light gray siltstone; increased amount of cemented sandstone on gravel clasts
35	C		150				
36	C						
			155				
37	C						
			160				

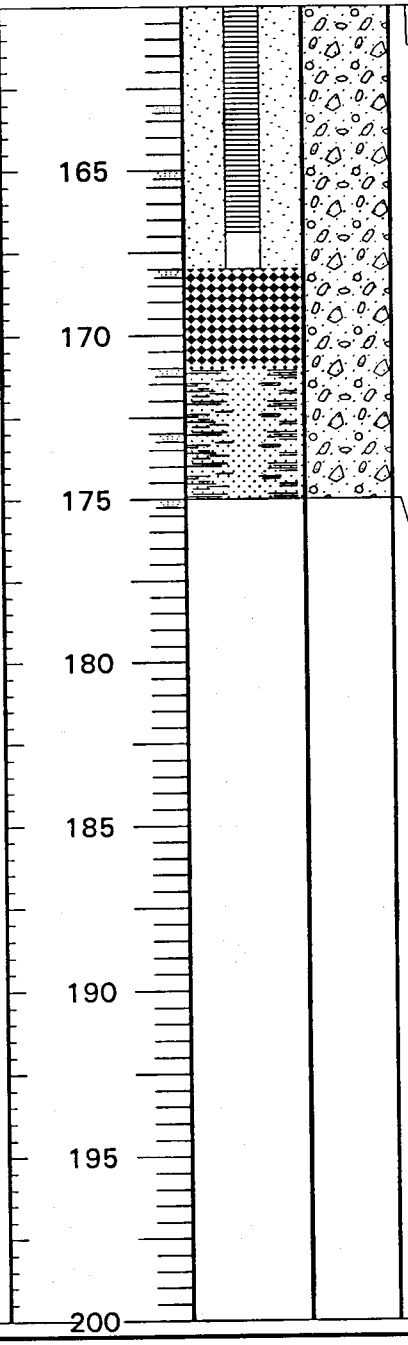
REMARKS

(1) C = cutting sample collected with fine-mesh sieve. (2) Water samples collected at 157 feet and 175 feet. (3) Open triangle = approximate depth at which water was encountered during drilling. Black triangle = water level in completed well. (4) Borehole was drilled with an air rotary rig; 10-inch bit, threaded casing to 155 feet, open hole to 175 feet.

LOG OF EXPLORATORY BORING

PROJECT NAME	Cascade Corporation	BORING NO.	EMC-2(usg)
LOCATION	Troutdale, Oregon	PAGE	5 OF 5
DRILLED BY	Staco Well Services	GROUND ELEV.	52.9'
DRILL METHOD	Air Rotary	TOTAL DEPTH	175.00'
LOGGED BY	Bob Williams	DATE COMPLETED	09/11/97

SAMPLE NUMBER	SAMPLE TYPE
38	C
39	C
40	C
41	C
42	C
43	C



(10 percent fines, 40 percent sand, 50 percent gravel).

148.5 to 175.0 feet: SANDY GRAVEL (GW), black basaltic and light yellowish brown quartzitic gravel, fine to coarse, well graded, subangular to rounded with black to light brown-yellow basaltic and quartzitic sand, subangular to rounded, fine to medium, well graded, moderate to well cemented, trace brown silt. (SAND AND GRAVEL AQUIFER)

@ 157.0 feet: increased percentage of sand.

@ 165.0 feet: increased percentage of sand.

@ 172.0 feet: decreasing cementation.

@ 175.0 feet: water production up to 75 gpm with 20 feet of open hole.

Total depth drilled = 175.0 feet.
Total depth sampled = 175.0 feet.

WELL COMPLETION DETAILS:

0 to 157.0 feet: 4-inch-diameter, flush-threaded, Schedule 40 PVC blank riser pipe.

157.0 to 167.0 feet: 4-inch-diameter, flush-threaded, Schedule 40 PVC well screen with 0.040-inch, machine-cut, slots.

167.0 to 168.0 feet: 4-inch-diameter, Schedule 40 PVC sump.

0 to 3.0 feet: 3/8-inch bentonite chips hydrated with potable water.

3.0 to 153.0 feet: Bentonite grout.

153.0 to 155.0 feet: 20 mesh sand.

155.0 to 168.0 feet: 8 - 12 mesh silica sand.

168.0 to 171.0 feet: 3/8-inch bentonite chips.

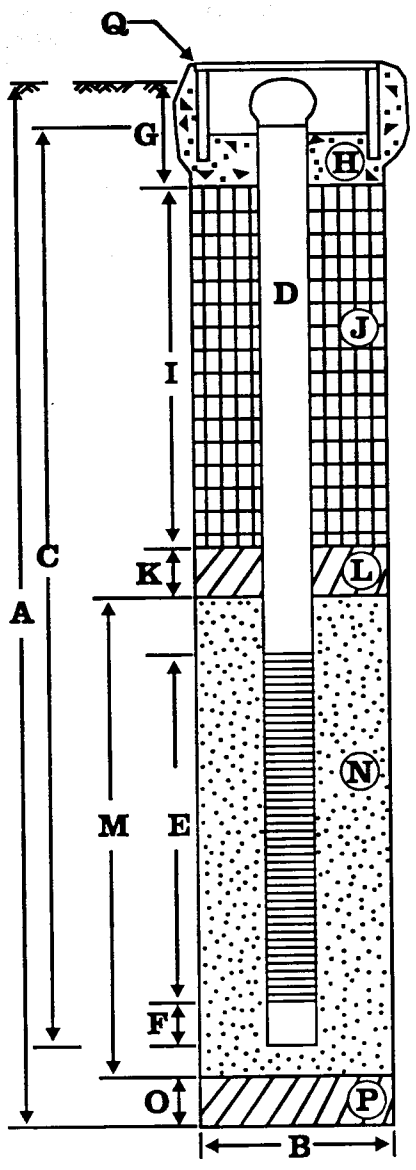
171.0 to 175.0 feet: Slough (native material).

REMARKS

(1) C = cutting sample collected with fine-mesh sieve. (2) Water samples collected at 157 feet and 175 feet. (3) Open triangle = approximate depth at which water was encountered during drilling. Black triangle = water level in completed well. (4) Borehole was drilled with an air rotary rig; 10-inch bit, threaded casing to 155 feet, open hole to 175 feet.

WELL DETAILS

Project Number:	40683-008.027 Task 6	Boring/Well No.:	EMC-2(usg)
Client Name:	Cascade Corporation	Top of Casing Elev.:	54.93
Project Name:	TSA Remedy	Ground Surface Elev.:	52.9
Location:	Troutdale, Oregon	Installation Date:	9/11/97
Driller:	Staco Well Services	Permit/Start Card No.:	104252



	Depth (ft, bgs)	Elev. (ft, msl)
	0.0	52.9
	3.0	49.9
	153.0	-100.1
	155.0	-102.1
	157.0	-104.1
	167.0	-114.1
	168.0	-115.1
	168.0	-115.1
	175.0	-122.1

Installed by: Bob Williams

Reviewed by: Eric Tuppan

Date: 10/10/1997

EXPLORATORY BORING

A. Total depth:	175 ft.
B. Diameter:	10 in.
Drilling method:	Air Rotary

WELL CONSTRUCTION

C. Well casing length:	168 ft.
Well casing material:	Schedule 80 PVC
D. Well casing diameter:	4 in.
E. Well screen length:	10 ft.
Well screen type:	MS PVC
Well screen slot size:	0.040 in.
F. Well sump/end cap length:	1.0 ft.
G. Surface seal thickness:	3 ft.
H. Surface seal material:	Bentonite chips
I. Annular seal thickness:	153 ft.
J. Annular seal material:	Bentonite grout
K. Filter pack seal thickness:	2 ft.
L. Filter pack seal material:	#20 Silica sand
M. Sand pack thickness:	13 ft.
N. Sand pack material:	8-12 Silica sand
O. Bottom material thickness:	3 ft.
P. Bottom material:	Bentonite+slough
Q. Vault box type:	Flush mount
Well centralizer depths:	37 ft.
	77 ft.
	117 ft.
	157 ft.
	167 ft.

NOTES: MS PVC = machine slotted polyvinyl chloride.
Bottom material includes bentonite chips from 168.0 to 171.0 and native material slough from 171.0 to 175.0 ft.

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STATE OF OREGON MONITORING WELL REPORT

(as required by ORS 537.765 & OAR 690-240-485)

DEC 23 1997 MULT 54838

WATER RESOURCES DEPT. SALEM, OREGON

Well ID# L163364

Start Card # 104252

(1) OWNER/PROJECT:

WELL NO. EMC 2

Name Cascade Corporation

Mailing PO Box 20187

City Portland State OR Zip 97220

(2) TYPE OF WORK:

☒ New construction ☐ Repair ☐ Recondition

☐ Conversion ☐ Deepening ☐ Abandonment

(3) DRILLING METHOD

☒ Rotary Air ☐ Rotary Mud ☐ Cable

☐ Hollow Stem Auger ☐ Other

(6) LOCATION OF WELL By legal description

Well Location: County Marion

Township 1N (N or S) Range 3E (E or W) Section 29

1. NE 1/4 of SE 1/4 of above section.
2. Street address of well location 2201 NE 201st.
3. Tax lot number of well location 35
4. ATTACH MAP WITH LOCATION IDENTIFIED.

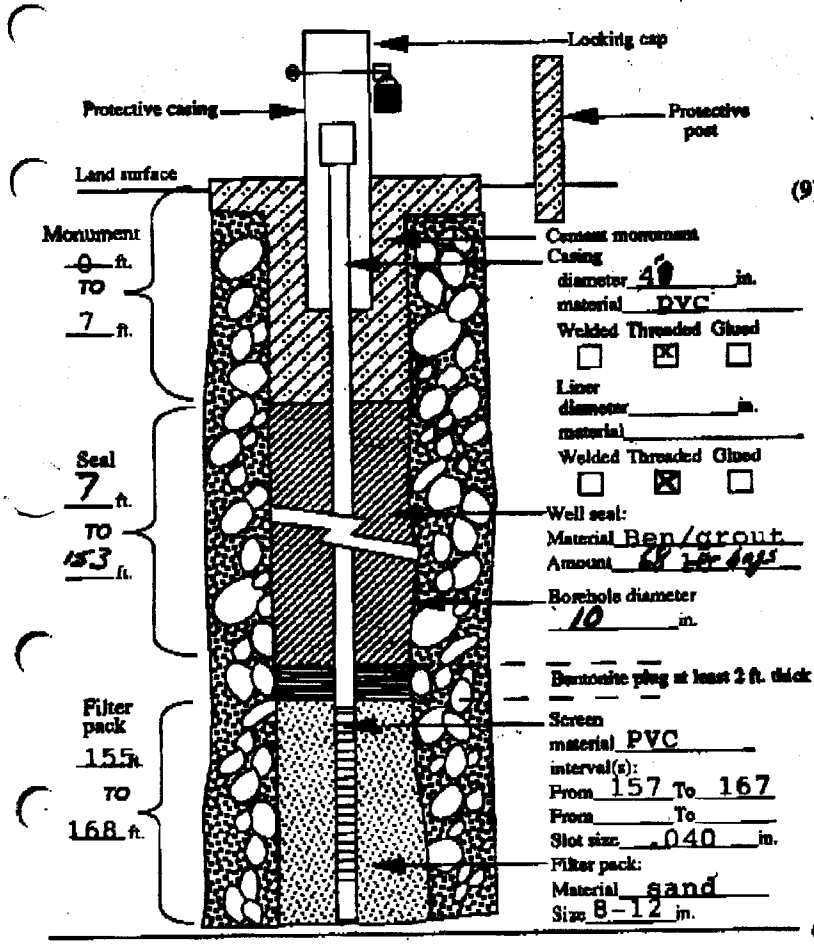
(7) STATIC WATER LEVEL:

38.2 ft. below land surface. Date 9-12-97

Artesian Pressure — lb/sq. in. Date —

(4) BORE HOLE CONSTRUCTION

Special Standards Yes ☒ No ☐ Depth of completed well 168 ft.



(8) WATER BEARING ZONES:

Depth at which water was first found

From	To	Est. Flow Rate	SWL
40	130	60gpm	38.5
170	175	75	41.2

(9) WELL LOG:

Ground elevation

Material	From	To	SWL
Top soil	0	1	
Silt brown	1	19	
Sand stone black	19	49	
Gravels cemented	49	130	
Silt stone lightB	130		
Gravels cemented		148.5	
Gravels cemented	148.5	175	

Date started 8-28-97 Completed 9-12-97

(5) WELL TEST:

☐ Pump ☐ Bailer ☐ Air ☐ Flowing Artesian

Permeability Yield GPM

Conductivity PH

Temperature of water °F/C Depth artesian flow found ft.

Was water analysis done? ☒ Yes ☐ No

By whom? EMCON

Depth of strata to be analyzed. From ft. to ft.

Remarks:

Name of supervising Geologist/Engineer Emcon/Calin

(unbonded) Monitor Well Constructor Certification:

I certify that the work I performed on the construction, alteration, or abandonment of this well is in compliance with Oregon well construction standards. Materials used and information reported above are true to the best knowledge and belief.

MWC Number 12358

Signed Date

(bonded) Monitor Well Constructor Certification:

I accept responsibility for the construction, alteration, or abandonment work performed on this well during the construction dates reported above. All work performed during this time is in compliance with Oregon well construction standards. This report is true to the best of my knowledge and belief.

MWC Number 1097

Signed Date 9-18-97

ORIGINAL & FIRST COPY-WATER RESOURCES DEPARTMENT SECOND COPY-CONSTRUCTOR THIRD COPY-CUSTOMER

EMC-2w9