King County Department of Natural Resources and Parks

Solid Waste Division

Phase 1 – Interim Actions

CONTRACT NO. E00286E12

Cedar Hills Regional Landfill – EPZ Phase I Interim Actions - Infrastructure Upgrades Technical Memorandum

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King County
Department of
Natural Resources and Parks
Solid Waste Division

Waste **Prevention** | *Resource* **Recovery** | *Waste* **Disposal**

www.kingcounty.gov/solidwaste

Final, August 31, 2018

CEDAR HILLS REGIONAL LANDFILL – EPZ PHASE I INTERIM ACTIONS - INFRASTRUCTURE UPGRADES TECHNICAL MEMORANDUM

Prepared for: King County Solid Waste Division

Project No. 130088 • August 31, 2018 • Final

Aspect Consulting, LLC

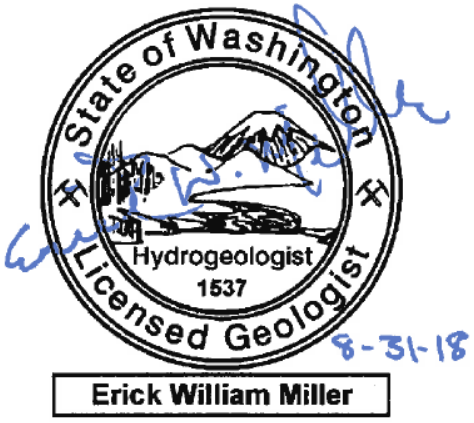

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

1.0 INTRODUCTION

Aspect Consulting, LLC (Aspect) prepared this Technical Memorandum (Tech Memo) to summarize the drilling and installation of six monitoring wells at the Cedar Hills Regional Landfill (CHRLF; the Site: see Figure 1) and six landfill gas (LFG) probes near the Passage Point facility (Figures 2 and 3). The installations described in this Tech Memo upgrades the infrastructure at the CHRLF East Perched Zones (EPZ), as recommended in the *East Perched Zones Remedial Investigation and Feasibility Study Report* prepared by Aspect (Aspect, 2016a) under King County Contract No. E00286E12. This work included the following:

- **Predrilling activities,** including initial Site visit, siting borings, and utility locates of drilling locations.
- **Drilling and installation of six monitoring wells (MW-107 to MW-112)** along the eastern boundary within the Main Hill area and EPZ to replace the decommissioned extraction wells (EW) and to serve as performance-monitoring wells.
- **Drilling and installation of six LFG probes at two locations (GP-63 A/B/C[1] and GP-64 A/B/C),** which were installed to provide baseline data for assessing the effectiveness of the interim remedial action at reducing LFG migration within the EPZ and to inform a preliminary evaluation of the vapor intrusion exposure pathway.
- **Erosion control and Site restoration,** by installing and maintaining standard temporary erosion and sediment control (TESC) facilities.
- **Managing investigative-derived waste.**

2.0 PREDRILLING ACTIVITIES

Prior to the commencement of field work, drilling locations were field-staked with project representatives from King County Solid Waste Division (KCSWD; County), Aspect, and the drilling contractor, Holt Services (Holt). Public and private utility locates were conducted prior to drilling.

3.0 MONITORING WELL & LFG PROBE INSTALLATION

3.1 Drilling Methods

The monitoring wells and LFG probes were installed using a dual-casing rotosonic drilling system that allows the collection of continuous-core soil samples. During drilling, samples for soil classification and field screening were collected continuously in 5- or 10-foot lengths using 4.75-inch and 7-inch-diameter inner core barrels and 6-inch (LFG probes) and 8-inch-diameter outer casings (monitoring wells). Holt provided

[1] Probe-installation intervals defined as: A = shallow; B = intermediate; C = deep.

the potable water necessary for drilling activities from an off-site source[2] and supplemented by potable water sourced from a hydrant located near Pump Station 4 located at CHRLF, as per authorization from KCSWD.

Soil samples and cuttings were field-screened for the presence of volatile organic compound (VOC) vapors using a MiniRae 3000 photoionization detector (PID). The PID is designed to detect and measure VOC vapors in air, but it does not detect methane. The VOC concentrations were used to monitor worker health and safety during drilling, and to monitor VOCs present in the soil or refuse encountered during drilling. A LandTec GEM 5000 LFG meter was used to monitor methane, carbon dioxide, oxygen, and hydrogen sulfide (H_2S) concentrations during drilling. LFG and H_2S measurements were taken from the top of the drill casing after each sample run, and periodic ambient air measurements were recorded as part of Health and Safety monitoring. PID and methane levels in the breathing zone were below concentrations that would trigger mitigation or work stoppage, as specified in the *Project Specific Health and Safety Plan* (Aspect, 2018a). A summary of VOC and methane monitoring results are presented in Table 1. Monitoring well and gas probe construction logs are included in Appendix A.

To ensure that targeted depths of new monitoring well and gas probe locations were achieved during drilling, an Aspect field geologist was on-Site collecting soil samples, logging cores, measuring water levels, and interpreting stratigraphy. These interpretations were based on the conceptual site model (CSM) and geologic and groundwater conditions identified during previous investigations conducted in the EPZ area. Aspect's lead hydrogeologist and field geologist were in close communication to ensure that accurate stratigraphic interpretations were made.

Soil samples were collected from the inner-core barrel during sonic drilling, which provides a near-continuous section of cored soil. The sonic core was carefully extruded from the inner core barrel into a plastic wrap at ground surface to preserve sample moisture content and laid out onto the sample collection and logging area. The plastic wrap was cut open, and the resulting core segment logged by the Aspect field geologist on-Site, including PID field screening. Sample descriptions were made in general accordance with ASTM International (ASTM) Method D2488, *Standard Practice for Description and Identification of Soils* (Visual/Manual Procedure). Geologic and well construction information pertaining to the borings was recorded on field boring logs, including PID field screening results. The core was subsampled at 5-foot intervals and at lithologic changes, and then placed in 8 oz soil jars for archiving. Core samples were

[2] The source of water was previously sampled on January 12, 2016, during drilling activities at the Hobart Landfill, submitted to the King County Environmental Laboratory for analysis of groundwater quality parameters, and results were documented in Appendix B of the *Hobart Landfill Piezometer and Transducer Installation Technical Memo* (Aspect, 2016b). The laboratory results indicated no VOCs were detected, and the water source was considered appropriate for drilling purposes.

photographed; these photo logs are available in Appendix B. Soil cuttings were stored in dedicated roll-off containers and managed as described in Section 5.0—Investigative-Derived Waste.

3.2 Monitoring Well Installation

The EPZ infrastructure upgrades presented in the *Cedar Hills Regional Landfill – EPZ Infrastructure Upgrades Work Plan* (Work Plan; Aspect, 2018b) include the installation of six monitoring wells to replace the decommissioned EWs along the eastern boundary with the Main Hill area and EPZ. The EWs typically had long filter packs that extended through the glacial till into the glaciolacustrine deposits and, in some cases, into the stratified drift (Aspect, 2016a). The extended filter packs were designed to capture as much water as possible, but later were identified as potential preferential groundwater and LFG flow pathways. The long filter packs in many of the EWs may have allowed water from shallower zones to drain through the filter pack into the well. Many of the EWs were completed in low-permeability glaciolacustrine deposits, effectively causing the lower part of the well to act as a sump.

Monitoring wells MW-107 through MW-112 were screened to target shallow groundwater based on field observations and extraction well boring logs in accordance with the Work Plan. Water level measurements were made in the borehole periodically to determine if free water was present. These measurements consisted of directing the driller to pull back the drill casing to expose the target interval and making water level measurements for up to 1 hour. The water level was measured to the nearest 0.1 feet through the drill string and referenced to the surveyed ground-surface elevation. The completion interval for the wells were consistent with the Work Plan and are summarized as follows:

- **MW-107** – Completed within a water-bearing silty gravel in the Stratified Drift. Stratified Drift was identified from ground surface to the total depth of this well boring (40 feet).
- **MW-108** – This well boring was drilled to a depth of 40 feet. The well penetrated a sequence of fill, weathered till, glaciolacustrine deposits, and Stratified Drift. No water was identified in the borehole or cuttings during drilling. The well was completed in a slightly sandy, gravelly silt portion of weathered till overlying glaciolacustrine deposits. No water was present in this well; however, the well may become saturated on a seasonal basis.
- **MW-109 through 112** – Each of these wells were drilled into the lacustrine deposits. No water was identified in the lacustrine deposits. The bottom section of the boreholes was decommissioned and the wells completed in relatively-thin, perched-water-bearing zones within the glacial till.

All monitoring wells were completed with a 2-inch-diameter Schedule 40 polyvinyl chloride (PVC) well casing, a 0.020-slot PVC screen, and 10/20 Colorado Silica Sand filter pack. Screen lengths were constructed from 5 to 10 feet in length depending on subsurface conditions observed during drilling and well depths were completed from 13 to 39 feet below ground surface. Steel aboveground monuments with hinged lids were installed and painted yellow in accordance with KCSWD specifications and bollards were

installed as specified by Washington Administrative Code (WAC) 173-160. Well construction details can be found in Table 2.

Overdrilled sections greater than 3 feet were backfilled with hydrated bentonite chips. A minimum 3-foot-thick bentonite seal was placed above the top of the Colorado Silica Sand filter pack, and the remainder of the annular space was backfilled with bentonite chips to within approximately 2 to 3 feet below ground surface (bgs). As the bentonite chips were placed, they were continuously sounded to ensure bridging did not occur. Water used for hydrating chips or well installation was from the sampled potable source provided by Holt.

After monitoring well installation, wells were developed using a 2-inch-diameter surge block and submersible pump. Development at MW-107 and MW-112 was conducted until field parameters and turbidity stabilized or the turbidity was observed to be less than 50 NTUs. Monitoring wells MW-107 through MW-111 were low yielding, consistent with their completion in glacial till. The low well yields hampered complete well development but surging and purging techniques were used to the extent practical. No water was observed in MW-108 during field operations. It is recommended that MW-107 through MW-111 are developed again prior to sampling. Well development records are presented in Appendix C and measured field parameters at the end of development are presented in Table 3.

After installation and development, the drilling site was restored to its original condition to the extent practical, as described in Section 4. Before moving to a new drilling location, the driller decontaminated any used drilling equipment at a designated decontamination pad.

All new monitoring wells and LFG probes were surveyed by King County; the surveyor's report is available in Appendix D.

3.3 LFG Probe Installation

The EPZ infrastructure upgrades presented in the Work Plan (Aspect, 2018b) include the installation of six LFG probes at two locations (GP-63 A/B/C and GP-64 A/B/C) in front of the Passage Point facility to provide baseline data for assessing the effectiveness of the interim remedial action at reducing LFG migration within the EPZ and to inform a preliminary evaluation of the vapor intrusion exposure pathway.

The deepest probe was drilled first to identify stratigraphy near each set of probes. Shallow, intermediate, and deep probes targeted depths of about 6.5, 25, and 60 feet bgs, respectively. Screens were placed in the most conductive soil units (based on field observations). No groundwater was identified during drilling. Shallow gas probes were screened to monitor LFG in the weathered glacial till soils; intermediate gas probes were screened to monitor the upper portion of the stratified drift; and deep gas probes were completed in a deeper portion of the stratified drift. LFG probe completion logs are included in Appendix A.

All LFG probes were completed with a 0.5-inch-diameter Schedule 80 PVC well casing, a 0.020-slot PVC screen, and a pea gravel filter pack. The shallow, intermediate, and deep probes were spaced a minimum horizontal distance of 5 feet apart to prevent risk of interference during drilling.

A 1.5-foot-long screen was used for each shallow-interval probe, and 5-foot-long screens were used in the intermediate and deep probes. The probes were installed with a valved barb fitting, which will remain closed to prevent unintended discharge of LFG to the atmosphere. Steel aboveground monuments with hinged lids and bollards were installed and painted yellow in accordance with KCSWD specifications. LFG probe construction details can be found in Table 4.

Overdrilled sections greater than 3 feet were backfilled with hydrated bentonite chips. A minimum 3-foot-thick bentonite seal was placed above the top of the Colorado Silica Sand filter pack, and the remainder of the annular space was backfilled with bentonite chips to within approximately 2 to 3 feet bgs. As the bentonite chips were placed, they were continuously sounded to ensure bridging did not occur. Water used for hydrating chips or well installation was from the sampled potable sources referenced earlier in this memorandum.

4.0 EROSION CONTROL AND SITE RESTORATION

During drilling, Holt installed and maintained standard temporary erosion and sediment control (TESC) facilities such as straw wattles, silt fences, and hay bales, as needed. These TESC facilities were placed around the drilling site to prevent sediment or sediment-laden water from entering the drainage system or roadways. Holt inspected TESC facilities daily to ensure that they functioned as expected.

Following drilling, areas disturbed during well installation were lightly regraded immediately after moving off of the drill site, but before drilling commenced at the next drill site.

5.0 INVESTIGATIVE-DERIVED WASTE

All drill cuttings from the drilling and installation of the monitoring wells and LFG probes were contained in roll-off containers designed for hauling to an approved facility following designation sampling. The containers were appropriately labeled as investigative-derived waste (IDW). Soil cuttings within each container were disposed of at the Cedar Hills Regional Landfill in accordance with King County waste clearance requirements on February 16, 2017.

All water generated during the drilling and decommissioning activities was temporarily contained in Washington State Department of Transportation (WSDOT)-approved 55-gallon drums. The water generated during drilling will be removed by a County vactor truck for disposal.

6.0 DECONTAMINATION PROCEDURES

Equipment used for drilling or making measurements in boreholes was decontaminated prior to use on-Site and decontaminated again between borings. Drilling equipment was decontaminated by Holt using appropriate decontamination procedures, including a mobile, hot-water, high-pressure washer, buckets, and brushes.

Any sampling equipment used in the boreholes, such as water level indicators, was decontaminated after use at each borehole location. The decontamination procedure consisted of spraying Alconox or other nonphosphate detergent on the equipment, scrubbing the equipment with a brush, rinsing it thoroughly with potable water, and then rinsing it thoroughly with distilled water.

7.0 REFERENCES

Aspect Consulting, LLC (Aspect), 2016a, East Perched Zones Remedial Investigation and Feasibility Study – Cedar Hills Regional Landfill, December 2016, Agency Review Draft.

Aspect Consulting, LLC (Aspect), 2016b, Hobart Landfill Piezometer and Transducer Installation Technical Memo, Deliverable D610.2.1.1.1, April 29, 2016, Draft.

Aspect Consulting, LLC (Aspect), 2018a (revised), Project Specific Health and Safety Plan, Project No. 130088, May 2, 2018.

Aspect Consulting, LLC (Aspect), 2018b, Cedar Hills Regional Landfill – EPZ Infrastructure Upgrades Work Plan, May 2018.

TABLES

Table 1 - Summary of VOC and Methane Monitoring Results

Project No, 130088, Cedar Hills Regional Landfill, King County, Washington

Monitoring Well ID	Depth of Measurement	PID (ppm)	CH_4 (%)
MW-107	10	0	0
	20	0	0
	30	0	0
	40	0	0
MW-108	10	6	0
	20	3	0
	30	0	0
	40	0	0
MW-109	10	---	0
	20	---	0
	30	---	0
MW-110	10	---	0
	20	---	0
	25	---	0
MW-111	10	0	0
	20	0	0
	25	0	0
MW-112	10	0	0
	20	0	0
	25	0	0
GP-63 A	9	0	0
GP-63 B	10	0	0
	20	0	0
	30	0	0
	38	0	0
GP-63 C	10	0	0
	20	0	0
	30	0	0
	40	0	0
	50	0	0
	60	0	0
GP-64 A	9	0	0
GP-64 B	10	0	0
	20	0	0
	25	0	0
GP-64 C	10	0	0
	20	0	0
	30	0	0
	40	0	0
	50	0	0
	60	0	0

Notes:

landfill gas monitor. Both instruments were calibrated each day in accordance with manufacturer's recommendations.

--- Indicates data not available.

CH_4 = Methane

Table 2 - Summary of Monitoring Well Construction Details

Project No, 130088, Cedar Hills Regional Landfill, King County, Washington

Well ID	Installation Date	Total Well Depth (feet bgs)	Screen Interval (feet bgs)	Screen Length (feet)	Filter Pack Interval (feet bgs)	Screened Unit	Well Stickup (feet)
MW-107	6/7/2018	39	29-39	10	27-40	Stratified Drift	2.53
MW-108	6/8/2018	17	12-17	5	10-18	Glacial Till	2.72
MW-109	6/12/2018	13	8-13	5	7-14	Glacial Till	1.84
MW-110	6/10/2018	19	9-19	10	8-20	Glacial Till	2.52
MW-111	6/11/2018	13.5	8.5-13.5	5	7.5-14.5	Glacial Till	2.15
MW-112	6/11/2018	17	12-17	5	10-18	Glacial Till	2.09

Notes

bgs- below ground surface

Table 3 - Summary of Well Development Field Water Quality Parameters

Project No, 130088, Cedar Hills Regional Landfill, King County, Washington

Well ID	Screen Interval (feet bgs)	Date	Volume Purged (gallons)	Temperature (degrees C)	pH	Specific Conductance (µmhos/cm)	Turbidity (NTU)
MW-107	29-39	6/20/2018	32	12.6	7.10	354.7	>1000
MW-108	12-17	6/20/2018	Dry				
MW-109	8-13	6/20/2018	2.5	10.5	7.09	249.6	>1000
MW-110	9-19	6/20/2018	11	11.0	6.93	160.4	>1000
MW-111	8.5-13.5	6/20/2018	4	10.5	7.13	175.6	>1000
MW-112	12-17	6/20/2018	78	10.5	7.10	329.4	34.5

Notes

NTU - Nephelometric Turbidity Unit

bgs - below ground surface

Values taken at end of development

Table 4 - Summary of Landfill Gas Probe Construction Details

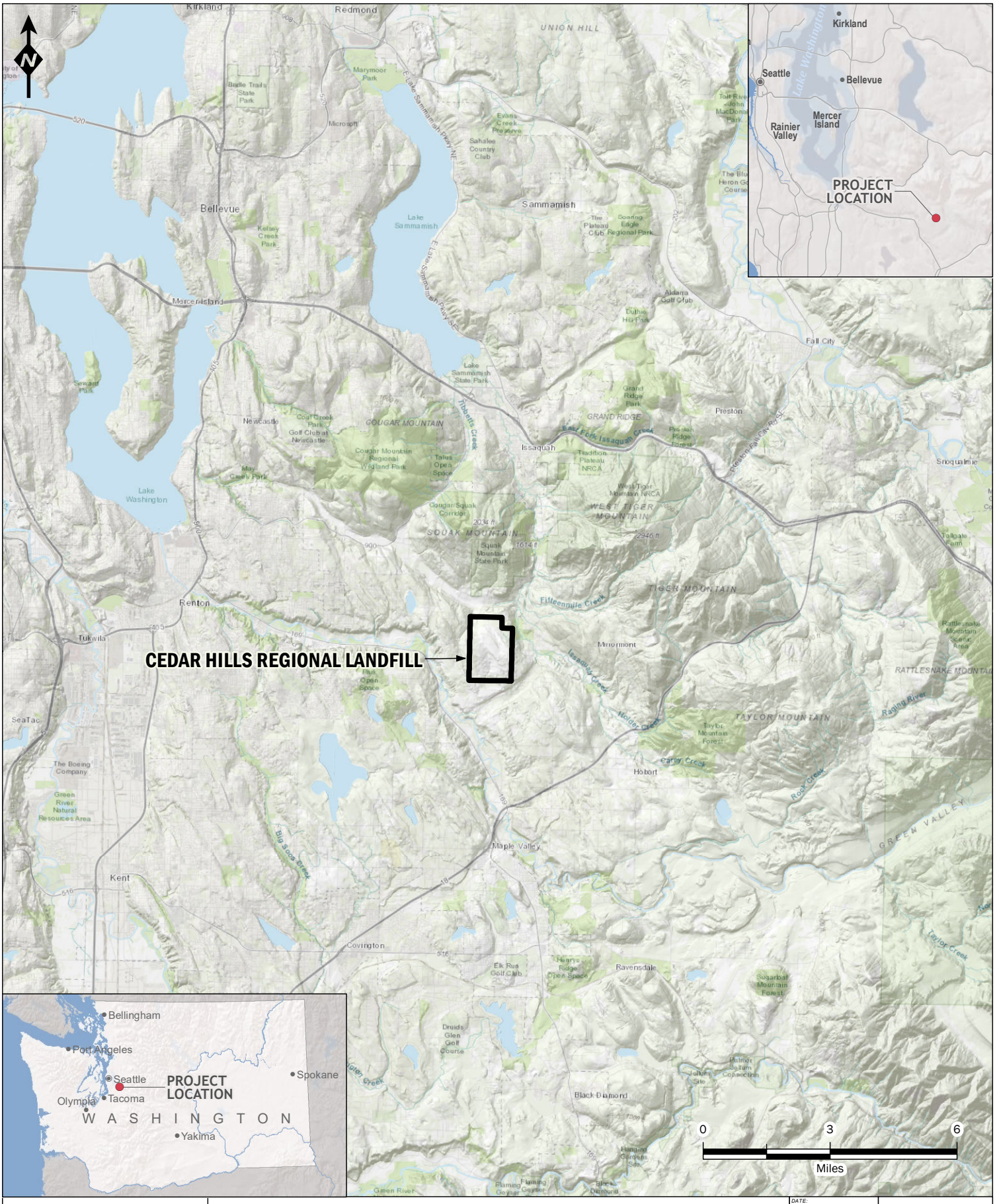
Project No, 130088, Cedar Hills Regional Landfill, King County, Washington

Monitoring Location	Installation Date	Total Well Depth (feet bgs)	Screen Setting (feet bgs)	Screen Length (feet)	Filter Pack Interval (feet bgs)	Screened Unit	Well Stickup (feet)
GP-63A	6/14/2018	8	6.5-8.0	2.5	5.5-9.0	Glacial Till	2.96
GP-63B	6/15/2018	37	32-37	5	31-38	Stratified Drift	2.98
GP-63C	6/12/2018	60	55-60	5	53-61	Stratified Drift	3.16
GP-64A	6/10/2018	8	6.5-8.0	2.5	5.5-9.0	Glacial Till	3.13
GP-64B	6/11/2018	25	20-25	5	19-26	Stratified Drift	2.80
GP-64C	6/11/2018	59	54-59	5	52-60	Stratified Drift	2.94

Notes

bgs- below ground surface

FIGURES



King County

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Project Location Map

Cedar Hills Regional Landfill

King County, Washington

DATE: Apr-2018	PROJECT NO. 130088
DESIGNED BY: KSL/RAP	
DRAWN BY: KSL/RAP	FIGURE NO. 1
REVISED BY: AO / RAP	

King County

Aspect CONSULTING

Cedar Hills Regional Landfill Property Features

Cedar Hills Regional Landfill

King County, Washington

DATE: Apr-2018	PROJECT NO. 130088
DESIGNED BY: KSL/RAP	
DRAWN BY: KSL/RAP	FIGURE NO. 2
REVISED BY: AO / RAP	

New Gas Probe Locations
6 Total at 2 Locations

New Compliance Groundwater Monitoring Wells
6 Total

MW-103
GP-63A/B/C
GP-64A/B/C
MW-104
EB-6D
MW-102
MW-68
MW-47
MW-50
MW-108
MW-109
MW-110
MW-111
MW-112
MW-30A
MW-107
MW-80

- New Gas Probe
- New Well
- Gas Extraction/Dual-Phase/Leachate Well
- Perched Zone Monitoring Well
- Perched Zone Piezometer
- Regional Aquifer Monitoring Well
- LFG System
- Gas Probe Performance Monitoring Location
- Groundwater MNA Location
- Approximate Extent of Wetland Areas
- Project Location
- Landfill Cover Limits
- Property Boundary

Note: MNA = Monitored Natural Attenuation

0 300 600
Feet

King County
Aspect CONSULTING

New Groundwater Monitoring Wells and Landfill Gas Probes

Cedar Hills Regional Landfill - EPZ Infrastructure Upgrades Technical Memorandum
King County, Washington

DATE: Jul-2018	PROJECT NO. 130088
DESIGNED BY: KSL / AO	
DRAWN BY: RAP	FIGURE NO. 3
REVISED BY: TDR	

APPENDIX A

Boring Logs:
Monitoring Wells
& LFG Probe Construction

Coarse-Grained Soils - More than 50% (1) Retained on No. 200 Sieve	Gravels - More than 50% (1) of Coarse Fraction Retained on No. 4 Sieve	≤5% Fines (5)	GW	Well-graded gravel and gravel with sand, little to no fines
			GP	Poorly-graded gravel and gravel with sand, little to no fines
		≥15% Fines (5)	GM	Silty gravel and silty gravel with sand
			GC	Clayey gravel and clayey gravel with sand
	Sands - 50% (1) or More of Coarse Fraction Passes No. 4 Sieve	≤5% Fines (5)	SW	Well-graded sand and sand with gravel, little to no fines
			SP	Poorly-graded sand and sand with gravel, little to no fines
		≥15% Fines (5)	SM	Silty sand and silty sand with gravel
			SC	Clayey sand and clayey sand with gravel
Fine-Grained Soils - 50% (1) or More Passes No. 200 Sieve	Silts and Clays Liquid Limit Less than 50		ML	Silt, sandy silt, gravelly silt, silt with sand or gravel
			CL	Clay of low to medium plasticity; silty, sandy, or gravelly clay, lean clay
			OL	Organic clay or silt of low plasticity
	Silts and Clays Liquid Limit 50 or More		MH	Elastic silt, clayey silt, silt with micaceous or diato-maceous fine sand or silt
			CH	Clay of high plasticity, sandy or gravelly clay, fat clay with sand or gravel
			OH	Organic clay or silt of medium to high plasticity
Highly Organic Soils			PT	Peat, muck and other highly organic soils

Terms Describing Relative Density and Consistency

	Density	SPT (2) blows/foot
Coarse-Grained Soils	Very Loose	0 to 4
	Loose	4 to 10
	Medium Dense	10 to 30
	Dense	30 to 50
	Very Dense	>50
	Consistency	**SPT (2) blows/foot**
Fine-Grained Soils	Very Soft	0 to 2
	Soft	2 to 4
	Medium Stiff	4 to 8
	Stiff	8 to 15
	Very Stiff	15 to 30
	Hard	>30

Test Symbols

FC = Fines Content
G = Grain Size
M = Moisture Content
A = Atterberg Limits
C = Consolidation
DD = Dry Density
K = Permeability
Str = Shear Strength
Env = Environmental
PiD = Photoionization Detector

Component Definitions

Descriptive Term	Size Range and Sieve Number
Boulders	Larger than 12"
Cobbles	3" to 12"
Gravel	3" to No. 4 (4.75 mm)
Coarse Gravel	3" to 3/4"
Fine Gravel	3/4" to No. 4 (4.75 mm)
Sand	No. 4 (4.75 mm) to No. 200 (0.075 mm)
Coarse Sand	No. 4 (4.75 mm) to No. 10 (2.00 mm)
Medium Sand	No. 10 (2.00 mm) to No. 40 (0.425 mm)
Fine Sand	No. 40 (0.425 mm) to No. 200 (0.075 mm)
Silt and Clay	Smaller than No. 200 (0.075 mm)

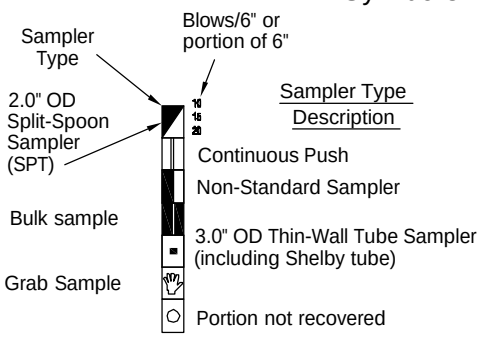
(3) Estimated Percentage

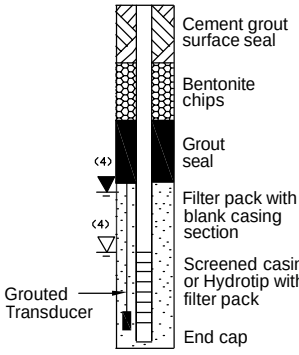
Percentage by Weight	Modifier
<5	Trace
5 to 15	Slightly (sandy, silty, clayey, gravelly)
15 to 30	Sandy, silty, clayey, gravelly)
30 to 49	Very (sandy, silty, clayey, gravelly)

Moisture Content

Dry - Absence of moisture, dusty, dry to the touch
Slightly Moist - Perceptible moisture
Moist - Damp but no visible water
Very Moist - Water visible but not free draining
Wet - Visible free water, usually from below water table

Symbols





(1) Percentage by dry weight
(2) (SPT) Standard Penetration Test (ASTM D-1586)
(3) In General Accordance with Standard Practice for Description and Identification of Soils (ASTM D-2488)
(4) Depth of groundwater — ATD = At time of drilling; Static water level (date); BGS = below ground surface
(5) Combined USCS symbols used for fines between 5% and 15% as estimated in General Accordance with Standard Practice for Description and Identification of Soils (ASTM D-2488)

Classifications of soils in this report are based on visual field and/or laboratory observations, which include density/consistency, moisture condition, grain size, and plasticity estimates and should not be construed to imply field or laboratory testing unless presented herein. Visual-manual and/or laboratory classification methods of ASTM D-2487 and D-2488 were used as an identification guide for the Unified Soil Classification System.

Aspect CONSULTING

Exploration Log Key

DATE:
DESIGNED BY:
DRAWN BY:
REVISED BY:

PROJECT NO.

FIGURE NO.
A-1

Q:_ACAD Standards\Standard Details\Exploration Log Key A1.dwg

Aspect CONSULTING	Cedar Hills Landfill - 130088		Monitoring Well Log	
	Project Address & Site Specific Location: 16645 228th Ave SE, Maple Valley, WA, South end of Passage Point property		Coordinates (Lat,Lon WGS84): 47.461, -122.037	Exploration Number: **GP-63A**
Contractor: Holt Services	Equipment: Rotary drill rig	Sampling Method: Rotary core	Ground Surface (GS) Elev. (NAVD29): 634.2175'	Ecology Well Tag No. BKX-454
Operator: Pete S.	Exploration Method(s): Sonic	Work Start/Completion Dates: 6/14/2018	Top of Casing Elev. (NAVD29): 637.1805'	Depth to Water (Below GS): No Water Encountered

Depth (feet)	Elev. (feet)	Exploration Completion and Notes	Sample Type/ID	Analytical Sample Number & Lab Test(s)	Field Tests	Material Type	Description	Depth (ft)
-3	637	Monument lid Valved hose barb						-3
-2	636							-2
-1	635	8-inch steel monument						-1
0	634						**FILL** Moist, brown to black, slightly silty, sandy, gravelly Topsoil; fine to medium sand, fine to coarse subrounded gravel, abundant to trace root organics.	0
1	633	Concrete			PID= 0.0			1
2	632		S1					2
3	631	Bentonite chips			PID= 0.0		**WEATHERED GLACIAL TILL** Moist, gray brown, sandy, gravelly SILT (ML); fine to coarse sand, fine to coarse subrounded gravel, reddish brown mottling.	3
4	630	0.5-inch SCH80 PVC casing						4
5	629							5
6	628	Graded pea gravel filter pack			PID= 0.0			6
7	627	0.5-inch SCH80 PVC 20-slot screen	S2					7
8	626	End cap			PID= 0.0		Becomes slightly moist.	8
9	625						Bottom of exploration at 9 ft. bgs. Note: 6-inch borehole diameter. PID readings are elevated due to abundandant water vapor and heat produced by drilling friction.	9
10	624							10
11	623							11

Legend

Sample Method: Continuous core 4" ID

Water Level: No Water Encountered

See Exploration Log Key for explanation of symbols

Logged by: MML
Approved by: EWM

Exploration Log GP-63A
Sheet 1 of 1

ASPECT STANDARD EXPLORATION LOG TEMPLATE \\BISERVER1.ASPECT.LOCAL\PROJECTS\GINTW\PROJECTS\2018_130088_CHRLF_MWS AND GPS.GPJ August 29, 2018

Aspect CONSULTING	Cedar Hills Landfill - 130088		Monitoring Well Log	
	Project Address & Site Specific Location: 16645 228th Ave SE, Maple Valley, WA, South end of Passage Point property		Coordinates (Lat,Lon WGS84): 47.461, -122.037	Exploration Number: **GP-63B**
Contractor: Holt Services	Equipment: Rotary drill rig	Sampling Method: Rotary core	Ground Surface (GS) Elev. (NAVD29): 633.9721'	Ecology Well Tag No. BKX-453
Operator: Pete S.	Exploration Method(s): Sonic	Work Start/Completion Dates: 6/15/2018	Top of Casing Elev. (NAVD29): 636.948'	Depth to Water (Below GS): No Water Encountered

Depth (feet)	Elev. (feet)	Exploration Completion and Notes	Sample Type/ID	Analytical Sample Number & Lab Test(s)	Field Tests	Material Type	Description	Depth (ft)
		Monument lid Valved hose barb						
	635	8-inch steel monument						
0							**FILL** Moist, brown to black, slightly silty, sandy, gravelly Topsoil; abundant to trace root organics.	0
		Concrete			PID= 0.0		**WEATHERED GLACIAL TILL** Moist, brown, slightly sandy, gravelly SILT (ML); fine sand, fine to coarse subrounded gravel.	
		Bentonite chips	S1		PID= 0.0			
	630	0.5-inch SCH80 PVC casing						
5					PID= 0.0			5
			S2		PID= 0.0			
	625							
10							Becomes gray brown.	10
					PID= 19.1			
			S3		PID= 18.0			
	620							
15					PID= 17.2			15
			S4					
					PID= 16.7			

Legend

Sample Method: Continuous core 4" ID

Water Level: No Water Encountered

See Exploration Log Key for explanation of symbols

Logged by: MML
Approved by: EWM

Exploration Log GP-63B

Sheet 1 of 2

ASPECT STANDARD EXPLORATION LOG TEMPLATE \\BISERVER1.ASPECT.LOCAL\PROJECTS\GINTW\PROJECTS\2018_130088_CHRLF_MWS AND GPS.GPJ August 29, 2018

Aspect CONSULTING	Cedar Hills Landfill - 130088		Monitoring Well Log	
	Project Address & Site Specific Location: 16645 228th Ave SE, Maple Valley, WA, South end of Passage Point property		Coordinates (Lat,Lon WGS84): 47.461, -122.037	Exploration Number: **GP-63B**
Contractor: Holt Services	Equipment: Rotary drill rig	Sampling Method: Rotary core	Ground Surface (GS) Elev. (NAVD29): 633.9721'	Ecology Well Tag No. BKX-453
Operator: Pete S.	Exploration Method(s): Sonic	Work Start/Completion Dates: 6/15/2018	Top of Casing Elev. (NAVD29): 636.948'	Depth to Water (Below GS): No Water Encountered

Depth (feet)	Elev. (feet)	Exploration Completion and Notes	Sample Type/ID	Analytical Sample Number & Lab Test(s)	Field Tests	Material Type	Description	Depth (ft)
20	615		S4				**GLACIO-LACUSTRINE** Slightly moist, gray SILT (ML); trace fine sand, weathers to brown. (continued)	20
					PID= 56.6			
25	610		S5		PID= 47.1			25
					PID= 43.2			
30	605				PID= 25.2			30
		Graded pea gravel filter pack					**STRATIFIED DRIFT** Slightly moist, gray brown, gravelly, silty SAND (SM); fine to coarse sand, fine to coarse subrounded gravel.	
35	600	0.5-inch SCH80 PVC 20-slot screen	S6		PID= 0.0			35
					PID= 0.0		Slightly moist, gray brown, very sandy, silty GRAVEL (GM); fine to coarse sand, fine to coarse subrounded gravel.	
40	595	End cap					Bottom of exploration at 38 ft. bgs. Note: 6-inch borehole diameter. PID readings are elevated due to abundandant water vapor and heat produced by drilling friction.	40

Legend

Sample Method: ◧ Continuous core 4" ID

Water Level: No Water Encountered

See Exploration Log Key for explanation of symbols

Logged by: MML
Approved by: EWM

Exploration Log GP-63B
Sheet 2 of 2

ASPECT STANDARD EXPLORATION LOG TEMPLATE \\BISERVER1.ASPECT.LOCAL\PROJECTS\GINT\WPROJECTS\2018_130088_CHRLF_MWS AND GPS.GPJ August 29, 2018

Aspect CONSULTING	Cedar Hills Landfill - 130088		Monitoring Well Log	
	Project Address & Site Specific Location: 16645 228th Ave SE, Maple Valley, WA, South end of Passage Point property		Coordinates (Lat,Lon WGS84): 47.461, -122.037	Exploration Number: **GP-63C**
Contractor: Holt Services	Equipment: Rotary drill rig	Sampling Method: Rotary core	Ground Surface (GS) Elev. (NAVD29): 634.1058'	Ecology Well Tag No. BKX-455
Operator: Pete S.	Exploration Method(s): Sonic	Work Start/Completion Dates: 6/14/2018	Top of Casing Elev. (NAVD29): 637.2651'	Depth to Water (Below GS): No Water Encountered

Depth (feet)	Elev. (feet)	Exploration Completion and Notes	Sample Type/ID	Analytical Sample Number & Lab Test(s)	Field Tests	Material Type	Description	Depth (ft)
		Monument lid Valved hose barb						
	635	8-inch steel monument						
0		Concrete	S1		PID= 0.0		**FILL** Moist, brown to black, slightly silty, sandy, gravelly Topsoil; abundant to trace root organics.	0
		Bentonite chips			PID= 0.0		**WEATHERED GLACIAL TILL** Moist, brown, slightly sandy, gravelly SILT (ML); fine to coarse sand, fine to coarse subrounded gravel, low to nonplastic.	
	630	0.5-inch SCH80 PVC casing						
5					PID= 4.3			5
			S2		PID= 7.6			
	625							
10					PID= 0.6			10
			S3		PID= 0.7			
	620							
15					PID= 0.3		**GLACIO-LACUSTRINE** Moist, gray SILT (ML); trace fine sand, trace clay.	15
			S4		PID= 0.0			

Legend

Sample Method
- ◯ No Soil Sample Recovery
- ◧ Continuous core 4" ID

Water Level
- No Water Encountered

See Exploration Log Key for explanation of symbols

Logged by: MML
Approved by: EWM

Exploration Log GP-63C
Sheet 1 of 3

ASPECT STANDARD EXPLORATION LOG TEMPLATE \\BISERVER1.ASPECT.LOCAL\PROJECTS\GINTWPROJECTS\2018_130088_CHRLF_MWS AND GPS.GPJ August 29, 2018

Aspect CONSULTING	Cedar Hills Landfill - 130088		Monitoring Well Log	
	Project Address & Site Specific Location 16645 228th Ave SE, Maple Valley, WA, South end of Passage Point property		*Coordinates (Lat,Lon WGS84)* 47.461, -122.037	*Exploration Number* **GP-63C**
Contractor Holt Services	*Equipment* Rotary drill rig	*Sampling Method* Rotary core	*Ground Surface (GS) Elev. (NAVD29)* 634.1058'	Ecology Well Tag No. BKX-455
Operator Pete S.	*Exploration Method(s)* Sonic	*Work Start/Completion Dates* 6/14/2018	*Top of Casing Elev. (NAVD29)* 637.2651'	*Depth to Water (Below GS)* No Water Encountered

Depth (feet)	Elev. (feet)	Exploration Completion and Notes	Sample Type/ID	Analytical Sample Number & Lab Test(s)	Field Tests	Material Type	Description	Depth (ft)
20	615		S4		PID= 1.2		**GLACIO-LACUSTRINE** Moist, gray SILT (ML); trace fine sand, trace clay. (continued)	20
					PID= 0.0			
					PID= 0.0			
25	610		S5					25
					PID= 0.0			
					PID= 0.0			
30	605						**STRATIFIED DRIFT** Moist, brown, gravelly, silty SAND (SM); fine to coarse sand, fine to coarse subrounded gravel, with cobbles.	30
					PID= 2.9			
					PID= 12.8			
35	600		S6				Moist, brown, sandy, silty GRAVEL (GM); fine to coarse sand, fine to coarse subrounded gravel, with cobbles.	35
					PID= 3.2			
					PID= 3.3			
40	595		S7					40

Legend

Sample Method
- ◯ No Soil Sample Recovery
- ◧ Continuous core 4" ID

Water Level
- No Water Encountered

See Exploration Log Key for explanation of symbols

Logged by: MML
Approved by: EWM

Exploration Log GP-63C
Sheet 2 of 3

ASPECT STANDARD EXPLORATION LOG TEMPLATE \\BISERVER1.ASPECT.LOCAL\PROJECTS\GINTWPROJECTS\2018_130088_CHRLF_MWS AND GPS.GPJ August 29, 2018

Aspect CONSULTING	Cedar Hills Landfill - 130088		Monitoring Well Log	
	Project Address & Site Specific Location: 16645 228th Ave SE, Maple Valley, WA, South end of Passage Point property		Coordinates (Lat,Lon WGS84): 47.461, -122.037	Exploration Number: GP-63C
Contractor: Holt Services	Equipment: Rotary drill rig	Sampling Method: Rotary core	Ground Surface (GS) Elev. (NAVD29): 634.1058'	Ecology Well Tag No. BKX-455
Operator: Pete S.	Exploration Method(s): Sonic	Work Start/Completion Dates: 6/14/2018	Top of Casing Elev. (NAVD29): 637.2651'	Depth to Water (Below GS): No Water Encountered

Depth (feet)	Elev. (feet)	Exploration Completion and Notes	Sample Type/ID	Analytical Sample Number & Lab Test(s)	Field Tests	Material Type	Description	Depth (ft)
					PID= 0.0		Moist to very moist, brown, gravelly, silty SAND (SM); predominantly coarse sand, fine to coarse gravel. (continued)	
					PID= 7.9			
45	590		S7		PID= 1.0		Moist, brown, sandy, silty GRAVEL (GM); fine to coarse sand, fine to coarse subrounded gravel, with cobbles.	45
					PID= 20.5			
50	585				PID= 58.5			50
					PID= 29.8			
55	580	Graded pea gravel filter pack 0.5-inch SCH80 PVC 20-slot screen	S8		PID= 0.0			55
					PID= 1.7		Slightly moist, brown, slightly silty GRAVEL (GP-GM); fine to coarse sand, fine to coarse subrounded gravel.	
60	575	End cap					Bottom of exploration at 61 ft. bgs. Note: 6-inch borehole diameter. PID readings are elevated due to abundandant water vapor and heat produced by drilling friction.	60

Legend

Sample Method
- ◯ No Soil Sample Recovery
- ◧ Continuous core 4" ID

Water Level
- No Water Encountered

See Exploration Log Key for explanation of symbols

Logged by: MML
Approved by: EWM

Exploration Log GP-63C
Sheet 3 of 3

ASPECT STANDARD EXPLORATION LOG TEMPLATE \\BISERVER1.ASPECT.LOCAL\PROJECTS\GINT\WPROJECTS\2018_130088_CHRLF_MWS AND GPS.GPJ August 29, 2018

Aspect CONSULTING	Cedar Hills Landfill - 130088		Monitoring Well Log	
	Project Address & Site Specific Location 16645 228th Ave SE, Maple Valley, WA, North end of Passage Point property		*Coordinates (Lat,Lon WGS84)* 47.460, -122.037	*Exploration Number* **GP-64A**
Contractor Holt Services	*Equipment* Rotary drill rig	*Sampling Method* Rotary core	*Ground Surface (GS) Elev. (NAVD29)* 629.5254'	Ecology Well Tag No. BKX-458
Operator Pete S.	*Exploration Method(s)* Sonic	*Work Start/Completion Dates* 6/13/2018	*Top of Casing Elev. (NAVD29)* 632.656'	*Depth to Water (Below GS)* No Water Encountered

Depth (feet)	Elev. (feet)	Exploration Completion and Notes	Sample Type/ID	Analytical Sample Number & Lab Test(s)	Field Tests	Material Type	Description	Depth (ft)
-3	632	Monument lid Valved hose barb						-3
-2	631							-2
-1	630	8-inch steel monument						-1
0	629						**FILL** Moist, brown to black, slightly silty, sandy, gravelly Topsoil; abundant to trace root organics.	0
1	628	Concrete			PID= 0.0			1
2	627							2
3	626	Bentonite chips					**WEATHERED GLACIAL TILL** Moist, gray brown, sandy, gravelly SILT (ML); fine to coarse sand, fine to coarse subrounded gravel, reddish brown mottling.	3
4	625	0.5-inch SCH80 PVC casing	S1		PID= 0.0			4
5	624							5
6	623	Graded pea gravel filter pack						6
7	622	0.5-inch SCH80 PVC 20-slot screen			PID= 2.0			7
8	621	End cap			PID= 0.0			8
9	620						Bottom of exploration at 9 ft. bgs. Note: 6-inch borehole diameter. PID readings are elevated due to abundandant water vapor and heat produced by drilling operation	9

Legend

Sample Method: Continuous core 4" ID

Water Level: No Water Encountered

See Exploration Log Key for explanation of symbols

Logged by: MML
Approved by: EWM

Exploration Log GP-64A

Sheet 1 of 1

ASPECT STANDARD EXPLORATION LOG TEMPLATE \\BISERVER1.ASPECT.LOCAL\PROJECTS\GINT\WPROJECTS\2018_130088_CHRLF_MWS AND GPS.GPJ August 29, 2018

Aspect CONSULTING	Cedar Hills Landfill - 130088		Monitoring Well Log	
	Project Address & Site Specific Location: 16645 228th Ave SE, Maple Valley, WA, North end of Passage Point property		Coordinates (Lat,Lon WGS84): 47.460, -122.037	Exploration Number: **GP-64B**
Contractor: Holt Services	Equipment: Rotary drill rig	Sampling Method: Rotary core	Ground Surface (GS) Elev. (NAVD29): 629.3654'	Ecology Well Tag No. BKX-457
Operator: Pete S.	Exploration Method(s): Sonic	Work Start/Completion Dates: 6/13/2018	Top of Casing Elev. (NAVD29): 632.1635'	Depth to Water (Below GS): No Water Encountered

Depth (feet)	Elev. (feet)	Exploration Completion and Notes	Sample Type/ID	Analytical Sample Number & Lab Test(s)	Field Tests	Material Type	Description	Depth (ft)
0	630	Monument lid Valved hose barb 8-inch steel monument Concrete Bentonite chips 0.5-inch SCH80 PVC casing	S1		PID= 0.0 PID= 0.0 PID= 0.0		**FILL** Moist, brown to black, slightly silty, sandy, gravelly Topsoil; abundant to trace root organics.	0
5	625		S2		PID= 0.0 PID= 0.0		**WEATHERED GLACIAL TILL** Moist, gray brown, slightly sandy SILT (ML); fine sand, low to none plasticity, brown mottling. Becomes gravelly and browner.	5
10	620		S3		PID= 0.7 PID= 1.1		Becomes slightly moist.	10
15	615		S4		PID= 0.3		Becomes very sandy.	15

Legend

Sample Method: Continuous core 4" ID

Water Level: No Water Encountered

See Exploration Log Key for explanation of symbols

Logged by: MML
Approved by: EWM

Exploration Log GP-64B

Sheet 1 of 2

ASPECT STANDARD EXPLORATION LOG TEMPLATE \\BISERVER1.ASPECT.LOCAL\PROJECTS\GINTW\PROJECTS\2018_130088_CHRLF_MWS AND GPS.GPJ August 29, 2018

Aspect CONSULTING	Cedar Hills Landfill - 130088		Monitoring Well Log	
	Project Address & Site Specific Location 16645 228th Ave SE, Maple Valley, WA, North end of Passage Point property		*Coordinates (Lat,Lon WGS84)* 47.460, -122.037	*Exploration Number* **GP-64B**
Contractor Holt Services	*Equipment* Rotary drill rig	*Sampling Method* Rotary core	*Ground Surface (GS) Elev. (NAVD29)* 629.3654'	Ecology Well Tag No. BKX-457
Operator Pete S.	*Exploration Method(s)* Sonic	*Work Start/Completion Dates* 6/13/2018	*Top of Casing Elev. (NAVD29)* 632.1635'	*Depth to Water (Below GS)* No Water Encountered

Depth (feet)	Elev. (feet)	Exploration Completion and Notes	Sample Type/ID	Analytical Sample Number & Lab Test(s)	Field Tests	Material Type	Description	Depth (ft)
			S4		PID= 0.6		**GLACIAL TILL** Moist, blue gray, sandy, gravelly SILT (ML); fine to medium sand, fine to coarse subrounded gravel, low to none plasticity, diamict. (continued)	
20	610	Graded pea gravel filter pack 0.5-inch SCH80 PVC 20-slot screen	S5		PID= 0.0 PID= 0.0		**STRATIFIED DRIFT** Slightly moist, very gravelly, silty SAND (SM); fine to coarse sand, fine to coarse subrounded gravel.	20
25	605	End cap					Bottom of exploration at 26 ft. bgs. Note: 6-inch borehole diameter. PID readings are elevated due to abundandant water vapor and heat produced by drilling friction.	25
30	600							30
35	595							35

Legend

Sample Method: Continuous core 4" ID

Water Level: No Water Encountered

See Exploration Log Key for explanation of symbols

Logged by: MML
Approved by: EWM

Exploration Log GP-64B
Sheet 2 of 2

ASPECT STANDARD EXPLORATION LOG TEMPLATE \\BISERVER1.ASPECT.LOCAL\PROJECTS\GINTWPROJECTS\2018_130088_CHRLF_MWS AND GPS.GPJ August 29, 2018

Aspect CONSULTING	Cedar Hills Landfill - 130088		Monitoring Well Log	
	Project Address & Site Specific Location: 16645 228th Ave SE, Maple Valley, WA, North end of Passage Point property		Coordinates (Lat,Lon WGS84): 47.460, -122.037	Exploration Number: GP-64C
Contractor: Holt Services	Equipment: Rotary drill rig	Sampling Method: Rotary core	Ground Surface (GS) Elev. (NAVD29): 629.4852'	Ecology Well Tag No. BKX-456
Operator: Pete S.	Exploration Method(s): Sonic	Work Start/Completion Dates: 6/12/2018	Top of Casing Elev. (NAVD29): 632.4218'	Depth to Water (Below GS): No Water Encountered

Depth (feet)	Elev. (feet)	Exploration Completion and Notes	Sample Type/ID	Analytical Sample Number & Lab Test(s)	Field Tests	Material Type	Description	Depth (ft)
0	630	Monument lid Valved hose barb 8-inch steel monument Concrete surface seal Backfilled with bentonite chips 0.5-inch SCH80 PVC casing	S1		PID= 5.8 PID= 1.5		**FILL** Moist, brown to black, slightly silty, sandy, gravelly Topsoil; abundant to trace root organics.	0
5	625		S2		PID= 2.1 PID= 10.3 PID= 2.3		**WEATHERED GLACIAL TILL** Moist, brown, slighly sandy, gravelly SILT (ML); trace silt, fine to coarse sand, fine to coarse subrounded gravel, diamict. Grades to slightly moist.	5
10	620		S3		PID= 8.5 PID= 1.4		Becomes brown.	10
15	615		S4		PID= 4.7 PID= 1.8 PID= 10.5			15

Legend

Sample Method: Continuous core 4" ID

Water Level: No Water Encountered

See Exploration Log Key for explanation of symbols

Logged by: MML
Approved by: EWM

Exploration Log GP-64C

Sheet 1 of 3

ASPECT STANDARD EXPLORATION LOG TEMPLATE \\BISERVER1.ASPECT.LOCAL\PROJECTS\GINTW\PROJECTS\2018_130088_CHRLF_MWS AND GPS.GPJ August 29, 2018

Aspect CONSULTING	Cedar Hills Landfill - 130088		Monitoring Well Log	
	Project Address & Site Specific Location 16645 228th Ave SE, Maple Valley, WA, North end of Passage Point property		*Coordinates (Lat,Lon WGS84)* 47.460, -122.037	*Exploration Number* **GP-64C**
Contractor Holt Services	*Equipment* Rotary drill rig	*Sampling Method* Rotary core	*Ground Surface (GS) Elev. (NAVD29)* 629.4852'	Ecology Well Tag No. BKX-456
Operator Pete S.	*Exploration Method(s)* Sonic	*Work Start/Completion Dates* 6/12/2018	*Top of Casing Elev. (NAVD29)* 632.4218'	*Depth to Water (Below GS)* No Water Encountered

Depth (feet)	Elev. (feet)	Exploration Completion and Notes	Sample Type/ID	Analytical Sample Number & Lab Test(s)	Field Tests	Material Type	Description	Depth (ft)
20	610		S4		PID= 6.4		**GLACIAL TILL** Moist, blue gray, sandy, gravelly SILT (ML); trace silt, fine to coarse sand, fine to coarse subrounded gravel, diamict.	20
							STRATIFIED DRIFT Moist to very moist, gravelly, silty SAND (SM); fine to coarse sand, fine to coarse gravel.	
					PID= 44.1			
					PID= 0.4			
25	605		S5					25
					PID= 0.0		Increased coarse sand.	
					PID= 10.9			
					PID= 5.1			
30	600							30
					PID= 14.5		Moist, gray brown, slightly sandy, silty GRAVEL (GM); fine to coarse sand, fine to coarse gravel.	
					PID= 3.1			
35	595		S6				Moist, gray brown, gravelly, slightly silty SAND (SP-SM); predominantly fine to medium sand, fine subangular to subrounded gravel.	35
					PID= 3.2		Moist, blue gray, very gravelly, silty SAND (SM); fine to coarse sand, fine to coarse subrounded gravel.	
							Moist, blue gray, very sandy, silty GRAVEL (GM); fine to coarse sand, fine to coarse subrounded gravel.	
					PID= 2.9		Grades to gray brown.	
40	590		S7					40

Legend

Sample Method: Continuous core 4" ID

Water Level: No Water Encountered

See Exploration Log Key for explanation of symbols

Logged by: MML
Approved by: EWM

Exploration Log GP-64C

Sheet 2 of 3

ASPECT STANDARD EXPLORATION LOG TEMPLATE \\BISERVER1.ASPECT.LOCAL\PROJECTS\GINTW\PROJECTS\2018_130088_CHRLF_MWS AND GPS.GPJ August 29, 2018

Aspect CONSULTING	Cedar Hills Landfill - 130088		Monitoring Well Log	
	Project Address & Site Specific Location: 16645 228th Ave SE, Maple Valley, WA, North end of Passage Point property		Coordinates (Lat,Lon WGS84): 47.460, -122.037	Exploration Number: **GP-64C**
Contractor: Holt Services	Equipment: Rotary drill rig	Sampling Method: Rotary core	Ground Surface (GS) Elev. (NAVD29): 629.4852'	Ecology Well Tag No. BKX-456
Operator: Pete S.	Exploration Method(s): Sonic	Work Start/Completion Dates: 6/12/2018	Top of Casing Elev. (NAVD29): 632.4218'	Depth to Water (Below GS): No Water Encountered

Depth (feet)	Elev. (feet)	Exploration Completion and Notes	Sample Type/ID	Analytical Sample Number & Lab Test(s)	Field Tests	Material Type	Description	Depth (ft)
45	585		S7		PID= 22.6 PID= 29.9 PID= 8.6		Moist, blue gray, very sandy, silty GRAVEL (GM); fine to coarse sand, fine to coarse subrounded gravel. (continued) Cobbles between 35 and 38 ft bgs.	45
50	580		S8		PID= 10.3 PID= 6.2			50
55	575	Graded pea gravel filter pack 0.5-inch SCH80 PVC 20-slot screen	S9		PID= 15.3 PID= 59.9 PID= 51.5			55
60	570	End cap			PID= 18.9		Bottom of exploration at 60 ft. bgs. Note: 6-inch borehole diameter. PID readings are elevated due to abundandant water vapor and heat produced by drilling friction.	60

Legend

Sample Method: Continuous core 4" ID

Water Level: No Water Encountered

See Exploration Log Key for explanation of symbols

Logged by: MML
Approved by: EWM

Exploration Log GP-64C

Sheet 3 of 3

ASPECT STANDARD EXPLORATION LOG TEMPLATE \\BISERVER1.ASPECT.LOCAL\PROJECTS\GINT\WPROJECTS2018_130088_CHRLF_MWS AND GPS.GPJ August 29, 2018

Aspect CONSULTING	Cedar Hills Landfill - 130088		Monitoring Well Log	
	Project Address & Site Specific Location 16645 228th Ave SE, Maple Valley, WA, South end of landfill		*Coordinates (Lat,Lon WGS84)* 47.466, -122.040	*Exploration Number* **MW-107**
Contractor Holt Services	*Equipment* Rotary drill rig	*Sampling Method* Rotary core	*Ground Surface (GS) Elev. (NAVD29)* 586.5001'	Ecology Well Tag No. BKX-447
Operator Brian O.	*Exploration Method(s)* Sonic	*Work Start/Completion Dates* 6/7/2018	*Top of Casing Elev. (NAVD29)* 589.0288'	*Depth to Water (Below GS)* 28.87' (Static)

Depth (feet)	Elev. (feet)	Exploration Completion and Notes	Sample Type/ID	Analytical Sample Number & Lab Test(s)	Field Tests	Material Type	Description	Depth (ft)
0	585	Monument lid Compression cap 8-inch steel monument Concrete surface seal Bentonite chips 2-inch SCH40 PVC casing	S1				**STRATIFIED DRIFT** Slightly moist, light brown, sandy, gravelly SILT (ML); fine to coarse sand, fine to coarse subrounded to subangular gravel, with cobbles, trace organics.	0
5	580						Moist, brown, slightly sandy, silty GRAVEL (GM); fine to coarse sand, fine to coarse subrounded to rounded gravel with cobbles.	5
10	575							10
15	570		S2				Becomes light brown with no cobbles between 16 and 17 ft bgs.	15
20	565	Top centralizer	S3					20

Legend

Sample Method: Continuous core 7" ID

Water Level: Static Water Level; Water Level ATD

See Exploration Log Key for explanation of symbols

Logged by: MvdA
Approved by: EWM

Exploration Log MW-107

Sheet 1 of 2

ASPECT STANDARD EXPLORATION LOG TEMPLATE \\BISERVER1.ASPECT.LOCAL\PROJECTS\GINTW\PROJECTS\2018_130088_CHRLF_MWS AND GPS.GPJ August 29, 2018

Aspect CONSULTING	Cedar Hills Landfill - 130088		Monitoring Well Log	
	Project Address & Site Specific Location 16645 228th Ave SE, Maple Valley, WA, South end of landfill		*Coordinates (Lat,Lon WGS84)* 47.466, -122.040	*Exploration Number* **MW-107**
Contractor Holt Services	*Equipment* Rotary drill rig	*Sampling Method* Rotary core	*Ground Surface (GS) Elev. (NAVD29)* 586.5001'	Ecology Well Tag No. BKX-447
Operator Brian O.	*Exploration Method(s)* Sonic	*Work Start/Completion Dates* 6/7/2018	*Top of Casing Elev. (NAVD29)* 589.0288'	*Depth to Water (Below GS)* 28.87' (Static)

Depth (feet)	Elev. (feet)	Exploration Completion and Notes	Sample Type/ID	Analytical Sample Number & Lab Test(s)	Field Tests	Material Type	Description	Depth (ft)
25	560	10/20 Colorado silica sand ▼ 6/20/2018 ▽ 6/11/2018 2-inch SCH40 PVC 20-slot screen	S3				Moist, brown, slightly sandy, silty GRAVEL (GM); fine to coarse sand, fine to coarse subrounded to rounded gravel with cobbles. (continued) Becomes gray.	25
30	555		S4				Becomes very moist.	30
35	550	Bottom centralizer Threaded end cap					Becomes moist.	35
40	545						Bottom of exploration at 40 ft. bgs. Note: 8-inch borehole diameter.	40
45	540							45

Legend

Sample Method: ◫ Continuous core 7" ID

Water Level: ▼ Static Water Level; ▽ Water Level ATD

See Exploration Log Key for explanation of symbols

Logged by: MvdA
Approved by: EWM

Exploration Log MW-107
Sheet 2 of 2

ASPECT STANDARD EXPLORATION LOG TEMPLATE \\BISERVER1.ASPECT.LOCAL\PROJECTS\GINT\WPROJECTS\2018_130088_CHRLF_MWS AND GPS.GPJ August 29, 2018

Aspect Consulting	Cedar Hills Landfill - 130088		Monitoring Well Log	
	Project Address & Site Specific Location 16645 228th Ave SE, Maple Valley, WA, North of MW-107		*Coordinates (Lat,Lon WGS84)* 47.465, -122.039	*Exploration Number* **MW-108**
Contractor Holt Services	*Equipment* Rotary drill rig	*Sampling Method* Rotary core	*Ground Surface (GS) Elev. (NAVD29)* 609.5428'	Ecology Well Tag No. BKX-448
Operator Brian O.	*Exploration Method(s)* Sonic	*Work Start/Completion Dates* 6/7/2018 to 6/8/2018	*Top of Casing Elev. (NAVD29)* 612.2584'	*Depth to Water (Below GS)* No Water Encountered

Depth (feet)	Elev. (feet)	Exploration Completion and Notes	Sample Type/ID	Analytical Sample Number & Lab Test(s)	Field Tests	Material Type	Description	Depth (ft)
0	610	Monument lid Compression cap 8-inch steel monument Concrete surface seal					**FILL** Slightly moist, light brown, silty SAND (SM); trace fine subrounded gravel, fine to medium sand.	0
5	605	Bentonite chips 2-inch SCH40 PVC casing Top centralizer	S1				**WEATHERED TILL** Moist, brown, slightly sandy, gravelly SILT (ML); fine to medium sand, fine to coarse subrounded gravel, non plastic, red mottling, with 10% cobbles.	5
10	600	10/20 Colorado silica sand 2-inch SCH40 PVC 20-slot screen					Moist, brown, slightly sandy, silty GRAVEL (GM); fine to coarse sand, fine to coarse subrounded gravel.	10
15	595	Bottom centralizer Threaded end cap	S2				Moist, brown, slightly sandy, gravelly SILT (ML); fine to coarse sand, fine to coarse gravel, with reddish mottling.	15
20	590	Bentonite chips	S3				**GLACIOLACUSTRINE** Slightly moist, blue gray SILT (ML); non plastic.	20

Legend

Sample Method: Continuous core 4" ID

Water Level: No Water Encountered

See Exploration Log Key for explanation of symbols

Logged by: MvdA
Approved by: EWM

Exploration Log MW-108

Sheet 1 of 2

ASPECT STANDARD EXPLORATION LOG TEMPLATE \\BISERVER1.ASPECT.LOCAL\PROJECTS\GINTW\PROJECTS\2018_130088_CHRLF_MWS AND GPS.GPJ August 29, 2018

Aspect CONSULTING	Cedar Hills Landfill - 130088		Monitoring Well Log	
	Project Address & Site Specific Location 16645 228th Ave SE, Maple Valley, WA, North of MW-107		*Coordinates (Lat,Lon WGS84)* 47.465, -122.039	*Exploration Number* **MW-108**
Contractor Holt Services	*Equipment* Rotary drill rig	*Sampling Method* Rotary core	*Ground Surface (GS) Elev. (NAVD29)* 609.5428'	Ecology Well Tag No. BKX-448
Operator Brian O.	*Exploration Method(s)* Sonic	*Work Start/Completion Dates* 6/7/2018 to 6/8/2018	*Top of Casing Elev. (NAVD29)* 612.2584'	*Depth to Water (Below GS)* No Water Encountered

Depth (feet)	Elev. (feet)	Exploration Completion and Notes	Sample Type/ID	Analytical Sample Number & Lab Test(s)	Field Tests	Material Type	Description	Depth (ft)
							GLACIOLACUSTRINE Slightly moist, blue gray SILT (ML); non plastic. (continued)	
25	585		S3				**STRATIFIED DRIFT** Very moist, brown, slightly gravelly, silty SAND (SM); medium to coarse sand, fine to coarse subrounded gravel.	25
30	580						Moist, gray, slightly sandy, silty GRAVEL (GM); fine to coarse sand, fine to coarse subrounded gravel.	30
35	575		S4					35
40	570						Bottom of exploration at 40 ft. bgs. Note: 8-inch borehole diameter.	40
45	565							45

Legend

Sample Method: Continuous core 4" ID

Water Level: No Water Encountered

See Exploration Log Key for explanation of symbols

Logged by: MvdA
Approved by: EWM

Exploration Log MW-108
Sheet 2 of 2

ASPECT STANDARD EXPLORATION LOG TEMPLATE \\BISERVER1.ASPECT.LOCAL\PROJECTS\GINTW\PROJECTS\2018_130088_CHRLF_MWS AND GPS.GPJ August 29, 2018

Aspect CONSULTING	Cedar Hills Landfill - 130088		Monitoring Well Log	
	Project Address & Site Specific Location 16645 228th Ave SE, Maple Valley, WA, North of MW-108		*Coordinates (Lat,Lon WGS84)* 47.463, -122.039	*Exploration Number* **MW-109**
Contractor Holt Services	*Equipment* Rotary drill rig	*Sampling Method* Rotary core	*Ground Surface (GS) Elev. (NAVD29)* 636.8872'	Ecology Well Tag No. BKX-449
Operator Brian O.	*Exploration Method(s)* Sonic	*Work Start/Completion Dates* 6/8/2018 to 6/9/2018	*Top of Casing Elev. (NAVD29)* 638.7279'	*Depth to Water (Below GS)* 10.58' (Static)

Depth (feet)	Elev. (feet)	Exploration Completion and Notes	Sample Type/ID	Analytical Sample Number & Lab Test(s)	Field Tests	Material Type	Description	Depth (ft)
0		Monument lid Compression cap 8-inch steel monument						
		Concrete surface seal					**WEATHERED TILL** Moist, dark brown, slightly gravelly, sandy SILT (ML); fine to medium sand, fine subangular gravel, non plastic, with 10% cobbles.	0
	635	Bentonite chips						
5		2-inch SCH40 PVC casing Top centralizer	S1				Moist, dark gray, slightly sandy, gravelly, silty GRAVEL (GM); fine to coarse sand, fine to coarse subrounded gravel with 10% cobbles.	5
	630	10/20 Colorado silica sand						
		2-inch SCH40 PVC 20-slot screen						
10		▼ 6/20/2018					Becomes wet.	10
	625	▽ 6/9/2018 Bottom centralizer Threaded end cap	S2				Becomes dry.	
15		Bentonite chips					Becomes slightly moist.	15
	620		S3				**GLACIOLACUSTRINE** Slightly moist, gray SILT (ML); trace fine sand, trace gravel, nonplastic with brown lenses.	
20							Bottom of exploration at 20 ft. bgs. Note: 8-inch borehole diameter.	20
	615							

Legend

Sample Method: ◫ Continuous core 4" ID

Water Level: ▼ Static Water Level; ▽ Water Level ATD

See Exploration Log Key for explanation of symbols

Logged by: MvdA
Approved by: EWM

Exploration Log MW-109
Sheet 1 of 1

ASPECT STANDARD EXPLORATION LOG TEMPLATE \\BISERVER1.ASPECT.LOCAL\PROJECTS\GINTW\PROJECTS\2018_130088_CHRLF_MWS AND GPS.GPJ August 29, 2018

Aspect CONSULTING	Cedar Hills Landfill - 130088		Monitoring Well Log	
	Project Address & Site Specific Location 16645 228th Ave SE, Maple Valley, WA, North of MW-109		*Coordinates (Lat,Lon WGS84)* 47.462, -122.039	*Exploration Number* **MW-110**
Contractor Holt Services	*Equipment* Rotary drill rig	*Sampling Method* Rotary core	*Ground Surface (GS) Elev. (NAVD29)* 639.2215'	Ecology Well Tag No. BKX-450
Operator Brian O.	*Exploration Method(s)* Sonic	*Work Start/Completion Dates* 6/10/2018 to 6/11/2018	*Top of Casing Elev. (NAVD29)* 641.7425'	*Depth to Water (Below GS)* 7.75' (Static)

Depth (feet)	Elev. (feet)	Exploration Completion and Notes	Sample Type/ID	Analytical Sample Number & Lab Test(s)	Field Tests	Material Type	Description	Depth (ft)
0	640	Monument lid Compression cap 8-inch steel monument Concrete surface seal	S1				**WEATHERED TILL** Slightly moist, light brown, slightly sandy, gravelly SILT (ML); fine to coarse sand, fine to coarse subrounded gravel, nonplastic.	0
5	635	Bentonite chips 2-inch SCH40 PVC casing Top centralizer 6/20/2018 6/11/2018					Becomes gray. Becomes brown.	5
10	630	10/20 Colorado silica sand 2-inch SCH40 PVC 20-slot screen	S2				Becomes gray. Moist, brown, slightly sandy, silty GRAVEL (GM); fine to coarse sand, fine to coarse subrounded gravel, nonplastic.	10
15	625							15
20	620	Bottom centralizer Threaded end cap Bentonite chips	S3				**GLACIOLACUSTRINE** Moist, blue gray SILT (ML); nonplastic.	20
25	615						Bottom of exploration at 25 ft. bgs. Note: 8-inch borehole diameter.	25

Legend

Sample Method: Continuous core 7" ID

Water Level: Static Water Level; Water Level ATD

See Exploration Log Key for explanation of symbols

Logged by: MvdA
Approved by: EWM

Exploration Log MW-110
Sheet 1 of 1

ASPECT STANDARD EXPLORATION LOG TEMPLATE \\BISERVER1.ASPECT.LOCAL\PROJECTS\GINT\WPROJECTS\2018_130088_CHRLF_MWS AND GPS.GPJ August 29, 2018

Aspect CONSULTING	Cedar Hills Landfill - 130088		Monitoring Well Log	
	Project Address & Site Specific Location 16645 228th Ave SE, Maple Valley, WA, South of Water Tower		*Coordinates (Lat,Lon WGS84)* 47.461, -122.039	*Exploration Number* **MW-111**
Contractor Holt Services	*Equipment* Rotary drill rig	*Sampling Method* Rotary core	*Ground Surface (GS) Elev. (NAVD29)* 641.6421'	Ecology Well Tag No. BKX-451
Operator Brian O.	*Exploration Method(s)* Sonic	*Work Start/Completion Dates* 6/11/2018	*Top of Casing Elev. (NAVD29)* 643.7965'	*Depth to Water (Below GS)* 10.79' (Static)

Depth (feet)	Elev. (feet)	Exploration Completion and Notes	Sample Type/ID	Analytical Sample Number & Lab Test(s)	Field Tests	Material Type	Description	Depth (ft)
0	640	Monument lid Compression cap 8-inch steel monument Concrete surface seal	S1				**FILL** Moist, brown to black, slightly silty, sandy, gravelly Topsoil; fine to medium sand, fine to coarse subrounded gravel, abundant to trace root organics.	0
5	635	Bentonite chips 2-inch SCH40 PVC casing Top centralizer	S2		PID= 0.0		**WEATHERED TILL** Moist, gray brown, sandy, gravelly SILT (ML); fine to coarse sand, predominantly fine subrounded gravel, orange mottling.	5
10	630	10/20 Colorado silica sand ▽ 6/11/2018 2-inch SCH40 PVC 20-slot screen ▼ 6/20/2018	S3		PID= 0.0		Wet, brown SAND (SP); fine sand. Wet, brown SILT (ML); trace fine sand, non plastic silt. Moist, blue gray, sandy, gravelly SILT (ML); fine to coarse sand, fine to coarse subrounded gravel, with scattered sandy lenses and extensive mottling.	10
15	625	Bottom centralizer Threaded end cap Bentonite chips	S4		PID= 0.0			15
20	620		S5		PID= 0.0		**GLACIOLACUSTRINE** Slightly moist, brown SILT (ML); trace fine sand. Becomes blue gray.	20
25	615				PID= 0.0		Bottom of exploration at 25 ft. bgs. Note: 8-inch borehole diameter. PID readings are elevated due to abundandant water vapor and heat produced by drilling friction.	25

Legend

Sample Method: ◫ Continuous core 6" ID

Water Level: ▼ Static Water Level; ▽ Water Level ATD

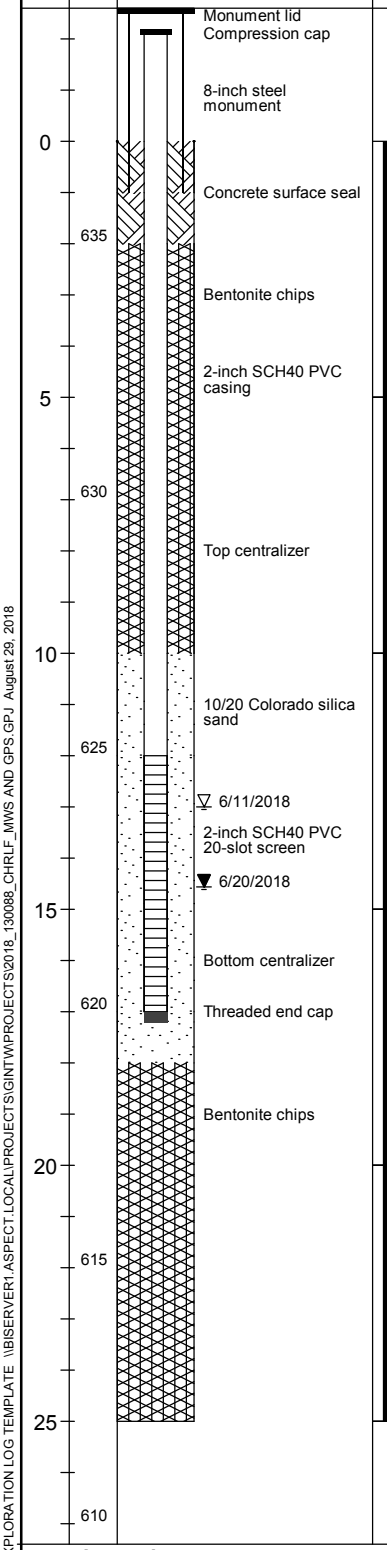
See Exploration Log Key for explanation of symbols

Logged by: MML
Approved by: EWM

Exploration Log MW-111
Sheet 1 of 1

ASPECT STANDARD EXPLORATION LOG TEMPLATE \\BISERVER1.ASPECT.LOCAL\PROJECTS\GINTW\PROJECTS\2018_130088_CHRLF_MWS AND GPS.GPJ August 29, 2018

Aspect CONSULTING	Cedar Hills Landfill - 130088		Monitoring Well Log	
	Project Address & Site Specific Location 16645 228th Ave SE, Maple Valley, WA, North of Water Tower		*Coordinates (Lat,Lon WGS84)* 47.460, -122.040	*Exploration Number* **MW-112**
Contractor Holt Services	*Equipment* Rotary drill rig	*Sampling Method* Rotary core	*Ground Surface (GS) Elev. (NAVD29)* 636.8379'	Ecology Well Tag No. BKX-452
Operator Brian O.	*Exploration Method(s)* Sonic	*Work Start/Completion Dates* 6/11/2018	*Top of Casing Elev. (NAVD29)* 638.9286'	*Depth to Water (Below GS)* 14.56' (Static)



Depth (feet)	Elev. (feet)	Field Tests	Material Type	Description	Depth (ft)
0					0
				FILL Moist, brown to black, slightly silty, sandy, gravelly Topsoil; fine to medium sand, fine to coarse subrounded gravel, abundant to trace root organics.	
	635			**WEATHERED TILL** Moist, brown SILT (ML); trace fine sand, trace fine to coarse subrounded gravel, orange mottling.	
5		PID= 1.2		Slightly moist.	5
	630				
10		PID= 0.6		Slighly moist, gray blue, gravelly SILT (ML); trace fine sand.	10
	625				
				Wet, brown SAND (SP); trace silt, predominantly medium sand with 2-inch silt lens at 14 ft bgs.	
15		PID= 0.5		Wet, brown, slightly silty SAND (SP-SM); predominantly medium to coarse sand.	15
	620			Wet, blue gray, silty SAND (SM); predominantly medium to coarse sand.	
				GLACIOLACUSTRINE Slightly moist, blue gray SILT (ML); trace fine sand, trace fine subangular to subrounded gravel.	
20		PID= 0.0			20
	615				
25		PID= 0.0		Bottom of exploration at 25 ft. bgs. Note: 8-inch borehole diameter. PID readings are elevated due to abundandant water vapor and heat produced by drilling friction.	25
	610				

Legend

Sample Method: Continuous core 6" ID

Water Level: Static Water Level; Water Level ATD

See Exploration Log Key for explanation of symbols

Logged by: MML
Approved by: EWM

Exploration Log MW-112
Sheet 1 of 1

ASPECT STANDARD EXPLORATION LOG TEMPLATE \\BISERVER1.ASPECT.LOCAL\PROJECTS\GINTWPROJECTS\2018_130088_CHRLF_MWS AND GPS.GPJ August 29, 2018

APPENDIX B

Boring Log Photos


GP-63A
0'
5'

5'
10'

GP-63B

5'

10'

15'

20'

20'

25'

30.

30

35

GP-63C

5'

5'

10

15'

15'

20'

20'

25'

30'

35

40'

40'

45'

50'

50'

55'

GP-64A

5'

10'

GP-64B

5'

5'

10'

10'

15'

15'

20'

20'
25'

GP-64C

4
5
6
5'

10'

10'

15'

20'

25'

30'

30'

35'

46'

40'

45'

50'

50'

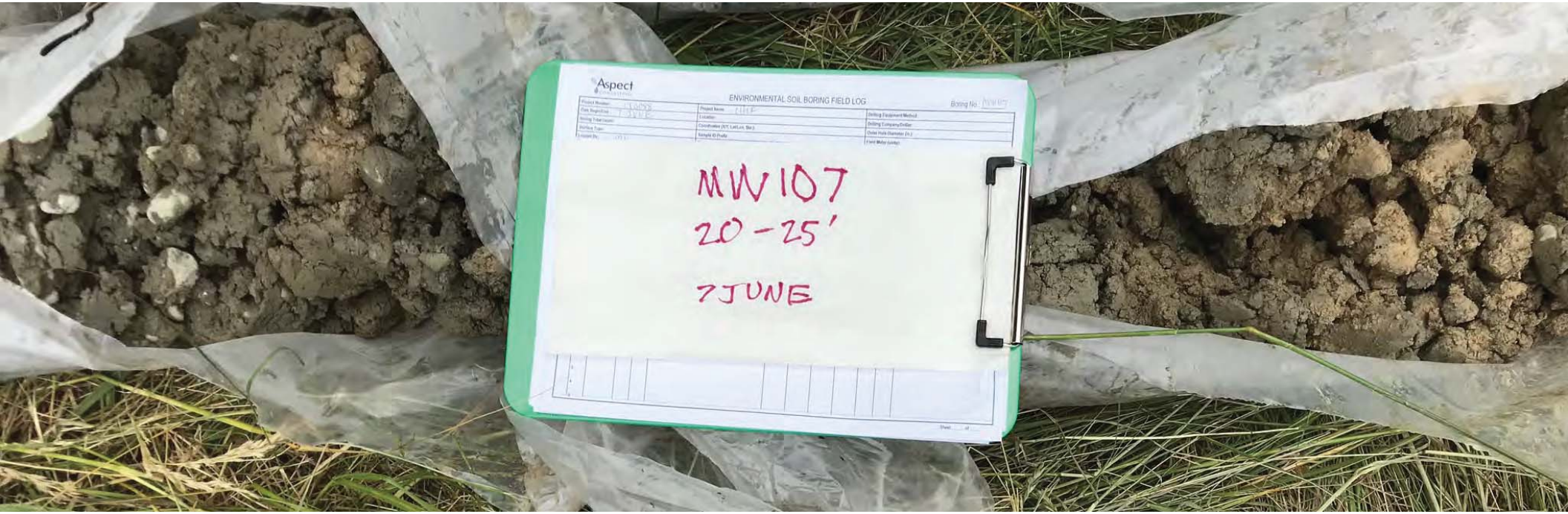
55'

MW-107

MW07
6-10'


MW107
10-15'
7 JUNE

MW101
15'-20'
SAMPLE


Aspect
ENVIRONMENTAL SOIL BORING FIELD LOG
MW107
20-25'
7JUNE

MW107
25-30'
7JUNE


MW107
35'-40'
7 JUNE

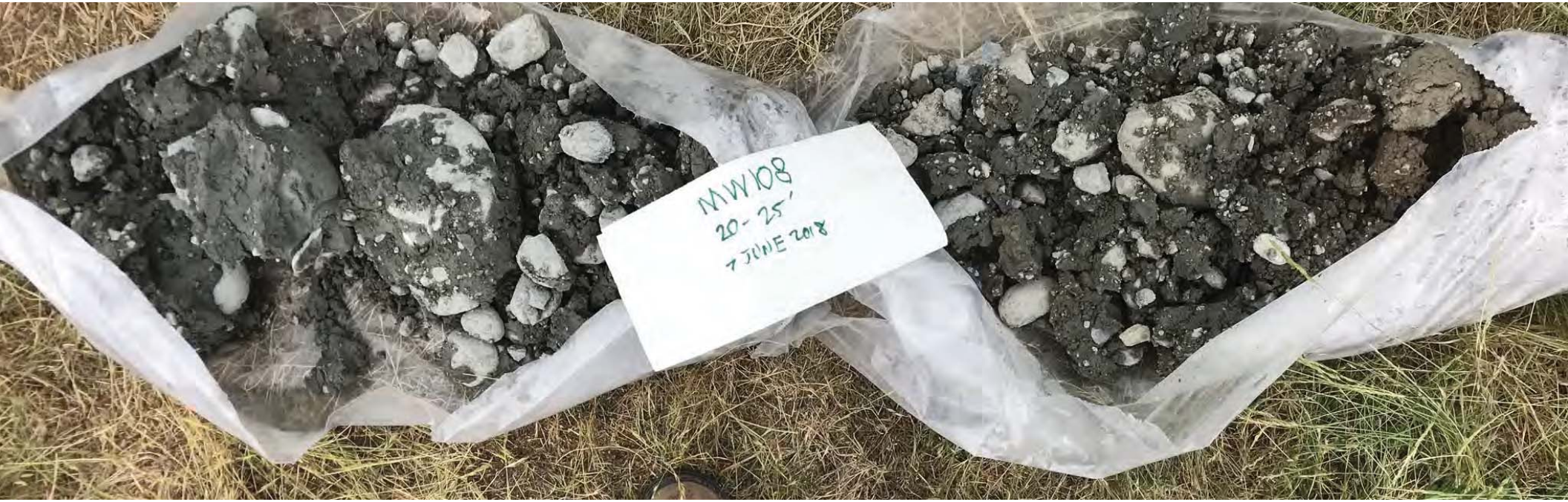
MW-107
35'-40'
7 JUNE

MW-108

MW108
5'-0"
EMPTY

MW 108
10'-15'
7 JUNE 2018


MW 108
15 - 20'
7 JUNE 2018
20


MW08
20-25'
7 JUNE 2018

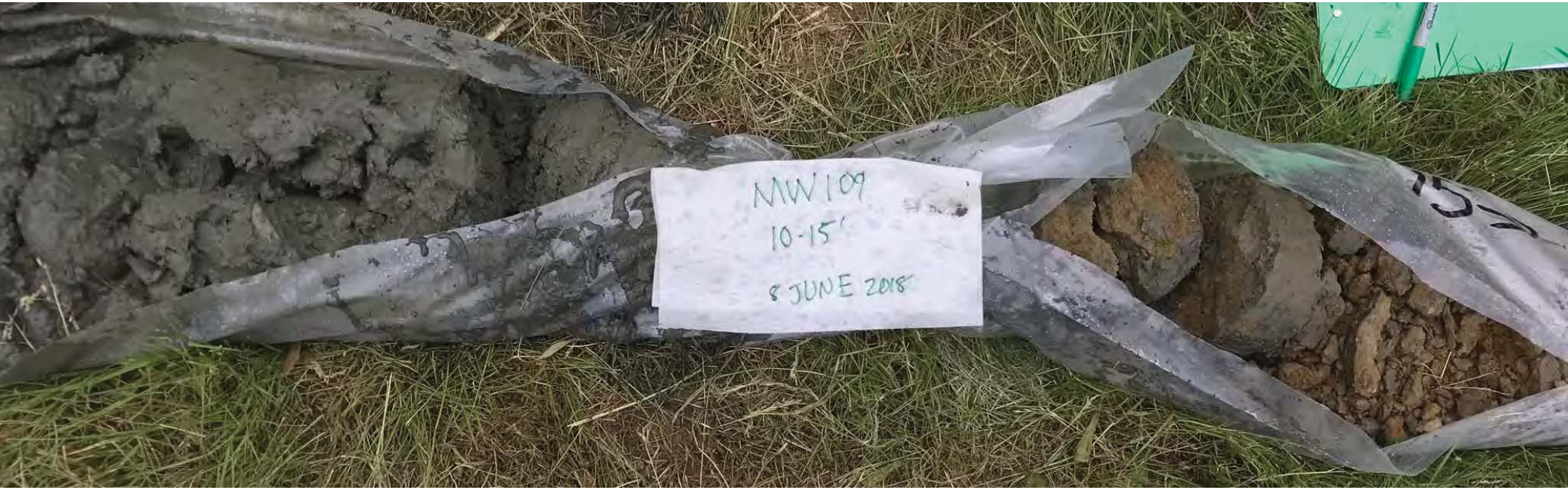

MW108
25-30'
7 JUNE 2018

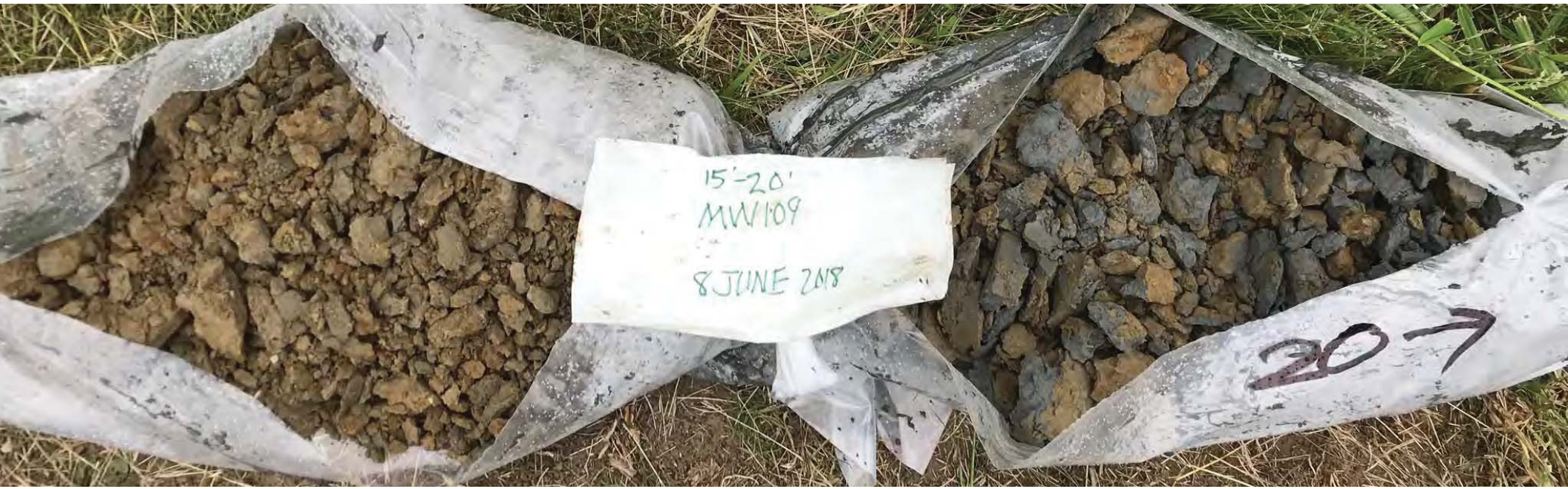

MW108
30-35
8 JUNE 2018


MW108
35-40'
8 JUNE 2018

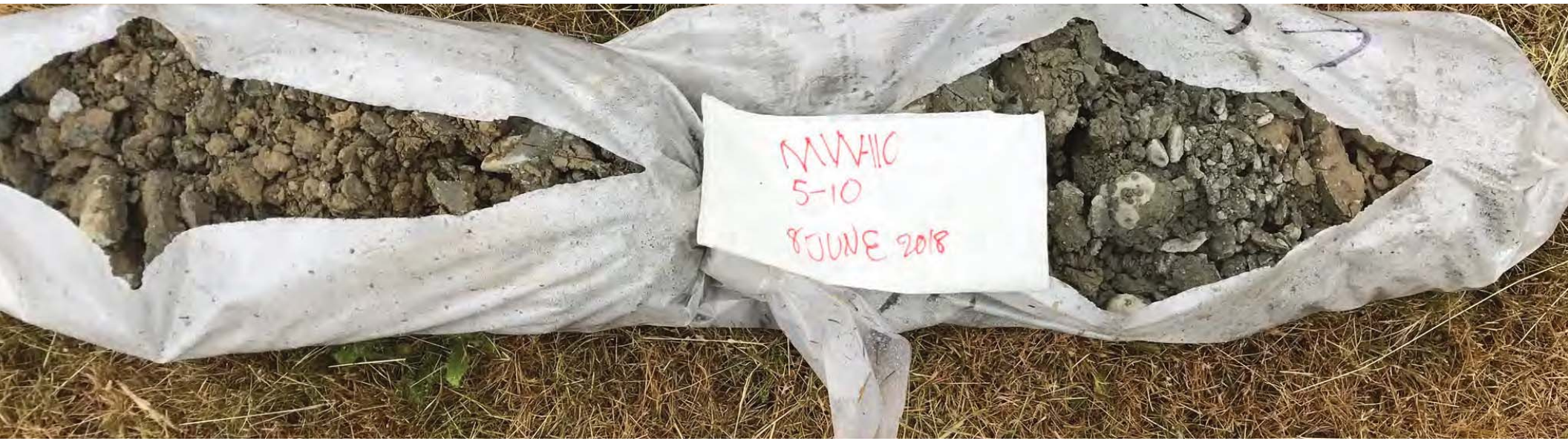
MW-109


MW109
5-10'
8 JUNE 2018

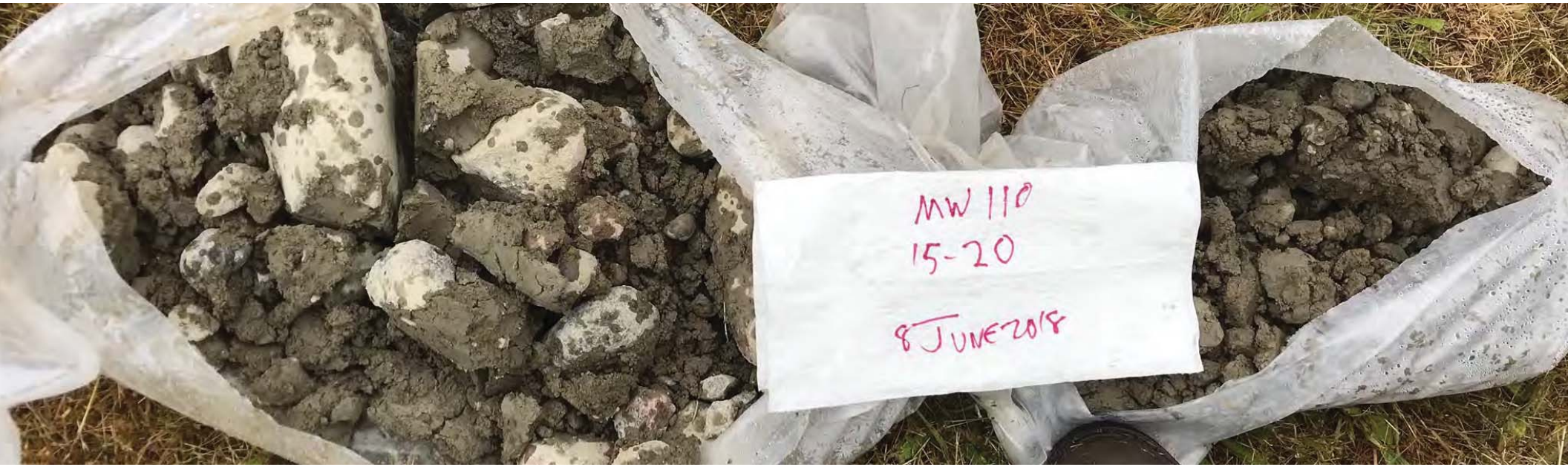

MW109
10-15'
8 JUNE 2018


15'-20'
MW109
8 JUNE 2018
207

MW-110


MWHC
5-10
8 JUNE 2018


MW-110
10-15'
8 JUNE 2018


MW 110
15-20
8 JUNE 2018


MW-110
20-25
8 JUNE 2018
25

MW-111

5'

10'

10'

15'

20'


20'


25'

MW-112

5'

10'


15'

20'

25'

APPENDIX C

Well Development Field Records

WELL DEVELOPMENT RECORD

WELL NUMBER: MW-107

Project Name:	CHRL
Date:	6/20/18
Developed by:	~~MMC~~ HoH
Measuring Point of Well:	TOC
Screened Interval (ft. BGS):	
Filter Pack Interval (ft. BGS):	

Project Number:	130088
Starting Water Level (ft TOC):	31.10
Casing Stickup (ft BGS):	2.23 mon=2.59
Total Depth (ft TOC):	39.2
Casing Diameter (inches):	2

Casing Volume: ft Water x gpf =
Casing volumes: 2" = 0.16 gpf 4" = 0.65 gpf 6" = 1.47 gpf

BKX-447

DEVELOPMENT MEASUREMENTS

Elapsed Time (min)	Cumul. Vol. (gallons)	Purge Rate (gpm)	Temp. (C or F)	pH	Specific Conductance (µmhos/cm)	Turbidity (NTU)	~~Imhoff Cone~~ (ml/L)	Comments
1312	0	~1	12.7	7.17	351.1	muddy	brown	Start purge
1317	↓	↓	12.7	7.16	346.1	muddy	gray	
1323	↓	↓	↓	7.14	345.0	>1000	↓	
1328	↓	↓	↓	7.14	346.7	>1000	↓	
1332	~20	↓	↓	↓	↓	↓	↓	Dry: Stop
1348	↓	↓	↓	↓	↓	>1000	↓	Surge then resume
1356	~28	↓	~~12.7~~	~~7.13~~	~~357.6~~	>1000	↓	Stop: Dry
1410	↓	↓	12.7	7.13	357.6	>1000	↓	Resume
1414	~32	↓	12.6	7.10	354.7	>1000	↓	Dry

Total Discharge (gallons): ~32 Total Casing Volumes Removed (gallons): ~25

Ending Water Level (ft TOC): not static, rising Ending Total Depth (ft TOC): 39.2

METHODS

Cleaning Equipment:	Alconox + DI water
Development Equipment:	Surge block, submersible pump
Disposal of Discharged Water:	DRM
Observations/Comments:	Surged for ~10 min before surge

WELL DEVELOPMENT RECORD

WELL NUMBER: MW-108

Project Name:	CH RL
Date:	6/20/18
Developed by:	~~AMH~~ Holt
Measuring Point of Well:	TOC
Screened Interval (ft. BGS):	
Filter Pack Interval (ft. BGS):	

Project Number:	130088
Starting Water Level (ft TOC):	Dry
Casing Stickup (ft BGS):	3.23 - 0.50 = 2.73
Total Depth (ft TOC):	20.20
Casing Diameter (inches):	2

Casing Volume: ft Water x gpf =

Casing volumes: 2" = 0.16 gpf 4" = 0.65 gpf 6" = 1.47 gpf

BKX-498

DEVELOPMENT MEASUREMENTS

Elapsed Time (min)	Cumul. Vol. (gallons)	Purge Rate (gpm)	Temp. (C or F)	pH	Specific Conductance (µmhos/cm)	Turbidity (NTU)	Imhoff Cone (ml/L)	Comments
								No Development: Dry

Total Discharge (gallons): _____ Total Casing Volumes Removed (gallons): _____

Ending Water Level (ft TOC): _____ Ending Total Depth (ft TOC): _____

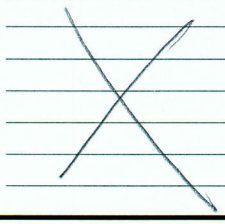
METHODS

Cleaning Equipment:

Development Equipment:

Disposal of Discharged Water:

Observations/Comments:



WELL DEVELOPMENT RECORD

Project Name:	CHRL
Date:	6/20/18
Developed by:	Holt
Measuring Point of Well:	TOC
Screened Interval (ft. BGS):	
Filter Pack Interval (ft. BGS):	

WELL NUMBER:

Project Number:	MW-109
Starting Water Level (ft TOC):	12.12
Casing Stickup (ft BGS):	2.80 - 1.26 = 1.54
Total Depth (ft TOC):	15.18
Casing Diameter (inches):	2

Casing Volume: ft Water x gpf =
Casing volumes: 2" = 0.16 gpf 4" = 0.65 gpf 6" = 1.47 gpf

BKX-449

DEVELOPMENT MEASUREMENTS

Elapsed Time (min)	Cumul. Vol. (gallons)	Purge Rate (gpm)	Temp. (C or F)	pH	Specific Conductance (µmhos/cm)	Turbidity (NTU)	~~Imhoff Cone~~ (ml/L)	Comments
1248	∅	~1				—		Surge Block
1252	∅	|	10.7	7.13	238.2	71000		Purge start
1254	~2	|				71000		Dry
1300	√	|	10.5	7.09	249.6			Resume
1301	~2½	|				71000		Dry

Total Discharge (gallons): _____ Total Casing Volumes Removed (gallons): _____

Ending Water Level (ft TOC): _____ Ending Total Depth (ft TOC): _____

METHODS

Cleaning Equipment:	Alconox + DI water
Development Equipment:	Surgeblock, 12v submersible pump
Disposal of Discharged Water:	Dam
Observations/Comments:	Water is greenish brown. Not enough water to develop.

WELL DEVELOPMENT RECORD

WELL NUMBER: MW-110

Project Name:	CHRL
Date:	6/20/18
Developed by:	Holt
Measuring Point of Well:	TOC
Screened Interval (ft. BGS):	
Filter Pack Interval (ft. BGS):	

Project Number:	130088
Starting Water Level (ft TOC):	10.19
Casing Stickup (ft BGS):	3.14 - 0.70 = 2.44
Total Depth (ft TOC):	~21.5 soft
Casing Diameter (inches):	2

Casing Volume: ft Water x gpf =
Casing volumes: 2" = 0.16 gpf 4" = 0.65 gpf 6" = 1.47 gpf

BKX = 450

DEVELOPMENT MEASUREMENTS

Elapsed Time (min)	Cumul. Vol. (gallons)	Purge Rate (gpm)	Temp. (C or F)	pH	Specific Conductance (µmhos/cm)	Turbidity (NTU)	Imhoff Cone (ml/L)	Comments
1121	∅	–				–		Surge block
1130	∅	~1				Muddy		Start purge
1135	~5		11.1	6.94	153.3	>1000		
1138	~8					>1000		Stop: Dry
1215	↓		11.1	6.91	157.4			Resume
1217	~10					>1000		Dry
1242	↓		11.0	6.93	160.4			Resume
1243	~11					>1000		Dry

Total Discharge (gallons): _____ Total Casing Volumes Removed (gallons): _____

Ending Water Level (ft TOC): _____ Ending Total Depth (ft TOC): _____

METHODS

Cleaning Equipment: Alconox + H_2O
Development Equipment: Surge Block + submersible pump
Disposal of Discharged Water: Drum
Observations/Comments: Recharge very slow, not enough to develop.

WELL DEVELOPMENT RECORD

WELL NUMBER: MW-111

Project Name:	CHRL
Date:	6/20/18
Developed by:	Holt
Measuring Point of Well:	TOC
Screened Interval (ft. BGS):	
Filter Pack Interval (ft. BGS):	

Project Number:	130088
Starting Water Level (ft TOC):	12.88
Casing Stickup (ft BGS):	2.84 - 0.73 = 2.09
Total Depth (ft TOC):	15.18
Casing Diameter (inches):	2

Casing Volume: ft Water x gpf =

Casing volumes: 2" = 0.16 gpf 4" = 0.65 gpf 6" = 1.47 gpf

BKX-451

DEVELOPMENT MEASUREMENTS

Elapsed Time (min)	Cumul. Vol. (gallons)	Purge Rate (gpm)	Temp. (C or F)	pH	Specific Conductance (µmhos/cm)	Turbidity (NTU)	Imhoff Cone (ml/L)	Comments
1030	~~0~~	–				–		surge block
1045	~~0~~	~1	10.5	7.16	175.1	71000		Start purge
1048	~3					71000		Dry
1053	↓		10.5	7.14	175.2			Resume
1053	~3½					71000		Dry
1100	~~4~~		10.5	7.13	175.6	71000		Resume
1100	~4	↓				71000		Dry

Total Discharge (gallons): ~4 Total Casing Volumes Removed (gallons):

Ending Water Level (ft TOC): Ending Total Depth (ft TOC):

METHODS

Cleaning Equipment: Alconox

Development Equipment: Surge block, DI water

Disposal of Discharged Water: Drum

Observations/Comments: Very slow recharge, not enough water to develop

WELL DEVELOPMENT RECORD

WELL NUMBER: MW-112

Project Name:	CHRL	Project Number:	130988
Date:	6/20/18	Starting Water Level (ft TOC):	14.56
Developed by:	Holt	Casing Stickup (ft BGS):	2.32
Measuring Point of Well:	Toc	Total Depth (ft TOC):	~19.7 Soft
Screened Interval (ft. BGS):		Casing Diameter (inches):	2
Filter Pack Interval (ft. BGS):			

Casing Volume: ft Water x gpf =
Casing volumes: 2" = 0.16 gpf 4" = 0.65 gpf 6" = 1.47 gpf

BKX-452

DEVELOPMENT MEASUREMENTS

Elapsed Time (min)	Cumul. Vol. (gallons)	Purge Rate (gpm)	Temp. (C or F)	pH	Specific Conductance (µmhos/cm)	Turbidity (NTU)	Imhoff Cone (ml/L)	Comments
8:46	—	—				—		surge block
9:07	∅	~1				Muddy		Start purge
9:19			10.5	7.15	340.1	71000		
9:24				7.14	3378	71000		
9:29				7.12	335.1	859		
9:34				7.11	331.4	604		
9:39	~32					909		Stop
9:44						—		Resume
9:49				7.12	331.5	71000		surging w/ pump
9:54				7.10	330.1	670		
10:08				7.10	330.0	540		
10:13				7.10	329.8	188		
10:18					329.7	88.3		
10:23					329.5	50.5		
10:25	~78				329.4	34.5		Stop

Total Discharge (gallons): ~78
Total Casing Volumes Removed (gallons):
Ending Water Level (ft TOC): 17.42, non static ↑
Ending Total Depth (ft TOC): 19.69 hard

METHODS

Cleaning Equipment: Alconox + DI water
Development Equipment: Surgeblock + 12v submersible pump
Disposal of Discharged Water: Dam
Observations/Comments:

APPENDIX D

King County Survey Data

CHRLF – EPZ Infrastructure Upgrades

Gas Probe and Monitoring Well Survey Information

NAD 27 NGVD 29 LOCALIZED

1000,172176.7065,1701638.4638,586.5001,MW-107 GD
1001,172176.3319,1701638.4104,589.0288,MW-107 TOP PVC
1002,172176.6209,1701638.5897,589.3872,MW-107 TOP STEEL CASE
1003,171786.8824,1701824.4279,609.5428,MW-108 GD
1004,171786.4603,1701824.3466,612.2584,MW-108 TOP PVC
1005,171786.7693,1701824.4632,612.7188,MW-108 TOP STEEL CASE
1006,171159.2932,1701828.6546,636.8872,MW-109 GD
1007,171159.1880,1701828.7253,639.8038,MW-109 TOP STEEL CASE
1008,171158.8804,1701828.5005,638.7279,MW-109 TOP PVC
1009,170865.7586,1701725.7590,639.2215,MW-110 GD
1010,170865.3339,1701725.6694,641.7425,MW-110 TOP PVC
1011,170865.6552,1701725.6831,642.4430,MW-110 TOP STEEL CASE
1012,170581.1294,1701647.6895,641.6421,MW-111 GD
1013,170580.6052,1701647.6246,643.7965,MW-111 TOP PVC
1014,170581.0340,1701647.6532,644.5438,MW-111 TOP STEEL CASE
1015,170258.9139,1701612.3548,636.8379,MW-112 GD
1016,170258.5916,1701612.2189,638.9286,MW-112 TOP PVC
1017,170258.9142,1701612.3077,639.5763,MW-112 TOP STEEL CASE
1018,170320.0438,1702187.8847,634.2175,GP-63A GD
1019,170319.5883,1702187.4615,637.1805,GP-63A TOP OF VALVE
1020,170319.9372,1702187.7788,637.2442,GP-63A TOP OF STEEL CASE
1021,170315.0386,1702190.8445,633.9721,GP-63B GD
1022,170314.6120,1702190.6881,636.9480,GP-63B TOP OF VALVE
1023,170314.9270,1702190.8030,637.0862,GP-63B TOP OF STEEL CASE
1024,170315.3700,1702185.3315,634.1058,GP-63C GD
1025,170314.8429,1702185.3604,637.2651,GP-63C TOP OF VALVE
1026,170315.1991,1702185.4878,637.2981,GP-63C TOP OF STEEL CASE
1027,169989.1060,1702140.1014,629.5254,GP-64A GD
1028,169988.5619,1702139.9161,632.6560,GP-64A TOP OF VALVE
1029,169988.9864,1702140.1214,632.6222,GP-64A TOP OF STEEL CASE
1030,169992.4043,1702148.2134,629.3654,GP-64B GD
1031,169992.0272,1702147.7712,632.1635,GP-64B TOP OF VALVE
1032,169992.2319,1702148.1963,632.6893,GP-64B TOP OF STEEL CASE
1033,169995.8846,1702141.5331,629.4852,GP-64C GD
1034,169995.4521,1702141.3006,632.4218,GP-64C TOP OF VALVE
1035,169995.8055,1702141.5382,632.7147,GP-64C TOP OF STEEL CASE