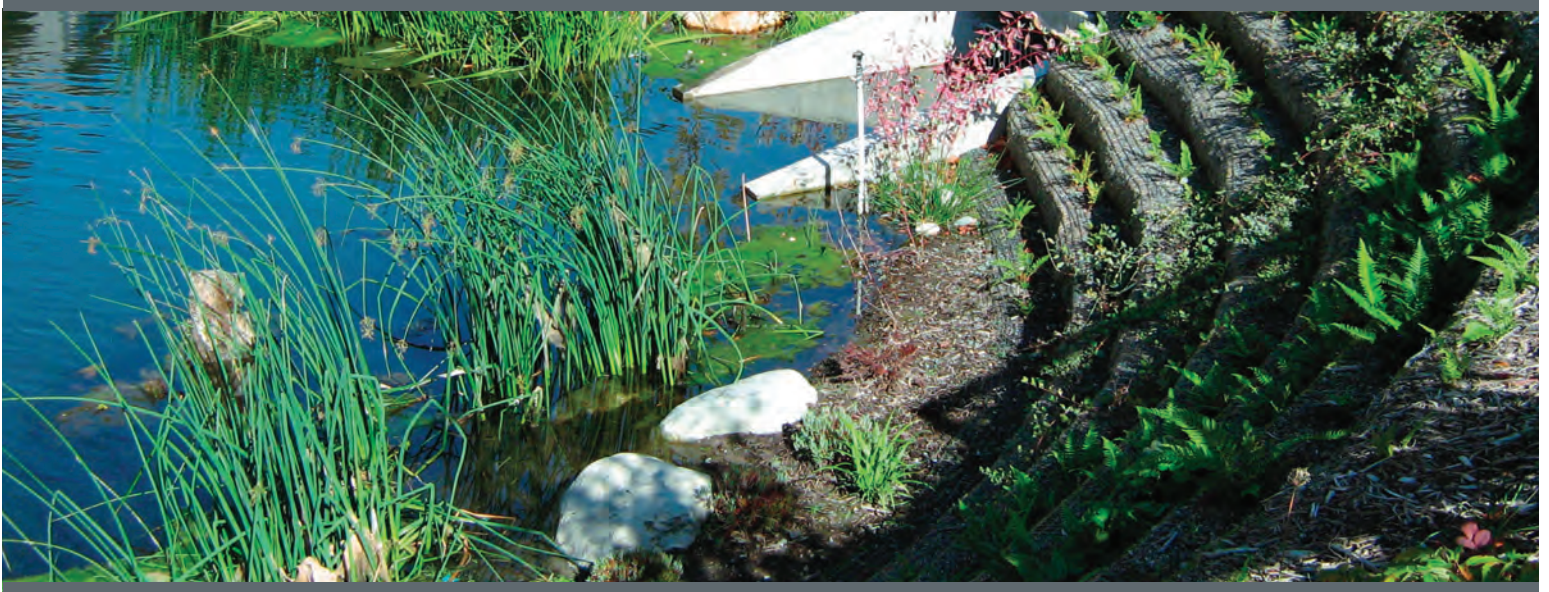


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Geotechnical Exploration and Recommendations

RESERVE AT WOODLANDS REGIONAL STORMWATER CONTROL FACILITY

Black Diamond, Washington

Prepared For:

CCD BLACK DIAMOND PARTNERS LLC

Project No. 20240186H002

November 14, 2024



Associated Earth Sciences, Inc.

www.aesgeo.com

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1.0 INTRODUCTION

Associated Earth Sciences Inc. (AESI) has prepared this Geotechnical Report (the Report) for CCD Black Diamond Partners LLC (CCD) summarizing the results of investigations, field testing, and recommendations for the design and construction of a Regional Stormwater Management Facility (The Facility) located in King County, Washington. The Facility and its proximity to the planned Reserve at Woodlands development, Crisp Creek, and the Green River are shown in Figure 1. This Report incorporates requirements contained in the Development Agreement (DA) between King County and BD Villages LP, the predecessor-in-interest to CCD. The DA contains certain obligations during the development of the Facility.

The purpose of this report is to provide geotechnical recommendations for the Facility to David Evans & Associates Inc. (DEA), the Facility designer. AESI staff and DEA have been working closely throughout the Facility planning and design. For reference, selected sheets from DEA's civil drawing set of the Facility are included in Appendix A.

2.0 PROJECT BACKGROUND

2.1 Site Description

The Facility is situated on approximately 10 acres of undeveloped land primarily lying east of 218th Ave SE, at the northeast corner of the Reserve at Woodlands planned development and west of the Ten Trails Master Planned Development (MPD) (Figure 2). The Facility property (Site) is comprised of King County parcels 2121069059, 2121069060, and 2121069062. The Site is undeveloped and covered with small second-growth trees and shrubs. Access is by a gravel logging road from 218th Ave SE. In 2015, a small temporary or initial infiltration testing facility was constructed by excavation on the parcel in accordance with the DA agreement with King County to receive and infiltrate water periodically pumped from Horseshoe Lake by the County to protect shoreline homes from flooding.

The Site topography is flat to gently sloping with elevations in the central portion of the Facility of about 550 feet and a high of 570 in the north and low of 536 in the south. The Site occupies a roughly north-south trending, flat bottomed outwash paleochannel feature formed by flowing water thousands of years ago during retreat of the Vashon-age glacier. The paleochannel drops in elevation from north to south and extends off-site to the east. The channel feature is dry and can be seen in the lidar background in Figure 3 and is bounded on the east and west by uplands that define the boundaries of the paleochannel.

The Facility will include stormwater treatment and infiltration and will be designed with an infiltration rate calculated using the 2021 *King County Stormwater Design Manual* (KCSWDM) and the 2019 Washington State Department of Ecology (Ecology) *Stormwater Management*

Manual for Western Washington (2019 SWMM-WW). The more conservative infiltration rate calculated from the procedures outlined in either manual will be used as the preliminary design infiltration rate in this report. Performance testing as required by Section 5.2.1 of the KCSWDM will be conducted during construction of the Facility. The areas served by the Facility also include the provision for infiltration of water periodically pumped from Horseshoe Lake as part of King County's ongoing flood protection of homes along the lake shoreline. This will take place in a cell dedicated to Horseshoe Lake infiltration located at the north end of the Facility. The Facility does not propose providing water quality treatment for pumped Horseshoe Lake water.

2.2 Facility Description

The planned Facility consists of four cells arranged in a row from south to north. The overall facility dimensions are approximately 1,900 feet long and 350 feet wide, with a floor elevation ranging from 525 to 539.5 feet NAVD88. The excavation depths to reach the design floor elevation from current grades are expected to be approximately 15 feet for Cells 1 and 4 and 20 to 27 feet for Cells 2 and 3. All the Facility cells will be created by cutting into native soils. No exterior berms or embankments are needed to construct the cells. Interior berms will separate cells. The side slopes will be created by excavation into outwash type sand and gravel soils on the north, south and east sides and will be inclined at 3H:1V or flatter. The west slopes of the Facility may include excavation into till soils. Facility design details for each cell are summarized in Table 2-1.

The Facility is anticipated to receive stormwater from development surfaces in future development plats located in Ten Trails in Black Diamond just east of the Facility and runoff from portions of the Reserve at Woodlands development adjacent to the Facility. The Facility design guidance is somewhat unique because the Facility is located in King County but will be receiving stormwater from both the County and the City of Black Diamond. The goal of the project design is to meet the requirements of both the 2021 KCSWDM and the 2019 Ecology SWMM-WW. The Facility will provide stormwater treatment and infiltration and will include a pre-settling cell, a large sand filter cell, and an infiltration cell, including a smaller fourth cell at the north end of the Facility reserved for infiltration of water pumped from Horseshoe Lake by King County.

Stormwater from development surfaces will be piped into the south end of Cell 1, a lined pre-settling cell where fine particles will be removed. From Cell 1 water will flow through weirs within separator berms to Cells 2 and 3 which are infiltration cells. Cell 2 contains an 18-inch sand filter layer designed for enhanced water quality treatment. Cell 4 is not connected to Cells 1-3 and will only receive flows pumped to it via an existing pipeline from Horseshoe Lake during emergency high water events. Cell 4 inlet is located on the northeast corner of the cell. Historically Horseshoe Lake pumping events occur in March or April and last from one to five days. King County has also performed pre-emptive pumping of the lake if it appears, based on lake level monitoring, that critical levels will be reached due to forecast rainfall events.

The civil plans include a provisional design for a piped overflow route that conveys water from the facility to the west, approximately along the south edge of the Woodlands property to an outfall in a roadside ditch on the east shoulder of 218th Avenue SE.

The Facility civil design plans include a phasing diagram that divides Cell 3 into three roughly equal parts to be constructed in phases which correspond to the phased development of the tributary basin. The phasing of the facility will allow monitoring and operating data to be gathered that can be used to evaluate the effectiveness of the facility.

In the initial phase (Phase 1) the pre-settling cell (Cell 1), the sand filter cell (Cell 2), and the Horseshoe Lake infiltration cell (Cell 4) are proposed to be constructed in full along with the maintenance access road and conveyance piping. During Phase 1 a portion of the infiltration cell (Cell 3) will be excavated to the design bottom elevation to provide infiltration capacity for only the tributary development approved for Phase 1. The remainder of the infiltration cell will be excavated to the design water surface elevation of 532.50. This will limit the infiltration capacity of the Facility until subsequent phases are approved. In total, three phases of Facility construction are proposed.

Operation of the Facility will be phased in accordance with anticipated future residential unit buildout in the areas served by the facility. The three phases of the Facility are described below.

- Phase I will serve 471 dwelling units. Necessary construction of the Facility to serve Phase I includes completing Cell 1, Cell 2 and at least a portion of Cell 3 adjacent to the sand filter. The north portion of Cell 3 will be excavated to within about 7 feet of final grade.
- Phase II will serve an additional 1280 units of housing. Necessary construction of the Facility to serve Phase II includes expansion of Cell 3 to the north.
- Phase III will serve the final 636 dwelling units. Necessary construction of the Facility includes final expansion and completion of Cell 3 to the north.

Table 2-1. Summary of Regional Stormwater Control Facility Design Configurations

Facility Cell	Approximate Dimensions (feet)	Bottom Elevation (feet) ¹	Design Surface Water Elevation (feet)	Design Storage Capacity (feet)	Storage Volume (ft ³)	Notes
1 Pre-settling	125 x 350	527.50	534.50	6	381,156	Lined settling cell to reduce fines before entering Cell 2 – Sand Filter
2 Sand Filter	250 x 350	527	533.50	6	578,784	Infiltrates stormwater through an 18- inch filter sand layer into underlying outwash deposits. Cell 2 is designed to infiltrate 90% of stormwater.
3 Infiltration Cell	625 x 350	525	532.50	7.5	1,345,240	Unlined cell to infiltrate overflow stormwater from Cell 2
4 Horseshoe Lake Infiltration Cell	150 x 250	539.50	545.50	6	N/A ²	Unlined cell designed to infiltrate pumped water from Horseshoe Lake of up to 6 cubic feet per second (cfs) for 14 days during lake flooding events as described in the DA.
Merged Cells 1, 2, and 3	1500 x 350	525	536.5	9	3,230,821	Emergency overflow condition - Combination of Cells 1, 2, and 3 in the event of exceedance of storage in Cells 2 and 3.

1. Vertical Datum = NAVD88

2. N/A = not applicable; Horseshoe Infiltration Pond (Cell 4) storage volume not calculated

2.3 Development Agreement

BD Villages, predecessor-in-interest to CCD, entered into a DA with King County (King County 2014) for the creation of a regional stormwater facility serving future development tracts in Ten Trails in addition to accepting water pumped periodically to lower water levels in Horseshoe Lake to protect shoreline homes from flooding. The DA also recognized the Tribe's interest in the project including water quality, as it relates to the Tribe's Keta Creek Fish Hatchery Complex (the Hatchery) facilities located on Crisp Creek approximately one mile southwest of the planned Facility.

In accordance with provision 6.5.2 of the DA entitled "Horseshoe Lake Pumping to Infiltration Facility" CCD constructed a 2/3-acre initial infiltration test facility in the northeast corner of the Site in 2015 (Figure 2). Infiltration and mounding analyses were conducted in the initial infiltration facility using water pumped from Horseshoe Lake (HSL), in accordance with DA section

6.5.3 entitled “Horseshoe Lake Pumping Tests”. Water from HSL was discharged to an energy dissipater located at the north end of the inner ring of the facility. The “Qualifying Pump Tests” described in DA Section 6.5.3 were completed in 2016 (Test #1) and 2017 (Test #2) and accepted as complete by King County. A copy of the draft technical memorandum summarizing the qualifying pump tests (Golder 2018) is included in Appendix B.

3.0 FIELD INVESTIGATIONS

Our study included reviewing previously completed explorations by AESI and others to characterize subsurface conditions at the site. The locations of previous explorations are included in Figure 3. The various types of sediments, as well as the depths where characteristics of the sediments changed, are indicated on the exploration logs presented in Appendix C. The depths indicated on the logs where conditions changed may represent gradational variations between sediment types in the field. The following section briefly summarizes past field explorations and previous studies at the site.

3.1 Borings and Monitoring Wells

Seven geotechnical exploration borings and 11 groundwater monitoring wells were completed by AESI and Golder in or adjacent to the planned Facility. Table 2-2 summarizes the completion information for the explorations. Summary records of the explorations listed below are included in Appendix C. Additional monitoring wells have been installed up and downgradient of the Facility for long-term monitoring of groundwater levels and quality. The explorations listed in Table 2-2 and the additional monitoring wells are shown in Figure 2.

Table 2-2. Summary of Explorations

Exploration ID	Date	Exploration Type	Ground Elevation (feet) ¹	Exploration Depth (feet)
UIC-1 ²	2006 ¹	UIC Test Well	555	71.0
MW-11	2006	Monitoring Well	530.6	318.0
MW-12	2006	Monitoring Well	530.5	79.0
MW-13	2006	Monitoring Well	530.4	51.0
MW-29	2010	Monitoring Well	554.3	70.5
MW-29R (1, 2) ³	2022	Monitoring Well	545.0	60.0
MW-30	2010	Monitoring Well	551.1	70.5
MW-30R	2022	Monitoring Well	550.4	80.0
MW-31 (1, 2) ³	2022	Monitoring Well	564.7	85.0
MW-32	2022	Monitoring Well	586.3	125.0
MW-33 (1, 2) ³	2022	Monitoring Well	546.5	70.0
GB-3	2010	Borehole	552.2	71.5

Exploration ID	Date	Exploration Type	Ground Elevation (feet) ¹	Exploration Depth (feet)
GB-4	2022	Borehole	548.2	50.0
GB-5	2022	Borehole	553.9	70.0
GB-6	2022	Borehole	554.8	80.0
GB-7	2022	Borehole	566.2	80.0
GB-8	2022	Borehole	545.2	60.0
GB-9	2022	Borehole	557.2	50.0

1. Vertical datum = NAVD88.

2. UIC-1 data and elevation are estimated.

3. Auger drilling hit refusal and was re-drilled using sonic methods so there are two boring logs for each well.

UIC-1 was drilled in 2006 by AESI to conduct preliminary infiltration testing for future facility feasibility. AESI also installed MW-11, 12, and 13 the same year. Monitoring wells MW-29 and 30 and exploration boring GB-3 were completed by WSP (formerly Golder Associates) in 2010 to monitor the aquifer response to infiltration of water during Horseshoe Lake emergency pumping events to the initial infiltration pond installed at the north end of the planned Facility. Subsequent exploration borings and monitoring wells were completed in 2022 to understand unit stratigraphy, obtain samples for laboratory testing, and monitor long-term seasonal groundwater levels. Transducers and data loggers were installed in each of the monitoring wells to record water levels.

3.2 Initial Infiltration Facility Testing

The initial infiltration testing facility was constructed in 2015 at the north end of the planned Facility in accordance with provision 6.5.2 of the DA entitled *“Horseshoe Lake Pumping to Infiltration Facility”* to evaluate the infiltration feasibility of the soils within the proposed Facility footprint and provide a place for infiltration of water pumped from Horseshoe Lake until the regional Facility is completed. Two circular rings were excavated to create an inner and outer pond with different floor elevations. The inner ring has a diameter of about 100 feet and a floor elevation of approximately 546.5 feet. The outer ring is about 200 feet in diameter and has a floor elevation of approximately 548.5 feet.

Two large-scale infiltration tests were conducted in the temporary infiltration testing facility in 2016 and 2017 with the intent of evaluating the infiltration capacity of the soils underlying the proposed Facility and monitoring the groundwater aquifer water quality and mounding response to the infiltration events. Approximately 87-acre feet (AF) was infiltrated in four cycles in Test #1, and approximately 92 AF were infiltrated over six cycles in Test #2.

Constant-head infiltration rates for the two tests ranged from about 6.8 to 7.0 inches per hour (in/hr) at pumping rates of 700 to 718 gallons per minute. The facility stage during the period when constant-head rates were evaluated ranged from about 2.2 to 2.6 feet depending on the

duration and rates of infiltration prior to the constant-head phase. Infiltration resulted in a temporary groundwater level increase, or mound, of about 5 to 10 feet observed in wells closest to the facility (MW-29 and MW-30) depending on infiltration rate and duration.

Additional details and results of the pump and infiltration tests are presented in the Golder (2018) technical memorandum included in Appendix B.

3.3 Laboratory Soils Testing

Grain size analyses were performed on representative soil samples collected from boreholes GB-3 through GB-9 and monitoring wells MW-29 and MW-30. The grain size analyses were performed in general accordance with ASTM D6913 on 52 samples collected at various depth intervals above and below the planned Facility floor. A summary of the laboratory testing results is included in Appendix D.

4.0 SUBSURFACE CONDITIONS

Subsurface conditions at the project site were interpreted from review of field explorations accomplished for prior studies, visual reconnaissance of the site, and review of selected geologic literature. Facility subsurface conditions are summarized in the paragraphs below, in interpretive geologic cross-sections (Figures 4a & 4b) and are detailed on the exploration logs presented in Appendix C. The locations of the explorations are shown in Figure 3. Our findings were in general agreement with prior studies by AESI and others performed at or adjacent to the site.

4.1 General

The site of the planned Facility was identified in the Villages Environmental Impact Statement (EIS) Technical Report on Geology, Soils, and Groundwater (EIS Technical Report; AESI 2008) as a potential location where post-glacial fluvial recessional outwash deposits may be in direct contact with older, pre-Olympia outwash deposits. These locations were identified as potentially suitable for infiltration facilities.

The most recent glaciation, the Vashon Stade of the Fraser Glaciation, is largely responsible for the present topography throughout the Puget Lowland. The Lowland is generally capped by glacial sediments that were deposited during the Vashon Stade approximately 15,000 years ago and form a broad, undulating plain. Elongate northwest-southeast-trending hills parallel the Vashon ice sheet flow direction and are underlain by dense Vashon glacial till (Qvt), deposited at the base of the active glacial ice. Meltwater streams emanating from receding glaciers near the end of the Fraser Glaciation generally flowed northeast-southwest, cross-cutting the till hills and depositing coarse-grained river channel sediment – Vashon recessional outwash sand and gravel (Qvr) – within topographic low areas between the till hills. The result, in the project area vicinity,

are several till-mantled upland “islands” surrounded by outwash plains and channels (Figure 3). In some areas, the outwash rivers scoured through the underlying till before depositing the Qvr and created “windows” to older sediments. These “windows” through the till provide conduits for groundwater to recharge deeper units. In these areas, the Qvr commonly overlies older Qpog, which primarily consisted of pre-Olympia till and coarse-grained sand and gravel with a variable silt content. The Qpog has a lower permeability than the Qvr, but the sand and gravel intervals are very permeable and support a regional aquifer system. The geomorphology of the till uplands, surrounding outwash terrain, and till windows play an important role on the distribution and patterns of groundwater flow.

As discussed below, the character and distribution of the Qpog deposits are important to the Facility discussion for several reasons: (1) groundwater contained within the Qpog sediments is of regional importance to drinking water users, Crisp Creek baseflows, and Tribal hatchery production; (2) groundwater contained within the Qpog deposits discharges to landslide deposits along the Green River valley wall, and (3) the upper portion of the Qpog sediments is unsaturated and is the target infiltration receptor horizon for the regional Facility.

4.2 Geologic Units

Facility-specific subsurface conditions were inferred from the field explorations accomplished for this study, subsurface explorations completed by others, visual reconnaissance of the site, and review of selected geologic literature. The general distribution of geologic units is shown on the exploration logs. The following section presents more detailed subsurface information specific to the Facility organized from the shallowest (youngest) to the deepest (oldest) sediment types. Copies of the exploration logs are included in Appendix C. AESI’s interpretation of subsurface conditions is represented on geologic cross-sections Figure 4a and Figure 4b.

The vertical and horizontal boundaries between soil units can be gradual or abrupt and in many cases the depth or lateral extent is interpreted to have occurred between exploration sampling intervals or between borings and therefore should be considered approximate.

- Vashon Recessional Outwash Deposits (Qvr) are interpreted to be present at the ground surface throughout the entire Facility area with a few exceptions along the west boundary and extend beyond the Facility off-site to the east, south and to a more limited extent, north. Qvr is a loose to medium dense, fine to coarse sand, and fine to coarse gravel with some to trace silt. The Qvr is highly permeable, allowing rapid infiltration of rainfall. The Qvr was deposited by fast flowing rivers that carved channels into the glacial till covered landscape during the melting and retreat of the Vashon-age glacier. The linear, north-to-south low topographic relief feature at the Facility is an outwash channel that was eroded into the underlying glacial deposits including till and older glacial units, leaving behind recessional outwash deposits. Because of the depth of the channel erosion, the Qvr is in contact with older pre-Olympia glacial deposits creating a hydrogeologic “window” that

connects the permeable shallow Qvr aquifer directly with the older and deeper pre-Olympia aquifer. The thickness of the Qvr deposit was difficult to interpret due to different sampling methods used in the exploration borings and wells (SPT & roto-sonic) and the similarity of the deposits. Based on the boring logs the Qvr deposit may be as much as 40 to 70 feet thick at the Facility location. However, the lower portion of the Qvr in many boring logs is described as silty. The underlying Qpog deposit (described below) is also a silty coarse-grained deposit making differentiation from the Qvr sediments challenging. The Qvr deposit is not glacially consolidated, and therefore, less dense than the Qpog which was glacially consolidated. However, many of the explorations were drilled with roto-sonic methods which do not provide direct density correlations.

To provide some additional clarity on this point, Geologic Cross-Section A-A' includes an interpreted layer approximating the elevation of the transition to a siltier outwash deposit. The sediments below the dotted line in Section A-A' may be interpreted as Qvr deposits or Qpog deposits based on their higher silt content.

- Vashon Lodgement Till (Qvt) is present at the surface of the upland areas to the east and west of the Facility and to a lesser degree to the north marking the edges of the north-south trending Qvr deposit. Qvt is a dense to very dense, non-stratified, silty sand with variable gravel, cobble and boulder content. The Qvt was deposited by basal, debris-laden, glacial ice during the Vashon Stade of the Fraser Glaciation. The high relative density characteristic of the Qvt is due to its consolidation during deposition by the massive weight of the overriding glacial ice. The Qvt is considered a low permeability barrier to groundwater flow and infiltration. The Qvt appears to have been eroded and removed below most of the Qvr in the Facility area. The west slope of the Facility is likely to be excavated through till. The Qvt deposits are up to 50+ feet thick beneath the upland that borders the channel to the west of the Facility.
- Pre-Olympia Outwash Deposits (Qpog) are present below the Vashon age deposits (Qvr, Qvic and Qvt). Qpog is heterogenous and ranges from medium to coarse sand and gravel, with trace to some silt to silty sand and silt with variable gravel content. The upper portion of Qpog was typically silty where in contact with the Qvr and identification of the elevation of the contact was challenging (see discussion above for the Qvr sediments). In several AESI explorations, the Qpog was distinguished from overlying Qvr by the presence of scattered charcoal fragments. The Qpog deposits are up to approximately 40 to 70 feet thick in the Facility area. There was a 5-foot thick, till-like layer described within the Qpog unit in MW-11, 12, and 13 at the south end of the Facility property. The coarse-grained sections of the Qpog were deposited by meltwater streams and may be channelized with lateral and vertical changes in grain size. The Qpog is present beneath the entire Facility and Site, is regionally extensive, and was observed in explorations completed on and offsite by AESI and others (AESI, 2008). A major regional aquifer is formed within coarse-grained Qpog, developed over the top of a fine-grained geologic unit underlying the Qpog.

This fine-grained interval was not identified in any of the borings completed beneath the facility but was encountered in off-site borings in the vicinity by AESI and others at elevations ranging from about 390 to 460 feet (AESI, 2008).

- Pre-Olympia Non-Glacial Deposits (Qpon) are present below the Qpog deposits. The Qpon includes both coarse-grained and fine-grained sediments. For this report, the Qpon coarse-grained sediments are grouped with the Qpog coarse grained sediments to form the Qpog aquifer. The fine-grained Qpon sediments form the base of the regional Qpog aquifer, and generally consist of laminated or thinly interbedded gray to dark gray to olive gray silt, clay and fine sand with scattered organics. Where a lower contact was interpreted in MW-11 at the south end of the Facility property, the thickness of the deposits was approximately 150 feet. Note that the interpreted contact between the Qpon deposits and the underlying Hammer Bluff was not abrupt; instead, the interpretation is based on: (1) a relative increase in drilling difficulty and amount of intact silt/clay clasts returned in the drill cuttings returns, and (2) stratigraphic position overlying the weathered Puget Group sandstone and proximity to mapped Hammer Bluff Formation deposits at similar elevations south along the Green River valley wall. The Qpon deposits in combination with the underlying Hammer Bluff Formation form the base of the Qpog aquifer beneath the site. Groundwater springs emanating from the sand lenses within the Qpon deposits and the overlying units discharge along the Green River valley wall. The emergence of groundwater along the slopes that form the northern Green River valley wall discharge onto large pre-historic landslide complexes visible in the LiDAR hillshade in Figure 3.
- Hammer Bluff Formation (Th) is a Tertiary-age bedrock with an upper and lower member consisting of clayey fluvial sand and gravel and lacustrine and fluvial quartzose sand and clay. The Th deposit was encountered in MW-11 from about 254 to 303 feet in depth; the contact was not abrupt, as described above.
- Puget Group (Tp) is another Tertiary-age bedrock unit consisting of Arkosic sandstone, mudstone and shale localized coal beds, flint clay, with traces of oil and gas deposits. It was encountered at 303 feet in MW-11 and extended to the final depth of 318 feet. The maximum thickness of the Tp is estimated to be about 5,500 feet.

4.3 Groundwater Conditions

Groundwater below the planned Facility occurs primarily in the Qpog deposits under unconfined conditions. The Qpog aquifer is formed over the top of older non-glacial fine-grained sediments (AESI, 2008). The aquifer is regional in extent with a strong south-southwesterly gradient in the vicinity of the site. The groundwater flow direction from the area of the planned Facility is generally to the southwest where it discharges as springs on the slopes above the Green River and to the lower elevations of Crisp Creek. Many area water supply wells north and west of the site are completed in the Qpog aquifer.

Based on previously installed AESI observation wells completed in the Qpog aquifer in the project vicinity, the aquifer generally ranges from about 43 to 113 feet thick (AESI, 2008). The Qpog aquifer below the Regional Pond is at least 55 feet thick based on the groundwater level monitoring data from Well MW-29 and Well MW-30. Based on the water level monitoring data and stratigraphy observed, the Qpog aquifer is unconfined, which is consistent with AESI's groundwater level monitoring data offsite.

Perched groundwater is also present within the Qvr and Qvic where the Qvt layer has not been scoured or eroded away, above silty layers in the Qvr, and at the contact with the underlying Qpog where the Qpog is silty.

4.3.1 Groundwater Elevations

Groundwater in the vicinity of the Facility occurs primarily in the Qpog materials. The natural groundwater elevation in the Qpog below the planned Facility ranges seasonally between about 490 and 505 feet NAVD88. The natural seasonal groundwater level fluctuation is about 5 to 11 feet depending on seasonal precipitation recharge. The highest groundwater elevations occur in the winter and early spring (January through April) and the lowest groundwater elevations occur in the late fall and early winter (October and November). There is typically a double peak in groundwater elevations in the wet season, the first around November-January and the second around February-April which appear to reflect precipitation trends. Hydrographs for monitoring wells listed in Table 2-2 are included in Appendix F.

Emergency pumping to the interim infiltration facility was performed by King County in the spring of 2011, 2014, 2016, 2017, 2018, 2020, and 2022. A short-term, localized groundwater mound forms below the temporary infiltration facility during emergency pumping of Horseshoe Lake to the interim infiltration facility. The elevated water level caused by the mound can be seen in the hydrograph for MW-30 (Appendix F). During emergency pumping events and infiltration, groundwater levels below the facility have risen to a maximum of about 505 to 513 feet NAVD88. The variability in the water level mound below the facility is likely related to the groundwater level at the start of pumping and the volume and duration of the emergency pumping.

4.3.2 Groundwater Recharge and Flow Direction

Groundwater in the Qpog is recharged from infiltration of rainwater and stormwater runoff through the overlying units (Qvr and Qvt). Greater recharge occurs through till windows where infiltration can quickly reach the Qpog deposits. Recharge to the aquifer also occurs in Horseshoe Lake and the large wetland located west of the Facility adjacent to 218th Ave SE, both of which are considered till windows.

Groundwater flow in the Qpog is to the west-southwest to southwest. The direction of groundwater flow likely has a slight seasonal variability and may be influenced by the distribution

of thick low-permeability soils encountered in monitoring wells in the southwest corner of the Reserve at Woodlands property.

Based on interpreted groundwater flow directions, groundwater in the Qpog deposit below the Facility discharges to seeps and springs in the lower elevations of Crisp Creek and the north slopes of the Green River valley. The elevation of the seeps and springs identified during field reconnaissance on the Green River valley slopes about 1,000 feet south of the planned Facility are estimated to range from about 340 to 460 feet NAVD88. The springs observed discharging to slopes on the east side of Crisp Creek about 1,200 feet southwest of the planned Facility are at an elevation of about 370 to 400 feet NAVD88. Based on these elevations, the spring discharges are likely from the Qpog aquifer, above the contact with the underlying silty zone of the Qpon unit.

5.0 DESIGN CONSIDERATIONS AND RECOMMENDATIONS

5.1 General

This section presents the design considerations and recommendations for the proposed infiltration pond including infiltration, pond slopes, pond berms, pond liner system, and pond piping.

5.2 Infiltration

5.2.1 Infiltration Rate Estimation

Design infiltration rates can be estimated in several ways in accordance with the 2021 KCSWDM (King County 2021) and the 2019 SWMM-WW (WSDOE 2019) manuals that are applicable to this project. Design infiltration rates can be estimated by performing large-scale pilot infiltration tests (PIT), small-scale pilot infiltration tests, soil grain size analysis, double ring infiltrometer test (ASTM D3385), or a single ring percolation test. The design infiltration rates for the Facility will be estimated using the large-scale pilot infiltration test.

Large-scale infiltration testing was completed at the interim infiltration facility location for the evaluation of Cell #4 for Horseshoe Lake emergency pumping (see Section 3.2). The testing was conducted at approximate elevations of 548 to 550 feet. The design floor elevation of Cell #4 is 539.5 feet or about 8.5 to 10.5 feet below the initial infiltration test cell elevation.

The planned floor elevation of the Facility infiltration Cells #2 & 3 is significantly lower than existing site grades (about 18.5 feet for Cell #2 and 27 feet for Cell #3) rendering PITs infeasible until the facility excavation is completed. For the purposes of preliminary infiltration rate estimation, we utilized the information from large-scale field infiltration testing, the Massman (2003) Soil Grain Size Analysis method outlined in the 2019 SWMM-WW (WSDOE, 2019) using soil samples collected from borings in the Facility at elevations between bottom of pond and the

seasonal high groundwater elevation (505 feet), and our experience with permeability reduction due to glacial consolidation.

5.2.2 Preliminary Design Infiltration Rates

The measured infiltration rates (I_{measured} , also referred to as K_{sat} in 2019 SWMM-WW) from the large-scale field infiltration testing were converted to preliminary design infiltration rates (I_{design}). The measured values and preliminary design infiltration rates are summarized in Table 5-1. We also reviewed soil gradation testing from explorations in the footprint of the infiltration cells. Two different methods were used to estimate preliminary design infiltration rates:

1. Equations 5-11 and 5-12 of the 2021 KCSWDM (King County, 2021)
2. Section V-5.4 (Table V-5.1) of the 2019 SWMM-WW (WSDOE, 2019)

Both methods follow the same general procedure in which I_{measured} is multiplied by several correction factors. The selected correction factors for each method are summarized below.

2021 KCSWDM Correction Factors

- i) **F_{geometry}** , correction factor for the facility geometry and depth to groundwater table. F_{geometry} is set equal to 1 when a groundwater mounding analysis is conducted.
- ii) **F_{testing}** , correction factor for test method.
 - F_{testing} was set equal to 0.75 for the large-scale field infiltration testing.
- iii) **F_{plugging}** , correction factor for long-term plugging of the soils.
 - F_{plugging} was set equal to 1.0 for coarse sands or cobbles, or any soil type in an infiltration facility preceded by a water quality facility.

2019 SWMM-WW Correction Factors

- i) **CF_v** , correction factor for site variability and number of tests conducted.
 - CF_v was set equal to 0.5 for Soil Grain Size Analysis.
 - CF_v was set equal to 1.0 for the large-scale field infiltration testing.
- ii) **CF_t** , correction factor for test method.
 - CF_t was set equal to 0.4 for Soil Grain Size Analysis.
 - CF_t was set equal to 0.75 for the large-scale field infiltration testing.
- iii) **CF_m** , Correction factor for the degree of influent control to prevent siltation and bio-buildup. The manual recommends 0.9.

Table 5-1. Preliminary Design Infiltration Rates

	I_{measured} (in/hr)		Correction Factors		Factored Infiltration Rate (in/hr)	Preliminary I_{design} (in/hr)	
Pond Cell	Large-Scale Field Infiltration Test ¹	Soil Grain Size Analysis	2021 KCSWDM	2019 SWMM-WW	2021 KCSWMD ²	2019 SWMM-WW ³	Preliminary I_{design} (in/hr) ⁵
2 (Sand Filter)	-	6.6 to 83		$CF_v = 0.5$ $CF_t = 0.4$ $CF_m = 0.9$		1 to 15	1.0 ⁴
3 (Primary Infiltration)	-	6.6 to 83		$CF_v = 0.5$ $CF_t = 0.4$ $CF_m = 0.9$		1 to 15	5.1 ⁵
4 (Horseshoe Lake Overflow)	6.8 to 7.0	-	$F_{\text{geometry}} = 1.0$ $F_{\text{testing}} = 0.75$ $F_{\text{plugging}} = 1.0$		5.1		5.1 ⁵

in/hr = inches per hour

1. Refer to Section 3.2 and Appendix B for details regarding the large-scale field infiltration test.
2. Factored Infiltration Rate = $I_{\text{measured}} * F_{\text{testing}} * F_{\text{geometry}} * F_{\text{plugging}}$.
3. Factored Infiltration Rate = $I_{\text{measured}} * C_v * C_t * C_m$.
4. The sand filter material at the bottom of Cell 2 is intended to slow the infiltration rate to 1.0 in/hr.
5. Preliminary I_{design} values should be verified after pond construction as discussed below.

5.2.3 Final Design Infiltration Rates

In accordance with the KCSWDM, final design infiltration rates for Cells #2 and #3 will be based on large-scale PITs completed once the infiltration cells have been excavated to design floor elevation. The preliminary design values provided in this report may vary from the final design values based on the PITs. This is because of several things including: most of the highly permeable Qvr soils are being removed to reach the Facility cell grades; natural variability in the grain size and layering of both the Qvr and underlying Qpog geologic units; and the difference in the infiltration test method used to estimate the preliminary and design rates. The sediments at or below the planned floor of the Facility infiltration cells can be silty in places and may include Qpog materials which will have lower infiltrations rates due to glacial compaction. If the final design infiltration values significantly exceed the preliminary values, there may be an opportunity to reduce the final buildout size of Cell #3. If the final design infiltration values are lower than the preliminary values, mitigation measures will need to be considered.

Mitigations commonly used to augment lower than estimated infiltration rates include changes to the facility geometry or augmentation to the infiltration receptor soils. Any changes to the Facility design would involve the civil designer, DEA. A commonly used mitigation measure to

increase infiltration rates in the receptor soils involves the installation of gravel filled pit drains on the floor of the infiltration cells, as described below.

Stratification Considerations and Pit Drains

The coarse-grained sediments observed in explorations completed on the site are highly stratified. There are intervals (or strata) of relatively clean (low percentage of fine-grained sediments – silts and clays) gravelly sands and gravels, interbedded with intervals of silty sands or silty gravels. This stratification limits or slows the downward migration of infiltrated water.

In similar stratified sediments, AESI has previously used vertical “pit drains” or infiltration trenches to improve the flow characteristics of the receptor soils beneath infiltration facilities. Shallow vertical drains referred to as “pit drains” are constructed by digging a hole through naturally layered or interbedded sediments, and then filling the excavation with free-draining backfill. Infiltrated water flows vertically to the base of the drain and then into the surrounding sediments. The pit drains act to improve infiltration performance by penetrating low-permeability interbeds and preventing “micro-mounding” beneath an infiltration facility, and can result in a high degree of connectivity with more permeable receptor horizons. This allows for high-rate horizontal flow to occur as early in the storm event as possible and results in improved facility performance. In addition, the pit drains provide an effective transfer of hydraulic head into the subsurface. This allows the head to drive water away from the facility as efficiently as possible into the subsurface. In summary, the pit drains allow for exposure to a large cross-sectional area of the most permeable intervals present in the receptor interval and provide hydraulic head to optimize flow rates into the formation. AESI has previously used shallow and deep vertical pit drains to improve the flow characteristics of the receptor soils beneath bioretention systems, infiltration ponds, infiltration trenches, and infiltration vaults. It is AESI’s experience that properly constructed pit drains can provide a significant improvement in infiltration system performance. The depth of pit drains will be constrained by the Qpog water table.

5.2.4 Groundwater Mounding Analysis

A groundwater mounding analysis was completed for the sand filter cell (Cell #2) and infiltration cell (Cell #3) of the planned Facility. Both cells will allow infiltration. A pre-settling cell (Cell #1) is located upstream of Cells #2 and #3, is fully lined, and will not allow infiltration. Cell #4, located at the north end of the facility is used only for infiltration of water pumped under emergency high lake water conditions from Horseshoe Lake. Infiltration and mounding analysis for Cell 4 were analyzed as a DA requirement to complete “Qualifying Pump Tests”. The results of the Qualifying Pump Tests are summarized in a technical memorandum (Golder, 2018) included in Appendix B.

The mounding analysis for Cells #2 and #3 was performed to simulate the maximum groundwater mound height that forms during infiltration of two design storm inflow events and compare it to

the design high water elevation (DHWE) in the proposed infiltration facility. Groundwater mounding can occur when water is introduced into an infiltration facility at a higher rate than can be conveyed from the area beneath the facility. The introduced water can “mound” on the groundwater table or on a less permeable interbed within the receptor soils during a storm event. When the storm event is over and water is not flowing into the system, the mound will normally dissipate.

The MODRET computer program (Wet Weather Software, 2016) was used to model potential groundwater mounding beneath the proposed infiltration facility under two design time series. Infiltration system civil design details and stormwater inflow hydrographs were provided by the Facility designer, DEA and are described in their signed and stamped letter. A discussion of the MODRET input parameters, stormwater hydrographs, summary results, and the DEA letter are provided in Appendix G.

The mounding analysis results presented here are based on a 20-foot vertical separation between the bottom of the infiltration facility (525 feet) and seasonal high groundwater (505 feet). The results of the MODRET simulations indicate that the modeled infiltration facility will have the capacity to infiltrate the stormwater runoff routed to the facility during the design storm time series hydrographs provided by DEA, without reaching the DHWE. Under the peak flow and maximum volume hydrographs and the seasonal high groundwater elevation, the maximum groundwater mound elevation was above the Cell #2 and Cell #3 bottom elevations of 527.5 feet (top of sand layer) and 525 feet, respectively, and below the DHWEs of 533.5 feet and 532.5 feet, respectively.

5.3 Pond Slope Stability and Berm Seepage Analysis

DEA civil plans indicate site grading for the stormwater infiltration facility will result in cut slopes inclined at 3H:1V. Therefore, AESI evaluated the global stability of two critical cross-sections of the pond slopes (A-A' and B-B') as shown in Figure H-1 in Appendix H. These cross-sections represent the critical slope configurations within the proposed stormwater infiltration facility.

The stability analyses were performed in SLOPE/W version 24.2.1.28 (GeoStudio, 2024) slope stability software using Morgenstern-Price method which satisfies both force and moment equilibrium. Only circular sliding surfaces were considered in the current analyses as no weak layers or failure planes are known to exist. AESI analyzed two scenarios under static and pseudo-static loading conditions. A horizontal seismic load of $k_h = 0.28g$ was used in the pseudo-static analysis which is equivalent to $\frac{1}{2} \times PGA_M$ (i.e., $\frac{1}{2} \times 0.56g$).

For cross-section A-A', AESI also performed a seepage analysis for a possible condition in which the water level in the horseshoe lake overflow infiltration pond (Cell 4) is at maximum height (elevation 545.5 feet) and there is no water in the primary infiltration pond (Cell 3). This scenario represents the highest potential (highest head differential and/or piping potential) for development of critical seepage conditions between Cell 3 and Cell 4.

The following strength and hydraulic properties were assigned to the native recessional outwash:

- $\Phi = 34$ degrees
- Cohesion = 50 psf
- Unit Weight = 125 pcf
- Vertical Hydraulic Conductivity (k_v) = 0.00023 ft/s
- K-ratio (k_h/k_v) = 0.1

A summary of the slope stability results is presented in Table 5-2 and the SLIDE output files are presented in Appendix H.

Table 5-2. Results of Global Stability Analyses

Section	Case	Factor of Safety
A-A'	Static	2.4
	Pseudo-static	1.2
	Static with Seepage	1.6
B-B'	Static	2.3
	Pseudo-static	1.2

The slope stability and seepage results indicate that the proposed pond slopes will be stable under static and seismic loading conditions. However, the seepage analysis suggests that seepage from the south facing toe of the embankment slope separating Cell 4 from Cell 3 may be possible when Cell 4 is at a maximum capacity, and Cell 3 is empty. We anticipate that future mitigation measures may be necessary to prevent piping and erosion at the seepage front. Potential mitigation strategies include the installation of a graded filter blanket on the lower portion of slope or potentially installation of a toe drain. Based on limited subsurface data, we presently estimate relatively low toe-of-slope seepage rates on the order of 0.001 to 0.003 cubic feet per second. These estimates are steady state estimates assuming Cell 4 is full. The DA requirement is for Cell 4 to accommodate up to 6 cubic feet/second for up to 14 days. In practice, historic pumping to Cell 4 has only been for short periods of time, a few days at most. Based on these preliminary estimates, we recommend observing seepage patterns and potential erosion while monitoring groundwater levels in the berm during future Horseshoe Lake pumping events. If the potential for erosion caused by seepage through the embankment is confirmed mitigation measures should be implemented appropriate to the observed erosion risk.

5.4 Pond Berms and Liner System

The Facility cells will be separated internally by interior berms with 3H:1V side slopes and a maximum height of 11 feet. The west end of the berms will contain pipe penetrations connecting the adjacent cells through three vaults constructed within each berm. The berms also contain central spillways with rock lined pads on the downstream side of the berms (Sheet 5 of 42, Appendix A).

The method of construction of the internal berms is unknown but could be accomplished largely by excavation (leaving most of the berm fill in place while excavating the adjacent cells) or by engineered fill. At a minimum, engineered fill will be needed to backfill around the vaults and pipe penetrations at the west end of the berms. In our opinion, constructing the berms after excavation of the cells is an acceptable approach provided the berm foundations are properly keyed into the underlying native soils. The contractor should submit a construction sequencing and grading plan describing how the pond berm, vault construction, and piping will be sequenced and constructed. The plan should be reviewed and approved by DEA and AESI.

The pre-settling cell (Cell 1) will require a liner system to prevent infiltration and allow for sediment and small debris to settle out of the stormwater prior to flowing to the sand filter cell. The liner system for the pre-settling cell should at a minimum consist of a geomembrane. AESI recommends the following for the proposed liner system:

- Low density polyethylene (LLDPE) geomembrane along the side slopes and bottom of the pre-settling cell. The LLDPE geomembrane should have a minimum thickness of 40-mil.
- Geotextile fabric on top of LLDPE geomembrane to provide a cushion layer. The geotextile should have a minimum weight of 12 ounce per square yard.
- A minimum 1-foot-thick soil cover should be placed on top of the liner and cushion layer. The soil cover should consist of clean, non-expansive soil with a maximum particle size of ½-inch. The material type shall be submitted to AESI for approval prior to installation. Additional marker layer materials and soil cover to facilitate pond sediment cleaning are recommended and should be included in the civil design for the liner system.
- The subgrade below the LLDPE geomembrane should be proof rolled using a smooth drum roller prior to placement of the geomembrane to provide a smooth surface free of angular gravels or protrusions that could damage the geomembrane.
- All geosynthetic layers should be anchored in a trench at the top of the pre-settling cell side slopes. The trench should be a minimum of 2 feet wide by 2 feet deep. The anchor trenches should be backfilled with structural fill. The first lift of anchor trench backfill may be placed with a maximum loose lift thickness of 12 inches compacted to at least 85 percent of the maximum dry density according to ASTM D1557 and at a moisture content within 2 percent of the optimum moisture content. The remaining lifts should be compacted to at least 90 percent of the maximum dry density according to ASTM D1557 and within moisture content range given above.
- All geosynthetic materials should be delivered, handled, and installed in accordance with the manufacturer's specifications.

5.5 Berm Pipe Penetrations

Water flow between Facility cells will occur through pipes and weir vaults installed in the berms separating cells. It is essential that pipe trench backfill not provide a conduit for water to flow out of or under the internal berm slopes. The use of trench backfills with a permeability lower than the berm embankment fill and the use of filter diaphragms in the pipe trenches will reduce the possibility of this occurrence. Details of the internal cell berms and weir construction methods are discussed in Section 5.4 but are not known at this time. The contractor should submit a construction sequencing and grading plan describing how the pond berm, vault construction, and piping will be sequenced and constructed. The plan should be reviewed and approved by DEA and AESI.

6.0 CONSTRUCTION CONSIDERATIONS

Based on the preliminary Site plans (Appendix A), the Facility will be constructed entirely by excavation. No perimeter embankments will be constructed. Cells within the Facility will be separated by internal berms. The contractor should be required to submit the proposed construction sequence and methods in writing to be reviewed by the engineer prior to starting any major earthwork. All fills placed on slopes should be placed in horizontal lifts and be keyed into existing soils.

- **DRAINAGE:** Seepage should be anticipated at the contact between recessional outwash and till deposits, and at the contact with low-permeability interbeds in the Qvr or Qpog. The contractor shall control seepage during construction. If seepage persists in specific areas well after excavation is complete, then slope erosion protection should be installed to protect the pond side slopes.
- **GEOTECHNICAL OBSERVATION:** Due to natural variability of the subsurface conditions, the potential for field adjustments should be anticipated based on actual conditions encountered during construction. We recommend that a representative of AESI observe the subgrade, be present during the excavation of the infiltration facility, and complete large-scale pilot infiltration testing and subgrade soil investigations at the time of construction.
- **INFILTRATION SUBGRADE PROTECTION AND PREPARATION:** The native subgrade for the sand filter cell, infiltration cell and Horseshoe Lake infiltration pond should be protected from contamination by silty soils, seepage and compaction from heavy construction equipment traffic. This could be accomplished by completing the mass excavation while leaving the infiltration subgrade a minimum of 1-foot high. Similarly, when the filter sand is placed in Cell 2, care should be taken to avoid compaction of the subgrade by heavy equipment. Excavation should be performed in a manner that does not disturb the underlying receptor horizon. Use of heavy equipment in the areas proposed for

infiltration has the potential to compact the subgrade and reduce infiltration potential. We recommend using an excavator with a toothed bucket to strip and scarify the final subgrade without tracking over it. Construction activity on the surface that results in compaction of the native soil will have a detrimental effect on the infiltration rate.

- **STRUCTURAL FILL:** Any structural fill placed to construct internal berms or backfill utility trenches should be compacted to at least 95 percent of maximum dry density as determined by ASTM D-1557.
- **PRE-SETTLING CELL LINER:** The floor of the pre-settling cell will be permeable. To maintain dead storage water levels, the floor and side slopes of the cell will need to be lined. Section 5.4 provides liner recommendations.
- **LARGE SAND FILTER CELL:** The treatment sand liner material must be submitted for approval prior to delivery onsite. The treatment sand must be placed in accordance with plans and specifications in a way that does not compromise permeability. Care must be taken by using proper TESC practices and management of the imported materials stockpile to ensure the imported materials are clean and free of fines. Stockpiled backfill materials must be protected from site soils and runoff from silt-contaminated surfaces. Contaminated backfill materials cannot be used in the infiltration facilities and will be rejected by AESI.
- **STRUCTURAL FILL:** Any structural fill placed to construct internal berms or backfill utility trenches should be compacted to at least 95 percent of maximum dry density as determined by ASTM D-1557.
- **PIPE BACKFILL AND BERM WEIR CONSTRUCTION:** It is essential that pipe trench backfill in the Facility does not provide a conduit for water to flow out of or through the pond slopes or internal berms. Construction methods for the inlet pipes and structures, weir vaults and piping in the internal Facility berms are not detailed in the civil plans and could be accomplished in several ways. Construction methods can have a significant impact on the berm stability and development of seepage paths through the berm. To limit damaging effects of seepage along pipe trench backfill or around the weir vaults, we recommend that the contractor prepare and submit a construction plan for the berm weir and pipe penetration details to be reviewed and approved by the civil and geotechnical engineer. Where appropriate, filter drains or trench breakers should be installed.
- **POND SLOPES:** We recommend that side slopes on the pre-settling cell, large sand filter cell and infiltration ponds be no steeper than 3H:1V based on the slope stability analysis presented in Appendix H. The Facility civil design indicates 3H:1V slopes are proposed for all pond slopes and berms. Steeper permanent slopes are not recommended as they typically experience a higher degree of short- and long-term maintenance due to severe erosion and sloughing particularly where fluctuating water levels or seepage occur.

Erosion control measures will be needed on all permanent cut and fill slopes in and around the pond.

- **SURFACE WATER CONTROL:** Surface water that normally flows toward the Facility should be intercepted before reaching the pond side slopes and collected and conveyed to a suitable discharge location. This may require temporary upslope interceptor ditches and conveyance pipes until permanent infrastructure is in place to collect surface water.
- **CONSTRUCTION MONITORING:** An experienced geotechnical field technician should observe and document that the recommendations contained in this report have been implemented during construction. This includes cut slopes, fill placement and compaction, cell subgrade preparation and embankment pipe penetrations.

6.0 ADDITIONAL GEOTECHNICAL STUDIES FOR FINAL DESIGN

The following additional studies are recommended as the Facility moves forward to final design and construction of Phase I:

Site Variability Documentation: The existing explorations documented subsurface variability both vertically and laterally and the preliminary design infiltration rate considers that initial variability. We recommend additional explorations to document the thickness of the Qvr beneath the subgrade and the degree of silty stratification within the Qpog. The information can be used to support or adjust the correction factors, inform the need for gravel trench or pit drains, and inform the groundwater mounding model and slope stability model.

Subgrade Infiltration Testing: The planned infiltration subgrade is located at depths beyond the reach of standard excavation equipment. We recommend large scale pilot infiltration testing be conducted prior to construction to provide subgrade specific infiltration rates.

Groundwater Response: We recommend that the current groundwater level monitoring program continue to document seasonal high and document infiltration rate and groundwater mounding during Horseshoe Lake pumping events.

7.0 CLOSING

This report has been prepared exclusively for the use of BD Villages LP and their consultants and contractors for specific application for the Reserve at Woodlands Regional Stormwater Facility in King County, Washington. We encourage review of this report by bidders and/or contractors as it relates to factual data only (exploration records, laboratory test results). The conclusions and recommendations presented in this report are based on the explorations and observations completed for this study, review of previous geotechnical and geologic studies in the project area, and conversations with the project team. These conclusions and recommendations are not

intended, nor should they be construed to represent a warranty regarding the proposed development but are forwarded to assist in the planning and design process.

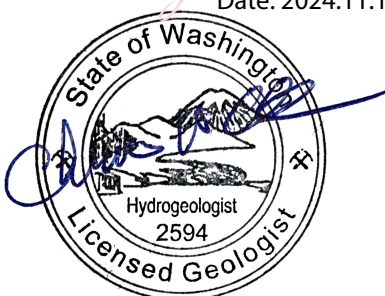
Judgment has been applied in interpreting and presenting the results. Variations in subsurface conditions over small distances are common, and actual conditions encountered during construction may be different from those interpreted in this report.

The subsurface explorations were performed in general accordance with locally accepted geotechnical engineering practice, subject to the time limits and financial and physical constraints applicable to the services for this project, to provide information for the areas explored. There are possible variations in the subsurface conditions between the explorations and variations over time.

Sincerely,
ASSOCIATED EARTH SCIENCES, INC.
Kirkland, Washington

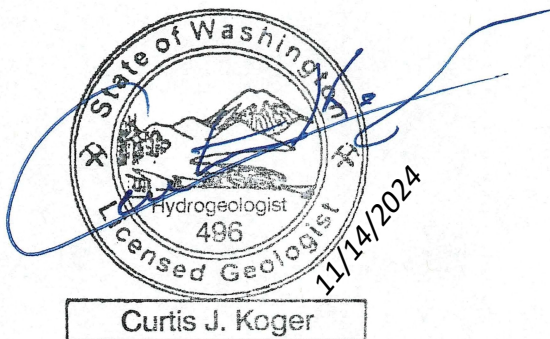
Christopher W. Allen

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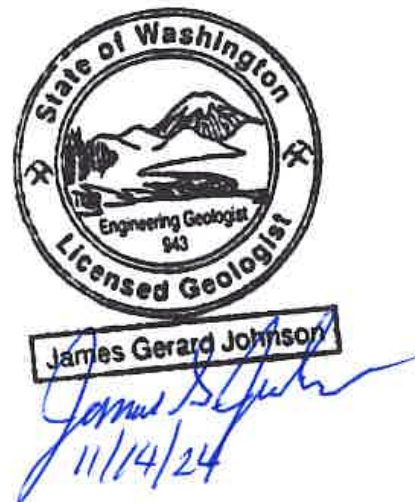


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Curtis J. Koger, L.G., L.E.G., L.Hg.
Senior Principal Geologist/Hydrogeologist

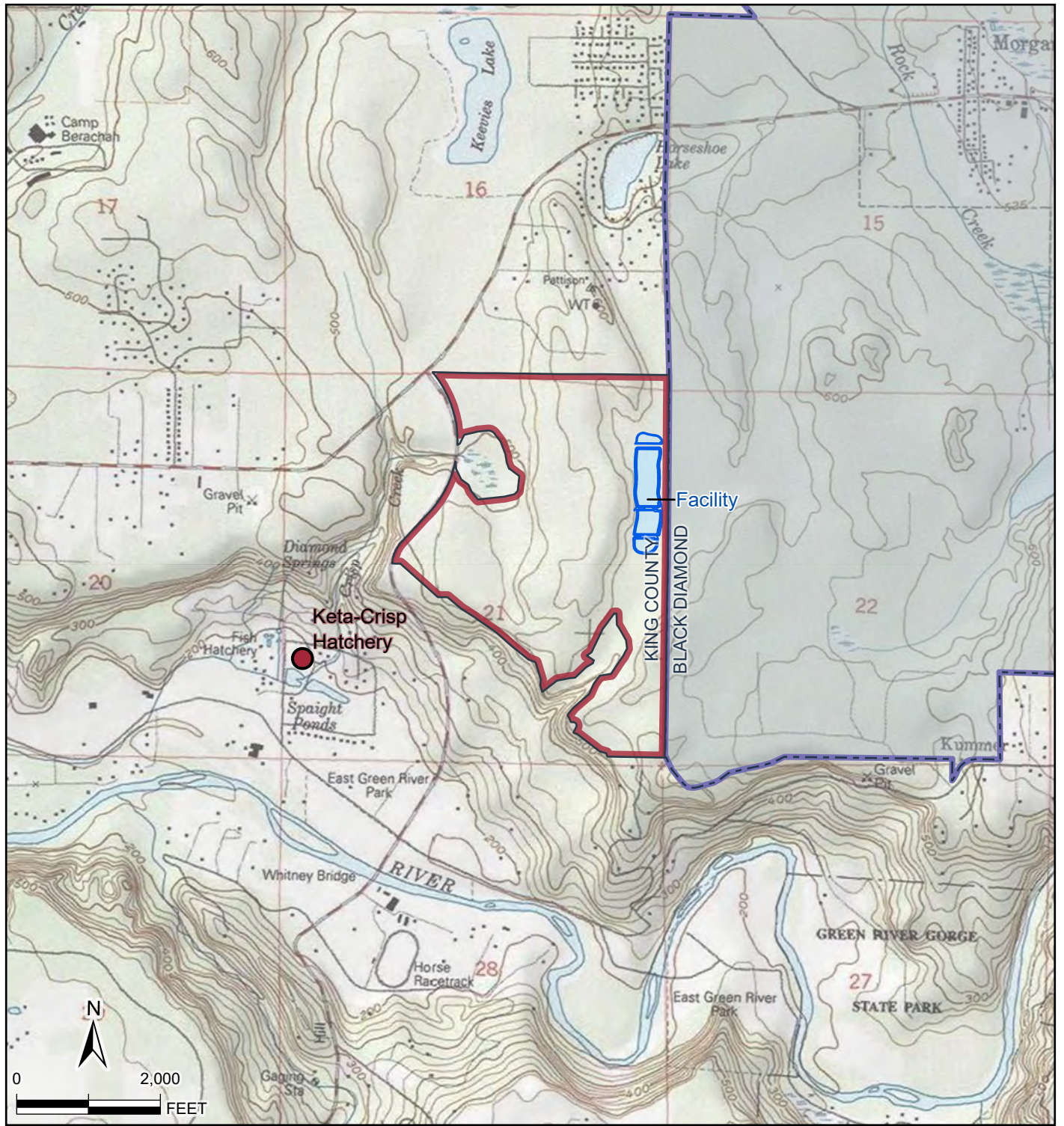


James G. Johnson, L.G., L.E.G.
Principal Engineering Geologist

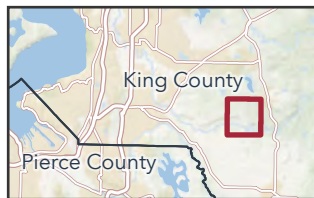
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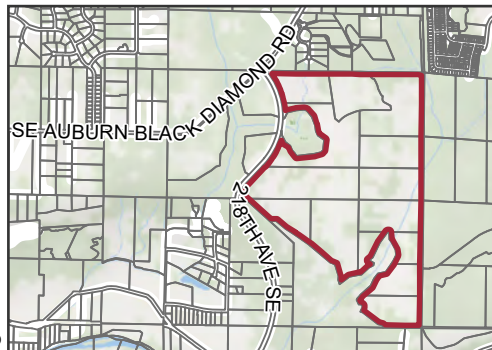
COUNTY LOCALE



ESRI, USGS, NATIONAL GEOGRAPHIC, DELORME, NATURALVUE, I-CUBED, GEBCO, ARCGIS ONLINE BASEMAP, WADOT STATE ROUTES 24K (12/20), KING CO: PARCELS, ROADS (8/24).

NOTE: LOCATION AND DISTANCES SHOWN ARE APPROXIMATE. BLACK AND WHITE REPRODUCTION OF THIS COLOR ORIGINAL MAY REDUCE ITS EFFECTIVENESS AND LEAD TO INCORRECT INTERPRETATION.

LOCATION



associated
earth sciences
incorporated

VICINITY MAP

CCD RESERVE AT WOODLANDS
KING COUNTY, WASHINGTON

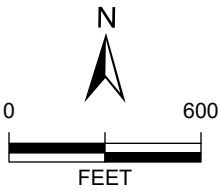
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- LEGEND**
- SITE
 - KETA CRISP HATCHERY
 - INTERIM INFILTRATION FACILITY
 - REGIONAL STORMWATER CONTROL FACILITY
 - CITY BOUNDARY
 - PARCEL
 - LOT

DATA SOURCES/REFERENCES:
KING COUNTY: PARCELS, CITY BOUNDARY, ROADS (8/24),
WATERBODIES (9/22), STREAMS (9/21). EAGLEVIEW TECHNOLOGIES,
INC.: AERIAL IMAGERY (2023). WSP: TEMPORARY INFILTRATION
FACILITIES, REGIONAL STORMWATER CONTROL FACILITIES (9/24).
BARGHAUSEN CONSULTING ENGINEERS: LOTS (10/31/24).



LOCATION AND DISTANCES
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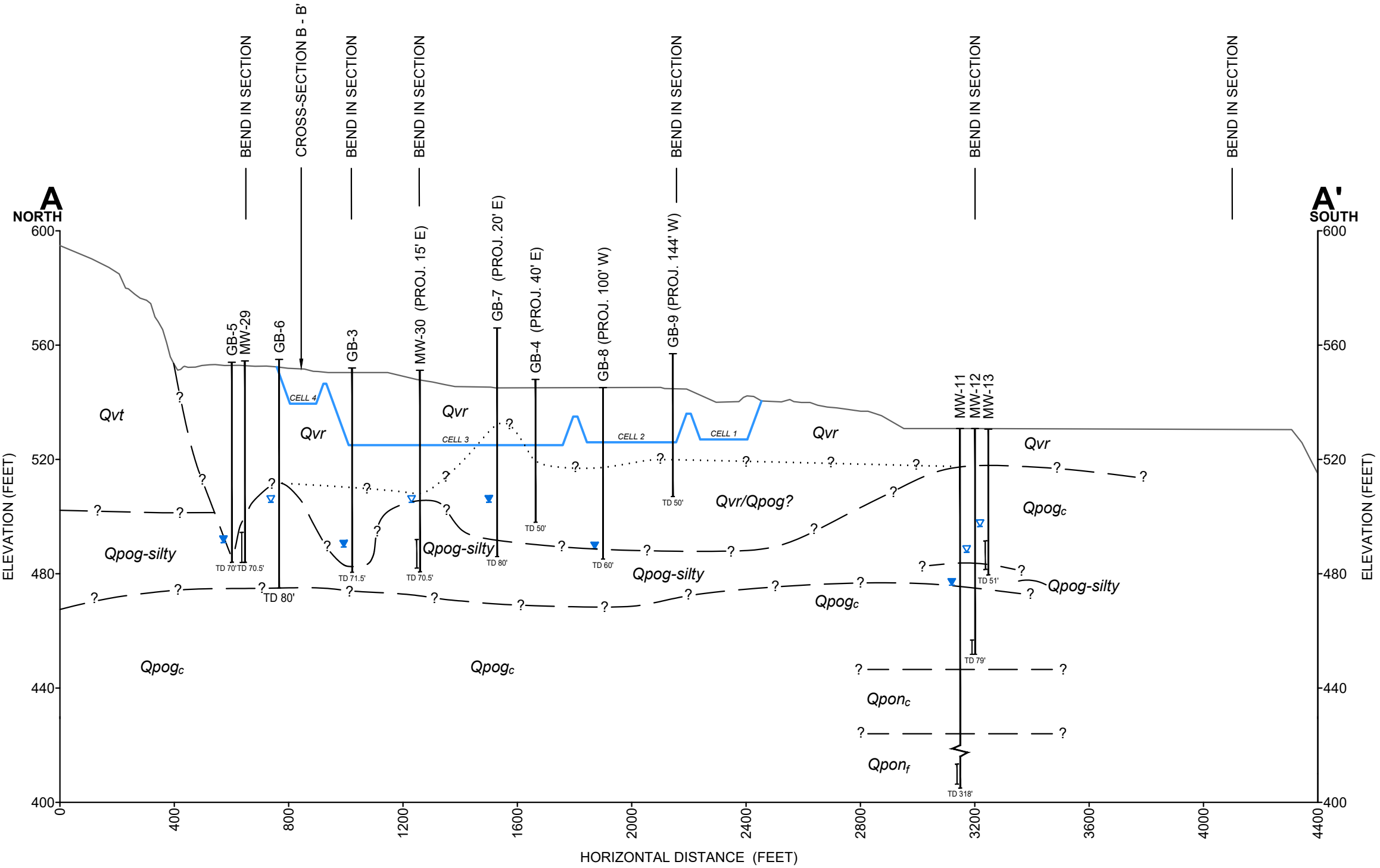
associated
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FACILITY SITE PLAN

CCD-RESERVE AT WOODLANDS
KING COUNTY, WASHINGTON

PROJECT NO.	DATE	FIGURE
20240186H003	10/24	2

2023 \ 20230040 Concord Playfield \ 20240186H002 GeoSects.dwg LAYOUT: F4a Sect A-A



- LEGEND:**
- Qvr* VASHON RECESSIONAL OUTWASH
 - Qvt* VASHON LODGEMENT TILL
 - Qpog - silty* PRE-OLYMPIA GLACIAL DEPOSITS - FINE-GRAINED
 - Qpog_c* PRE-OLYMPIA GLACIAL DEPOSITS - COARSE-GRAINED
 - Qpon_f* PRE-OLYMPIA NONGLACIAL DEPOSITS - FINE-GRAINED
 - Qpon_c* PRE-OLYMPIA NONGLACIAL DEPOSITS - COARSE-GRAINED

- BORING
- WATER LEVEL ATD - AT TIME OF DRILLING
- WATER LEVEL AT 2/2020
- SCREENED INTERVAL
- GEOLOGIC CONTACT
- SILTY TRANSITION IN *Qvr/Qpog?*

10X VERTICAL EXAGGERATION

NOTE: LOCATION AND DISTANCES SHOWN ARE APPROXIMATE

NOTES:
1. THE SUBSURFACE CONDITIONS PRESENTED IN THIS GEOLOGIC CROSS-SECTION ARE BASED ON AN INTERPRETATION OF CONDITIONS ENCOUNTERED IN WIDELY SPACED EXPLORATIONS COMPLETED AT THE SUBJECT SITE AND RELEVANT SITE INFORMATION DEVELOPED AND PROVIDED BY OTHERS. THE SUBSURFACE INTERPRETATIONS PRESENTED IN THIS GEOLOGIC CROSS-SECTION SHOULD NOT BE CONSTRUED AS A WARRANTY OF ACTUAL SUBSURFACE CONDITIONS AT THE SITE. OUR EXPERIENCE HAS SHOWN THAT SOIL AND GROUNDWATER CONDITIONS CAN VARY SIGNIFICANTLY OVER SMALL DISTANCES.

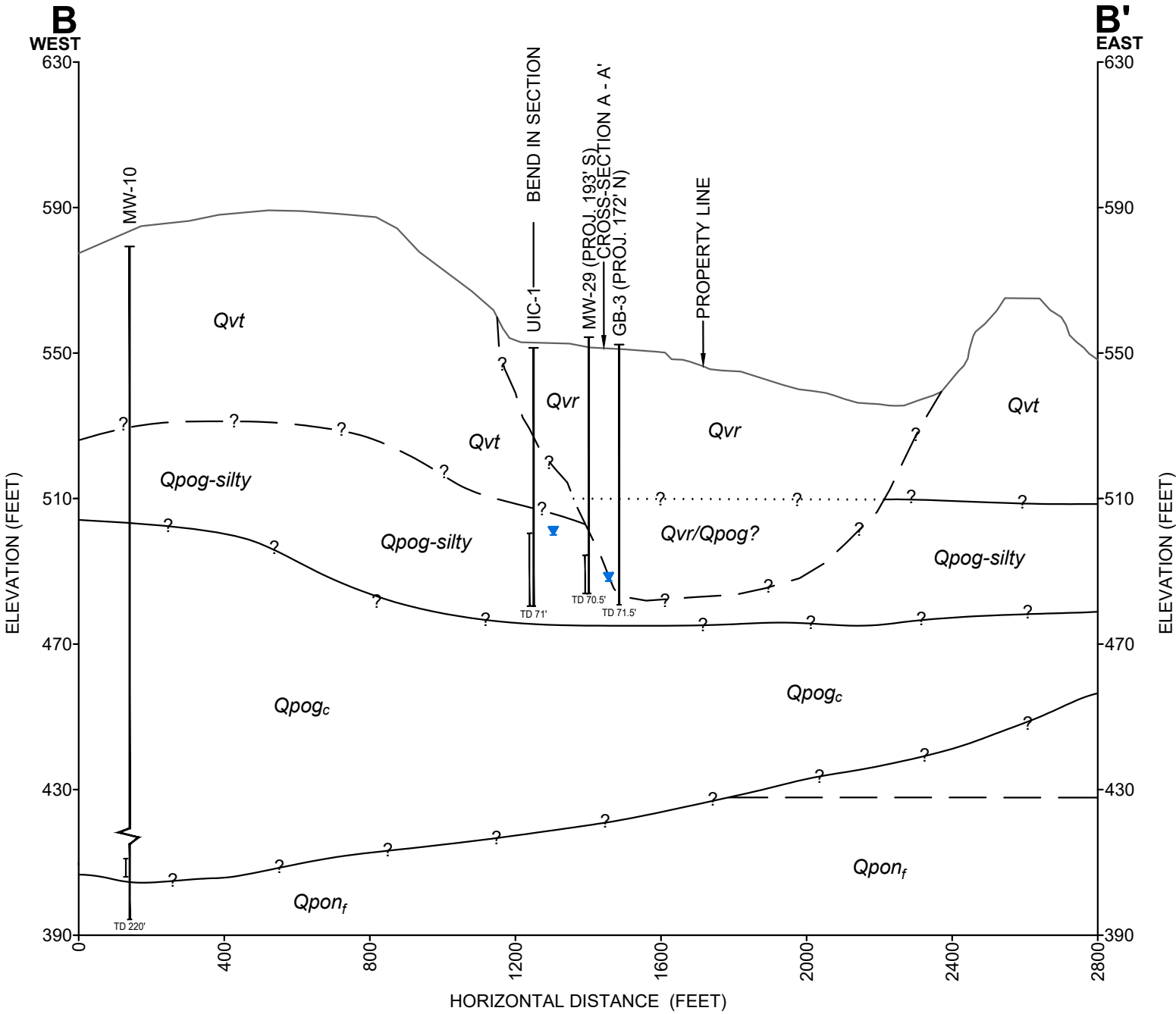
BLACK AND WHITE REPRODUCTION OF THIS COLOR ORIGINAL MAY REDUCE ITS EFFECTIVENESS AND LEAD TO INCORRECT INTERPRETATION



**GEOLOGIC
CROSS-SECTION A - A'**
RESERVE AT WOODLANDS
KING COUNTY, WASHINGTON

PROJ NO. 20240186H002 DATE: 10/24 FIGURE: 4a

2023 \ 20230040 Concord Playfield \ 20240186H002 GeoSects.dwg LAYOUT: F4b Sect B-B



LEGEND:

- Qvr* VASHON RECESSIONAL OUTWASH
Qvt VASHON LODGEMENT TILL
Qpog - silty PRE-OLYMPIA GLACIAL DEPOSITS
- FINE-GRAINED
Qpog_c PRE-OLYMPIA GLACIAL DEPOSITS
- COARSE-GRAINED
Qpon_f PRE-OLYMPIA NONGLACIAL DEPOSITS
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-  BORING
 WATER LEVEL ATD
- AT TIME OF DRILLING
 SCREENED INTERVAL
 GEOLOGIC CONTACT
 SILTY TRANSITION IN *Qvr/Qpog?*

10X VERTICAL EXAGGERATION

NOTE: LOCATION AND DISTANCES SHOWN ARE APPROXIMATE

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1. THE SUBSURFACE CONDITIONS PRESENTED IN THIS GEOLOGIC CROSS-SECTION ARE BASED ON AN INTERPRETATION OF CONDITIONS ENCOUNTERED IN WIDELY SPACED EXPLORATIONS COMPLETED AT THE SUBJECT SITE AND RELEVANT SITE INFORMATION DEVELOPED AND PROVIDED BY OTHERS. THE SUBSURFACE INTERPRETATIONS PRESENTED IN THIS GEOLOGIC CROSS-SECTION SHOULD NOT BE CONSTRUED AS A WARRANTY OF ACTUAL SUBSURFACE CONDITIONS AT THE SITE. OUR EXPERIENCE HAS SHOWN THAT SOIL AND GROUNDWATER CONDITIONS CAN VARY SIGNIFICANTLY OVER SMALL DISTANCES.

BLACK AND WHITE REPRODUCTION OF THIS COLOR ORIGINAL MAY REDUCE ITS EFFECTIVENESS AND LEAD TO INCORRECT INTERPRETATION



**GEOLOGIC
CROSS-SECTION B - B'
RESERVE AT WOODLANDS
KING COUNTY, WASHINGTON**

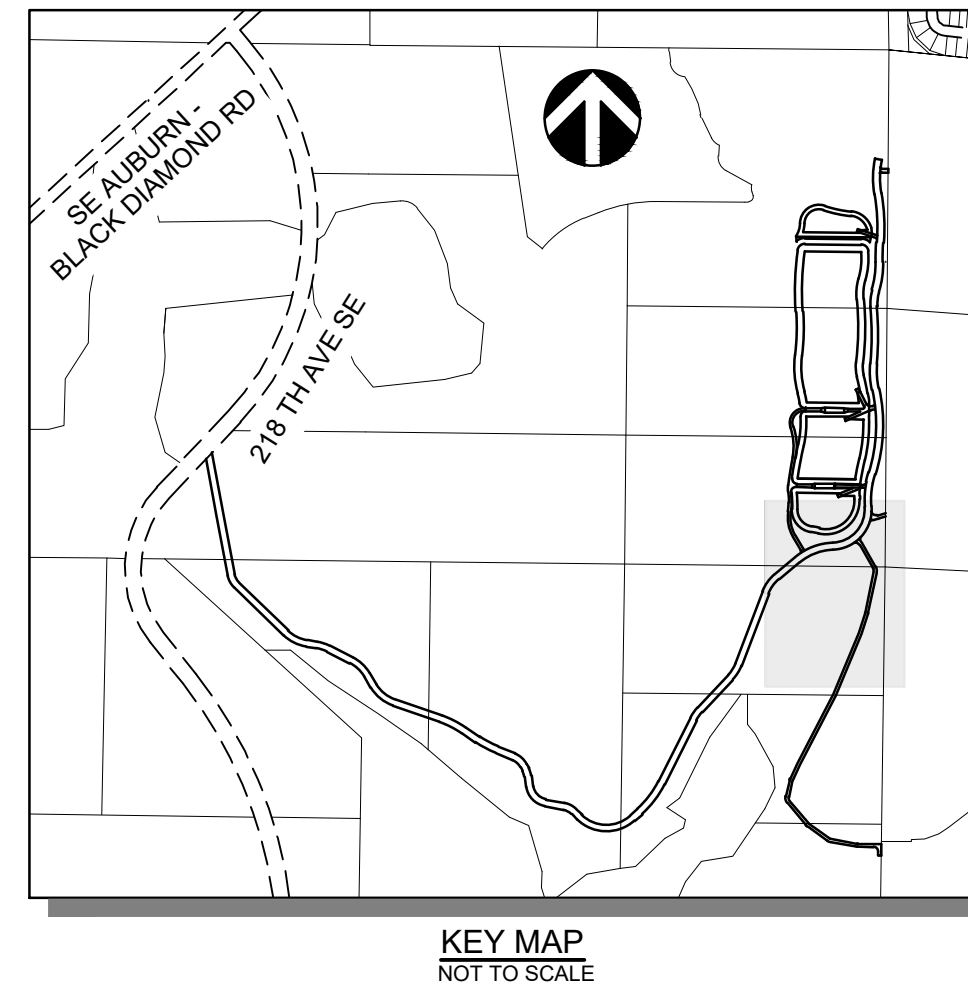
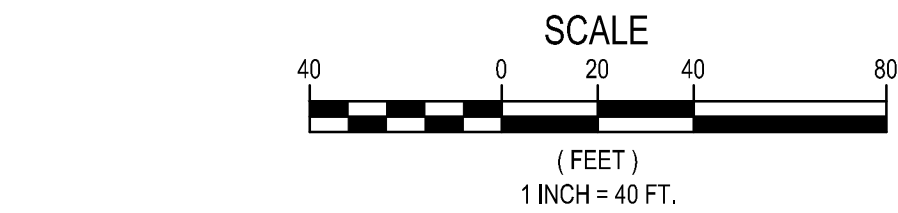
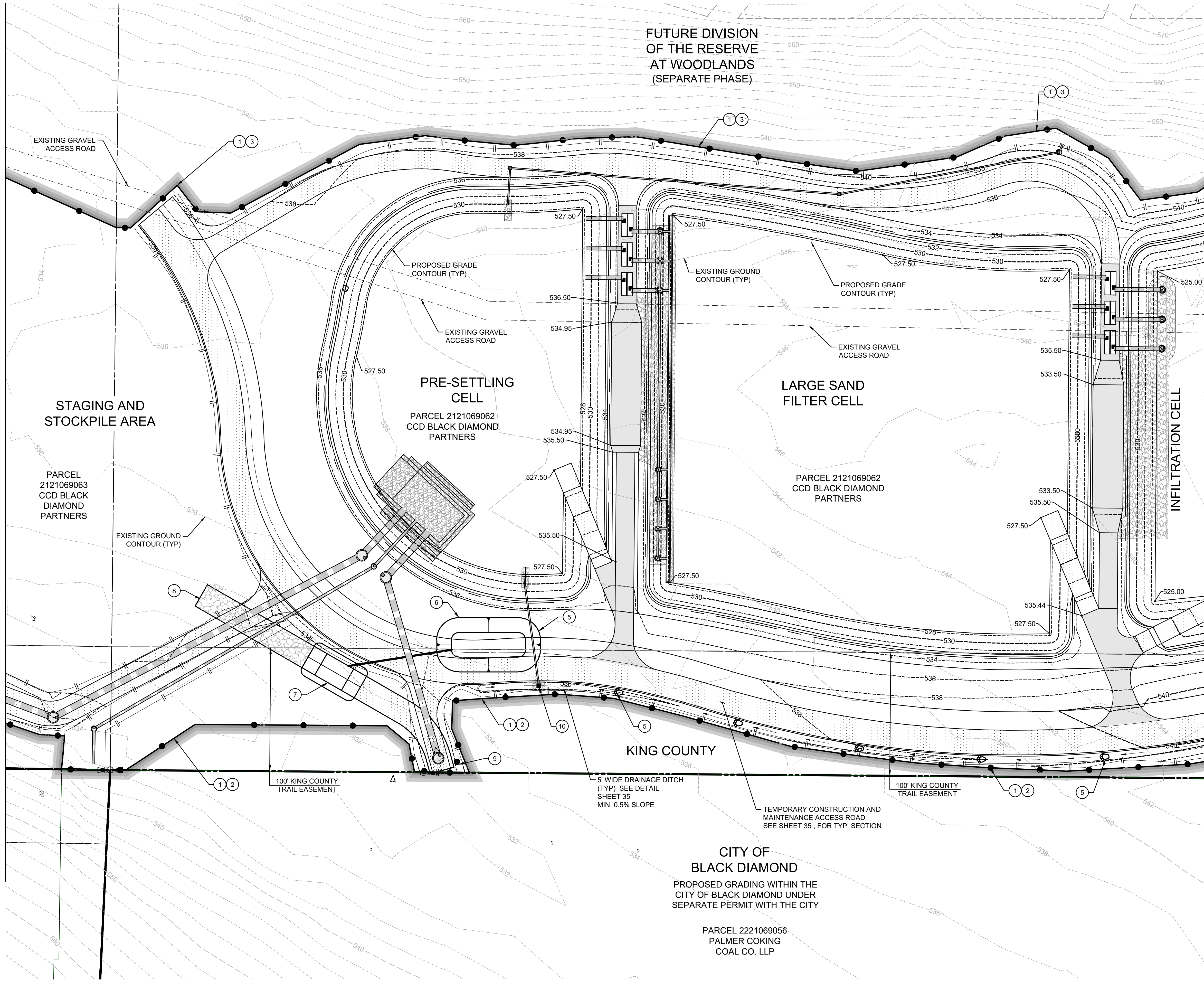
PROJ NO. 20240186H002 DATE: 10/24 FIGURE: 4b

APPENDIX A

Regional Stormwater Control Facility Civil Design (Sheets 5, 6, 7, and 12)

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Save Date: 8/15/2023 4:11 PM
By: Gabhe Lefayra
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NW 1/4 SEC 21, TWN 21 N, RGE 6 E, W.M.

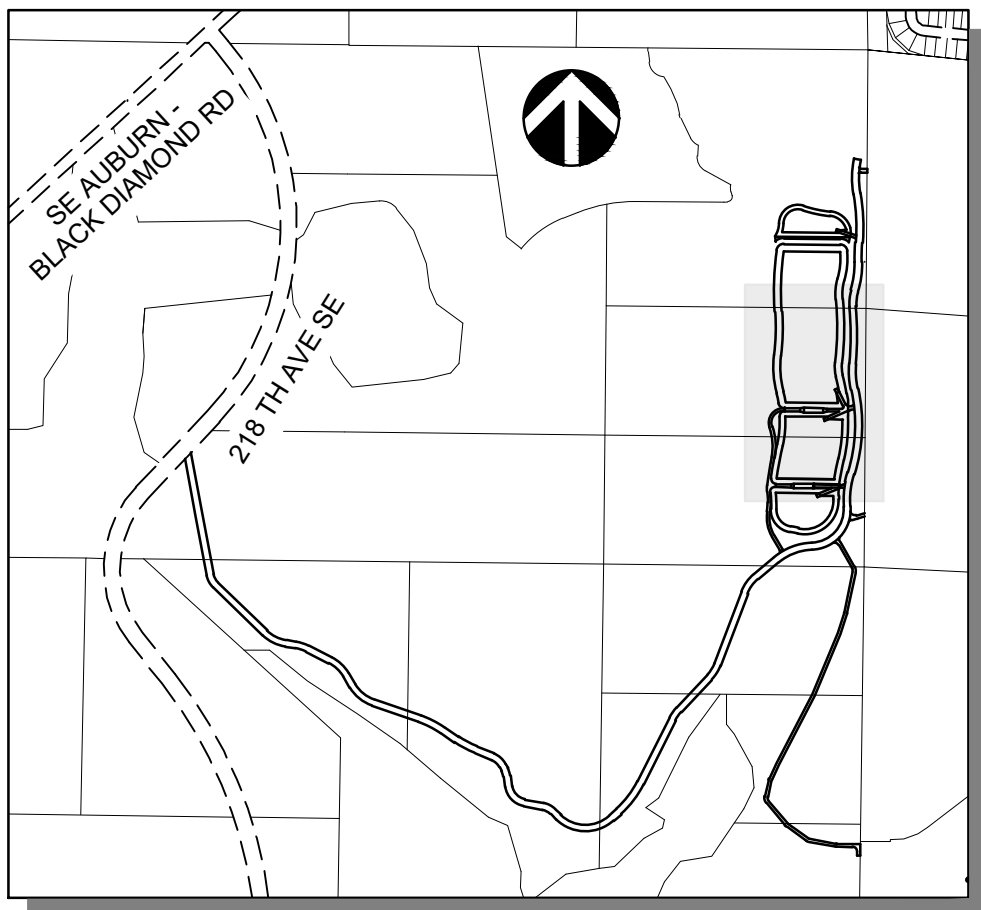
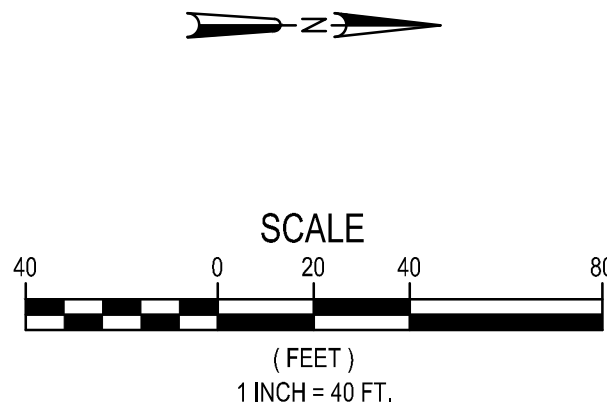


TEMPORARY EROSION CONTROL NOTES:

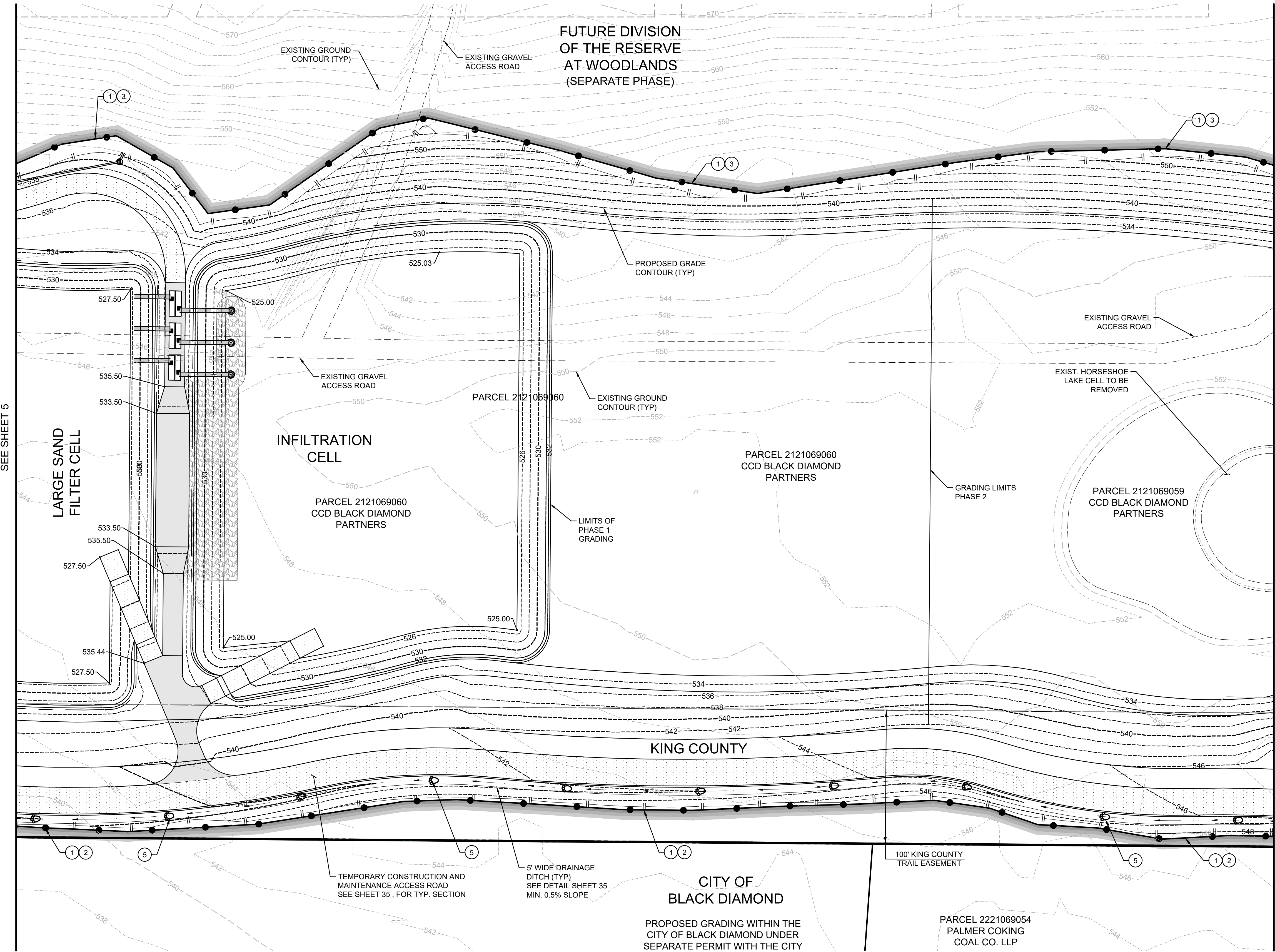
- 1 CONTINUOUS CLEARING LIMIT FLAGGING.
- 2 ORANGE SILT FENCE PER DETAIL, SHEET 8.
- 3 ORANGE CONSTRUCTION FENCE PER DETAIL, SHEET 8.
- 4 TEMPORARY 2' WIDE x 1' DEEP INTERCEPTOR SWALE PER DETAIL, SHEET 8.
- 5 ROCK CHECK DAM PER DETAIL, SHEET 8.
- 6 INFILTRATION SEDIMENT TRAP PER DETAIL, SHEET 8.
- 7 WHEEL WASH FACILITY. CONTRACTOR TO SUBMIT SHOP DRAWINGS OF WHEEL WASH FOR CITY APPROVAL PRIOR TO CONSTRUCTION.
- 8 100' LONG CONSTRUCTION ENTRANCE PER DETAIL, SHEET 8. 20' MINIMUM WIDTH.
- 9 CONTRACTOR TO INSTALL SIGN WITH SITE ADDRESS AND CONSTRUCTION SITE MAP. CONSTRUCTION SITE MAP SHALL PROVIDE DIRECTIONS TO EMPLOYEE PARKING AND CONSTRUCTION STAGING AREA ALONG WITH DIRECTIONS TO THE CONSTRUCTION TRAILER SITE.
- 10 CATCH BASIN TEMPORARY INLET PROTECTION SHEET 8.

CAUTION
LOCATION OF EXISTING UTILITIES SHOWN IS APPROXIMATE AND MAY NOT BE ACCURATE OR ALL INCLUSIVE. IT IS THE CONTRACTOR'S RESPONSIBILITY TO FIELD VERIFY LOCATION OF UTILITIES PRIOR TO PROCEEDING WITH CONSTRUCTION. YOU MUST CALL 811 NOT LESS THAN TWO FULL BUSINESS DAYS BEFORE BEGINNING EXCAVATION WHERE ANY UNDERGROUND UTILITIES MAY BE LOCATED. EXISTING UTILITIES TO BE LOCATED, PROTECTED, AND REPAIRED IN ACCORDANCE WITH RCW 19.122.

THE RESERVE AT WOODLANDS
REGIONAL STORMWATER FACILITY
TEMPORARY EROSION CONTROL PLAN



KEY MAP
NOT TO SCALE



TEMPORARY EROSION CONTROL NOTES:

- 1 CONTINUOUS CLEARING LIMIT FLAGGING.
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DATE: BY: OK

REVIEWED BY: NO. DATE REVISION

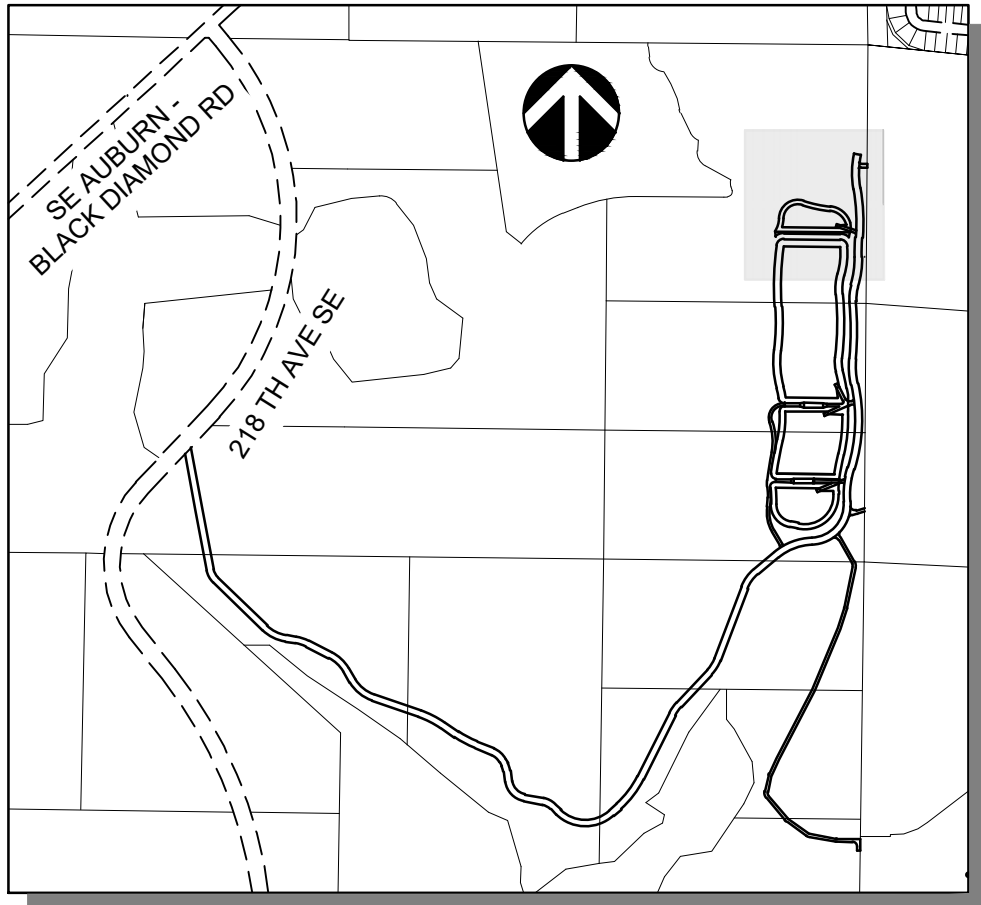
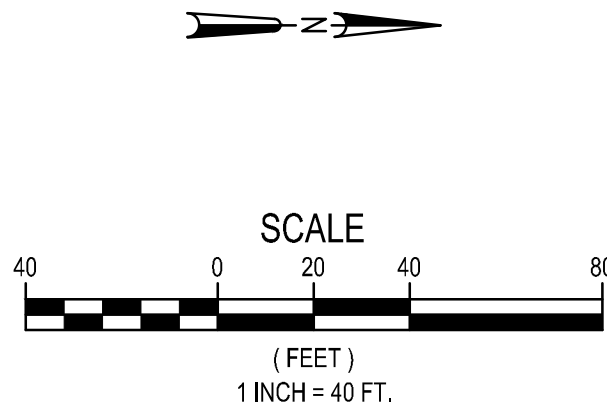


CHECKED BY: AYS
DESIGNED BY: DAM
DRAWN BY: CAH

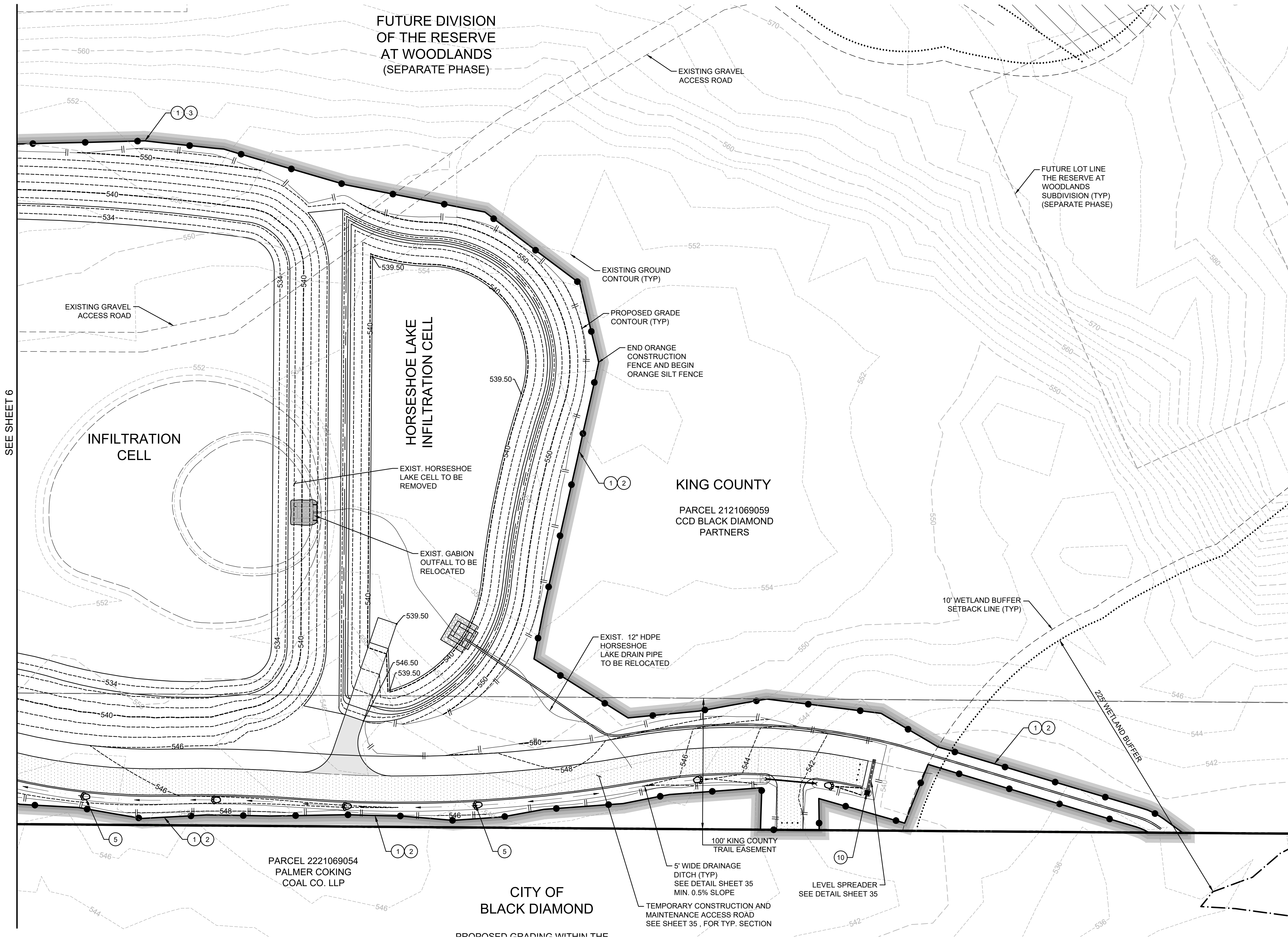
FIRST SUBMITTAL DATE:

PROJECT NO.
OAKPCBDP6001

SHEET NO.



KEY MAP
NOT TO SCALE



TEMPORARY EROSION CONTROL NOTES:

- 1 CONTINUOUS CLEARING LIMIT FLAGGING.
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THE RESERVE AT WOODLANDS
REGIONAL STORMWATER FACILITY
TEMPORARY EROSION CONTROL PLAN

WASHINGTON

KING COUNTY

REVIEWED BY:	DATE:	BY:	OK
NO. DATE REVISION			



CHECKED BY: AYS
DESIGNED BY: DAM
DRAWN BY: CAH
FIRST SUBMITTAL DATE:
PROJECT NO.
OAKPCBDP6001
SHEET NO.



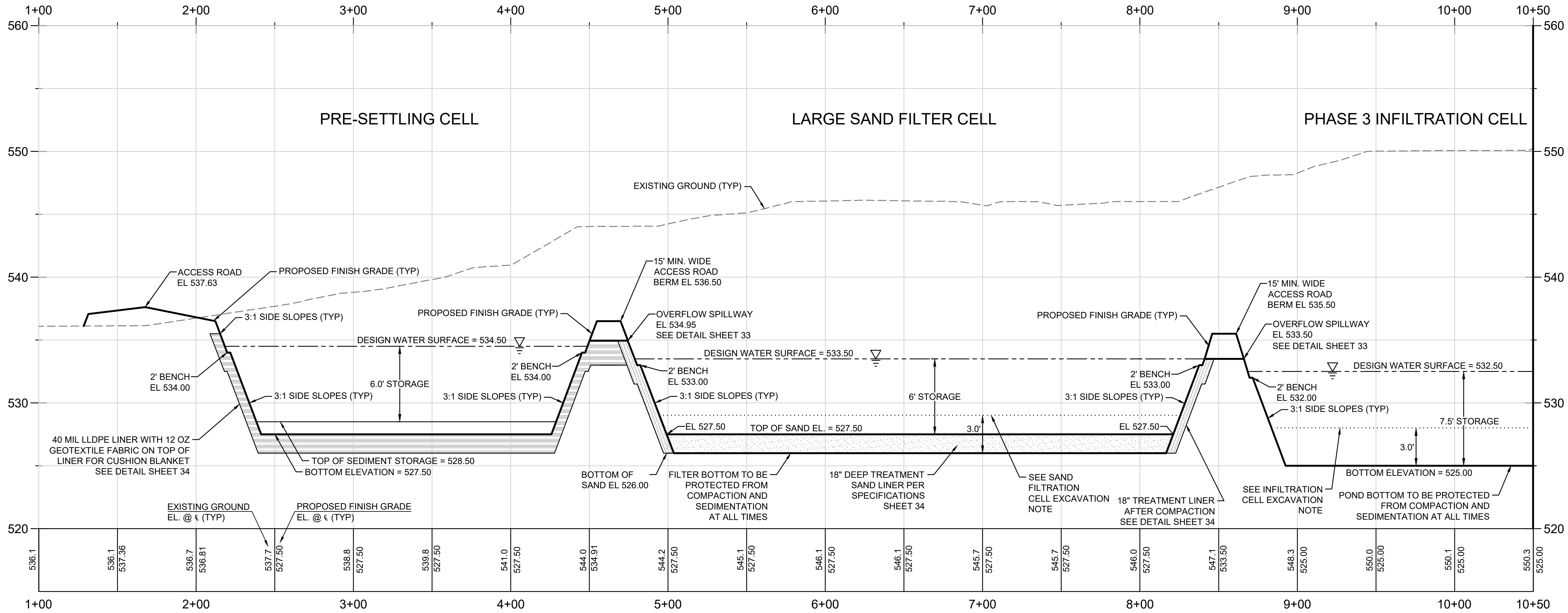
8/16/2023

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DRAWN BY: CAH

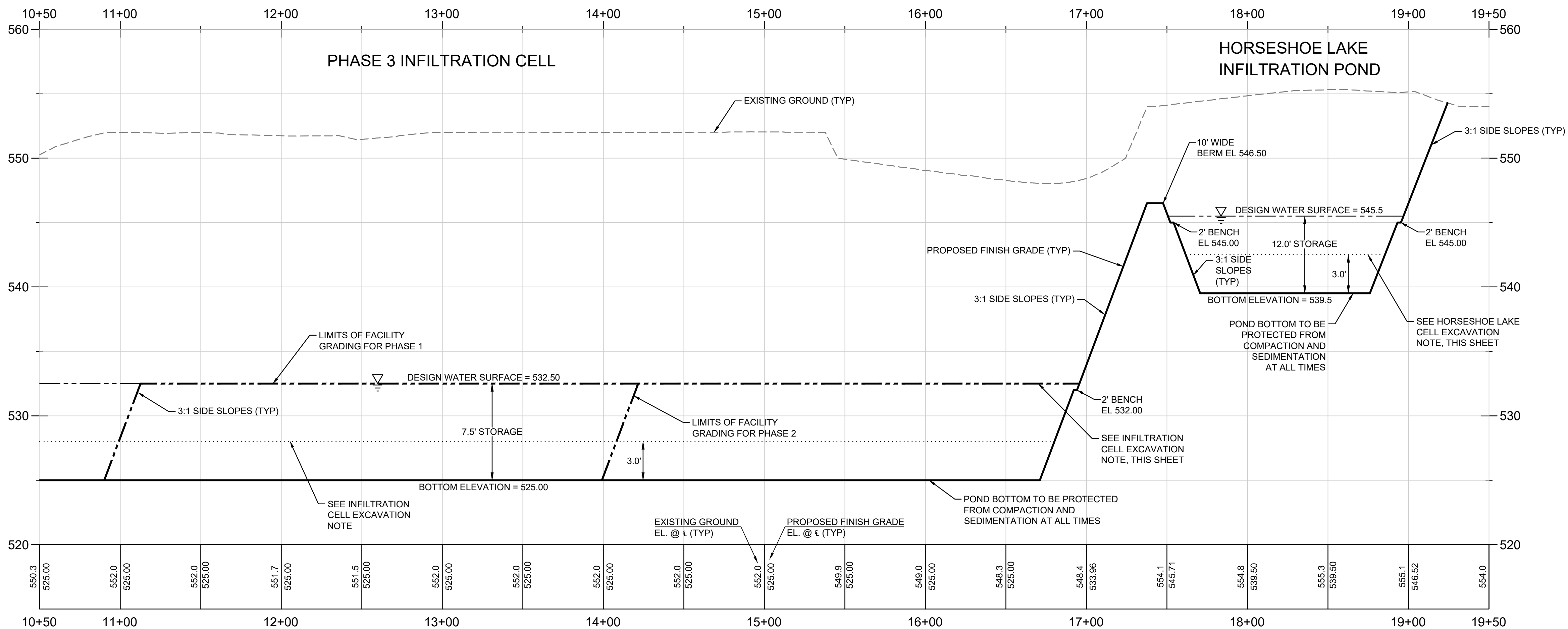
FIRST SUBMITTAL DATE:

PROJECT NO.
OAKPCBDP6001

SHEET NO.



SECTION A-A
SCALE: 1"=40' HORIZ.
1"=5' VERT



SECTION A-A
SCALE: 1"=40' HORIZ.
1"=5' VERT

SAND FILTRATION CELL EXCAVATION NOTE:
CONTRACTOR TO EXCAVATE DOWN TO ELEVATION 526.00
INITIALLY. HEAVY EQUIPMENT IS NOT ALLOWED TO
OPERATE WITHIN 3-FT OF FILTER BOTTOM. THE BOTTOM
3-FT WILL BE REQUIRED TO BE EXCAVATED BACK ACROSS
POND OR OTHER APPROVED METHOD UTILIZING TRACKED
EQUIPMENT TO AVOID COMPACTION OF FILTER BOTTOM.

INFILTRATION CELL EXCAVATION NOTE:
CONTRACTOR TO EXCAVATE DOWN TO ELEVATION 528.0
INITIALLY. HEAVY EQUIPMENT IS NOT ALLOWED TO
OPERATE WITHIN 3-FT OF FILTER BOTTOM. THE BOTTOM
3-FT WILL BE REQUIRED TO BE EXCAVATED BACK ACROSS
POND OR OTHER APPROVED METHOD UTILIZING TRACKED
EQUIPMENT TO AVOID COMPACTION OF FILTER BOTTOM.

HORSESHOE LAKE INFILTRATION CELL EXCAVATION NOTE:
CONTRACTOR TO EXCAVATE DOWN TO ELEVATION 542.5
INITIALLY. HEAVY EQUIPMENT IS NOT ALLOWED TO
OPERATE WITHIN 3-FT OF FILTER BOTTOM. THE BOTTOM
3-FT WILL BE REQUIRED TO BE EXCAVATED BACK ACROSS
POND OR OTHER APPROVED METHOD UTILIZING TRACKED
EQUIPMENT TO AVOID COMPACTION OF FILTER BOTTOM.

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LOCATION OF UTILITIES PRIOR TO PROCEEDING WITH
CONSTRUCTION. YOU MUST CALL 811 NOT LESS THAN TWO
FULL BUSINESS DAYS BEFORE BEGINNING EXCAVATION
WHERE ANY UNDERGROUND UTILITIES MAY BE LOCATED.
EXISTING UTILITIES TO BE LOCATED, PROTECTED, AND
REPAIRED IN ACCORDANCE WITH RCW 19.122.

SEE ABOVE - RIGHT

SEE BELOW - LEFT

APPENDIX B

Technical Memorandum Results of Qualifying Pump Tests, April 30, 2018

TECHNICAL MEMORANDUM

DATE April 30, 2018

Project No. 063-1076-016.16

TO Mr. Colin Lund, Chief Entitlement Officer
CCD Black Diamond Partners LLC

FROM James G. Johnson, LEG, LG and Michael
Klisch, LHG

RESERVE AT WOODLANDS – RESULTS OF QUALIFYING PUMP TESTS

This technical memorandum describes the results of two “Qualifying Pump Tests” completed in a temporary infiltration and testing facility constructed at the Reserve at Woodlands property located east of 218th Ave SE in King County, Washington. The Qualifying Pump Tests were monitored by Golder Associates Inc. (Golder) and coordinated by Golder and King County (County) in accordance with guidelines presented in Section 6.5.3 of a Development Agreement (DA) between King County and BD Village Partners LP (BD Villages) (DA 2014¹). The DA outlines the terms of an agreement for the testing of an Initial Infiltration Facility at the Woodlands and conditions for acceptance of a permanent infiltration facility. Capitalized terms in this memorandum shall be defined in accordance with the definitions set forth in the DA.

The Initial Infiltration Facility was constructed in the northeast corner of the Reserve at Woodlands (Woodlands). The facility consists of two excavated circular rings, the inner ring has a diameter of about 100 feet and a floor elevation of approximately 546.5 feet. The outer ring is about 200 feet in diameter and a floor elevation of approximately 548.5 feet. Water from Horseshoe Lake (HSL) was discharged to an energy dissipater located at the north end of the inner ring of the facility. The ponded water during all of the infiltration test events was contained within the smaller inner ring or during the highest pumping rates to a few feet beyond the edge of the inner ring. This resulted in a typical maximum ponded water depth for the infiltration tests of about 2 to 3 feet above the facility floor.

The purpose of constructing the Initial Infiltration Facility and permitting the Regional Stormwater Facility, as described in the DA, is to satisfy the following dual purposes:

- 1) Creating a facility to infiltrate water pumped from HSL during periodic spring high-water events - Since the 1990s the County periodically pumps water from the lake in the spring when natural season high water levels threaten flooding of shoreline homes. The County has used several locations to dispose of the pumped water in the past and is interested in permitting a permanent stormwater facility to receive the HSL water. The Regional Stormwater Facility will be sized to allow infiltration of up to 6 cubic feet per second (cfs) of water annually from HSL annually for a two-week period.
- 2) Testing of the Regional Stormwater Facility - The DA outlines a methodology for acceptance of two “Qualified Pump Tests” to demonstrate the ability of the Regional Stormwater Facility to infiltrate the water and monitoring to evaluate groundwater mounding and water quality testing to evaluate the effects of

¹ Development Agreement Between King County, Washington and BD Village Partners LP, January 27, 2014.

infiltration on the receptor aquifer and down gradient areas. The DA methodology outlines the testing and monitoring responsibilities of BD Villages and the County.

The two Qualifying Pump Tests were completed in February and March 2016 and between March and May 2017. Water for the qualifying tests was supplied by pumping water from HSL by the County as part of emergency management of lake levels. The Initial Infiltration Facility, surface water bodies, and monitoring wells near the Initial Infiltration Testing facility are shown on Figure 1.

1.0 DA INFILTRATION TEST REQUIREMENTS

Section 6.5.3 of the DA contains a description of the testing that will be done at the Initial Infiltration Facility during and after infiltration events. The section contains the following annotated requirements:

- A) During periods of pumping from HSL, BD Villages shall monitor ground water levels at its test wells and evaluate them against its model. BD Villages shall also monitor surface conditions in Crisp Creek and Green River Valley wall downhill of the infiltration facility to monitor for adverse conditions.
 - Pressure transducers and data loggers were installed by Golder on behalf of BD Villages in seven monitoring wells (MW-10, MW-11, MW-12, MW-13, MW-29, MW-30, and UIC-1) at Woodlands to monitor the groundwater response during each infiltration test event. A staff gage and pressure transducer and data logger were also installed in the infiltration facility to monitor facility stage during testing.
 - County staff measured and recorded flow rates from HSL. Flow rates during the pumping from HSL were estimated from the pump speed and pump curve for the February 2016 testing; a flowmeter was installed on the discharge line for the 2017 testing. The County also has a staff gage installed in the lake to measure and record the lake stage.
 - County staff performed groundwater sampling and water quality testing in seven monitoring wells during the tests (MW-10, MW-12, MW-13, MW-27, MW-28, MW-29, and MW-30). The results of the County groundwater quality sampling are summarized in a separate report prepared by County staff.
- B) BD Villages shall report the results of the monitoring to King County WLRD and DPER.
 - This report contains the results of the monitoring
- C) BD Villages shall conduct pilot infiltration tests (PIT) and mounding analysis to provide design infiltration rates. Rates will be used to design a regional infiltration facility capable of infiltrating runoff from all developed portions of the development plus up to 6 cfs of water from HSL for up to two weeks assuming wet season groundwater conditions.
 - The Initial Infiltration Facility was constructed in the northeast corner of the Woodlands in a recessional outwash channel. The facility is designed as a PIT on a scale large enough to accommodate the large volume and rate of water pumped from HSL. Mounding in the aquifer below the facility was measured during and after infiltration events in two monitoring wells immediately adjacent to the facility and in wells distal to the facility.
- D) The goal of this analysis is to achieve two Qualifying Pump Tests (infiltrated at the Initial Infiltration Facility) from Horseshoe Lake with a minimum of 40 acre-feet (AF) of water, termed a “Qualifying Pump Test”.
 - Two successful Qualifying Pump Tests were completed at the Initial Infiltration Facility in 2016 and 2017.

2.0 FEBRUARY AND MARCH 2016 - QUALIFYING TEST #1

Qualifying Test #1 took place between February 5 and March 19, 2016. Approximately 87 AF of water was pumped from the lake in four pumping cycles; the volume per cycle ranged from about 5 to 42.7 AF. Figure 2 shows the stage in Horseshoe Lake over the pumping period and the pumped volume for each pumping cycle.

Figure 3 shows the stage in the Initial Infiltration Facility and the pumped volume over the course of pumping, and Figure 4 shows the facility stages during each pumping and infiltration period. The stage in the facility ranged from about 2.5 to 3 feet during each cycle depending on the pumping rate and duration. For each cycle, the stage in the facility increased relatively quickly once pumping started but reached quasi-equilibrium stage with fluctuations attributable to changes in the pumping rate. Once pumping ceased, the stage in the Initial Infiltration Facility decreased rapidly.

Figures 5 and 6 show groundwater elevations in monitoring wells near the Initial Infiltration Facility and in distal wells, respectively. As shown on Figure 5, groundwater levels in all of the monitoring wells near the facility responded to the infiltration events. The greatest response of about 5 to 10 feet was observed in MW-30, located about 250 feet downgradient of the inner infiltration ring. Groundwater levels in MW-29 and MW-30 started to increase as soon as infiltration started, and started to decline once infiltration stopped. Groundwater levels remained above the pre-test level for about 2 weeks after all infiltration stopped. The maximum observed groundwater elevation during the testing was about 513 feet in MW-30, an increase of about 10 feet over the duration of the test. Based on an approximate facility floor elevation of 546 feet, the maximum groundwater level during testing was still about 33 feet below the facility's floor.

Groundwater in wells downgradient and cross gradient of the Initial Infiltration Facility did not appear to respond to the infiltration event (Figure 6). Similarly, the stage in the Crisp Creek tributary did not appear to respond to infiltration (Figure 7).

2.1 Test Evaluation

Initial Infiltration Facility data and the lake pumping rate data from two of the pumping cycles were used to estimate constant-head and falling-head infiltration rates (Figure 8). The analysis assumes the facility area over which infiltration is occurring is the circular inner ring area near the discharge to the facility, which has a wetted diameter of about 100 to 120 feet (depending on water level). This assumption is substantiated by visual observations made during pumping events.

A constant-head infiltration rate was estimated for infiltration on February 10, 2016 (24 hours duration) near the end of the first pumping and infiltration cycle (26.3 AF). The pumping rate over this period was about 718 gallons per minute (gpm). The constant-head infiltration rate was estimated to be 7.0 inches per hour (in/hr). The falling-head infiltration rate was estimated to be 5.6 in/hr at the end of the cycle (February 11, 2016). The falling-head portion of the test occurred over about 5.75 hours.

A constant-head infiltration rate was estimated for infiltration on March 17, 2016 (12 hours duration) about a day before the end of the fourth pumping and infiltration cycle (12.8 AF). The pumping rate over this period was about 718 gpm. The constant-head infiltration rate was estimated to be 7.0 in/hr. The falling-head infiltration rate was estimated to be 8.7 in/hr at the end of the cycle (March 18, 2016). The falling-head portion of the test occurred over about 3.25 hours.

3.0 2017 - QUALIFYING TEST #2

Qualifying Test #2 took place between March 21 and May 9, 2017. At least 92 AF of water was pumped from HSL in six pumping cycles of variable rate and duration. The pumping rates and durations from March 21 to March 23 and for two periods of pumping in late April and early May were either not recorded or the data were misplaced by the County. Figure 9 shows the stage in HSL over the pumping periods.

Figure 10 shows the stage in the Initial Infiltration Facility and the pumping rate over the course of pumping. The stage in the facility ranged from about 2.8 to 4.7 feet during each cycle depending on the pumping rate and duration. For each cycle, the stage in the facility increased relatively quickly once pumping started but did not reach a quasi-equilibrium level because of changes in the pumping rate. Once pumping ceases, the stage in the infiltration facility decreases rapidly.

Figures 11 and 12 show groundwater elevations in monitoring wells near the Initial Infiltration Facility and in distal wells, respectively. As shown on Figure 11, groundwater levels in all of the monitoring wells near the facility responded to the infiltration events. As with Test #1, the greatest rise in groundwater, about 13 feet, was observed in MW-30, located approximately 250 feet downgradient of the inner infiltration ring. Groundwater levels in MW-29 and MW-30 started to increase as soon as infiltration started, and started to decline once infiltration stopped. Groundwater levels remained above the pre-test level for about 2 weeks after all infiltration stopped. The maximum observed groundwater elevation during the testing was about 513 feet in MW-30. Based on an approximate facility floor elevation of 546 feet, the maximum groundwater level during testing was still about 33 feet below the facility floor.

Groundwater in wells downgradient and cross gradient of the Initial Infiltration Facility did not appear to respond to infiltration (Figure 12). Similarly, the stages in the Crisp Creek tributary and the stage in the King County wetland area did not appear to respond to infiltration (Figure 13). The transducer in the Crisp Creek tributary failed at some point after March 24, but the water level in the wetland started to decline in mid-March 2017 and continued decline over the course of infiltration in response to seasonal changes in recharge. The overall groundwater and surface water responses during Qualifying Test #2 were similar to the responses observed during Qualifying Test #1.

3.1 Test Evaluation

Initial Infiltration Facility data and the lake pumping rate data from a 2.25-hour period on March 31, 2017 when the pumping rate and infiltration facility stage were constant were used to estimate constant-head infiltration rates. A falling head infiltration rate was estimated for a 6-hour period on March 31 following shutdown of pumping. The analysis assumes the facility area over which infiltration is occurring is the circular inner ring area near the discharge to the facility, which has a diameter of about 122 feet.

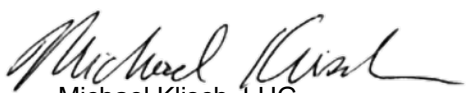
The constant-head infiltration rate was calculated to be about 6.8 in/hr for a pumping rate of 700 gpm. The falling-head infiltration rate was estimated to be 4.2 in/hr at the end of the cycle (March 18, 2016).

4.0 SUMMARY OF INFILTRATION FACILITY TESTING

Two Qualifying Pump Tests were completed at the Initial Infiltration Facility in 2016 and 2017. A total of about 87 AF was infiltrated in four cycles in Test #1, and a minimum of about 92 AF were infiltrated over six cycles in Test #2. The results of the Qualifying Pump Tests are summarized as follows:

- Constant-head infiltration rates ranged from about 6.8 to 7.0 in/hr at pumping rates of 700 to 718 gpm. The facility stage during the period when constant-head rates were evaluated ranged from about 2.2 to 2.6 feet depending on the duration and rates of infiltration prior to the constant-head phase.
- Falling head infiltration rates ranged from 4.2 to 8.7 in/hr depending on the duration and rates of infiltration prior to the falling-head phase.
- The calculated infiltration rates should be considered minimum infiltration rates for the observed conditions because the facility is deepest in the area of the energy dissipater where the staff gauge was located. Away from this area, the facility is somewhat shallower and the head of water over the facility floor during testing was smaller.
- Infiltration resulted in a temporary groundwater level increase, or mound, of about 5 to 10 feet observed only in wells closest to the facility (MW-29 and MW-30) depending on infiltration rate and duration. About 33 feet of unsaturated material remained below the facility floor when the highest groundwater level rise was observed. The groundwater mound dissipated within about 14 days following the end of infiltration.
- There was no apparent groundwater level response measured in monitoring wells distal (beyond MW-29 and MW-30) to the Initial Infiltration Facility. There were also no measured changes in spring or wetland discharge downgradient of the Initial Infiltration Facility. Distal changes in groundwater elevation and aquifer discharge rates at springs may be difficult to detect due to attenuation and time of travel effects. However, we also did not note any physical changes to monitoring locations such as erosion or slope slumps that might result from increased discharge.

Golder Associates Inc.


Michael Klisch, LHG
Senior Hydrogeologist

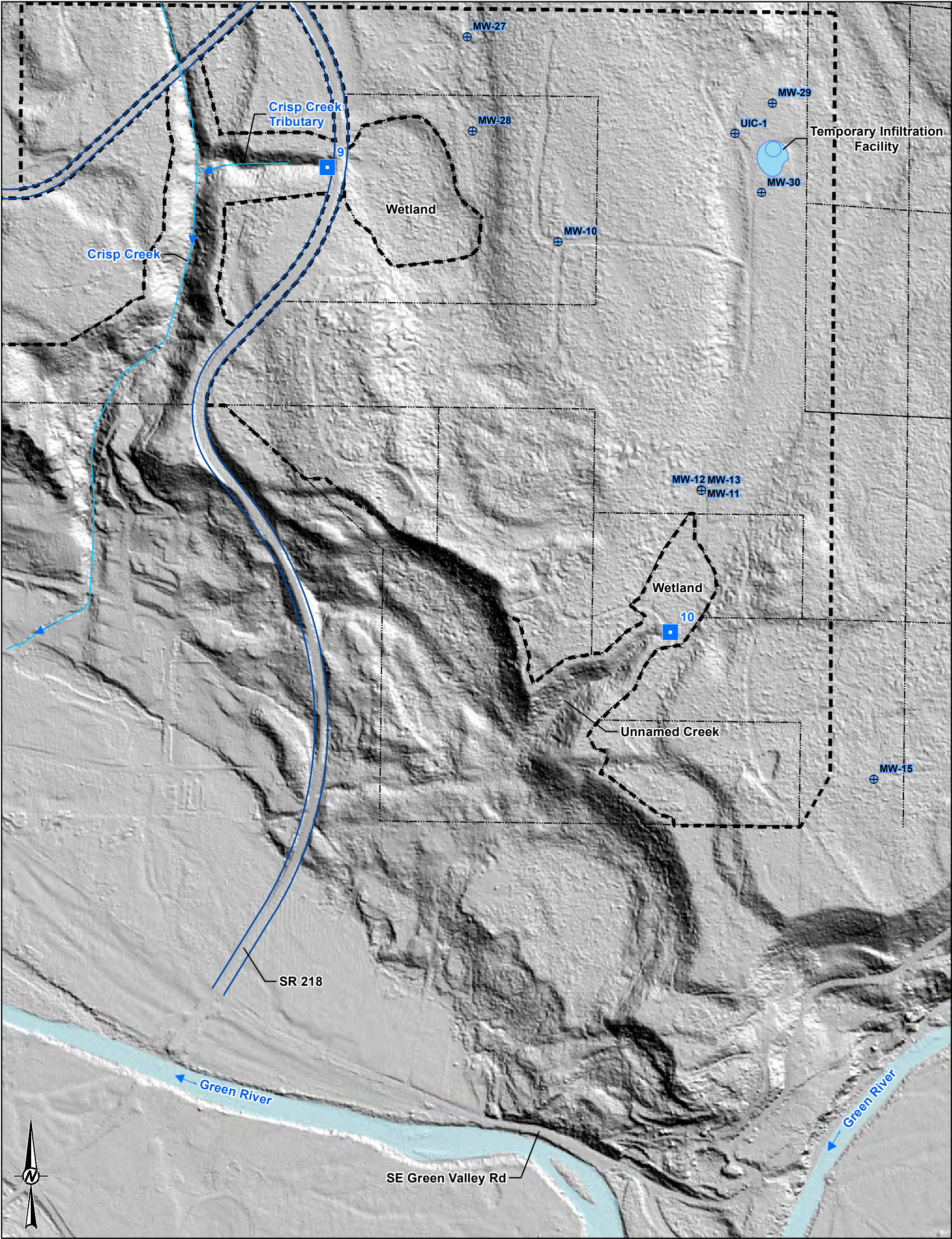

James G. Johnson
Principal

MPK/JGJ/ks

List of Figures

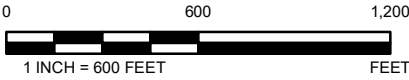
Figure 1	Location Map
Figure 2	Qualifying Test #1 Hydrographs – Horseshoe Lake Stage and Pumped Volume
Figure 3	Qualifying Test #1 Infiltration Hydrographs – Infiltration Facility Stage and Pumped Volume
Figure 4	Qualifying Test #1 Infiltration Hydrographs – Infiltration Facility Stages for Pumping Cycles
Figure 5	Qualifying Test #1 Hydrographs – Infiltration Facility Area Groundwater Levels
Figure 6	Qualifying Test #1 Hydrographs – Distal Monitoring Wells Groundwater Levels
Figure 7	Qualifying Test #1 Hydrographs – Crisp Creek Tributary Stage
Figure 8	Qualifying Test #1 Infiltration Rate Analysis
Figure 9	Qualifying Test #2 Hydrographs – Horseshoe Lake Stage and Pumping Periods
Figure 10	Qualifying Test #2 Infiltration Hydrographs – Infiltration Facility Stage and Pumping Rates
Figure 11	Qualifying Test #2 Hydrographs – Infiltration Facility Area Groundwater Levels
Figure 12	Qualifying Test #2 Hydrographs – Distal Wells Groundwater Levels
Figure 13	Qualifying Test #2 Hydrographs – Crisp Creek Tributary and King County Wetland Stage
Figure 14	Qualifying Test #2 Infiltration Testing – Test Analysis

p:\projects\2006\063-1076_bdp_the_villages\016 ccd bd_villages development\06 deliverables\reserve at woodlands_infiltration tests\rev 0\0631076016_rev0_infiltration testing_043018.docx



- LEGEND
- ⊕ MONITORING WELL
 - SURFACE WATER MONITORING STATION
 - CREEK
 - ROAD
 - - - - PARCEL BOUNDARY
 - GREEN RIVER
 - Temporary Infiltration Facility
 - Reserve at Woodlands

REFERENCE(S)
1. TRIAD ASSOCIATES (ROW, LOTS)
2. KING COUNTY (LIDAR, 2003)
3. COORDINATE SYSTEM: NAD 1983 STATE PLANE WASHINGTON NORTH (FT)



CLIENT
CCD BLACK DIAMOND PARTNERS LLC

PROJECT
BD VILLAGES/RESERVE AT WOODLANDS/WA

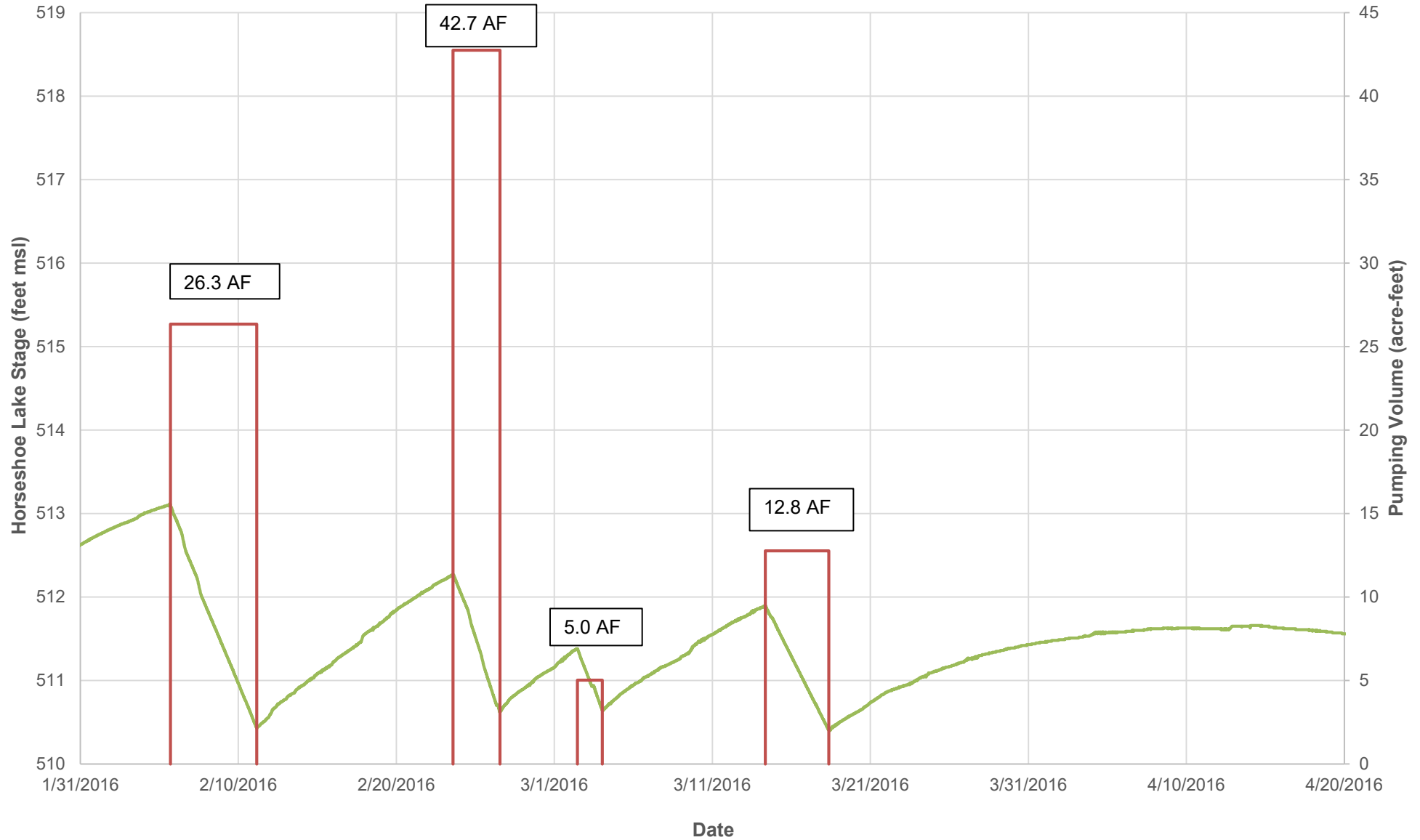
TITLE
SITE PLAN

CONSULTANT	YYYY-MM-DD	2018-04-16
	DESIGNED	JJ/BVJ
	PREPARED	BVJ
	REVIEWED	JJ
	APPROVED	JJ

PROJECT NO.	PHASE	REV.	FIGURE
0631076016	21	A	1



IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI B



LEGEND

— Horseshoe Lake Stage

CLIENT
CCD BLACK DIAMOND PARTNERS LLC

CONSULTANT



YYYY-MM-DD 2017-06-22

DESIGNED MPK

PREPARED MPK

REVIEWED JGJ

APPROVED —

PROJECT
THE WOODLANDS
HORSESHOE LAKE PUMPING
INFILTRATION TESTING

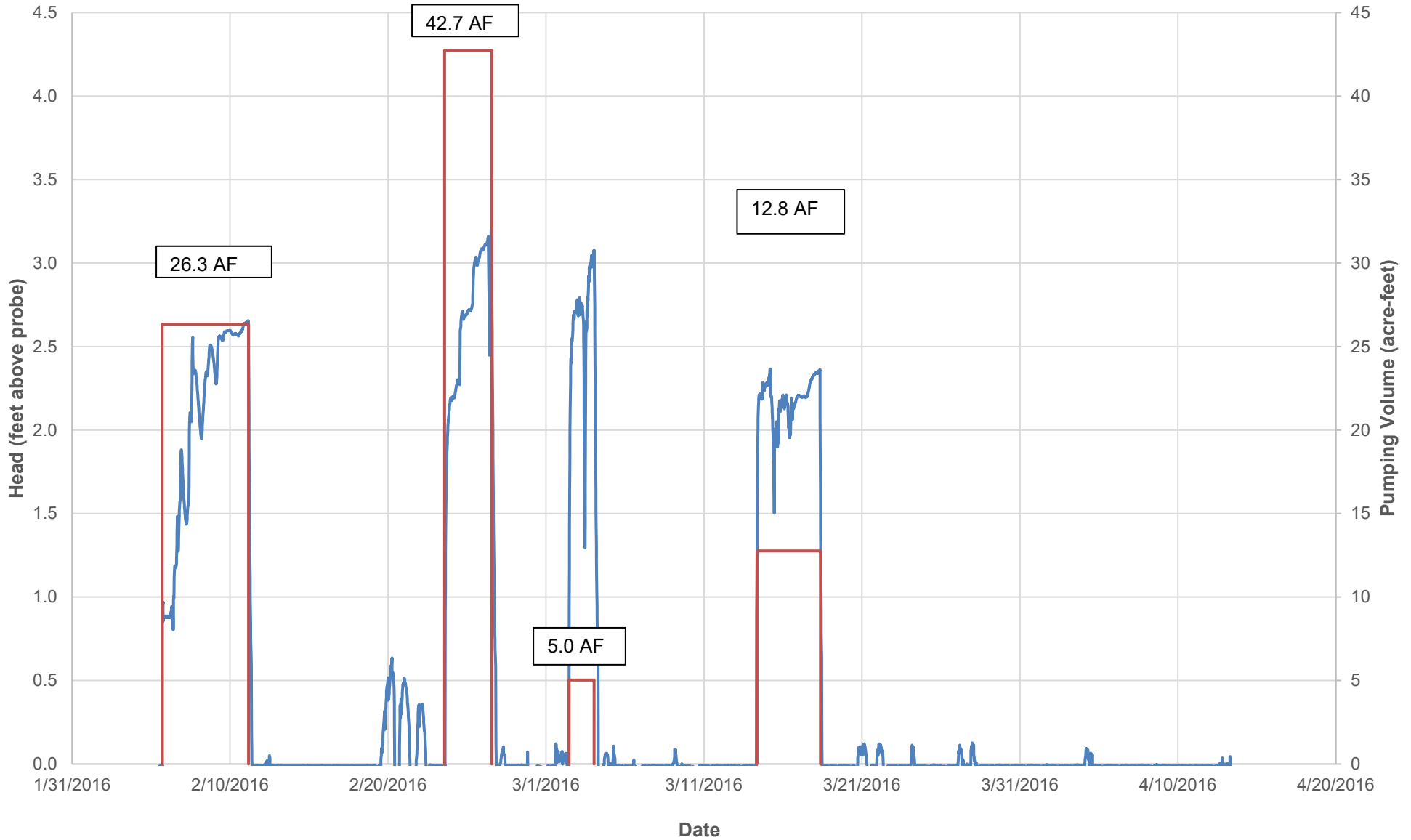
TITLE
**QUALIFYING TEST #1 INFILTRATION HYDROGRAPHS
HORSESHOE LAKE STAGE AND PUMPED VOLUME**

PROJECT NO.
063-1076.016.16

CONTROL

REV.
A

FIGURE
2



LEGEND

— Infiltration Pond

CLIENT
CCD BLACK DIAMOND PARTNERS LLC

CONSULTANT



YYYY-MM-DD 2017-06-22

DESIGNED MPK

PREPARED MPK

REVIEWED JGJ

APPROVED —

PROJECT
THE WOODLANDS
HORSESHOE LAKE PUMPING
INFILTRATION TESTING

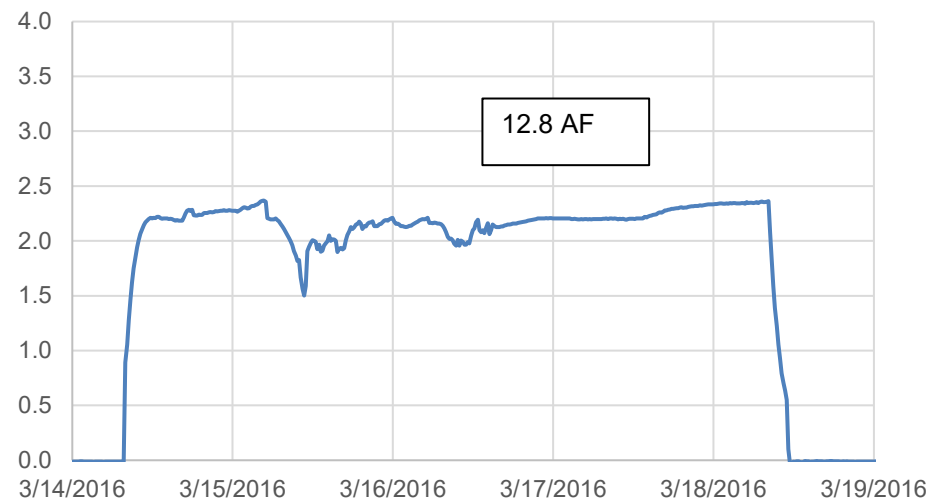
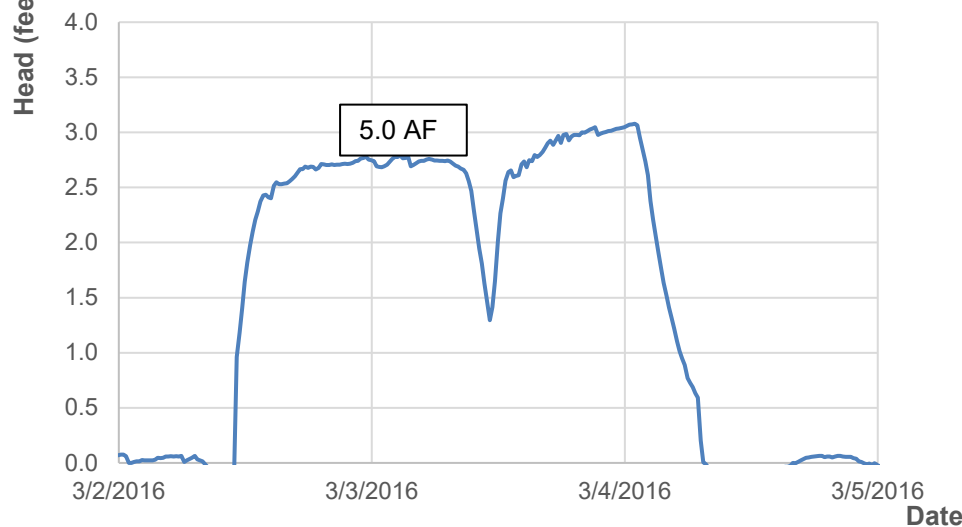
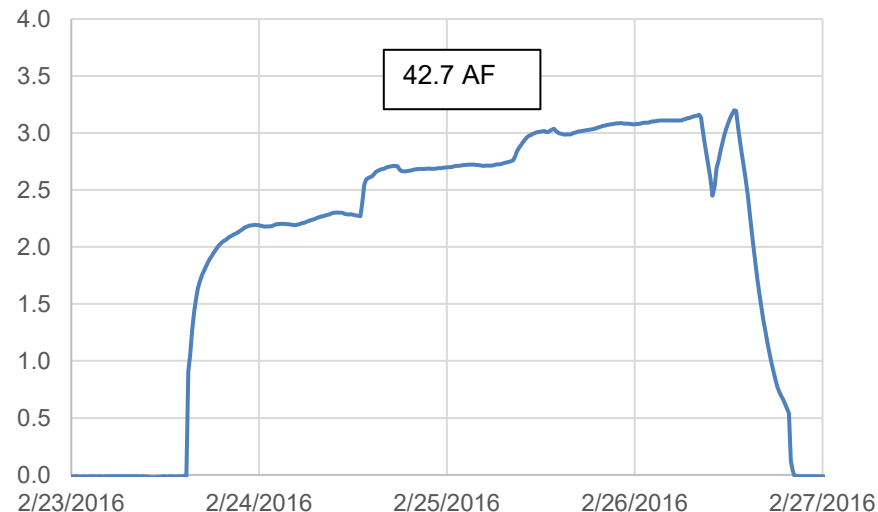
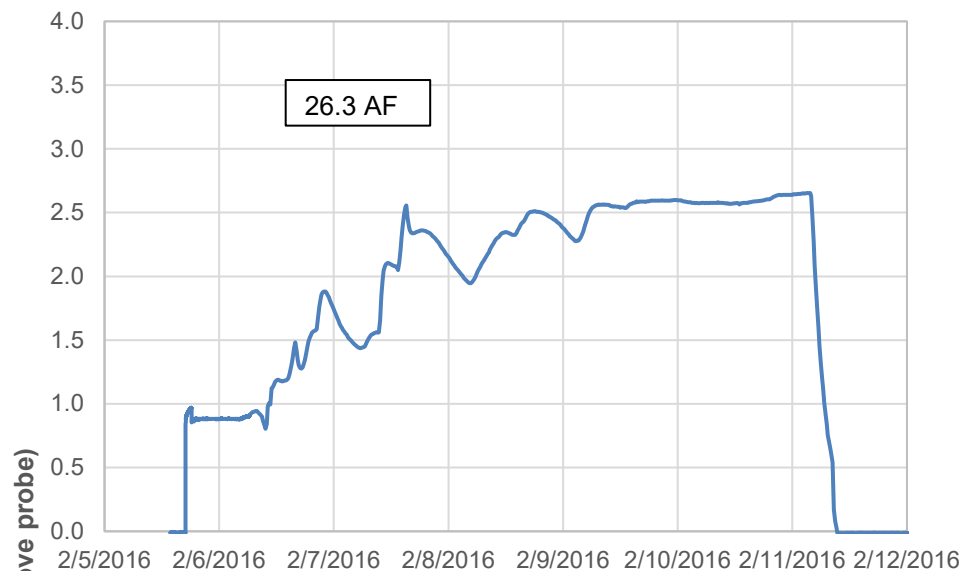
TITLE
**QUALIFYING TEST #1 INFILTRATION HYDROGRAPHS
INFILTRATION FACILITY STAGE AND PUMPED VOLUME**

PROJECT NO.
063-1076.016.16

CONTROL

REV.
A

FIGURE
3



LEGEND

— Infiltration Pond

CLIENT
CCD BLACK DIAMOND PARTNERS LLC

CONSULTANT



YYYY-MM-DD 2017-06-22

DESIGNED MPK

PREPARED MPK

REVIEWED JGJ

APPROVED —

PROJECT
THE WOODLANDS
HORSESHOE LAKE PUMPING
INFILTRATION TESTING

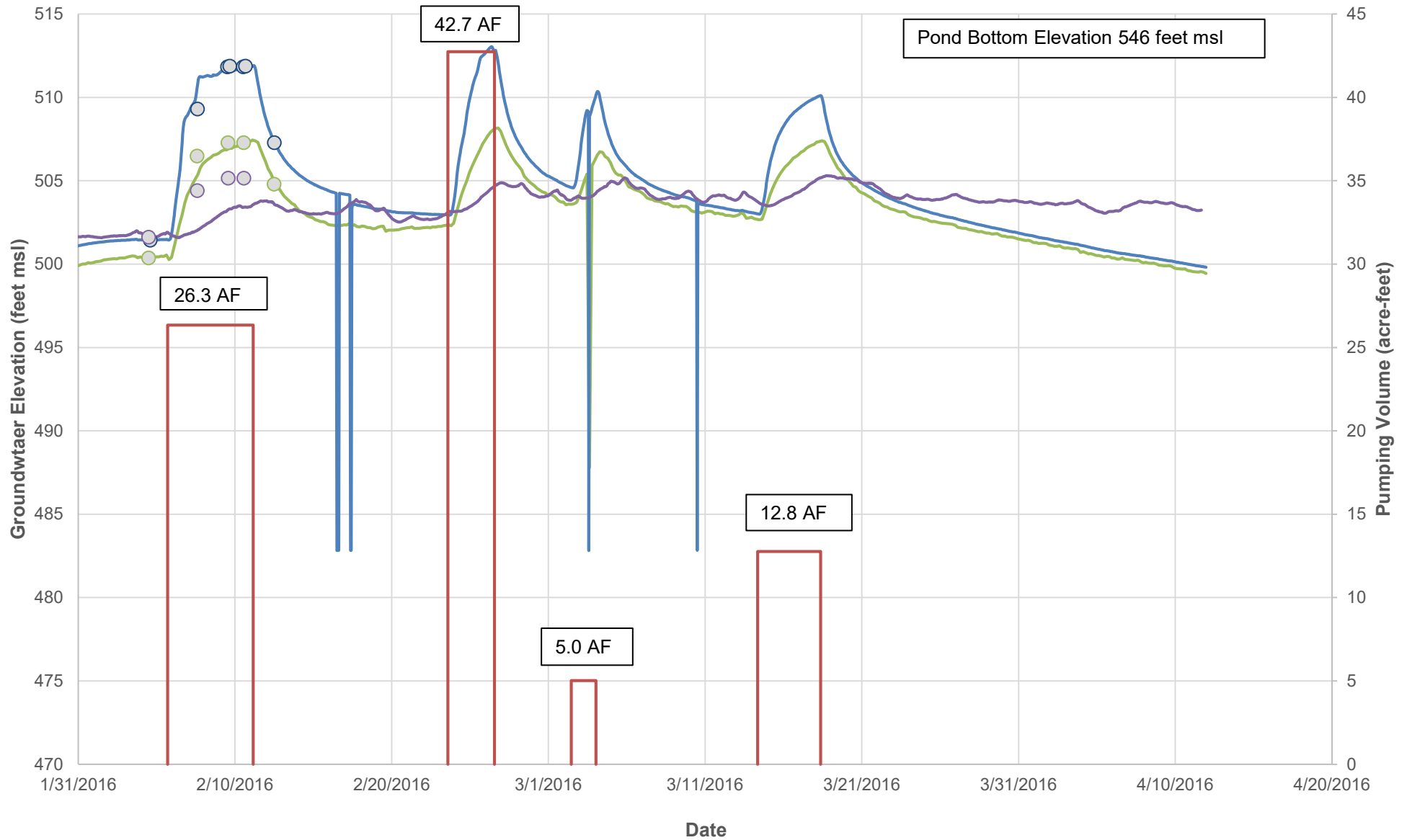
TITLE
**QUALIFYING TEST #1 INFILTRATION HYDROGRAPHS
INFILTRATION FACILITY STAGES
FOR PUMPING CYCLES**

PROJECT NO.
063-1076.016.16

CONTROL

REV.
A

FIGURE
4



LEGEND

- MW-29
- MW-30
- UIC-1
- Manual Measurements

CLIENT
CCD BLACK DIAMOND PARTNERS LLC

CONSULTANT



YYYY-MM-DD	2017-06-22
DESIGNED	MPK
PREPARED	MPK
REVIEWED	JGJ
APPROVED	—

PROJECT
THE WOODLANDS
HORSESHOE LAKE PUMPING
INFILTRATION TESTING

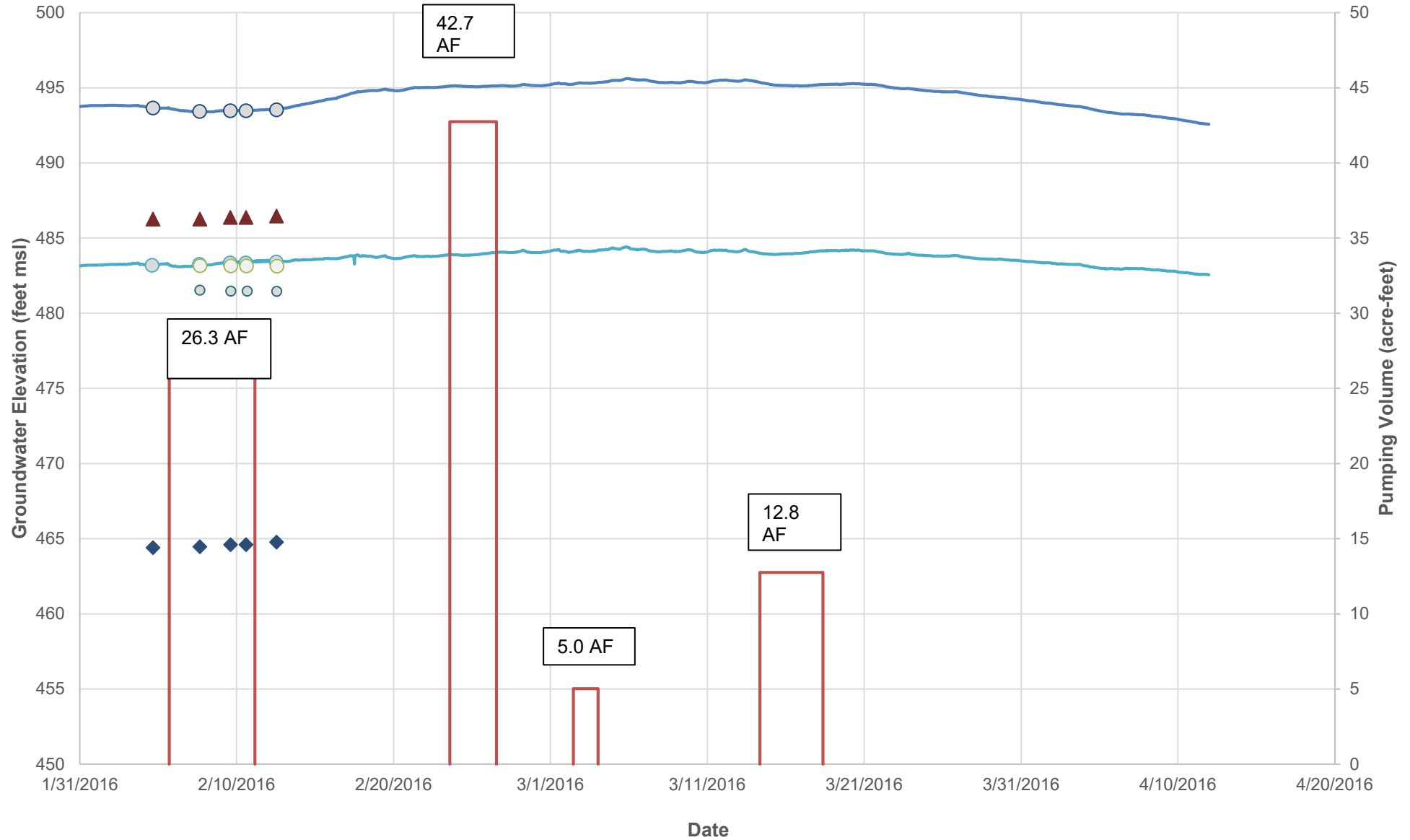
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**QUALIFYING TEST #1 HYDROGRAPHS
INFILTRATION FACILITY AREA
GROUNDWATER LEVELS**

PROJECT NO.
063-1076.016.16

CONTROL

REV.
A

FIGURE
5



LEGEND

- MW-10
- ◆ MW-11
- ▲ MW-12
- MW-13
- Manual Measurements
- Pumping Duration and Volume

CLIENT
CCD BLACK DIAMOND PARTNERS LLC

CONSULTANT



YYYY-MM-DD	2017-06-22
DESIGNED	MPK
PREPARED	MPK
REVIEWED	JGJ
APPROVED	—

PROJECT
THE WOODLANDS
HORSESHOE LAKE PUMPING
INFILTRATION TESTING

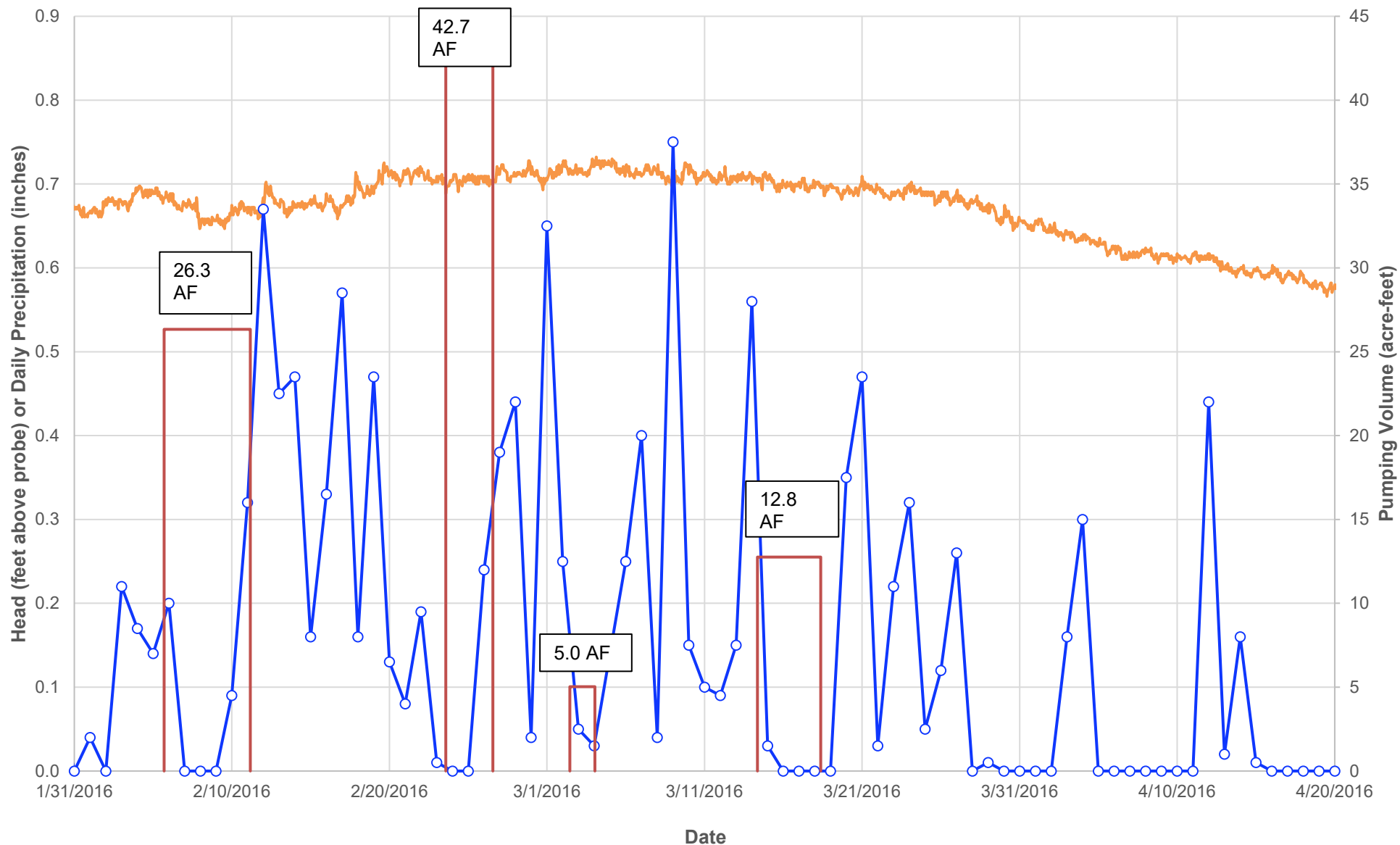
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**QUALIFYING TEST #1 HYDROGRAPHS
DISTAL MONITORING WELLS
GROUNDWATER LEVELS**

PROJECT NO.
063-1076.016.16

CONTROL

REV.
A

FIGURE
6



LEGEND

- Crisp Creek Tributary Stage
- Daily Precipitation
- Pumping Duration and Volume

CLIENT

CCD BLACK DIAMOND PARTNERS LLC

CONSULTANT



YYYY-MM-DD 2017-06-22

DESIGNED MPK

PREPARED MPK

REVIEWED JGJ

APPROVED —

PROJECT

THE WOODLANDS
HORSESHOE LAKE PUMPING
INFILTRATION TESTING

TITLE

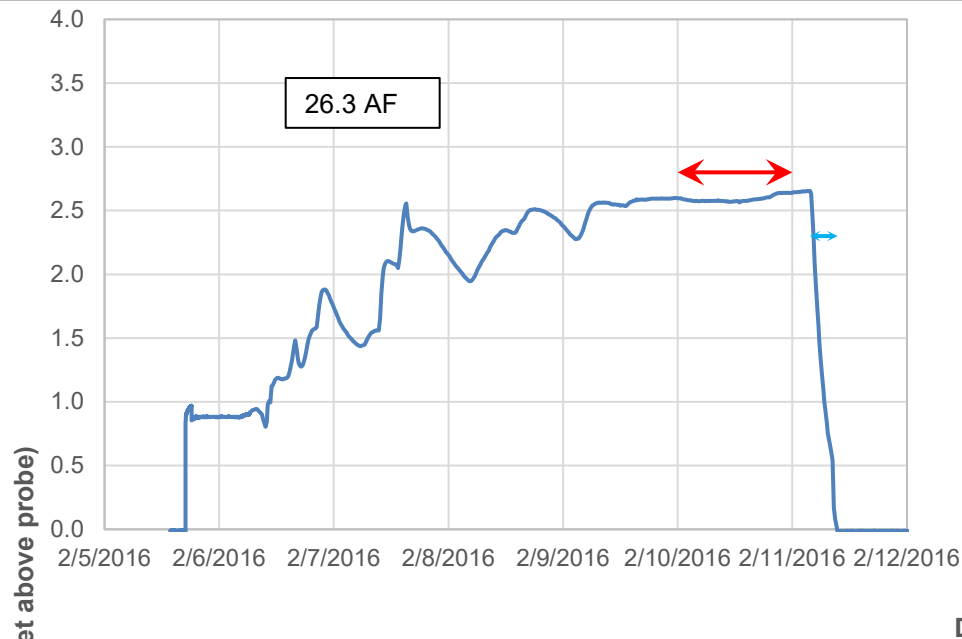
**QUALIFYING TEST #1 HYDROGRAPHS
CRISP CREEK TRIBUTARY STAGE**

PROJECT NO.
063-1076.016.16

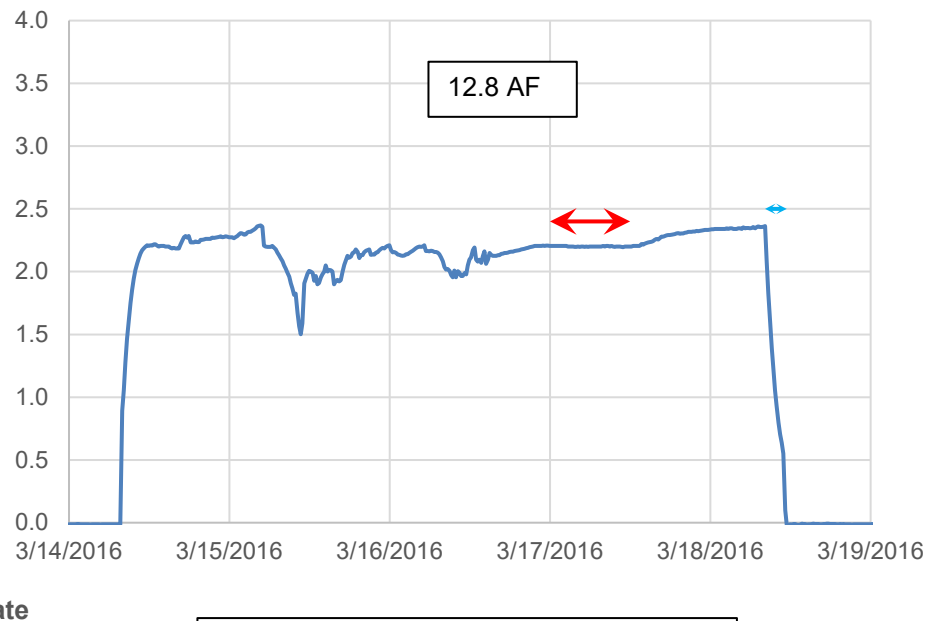
CONTROL

REV.
A

FIGURE
7



Infiltration Rate Summary:
Pumping Rate: 718 gpm
Constant Head: 7.0 in/hr over 24 hours
Falling Head: 5.6 in/hr over 5.75 hours



Infiltration Rate Summary:
Pumping Rate: 718 gpm
Constant Head: 7.0 in/hr over 12 hours
Falling Head: 8.7 in/hr over 3.25 hours

LEGEND

- Infiltration Pond
- ↔ Constant Head Interval
- Falling Head Interval

CLIENT
CCD BLACK DIAMOND PARTNERS LLC

CONSULTANT



YYYY-MM-DD 2017-06-22

DESIGNED MPK

PREPARED MPK

REVIEWED JGJ

APPROVED ---

PROJECT
THE WOODLANDS
HORSESHOE LAKE PUMPING
INFILTRATION TESTING

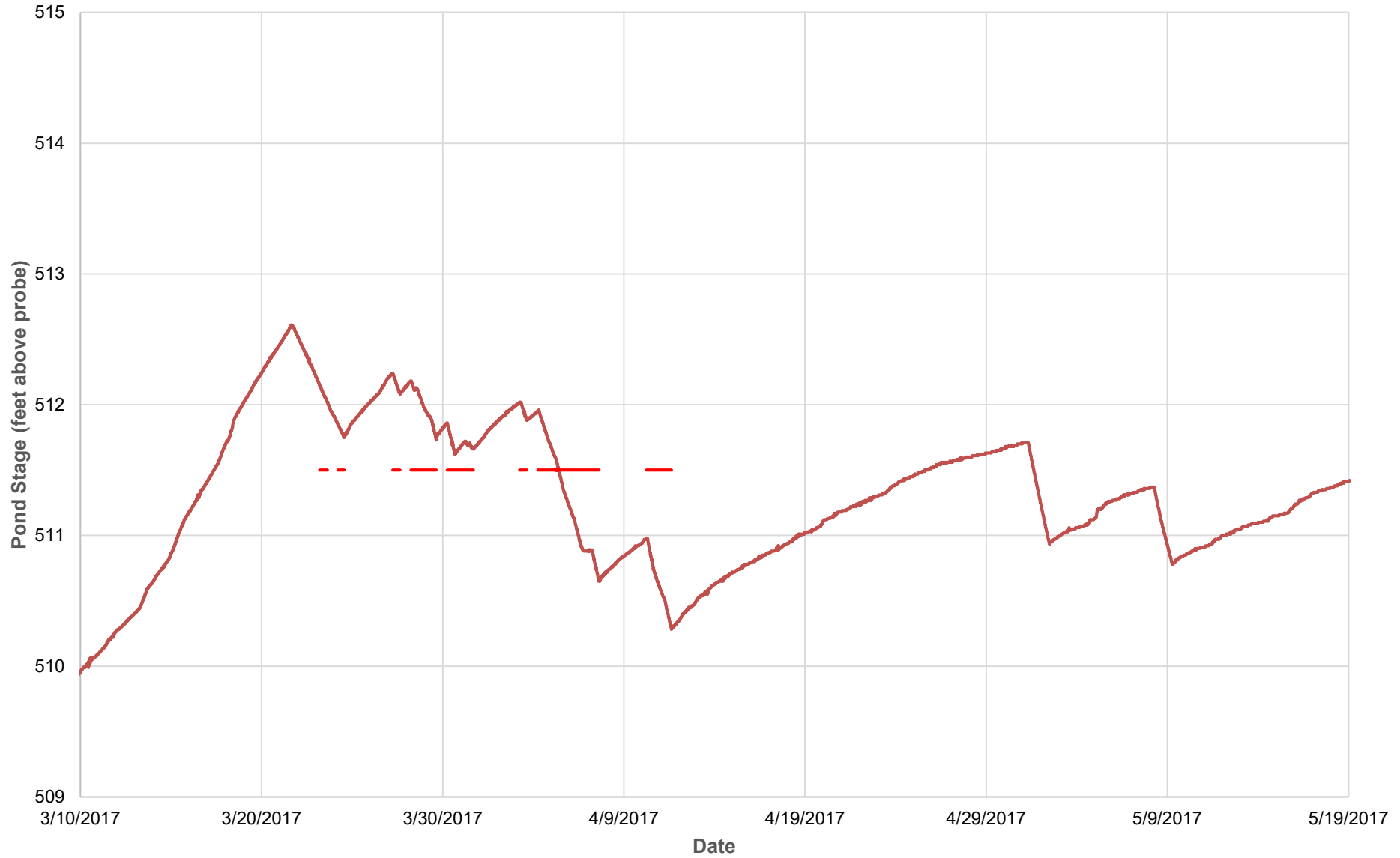
TITLE
QUALIFYING TEST #1 INFILTRATION RATE ANALYSIS

PROJECT NO.
063-1076.016.16

CONTROL

REV.
A

FIGURE
8



LEGEND

- Horseshoe Lake
- - - Pump On-Off (from King County)

CLIENT

CCD BLACK DIAMOND PARTNERS LLC

CONSULTANT



YYYY-MM-DD 2017-06-22

DESIGNED MPK

PREPARED MPK

REVIEWED JGJ

APPROVED —

PROJECT

THE WOODLANDS
HORSESHOE LAKE PUMPING
INFILTRATION TESTING

TITLE

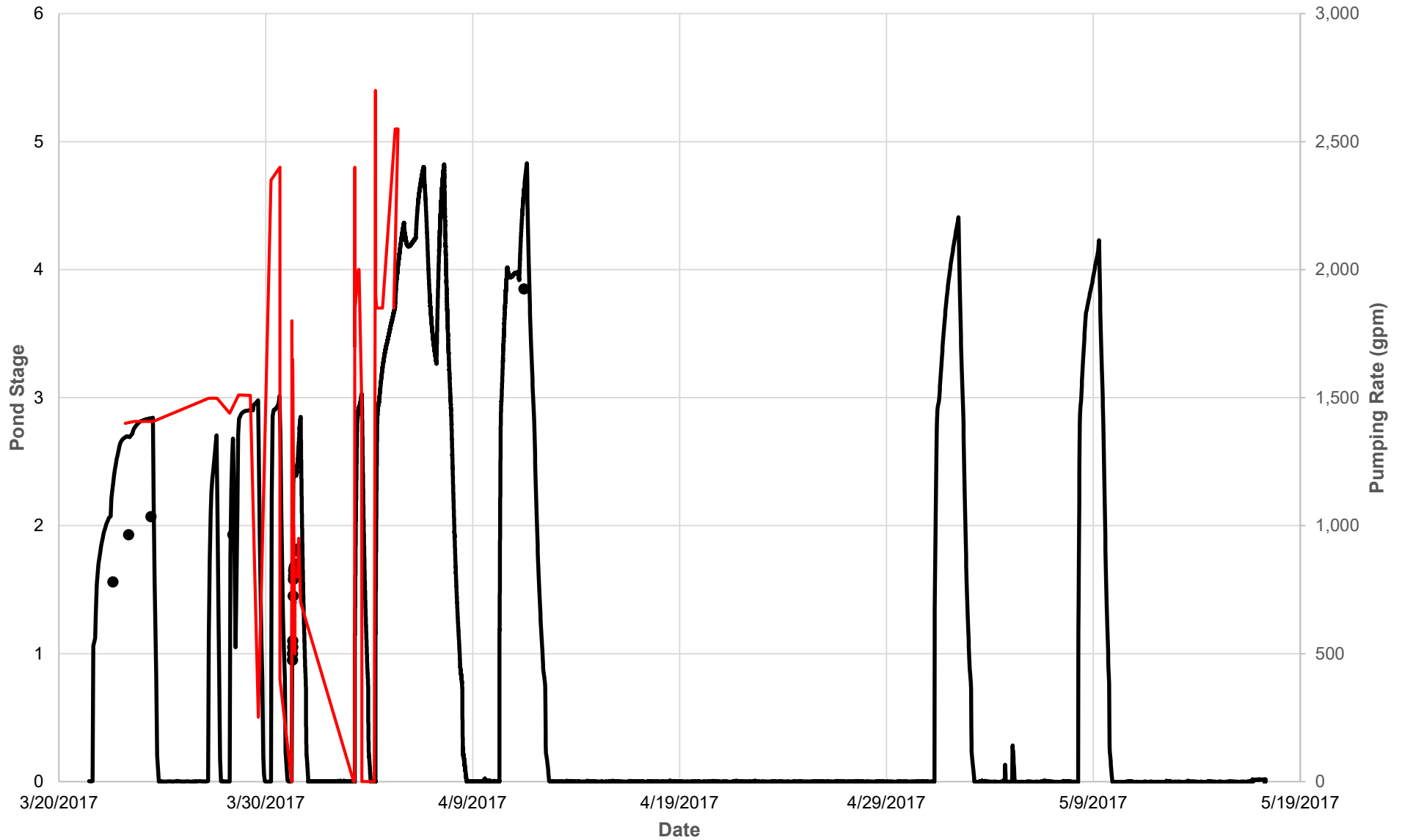
**QUALIFYING TEST #2 HYDROGRAPHS
HORSESHOE LAKE STAGE AND PUMPING PERIODS**

PROJECT NO.
063-1076.016.16

CONTROL

REV.
A

FIGURE
9



LEGEND

- Infiltration Pond
- Manual Stage Measurements
- Pumping Rate

CLIENT
CCD BLACK DIAMOND PARATNERS LLC

CONSULTANT



YYYY-MM-DD 2017-06-22

DESIGNED MPK

PREPARED MPK

REVIEWED JGJ

APPROVED —

PROJECT
THE WOODLANDS
HORSESHOE LAKE PUMPING
INFILTRATION TESTING

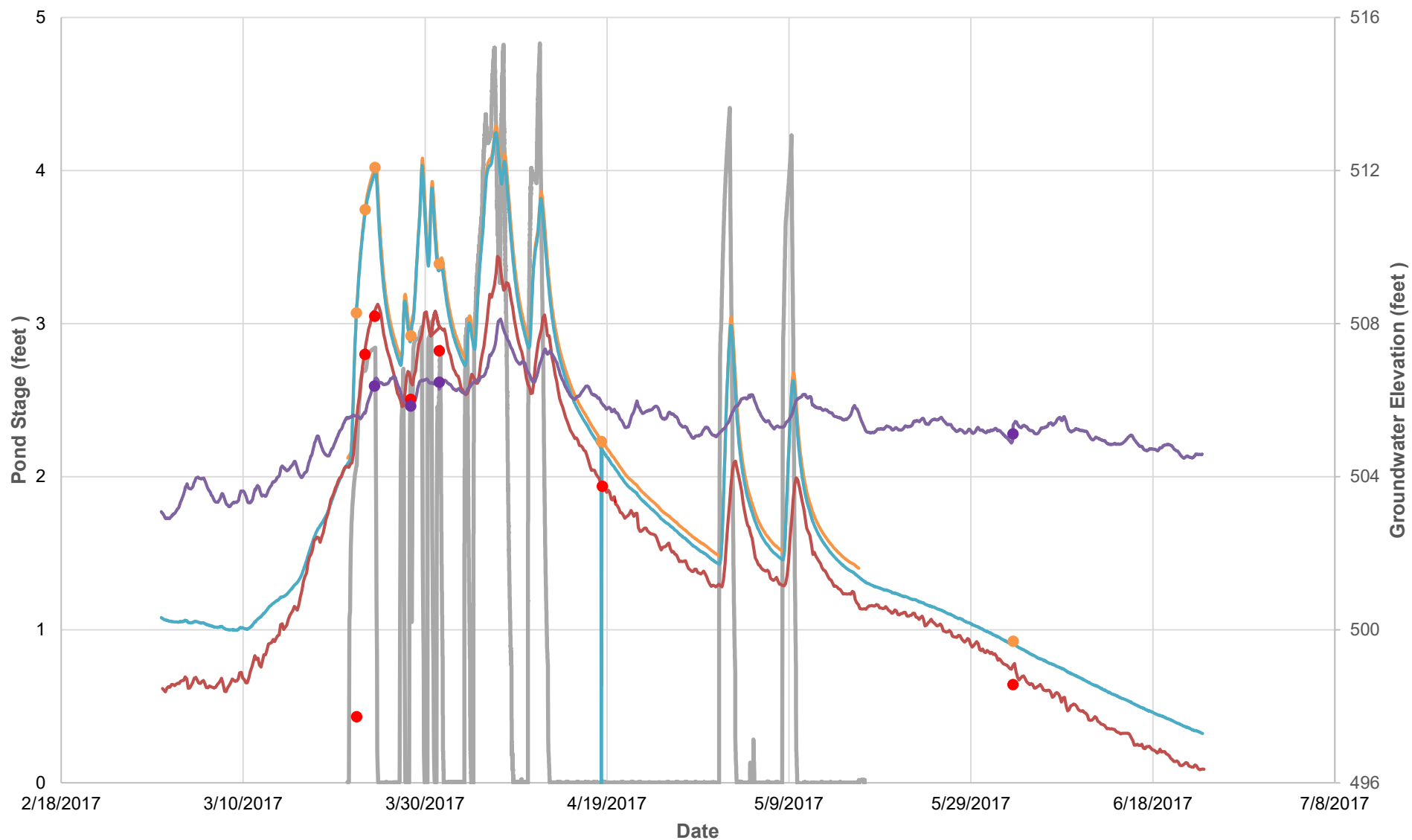
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**QUALIFYING TEST #2 HYDROGRAPHS
INFILTRATION FACILITY STAGE AND PUMPING RATES**

PROJECT NO.
063-1076.016.16

CONTROL

REV.
A

FIGURE
10



LEGEND

- Infiltration Pond
- MW-30
- MW-30 (Solinst)
- MW-29
- UIC-1

CLIENT
CCD BLACK DIAMOND PARTNERS LLC

CONSULTANT



YYYY-MM-DD 2017-06-22

DESIGNED MPK

PREPARED MPK

REVIEWED JGJ

APPROVED —

PROJECT
THE WOODLANDS
HORSESHOE LAKE PUMPING
INFILTRATION TESTING

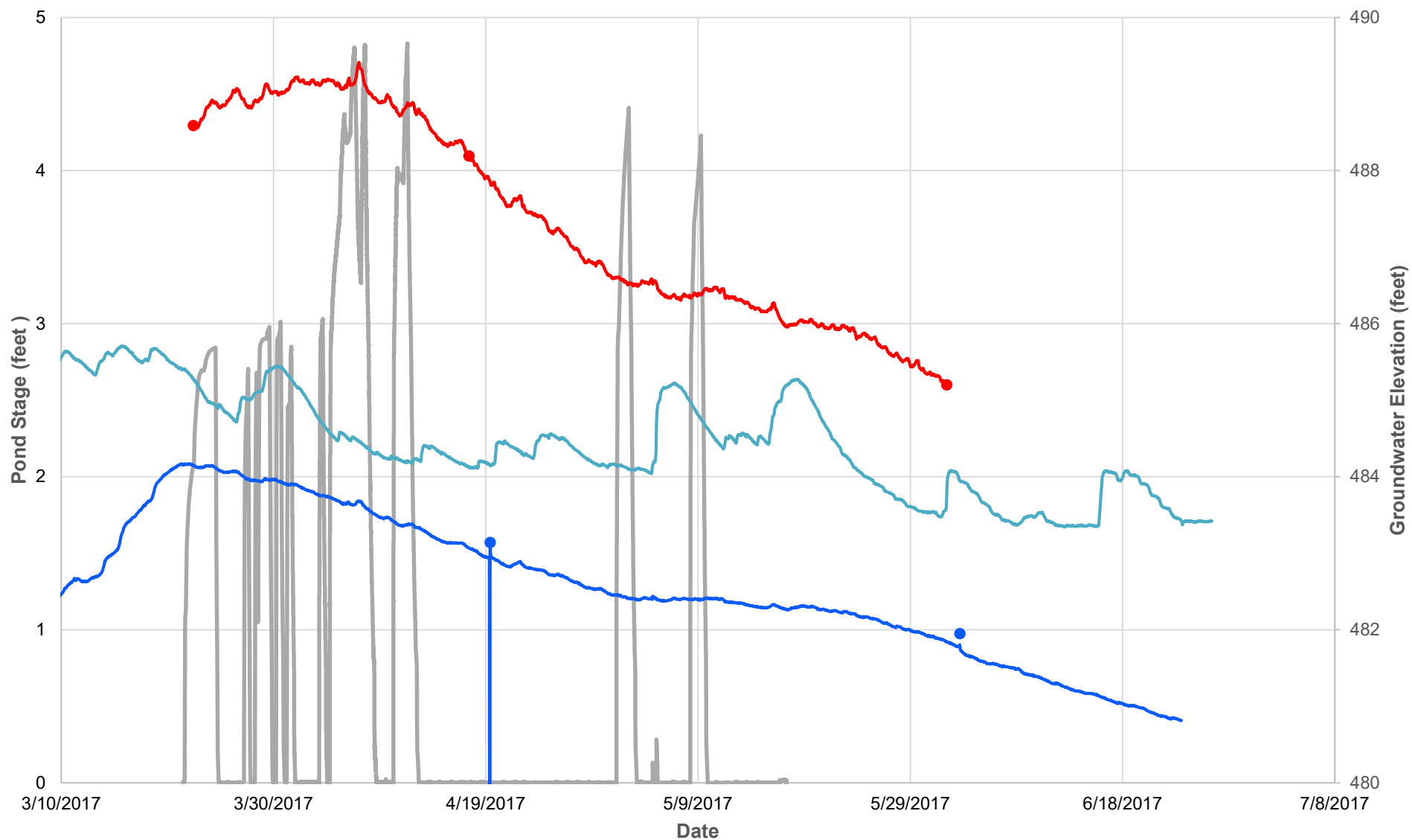
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**QUALIFYING TEST #2 HYDROGRAPHS
INFILTRATION FACILITY AREA GROUNDWATER LEVELS**

PROJECT NO.
063-1076.016.16

CONTROL

REV.
A

FIGURE
11



LEGEND

- Infiltration Pond
- MW-27
- MW-12
- MW-10

CLIENT

CCD BLACK DIAMOND PARATNERS LLC

CONSULTANT



YYYY-MM-DD 2017-06-22

DESIGNED MPK

PREPARED MPK

REVIEWED JGJ

APPROVED —

PROJECT

THE WOODLANDS
HORSESHOE LAKE PUMPING
INFILTRATION TESTING

TITLE

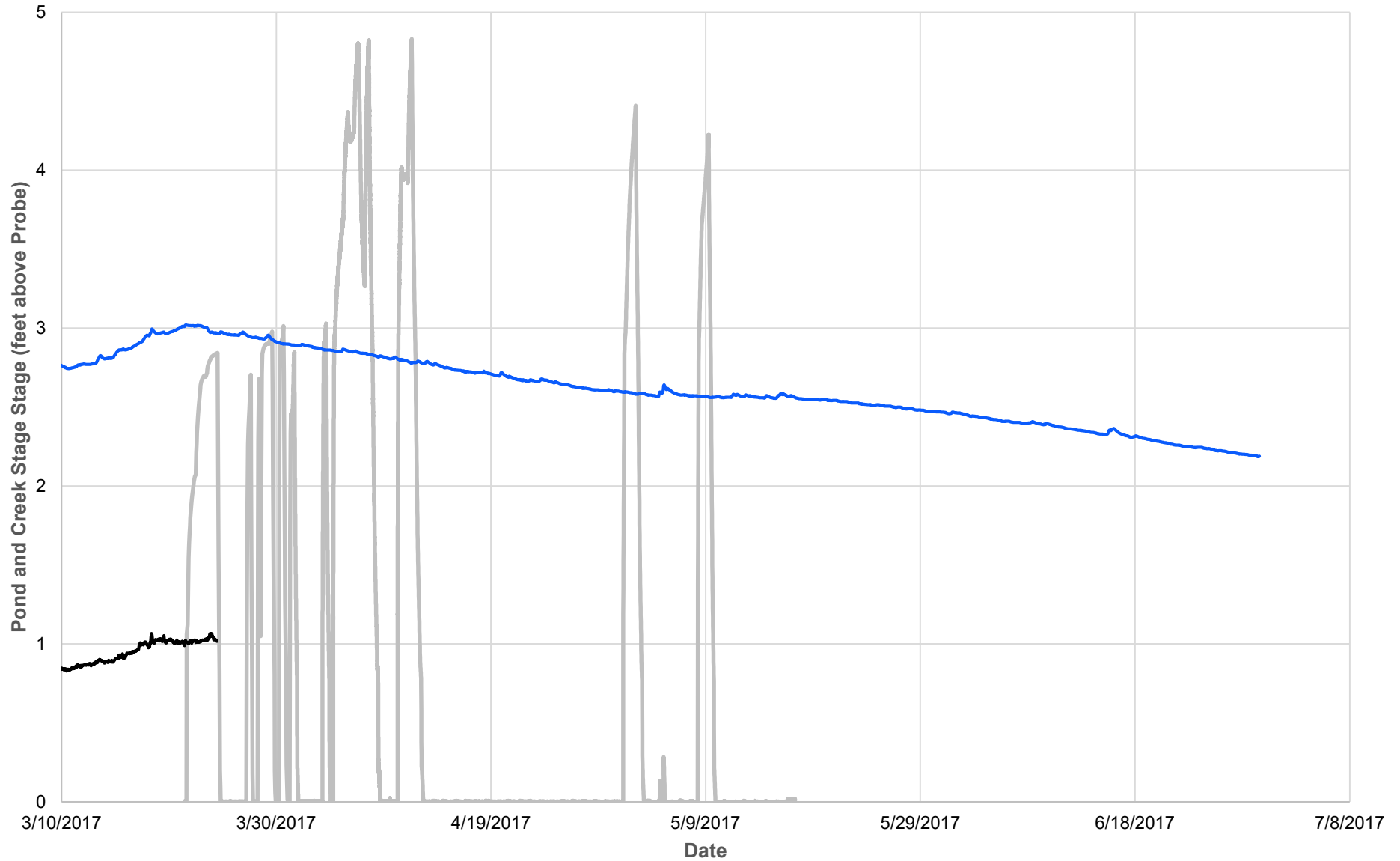
**QUALIFYING TEST #2 HYDROGRAPHS
DISTAL WELLS GROUNDWATER LEVELS**

PROJECT NO.
063-1076.016.16

CONTROL

REV.
A

FIGURE
12



LEGEND

- Infiltration Pond
- Crisp Creek Tributary
- King County Wetland

CLIENT
CCD BLACK DIAMOND PARTNERS LLC

CONSULTANT



YYYY-MM-DD	2017-06-22
DESIGNED	MPK
PREPARED	MPK
REVIEWED	JGJ
APPROVED	—

PROJECT
THE WOODLANDS
HORSESHOE LAKE PUMPING
INFILTRATION TESTING

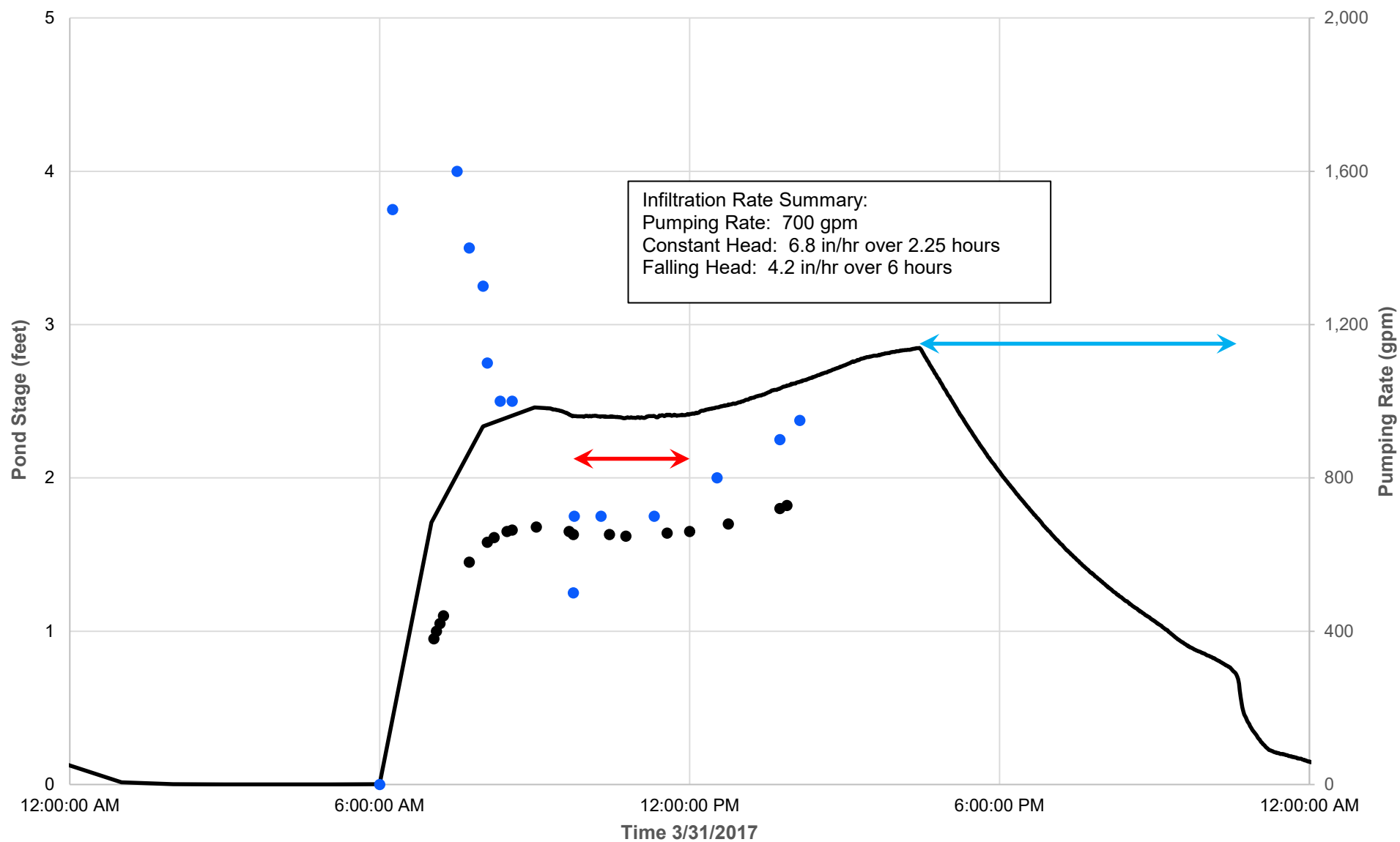
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**QUALIFYING TEST #2 INFILTRATION HYDROGRAPHS
CRISP CREEK TRIBUTARY
AND KING COUNTY WETLAND STAGE**

PROJECT NO.
063-1076.016.16

CONTROL

REV.
A

FIGURE
13



LEGEND

- Infiltration Pond
- Manual Stage Measurements
- Pumping Rate
- ◄ Constant Head Interval
- Falling Head Test Interval

CLIENT

CCD BLACK DIAMOND PARTNERS LLC

CONSULTANT



YYYY-MM-DD 2017-06-22

DESIGNED MPK

PREPARED MPK

REVIEWED JGJ

APPROVED —

PROJECT

THE WOODLANDS
 HORSESHOE LAKE PUMPING
 INFILTRATION TESTING

TITLE

QUALIFYING TEST #2 INFILTRATION RATE ANALYSIS

PROJECT NO.
 063-1076.016.16

CONTROL

REV.
 A

FIGURE
 14

APPENDIX C

Regional Stormwater Control Facility Exploration Logs

RECORD OF BOREHOLE GB-3

SHEET 1 of 4

PROJECT: BDVillages/The Villages Project DRILLING METHOD: Hollow Stem Auger
PROJECT NUMBER: 063-1076-001.503 DRILLING DATE: 10/14/10
LOCATION: Black Diamond, WA DRILL RIG: Marooka track-mount

DATUM: MSL
AZIMUTH: N/A
COORDINATES: not surveyed

ELEVATION: 552.19
INCLINATION: -90

DEPTH (ft)	BORING METHOD	SOIL PROFILE				SAMPLES				PENETRATION RESISTANCE BLOWS / ft ■					NOTES WATER LEVELS GRAPHIC				
		DESCRIPTION	USCS	GRAPHIC LOG	ELEV.	NUMBER	TYPE	BLOWS per 6 in 140 lb hammer 30 inch drop	N	REC / ATT	10	20	30	40					
					DEPTH (ft)						WATER CONTENT (PERCENT)								
											W _p	I ^W	W _L	W _I					
0	4.25-inch ID Hollow Stem Auger	0.0 - 8.0 Compact to dense, olive gray to gray, non-stratified, fine to coarse GRAVEL, some fine to coarse sand, trace silt, trace cobbles, damp to moist. (GW) (OUTWASH)	GW																
5		1			HD	7-21-22	43	1.1 1.5	○										
			8.0 - 13.0 Becomes fine to coarse SAND and fine to coarse GRAVEL, trace silt. (SW/GW)	SW/GW		544.2 8.0													
10																			
		2	HD			8-9-9	18	1.1 1.5	○										
			13.0 - 23.0 Becomes fine to coarse GRAVEL and fine to coarse SAND, trace silt, trace cobbles. (GW/SW)	GW/SW		539.2 13.0													
15																			
	3	HD	9-15-18			33	1.1 1.5	○											
20		Log continued on next page																	

Infiltration test

1 in to 3 ft
DRILLING CONTRACTOR: Cascade Drilling, LP
DRILLER: Andy

LOGGED: J. DeKoekkoek
CHECKED: J. Johnson
DATE: 1/6/2011



BOREHOLE RECORD 0631076001.503 BORINGS OCT2010.GPJ GLDR_WA.GDT 10/12/11

RECORD OF BOREHOLE GB-3

SHEET 2 of 4

PROJECT: BD Villages/The Villages Project DRILLING METHOD: Hollow Stem Auger
PROJECT NUMBER: 063-1076-001.503 DRILLING DATE: 10/14/10
LOCATION: Black Diamond, WA DRILL RIG: Marooka track-mount

DATUM: MSL
AZIMUTH: N/A
COORDINATES: not surveyed

ELEVATION: 552.19
INCLINATION: -90

DEPTH (ft)	BORING METHOD	SOIL PROFILE				SAMPLES				PENETRATION RESISTANCE BLOWS / ft ■				NOTES WATER LEVELS GRAPHIC		
		DESCRIPTION	USCS	GRAPHIC LOG	ELEV.	NUMBER	TYPE	BLOWS per 6 in 140 lb hammer 30 inch drop	N	REC / ATT	WATER CONTENT (PERCENT)					
					DEPTH (ft)						W _p ——— W _L					
												10	20	30	40	
20	4.25-inch ID Hollow Stem Auger	13.0 - 23.0 Becomes fine to coarse GRAVEL and fine to coarse SAND, trace silt, trace cobbles. (GW/SW) (Continued)	GW/SW		529.2 23.0	4	HD	6-9-10	19	$\frac{1.1}{1.5}$	○	■			performed at 20 ft bgs.	
		23.0 - 28.0 Becomes fine to coarse GRAVEL, some fine to coarse sand, trace silt. (GW)	GW										■			
25																
		28.0 - 33.0 Becomes fine to coarse SAND and fine to coarse GRAVEL, trace silt. (SP/GP)	SP/GP		524.2 28.0											
30						6	HD	4-8-13	21	$\frac{0.8}{1.5}$	○		■		Infiltration test performed at 30 ft bgs.	
		33.0 - 48.0 Becomes very dense, fine to coarse GRAVEL and to some fine to coarse SAND, trace silt. (GW/SW)	GW/SW		519.2 33.0											
35					7	HD	10-25-33	>50	$\frac{0.8}{1.5}$	○		■		Backfilled with bentonite chips.		
40																

Log continued on next page.

BOREHOLE RECORD 0631076001.503 BORINGS OCT2010.GPJ GLDR_WA.GDT 10/12/11

1 in to 3 ft
DRILLING CONTRACTOR: Cascade Drilling, LP
DRILLER: Andy

LOGGED: J. DeKoekkoek
CHECKED: J. Johnson
DATE: 1/6/2011



SHEET 3 of 4
ELEVATION: 552.19
INCLINATION: -90

DATUM: MSL
AZIMUTH: N/A
COORDINATES: not surveyed

[illegible]

BOREHOLE RECORD 0631076001.503_BORINGS OCT2010.GPJ GLDR_WA.GDT 10/12/11

1 in to 3 ft
DRILLING CONTRACTOR: Cascade Drilling, LP
DRILLER: Andy

LOGGED: J. DeKoekkoek
CHECKED: J. Johnson
DATE: 1/6/2011



RECORD OF BOREHOLE GB-3

SHEET 4 of 4

PROJECT: BD Villages/The Villages Project DRILLING METHOD: Hollow Stem Auger
PROJECT NUMBER: 063-1076-001.503 DRILLING DATE: 10/14/10
LOCATION: Black Diamond, WA DRILL RIG: Marooka track-mount

DATUM: MSL
AZIMUTH: N/A
COORDINATES: not surveyed

ELEVATION: 552.19
INCLINATION: -90

DEPTH (ft)	BORING METHOD	SOIL PROFILE				SAMPLES					PENETRATION RESISTANCE BLOWS / ft ■					NOTES WATER LEVELS GRAPHIC			
		DESCRIPTION	USCS	GRAPHIC LOG	ELEV.	NUMBER	TYPE	BLOWS per 6 in 140 lb hammer 30 inch drop	N	REC / ATT	WATER CONTENT (PERCENT)								
					DEPTH (ft)						W _p		W _L						
60	4.25-inch ID Hollow Stem Auger	58.0 - 63.0 Becomes fine to coarse SAND, little fine gravel, little silt. (SW-SM) (Continued)	SW-SM			12	HD	8-17-16	33	$\frac{1.2}{1.5}$							Originally logged as BH-B.		Groundwater measured 62.8 ft bgs during drilling.
		63.0 - 68.0 Becomes dense, fine to coarse SAND, little silt, trace fine gravel, wet. (SP-SM)	SP-SM		489.2 63.0														
65																			
		68.0 - 71.5 Dense, gray, thinly laminated, SILT, wet. (ML) (GLACIOLACUSTRINE DEPOSIT)	ML		484.2 68.0														
70																			
						14	HD	10-12-20	32	$\frac{0.8}{1.5}$									
		Boring completed at 71.5 ft.			480.7 71.5														
75																			
80																			

Groundwater measured 62.8 ft bgs during drilling.

BOREHOLE RECORD 0631076001.503 BORINGS OCT2010.GPJ GLDR_WA.GDT 10/12/11

1 in to 3 ft
DRILLING CONTRACTOR: Cascade Drilling, LP
DRILLER: Andy

LOGGED: J. DeKoekkoek
CHECKED: J. Johnson
DATE: 1/6/2011



RECORD OF BOREHOLE: GB-4

Sheet 1 of 2

CLIENT: Oakpointe

PROJECT: Reserve at Woodlands

PROJECT NO: 063107621A

LOCATION: Black Diamond, WA

DATE: January 06, 2022

INCLINATION: -90.0°

CONTRACTOR: AEC

ELEVATION: 548.2 ft (Ground)

COORDINATES: N: 110518.0 ft E: 1341046.3 ft

COORD SYS: SP WA North FIPS 4601 Ft

HORZ DATUM: NAD83

HOLE LOC: E of the road intersection S of pond

DEPTH (ft)	DRILL RIG	DRILL METHOD	MATERIAL PROFILE				SAMPLES				SOIL CORE				GROUNDWATER OBSERVATIONS	
			DESCRIPTION	USCS	STRATA PLOT	ELEV. ----- DEPTH (ft)	Hammer: N/A ASTM D1586, Blows per 0.15 m 623-N hammer, 0.76-m drop				RUN NO.	REC %				
							NUMBER	TYPE	REC %	N-VALUE		20	40	60		80
1	TSI 150 cc Sonic Drilling		No recovery			0.0					1					
2																
3																
4																
5																
6																
7																
8																
9																
10																
11																
12																
13																
14																
15																
16																
17																
18																
19																
20																
21																
22																
23																
24																
25																
Continued on Next Page																

Continued on Next Page

HAMMER TYPE: N/A



REV:

4

LOGGED: M. Stearn
CHECKED: J. Johnson

DATE: Jan 06, 2022
DATE: Jun 06, 2022

RECORD OF BOREHOLE: GB-4

Sheet 2 of 2

CLIENT: Oakpointe

PROJECT: Reserve at Woodlands

PROJECT NO: 063107621A

LOCATION: Black Diamond, WA

DATE: January 06, 2022

INCLINATION: -90.0°

CONTRACTOR: AEC

ELEVATION: 548.2 ft (Ground)

COORDINATES: N: 110518.0 ft E: 1341046.3 ft

COORD SYS: SP WA North FIPS 4601 Ft

HORZ DATUM: NAD83

HOLE LOC: E of the road intersection S of pond

DEPTH (ft)		DRILL RIG	DRILL METHOD	MATERIAL PROFILE				SAMPLES				SOIL CORE				GROUNDWATER OBSERVATIONS			
				DESCRIPTION	USCS	STRATA PLOT	ELEV. DEPTH (ft)	Hammer: N/A ASTM D1586, Blows per 0.15 m 623-N hammer, 0.76-m drop				RUN NO.	REC %						
								NUMBER	TYPE	REC %	N-VALUE		20	40	60		80		
26		TSI 150 cc Sonic Drilling		(SM) gravelly SILTY SAND, fine to coarse rounded to subrounded, low-plasticity fines, fine to coarse subrounded to subangular gravel, trace subrounded to subangular cobbles; weak stratification; light brown to brownish gray; moist. (Qvr)	SM				2	GS				3					
27																			
28																			
29																			
30																			
31																			
32																			
33																			
34																			
35																			
36																			
37																			
38																			
39																			
40																			
41																			
42																			
43																			
44																			
45																			
46																			
47																			
48																			
49																			
50																			
				(GM) sandy SILTY GRAVEL, fine to coarse rounded to subrounded, non-plastic fines, fine to coarse rounded to subrounded sand, trace rounded to subrounded cobbles; reddish gray, weathered, iron oxide staining; moist. (Qvr)	GM				3	GS									
				(SM) SILTY SAND, fine to coarse, subrounded to rounded, non-plastic fines, some fine to coarse subrounded gravel; light brown to dark brownish gray, moist. (Qvr)	SM									4					
31																			
32																			
33																			
34																			
35																			
36																			
37																			
38																			
39																			
40																			
41																			
42																			
43																			
44																			
45																			
46																			
47																			
48																			
49																			
50																			
				- 45.0 to 46.0 ft: gravel pocket										5					
45																			
46																			
47																			
48																			
49																			
50																			
				End of hole at 50.00 ft.															

HAMMER TYPE: N/A



LOGGED: M. Stearn
CHECKED: J. Johnson

DATE: Jan 06, 2022
DATE: Jun 06, 2022

REV:
4

RECORD OF BOREHOLE: GB-5

Sheet 1 of 3

CLIENT: Oakpoint

PROJECT: Reserve at Woodlands

PROJECT NO: 063107621A

LOCATION: Black Diamond, WA

DATE: February 25, 2022

INCLINATION: -90.0°

CONTRACTOR: AEC

ELEVATION: 553.9 ft (Ground)

COORDINATES: N: 111577.2 ft E: 1341099.7 ft

COORD SYS: SP WA North FIPS 4601 Ft

HORZ DATUM: NAD83

DEPTH (ft)	DRILL RIG	DRILL METHOD	MATERIAL PROFILE				SAMPLES				SOIL CORE				GROUNDWATER OBSERVATIONS													
			DESCRIPTION	USCS	STRATA PLOT	ELEV. ----- DEPTH (ft)	Hammer: N/A ASTM D1586, Blows per 0.15 m 623-N hammer, 0.76-m drop				RUN NO.	REC %																
							NUMBER	TYPE	REC %	N-VALUE		20	40	60		80												
1	TSI 150 cc Sonic Drilling		Forest duff.			0.0						1																
(SM) SILTY SAND, fine to medium, low-plasticity fines, some fine to coarse subrounded gravel; reddish brown, trace rootlets; moist. (Qvr)			SM		552.9 1.0																							
(SP) gravelly SAND, fine to medium, poorly graded, fine to coarse subrounded to subangular gravel, some non-plastic fines; dark grayish brown, heterogeneous; moist. (Qvr)			SP		550.4 3.5																							
10			No recovery			543.9 10.0												SC-1	GS	2								

Continued on Next Page

HAMMER TYPE: N/A



REV:

4

LOGGED: M. Rutte
CHECKED: J. Johnson

DATE: Feb 25, 2022
DATE: Jun 06, 2022

RECORD OF BOREHOLE: GB-5

Sheet 2 of 3

CLIENT: Oakpointe

PROJECT: Reserve at Woodlands

PROJECT NO: 063107621A

LOCATION: Black Diamond, WA

DATE: February 25, 2022

INCLINATION: -90.0°

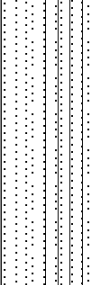
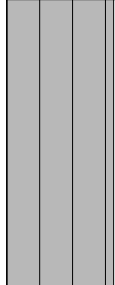
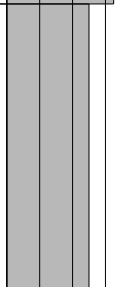
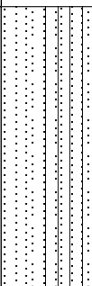
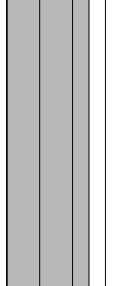
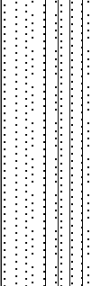
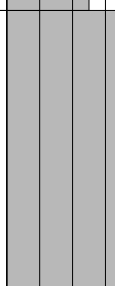
CONTRACTOR: AEC

ELEVATION: 553.9 ft (Ground)

COORDINATES: N: 111577.2 ft E: 1341099.7 ft

COORD SYS: SP WA North FIPS 4601 Ft

HORZ DATUM: NAD83

DEPTH (ft)	DRILL RIG	DRILL METHOD	MATERIAL PROFILE				SAMPLES				SOIL CORE				GROUNDWATER OBSERVATIONS					
			DESCRIPTION	USCS	STRATA PLOT	ELEV. ----- DEPTH (ft)	Hammer: N/A ASTM D1586, Blows per 0.15 m 623-N hammer, 0.76-m drop				RUN NO.	REC %								
							NUMBER	TYPE	REC %	N-VALUE		20	40	60		80				
26	TSI 150 cc Sonic Drilling		(SP-SM) gravelly SAND, fine to medium, poorly graded, fine to coarse subrounded to subangular gravel, some non-plastic fines; dark grayish brown; moist. (Qvr)	SP-SM		527.4 26.5						3								
(SP-SM) SAND, fine to medium, poorly graded, some non-plastic fines; brown; moist. (Qvr)			SC-2												GS					
28																				
29																				
30					No recovery			523.9 30.0						4						
31																				
32																				
33																				
34																				
35			(SP-SM) SAND, fine to medium, poorly graded, some non-plastic fines; brownish yellow; moist. (Qvr)	SP-SM		518.9 35.0							5							
36			- 36.0 to 36.5 ft: light gray to white silt layer																	
37																				
38								SC-3	GS											
39																				
40							B-4	GS												
41																				
42																				
43																				
44			- 44.0 ft: sand coarsens																	
45																				
46			(SP-SM) gravelly SAND, medium, poorly graded, some low-plasticity fines, some fine to coarse subrounded to subangular gravel, trace subrounded to subangular cobbles; grayish brown, non-stratified, heterogeneous; moist. (Qvr)			507.9 46.0														
47						SC-4	GS													
48																				
49						B-5	GS													
50																				

Continued on Next Page

HAMMER TYPE: N/A



REV:

4

LOGGED: M. Rutte

DATE: Feb 25, 2022

CHECKED: J. Johnson

DATE: Jun 06, 2022

RECORD OF BOREHOLE: GB-5

Sheet 3 of 3

CLIENT: Oakpointe

PROJECT: Reserve at Woodlands

PROJECT NO: 063107621A

LOCATION: Black Diamond, WA

DATE: February 25, 2022

INCLINATION: -90.0°

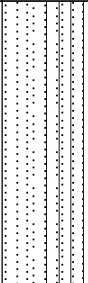
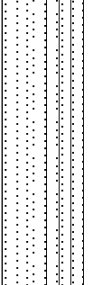
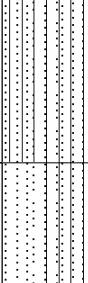
CONTRACTOR: AEC

ELEVATION: 553.9 ft (Ground)

COORDINATES: N: 111577.2 ft E: 1341099.7 ft

COORD SYS: SP WA North FIPS 4601 Ft

HORZ DATUM: NAD83

DEPTH (ft)	DRILL RIG	DRILL METHOD	MATERIAL PROFILE				SAMPLES				SOIL CORE				GROUNDWATER OBSERVATIONS							
			DESCRIPTION	USCS	STRATA PLOT	ELEV. ----- DEPTH (ft)	Hammer: N/A ASTM D1586, Blows per 0.15 m 623-N hammer, 0.76-m drop				RUN NO.	REC %										
							NUMBER	TYPE	REC %	N-VALUE		20	40	60		80						
51	TSI 150 cc Sonic Drilling		(SP-SM) gravelly SAND, medium, poorly graded, some low-plasticity fines, some fine to coarse subrounded to subangular gravel, trace subrounded to subangular cobbles; grayish brown, non-stratified, heterogeneous; moist. (Qvr)	SP-SM			SC-	5	GS	6												
52																						
53							SC-	6	GS													
54																						
55																						
56																						
57			- 55.0 ft: sand coarsens	SP-SM			B-6	GS														
58																						
59																						
60			(SM) SILTY SAND, fine to coarse, non-plastic fines, some fine to coarse subrounded to subangular gravel; dark grayish brown, non-stratified, heterogeneous; wet. (Qvr)	SM		491.9 62.0					7											
61																						
62																						
63			(SP-SM) SAND and GRAVEL, fine to coarse sand, fine to coarse subrounded to subangular gravel, poorly graded, some low-plasticity fines, trace subrounded to subangular cobbles; dark grayish brown, non-stratified, heterogeneous, socketed matrix; moist. (Qpog)	SP-SM		486.4 67.5	SC-	7	GS													
64																						
65																						
66				SP-SM		483.9	SC-	8	GS													
67																						
68							B-7	GS														
69			End of hole at 70.00 ft.																			
70																						
71																						
72																						
73																						
74																						
75																						

RECORD OF BOREHOLE: GB-6

Sheet 1 of 4

CLIENT: Oakpointe

PROJECT: Reserve at Woodlands

PROJECT NO: 063107621A

LOCATION: Black Diamond, WA

DATE: February 24, 2022

INCLINATION: -90.0°

CONTRACTOR: AEC

ELEVATION: 554.8 ft (Ground)

COORDINATES: N: 111421.3 ft E: 1341102.3 ft

COORD SYS: SP WA North FIPS 4601 Ft

HORZ DATUM: NAD83

DEPTH (ft)	DRILL RIG	DRILL METHOD	MATERIAL PROFILE				SAMPLES				SOIL CORE				GROUNDWATER OBSERVATIONS		
			DESCRIPTION	USCS	STRATA PLOT	ELEV. DEPTH (ft)	Hammer: N/A ASTM D1586, Blows per 0.15 m 623-N hammer, 0.76-m drop				RUN NO.	REC %					
							NUMBER	TYPE	REC %	N-VALUE		20	40	60		80	
1	TSI 150 cc Sonic Drilling		Topsoil.			0.0					1						
							553.8										
2			(SM) SILTY SAND, fine to medium, low-plasticity fines, some fine to coarse subrounded gravel; reddish brown, trace roots; moist. (Qvr)	SM		1.0											
3			(GP-GM) GRAVEL and SAND, fine to coarse subrounded to subangular gravel, medium to coarse sand, poorly graded, some low-plasticity fines; grayish brown, non-stratified, heterogeneous, socketed matrix; moist to wet. (Qvr)	GP-GM		552.8											
4						2.0											
5																	
6																	
7																	
8																	
9																	
10						- 9.0 ft: color change to gray											
11						No recovery				544.8							
12										10.0							
13																	
14																	
15																	
16																	
17																	
18																	
19								535.8									
20			(SP-SM) SAND and GRAVEL, medium to coarse sand, fine to coarse subrounded to subangular gravel, poorly graded, some low-plasticity fines; grayish brown, non-stratified, heterogeneous, socketed matrix; moist to wet. (Qvr)	SP-SM		19.0											
21			19.0 to 20.0 ft: slough (SP) SAND, medium to coarse, poorly graded, trace non-plastic fines, trace fine subrounded gravel; light brown; moist. (Qvr)	SP		534.8	B-1		GS								
22						20.0	SC-	2		GS							
23			(SM) SILTY SAND, fine, non-plastic fines; light brown; moist. (Qvr)	SM		532.8											
24			(SP) SAND, fine to coarse, poorly graded, trace non-plastic fines, trace fine subrounded gravel; light brown; moist. (Qvr)	SP		22.0											
25	530.3	SC-				3		GS									
				24.5													

Continued on Next Page

HAMMER TYPE: N/A



REV:

4

LOGGED: M. Rutte
CHECKED: J. Johnson

DATE: Feb 24, 2022
DATE: Jun 06, 2022

RECORD OF BOREHOLE: GB-6

Sheet 2 of 4

CLIENT: Oakpointe

PROJECT: Reserve at Woodlands

PROJECT NO: 063107621A

LOCATION: Black Diamond, WA

DATE: February 24, 2022

INCLINATION: -90.0°

CONTRACTOR: AEC

ELEVATION: 554.8 ft (Ground)

COORDINATES: N: 111421.3 ft E: 1341102.3 ft

COORD SYS: SP WA North FIPS 4601 Ft

HORZ DATUM: NAD83

DEPTH (ft)	DRILL RIG	DRILL METHOD	MATERIAL PROFILE				SAMPLES				SOIL CORE				GROUNDWATER OBSERVATIONS			
			DESCRIPTION	USCS	STRATA PLOT	ELEV. ----- DEPTH (ft)	Hammer: N/A ASTM D1586, Blows per 0.15 m 623-N hammer, 0.76-m drop				RUN NO.	REC %						
							NUMBER	TYPE	REC %	N-VALUE		20	40	60		80		
26	TSI 160 cc Sonic Drilling		(SP) SAND, fine to coarse, poorly graded, trace non-plastic fines, trace fine subrounded gravel; light brown; moist. (Qvr)	SP				B-2	GS			3						
27								- 27.0 ft: transition to medium-coarse sand	SC-4	GS								
28																		
29									B-3	GS								
30			(SM) SILTY SAND, fine, low-plasticity fines, trace fine subrounded to subangular gravel; dark grayish brown, trace rootlets, organic smell; moist. (Qvr)	SM					SC-5	GS			4					
31																		
32																		
33																		
34			(SP-SM) SAND, medium to coarse, poorly graded, some non-plastic fines, trace fine to coarse subrounded to subangular gravel; brownish gray; moist. (Qvr)	SP-SM						B-4	GS			5				
35																		
36																		
37																		
38			- 43.5 to 45.0 ft: material coarsens							SC-6	GS							
39																		
40																		
41																		
42			(SM) SILTY SAND, fine to medium, some low-plasticity fines, some fine to coarse subrounded to subangular gravel; grayish brown, non-stratified, heterogeneous, socketed matrix; moist. (Qpog)	SM							SC-7	GS						
43																		
44																		
45																		
46																		
47																		
48																		
49																		
50																		

Continued on Next Page

HAMMER TYPE: N/A



REV:

4

LOGGED: M. Rutte
CHECKED: J. Johnson

DATE: Feb 24, 2022
DATE: Jun 06, 2022

RECORD OF BOREHOLE: GB-6

Sheet 3 of 4

CLIENT: Oakpointe

PROJECT: Reserve at Woodlands

PROJECT NO: 063107621A

LOCATION: Black Diamond, WA

DATE: February 24, 2022

INCLINATION: -90.0°

CONTRACTOR: AEC

ELEVATION: 554.8 ft (Ground)

COORDINATES: N: 111421.3 ft E: 1341102.3 ft

COORD SYS: SP WA North FIPS 4601 Ft

HORZ DATUM: NAD83

DEPTH (ft)		DRILL RIG	DRILL METHOD	MATERIAL PROFILE				SAMPLES				SOIL CORE				GROUNDWATER OBSERVATIONS																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																							
				DESCRIPTION	USCS	STRATA PLOT	ELEV. ----- DEPTH (ft)	Hammer: N/A ASTM D1586, Blows per 0.15 m 623-N hammer, 0.76-m drop				RUN NO.	REC %																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																										
								NUMBER	TYPE	REC %	N-VALUE		20	40	60		80																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																						
51		TSI 150 cc Sonic Drilling		(SM) SILTY SAND, fine to medium, some low-plasticity fines, some fine to coarse subrounded to subangular gravel; grayish brown, non-stratified, heterogeneous, socketed matrix; moist. (Qpog)	SM																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																		</

Continued on Next Page

HAMMER TYPE: N/A



REV:

4

LOGGED: M. Rutte
CHECKED: J. Johnson

DATE: Feb 24, 2022
DATE: Jun 06, 2022

RECORD OF BOREHOLE: GB-6

Sheet 4 of 4

CLIENT: Oakpointe

PROJECT: Reserve at Woodlands

PROJECT NO: 063107621A

LOCATION: Black Diamond, WA

DATE: February 24, 2022

INCLINATION: -90.0°

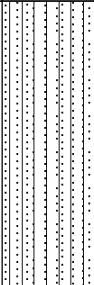
CONTRACTOR: AEC

ELEVATION: 554.8 ft (Ground)

COORDINATES: N: 111421.3 ft E: 1341102.3 ft

COORD SYS: SP WA North FIPS 4601 Ft

HORZ DATUM: NAD83

DEPTH (ft)	DRILL RIG	DRILL METHOD	MATERIAL PROFILE				SAMPLES				SOIL CORE				GROUNDWATER OBSERVATIONS		
			DESCRIPTION	USCS	STRATA PLOT	ELEV. ----- DEPTH (ft)	Hammer: N/A ASTM D1586, Blows per 0.15 m 623-N hammer, 0.76-m drop				RUN NO.	REC %					
							NUMBER	TYPE	REC %	N-VALUE		20	40	60		80	
76	TSI 150 cc	Sonic Drilling	(SM) SILTY SAND, fine to medium, low-plasticity fines, some fine to coarse subrounded to subangular gravel, trace subrounded to subangular cobbles; grayish brown, non-stratified, heterogeneous, socketed matrix; moist. (Qpog)	SM		474.8					8						
77																	
78																	
79							B-8	GS									
80			End of hole at 80.00 ft.														
81																	
82																	
83																	
84																	
85																	
86																	
87																	
88																	
89																	
90																	
91																	
92																	
93																	
94																	
95																	
96																	
97																	
98																	
99																	
100																	

RECORD OF BOREHOLE: GB-7

Sheet 1 of 4

CLIENT: Oakpointe

PROJECT: Reserve at Woodlands

PROJECT NO: 063107621A

LOCATION: Black Diamond, WA

DATE: February 24, 2022

INCLINATION: -90.0°

CONTRACTOR: AEC

ELEVATION: 566.2 ft (Ground)

COORDINATES: N: 110863.5 ft E: 1341091.6 ft

COORD SYS: SP WA North FIPS 4601 Ft

HORZ DATUM: NAD83

DEPTH (ft)		DRILL RIG	DRILL METHOD	MATERIAL PROFILE				SAMPLES				SOIL CORE				GROUNDWATER OBSERVATIONS			
				DESCRIPTION	USCS	STRATA PLOT	ELEV. ----- DEPTH (ft)	Hammer: N/A ASTM D1586, Blows per 0.15 m 623-N hammer, 0.76-m drop				RUN NO.	REC %						
								NUMBER	TYPE	REC %	N-VALUE		20	40	60		80		
1		TSI 150 cc Sonic Drilling	Topsoil. (Qvr)			0.0													
2			(SM) SILTY SAND, fine to medium, low-plasticity fines, some fine to coarse subrounded gravel; reddish brown, non-stratified, trace rootlets; moist. (Qvr)	SM		565.2 1.0													
3																			
4																			
5																			
6			(GP) GRAVEL, fine to coarse, subrounded to subangular, some non-plastic fines, some fine to coarse sand; light grayish brown, non-stratified, heterogeneous; moist. (Qvr)	GP		561.7 4.5						1							
7																			
8																			
9																			
10			No recovery			556.2 10.0													
11																			
12																			
13																			
14																			
15																			
16																			
17																			
18			(SP-SM) SAND and GRAVEL, medium to coarse sand, fine to coarse subrounded to subangular gravel, poorly graded, some non-plastic fines; light grayish brown, non-stratified, heterogeneous, socketed matrix; moist. (Qvr)	SP-SM		546.2 20.0													
20																			
21																			
22																			
23			(GP-GM) SILTY GRAVEL, fine to coarse subrounded to subangular, poorly graded, low-plasticity fines, some fine to coarse sand, trace subrounded to subangular cobbles; light grayish brown, non-stratified, heterogeneous; moist. (Qvr)	GP-GM		542.2 24.0													
24																			
25																			
Continued on Next Page																			

Continued on Next Page

HAMMER TYPE: N/A



REV:

4

LOGGED: M. Rutte
CHECKED: J. Johnson

DATE: Feb 24, 2022
DATE: Jun 06, 2022

RECORD OF BOREHOLE: GB-7

Sheet 2 of 4

CLIENT: Oakpoint

PROJECT: Reserve at Woodlands

PROJECT NO: 063107621A

LOCATION: Black Diamond, WA

DATE: February 24, 2022

INCLINATION: -90.0°

CONTRACTOR: AEC

ELEVATION: 566.2 ft (Ground)

COORDINATES: N: 110863.5 ft E: 1341091.6 ft

COORD SYS: SP WA North FIPS 4601 Ft

HORZ DATUM: NAD83

		MATERIAL PROFILE				SAMPLES				SOIL CORE				GROUNDWATER OBSERVATIONS								
DEPTH (ft)	DRILL RIG	DRILL METHOD	DESCRIPTION	USCS	STRATA PLOT	ELEV. ----- DEPTH (ft)	Hammer: N/A ASTM D1586, Blows per 0.15 m 623-N hammer, 0.76-m drop				RUN NO.	REC %										
							NUMBER	TYPE	REC %	N-VALUE		20	40		60	80						
26	TSI 150 cc Sonic Drilling		(GP-GM) SILTY GRAVEL, fine to coarse subrounded to subangular, poorly graded, low-plasticity fines, some fine to coarse sand, trace subrounded to subangular cobbles; light grayish brown, non-stratified, heterogeneous; moist. (Qvr)	GP-GM		538.7 27.5	B-2	GS			3											
27																						
28			(SP) gravelly SAND, fine to coarse, poorly graded, some fine rounded to subrounded gravel, trace non-plastic fines; grayish brown, non-stratified; moist. (Qvr)	SP		529.7 36.5	SC-2	GS			4											
29																						
30							B-3	GS														
31																						
32																						
33																						
34																						
35																						
36																						
37			(SP-SM) SAND, fine to coarse, poorly graded, some fines, some fine to coarse subrounded to subangular gravel; dark brown, non-stratified, heterogeneous, socketed matrix; moist. (Qvr)	SP-SM		526.2 40.0	SC-3	GS			5											
38																						
39																						
40							B-4	GS														
41			(SP-SM) SAND, fine, poorly graded, some non-plastic fines, trace fine subrounded gravel; dark brown, non-stratified, heterogeneous; wet. (Qvr)																			
42			- 40.0 ft: sample lost due to heat																			
43																						
44																						
45																						
46																						
47																						
48																						
49							SC-4	GS														
50							B-5	GS														

Continued on Next Page

HAMMER TYPE: N/A



REV:

4

LOGGED: M. Rutte
CHECKED: J. Johnson

DATE: Feb 24, 2022
DATE: Jun 06, 2022

RECORD OF BOREHOLE: GB-7

Sheet 3 of 4

CLIENT: Oakpointe

PROJECT: Reserve at Woodlands

PROJECT NO: 063107621A

LOCATION: Black Diamond, WA

DATE: February 24, 2022

INCLINATION: -90.0°

CONTRACTOR: AEC

ELEVATION: 566.2 ft (Ground)

COORDINATES: N: 110863.5 ft E: 1341091.6 ft

COORD SYS: SP WA North FIPS 4601 Ft

HORZ DATUM: NAD83

DEPTH (ft)	DRILL RIG	DRILL METHOD	MATERIAL PROFILE				SAMPLES				SOIL CORE				GROUNDWATER OBSERVATIONS										
			DESCRIPTION	USCS	STRATA PLOT	ELEV. ----- DEPTH (ft)	Hammer: N/A ASTM D1586, Blows per 0.15 m 623-N hammer, 0.76-m drop				RUN NO.	REC %													
							NUMBER	TYPE	REC %	N-VALUE		20	40	60		80									
51	TSI 150 cc Sonic Drilling		(SP-SM) SAND, fine, poorly graded, some non-plastic fines, trace fine subrounded gravel; dark brown, non-stratified, heterogeneous; wet. (Qvr) - 50.0 ft: material logged from bucket	SP-SM							6														
52																									
53																									
54																									
55																									
56																									
57																									
58																									
59																									
60								B-6	GS																
61																									
62																									
63																									
64																									
65																									
66																									
67																									
68																									
69																									
70																									
71								SC-5	GS																
72																									
73			- 72.0 ft: color change to greenish black								8														
74																									
75																									
Continued on Next Page						491.2 75.0																			

HAMMER TYPE: N/A



LOGGED: M. Rutte
CHECKED: J. Johnson

DATE: Feb 24, 2022
DATE: Jun 06, 2022

REV:
4

RECORD OF BOREHOLE: GB-7

Sheet 4 of 4

CLIENT: Oakpointe

PROJECT: Reserve at Woodlands

PROJECT NO: 063107621A

LOCATION: Black Diamond, WA

DATE: February 24, 2022

INCLINATION: -90.0°

CONTRACTOR: AEC

ELEVATION: 566.2 ft (Ground)

COORDINATES: N: 110863.5 ft E: 1341091.6 ft

COORD SYS: SP WA North FIPS 4601 Ft

HORZ DATUM: NAD83

DEPTH (ft)	DRILL RIG	DRILL METHOD	MATERIAL PROFILE				SAMPLES				SOIL CORE				GROUNDWATER OBSERVATIONS			
			DESCRIPTION	USCS	STRATA PLOT	ELEV. ----- DEPTH (ft)	Hammer: N/A ASTM D1586, Blows per 0.15 m 623-N hammer, 0.76-m drop				RUN NO.	REC %						
							NUMBER	TYPE	REC %	N-VALUE		20	40	60		80		
76	TSI 150 cc	Sonic Drilling	(SM) SILTY SAND, fine, low-plasticity fines, trace fine subrounded gravel; grayish brown, non-stratified, heterogeneous, socketed matrix; moist. (Qpog)	SM														
77																		
78			(SP-SM) gravelly SAND, fine, poorly graded, fine to coarse subrounded gravel, trace low-plasticity fines; dark brown; moist. (Qpog)	SP-SM														
79																		
80			End of hole at 80.00 ft.															
81																		
82																		
83																		
84																		
85																		
86																		
87																		
88																		
89																		
90																		
91																		
92																		
93																		
94																		
95																		
96																		
97																		
98																		
99																		
100																		

RECORD OF BOREHOLE: GB-8

Sheet 1 of 3

CLIENT: Oakpointe

PROJECT: Reserve at Woodlands

PROJECT NO: 063107621A

LOCATION: Black Diamond, WA

DATE: February 24, 2022

INCLINATION: -90.0°

CONTRACTOR: AEC

ELEVATION: 545.1 ft (Ground)

COORDINATES: N: 110280.0 ft E: 1341084.6 ft

COORD SYS: SP WA North FIPS 4601 Ft

HORZ DATUM: NAD83

DEPTH (ft)	DRILL RIG	DRILL METHOD	MATERIAL PROFILE				SAMPLES				SOIL CORE				GROUNDWATER OBSERVATIONS			
			DESCRIPTION	USCS	STRATA PLOT	ELEV. ----- DEPTH (ft)	Hammer: N/A ASTM D1586, Blows per 0.15 m 623-N hammer, 0.76-m drop				RUN NO.	REC %						
							NUMBER	TYPE	REC %	N-VALUE		20	40	60		80		
1	TSI 150 cc Sonic Drilling		Topsoil.			0.0						1						
2			SM		544.1													
3					1.0													
4																		
5																		
6			GP		540.6													
7					4.5													
8																		
9																		
10																		
11			No recovery - 10.0 ft: B-1 collected at 10 ft			535.1							2					
12						10.0												
13																		
14																		
15																		
16																		
17																		
18																		
19																		
20						(GP-GM) GRAVEL and SAND, fine to coarse, trace non-plastic fines; grayish brown, non-stratified, heterogeneous; moist. (Qvr)	GP-GM		525.1								3	
21			20.0															
22																		
23																		
24																		
25			(GP) sandy GRAVEL, fine to coarse, trace non-plastic fines; dark brown, non-stratified, heterogeneous; moist. (Qvr)	GP		520.6												
	24.5																	

Continued on Next Page

HAMMER TYPE: N/A



REV:

4

LOGGED: M. Rutte
CHECKED: J. Johnson

DATE: Feb 24, 2022
DATE: Jun 06, 2022

RECORD OF BOREHOLE: GB-8

Sheet 2 of 3

CLIENT: Oakpointe

PROJECT: Reserve at Woodlands

PROJECT NO: 063107621A

LOCATION: Black Diamond, WA

DATE: February 24, 2022

INCLINATION: -90.0°

CONTRACTOR: AEC

ELEVATION: 545.1 ft (Ground)

COORDINATES: N: 110280.0 ft E: 1341084.6 ft

COORD SYS: SP WA North FIPS 4601 Ft

HORZ DATUM: NAD83

DEPTH (ft)		DRILL RIG	DRILL METHOD	MATERIAL PROFILE				SAMPLES				SOIL CORE				GROUNDWATER OBSERVATIONS		
				DESCRIPTION	USCS	STRATA PLOT	ELEV. ----- DEPTH (ft)	Hammer: N/A ASTM D1586, Blows per 0.15 m 623-N hammer, 0.76-m drop				RUN NO.	REC %					
								NUMBER	TYPE	REC %	N-VALUE		20	40	60		80	
26	TSI 150 cc Sonic Drilling		(GP) sandy GRAVEL, fine to coarse, trace non-plastic fines; dark brown, non-stratified, heterogeneous; moist. (Qvr)	GP		515.1 30.0					3							
27																		
28																		
29							SC-3	GS										
30			No recovery				515.1 30.0	B-4	GS									
31																		
32																		
33																		
34																		
35																		
36																		
37																		
38																		
39																		
40			(SP) SAND, fine to coarse subrounded to subangular, poorly graded, some fine to coarse subrounded to subangular gravel, trace non-plastic fines; dark brown, non-stratified, heterogeneous; moist. (Qvr)	SP		505.1 40.0					4							
41							B-5	GS										
42							SC-4	GS										
43																		
44			(GM-SM) silty GRAVEL and SAND, poorly graded, some non-plastic fines; grayish brown, non-stratified, heterogeneous; moist. (Qvr)	GM-SM		500.1 45.0					5							
45																		
46																		
47																		
48							SC-5	GS										
49							B-6	GS										
50																		

Continued on Next Page

HAMMER TYPE: N/A



REV:

4

LOGGED: M. Rutte
CHECKED: J. Johnson

DATE: Feb 24, 2022
DATE: Jun 06, 2022

RECORD OF BOREHOLE: GB-8

Sheet 3 of 3

CLIENT: Oakpointe

PROJECT: Reserve at Woodlands

PROJECT NO: 063107621A

LOCATION: Black Diamond, WA

DATE: February 24, 2022

INCLINATION: -90.0°

CONTRACTOR: AEC

ELEVATION: 545.1 ft (Ground)

COORDINATES: N: 110280.0 ft E: 1341084.6 ft

COORD SYS: SP WA North FIPS 4601 Ft

HORZ DATUM: NAD83

DEPTH (ft)	DRILL RIG	DRILL METHOD	MATERIAL PROFILE				SAMPLES				SOIL CORE				GROUNDWATER OBSERVATIONS	
			DESCRIPTION	USCS	STRATA PLOT	ELEV. ----- DEPTH (ft)	Hammer: N/A ASTM D1586, Blows per 0.15 m 623-N hammer, 0.76-m drop				RUN NO.	REC %				
							NUMBER	TYPE	REC %	N-VALUE		20	40	60		80
51	TSI 150 cc Sonic Drilling		(GM-SM) silty GRAVEL and SAND, poorly graded, some non-plastic fines; grayish brown, non-stratified, heterogeneous; moist. (Qvr)	GM-SM							6					
52																
53																
54																
55																
56																
57			(ML) gravelly sandy SILT, mostly low-plasticity fines; light brown, non-stratified, heterogeneous; wet. (Qpog)	ML		488.6	SC	6	GS							
58						56.5										
59																
60							B-7	GS								
61																
62																
63	End of hole at 60.00 ft.															
64																
65																
66																
67																
68																
69																
70																
71																
72																
73																
74																
75																

Goldier Log Imperial / Soil-Scan 1 Well / Goldier - 3 Imperial US / Goldier US Auto (common in US) / 2024-11-12

RECORD OF BOREHOLE: GB-9

Sheet 1 of 2

CLIENT: Oakpointe

PROJECT: Reserve at Woodlands

PROJECT NO: 063107621A

LOCATION: Black Diamond, WA

START DATE: February 22, 2022

END DATE: February 24, 2022

INCLINATION: -90.0°

CONTRACTOR: AEC

ELEVATION: 557.2 ft (Ground)

COORDINATES: N: 110045.3 ft E: 1341072.2 ft

COORD SYS: SP WA North FIPS 4601 Ft

HORZ DATUM: NAD83

		MATERIAL PROFILE				SAMPLES				SOIL CORE				GROUNDWATER OBSERVATIONS			
DEPTH (ft)	DRILL RIG	DRILL METHOD	DESCRIPTION	USCS	STRATA PLOT	ELEV. ----- DEPTH (ft)	Hammer: N/A ASTM D1586, Blows per 0.15 m 623-N hammer, 0.76-m drop				RUN NO.	REC %					
							NUMBER	TYPE	REC %	N-VALUE		20	40		60	80	
1	TSI 150 cc Sonic Drilling		Forest duff.	SM		0.0						1					
						556.2											
2			(SM) SILTY SAND, fine to medium, low-plasticity fines, some fine to coarse subrounded gravel; reddish brown, non-stratified, trace rootlets; moist. (Qvr)			1.0											
3			(GP) sandy GRAVEL, fine to coarse, trace low-plasticity fines; dark grayish brown, non-stratified, heterogeneous, socketed matrix; moist. (Qvr) - 3.2 ft: color change to olive brown - 4.0 ft: color change to dark gray	GP		555.2											
4						2.0											
5																	
6																	
7																	
8																	
9																	
10						- 10.0 ft: increasing gravel content, encountered cobbles											
11						- 11.0 ft: color change to dark grayish brown											
12																	
13																	
14						(GP) sandy GRAVEL, fine to coarse trace non-plastic fines; grayish brown, non-stratified, heterogeneous; moist. (Qvr)											
15					13.0												
16																	
17																	
18																	
19																	
20			- 20.0 ft: difficult drilling														
21																	
22			- 21.5 to 22.0 ft: reddish brown gravel pocket														
23			(GW-SW) GRAVEL and SAND, fine to coarse, well graded, some non-plastic fines; light grayish brown, non-stratified, heterogeneous; moist. (Qvr)	GW-SW		535.2											
24						22.0											
25																	

Continued on Next Page

HAMMER TYPE: N/A



REV:

4

LOGGED: M. Rutte
CHECKED: J. Johnson

DATE: Feb 22, 2022
DATE: Jun 06, 2022

RECORD OF BOREHOLE: GB-9

Sheet 2 of 2

CLIENT: Oakpointe

PROJECT: Reserve at Woodlands

PROJECT NO: 063107621A

LOCATION: Black Diamond, WA

START DATE: February 22, 2022

END DATE: February 24, 2022

INCLINATION: -90.0°

CONTRACTOR: AEC

ELEVATION: 557.2 ft (Ground)

COORDINATES: N: 110045.3 ft E: 1341072.2 ft

COORD SYS: SP WA North FIPS 4601 Ft

HORZ DATUM: NAD83

DEPTH (ft)	DRILL RIG	DRILL METHOD	MATERIAL PROFILE				SAMPLES				SOIL CORE				GROUNDWATER OBSERVATIONS				
			DESCRIPTION	USCS	STRATA PLOT	ELEV. ----- DEPTH (ft)	Hammer: N/A ASTM D1586, Blows per 0.15 m 623-N hammer, 0.76-m drop				RUN NO.	REC %							
							NUMBER	TYPE	REC %	N-VALUE		20	40	60		80			
26	TSI 150 cc Sonic Drilling		(GW-SW) GRAVEL and SAND, fine to coarse, well graded, some non-plastic fines; light grayish brown, non-stratified, heterogeneous; moist. (Qvr)	GW-SW				SC-2	GS			3							
27																			
28																			
29																			
30																			
31																			
32																			
33																			
34																			
35																			
36																			
37																			
38																			
39																			
40																			
41																			
42																			
43																			
44																			
45																			
46																			
47																			
48																			
49																			
50																			
End of hole at 50.00 ft.																			

HAMMER TYPE: N/A



LOGGED: M. Rutte
CHECKED: J. Johnson

DATE: Feb 22, 2022
DATE: Jun 06, 2022

REV: 4

RECORD OF BOREHOLE: MW-10R

Sheet 1 of 4

CLIENT:	Oakpointe	START DATE:	February 25, 2022	ELEVATION:	564.2 ft (Ground)
PROJECT:	Reserve at Woodlands	END DATE:	February 26, 2022	COORDINATES:	N: 110594.3 ft E: 1339550.5 ft
PROJECT NO:	063107621A	INCLINATION:	-90.0°	COORD SYS:	SP WA North FIPS 4601 Ft
LOCATION:	Black Diamond, WA	CONTRACTOR:	AEC	HORZ DATUM:	NAD83

DEPTH (ft)	DRILL RIG	DRILL METHOD	MATERIAL PROFILE				SAMPLES				SOIL CORE				GROUNDWATER OBSERVATIONS	CONSTRUCTION AND INSTALLATION DETAILS																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																					
			DESCRIPTION	USCS	STRATA PLOT	ELEV. ----- DEPTH (ft)	Hammer: N/A ASTM D1586, Blows per 0.15 m 623-N Hammer, 0.76-m drop				RUN NO.	REC %																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																									
							NUMBER	TYPE	REC %	N-VALUE		20	40	60				80																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																			
1	TSI 150 cc Sonic Drilling		(SM) SILTY SAND, fine, low-plasticity fines, some fine to coarse subrounded to subangular gravel; grayish brown, non-stratified, heterogeneous, socketed matrix; moist. (Qvt) - 7.5 ft: gravel fine to coarse	SM		0.0	SC-1	GS			1																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																										

Continued on Next Page

HAMMER TYPE: N/A



LOGGED: M. Rutte
CHECKED: J. Johnson

DATE: Feb 25, 2022
DATE: Jun 06, 2022

REV:
4

RECORD OF BOREHOLE: MW-10R

Sheet 2 of 4

CLIENT:	Oakpointe	START DATE:	February 25, 2022	ELEVATION:	564.2 ft (Ground)
PROJECT:	Reserve at Woodlands	END DATE:	February 26, 2022	COORDINATES:	N: 110594.3 ft E: 1339550.5 ft
PROJECT NO:	063107621A	INCLINATION:	-90.0°	COORD SYS:	SP WA North FIPS 4601 Ft
LOCATION:	Black Diamond, WA	CONTRACTOR:	AEC	HORZ DATUM:	NAD83

DEPTH (ft)	DRILL RIG	DRILL METHOD	MATERIAL PROFILE				SAMPLES				SOIL CORE				GROUNDWATER OBSERVATIONS	CONSTRUCTION AND INSTALLATION DETAILS																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
			DESCRIPTION	USCS	STRATA PLOT	ELEV. DEPTH (ft)	ASTM D1586, Blows per 0.15 m 62.5-N hammer, 0.76-m drop				RUN NO.	REC %																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																				
							NUMBER	TYPE	REC %	N-VALUE		20	40	60				80																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																														
26	TSI 150 cc Sonic Drilling		(SM) SILTY SAND, fine, low-plasticity fines, some fine to coarse subrounded to subangular gravel; grayish brown, non-stratified, heterogeneous, socketed matrix; moist. (Qvt)	SM				SC-	3	GS																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																						</

Continued on Next Page

HAMMER TYPE: N/A



LOGGED: M. Rutte
CHECKED: J. Johnson

DATE: Feb 25, 2022
DATE: Jun 06, 2022

REV:
4

RECORD OF BOREHOLE: MW-10R

Sheet 3 of 4

CLIENT:	Oakpointe	START DATE:	February 25, 2022	ELEVATION:	564.2 ft (Ground)
PROJECT:	Reserve at Woodlands	END DATE:	February 26, 2022	COORDINATES:	N: 110594.3 ft E: 1339550.5 ft
PROJECT NO:	063107621A	INCLINATION:	-90.0°	COORD SYS:	SP WA North FIPS 4601 Ft
LOCATION:	Black Diamond, WA	CONTRACTOR:	AEC	HORZ DATUM:	NAD83

DEPTH (ft)	DRILL RIG	DRILL METHOD	MATERIAL PROFILE				SAMPLES				SOIL CORE				GROUNDWATER OBSERVATIONS	CONSTRUCTION AND INSTALLATION DETAILS							
			DESCRIPTION	USCS	STRATA PLOT	ELEV. DEPTH (ft)	Hammer: N/A ASTM D1586, Blows per 0.15 m 623-N Hammer, 0.75-m drop				RUN NO.	REC %											
							NUMBER	TYPE	REC %	N-VALUE		20	40	60				80					
51	TSI 150 cc Sonic Drilling		(SM) SILTY SAND, fine to medium, low-plasticity fines, some fine to coarse subrounded to subangular gravel; grayish brown, non-stratified, heterogeneous, socketed matrix; moist to wet. (Qvt)	SM		SC	7	GS		6													
52																							
53																							
54																							
55																							
56						- 56.0 to 57.0 ft: drier material																	
57																							
58																							
59						- 59.0 to 60.0 ft: drier material																	
60																							
61																							
62																							
63																							
64																							
65																							
66												SC	8	GS									
67																							
68																							
69						- 69.0 to 70.0 ft: pulverized rock																	
70																							
71																							
72																							
73																							
74																							
75																							

Continued on Next Page

Continued on Next Page

HAMMER TYPE: N/A



LOGGED: M. Rutte
CHECKED: J. Johnson

DATE: Feb 25, 2022
DATE: Jun 06, 2022

REV:
4

RECORD OF BOREHOLE: MW-10R

CLIENT: Oakpointe

PROJECT: Reserve at Woodlands

PROJECT NO: 063107621A

LOCATION: Black Diamond, WA

START DATE: February 25, 2022

END DATE: February 26, 2022

INCLINATION: -90.0°

CONTRACTOR: AEC

ELEVATION: 564.2 ft (Ground)

COORDINATES: N: 110594.3 ft E: 1339550.5 ft

COORD SYS: SP WA North FIPS 4601 Ft

HORZ DATUM: NAD83

DEPTH (ft)	DRILL RIG	DRILL METHOD	MATERIAL PROFILE				SAMPLES				SOIL CORE				GROUNDWATER OBSERVATIONS	CONSTRUCTION AND INSTALLATION DETAILS																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																							
			DESCRIPTION	USCS	STRATA PLOT	ELEV. DEPTH (ft)	Hammer: N/A ASTM D1586, Blows per 0.15 m 623-N hammer, 0.75-m drop				RUN NO.	REC %																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																											
							NUMBER	TYPE	REC %	N-VALUE		20	40	60				80																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																					
76	TSI 150 cc Sonic Drilling		(SM) SILTY SAND, fine to medium, low-plasticity fines, some fine to coarse subrounded to subangular gravel; grayish brown, non-stratified, heterogeneous, socketed matrix; moist to wet. (Qvt)	SM							8																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																												

RECORD OF BOREHOLE: MW-27R

Sheet 1 of 3

CLIENT:	Oakpointe	DATE:	February 26, 2022	ELEVATION:	544.2 ft (Ground)
PROJECT:	Reserve at Woodlands			COORDINATES:	N: 111940.1 ft E: 1339352.5 ft
PROJECT NO:	063107621A	INCLINATION:	-90.0°	COORD SYS:	SP WA North FIPS 4601 Ft
LOCATION:	Black Diamond, WA	CONTRACTOR:	AEC	HORZ DATUM:	NAD83

DEPTH (ft)	DRILL RIG	DRILL METHOD	MATERIAL PROFILE				SAMPLES				SOIL CORE				GROUNDWATER OBSERVATIONS	CONSTRUCTION AND INSTALLATION DETAILS																
			DESCRIPTION	USCS	STRATA PLOT	ELEV. DEPTH (ft)	Hammer: N/A ASTM D1586, Blows per 0.15 m 62.3-N hammer, 0.75-m drop				RUN NO.	REC %																				
							NUMBER	TYPE	REC %	N-VALUE																						
1	TSI 150 cc Sonic Drilling		(SM) SILTY SAND, fine, with fine subrounded to subangular gravel, trace coarse gravel, trace cobbles; brown, socketing; wet. (Qvt)	SM		0.0	SC-1	GS			1																					
2						539.2																										
3						5.0																										
4						536.2																										
5			(GM) SILTY GRAVEL, fine to coarse subrounded to subangular, low-plasticity fines, some coarse sand, trace cobbles; brown; moist. (Qvt)	GM		8.0	SC-2	GS																								
6			534.2																													
7			(SM) gravelly SILTY SAND, fine to medium, non-plastic fines, fine to coarse subrounded to subangular gravel; brown to gray, friable, socketing; moist. (Qvt)	SM		10.0						2																				
8						521.2													23.0													
9																																(SM) SILTY SAND, fine to medium, low-plasticity fines, some fine to coarse subrounded to subangular gravel, trace cobbles; brown, socketing; moist. (Qvt)
10																																(GM) SILTY GRAVEL, fine to coarse subrounded to subangular, low-plasticity fines, some fine to medium sand; brown to gray, friable, some socketing; moist. (Qvt)
11																																
12																																
13																																
14																																
15																																
16																																
17																																
18																																
19																																
20																																
21																																
22																																
23																																
24																																
25																																

Continued on Next Page

Continued on Next Page

HAMMER TYPE: N/A



LOGGED: J. Xi
CHECKED: J. Johnson

DATE: Feb 26, 2022
DATE: Jun 06, 2022

REV:
4

RECORD OF BOREHOLE: MW-27R

CLIENT: Oakpointe

PROJECT: Reserve at Woodlands

PROJECT NO: 063107621A

LOCATION: Black Diamond, WA

DATE: February 26, 2022

INCLINATION: -90.0°

CONTRACTOR: AEC

ELEVATION: 544.2 ft (Ground)

COORDINATES: N: 111940.1 ft E: 1339352.5 ft

COORD SYS: SP WA North FIPS 4601 Ft

HORZ DATUM: NAD83

DEPTH (ft)	DRILL RIG	DRILL METHOD	MATERIAL PROFILE				SAMPLES				SOIL CORE				GROUNDWATER OBSERVATIONS	CONSTRUCTION AND INSTALLATION DETAILS			
			DESCRIPTION	USCS	STRATA PLOT	ELEV. DEPTH (ft)	NUMBER	TYPE	REC %	N-VALUE	RUN NO.	REC %							
												20	40	60				80	
26	TSI 150 cc Sonic Drilling		(GM) SILTY GRAVEL, fine to coarse subrounded to subangular, low-plasticity fines, some fine to medium sand; brown to gray, friable, some socketing; moist. (Qvt) - 25.0 to 25.5 ft: coal or organic material	GM			SC-3	GS			3						Pipe Elev: 543.7 ft		
27																			
28																			
29																			
30			(GM) SILTY GRAVEL, fine to coarse subrounded to subangular, low-plasticity fines, some fine to medium sand, trace cobbles; reddish brown, some socketing; moist. (Qvt) - 30.0 to 31.0 ft: reddish brown gravel pocket (SM) SILTY SAND, fine to medium, low-plasticity fines, fine subrounded to subangular gravel; brown, some socketing; moist. (Qvt) - 38.0 ft: increasing sand content and gravel size	SM		514.2						4							
31			30.0																
32			513.2																
33			31.0																
34																			
35																			
36									SC-4	GS									
37																			
38																			
39																			
40									SC-5	GS									
41																			
42																			
43																			
44																			
45					(GM) SILTY GRAVEL, fine subrounded to subangular, non-plastic fines, some coarse sand, trace coarse gravel; brown to gray; moist. (Qvt) - 48.0 to 50.0 ft: drier material	GM		499.2					5						
46			45.0	SC-6	GS														
47																			
48																			
49																			
50																			

Continued on Next Page

RECORD OF BOREHOLE: MW-27R

Sheet 3 of 3

CLIENT:	Oakpointe	DATE:	February 26, 2022	ELEVATION:	544.2 ft (Ground)
PROJECT:	Reserve at Woodlands			COORDINATES:	N: 111940.1 ft E: 1339352.5 ft
PROJECT NO:	063107621A	INCLINATION:	-90.0°	COORD SYS:	SP WA North FIPS 4601 Ft
LOCATION:	Black Diamond, WA	CONTRACTOR:	AEC	HORZ DATUM:	NAD83

DEPTH (ft)	DRILL RIG	DRILL METHOD	MATERIAL PROFILE				SAMPLES				SOIL CORE				GROUNDWATER OBSERVATIONS	CONSTRUCTION AND INSTALLATION DETAILS										
			DESCRIPTION	USCS	STRATA PLOT	ELEV. DEPTH (ft)	ASTM D1586, Blows per 0.15 m 623-N hammer, 0.76-m drop				RUN NO.	REC %														
							NUMBER	TYPE	REC %	N-VALUE		20	40	60				80								
51	TSI 150 cc Sonic Drilling		(GW-GM) GRAVEL with silt, fine to coarse, subrounded to subangular, trace to some low-plasticity fines, some fine to medium sand; gray; moist. (Qpog)	GW-GM		469.2					6															
52																										
53			- 53.0 ft: sand coarsens, moisture increases																							
54																										
55																										
56																										
57																										
58																										
59																										
60																										
61																										
62			- 62.0 ft: becomes wet; silt content increases																							
63																										
64																										
65																										
66																										
67																										
68			- 68.0 ft: increasing sand content																							
69																										
70																										
71			- 71.0 to 72.0 ft: dry silt pocket																							
72																										
73																										
74																										
75			End of hole at 75.00 ft.																							

Pipe Elev: 543.7 ft

▽

62.0 ft bgs: groundwater observed at time of drilling
54.0 - 72.0 ft bgs: 2-inch nominal diameter 20 slot schedule 40 PVC screen set in #10/20 silica sand
57.00 - 72.00 ft bgs: Screen Interval

72.0 - 75.0 ft bgs: surface cuttings backfill

HAMMER TYPE: N/A



LOGGED: J. Xi
CHECKED: J. Johnson

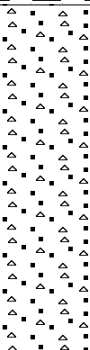
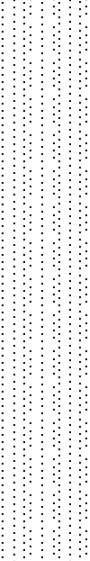
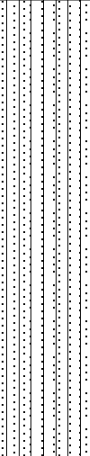
DATE: Feb 26, 2022
DATE: Jun 06, 2022

REV:
4

RECORD OF BOREHOLE: MW-29R-1

Sheet 1 of 2

CLIENT: Oakpointe DATE: December 14, 2021 ELEVATION: 545.0 ft (Ground)
 PROJECT: Reserve at Woodlands COORDINATES: N: 111828.7 ft E: 1341149.3 ft
 PROJECT NO: 063107621A INCLINATION: -90.0° COORD SYS: SP WA North FIPS 4601 Ft
 LOCATION: Black Diamond, WA CONTRACTOR: Holocene HORZ DATUM: NAD83

DEPTH (ft)	DRILL RIG	DRILL METHOD	MATERIAL PROFILE				SAMPLES				SOIL CORE				GROUNDWATER OBSERVATIONS					
			DESCRIPTION	USCS	STRATA PLOT	ELEV. ----- DEPTH (ft)	Hammer: Automatic, 140lb, 30" drop ASTM D1586, Blows per 0.15 m 623-N hammer, 0.76-m drop				RUN NO.	REC %								
							NUMBER	TYPE	REC %	N-VALUE		20	40	60		80				
1	Dietrich D-70 4 1/4 HSA		Forest duff.			0.0														
2			(SW) SAND, fine to coarse, well graded, some fines; grayish brown; moist, compact. (Qvr)	SW		544.0 1.0														
3																				
4																				
5																				
6																				
7				(SP) SAND, fine to medium, poorly graded, trace fines; gray, weakly stratified; moist, compact. (Qvr)	SP		538.0 7.0													
8																				
9																				
10																				
11																				
12																				
13																				
14																				
15																				
16																				
17				(SM) SILTY SAND, fine to coarse, some fine to coarse gravel, trace cobbles; gray, non-stratified; moist, very dense. (Qvt)	SM		528.0 17.0													
18																				
19																				
20																				
21																				
22																				
23																				
24																				
25																				

Continued on Next Page

Continued on Next Page

HAMMER TYPE: Automatic, 140lb, 30" drop



LOGGED: J. Coleman
CHECKED: J. Johnson

DATE: Dec 14, 2021
DATE: Jun 06, 2022

REV:
4

RECORD OF BOREHOLE: MW-29R-1

Sheet 2 of 2

CLIENT: Oakpointe

PROJECT: Reserve at Woodlands

PROJECT NO: 063107621A

LOCATION: Black Diamond, WA

DATE: December 14, 2021

INCLINATION: -90.0°

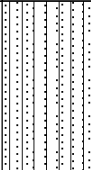
CONTRACTOR: Holocene

ELEVATION: 545.0 ft (Ground)

COORDINATES: N: 111828.7 ft E: 1341149.3 ft

COORD SYS: SP WA North FIPS 4601 Ft

HORZ DATUM: NAD83

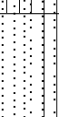
DEPTH (ft)	DRILL RIG	DRILL METHOD	MATERIAL PROFILE				SAMPLES				SOIL CORE					GROUNDWATER OBSERVATIONS	
			DESCRIPTION	USCS	STRATA PLOT	ELEV. ----- DEPTH (ft)	Hammer: Automatic, 140lb, 30" drop ASTM D1586, Blows per 0.15 m 623-N hammer, 0.76-m drop				RUN NO.	REC %					
							NUMBER	TYPE	REC %	N-VALUE							
26	Dietrich D-70	4 1/4 HSA	(SM) SILTY SAND, fine to coarse, some fine to coarse gravel, trace cobbles; gray, non-stratified; moist, very dense. (Qvt)	SM		517.0	5	SS	0								
27																	
28			End of hole at 28.00 ft.														
29																	
30																	
31																	
32																	
33																	
34																	
35																	
36																	
37																	
38																	
39																	
40																	
41																	
42																	
43																	
44																	
45																	
46																	
47																	
48																	
49																	
50																	

Goldier Log Imperial / Soil-Source 1 Well / Goldier - 3 Imperial US / Goldier US Auto (common in US) / 2024-11-12

RECORD OF BOREHOLE: MW-29R-2

Sheet 1 of 3

CLIENT:	Oakpointe	START DATE:	January 10, 2022	ELEVATION:	545.0 ft (Ground)
PROJECT:	Reserve at Woodlands	END DATE:	January 12, 2022	COORDINATES:	N: 111828.7 ft E: 1341149.3 ft
PROJECT NO:	063107621A	INCLINATION:	-90.0°	COORD SYS:	SP WA North FIPS 4601 Ft
LOCATION:	Black Diamond, WA	CONTRACTOR:	AEC	HORZ DATUM:	NAD83
				HOLE LOC:	Bottom of hill at end of road N of pond

DEPTH (ft)	DRILL RIG	DRILL METHOD	MATERIAL PROFILE				SAMPLES				SOIL CORE				GROUNDWATER OBSERVATIONS	CONSTRUCTION AND INSTALLATION DETAILS		
			DESCRIPTION	USCS	STRATA PLOT	ELEV. DEPTH (ft)	NUMBER	TYPE	REC %	N-VALUE	RUN NO.	REC %						
												20	40	60				80
			Forest duff. - 0.0 to 13.0 ft: no recovery sonic core			0.0 544.0											Pipe Elev: 545.0 ft	
1		Sonic Drilling TSI 150	(SW) SAND, fine to coarse, well graded, some fines; grayish brown; moist, compact. (Qvr)	SW		1.0											0.0 - 4.0 ft bgs: cement monument	
2																		
3																		
4																		
5																		
6										1								
7			(SP) SAND, fine to medium, poorly graded, trace fines; dark brownish gray, weakly stratified; moist. (Qvr)	SP		538.0 7.0											18.0 ft bgs: groundwater observed at end of drilling	
8																		
9																		
10																		
11																		
12																		
13			(SM) SILTY SAND, fine, low-plasticity fines; brownish red, iron oxide staining, trace rootlets; moist. (Qvt)	SM		532.0 13.0											4.0 - 37.0 ft bgs: 2-inch nominal diameter solid schedule 40 PVC pipe set in medium bentonite chips	
14																		
15																		
16																		
17																		
18																		
19		(SP-SM) SAND, fine to coarse, poorly graded, some low-plasticity fines; orangish brown to brownish gray, iron oxide staining; moist. (Qvt)	SP-SM		531.0 14.0													
20																		
21																		
22																		
23																		
24																		
25		(ML) SILT, non-plastic, some fine sand; light brown mottled orangish brown, iron oxide staining; moist. (Qvt)	ML		529.0 16.0													
16																		
17																		
18																		
19		(SM) SILTY SAND, fine to coarse, some fine to coarse gravel, trace subrounded to subangular cobbles; olive gray, faceted, socketed matrix; moist. (Qvt)	SM		528.0 17.0													
20																		
21																		
22																		
23																		
24																		
25																		

Continued on Next Page

HAMMER TYPE: N/A



LOGGED: M. Stearn
CHECKED: J. Johnson

DATE: Jan 10, 2022
DATE: Jun 06, 2022

REV:
4

RECORD OF BOREHOLE: MW-29R-2

Sheet 2 of 3

CLIENT:	Oakpointe	START DATE:	January 10, 2022	ELEVATION:	545.0 ft (Ground)
PROJECT:	Reserve at Woodlands	END DATE:	January 12, 2022	COORDINATES:	N: 111828.7 ft E: 1341149.3 ft
PROJECT NO:	063107621A	INCLINATION:	-90.0°	COORD SYS:	SP WA North FIPS 4601 Ft
LOCATION:	Black Diamond, WA	CONTRACTOR:	AEC	HORZ DATUM:	NAD83
				HOLE LOC:	Bottom of hill at end of road N of pond

DEPTH (ft)	DRILL RIG	DRILL METHOD	MATERIAL PROFILE				SAMPLES				SOIL CORE				GROUNDWATER OBSERVATIONS	CONSTRUCTION AND INSTALLATION DETAILS		
			DESCRIPTION	USCS	STRATA PLOT	ELEV. DEPTH (ft)	NUMBER	TYPE	REC %	N-VALUE	RUN NO.	REC %						
												20	40	60				80
26	TSI 150 Sonic Drilling		(SM) SILTY SAND, fine to coarse, some fine to coarse gravel, trace subrounded to subangular cobbles; olive gray, faceted, socketed matrix; moist. (Qvt)	SM							3							
27																		
28																		
29				GM		514.0 31.0	SC-5	GS			4							
30																		
31																		
32			(GM) sandy SILTY GRAVEL, fine to coarse subrounded to subangular, fine to coarse subrounded to subangular sand; gray to brownish gray, non-stratified, heterogeneous, faceted; wet. (Qvt)															
33				ML		509.0 36.0 508.0 37.0	SC-6	GS			5							
34																		
35																		
36			(ML) gravelly sandy SILT, non-plastic, fine to coarse subrounded to subangular sand, fine to coarse subrounded to subangular gravel; olive gray, laminated, iron oxide staining, faceted, tan 1mm lamination, blocky; moist to wet. (Qvt)	GM			SC-7	GS										
37																		
38			(GM) sandy SILTY GRAVEL, fine to coarse, subrounded to subangular, fine to coarse subrounded to subangular sand; gray to brownish gray, heterogeneous, faceted, socketed matrix; wet. (Qvt)															
39				ML		499.0 46.0	SC-8	GS										
40																		
41																		
42																		
43																		
44																		
45																		
46																		
47																		
48																		
49																		
50																		

Continued on Next Page

HAMMER TYPE: N/A



LOGGED: M. Stearn
CHECKED: J. Johnson

DATE: Jan 10, 2022
DATE: Jun 06, 2022

REV:
4

RECORD OF BOREHOLE: MW-29R-2

Sheet 3 of 3

CLIENT: Oakpointe

PROJECT: Reserve at Woodlands

PROJECT NO: 063107621A

LOCATION: Black Diamond, WA

START DATE: January 10, 2022

END DATE: January 12, 2022

INCLINATION: -90.0°

CONTRACTOR: AEC

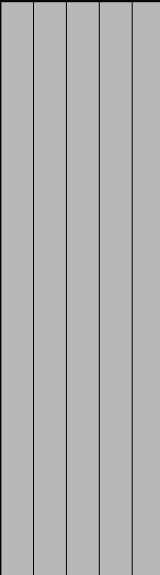
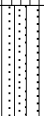
ELEVATION: 545.0 ft (Ground)

COORDINATES: N: 111828.7 ft E: 1341149.3 ft

COORD SYS: SP WA North FIPS 4601 Ft

HORZ DATUM: NAD83

HOLE LOC: Bottom of hill at end of road N of pond

DEPTH (ft)	DRILL RIG	DRILL METHOD	MATERIAL PROFILE				SAMPLES				SOIL CORE				GROUNDWATER OBSERVATIONS	CONSTRUCTION AND INSTALLATION DETAILS		
			DESCRIPTION	USCS	STRATA PLOT	ELEV. DEPTH (ft)	Hammer: N/A ASTM D1586, Blows per 0.15 m 623-N hammer, 0.76-m drop				RUN NO.	REC %						
							NUMBER	TYPE	REC %	N-VALUE		20	40	60				80
51	TSI 150 cc Sonic Drilling		(ML) gravelly sandy SILT, non-plastic, fine to coarse subrounded to subangular sand, fine to coarse subrounded to subangular gravel; olive gray, laminated, iron oxide staining, faceted, tan 1mm lamination, blocky; moist to wet. (Qvt)	ML		492.0					6							
52																		
53			(SM) gravelly SILTY SAND, fine to coarse, subrounded to subangular, fine to coarse subrounded to subangular gravel, trace subrounded to subangular cobbles; olive gray, heterogeneous, iron oxide staining, faceted; wet. (Qpog)	SM		53.0	SC-9	GS										
54																		
55			(ML) SILT, non-plastic, some fine sand; light olive gray, laminated; wet. (Qpog)	ML		490.0	SC-10	GS										
56																		
57																		
58																		
59																		
60			End of hole at 60.00 ft.			485.0												
61																		
62																		
63																		
64																		
65																		
66																		
67																		
68																		
69																		
70																		
71																		
72																		
73																		
74																		
75																		

RECORD OF BOREHOLE: MW-30R

Sheet 1 of 4

CLIENT:	Oakpointe	DATE:	January 10, 2022	ELEVATION:	550.4 ft (Ground)
PROJECT:	Reserve at Woodlands			COORDINATES:	N: 110950.5 ft E: 1340827.1 ft
PROJECT NO:	063107621A	INCLINATION:	-90.0°	COORD SYS:	SP WA North FIPS 4601 Ft
LOCATION:	Black Diamond, WA	CONTRACTOR:	AEC	HORZ DATUM:	NAD83
				HOLE LOC:	End of path W of pond

DEPTH (ft)	DRILL RIG	DRILL METHOD	MATERIAL PROFILE				SAMPLES				SOIL CORE				GROUNDWATER OBSERVATIONS	CONSTRUCTION AND INSTALLATION DETAILS												
			DESCRIPTION	USCS	STRATA PLOT	ELEV. DEPTH (ft)	Hammer: N/A ASTM D1586, Blows per 0.15 m 62.3-N hammer, 0.75-m drop				RUN NO.	REC %																
							NUMBER	TYPE	REC %	N-VALUE		20	40	60				80										
1	TSI 150 cc Sonic Drilling		(SM) SILTY SAND, fine to coarse, subrounded to subangular, some fine to coarse subrounded to subangular gravel, trace subrounded cobbles; grayish brown to brownish gray, weathered, heterogeneous, socketed matrix; moist. (Qvt)	SM		0.0					1																	
2																												
3																												
4																												
5																												
6																												
7							(SM) gravelly SILTY SAND, fine to coarse, subrounded to subangular, fine to coarse subrounded to subangular gravel, trace subrounded cobbles; brownish gray to gray, heterogeneous, socketed matrix; moist. (Qvt)			543.4					2													
8								7.0																				
9																												
10																												
11																												
12																												
13																												
14																												
15																												
16																												
17																												
18																												
19																												
20																												
21																												
22																												
23																												
24																												
25																												

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Continued on Next Page

HAMMER TYPE: N/A



LOGGED: M. Stearn
CHECKED: J. Johnson

DATE: Jan 10, 2022
DATE: Jun 06, 2022

REV:
4

RECORD OF BOREHOLE: MW-30R

Sheet 2 of 4

CLIENT:	Oakpointe	DATE:	January 10, 2022	ELEVATION:	550.4 ft (Ground)
PROJECT:	Reserve at Woodlands			COORDINATES:	N: 110950.5 ft E: 1340827.1 ft
PROJECT NO:	063107621A	INCLINATION:	-90.0°	COORD SYS:	SP WA North FIPS 4601 Ft
LOCATION:	Black Diamond, WA	CONTRACTOR:	AEC	HORZ DATUM:	NAD83
				HOLE LOC:	End of path W of pond

DEPTH (ft)	DRILL RIG	DRILL METHOD	MATERIAL PROFILE				SAMPLES				SOIL CORE				GROUNDWATER OBSERVATIONS	CONSTRUCTION AND INSTALLATION DETAILS																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																						
			DESCRIPTION	USCS	STRATA PLOT	ELEV. DEPTH (ft)	Hammer: N/A ASTM D1586, Blows per 0.15 m 623-N hammer, 0.76-m drop				RUN NO.	REC %																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																										
							NUMBER	TYPE	REC %	N-VALUE		20	40	60				80																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																				
26	TSI 150 cc Sonic Drilling		(SM) gravelly SILTY SAND, fine to coarse, subrounded to subangular, fine to coarse subrounded to subangular gravel, trace subrounded cobbles; brownish gray to gray, heterogeneous, socketed matrix; moist. (Qvt) - 25.0 ft: silt content increases	SM							4																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																											</

Continued on Next Page

HAMMER TYPE: N/A



LOGGED: M. Stearn
CHECKED: J. Johnson

DATE: Jan 10, 2022
DATE: Jun 06, 2022

REV:
4

RECORD OF BOREHOLE: MW-30R

Sheet 3 of 4

CLIENT: Oakpointe	DATE: January 10, 2022	ELEVATION: 550.4 ft (Ground)
PROJECT: Reserve at Woodlands		COORDINATES: N: 110950.5 ft E: 1340827.1 ft
PROJECT NO: 063107621A	INCLINATION: -90.0°	COORD SYS: SP WA North FIPS 4601 Ft
LOCATION: Black Diamond, WA	CONTRACTOR: AEC	HORZ DATUM: NAD83
		HOLE LOC: End of path W of pond

DEPTH (ft)	DRILL RIG	DRILL METHOD	MATERIAL PROFILE				SAMPLES				SOIL CORE				GROUNDWATER OBSERVATIONS	CONSTRUCTION AND INSTALLATION DETAILS																	
			DESCRIPTION	USCS	STRATA PLOT	ELEV. ----- DEPTH (ft)	Hammer: N/A ASTM D1586, Blows per 0.15 m 623-N hammer, 0.76-m drop				RUN NO.	REC %																					
							NUMBER	TYPE	REC %	N-VALUE		20	40	60				80															
51	TSI 150 cc Sonic Drilling		(SM) gravelly SILTY SAND, fine to coarse, subrounded to subangular, fine to coarse subrounded to subangular gravel, trace subrounded cobbles; brownish gray to gray, heterogeneous, socketed matrix; moist. (Qvt)	SM							7																						
52			- 55.0 ft: increasing gravel content, encountered cobbles																														
53																																	
54																																	
55																																	
56			(GM) sandy SILTY GRAVEL, fine to coarse, subrounded to subangular, fine to coarse subrounded to subangular sand; brownish gray to gray, iron oxide staining; moist. (Qvt)	GM																													
57																																	
58																																	
59			(ML) gravelly sandy SILT, non-plastic, fine to medium subrounded to subangular sand, fine to coarse subrounded to subangular gravel; gray, heterogeneous; moist to wet. (Qvt)	ML																													
60																																	
61																																	
62			(SM) gravelly SILTY SAND, fine to coarse, subrounded to subangular, fine to coarse subrounded to subangular gravel, trace subrounded cobbles; brownish gray to gray, heterogeneous, socketed matrix; moist. (Qvt)	SM																													
63																																	
64			(SP-SM) gravelly SAND, poorly graded, fine to coarse subrounded to subangular gravel, some fines; brownish gray, heterogeneous; moist to wet. (Qvt)	SP-SM																													
65																																	
66	(ML) gravelly sandy SILT, non plastic, fine to medium subrounded to subangular sand, fine to coarse subrounded to subangular gravel; gray, heterogeneous; moist to wet. (Qvt)	ML																															
67																																	
68	(SM) gravelly SILTY SAND, fine to coarse, subrounded to subangular, fine to coarse subrounded to subangular gravel, trace subrounded cobbles; brownish gray to gray, heterogeneous, socketed matrix; moist to wet. (Qvt)	SM																															
69																																	
70	- 69.0 ft: encountered cobbles																																
71	(GP-GM) GRAVEL and SAND, fine to coarse subrounded to subangular gravel, fine to coarse subrounded to subangular sand, poorly graded, some fines; brownish gray, heterogeneous; wet. (Qvt)	GP-GM																															
72																																	
73																																	
74																																	
75																																	
Continued on Next Page																																	

Continued on Next Page

HAMMER TYPE: N/A



LOGGED: M. Stearn
CHECKED: J. Johnson

DATE: Jan 10, 2022
DATE: Jun 06, 2022

REV:
4

RECORD OF BOREHOLE: MW-30R

Sheet 4 of 4

CLIENT:	Oakpointe	DATE:	January 10, 2022	ELEVATION:	550.4 ft (Ground)
PROJECT:	Reserve at Woodlands			COORDINATES:	N: 110950.5 ft E: 1340827.1 ft
PROJECT NO:	063107621A	INCLINATION:	-90.0°	COORD SYS:	SP WA North FIPS 4601 Ft
LOCATION:	Black Diamond, WA	CONTRACTOR:	AEC	HORZ DATUM:	NAD83
				HOLE LOC:	End of path W of pond

DEPTH (ft)	DRILL RIG	DRILL METHOD	MATERIAL PROFILE				SAMPLES				SOIL CORE				GROUNDWATER OBSERVATIONS	CONSTRUCTION AND INSTALLATION DETAILS		
			DESCRIPTION	USCS	STRATA PLOT	ELEV. DEPTH (ft)	ASTM D1586, N/A 623-N hammer, 0.76-m drop				RUN NO.	REC %						
							NUMBER	TYPE	REC %	N-VALUE		20	40	60				80
76	TSI 150 cc	Sonic Drilling	(ML) gravelly sandy SILT, non plastic, fine to medium subrounded to subangular sand, fine to coarse subrounded to subangular gravel; gray, heterogeneous; moist to wet. (Qvt) (GP-GM) GRAVEL and SAND, fine to coarse subrounded to subangular gravel, fine to coarse subrounded to subangular sand, poorly graded, some fines; brownish gray mottled light brown, heterogeneous; wet. (Qpog)	ML		474.4	8	GS			9				Pipe Elev: 550.4 ft			
77						76.0												
78				GP-GM														
79																		
80			End of hole at 80.00 ft.			470.4												
81																		
82																		
83																		
84																		
85																		
86																		
87																		
88																		
89																		
90																		
91																		
92																		
93																		
94																		
95																		
96																		
97																		
98																		
99																		
100																		

RECORD OF BOREHOLE: MW-31-1

Sheet 1 of 2

CLIENT: Oakpointe

PROJECT: Reserve at Woodlands

PROJECT NO: 063107621A

LOCATION: Black Diamond, WA

DATE: December 14, 2021

INCLINATION: -90.0°

CONTRACTOR: Holocene

ELEVATION: 564.4 ft (Ground)

COORDINATES: N: 111252.3 ft E: 1340753.3 ft

COORD SYS: SP WA North FIPS 4601 Ft

HORZ DATUM: NAD83

DEPTH (ft)	DRILL RIG	DRILL METHOD	MATERIAL PROFILE				SAMPLES				SOIL CORE					GROUNDWATER OBSERVATIONS		
			DESCRIPTION	USCS	STRATA PLOT	ELEV. ----- DEPTH (ft)	Hammer: Automatic, 140lb, 30" drop ASTM D1586, Blows per 0.15 m 623-N hammer, 0.76-m drop				RUN NO.	REC %						
							NUMBER	TYPE	REC %	N-VALUE		20	40	60	80			
1	Dietrich D-70 4 1/4 HSA		Forest duff.	SM		0.0	1	SS	33	58								
(SM) SILTY SAND, fine to coarse, rounded, some fine to coarse rounded gravel; light tannish gray to light grayish brown, heterogeneous; moist, very dense. (Qvt)					563.4 1.0													
- 7.0 ft: cobbly drilling																		
9			GM	(GM) SILTY GRAVEL, fine to coarse, some fine to coarse sand, trace rounded to subrounded cobbles; brownish gray, weathered, heterogeneous; moist, very dense. (Qvt)		555.4 9.0	2	SS	100	72								
14			SM	(SM) SILTY SAND, fine to coarse, subrounded to subangular, some fine to coarse subrounded to subangular gravel, trace cobbles; gray; moist, very dense. (Qvt)		550.4 14.0	3	SS	13									
20				- 20.0 ft: cobbly drilling			4	SS	0	0								

Continued on Next Page

HAMMER TYPE: Automatic, 140lb, 30" drop



REV:

4

LOGGED: J. Coleman
CHECKED: J. Johnson

DATE: Dec 14, 2021
DATE: Jun 06, 2022

RECORD OF BOREHOLE: MW-31-1

Sheet 2 of 2

CLIENT: Oakpointe

PROJECT: Reserve at Woodlands

PROJECT NO: 063107621A

LOCATION: Black Diamond, WA

DATE: December 14, 2021

INCLINATION: -90.0°

CONTRACTOR: Holocene

ELEVATION: 564.4 ft (Ground)

COORDINATES: N: 111252.3 ft E: 1340753.3 ft

COORD SYS: SP WA North FIPS 4601 Ft

HORZ DATUM: NAD83

DEPTH (ft)	DRILL RIG	DRILL METHOD	MATERIAL PROFILE				SAMPLES				SOIL CORE				GROUNDWATER OBSERVATIONS	
			DESCRIPTION	USCS	STRATA PLOT	ELEV. ----- DEPTH (ft)	Hammer: Automatic, 140lb, 30" drop ASTM D1586, Blows per 0.15 m 623-N hammer, 0.76-m drop				RUN NO.	REC %				
							NUMBER	TYPE	REC %	N-VALUE						
			(SM) SILTY SAND, fine to coarse, subrounded to subangular, some fine to coarse subrounded to subangular gravel, trace cobbles; gray; moist, very dense. (Qvt)	SM	1	539.2	5	0	0			20	40	60	80	
26			End of hole at 25.20 ft.													
27																
28																
29																
30																
31																
32																
33																
34																
35																
36																
37																
38																
39																
40																
41																
42																
43																
44																
45																
46																
47																
48																
49																
50																

RECORD OF BOREHOLE: MW-31-2

Sheet 1 of 4

CLIENT:	Oakpointe	START DATE:	January 10, 2022	ELEVATION:	564.7 ft (Ground)
PROJECT:	Reserve at Woodlands	END DATE:	January 11, 2022	COORDINATES:	N: 111252.3 ft E: 1340753.3 ft
PROJECT NO:	063107621A	INCLINATION:	-90.0°	COORD SYS:	SP WA North FIPS 4601 Ft
LOCATION:	Black Diamond, WA	CONTRACTOR:	AEC	HORZ DATUM:	NAD83
				HOLE LOC:	W of NW corner of infiltration pond

DEPTH (ft)	DRILL RIG	DRILL METHOD	MATERIAL PROFILE				SAMPLES				SOIL CORE				GROUNDWATER OBSERVATIONS	CONSTRUCTION AND INSTALLATION DETAILS										
			DESCRIPTION	USCS	STRATA PLOT	ELEV. DEPTH (ft)	Hammer: N/A ASTM D1586, Blows per 0.15 m 62.5-N hammer, 0.75-m drop				RUN NO.	REC %														
							NUMBER	TYPE	REC %	N-VALUE		20	40	60				80								
1	TSI 150 cc Sonic Drilling		Forest duff.	SM		0.0					1						Pipe Elev: 564.4 ft									
(SM) SILTY SAND, fine to coarse, rounded, and fines, some fine to coarse rounded gravel; light tannish gray to light grayish brown, heterogeneous; moist. (Qvt)					563.7																					
					1.0																					
2																			0.0 - 4.0 ft bgs: cement monument							
3																										
4																										
5																										
6																										
7																										
8					- 7.0 ft: cobbly drilling																					
9																										
10					(GM) SILTY GRAVEL, fine to coarse, and fines, some fine to coarse sand, trace rounded to subrounded cobbles; brownish gray mottled gray, weathered, heterogeneous; moist. (Qvt)	GM		555.7											9.8 ft bgs: groundwater observed at time of drilling							
11							9.0																			
12																			2							
13																										
14					(SM) SILTY SAND, fine to coarse, rounded to subangular, some fine to coarse rounded to subangular gravel, trace rounded to subrounded cobbles; brownish gray mottled gray, weathered, heterogeneous, iron oxide staining; wet to moist. (Qvt)	SM		550.7					2													
15							14.0																			
16																			3							
17																										
18																										
19																										
20					(SM) SILTY SAND, fine to coarse, subrounded to subangular, some fine to coarse subrounded to subangular gravel, trace rounded to subrounded cobbles; olive gray; moist. (Qvt)			544.7					3													
21					- 20.0 ft: cobbly drilling		20.0																			
22																										
23																										
24																										
25																										

Continued on Next Page

HAMMER TYPE: N/A



REV:

4

LOGGED: M. Stearn
CHECKED: J. Johnson

DATE: Jan 10, 2022
DATE: Jun 06, 2022

RECORD OF BOREHOLE: MW-31-2

Sheet 2 of 4

CLIENT:	Oakpointe	START DATE:	January 10, 2022	ELEVATION:	564.7 ft (Ground)
PROJECT:	Reserve at Woodlands	END DATE:	January 11, 2022	COORDINATES:	N: 111252.3 ft E: 1340753.3 ft
PROJECT NO:	063107621A	INCLINATION:	-90.0°	COORD SYS:	SP WA North FIPS 4601 Ft
LOCATION:	Black Diamond, WA	CONTRACTOR:	AEC	HORZ DATUM:	NAD83
				HOLE LOC:	W of NW corner of infiltration pond

DEPTH (ft)	DRILL RIG	DRILL METHOD	MATERIAL PROFILE				SAMPLES				SOIL CORE				GROUNDWATER OBSERVATIONS	CONSTRUCTION AND INSTALLATION DETAILS		
			DESCRIPTION	USCS	STRATA PLOT	ELEV. DEPTH (ft)	ASTM D1586, Blows per 0.15 m 623-N hammer, 0.76-m drop				RUN NO.	REC %						
							NUMBER	TYPE	REC %	N-VALUE		20	40	60				80
26	TSI 150 cc Sonic Drilling		(SM) SILTY SAND, fine to coarse, subrounded to subangular, some fine to coarse subrounded to subangular gravel, trace rounded to subrounded cobbles; olive gray; moist. (Qvt)	SM							3							
27																		
28																		
29																		
30																		
31																		
32																		
33																		
34																		
35																		
36																		
37																		
38																		
39																		
40																		
41																		
42																		
43																		
44																		
45																		
46																		
47																		
48																		
49																		
50																		
			(SM) gravelly SILTY SAND, fine to coarse, subrounded to subangular, fine to coarse subrounded to subangular gravel, trace subrounded to subangular cobbles; gray, heterogeneous; moist. (Qvt)															
			(ML) gravelly sandy SILT, non-plastic, fine to coarse subrounded to subangular sand, fine to coarse subrounded to subangular gravel; gray, heterogeneous, faceted, socketed matrix; moist. (Qvt)	ML														
														</				

Continued on Next Page

HAMMER TYPE: N/A



REV:

4

LOGGED: M. Stearn
CHECKED: J. Johnson

DATE: Jan 10, 2022
DATE: Jun 06, 2022

RECORD OF BOREHOLE: MW-31-2

Sheet 3 of 4

CLIENT:	Oakpointe	START DATE:	January 10, 2022	ELEVATION:	564.7 ft (Ground)
PROJECT:	Reserve at Woodlands	END DATE:	January 11, 2022	COORDINATES:	N: 111252.3 ft E: 1340753.3 ft
PROJECT NO:	063107621A	INCLINATION:	-90.0°	COORD SYS:	SP WA North FIPS 4601 Ft
LOCATION:	Black Diamond, WA	CONTRACTOR:	AEC	HORZ DATUM:	NAD83
				HOLE LOC:	W of NW corner of infiltration pond

DEPTH (ft)	DRILL RIG	DRILL METHOD	MATERIAL PROFILE				SAMPLES				SOIL CORE				GROUNDWATER OBSERVATIONS	CONSTRUCTION AND INSTALLATION DETAILS		
			DESCRIPTION	USCS	STRATA PLOT	ELEV. DEPTH (ft)	NUMBER	TYPE	REC %	N-VALUE	RUN NO.	REC %						
												20	40	60				80
51	TSI 150 cc Sonic Drilling		(ML) gravelly sandy SILT, non-plastic, fine to coarse subrounded to subangular sand, fine to coarse subrounded to subangular gravel; gray, heterogeneous, faceted, socketed matrix; moist. (Qvt)	ML		511.7 53.0					6						Pipe Elev: 564.4 ft	
52							SC-4	GS										
53			(SM) gravelly SILTY SAND, fine to coarse, subrounded to subangular, fine to coarse subrounded to subangular gravel, trace subrounded to subangular cobbles; gray, heterogeneous; moist. (Qvt)															
54			- 55.0 ft: pocket of faceted gravels	SM							7							
55																		
56																		
57																		
58																		
59											8							
60																		
61																		
62				GM		497.7 67.0	SC-5	GS			9							
63																		
64																		
65																		
66																		
67			(GM) sandy SILTY GRAVEL, fine to coarse, subrounded to subangular, medium subrounded to subangular sand; gray mottled light brown, iron oxide staining; moist. (Qvt)				SC-6	GS										
68																		
69																		
70																		
71																		
72			(SM) gravelly SILTY SAND, fine to coarse, subrounded to subangular, fine to coarse subrounded to subangular gravel; gray mottled brownish gray, heterogeneous, faceted; wet. (Qvt)	SM		492.7 72.0	SC-7	GS										
73																		
74																		
75																		

Continued on Next Page

Continued on Next Page

HAMMER TYPE: N/A



REV:

4

LOGGED: M. Stearn
CHECKED: J. Johnson

DATE: Jan 10, 2022
DATE: Jun 06, 2022

RECORD OF BOREHOLE: MW-31-2

Sheet 4 of 4

CLIENT:	Oakpointe	START DATE:	January 10, 2022	ELEVATION:	564.7 ft (Ground)
PROJECT:	Reserve at Woodlands	END DATE:	January 11, 2022	COORDINATES:	N: 111252.3 ft E: 1340753.3 ft
PROJECT NO:	063107621A	INCLINATION:	-90.0°	COORD SYS:	SP WA North FIPS 4601 Ft
LOCATION:	Black Diamond, WA	CONTRACTOR:	AEC	HORZ DATUM:	NAD83
				HOLE LOC:	W of NW corner of infiltration pond

DEPTH (ft)	DRILL RIG	DRILL METHOD	MATERIAL PROFILE				SAMPLES				SOIL CORE				GROUNDWATER OBSERVATIONS	CONSTRUCTION AND INSTALLATION DETAILS															
			DESCRIPTION	USCS	STRATA PLOT	ELEV. DEPTH (ft)	Hammer: N/A ASTM D1586, Blows per 0.15 m 623-N hammer, 0.75-m drop				RUN NO.	REC %																			
							NUMBER	TYPE	REC %	N-VALUE		20	40	60				80													
76	TSI 150 cc Sonic Drilling		(SM) gravelly SILTY SAND, fine to coarse, subrounded to subangular, fine to coarse subrounded to subangular gravel; gray mottled brownish gray, heterogeneous, faceted; wet. (Qvt)	SM								9																			
77																															
78			(SP-SM) SAND, fine to coarse subrounded to subangular, poorly graded, some fine to coarse subrounded to subangular gravel, some fines; gray; wet. (Qpog)	SP-SM															486.7	SC-8	GS										
79																															
80			No recovery (Qpog)				484.7																								
81						80.0																									
82																															
83																															
84																															
85			End of hole at 85.00 ft.			479.7																									
86																															
87																															
88																															
89																															
90																															
91																															
92																															
93																															
94																															
95																															
96																															
97																															
98																															
99																															
100																															

Pipe Elev: 564.4 ft

75.0 ft bgs: groundwater observed at time of drilling

67.0 - 85.0 ft bgs: 2-inch nominal diameter 20 slot schedule 40 PVC screen set in #10/20 silica sand

70.00 - 85.00 ft bgs: Screen Interval

HAMMER TYPE: N/A



REV:

4

LOGGED: M. Stearn
CHECKED: J. Johnson

DATE: Jan 10, 2022
DATE: Jun 06, 2022

RECORD OF BOREHOLE: MW-32

Sheet 1 of 5

CLIENT: Oakpointe

PROJECT: Reserve at Woodlands

PROJECT NO: 063107621A

LOCATION: Black Diamond, WA

START DATE: February 28, 2022

END DATE: March 25, 2022

INCLINATION: -90.0°

CONTRACTOR: AEC

ELEVATION: 586.3 ft (Ground)

COORDINATES: N: 110786.7 ft E: 1340415.8 ft

COORD SYS: SP WA North FIPS 4601 Ft

HORZ DATUM: NAD83

HOLE LOC: SW corner of site

DEPTH (ft)	DRILL RIG	DRILL METHOD	MATERIAL PROFILE				SAMPLES				SOIL CORE				GROUNDWATER OBSERVATIONS	CONSTRUCTION AND INSTALLATION DETAILS			
			DESCRIPTION	USCS	STRATA PLOT	ELEV. DEPTH (ft)	Hammer: N/A ASTM D1586, Blows per 0.15 m 623-N hammer, 0.76-m drop				RUN NO.	REC %							
							NUMBER	TYPE	REC %	N-VALUE		20	40	60				80	
1	TSI 150 cc Sonic Drilling		Forest duff.	SM		0.0	SC-1	GS			1								
					585.3	1.0													
2					584.3	2.0													
3				(SP-SM) SAND, medium, poorly graded, some low-plasticity fines, some fine to coarse subrounded to subangular gravel; grayish brown, non-stratified, heterogeneous; moist. (Qvt)	SP-SM														
4																			
5				(ML) gravelly sandy SILT, non-plastic, some fine to medium sand, some fine to coarse subrounded gravel; light yellowish brown, non-stratified, heterogeneous, socketed matrix; moist. (Qvt)	ML		582.3												
6							4.0												
7				(SP-GP) SAND and GRAVEL with silt, fine to coarse, some low-plasticity fines; grayish brown, non-stratified, heterogeneous, socketed matrix; moist. (Qvt)	SP-GP		580.3												
8																			
9																			
10																			
11																			
12																			
13																			
14																			
15																			
16																			
17																			
18					- 17.0 ft: color change to dark grayish brown, silt content increases														
19																			
20																			
21																			
22																			
23																			
24																			
25																			

Continued on Next Page

25.0

RECORD OF BOREHOLE: MW-32

Sheet 2 of 5

CLIENT:	Oakpointe	START DATE:	February 28, 2022	ELEVATION:	586.3 ft (Ground)
PROJECT:	Reserve at Woodlands	END DATE:	March 25, 2022	COORDINATES:	N: 110786.7 ft E: 1340415.8 ft
PROJECT NO:	063107621A	INCLINATION:	-90.0°	COORD SYS:	SP WA North FIPS 4601 Ft
LOCATION:	Black Diamond, WA	CONTRACTOR:	AEC	HORZ DATUM:	NAD83
				HOLE LOC:	SW corner of site

DEPTH (ft)	DRILL RIG	DRILL METHOD	MATERIAL PROFILE				SAMPLES				SOIL CORE				GROUNDWATER OBSERVATIONS	CONSTRUCTION AND INSTALLATION DETAILS		
			DESCRIPTION	USCS	STRATA PLOT	ELEV. DEPTH (ft)	Hammer: N/A ASTM D1586, Blows per 0.15 m 623-N hammer, 0.75-m drop				RUN NO.	REC %						
							NUMBER	TYPE	REC %	N-VALUE		20	40	60				80
26	TSI 150 cc Sonic Drilling		(SM) SILTY SAND, fine to medium, some low-plasticity fines, some fine to coarse subrounded to subangular gravel; grayish brown, non-stratified, heterogeneous, socketed matrix; moist. (Qvt) - 32.0 to 34.0 ft: gravel fines	SM							3							
27																		
28																		
29																		
30																		
31																		
32																		
33																		
34																		
35																		
36																		
37																		
38																		
39																		
40																		
41																		
42																		
43																		
44																		
45																		
46																		
47																		
48																		
49																		
50																		

Continued on Next Page

HAMMER TYPE: N/A



REV:

4

LOGGED: M. Rutte
CHECKED: J. Johnson

DATE: Feb 28, 2022
DATE: Jun 06, 2022

RECORD OF BOREHOLE: MW-32

Sheet 3 of 5

CLIENT:	Oakpointe	START DATE:	February 28, 2022	ELEVATION:	586.3 ft (Ground)
PROJECT:	Reserve at Woodlands	END DATE:	March 25, 2022	COORDINATES:	N: 110786.7 ft E: 1340415.8 ft
PROJECT NO:	063107621A	INCLINATION:	-90.0°	COORD SYS:	SP WA North FIPS 4601 Ft
LOCATION:	Black Diamond, WA	CONTRACTOR:	AEC	HORZ DATUM:	NAD83
				HOLE LOC:	SW corner of site

DEPTH (ft)	DRILL RIG	DRILL METHOD	MATERIAL PROFILE				SAMPLES				SOIL CORE				GROUNDWATER OBSERVATIONS	CONSTRUCTION AND INSTALLATION DETAILS			
			DESCRIPTION	USCS	STRATA PLOT	ELEV. DEPTH (ft)	ASTM D1586, Blows per 0.15 m 623-N hammer, 0.76-m drop				RUN NO.	REC %							
							NUMBER	TYPE	REC %	N-VALUE		20	40	60				80	
51	TSI 150 cc Sonic Drilling		(SM) SILTY SAND, fine to medium, some low-plasticity fines, some fine to coarse subrounded to subangular gravel; grayish brown, non-stratified, heterogeneous, socketed matrix; moist. (Qvt)								6								
52																			
53																			
54																			
55																			
56																			
57																			
58																			
59																			
60					(SM) SILTY SAND, fine to coarse, low-plasticity fines, some fine to coarse subrounded to subangular gravel; grayish brown, non-stratified, heterogeneous, socketed matrix; moist. (Qvt)	SM													
61																			
62																			
63																			
64																			
65																			
66																			
67																			
68																			
69																			
70																			
71																			
72																			
73																			
74																			
75																			

Continued on Next Page

HAMMER TYPE: N/A



LOGGED: M. Rutte
CHECKED: J. Johnson

DATE: Feb 28, 2022
DATE: Jun 06, 2022

REV:
4

RECORD OF BOREHOLE: MW-32

Sheet 4 of 5

CLIENT:	Oakpointe	START DATE:	February 28, 2022	ELEVATION:	586.3 ft (Ground)
PROJECT:	Reserve at Woodlands	END DATE:	March 25, 2022	COORDINATES:	N: 110786.7 ft E: 1340415.8 ft
PROJECT NO:	063107621A	INCLINATION:	-90.0°	COORD SYS:	SP WA North FIPS 4601 Ft
LOCATION:	Black Diamond, WA	CONTRACTOR:	AEC	HORZ DATUM:	NAD83
				HOLE LOC:	SW corner of site

DEPTH (ft)	DRILL RIG	DRILL METHOD	MATERIAL PROFILE				SAMPLES				SOIL CORE				GROUNDWATER OBSERVATIONS	CONSTRUCTION AND INSTALLATION DETAILS		
			DESCRIPTION	USCS	STRATA PLOT	ELEV. DEPTH (ft)	Hammer: N/A ASTM D1586, Blows per 0.15 m 623-N hammer, 0.75-m drop				RUN NO.	REC %						
							NUMBER	TYPE	REC %	N-VALUE		20	40	60				80
76	TSI 150 cc Sonic Drilling		(SM) SILTY SAND, fine to coarse, some non-plastic fines, some fine to coarse subrounded to subangular gravel; grayish brown, non-stratified, heterogeneous, socketed matrix; moist. (Qvt)	SM							8							
77																		
78																		
79			- 79.0 to 80.0 ft: clean gravelly sand lens															
80																		
81																		
82																		
83																		
84																		
85																		
86																		
87																		
88																		
89																		
90																		
91																		
92																		
93																		
94																		
95																		
96																		
97																		
98																		
99																		
100	Continued on Next Page																	

Continued on Next Page

HAMMER TYPE: N/A



REV:

4

LOGGED: M. Rutte
CHECKED: J. Johnson

DATE: Feb 28, 2022
DATE: Jun 06, 2022

RECORD OF BOREHOLE: MW-32

Sheet 5 of 5

CLIENT:	Oakpointe	START DATE:	February 28, 2022	ELEVATION:	586.3 ft (Ground)
PROJECT:	Reserve at Woodlands	END DATE:	March 25, 2022	COORDINATES:	N: 110786.7 ft E: 1340415.8 ft
PROJECT NO:	063107621A	INCLINATION:	-90.0°	COORD SYS:	SP WA North FIPS 4601 Ft
LOCATION:	Black Diamond, WA	CONTRACTOR:	AEC	HORZ DATUM:	NAD83
				HOLE LOC:	SW corner of site

DEPTH (ft)	DRILL RIG	DRILL METHOD	MATERIAL PROFILE				SAMPLES				SOIL CORE				GROUNDWATER OBSERVATIONS	CONSTRUCTION AND INSTALLATION DETAILS														
			DESCRIPTION	USCS	STRATA PLOT	ELEV. DEPTH (ft)	Hammer: N/A ASTM D1586, Blows per 0.15 m 623-N hammer, 0.75-m drop				RUN NO.	REC %																		
							NUMBER	TYPE	REC %	N-VALUE		20	40	60				80												
101	TSI 150 cc Sonic Drilling		(GP-GM) SILTY GRAVEL, fine to coarse subrounded to subangular, poorly graded, non-plastic fines, some fine to coarse subrounded to subangular sand; brownish gray, non-stratified, heterogeneous; moist. (Qvt)	GP-GM							11			▽		Pipe Elev: 585.8 ft														
102			- 111.0 ft: iron oxide stains																											
103																														
104																														
105																														
106																														
107																														
108																														
109																														
110																														
111																														
112																														
113			(SP-SM) gravelly SAND, medium to coarse subrounded, poorly graded, fine subrounded gravel, trace non-plastic fines; grayish brown, non-stratified; wet. (Qpog)	SP-SM		473.3					12					110.0 ft bgs: groundwater observed at time of drilling														
114			- 114.0 ft: iron oxide stains			113.0											105.0 - 120.0 ft bgs: 2-inch nominal diameter 20 slot schedule 40 PVC screen set in #10/20 silica sand													
115																		105.00 - 120.00 ft bgs: Screen Interval												
116				GP-GM		469.3						13						120.0 - 125.0 ft bgs: cuttings backfill												
117			(GP-GM) sandy SILTY GRAVEL, fine to coarse subrounded, poorly graded, non-plastic fines, fine to coarse subrounded sand; gray to olive gray, non-stratified, heterogeneous; wet. (Qpog)			117.0													End of hole at 125.00 ft.											
118																														
119																														
120																														
121																														
122																														
123																														
124																														
125						461.3																								

HAMMER TYPE: N/A



REV:

4

LOGGED: M. Rutte
CHECKED: J. Johnson

DATE: Feb 28, 2022
DATE: Jun 06, 2022

RECORD OF BOREHOLE: MW-33-1

Sheet 1 of 2

CLIENT: Oakpointe

PROJECT: Reserve at Woodlands

PROJECT NO: 063107621A

LOCATION: Black Diamond, WA

DATE: December 13, 2021

INCLINATION: -90.0°

CONTRACTOR: Holocene

ELEVATION: 546.1 ft (Ground)

COORDINATES: N: 110062.2 ft E: 1340821.8 ft

COORD SYS: SP WA North FIPS 4601 Ft

HORZ DATUM: NAD83

DEPTH (ft)	DRILL RIG	DRILL METHOD	MATERIAL PROFILE				SAMPLES				SOIL CORE					GROUNDWATER OBSERVATIONS											
			DESCRIPTION	USCS	STRATA PLOT	ELEV. ----- DEPTH (ft)	Hammer: Automatic, 140lb, 30" drop ASTM D1586, Blows per 0.15 m 623-N hammer, 0.76-m drop				RUN NO.	REC %															
							NUMBER	TYPE	REC %	N-VALUE		20	40	60	80												
1	Dietrich D-70 4 1/4 HSA		Forest duff.	SM		0.0																					
(SM) SILTY SAND, fine to coarse, some fine to coarse subrounded to subangular gravel; brown and gray, heterogeneous, non-stratified, weathered, trace organics and rootlets; moist, very dense. (Qvt)					545.1 1.0																						
																				1	SS	100	54				
7				(GM) SILTY GRAVEL, fine to coarse, subrounded to subangular, some fine to coarse sand, trace subrounded cobbles; brown and gray, non-stratified, heterogeneous; wet, very dense. (Qvt)	GM		539.1 7.0																				
8																											
9																											
10																											
11																											
12																											
13				(SM) SILTY SAND, fine to coarse, some fine to coarse subrounded to subangular gravel; gray, non-stratified, heterogeneous, socketed matrix; wet, very dense. (Qvt)	SM		533.1 13.0																				
14																											
15																											
16																											
17																											
18				- 18.0 ft: cobbly drilling																							
19																											
20				- 20.0 ft: iron oxide stains																							
21																											
22																											
23																											
24																											
25																											

Continued on Next Page

HAMMER TYPE: Automatic, 140lb, 30" drop



REV:

4

LOGGED: J. Coleman
CHECKED: J. Johnson

DATE: Dec 13, 2021
DATE: Jun 06, 2022

RECORD OF BOREHOLE: MW-33-1

Sheet 2 of 2

CLIENT: Oakpointe

PROJECT: Reserve at Woodlands

PROJECT NO: 063107621A

LOCATION: Black Diamond, WA

DATE: December 13, 2021

INCLINATION: -90.0°

CONTRACTOR: Holocene

ELEVATION: 546.1 ft (Ground)

COORDINATES: N: 110062.2 ft E: 1340821.8 ft

COORD SYS: SP WA North FIPS 4601 Ft

HORZ DATUM: NAD83

DEPTH (ft)	DRILL RIG	DRILL METHOD	MATERIAL PROFILE				SAMPLES				SOIL CORE				GROUNDWATER OBSERVATIONS				
			DESCRIPTION	USCS	STRATA PLOT	ELEV. ----- DEPTH (ft)	Hammer: Automatic, 140lb, 30" drop ASTM D1586, Blows per 0.15 m 623-N hammer, 0.76-m drop				RUN NO.	SOIL CORE							
							NUMBER	TYPE	REC %	N-VALUE		REC %							
26	Dietrich D-70 4 1/4 HSA		(SM) SILTY SAND, fine to coarse, some fine to coarse subrounded to subangular gravel; gray, non-stratified, heterogeneous, socketed matrix; wet, very dense. (Qvt)	SM			5	S	S	100									
27																			
28																			
29																			
30							6	S	S	50									
31																			
32																			
33																			
34																			
35																			
36																			
37																			
38																			
39																			
40							8	S	S	00									
41																			
42																			
43																			
44																			
45																			
46																			
47																			
48																			
49																			
50																			
			End of hole at 41.00 ft.			505.1													

RECORD OF BOREHOLE: MW-33-2

Sheet 1 of 3

CLIENT: Oakpointe

PROJECT: Reserve at Woodlands

PROJECT NO: 063107621A

LOCATION: Black Diamond, WA

DATE: January 06, 2022

INCLINATION: -90.0°

CONTRACTOR: AEC

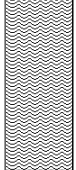
ELEVATION: 546.5 ft (Ground)

COORDINATES: N: 110062.2 ft E: 1340821.8 ft

COORD SYS: SP WA North FIPS 4601 Ft

HORZ DATUM: NAD83

HOLE LOC: SW of corner of pond location

DEPTH (ft)	DRILL RIG	DRILL METHOD	MATERIAL PROFILE				SAMPLES				SOIL CORE				GROUNDWATER OBSERVATIONS	CONSTRUCTION AND INSTALLATION DETAILS																																																												
			DESCRIPTION	USCS	STRATA PLOT	ELEV. DEPTH (ft)	NUMBER	TYPE	REC %	N-VALUE	RUN NO.	REC %																																																																
												20	40	60				80																																																										
1	TSI 150 cc Sonic Drilling		Forest duff.	SM		0.0	SC-1	GS								▽			Pipe Elev: 546.1 ft																																																									
(SM) SILTY SAND, fine to coarse, some fine to coarse subrounded to subangular gravel; brown and gray, heterogeneous, non-stratified, weathered, trace organics and rootlets; moist. (Qvt)					545.5	1.0																																																																						
																																		0.0 - 3.0 ft bgs: cement monument																																										
7			(GM) SILTY GRAVEL, fine to coarse, subrounded to subangular, some fine to coarse sand, trace subrounded cobbles; brown and gray, non-stratified, heterogeneous; wet. (Qvt)	GM		539.5	SC-2	GS																								9.0 ft bgs: groundwater observed at time of drilling 12/13/21																																												
13			(SM) SILTY SAND, fine to coarse, some fine to coarse subrounded to subangular angular gravel; non-stratified, heterogeneous, socketed matrix; wet. (Qvt)	SM		533.5	SC-3	GS																																																																				
17			- 17.0 ft: encountered cobbles																																																																									
18			- 18.0 ft: cobbly drilling																																																																									
19																																																																												
20			- 20.0 ft: iron oxide stains																																																																									
21																																																																												
22																																																																												
23																																																																												
24																																																																												
25																																																																												

Continued on Next Page

HAMMER TYPE: N/A



LOGGED: M. Stearn
CHECKED: J. Johnson

DATE: Jan 06, 2022
DATE: Jun 06, 2022

REV:
4

RECORD OF BOREHOLE: MW-33-2

Sheet 2 of 3

CLIENT: Oakpointe

PROJECT: Reserve at Woodlands

PROJECT NO: 063107621A

LOCATION: Black Diamond, WA

DATE: January 06, 2022

INCLINATION: -90.0°

CONTRACTOR: AEC

ELEVATION: 546.5 ft (Ground)

COORDINATES: N: 110062.2 ft E: 1340821.8 ft

COORD SYS: SP WA North FIPS 4601 Ft

HORZ DATUM: NAD83

HOLE LOC: SW of corner of pond location

DEPTH (ft)	DRILL RIG	DRILL METHOD	MATERIAL PROFILE				SAMPLES				SOIL CORE				GROUNDWATER OBSERVATIONS	CONSTRUCTION AND INSTALLATION DETAILS				
			DESCRIPTION	USCS	STRATA PLOT	ELEV. DEPTH (ft)	Hammer: N/A ASTM D1586, Blows per 0.15 m 623-N hammer, 0.75-m drop				RUN NO.	REC %								
							NUMBER	TYPE	REC %	N-VALUE		20	40	60				80		
26	TSI 150 cc Sonic Drilling		(SM) SILTY SAND, fine to coarse, some fine to coarse subrounded to subangular angular gravel; non-stratified, heterogeneous, socketed matrix; wet. (Qvt)	SM		516.5 30.0	5				4					3.0 - 52.0 ft bgs: 2-inch nominal diameter solid schedule 40 PVC pipe set in medium bentonite chips				
27																				
28											5									
29																				
30			(SM) SILTY SAND, fine to coarse, subrounded to subangular, some fine to coarse subrounded to subangular gravel; gray, heterogeneous; moist to wet, very dense. (Qvt)				6				5									
31																				
32																				
33			- 33.0 ft: cobbly drilling																	
34																				
35																				
36																				
37																				
38																				
39																				
40											8				6					
41																				
42											SC-5	GS								
43																				
44																				
45																				
46																				
47																				
48																				
49																				
50																				

Continued on Next Page

HAMMER TYPE: N/A



LOGGED: M. Stearn
CHECKED: J. Johnson

DATE: Jan 06, 2022
DATE: Jun 06, 2022

REV:
4

RECORD OF BOREHOLE: MW-33-2

Sheet 3 of 3

CLIENT:	Oakpointe	DATE:	January 06, 2022	ELEVATION:	546.5 ft (Ground)
PROJECT:	Reserve at Woodlands			COORDINATES:	N: 110062.2 ft E: 1340821.8 ft
PROJECT NO:	063107621A	INCLINATION:	-90.0°	COORD SYS:	SP WA North FIPS 4601 Ft
LOCATION:	Black Diamond, WA	CONTRACTOR:	AEC	HORZ DATUM:	NAD83
				HOLE LOC:	SW of corner of pond location

DEPTH (ft)	DRILL RIG	DRILL METHOD	MATERIAL PROFILE				SAMPLES				SOIL CORE				GROUNDWATER OBSERVATIONS	CONSTRUCTION AND INSTALLATION DETAILS			
			DESCRIPTION	USCS	STRATA PLOT	ELEV. DEPTH (ft)	Hammer: N/A ASTM D1586, Blows per 0.15 m 623-N hammer, 0.76-m drop				RUN NO.	REC %							
							NUMBER	TYPE	REC %	N-VALUE		20	40	60				80	
51	TSI 150 cc Sonic Drilling		(SM) SILTY SAND, fine to coarse, subrounded to subangular, some fine to coarse subrounded to subangular gravel; gray, heterogeneous; moist to wet, very dense. (Qvt)	SM							7						▼	Pipe Elev: 546.1 ft 54.0 ft bgs: groundwater observed at time of drilling 1/6/22 52.0 - 68.0 ft bgs: 2-inch nominal diameter 20 slot schedule 40 PVC screen set in #10/20 silica sand 55.00 - 65.00 ft bgs: Screen Interval 68.0 - 70.0 ft bgs: medium bentonite chips backfill	
52																			
53							493.5												
54			(GM) SILTY GRAVEL, fine to coarse, subrounded to subangular, some fine to coarse subrounded to subangular sand, trace subrounded cobbles; reddish tan, iron oxide stains, heterogeneous; wet, very dense. (Qpog)	GM			53.0	SC-6	GS										
55			(SM) SILTY SAND, fine to coarse, subrounded to subangular, some fine to coarse subrounded to subangular gravel, trace subrounded cobbles; olive gray mottled orangish gray, iron oxide staining; wet. (Qpog)	SM			492.5												
56							54.0												
57																			
58																			
59																			
60																			
61																			
62																			
63																			
64																			
65									SC-7	GS									
66																			
67																			
68																			
69																			
70					End of hole at 70.00 ft.			476.5											
71																			
72																			
73																			
74																			
75																			

HAMMER TYPE: N/A



LOGGED: M. Stearn
CHECKED: J. Johnson

DATE: Jan 06, 2022
DATE: Jun 06, 2022

REV:
4

RECORD OF BOREHOLE: MW-34-1

Sheet 1 of 2

CLIENT: Oakpointe

PROJECT: Reserve at Woodlands

PROJECT NO: 063107621A

LOCATION: Black Diamond, WA

DATE: December 13, 2021

INCLINATION: -90.0°

CONTRACTOR: Holocene

ELEVATION: 526.8 ft (Ground)

COORDINATES: N: 110483.3 ft E: 1338228.4 ft

COORD SYS: SP WA North FIPS 4601 Ft

HORZ DATUM: NAD83

DEPTH (ft)	DRILL RIG	DRILL METHOD	MATERIAL PROFILE				SAMPLES				SOIL CORE					GROUNDWATER OBSERVATIONS			
			DESCRIPTION	USCS	STRATA PLOT	ELEV. ----- DEPTH (ft)	Hammer: Automatic, 140lb, 30" drop ASTM D1586, Blows per 0.15 m 623-N hammer, 0.76-m drop				RUN NO.	REC %							
							NUMBER	TYPE	REC %	N-VALUE		20	40	60	80				
1	Dietrich D-70 4 1/4 HSA		Topsoil.			0.0													
2			(SM) SILTY SAND, fine to coarse, some fine to coarse gravel; grayish brown, weathered, non-stratified, heterogeneous, trace organics; moist, dense. (Qvt)	SM		525.8 1.0													
3																			
4																			
5																			
6																			
7			(SM) SILTY SAND, fine to coarse, some fine to coarse gravel, trace cobbles; gray, heterogeneous; moist, very dense. (Qvt)				519.8 7.0												
8																			
9																			
10																			
11																			
12																			
13																			
14																			
15																			
16																			
17																			
18																			
19																			
20																			
21																			
22																			
23																			
24						(GM) SILTY GRAVEL, fine to coarse, non-plastic fines, some fine to coarse sand; mottled reddish gray, heterogeneous, iron oxide staining; moist, very dense. (Qvt)	GM		502.8 24.0										
25																			

Continued on Next Page

HAMMER TYPE: Automatic, 140lb, 30" drop



LOGGED: J. Coleman
CHECKED: J. Johnson

DATE: Dec 13, 2021
DATE: Jun 06, 2022

REV:

4

RECORD OF BOREHOLE: MW-34-1

Sheet 2 of 2

CLIENT: Oakpointe

PROJECT: Reserve at Woodlands

PROJECT NO: 063107621A

LOCATION: Black Diamond, WA

DATE: December 13, 2021

INCLINATION: -90.0°

CONTRACTOR: Holocene

ELEVATION: 526.8 ft (Ground)

COORDINATES: N: 110483.3 ft E: 1338228.4 ft

COORD SYS: SP WA North FIPS 4601 Ft

HORZ DATUM: NAD83

DEPTH (ft)	DRILL RIG	DRILL METHOD	MATERIAL PROFILE				SAMPLES				SOIL CORE				GROUNDWATER OBSERVATIONS	
			DESCRIPTION	USCS	STRATA PLOT	ELEV. ----- DEPTH (ft)	Hammer: Automatic, 140lb, 30" drop ASTM D1586, Blows per 0.15 m 623-N hammer, 0.76-m drop				RUN NO.	REC %				
							NUMBER	TYPE	REC %	N-VALUE		20	40	60		80
26	Dietrich D-70	4 1/4 HSA	(GM) SILTY GRAVEL, fine to coarse, non-plastic fines, some fine to coarse sand; mottled reddish gray, heterogeneous, iron oxide staining; moist, very dense. (Qvt) - 25.0 ft: coal	GM		498.3	5	SS	100							
27																
28			- 27.8 ft: cobbly drilling													
29			End of hole at 28.50 ft.													
30																
31																
32																
33																
34																
35																
36																
37																
38																
39																
40																
41																
42																
43																
44																
45																
46																
47																
48																
49																
50																

Goldier Log Imperial / Soil-Source 1 Well / Goldier - 3 Imperial US / Goldier US Auto (common in US) / 2024-11-12

RECORD OF BOREHOLE: MW-34-2

Sheet 1 of 4

CLIENT:	Oakpointe	START DATE:	January 14, 2022	ELEVATION:	526.3 ft (Ground)
PROJECT:	Reserve at Woodlands	END DATE:	January 04, 2022	COORDINATES:	N: 110483.3 ft E: 1338228.4 ft
PROJECT NO:	063107621A	INCLINATION:	-90.0°	COORD SYS:	SP WA North FIPS 4601 Ft
LOCATION:	Black Diamond, WA	CONTRACTOR:	AEC	HORZ DATUM:	NAD83
				HOLE LOC:	Near 218th Ave

DEPTH (ft)	DRILL RIG	DRILL METHOD	MATERIAL PROFILE				SAMPLES				SOIL CORE				GROUNDWATER OBSERVATIONS	CONSTRUCTION AND INSTALLATION DETAILS																
			DESCRIPTION	USCS	STRATA PLOT	ELEV. DEPTH (ft)	Hammer: N/A ASTM D1586, Blows per 0.15 m 623-N hammer, 0.76-m drop				RUN NO.	REC %																				
							NUMBER	TYPE	REC %	N-VALUE		20	40	60				80														
1	TSI 150 cc Sonic Drilling		Topsoil.	SM		0.0					1																					
2			(SM) SILTY SAND, fine to coarse, some fine to coarse subrounded to subangular gravel; grayish brown, weathered, non-stratified, heterogeneous, trace organics; moist. (Qvt)			525.3 1.0														1												
3																																
4																																
5																																
6																																
7																																
8			(SM) SILTY SAND, fine to coarse, some fine to coarse subrounded to subangular gravel, trace subrounded to subangular cobbles; gray, heterogeneous; moist. (Qvt)			519.3 7.0																										
9																																
10																																
11																																
12																																
13																																
14						- 14.0 ft: color change to gray																										
15																																
16																																
17																																
18																																
19																																
20																																
21																																
22																																
23																																
24						(GM) SILTY GRAVEL, fine to coarse subrounded to subangular, non-plastic fines, some fine to coarse sand; mottled reddish gray, heterogeneous, iron oxide staining; moist. (Qvt)													GM		502.3 24.0											
25																																

Continued on Next Page

HAMMER TYPE: N/A



LOGGED: M. Stearn
CHECKED: J. Johnson

DATE: Jan 14, 2022
DATE: Jun 06, 2022

REV:
4

RECORD OF BOREHOLE: MW-34-2

Sheet 2 of 4

CLIENT:	Oakpointe	START DATE:	January 14, 2022	ELEVATION:	526.3 ft (Ground)
PROJECT:	Reserve at Woodlands	END DATE:	January 04, 2022	COORDINATES:	N: 110483.3 ft E: 1338228.4 ft
PROJECT NO:	063107621A	INCLINATION:	-90.0°	COORD SYS:	SP WA North FIPS 4601 Ft
LOCATION:	Black Diamond, WA	CONTRACTOR:	AEC	HORZ DATUM:	NAD83
				HOLE LOC:	Near 218th Ave

DEPTH (ft)	DRILL RIG	DRILL METHOD	MATERIAL PROFILE				SAMPLES				SOIL CORE				GROUNDWATER OBSERVATIONS	CONSTRUCTION AND INSTALLATION DETAILS		
			DESCRIPTION	USCS	STRATA PLOT	ELEV. DEPTH (ft)	Hammer: N/A ASTM D1586, Blows per 0.15 m 623-N hammer, 0.75-m drop				RUN NO.	REC %						
							NUMBER	TYPE	REC %	N-VALUE		20	40	60				80
26	TSI 150 cc Sonic Drilling		(GM) SILTY GRAVEL, fine to coarse subrounded to subangular, non-plastic fines, some fine to coarse sand; mottled reddish gray, heterogeneous, iron oxide staining; moist. (Qvt) - 25.0 ft: coal	GM		499.3 27.0	5				3						Pipe Elev: 526.3 ft	
27																		
28			(SM) SILTY SAND, fine to coarse, low-plasticity fines, some fine to coarse subrounded to subangular gravel, trace subrounded to subangular cobbles; gray, heterogeneous; moist. (Qvt) - 27.8 ft: cobbly drilling	SM			6	GS		4								
29																		
30																		
31																		
32																		
33																		
34																		
35					- 37.0 to 37.2 ft: iron oxide staining													
36																		
37																		
38																		
39																		
40																		
41																		
42																		
43																		
44					(SP-SM) SAND and GRAVEL, fine to coarse sand, fine to coarse subrounded gravel, poorly graded, low-plasticity fines; gray to olive gray, non-stratified, heterogeneous; wet. (Qvt)	SP-SM		482.3 44.0	7	GS		5						
45																		
46																		
47																		
48																		
49																		
50																		

3.0 - 72.0 ft bgs: 2-inch nominal diameter solid schedule 40 PVC pipe set in medium bentonite chips

Continued on Next Page

HAMMER TYPE: N/A



REV:

4

LOGGED: M. Stearn
CHECKED: J. Johnson

DATE: Jan 14, 2022
DATE: Jun 06, 2022

RECORD OF BOREHOLE: MW-34-2

Sheet 3 of 4

CLIENT:	Oakpointe	START DATE:	January 14, 2022	ELEVATION:	526.3 ft (Ground)
PROJECT:	Reserve at Woodlands	END DATE:	January 04, 2022	COORDINATES:	N: 110483.3 ft E: 1338228.4 ft
PROJECT NO:	063107621A	INCLINATION:	-90.0°	COORD SYS:	SP WA North FIPS 4601 Ft
LOCATION:	Black Diamond, WA	CONTRACTOR:	AEC	HORZ DATUM:	NAD83
				HOLE LOC:	Near 218th Ave

DEPTH (ft)		DRILL RIG	DRILL METHOD	MATERIAL PROFILE				SAMPLES				SOIL CORE				GROUNDWATER OBSERVATIONS	CONSTRUCTION AND INSTALLATION DETAILS				
				DESCRIPTION	USCS	STRATA PLOT	ELEV. ----- DEPTH (ft)	Hammer: N/A ASTM D1586, Blows per 0.15 m 625-N hammer, 0.76-m drop				RUN NO.	REC %								
								NUMBER	TYPE	REC %	N-VALUE		20	40	60				80		
51		TS1 150 cc Sonic Drilling		(SP-SM) SAND and GRAVEL, fine to coarse sand, fine to coarse subrounded gravel, poorly graded, low-plasticity fines; gray to olive gray, non-stratified, heterogeneous; wet. (Qvt)	SP-SM		475.3														
52	(GP-GM) silty GRAVEL and SAND, fine to coarse subrounded to subangular gravel, fine to coarse sand, poorly graded, low-plasticity fines, trace subrounded to subangular cobbles and boulders; gray, heterogeneous; moist. (Qvt)			51.0	8		GS												6		
53																					
54																					
55																					
56																					
57																					
58																					
59																					
60																					
61																					
62	(GM) SILTY GRAVEL, fine to coarse subrounded, low-plasticity fines, some fine to coarse sand, trace subrounded to subangular cobbles; mottled reddish gray, heterogeneous, iron oxide staining; moist. (Qpog)			GM	464.3																7
63	(SM-GM) SILTY SAND and GRAVEL, fine to coarse, low-plasticity fines, fine to coarse subrounded gravel, trace subrounded to subangular cobbles; gray, layered; moist to wet. (Qpog)			463.3	9		GS														
64																					
65																					
66																					
67																					
68																					
69																					
70																					
71																					
72																					
73																					
74																					
75																					

Continued on Next Page

Continued on Next Page

HAMMER TYPE: N/A



REV:

4

LOGGED: M. Stearn
CHECKED: J. Johnson

DATE: Jan 14, 2022
DATE: Jun 06, 2022

RECORD OF BOREHOLE: MW-34-2

Sheet 4 of 4

CLIENT:	Oakpointe	START DATE:	January 14, 2022	ELEVATION:	526.3 ft (Ground)
PROJECT:	Reserve at Woodlands	END DATE:	January 04, 2022	COORDINATES:	N: 110483.3 ft E: 1338228.4 ft
PROJECT NO:	063107621A	INCLINATION:	-90.0°	COORD SYS:	SP WA North FIPS 4601 Ft
LOCATION:	Black Diamond, WA	CONTRACTOR:	AEC	HORZ DATUM:	NAD83
				HOLE LOC:	Near 218th Ave

DEPTH (ft)	DRILL RIG	DRILL METHOD	MATERIAL PROFILE				SAMPLES				SOIL CORE				GROUNDWATER OBSERVATIONS	CONSTRUCTION AND INSTALLATION DETAILS		
			DESCRIPTION	USCS	STRATA PLOT	ELEV. ----- DEPTH (ft)	Hammer: N/A ASTM D1586, Blows per 0.15 m 623-N hammer, 0.75-m drop				RUN NO.	REC %						
							NUMBER	TYPE	REC %	N-VALUE		20	40	60				80
76	TSI 150 cc Sonic Drilling		(SM-GM) SILTY SAND and GRAVEL, fine to coarse, low-plasticity fines, fine to coarse subrounded gravel, trace subrounded to subangular cobbles; gray, layered; moist to wet. (Qpog) - 75.0 to 80.0 ft: sample lost due to heat	SM-GM							8							72.0 - 85.0 ft bgs: 2-inch nominal diameter 20 slot schedule 40 PVC screen set in #10/20 silica sand 75.00 - 85.00 ft bgs: Screen Interval
77																		
78																		
79																		
80																		
81																		
82																		
83																		
84																		
85																		
86			End of hole at 85.00 ft.			441.3												
87																		
88																		
89																		
90																		
91																		
92																		
93																		
94																		
95																		
96																		
97																		
98																		
99																		
100																		

HAMMER TYPE: N/A



LOGGED: M. Stearn
CHECKED: J. Johnson

DATE: Jan 14, 2022
DATE: Jun 06, 2022

REV:

4

RECORD OF BOREHOLE: MW-34R

CLIENT: Oakpointe

PROJECT: Reserve at Woodlands

PROJECT NO: 063107621A

LOCATION: Black Diamond, WA

START DATE: March 23, 2022

END DATE: March 24, 2022

INCLINATION: -90.0°

CONTRACTOR: AEC

ELEVATION: 526.7 ft (Ground)

COORDINATES: N: 110483.3 ft E: 1338234.4 ft

COORD SYS: SP WA North FIPS 4601 Ft

HORZ DATUM: NAD83

DEPTH (ft)	DRILL RIG	DRILL METHOD	MATERIAL PROFILE				SAMPLES				SOIL CORE				GROUNDWATER OBSERVATIONS	CONSTRUCTION AND INSTALLATION DETAILS																
			DESCRIPTION	USCS	STRATA PLOT	ELEV. DEPTH (ft)	ASTM D1586, Blows per 0.15 m 623-N Hammer, 0.76-m drop				RUN NO.	REC %																				
							NUMBER	TYPE	REC %	N-VALUE		20	40	60				80														
1	TSI 150 cc Sonic Drilling		Forest duff.	SM		0.0					1																					
(SM) SILTY SAND, fine to coarse, low-plasticity fines, some fine to coarse subrounded gravel; brown, non-stratified, weathered; moist. (Qvt)					525.7																											
(SM) gravelly SILTY SAND, fine to coarse, non-plastic fines, fine to coarse subrounded to subangular gravel, trace subrounded to subangular cobbles; grayish brown, non-stratified, heterogeneous; moist. (Qvt) - 3.0 ft: color change to gray					1.0																											
					524.2																											
					2.5																											
2																																
3																																
4																																
5																																
6																																
7																		- 6.5 to 7.0 ft: silty sand pocket with root debris														
8																																
9																																
10																																
11																																
12																																
13																																
14																																
15																																
16																																
17																		- 17.0 to 17.5 ft: high moisture silty sand pocket														
18																																
19																																
20																																
21																																
22																																
23			- 23.0 ft: increasing gravel content																													
24																																
25																																

Pipe Elev: 526.2 ft

0.0 - 3.0 ft bgs: cement monument

Continued on Next Page

HAMMER TYPE: N/A



LOGGED: M. Rutte
CHECKED: J. Johnson

DATE: Mar 23, 2022
DATE: Jun 06, 2022

REV:
4

RECORD OF BOREHOLE: MW-34R

Sheet 2 of 6

CLIENT:	Oakpointe	START DATE:	March 23, 2022	ELEVATION:	526.7 ft (Ground)
PROJECT:	Reserve at Woodlands	END DATE:	March 24, 2022	COORDINATES:	N: 110483.3 ft E: 1338234.4 ft
PROJECT NO:	063107621A	INCLINATION:	-90.0°	COORD SYS:	SP WA North FIPS 4601 Ft
LOCATION:	Black Diamond, WA	CONTRACTOR:	AEC	HORZ DATUM:	NAD83

DEPTH (ft)	DRILL RIG	DRILL METHOD	MATERIAL PROFILE				SAMPLES				SOIL CORE					GROUNDWATER OBSERVATIONS	CONSTRUCTION AND INSTALLATION DETAILS		
			DESCRIPTION	USCS	STRATA PLOT	ELEV. DEPTH (ft)	Hammer: N/A ASTM D1586, Blows per 0.15 m 62.5-N hammer, 0.75-m drop				RUN NO.	REC %							
							NUMBER	TYPE	REC %	N-VALUE		20	40	60	80				
26	TSI 150 cc Sonic Drilling		(SM) gravelly SILTY SAND, fine to coarse, non-plastic fines, fine to coarse subrounded to subangular gravel, trace subrounded to subangular cobbles; grayish brown, non-stratified, heterogeneous; moist. (Qvt)	SM							3								
27																			
28																			
29																			
30			(GM) SILTY GRAVEL, fine to coarse subrounded to subangular, low-plasticity fines, some fine to coarse sand, trace subrounded to subangular cobbles; grayish brown, non-stratified, faceted; moist. (Qvt)	GM															
31																			
32																			
33																			
34																			
35																			
36			(SM) gravelly SILTY SAND, fine to coarse, fine subrounded to subangular gravel, some low-plasticity fines, trace subrounded to subangular cobbles; dark grayish brown, non-stratified; wet. (Qvt)	SM									4						
37																			
38			(SM) SILTY SAND, fine to coarse, non-plastic fines, some fine subrounded to subangular gravel; dark grayish brown, non-stratified; wet. (Qvt)																
39																			
40			- 39.0 ft: decreasing silt content																
41																			
42	(SP-SM) SAND, fine to coarse, poorly graded, some non-plastic fines, some fine subrounded to subangular gravel, trace subrounded to subangular cobbles; light grayish brown, non-stratified; moist to wet. (Qvt)	SP-SM																	
43																			
44																			
45																			
46	(SM) SILTY SAND, fine to coarse, low-plasticity fines, some fine to coarse subrounded to subangular gravel; dark grayish brown, non-stratified; moist. (Qvt)	SM																	
47																			
48	- 46.5 ft: iron oxide stains																		
49																			
50	No recovery																		

Continued on Next Page

HAMMER TYPE: N/A



LOGGED: M. Rutte
CHECKED: J. Johnson

DATE: Mar 23, 2022
DATE: Jun 06, 2022

REV:
4

RECORD OF BOREHOLE: MW-34R

Sheet 3 of 6

CLIENT:	Oakpointe	START DATE:	March 23, 2022	ELEVATION:	526.7 ft (Ground)
PROJECT:	Reserve at Woodlands	END DATE:	March 24, 2022	COORDINATES:	N: 110483.3 ft E: 1338234.4 ft
PROJECT NO:	063107621A	INCLINATION:	-90.0°	COORD SYS:	SP WA North FIPS 4601 Ft
LOCATION:	Black Diamond, WA	CONTRACTOR:	AEC	HORZ DATUM:	NAD83

DEPTH (ft)	DRILL RIG	DRILL METHOD	MATERIAL PROFILE				SAMPLES				SOIL CORE				GROUNDWATER OBSERVATIONS	CONSTRUCTION AND INSTALLATION DETAILS			
			DESCRIPTION	USCS	STRATA PLOT	ELEV. DEPTH (ft)	Hammer: N/A ASTM D1586, Blows per 0.15 m 62.3-N hammer, 0.75-m drop				RUN NO.	REC %							
							NUMBER	TYPE	REC %	N-VALUE		20	40	60				80	
51	TSI 150 cc Sonic Drilling		(GM) SILTY GRAVEL, fine to coarse subrounded to subangular, non-plastic fines, some fine to coarse sand; light brown, non-stratified; wet. (Qvt)	GM							6							3.0 - 119.0 ft bgs: 2-inch nominal diameter solid schedule 40 PVC pipe set in medium bentonite chips	
52																			
53																			
54			(SM) SILTY SAND, fine to coarse, low-plasticity fines, some fine to coarse subrounded gravel; light brownish gray, non-stratified; moist to wet. (Qvt)			53.0													
55			- 54.5 ft: increasing sand content																
56																			
57			(SM) SILTY SAND, fine to coarse, low-plasticity fines, some fine to coarse subrounded to subangular gravel, trace cobbles; dark grayish brown, non-stratified; moist. (Qvt)	SM		470.7						7							
58						56.0													
59						56.0													
60				SM															
61																			
62																			
63				SM															
64																			
65																			
66			- 66.0 ft: rounded coarse gravels	SM															
67			(SM) SILTY SAND, fine to coarse, low-plasticity fines, some fine to coarse subrounded to subangular gravel, trace cobbles; dark grayish brown, non-stratified; moist. (Qvt)																
68			- 66.0 ft: rounded coarse gravels																
69				SM															
70																			
71																			
72				SM															
73																			
74																			
75				SM															

Continued on Next Page

Pipe Elev: 526.2 ft

3.0 - 119.0 ft bgs: 2-inch nominal diameter solid schedule 40 PVC pipe set in medium bentonite chips

Continued on Next Page

HAMMER TYPE: N/A



LOGGED: M. Rutte
CHECKED: J. Johnson

DATE: Mar 23, 2022
DATE: Jun 06, 2022

REV:
4

RECORD OF BOREHOLE: MW-34R

Sheet 4 of 6

CLIENT:	Oakpointe	START DATE:	March 23, 2022	ELEVATION:	526.7 ft (Ground)
PROJECT:	Reserve at Woodlands	END DATE:	March 24, 2022	COORDINATES:	N: 110483.3 ft E: 1338234.4 ft
PROJECT NO:	063107621A	INCLINATION:	-90.0°	COORD SYS:	SP WA North FIPS 4601 Ft
LOCATION:	Black Diamond, WA	CONTRACTOR:	AEC	HORZ DATUM:	NAD83

DEPTH (ft)	DRILL RIG	DRILL METHOD	MATERIAL PROFILE				SAMPLES				SOIL CORE				GROUNDWATER OBSERVATIONS	CONSTRUCTION AND INSTALLATION DETAILS			
			DESCRIPTION	USCS	STRATA PLOT	ELEV. DEPTH (ft)	ASTM D1586, Blows per 0.15 m 623-N hammer, 0.75-m drop				RUN NO.	REC %							
							NUMBER	TYPE	REC %	N-VALUE		20	40	60				80	
76	TSI 150 cc Sonic Drilling		(SM) SILTY SAND, fine to coarse, low-plasticity fines, some fine to coarse subrounded to subangular gravel, trace cobbles; dark grayish brown, non-stratified; moist. (Qvt)	SM							8								
77																			
78																			
79																			
80			- 80.0 ft: increasing silt content																
81																			
82																			
83																			
84																			
85																			
86																			
87																			
88																			
89																			
90			- 90.0 ft: color change to dark grayish brown; iron oxide stainin																
91																			
92																			
93																			
94																			
95																			
96																			
97			- 99.0 ft: color change to light grayish broown, reduced moisture; reduced silt content																
98			(GW-GM) GRAVEL to SILTY GRAVEL, fine to coarse, rounded to subangular, few non-plastic fines, some fine to coarse sand, trace cobbles; dark grayish brown, weakly stratified; moist. (Qpog)																
99			- 80.0 ft: increasing silt content - 90.0 ft: color change to dark grayish brown; iron oxide stainin - 99.0 ft: color change to light grayish broown, reduced moisture; reduced silt content																
100																			

Continued on Next Page

Continued on Next Page

HAMMER TYPE: N/A



REV:

4

LOGGED: M. Rutte

DATE: Mar 23, 2022

CHECKED: J. Johnson

DATE: Jun 06, 2022

RECORD OF BOREHOLE: MW-34R

Sheet 5 of 6

CLIENT: Oakpointe

PROJECT: Reserve at Woodlands

PROJECT NO: 063107621A

LOCATION: Black Diamond, WA

START DATE: March 23, 2022

END DATE: March 24, 2022

INCLINATION: -90.0°

CONTRACTOR: AEC

ELEVATION: 526.7 ft (Ground)

COORDINATES: N: 110483.3 ft E: 1338234.4 ft

COORD SYS: SP WA North FIPS 4601 Ft

HORZ DATUM: NAD83

DEPTH (ft)	DRILL RIG	DRILL METHOD	MATERIAL PROFILE				SAMPLES				SOIL CORE				GROUNDWATER OBSERVATIONS	CONSTRUCTION AND INSTALLATION DETAILS						
			DESCRIPTION	USCS	STRATA PLOT	ELEV. DEPTH (ft)	Hammer: N/A ASTM D1586, Blows per 0.15 m 623-N hammer, 0.76-m drop				RUN NO.	REC %										
							NUMBER	TYPE	REC %	N-VALUE		20	40	60				80				
101	TSI 150 cc Sonic Drilling		(SM) SILTY SAND, fine to coarse, low-plasticity fines, some fine to coarse subrounded to subangular gravel, trace cobbles; dark grayish brown, non-stratified; moist. (Qvt)	GS-MGM							11						Groundwater level indicated by inverted triangle symbol.	Pipe Elev: 526.2 ft				
102			(GW-GM) GRAVEL to SILTY GRAVEL, fine to coarse, rounded to subangular, few non-plastic fines, some fine to coarse sand, trace cobbles; dark grayish brown, weakly stratified; moist. (Qpog)																			
103																						
104																						
105																						
106																						
107																						
108			No recovery (Qpog)					419.2														
109								419.2														
110								107.5														
111																						
112																						
113																						
114																						
115																						
116																						
117																						
118																						
119																						
120																						
121																						
122																						
123																						
124																						
125																						

120.0 ft bgs:
groundwater observed
at time of drilling

HAMMER TYPE: N/A



LOGGED: M. Rutte
CHECKED: J. Johnson

DATE: Mar 23, 2022
DATE: Jun 06, 2022

REV:

4

RECORD OF BOREHOLE: MW-34R

Sheet 6 of 6

CLIENT:	Oakpointe	START DATE:	March 23, 2022	ELEVATION:	526.7 ft (Ground)
PROJECT:	Reserve at Woodlands	END DATE:	March 24, 2022	COORDINATES:	N: 110483.3 ft E: 1338234.4 ft
PROJECT NO:	063107621A	INCLINATION:	-90.0°	COORD SYS:	SP WA North FIPS 4601 Ft
LOCATION:	Black Diamond, WA	CONTRACTOR:	AEC	HORZ DATUM:	NAD83

DEPTH (ft)	DRILL RIG	DRILL METHOD	MATERIAL PROFILE				SAMPLES				SOIL CORE				GROUNDWATER OBSERVATIONS	CONSTRUCTION AND INSTALLATION DETAILS		
			DESCRIPTION	USCS	STRATA PLOT	ELEV. DEPTH (ft)	ASTM D1586, Hammer: N/A Blows per 0.15 m 623-N hammer, 0.76-m drop				RUN NO.	REC %						
							NUMBER	TYPE	REC %	N-VALUE		20	40	60				80
126	TSI 150 cc Sonic Drilling		(SM-GM) SILTY SAND and GRAVEL, fine to coarse, non-plastic fines, some fine to coarse subrounded to subangular gravel, trace cobbles; grayish brown; moist. (Qpog)	SM-GM						13								
127																		
128																		
129																		
130																		
131																		
132																		
133																		
134																		
135																		
136			(ML) SILT, non-plastic, some fine to medium sand, some fine to coarse subrounded gravel; dark grayish brown, socketed matrix; wet. (Qpon)	ML		390.7						14						
137						136.0												
138						389.2												
139			End of hole at 137.50 ft.															
140																		
141																		
142																		
143																		
144																		
145																		
146																		
147																		
148																		
149																		
150																		

HAMMER TYPE: N/A



LOGGED: M. Rutte
 CHECKED: J. Johnson

DATE: Mar 23, 2022
 DATE: Jun 06, 2022

REV:

4

RECORD OF BOREHOLE: MW-35

Sheet 1 of 4

CLIENT: Oakpointe

PROJECT: Reserve at Woodlands

PROJECT NO: 063107621A

LOCATION: Black Diamond, WA

DATE: January 05, 2022

INCLINATION: -90.0°

CONTRACTOR: AEC

ELEVATION: 532.6 ft (Ground)

COORDINATES: N: 109041.0 ft E: 1339272.0 ft

COORD SYS: SP WA North FIPS 4601 Ft

HORZ DATUM: NAD83

HOLE LOC: Halfway S side of loop, path NE of road

DEPTH (ft)	DRILL RIG	DRILL METHOD	MATERIAL PROFILE				SAMPLES				SOIL CORE				GROUNDWATER OBSERVATIONS	CONSTRUCTION AND INSTALLATION DETAILS														
			DESCRIPTION	USCS	STRATA PLOT	ELEV. DEPTH (ft)	Hammer: N/A ASTM D1586, Blows per 0.15 m 623-N hammer, 0.76-m drop				RUN NO.	REC %																		
							NUMBER	TYPE	REC %	N-VALUE		20	40	60				80												
1	TSI 150 cc Sonic Drilling		(SM) SILTY SAND, fine to medium, low-plasticity fines, trace fine to coarse subrounded to subangular gravel; brown, iron oxide staining trace rootlets; moist. (Qvr)	SM		0.0					1																			
2																														
3																														
4							1	GS																						
5																														
6			(SP-SM) SAND, fine to coarse, poorly graded, rounded to subrounded, some fine to coarse rounded to subrounded gravel, some non-plastic fines; brown, bedded; moist. (Qvr)			SP-SM		526.6					2																	
7								6.0																						
8																														
9																														
10								2	GS																					
11																														
12																														
13																														
14																														
15								- 15.0 to 17.0 ft: iron oxide stains																						
16								- 15.5 to 16.0 ft: silt pocket with rootlets																						
17																														
18																														
19																														
20																														
21																														
22																														
23																														
24								(SM) SILTY SAND, fine to coarse, non-plastic fines, some fine to coarse rounded to subrounded gravel, trace rounded to subrounded cobbles; brown, weathered; moist. (Qvt)	SM		508.6													3						
25											24.0																			

Continued on Next Page

HAMMER TYPE: N/A



LOGGED: M. Stearn
CHECKED: J. Johnson

DATE: Jan 05, 2022
DATE: Jun 06, 2022

REV:
4

RECORD OF BOREHOLE: MW-35

Sheet 2 of 4

CLIENT: Oakpointe

PROJECT: Reserve at Woodlands

PROJECT NO: 063107621A

LOCATION: Black Diamond, WA

DATE: January 05, 2022

INCLINATION: -90.0°

CONTRACTOR: AEC

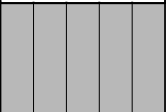
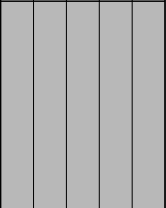
ELEVATION: 532.6 ft (Ground)

COORDINATES: N: 109041.0 ft E: 1339272.0 ft

COORD SYS: SP WA North FIPS 4601 Ft

HORZ DATUM: NAD83

HOLE LOC: Halfway S side of loop, path NE of road

DEPTH (ft)	DRILL RIG	DRILL METHOD	MATERIAL PROFILE				SAMPLES				SOIL CORE				GROUNDWATER OBSERVATIONS	CONSTRUCTION AND INSTALLATION DETAILS		
			DESCRIPTION	USCS	STRATA PLOT	ELEV. DEPTH (ft)	Hammer: N/A ASTM D1586, Blows per 0.15 m 623-N hammer, 0.76-m drop				RUN NO.	REC %						
							NUMBER	TYPE	REC %	N-VALUE		20	40	60				80
26	TSI 150 cc Sonic Drilling		(SM) SILTY SAND, fine to coarse, non-plastic fines, some fine to coarse rounded to subrounded gravel, trace rounded to subrounded cobbles; brown, weathered; moist. (Qvt)	SM		505.6 27.0	4	GS			3					Pipe Elev: 532.3 ft		
27			(SM) gravelly SILTY SAND, fine to coarse, fine to coarse subrounded to subangular gravel; gray to tan, heterogeneous, socketed matrix; moist to wet. (Qvt) - 27.0 ft: drier material				5	GS										
28																		
29																		
30																		
31																		
32																		
33																		
34																		
35																		
36					- 36.0 ft: tan layer	6	GS		4									
37																		
38																		
39																		
40					- 40.0 ft: encountered cobbles						5							
41																		
42																		
43								7	GS									
44																		
45								487.6 45.0										
46					(GM) sandy gravelly SILT, low-plasticity, fine to coarse subrounded to subangular gravel, fine to coarse sand; brownish gray, heterogeneous, iron oxide staining; moist to wet. (Qvt)	GM		8	GS			6						
47																		
48																		
49																		
50																		

Continued on Next Page

HAMMER TYPE: N/A



LOGGED: M. Stearn
CHECKED: J. Johnson

DATE: Jan 05, 2022
DATE: Jun 06, 2022

REV:
4

RECORD OF BOREHOLE: MW-35

Sheet 4 of 4

CLIENT: Oakpointe

PROJECT: Reserve at Woodlands

PROJECT NO: 063107621A

LOCATION: Black Diamond, WA

DATE: January 05, 2022

INCLINATION: -90.0°

CONTRACTOR: AEC

ELEVATION: 532.6 ft (Ground)

COORDINATES: N: 109041.0 ft E: 1339272.0 ft

COORD SYS: SP WA North FIPS 4601 Ft

HORZ DATUM: NAD83

HOLE LOC: Halfway S side of loop, path NE of road

DEPTH (ft)	DRILL RIG	DRILL METHOD	MATERIAL PROFILE				SAMPLES				SOIL CORE				GROUNDWATER OBSERVATIONS	CONSTRUCTION AND INSTALLATION DETAILS						
			DESCRIPTION	USCS	STRATA PLOT	ELEV. ----- DEPTH (ft)	Hammer: N/A ASTM D1586, Blows per 0.15 m 623-N hammer, 0.75-m drop				RUN NO.	REC %										
							NUMBER	TYPE	REC %	N-VALUE		20	40	60				80				
76	TSI 150 cc	Sonic Drilling	(GM) SILTY GRAVEL, fine to coarse subrounded to subangular, poorly graded, non-plastic fines, some fine to medium sand; light brownish gray; wet. (Qpog)	GM		452.6	12	GS			10							75.0 - 80.0 ft bgs: surface cuttings backfill				
77																						
78																						
79																						
80			End of hole at 80.00 ft.																			
81																						
82																						
83																						
84																						
85																						
86																						
87																						
88																						
89																						
90																						
91																						
92																						
93																						
94																						
95																						
96																						
97																						
98																						
99																						
100																						

RECORD OF BOREHOLE: MW-36

Sheet 1 of 3

CLIENT: Oakpointe

PROJECT: Reserve at Woodlands

PROJECT NO: 063107621A

LOCATION: Black Diamond, WA

DATE: January 13, 2022

INCLINATION: -90.0°

CONTRACTOR: AEC

ELEVATION: 550.3 ft (Ground)

COORDINATES: N: 112154.1 ft E: 1341780.7 ft

COORD SYS: SP WA North FIPS 4601 Ft

HORZ DATUM: NAD83

HOLE LOC: Bottom of the hill S of Juniper Street

DEPTH (ft)	DRILL RIG	DRILL METHOD	MATERIAL PROFILE				SAMPLES				SOIL CORE				GROUNDWATER OBSERVATIONS	CONSTRUCTION AND INSTALLATION DETAILS														
			DESCRIPTION	USCS	STRATA PLOT	ELEV. DEPTH (ft)	NUMBER	TYPE	REC %	N-VALUE	RUN NO.	REC %																		
												20	40	60				80												
1	TSI 150 cc Sonic Drilling		Forest duff.	SP		0.0	1	GS			1						Pipe Elev: 549.8 ft													
2			(SP) gravelly SAND, fine to coarse, poorly graded, fine to coarse subrounded to subangular gravel, trace non-plastic fines; orangish brown to brownish gray, weathered; moist. (Qvt)															549.3												0.0 - 4.0 ft bgs: cement monument
3																		1.0												
4																														
5																														
6																														
7																														
8			(GM) SILTY GRAVEL, fine to coarse subrounded to subangular, non-plastic fines, some fine to coarse sand, trace subrounded to subangular cobbles; brownish gray, heterogeneous; moist. (Qvt)	GM		542.8	2	GS				2																		
9																			7.5											
10																														
11																														
12																														
13																														
14			(SM) SILTY SAND with gravel, fine to coarse, fine to coarse subrounded to subangular gravel, some non-plastic fines, trace subrounded to subangular cobbles; brownish gray to olive gray, weathered, heterogeneous; moist. (Qvt)	SM		537.3	3	GS				3																		
15																			13.0											
16																														
17																														
18																														
19																														
20																														
21																														
22																														
23																														
24																														
25																														

Continued on Next Page

HAMMER TYPE: N/A



LOGGED: M. Stearn
CHECKED: J. Johnson

DATE: Jan 13, 2022
DATE: Jun 06, 2022

REV:
4

RECORD OF BOREHOLE: MW-36

Sheet 2 of 3

CLIENT: Oakpointe

PROJECT: Reserve at Woodlands

PROJECT NO: 063107621A

LOCATION: Black Diamond, WA

DATE: January 13, 2022

INCLINATION: -90.0°

CONTRACTOR: AEC

ELEVATION: 550.3 ft (Ground)

COORDINATES: N: 112154.1 ft E: 1341780.7 ft

COORD SYS: SP WA North FIPS 4601 Ft

HORZ DATUM: NAD83

HOLE LOC: Bottom of the hill S of Juniper Street

DEPTH (ft)	DRILL RIG	DRILL METHOD	MATERIAL PROFILE				SAMPLES				SOIL CORE				GROUNDWATER OBSERVATIONS	CONSTRUCTION AND INSTALLATION DETAILS												
			DESCRIPTION	USCS	STRATA PLOT	ELEV. DEPTH (ft)	Hammer: N/A ASTM D1586, Blows per 0.15 m 623-N hammer, 0.75-m drop				RUN NO.	REC %																
							NUMBER	TYPE	REC %	N-VALUE		20	40	60				80										
26	TSI 150 cc Sonic Drilling		(SM) SILTY SAND with gravel, fine to coarse, fine to coarse subrounded to subangular gravel, some non-plastic fines, trace subrounded to subangular cobbles; brownish gray to olive gray, weathered, heterogeneous; moist. (Qvt)	SM							3																	
27																												
28																												
29																												
30																												
31																												
32																												
33																												
34																												
35																												
36																												
37																												
38																												
39																												
40																												
41																												
42			(SM) gravelly SILTY SAND, fine to coarse, subrounded to subangular, fine to coarse subrounded to subangular gravel; gray, heterogeneous; moist to wet. (Qpog)								4																	
43																												
44																												
45																												
46																												
47																												
48																												
49																												
50											5																	
	Continued on Next Page					500.3 50.0	5	GS																				

RECORD OF BOREHOLE: MW-36

Sheet 3 of 3

CLIENT: Oakpointe

PROJECT: Reserve at Woodlands

PROJECT NO: 063107621A

LOCATION: Black Diamond, WA

DATE: January 13, 2022

INCLINATION: -90.0°

CONTRACTOR: AEC

ELEVATION: 550.3 ft (Ground)

COORDINATES: N: 112154.1 ft E: 1341780.7 ft

COORD SYS: SP WA North FIPS 4601 Ft

HORZ DATUM: NAD83

HOLE LOC: Bottom of the hill S of Juniper Street

DEPTH (ft)	DRILL RIG	DRILL METHOD	MATERIAL PROFILE				SAMPLES				SOIL CORE				GROUNDWATER OBSERVATIONS	CONSTRUCTION AND INSTALLATION DETAILS		
			DESCRIPTION	USCS	STRATA PLOT	ELEV. DEPTH (ft)	ASTM D1556, Blows per 0.15 m 623-N hammer, 0.75-m drop				RUN NO.	REC %						
							NUMBER	TYPE	REC %	N-VALUE		20	40	60				80
51	TSI 150 cc Sonic Drilling		(SM-GM) silty SAND and GRAVEL, fine to coarse subrounded to rounded, non-plastic fines; brownish gray with dark brown, weakly stratified; wet. (Qpog)	SM-GM		480.3	6	GS			6						50.0 ft bgs: groundwater observed at time of drilling	
52																		
53																		
54																		
55																		
56																		
57																		
58																		
59																		
60							- 59.0 to 68.0 ft: increased silt content	7	GS									
61								8	GS									
62																		
63																		
64																		
65																		
66																		
67																		
68																		
69							- 68.0 to 70.0 ft: decreased silt content	9	GS									
70							End of hole at 70.00 ft.											
71																		
72																		
73																		
74																		
75																		

HAMMER TYPE: N/A



LOGGED: M. Stearn
CHECKED: J. Johnson

DATE: Jan 13, 2022
DATE: Jun 06, 2022

REV:
4

RECORD OF BOREHOLE: MW-37

Sheet 1 of 6

CLIENT:	Oakpointe	START DATE:	February 21, 2022	ELEVATION:	540.0 ft (Ground)
PROJECT:	Reserve at Woodlands	END DATE:	March 01, 2022	COORDINATES:	N: 109650.9 ft E: 1338253.8 ft
PROJECT NO:	063107621A	INCLINATION:	-90.0°	COORD SYS:	SP WA North FIPS 4601 Ft
LOCATION:	Black Diamond, WA	CONTRACTOR:	AEC	HORZ DATUM:	NAD83

DEPTH (ft)	DRILL RIG	DRILL METHOD	MATERIAL PROFILE				SAMPLES				SOIL CORE				GROUNDWATER OBSERVATIONS	CONSTRUCTION AND INSTALLATION DETAILS			
			DESCRIPTION	USCS	STRATA PLOT	ELEV. DEPTH (ft)	Hammer: N/A ASTM D1586, Blows per 0.15 m 623-N hammer, 0.76-m drop				RUN NO.	REC %							
							NUMBER	TYPE	REC %	N-VALUE		20	40	60				80	
1	TSI 150 cc Sonic Drilling		(TOPSOIL - ML) SILT, non-plastic, medium to coarse sand, with fine to coarse subangular gravel; grayish brown, non-stratified, heterogeneous; moist.	ML		0.0	SC-1					1							
2																			
3			(SW-SM) SAND, medium to coarse, well graded, some coarse subrounded to subangular gravel, some non-plastic fines; grayish brown, non-stratified, heterogeneous, socketed matrix; moist. (Qvr)	SW-SM		537.0													
4						3.0	SC-2	GS											
5																			
6																			
7																			
8																			
9																			
10																			
11																			
12																			
13																			
14																			
15																			
16																			
17																			
18																			
19																			
20																			
21					(GP-GM) SILTY GRAVEL, fine to coarse subrounded to subangular, poorly graded, non-plastic fines, some medium to coarse sand; grayish brown, non-stratified, heterogeneous; moist. (Qvt)	GP-GM		520.0	SC-3	GS									
22									20.0										
23																			
24																			
25																			

Continued on Next Page

HAMMER TYPE: N/A



REV:

4

LOGGED: M. Rutte
CHECKED: J. Johnson

DATE: Feb 21, 2022
DATE: Jun 06, 2022

RECORD OF BOREHOLE: MW-37

Sheet 2 of 6

CLIENT: Oakpointe

PROJECT: Reserve at Woodlands

PROJECT NO: 063107621A

LOCATION: Black Diamond, WA

START DATE: February 21, 2022

END DATE: March 01, 2022

INCLINATION: -90.0°

CONTRACTOR: AEC

ELEVATION: 540.0 ft (Ground)

COORDINATES: N: 109650.9 ft E: 1338253.8 ft

COORD SYS: SP WA North FIPS 4601 Ft

HORZ DATUM: NAD83

DEPTH (ft)	DRILL RIG	DRILL METHOD	MATERIAL PROFILE				SAMPLES				SOIL CORE				GROUNDWATER OBSERVATIONS	CONSTRUCTION AND INSTALLATION DETAILS								
			DESCRIPTION	USCS	STRATA PLOT	ELEV. DEPTH (ft)	Hammer: N/A ASTM D1586, Blows per 0.15 m 623-N hammer, 0.76-m drop				RUN NO.	REC %												
							NUMBER	TYPE	REC %	N-VALUE		20	40	60				80						
26	TSI 150 cc Sonic Drilling		(GP-GM) SILTY GRAVEL, fine to coarse subrounded to subangular, poorly graded, non-plastic fines, some medium to coarse sand; grayish brown, non-stratified, heterogeneous; moist. (Qvt)	GP-GM		510.0 30.0	SC-4	GS		3							Pipe Elev: 539.7 ft							
(SM) SILTY SAND, fine, non-plastic fines, some fine to coarse subrounded to subangular gravel; grayish brown, non-stratified, heterogeneous, socketed matrix; moist. (Qvt)			SM																508.0 32.0	SC-5	GS			
(SP-SM) gravelly SAND, fine to coarse, poorly graded, fine to coarse subrounded to subangular gravel, some non-plastic fines; grayish brown, non-stratified, heterogeneous; moist. (Qvt)																							SP-SM	
			4																					

Continued on Next Page

HAMMER TYPE: N/A



LOGGED: M. Rutte
CHECKED: J. Johnson

DATE: Feb 21, 2022
DATE: Jun 06, 2022

REV:
4

RECORD OF BOREHOLE: MW-37

Sheet 3 of 6

CLIENT: Oakpointe

PROJECT: Reserve at Woodlands

PROJECT NO: 063107621A

LOCATION: Black Diamond, WA

START DATE: February 21, 2022

END DATE: March 01, 2022

INCLINATION: -90.0°

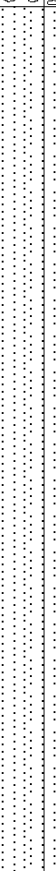
CONTRACTOR: AEC

ELEVATION: 540.0 ft (Ground)

COORDINATES: N: 109650.9 ft E: 1338253.8 ft

COORD SYS: SP WA North FIPS 4601 Ft

HORZ DATUM: NAD83

DEPTH (ft)	DRILL RIG	DRILL METHOD	MATERIAL PROFILE				SAMPLES				SOIL CORE				GROUNDWATER OBSERVATIONS	CONSTRUCTION AND INSTALLATION DETAILS			
			DESCRIPTION	USCS	STRATA PLOT	ELEV. DEPTH (ft)	Hammer: N/A ASTM D1586, Blows per 0.15 m 623-N hammer, 0.75-m drop				RUN NO.	REC %							
							NUMBER	TYPE	REC %	N-VALUE		20	40	60				80	
51	TSI 150 cc Sonic Drilling		(GP-GM) SILTY GRAVEL, fine to coarse subrounded to subangular, poorly graded, non-plastic fines, some medium to coarse sand; gray, non-stratified, heterogeneous, socketed matrix; moist. (Qvt)	GP-GM		480.0 60.0	SC-7	GS		6									
52																			
53																			
54																			
55																			
56							- 56.0 ft: increasing moisture, silt, and gravel size												
57																			
58							- 58.0 to 60.0 ft: cobble lens	SC-8	GS										
59							- 59.0 to 59.5 ft: light gray to white layer	SC-9	GS										
60																			
61			(SP-SM) SAND and GRAVEL, fine to medium sand, fine to coarse subrounded to subangular gravel, poorly graded, low-plasticity fines; grayish brown, non-stratified, heterogeneous; moist. (Qvt)	SP-SM		480.0 60.0	SC-10	GS		7									
62																			
63																			
64																			
65																			
66																			
67							- 67.0 to 75.0 ft: frequent cobbles												
68																			
69																			
70																			
71																			
72																			
73							- 73.0 ft: trace reddish gravel and cobbles	SC-11	GS			8							
74																			
75																			

HAMMER TYPE: N/A



LOGGED: M. Rutte
CHECKED: J. Johnson

DATE: Feb 21, 2022
DATE: Jun 06, 2022

REV:
4

RECORD OF BOREHOLE: MW-37

Sheet 4 of 6

CLIENT: Oakpointe

PROJECT: Reserve at Woodlands

PROJECT NO: 063107621A

LOCATION: Black Diamond, WA

START DATE: February 21, 2022

END DATE: March 01, 2022

INCLINATION: -90.0°

CONTRACTOR: AEC

ELEVATION: 540.0 ft (Ground)

COORDINATES: N: 109650.9 ft E: 1338253.8 ft

COORD SYS: SP WA North FIPS 4601 Ft

HORZ DATUM: NAD83

DEPTH (ft)	DRILL RIG	DRILL METHOD	MATERIAL PROFILE				SAMPLES				SOIL CORE				GROUNDWATER OBSERVATIONS	CONSTRUCTION AND INSTALLATION DETAILS			
			DESCRIPTION	USCS	STRATA PLOT	ELEV. DEPTH (ft)	Hammer: N/A ASTM D1586, Blows per 0.15 m 623-N hammer, 0.75-m drop				RUN NO.	REC %							
							NUMBER	TYPE	REC %	N-VALUE		20	40	60				80	
76	TSI 150 cc Sonic Drilling		(SP-SM) SAND and GRAVEL, fine to medium sand, fine to coarse subrounded to subangular gravel, poorly graded, low-plasticity fines; grayish brown, non-stratified, heterogeneous; moist. (Qvt)	SP-SM							8						Pipe Elev: 539.7 ft		
77																			
78																			
79																			
80																			
81																			
82																			
83			(SM) gravelly SILTY SAND, fine to medium, fine to coarse subrounded to subangular gravel; light grayish brown, non-stratified, heterogeneous; moist. (Qvt)	SM								9							
84																			
85																			
86			(ML) sandy SILT, low-plasticity, fine sand, some fine subangular gravel; light gray, non-stratified, heterogeneous; moist. (Qvt)	ML															
87																			
88			(SM) SILTY SAND, fine to medium, non-plastic fines, some fine to coarse subrounded to subangular gravel; light gray, non-stratified, heterogeneous, socketed matrix; moist. (Qvt)	SM															
89																			
90																			
91			(GP) GRAVEL and SAND, fine to coarse subrounded to subangular gravel, fine to medium sand, poorly graded, some non-plastic fines; light grayish brown, non-stratified, heterogeneous; moist. (Qvt)	GP									10						
92																			
93																			
94																			
95																			
96																			
97																			
98																			
99			(SM) gravelly SILTY SAND, fine, non-plastic fines, fine subrounded to subangular gravel; light gray, non-stratified, heterogeneous; moist. (Qvt)	SM															
100																			
Continued on Next Page																			

HAMMER TYPE: N/A



LOGGED: M. Rutte
CHECKED: J. Johnson

DATE: Feb 21, 2022
DATE: Jun 06, 2022

REV:

4

RECORD OF BOREHOLE: MW-37

Sheet 5 of 6

CLIENT: Oakpointe

PROJECT: Reserve at Woodlands

PROJECT NO: 063107621A

LOCATION: Black Diamond, WA

START DATE: February 21, 2022

END DATE: March 01, 2022

INCLINATION: -90.0°

CONTRACTOR: AEC

ELEVATION: 540.0 ft (Ground)

COORDINATES: N: 109650.9 ft E: 1338253.8 ft

COORD SYS: SP WA North FIPS 4601 Ft

HORZ DATUM: NAD83

DEPTH (ft)	DRILL RIG	DRILL METHOD	MATERIAL PROFILE				SAMPLES				SOIL CORE				GROUNDWATER OBSERVATIONS	CONSTRUCTION AND INSTALLATION DETAILS			
			DESCRIPTION	USCS	STRATA PLOT	ELEV. DEPTH (ft)	Hammer: N/A ASTM D1586, Blows per 0.15 m 623-N hammer, 0.75-m drop				RUN NO.	REC %							
							NUMBER	TYPE	REC %	N-VALUE		20	40	60				80	
101	TSI 150 cc Sonic Drilling		(SP-SM) SAND, fine to medium, poorly graded, some low-plasticity fines, some fine to coarse subrounded to subangular gravel, trace cobbles; grayish brown, non-stratified, heterogeneous; moist. (Qpog) - 106.0 to 106.5 ft: trace reddish brown gravel	SP-SM							11								
102																			
103																			
104																			
105																			
106																			
107																			
108																			
109																			
110																			
111																			
112																			
113																			
114																			
115																			
116																			
117																			
118																			
119																			
120																			
121																			
122																			
123																			
124																			
125																			
			(GP-GM) silty sandy GRAVEL, fine to coarse subrounded, non-plastic fines, fine to coarse sand, trace subrounded to subangular cobbles; dark grayish brown, non-stratified, heterogeneous; moist to wet. (Qpog) - 118.0 ft: increasing gravel content, encountered cobbles - 124.0 to 125.0 ft: silt pocket	GP-GM		422.0	118.0	SC-17	GS										

Continued on Next Page

Continued on Next Page

HAMMER TYPE: N/A



LOGGED: M. Rutte
CHECKED: J. Johnson

DATE: Feb 21, 2022
DATE: Jun 06, 2022

REV:

4

RECORD OF BOREHOLE: MW-37

Sheet 6 of 6

CLIENT: Oakpointe

PROJECT: Reserve at Woodlands

PROJECT NO: 063107621A

LOCATION: Black Diamond, WA

START DATE: February 21, 2022

END DATE: March 01, 2022

INCLINATION: -90.0°

CONTRACTOR: AEC

ELEVATION: 540.0 ft (Ground)

COORDINATES: N: 109650.9 ft E: 1338253.8 ft

COORD SYS: SP WA North FIPS 4601 Ft

HORZ DATUM: NAD83

DEPTH (ft)	DRILL RIG	DRILL METHOD	MATERIAL PROFILE				SAMPLES				SOIL CORE				GROUNDWATER OBSERVATIONS	CONSTRUCTION AND INSTALLATION DETAILS													
			DESCRIPTION	USCS	STRATA PLOT	ELEV. DEPTH (ft)	Hammer: N/A ASTM D1586, Blows per 0.15 m 623-N hammer, 0.75-m drop				RUN NO.	REC %																	
							NUMBER	TYPE	REC %	N-VALUE		20	40	60				80											
126	TSI 150 cc Sonic Drilling		(GP-GM) silty sandy GRAVEL, fine to coarse subrounded, non-plastic fines, fine to coarse sand, trace subrounded to subangular cobbles; dark grayish brown, non-stratified, heterogeneous; moist to wet. (Qpog)	GP-GM		413.0	SC-18	GS		13																			
127			127.0																										
128			(SP-SM) SAND, fine to coarse, poorly graded, some low-plasticity fines, some fine to coarse subrounded to subangular gravel; dark grayish brown, non-stratified, heterogeneous; moist to wet. (Qpog)	SP-SM		408.0 132.0					14																		
129																													
130																													
131																													
132			(SP-SM) gravelly SAND, medium to coarse, poorly graded, fine to coarse subrounded to subangular gravel, some low-plasticity fines; brownish yellow to reddish brown, non-stratified, heterogeneous, socketed matrix; wet. (Qpog)	ML		402.0 138.0																							
133			- 132.0 ft: coal debris																										
134																													
135																													
136																													
137																													
138																													
139			(ML) sandy SILT, low-plasticity, medium sand, some coarse subrounded to subangular gravel; dark gray, non-stratified, socketed matrix; moist to wet. (Qpog)	ML		138.0	SC-21	GS																					
140		400.0																											
141			End of hole at 140.00 ft.																										
142																													
143																													
144																													
145																													
146																													
147																													
148																													
149																													
150																													

HAMMER TYPE: N/A



LOGGED: M. Rutte
CHECKED: J. Johnson

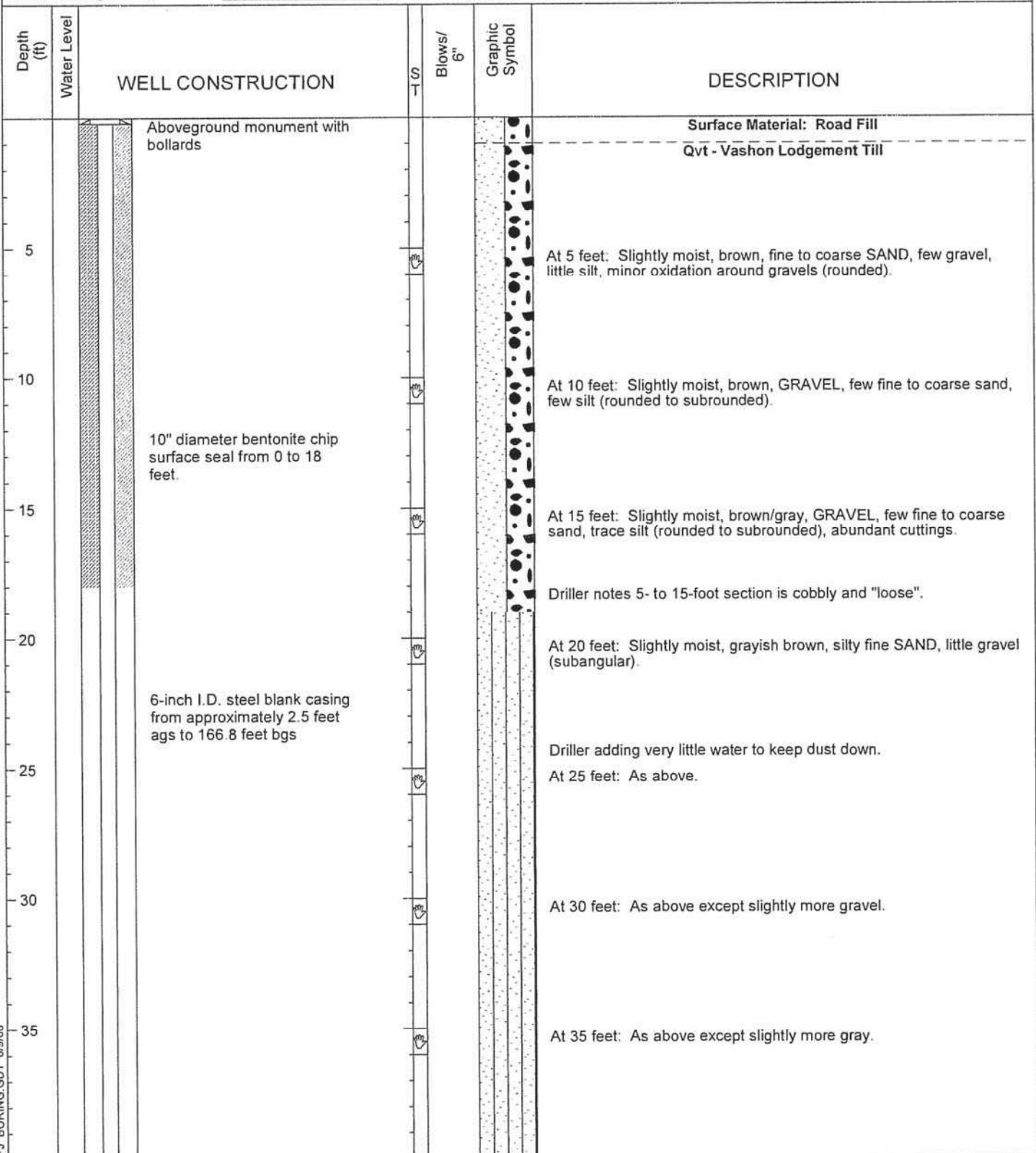
DATE: Feb 21, 2022
DATE: Jun 06, 2022

REV:

4



Geologic & Monitoring Well Construction Log

Project Number
KG060601AWell Number
MW-10Sheet
1 of 6Project Name The VillagesElevation (Top of Well Casing) 581.90'Water Level Elevation 480.14'Drilling/Equipment Tacoma Pump & Drilling/Air RotaryHammer Weight/Drop N/ALocation Black Diamond, WASurface Elevation (ft) 579.16'Date Start/Finish 9/28/06, 10/2/06Hole Diameter (in) 10" to 18 1/8" to TD

Sampler Type (ST):

☐ 2" OD Split Spoon Sampler (SPT)☐ 3" OD Split Spoon Sampler (D & M)☒ Grab Sample☐ No Recovery☐ Ring Sample☒ Shelby Tube Sample

M - Moisture

☒ Water Level (12/14/06)☒ Water Level at time of drilling (ATD)

Logged by: BAA

Approved by:



Geologic & Monitoring Well Construction Log

Project Number
KG060601AWell Number
MW-10Sheet
2 of 6

Project Name The Villages
 Elevation (Top of Well Casing) 581.90'
 Water Level Elevation 480.14'
 Drilling/Equipment Tacoma Pump & Drilling/Air Rotary
 Hammer Weight/Drop N/A

Location Black Diamond, WA
 Surface Elevation (ft) 579.16'
 Date Start/Finish 9/28/06 10/2/06
 Hole Diameter (in) 10" to 18'6" to TD

Depth (ft)	Water Level	WELL CONSTRUCTION	Blows/6"	Graphic Symbol	DESCRIPTION
45					At 40 feet: Slightly moist, brownish gray, silty fine SAND, little gravel, few medium to coarse sand; minor oxidation around some gravels (lighter in color than above and below).
					At 45 feet: As above.
50		6-inch I.D. steel blank casing from approximately 2.5 feet ags to 166.8 feet bgs			Qpog_{1c} - Pre-Olympia Glacial Deposits, Coarse-Grained Increased moisture at ~50 feet. At 50 feet: Moist, brownish gray, silty medium to coarse SAND with gravel, clay present, abundant orange and red sand and gravels, effervesces with HCL.
55					At 55 feet: As above.
60					At 60 feet: As above with minor zones of oxidation around gravels, associated with increased moisture.
65					At 65 feet: As above. Abundant volcanic gravels 50 to 80 feet.
70					At 70 feet: Moist, brownish gray, silty coarse SAND with gravel, few medium sand, effervesces with HCL.
75					At 75 feet: Moist, brownish gray, silty medium to coarse SAND with gravel, effervesces with HCL. Driller notes many cobbles 50 to 80 feet, formation caving somewhat.

Sampler Type (ST):

- ☐ 2" OD Split Spoon Sampler (SPT) ☐ No Recovery
☐ 3" OD Split Spoon Sampler (D & M) ☐ Ring Sample
☒ Grab Sample ☒ Shelby Tube Sample

M - Moisture

☒ Water Level (12/14/06)

☒ Water Level at time of drilling (ATD)

Logged by: BAA

Approved by:



Geologic & Monitoring Well Construction Log

Project Number
KG060601AWell Number
MW-10Sheet
3 of 6

Project Name The Villages
 Elevation (Top of Well Casing) 581.90'
 Water Level Elevation 480.14'
 Drilling/Equipment Tacoma Pump & Drilling/Air Rotary
 Hammer Weight/Drop N/A

Location Black Diamond, WA
 Surface Elevation (ft) 579.16'
 Date Start/Finish 9/28/06 10/2/06
 Hole Diameter (in) 10" to 18 1/6" to TD

Depth (ft)	Water Level	WELL CONSTRUCTION	ST	Blows/ 6"	Graphic Symbol	DESCRIPTION
85		6-inch steel blank casing from approximately 2.5 feet ags to 166.8 feet bgs				At 80 feet: Very moist, brownish gray, silty GRAVEL with medium to coarse sand (platey/flattened gravels), effervesces with HCL. Note with casing at 78 feet driller added a lot of water, most went into formation.
						At 85 feet: Moist, brownish gray, medium to coarse SAND with gravel, few silt; abundant cuttings, minor oxidation around some gravels, effervesces with HCL.
90						Losing air pressure into formation at 85 feet - more caving, cleaner material. At 90 feet: Dry, gray, GRAVEL, few medium to coarse sand, trace fine sand and silt (many volcanics and granites), effervesces with HCL. Driller adding little water to keep dust down.
95						At 95 feet: Moist, brownish gray, medium to coarse SAND with gravel, trace silt, effervesces with HCL.
100						At 100 feet: Moist, brownish gray, GRAVEL with medium to coarse sand, trace silt, effervesces with HCL. More intact, rounded gravels at 100 feet. Driller notes formation is siltier, getting air pressure back at 102 feet. Increased moisture.
105						At 105 feet: As above except very moist and little silt.
110						At 110 feet: Very moist, brownish gray, GRAVEL with medium to coarse SAND, few silt; abundant cuttings, effervesces with HCL.
115						At 115 feet: As above except fewer cuttings, minor oxidation around some gravels, effervesces with HCL. With BOC/BOH at 115.5 feet, driller estimates formation producing ~1 to 2 gpm. WL at 102.3' bgs on 9/29/06 with BOC/BOH at 115.5', after sitting overnight.

Sampler Type (ST):



2" OD Split Spoon Sampler (SPT)



No Recovery

M - Moisture

Logged by: BAA



3" OD Split Spoon Sampler (D & M)



Ring Sample

☐ Water Level (12/14/06)

Approved by:



Grab Sample



Shelby Tube Sample

☐ Water Level at time of drilling (ATD)

Geologic & Monitoring Well Construction Log

Project Number
KG060601AWell Number
MW-10Sheet
4 of 6

Project Name The Villages
 Elevation (Top of Well Casing) 581.90'
 Water Level Elevation 480.14'
 Drilling/Equipment Tacoma Pump & Drilling/Air Rotary
 Hammer Weight/Drop N/A

Location Black Diamond, WA
 Surface Elevation (ft) 579.16'
 Date Start/Finish 9/28/06 10/2/06
 Hole Diameter (in) 10" to 18'6" to TD

Depth (ft)	Water Level	WELL CONSTRUCTION	Blows/6"	Graphic Symbol	DESCRIPTION
125		6-inch steel blank casing from approximately 2.5 feet ags to 166.8 feet bgs			At 120 feet: Wet, brown, GRAVEL with coarse sand, few fine to medium sand, few silt. Rounded to subrounded gravels, more metamorphic clasts.
					At 125 feet: As above except little silt.
130					At 130 feet: Wet, brown, medium to coarse SAND with gravel, little silt. Driller notes producing more water at 133 feet ~40 to 50 gpm.
135					At 135 feet: Wet, brown, medium to coarse SAND, little gravel, trace silt.
140					Wet, brown, GRAVEL, little medium to coarse sand, trace silt (rounded gravels).
145					At 145 feet: Wet, brown, medium to coarse SAND, little gravel, trace silt. 140 to 160 feet run - fairly clean discharge water.
150					At 150 feet: As above. Driller notes boulders 145 to 155 feet.
155					At 155 feet: As above with many orange clasts (gravels), weathering rind around some gravels, many metamorphic gravels plus granites and some volcanics. Driller notes siltier at 158 feet. Dirty discharge water.

Sampler Type (ST):

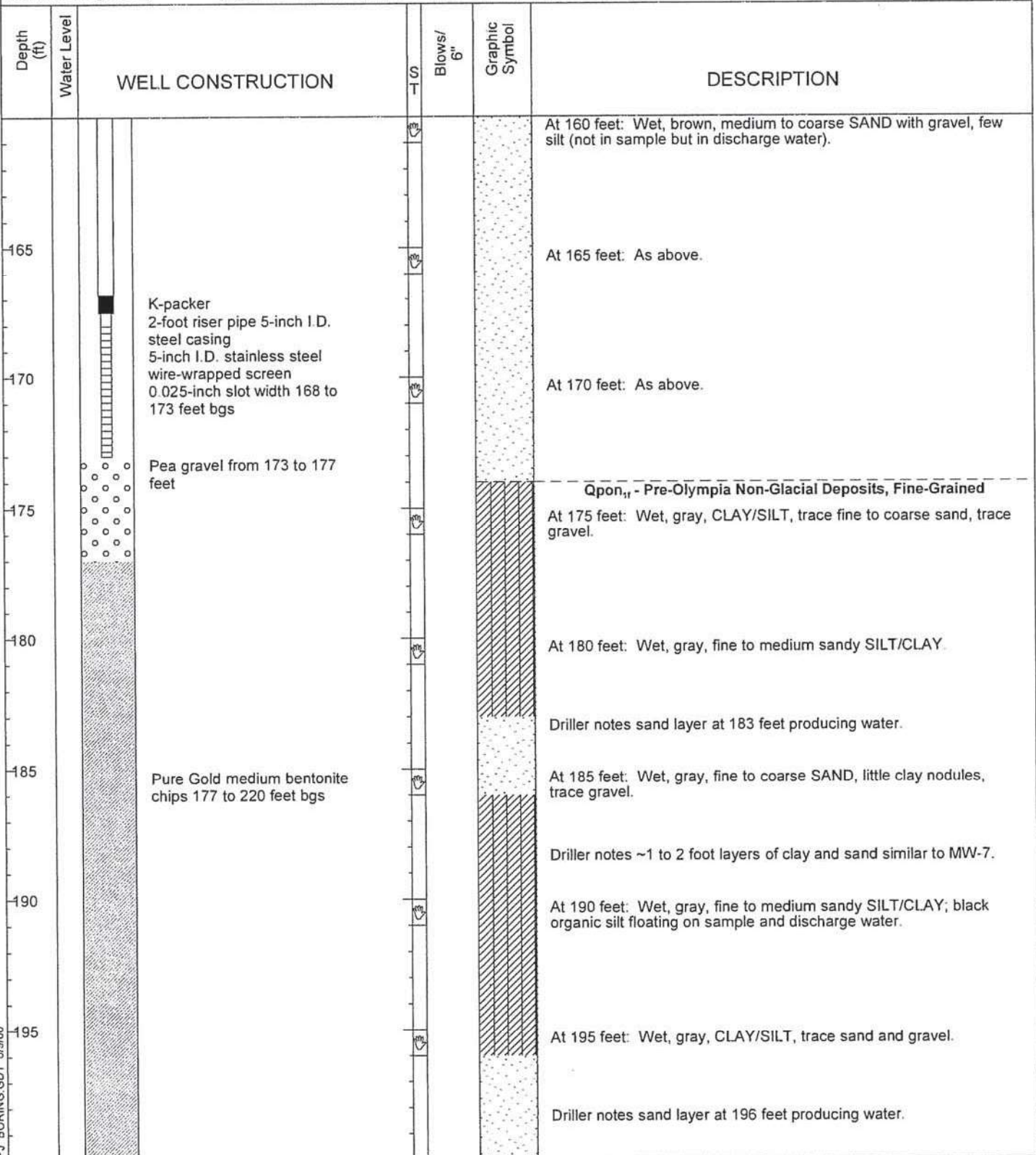
☐ 2" OD Split Spoon Sampler (SPT)☐ 3" OD Split Spoon Sampler (D & M)☐ Grab Sample☐ No Recovery☐ Ring Sample☐ Shelby Tube Sample

M - Moisture

☐ Water Level (12/14/06)☐ Water Level at time of drilling (ATD)

Logged by: BAA

Approved by:

Geologic & Monitoring Well Construction LogProject Number
KG060601AWell Number
MW-10Sheet
5 of 6Project Name The VillagesElevation (Top of Well Casing) 581.90'Water Level Elevation 480.14'Drilling/Equipment Tacoma Pump & Drilling/Air RotaryHammer Weight/Drop N/ALocation Black Diamond, WASurface Elevation (ft) 579.16'Date Start/Finish 9/28/06 10/2/06Hole Diameter (in) 10" to 18'6" to TD

Sampler Type (ST):

☐ 2" OD Split Spoon Sampler (SPT)☐ 3" OD Split Spoon Sampler (D & M)☐ Grab Sample☐ No Recovery☐ Ring Sample☐ Shelby Tube Sample

M - Moisture

☐ Water Level (12/14/06)☐ Water Level at time of drilling (ATD)

Logged by: BAA

Approved by:



Geologic & Monitoring Well Construction Log

Project Number
KG060601AWell Number
MW-10Sheet
6 of 6

Project Name The Villages
 Elevation (Top of Well Casing) 581.90'
 Water Level Elevation 480.14'
 Drilling/Equipment Tacoma Pump & Drilling/Air Rotary
 Hammer Weight/Drop N/A

Location Black Diamond, WA
 Surface Elevation (ft) 579.16'
 Date Start/Finish 9/28/06 10/2/06
 Hole Diameter (in) 10" to 18'6" to TD

Depth (ft)	Water Level	WELL CONSTRUCTION	Blows/ 6"	Graphic Symbol	DESCRIPTION
-205		Hole plug medium bentonite chips 177 to 220 feet bgs			At 200 feet: Wet, gray, CLAY with fine to coarse sand, trace gravel; possible organics. Driller notes all clay at 201 feet.
-210					At 205 feet: Wet, gray, CLAY, little fine to coarse sand, trace gravel. Black film on discharge water from 200' to 220', possible organics.
-215					At 210 feet: Wet, gray, CLAY, trace fine to coarse sand.
-220					At 215 feet: As above except few fine to coarse sand. At 220 feet: As above except trace fine to coarse sand.
-225					Boring terminated at 220 feet on 10/2/06
-230					
-235					

Sampler Type (ST):

- ☐ 2" OD Split Spoon Sampler (SPT)
☐ 3" OD Split Spoon Sampler (D & M)
☒ Grab Sample

- ☐ No Recovery
☐ Ring Sample
☒ Shelby Tube Sample

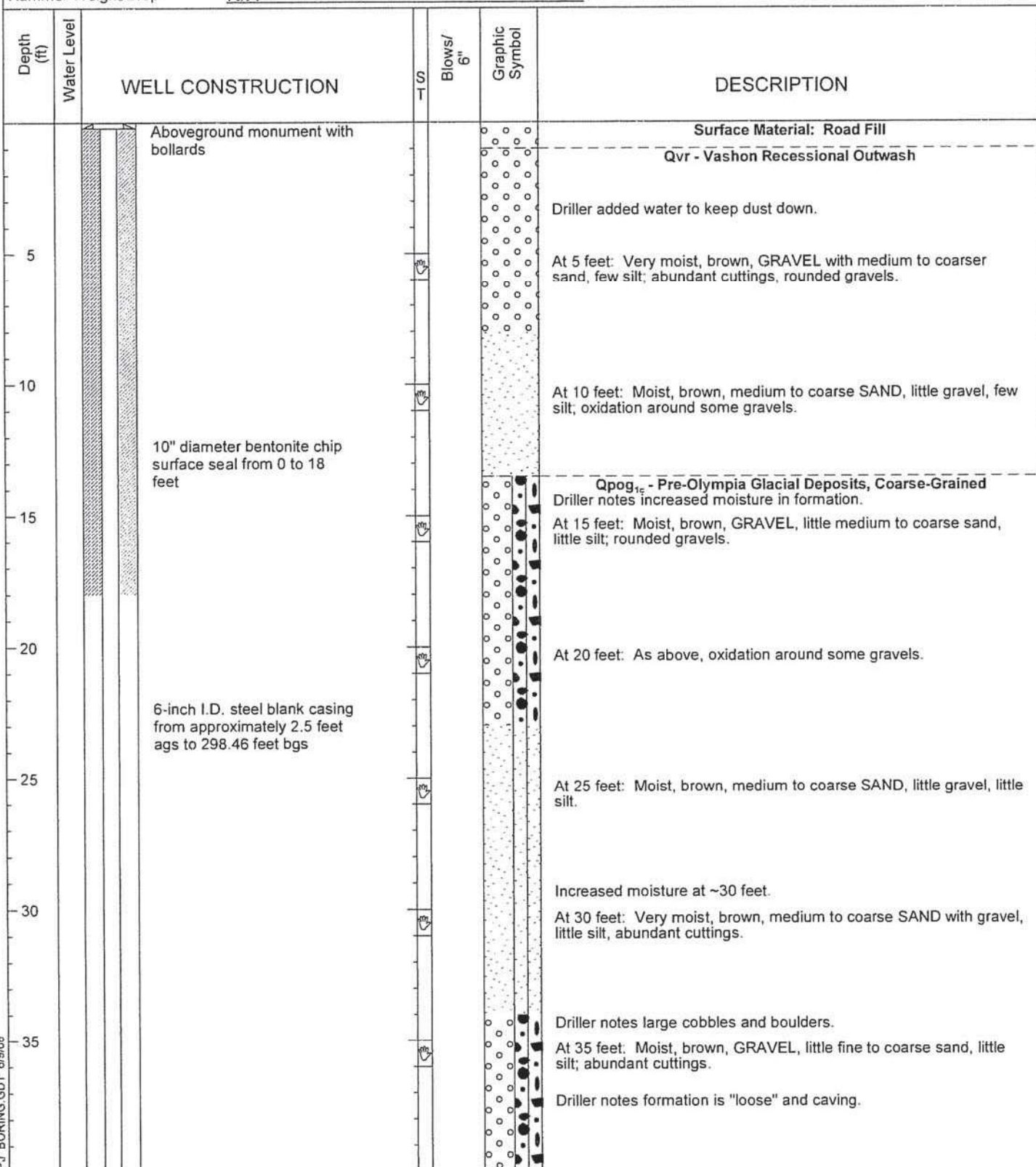
- M - Moisture
☒ Water Level (12/14/06)
☒ Water Level at time of drilling (ATD)

Logged by: BAA

Approved by:



Geologic & Monitoring Well Construction Log

Project Number
KG060601AWell Number
MW-11Sheet
1 of 8Project Name The VillagesElevation (Top of Well Casing) 532.95'Water Level Elevation 462.26'Drilling/Equipment Tacoma Pump & Drilling/Air RotaryHammer Weight/Drop N/ALocation Black Diamond, WASurface Elevation (ft) 530.61'Date Start/Finish 10/2/06 10/4/06Hole Diameter (in) 10" to 18 5/8" to TD

Sampler Type (ST):

☐ 2" OD Split Spoon Sampler (SPT)

☐ 3" OD Split Spoon Sampler (D & M)

☒ Grab Sample

☐ No Recovery

☐ Ring Sample

☒ Shelby Tube Sample

M - Moisture

Water Level (12/14/06)

Water Level at time of drilling (ATD)

Logged by: BAA

Approved by:

Geologic & Monitoring Well Construction Log

Project Number
KG060601AWell Number
MW-11Sheet
2 of 8Project Name The VillagesElevation (Top of Well Casing) 532.95'Water Level Elevation 462.26'

Drilling/Equipment

Tacoma Pump & Drilling/Air Rotary

Hammer Weight/Drop

N/A

Location

Black Diamond, WA

Surface Elevation (ft)

530.61'

Date Start/Finish

10/2/06 10/4/06

Hole Diameter (in)

10" to 18/6" to TD

Depth (ft)	Water Level	WELL CONSTRUCTION	Blows/ 6"	Graphic Symbol	DESCRIPTION
45					At 40 feet: Very moist, grayish brown, medium to coarse SAND with gravel, few silt. Driller notes formation is fairly "loose" - large cobbles and boulders.
45					At 45 feet: Very moist, grayish brown, GRAVEL, little medium to coarse sand, few silt.
50		6-inch steel blank casing from approximately 2.5 feet ags to 298.46 feet bgs			Driller notes possibly "till" - increase in silt (oxidation) at 49 feet. At 50 feet: Moist, brown, silty medium to coarse SAND, little gravel, increased oxidation around gravels (rounded to subangular gravels) (more fines, fewer coarse) (sticks together in clumps).
55					At 55 feet: Moist, brown, silty GRAVEL (rounded to subangular), little fine to coarse sand; oxidation around many gravels (numerous granitic gravels), possible trace organics (charcoal). Small amount of water seeped in during welding with BOH/BOC at 56 feet. Water level at 55.95' bgs on 10/4/06 after sitting overnight with BOC/BOH at 116 feet.
60					At 60 feet: Very moist, brown, as above (no evidence of organics). Driller notes too "clayey" to be till.
65					At 65 feet: Very moist, brown, silty fine to coarse SAND with gravel; oxidized.
70					At 70 feet: Very moist, brown, silty GRAVEL, little coarse sand; oxidized.
75					Free water in discharge at 77 feet, rose to 54.1 feet after ~10 minutes; driller notes producing ~12 gpm - very orange/oxidized color.

Sampler Type (ST):



2" OD Split Spoon Sampler (SPT)



No Recovery

M - Moisture

Logged by: BAA



3" OD Split Spoon Sampler (D & M)



Ring Sample

Water Level (12/14/06)

Approved by:



Grab Sample



Shelby Tube Sample

Water Level at time of drilling (ATD)



Geologic & Monitoring Well Construction Log

Project Number

KG060601A

Well Number

MW-11

Sheet

3 of 8

Project Name The VillagesElevation (Top of Well Casing) 532.95'Water Level Elevation 462.26'Drilling/Equipment Tacoma Pump & Drilling/Air RotaryHammer Weight/Drop N/ALocation Black Diamond, WASurface Elevation (ft) 530.61'Date Start/Finish 10/2/06 10/4/06Hole Diameter (in) 10" to 18'6" to TD

Depth (ft)	Water Level	WELL CONSTRUCTION	Blows/6"	Graphic Symbol	DESCRIPTION
					At 80 feet: Wet, brown, medium to coarse SAND with gravel, little silt; oxidized, trace clay nodules.
					Qpon_{1c} - Pre-Olympia Non-Glacial Deposits, Coarse-Grained
85					At 85 feet: Wet, gray, fine to coarse SAND, trace gravel, trace wood, little silt.
90		6-inch steel blank casing from approximately 2.5 feet ags to 298.46 feet bgs			At 90 feet: As above except few gravel, few silt.
95					At 95 feet: Wet, gray, fine to medium SAND, trace coarse sand, trace gravel, trace wood, few silt. With BOH at 96 feet, water level rose to 59.45 feet and rising after ~4.5 hours. Wood at 96 feet. Conventional radiocarbon age of >47,500 BP
100					At 100 feet: As above.
105					At 105 feet: As above.
					Qpon_{1f} - Pre-Olympia Non-Glacial Deposits, Fine-Grained
110					At 110 feet: Gray, SILT/CLAY, trace fine to medium sand. Driller added small amount of water to lift cuttings.
115					At 115 feet: Wet, gray, silty fine to medium SAND, trace silt/clay nodules, trace wood. Water level at 55.95' bgs on 10/4/06 after sitting overnight with BOH/BOC at 116'.

Sampler Type (ST):



2" OD Split Spoon Sampler (SPT)



No Recovery

M - Moisture

Logged by: BAA



3" OD Split Spoon Sampler (D & M)



Ring Sample



Water Level (12/14/06)

Approved by:



Grab Sample



Shelby Tube Sample



Water Level at time of drilling (ATD)


 Project Number
 KG060601A

 Well Number
 MW-11

 Sheet
 4 of 8

 Project Name The Villages
 Elevation (Top of Well Casing) 532.95'
 Water Level Elevation 462.26'
 Drilling/Equipment Tacoma Pump & Drilling/Air Rotary
 Hammer Weight/Drop N/A

 Location Black Diamond, WA
 Surface Elevation (ft) 530.61'
 Date Start/Finish 10/2/06 10/4/06
 Hole Diameter (in) 10" to 18 5/8" to TD

Depth (ft)	Water Level	WELL CONSTRUCTION	Blows/ 6"	Graphic Symbol	DESCRIPTION
					At 120 feet: Wet, gray, silty fine SAND, trace silt/clay nodules; trace organics (wood flecks and black film on discharge water).
-125					At 125 feet: Wet, gray, silty fine SAND, trace medium to coarse sand, trace organics.
-130		6-inch steel blank casing from approximately 2.5 feet ags to 298.46 feet bgs			At 130 feet: As above.
-135					At 135 feet: As above except few organics (wood). Driller notes a few thin lenses of clay 120 to 135 feet but predominantly fine sand with water.
-140					At 140 feet: As above.
-145					At 145 feet: As above except trace organics.
-150					At 150 feet: Gray, SILT/CLAY, little fine sand, trace organics. Driller adding water to lift cuttings.
-155					At 155 feet: As above with trace medium to coarse sand, few gravel.

Sampler Type (ST):



2" OD Split Spoon Sampler (SPT)



No Recovery

M - Moisture

Logged by: BAA



3" OD Split Spoon Sampler (D & M)



Ring Sample

Water Level (12/14/06)

Approved by:



Grab Sample



Shelby Tube Sample

Water Level at time of drilling (ATD)

Project Number
KG060601AWell Number
MW-11Sheet
5 of 8

Project Name The Villages
 Elevation (Top of Well Casing) 532.95'
 Water Level Elevation 462.26'
 Drilling/Equipment Tacoma Pump & Drilling/Air Rotary
 Hammer Weight/Drop N/A

Location Black Diamond, WA
 Surface Elevation (ft) 530.61'
 Date Start/Finish 10/2/06, 10/4/06
 Hole Diameter (in) 10" to 18 5/8" to TD

Depth (ft)	Water Level	WELL CONSTRUCTION	Blows/6"	Graphic Symbol	DESCRIPTION
165		6-inch steel blank casing from approximately 2.5 feet ags to 298.46 feet bgs			At 160 feet: Gray, SILT/CLAY, few fine sand, trace organics. Driller adding water to lift cuttings.
					At 165 feet: As above.
170					At 170 feet: Gray, silty fine SAND, trace medium sand; trace organics.
175					At 175 feet: As above. Driller notes gravel with no free water at 176 feet.
180					At 180 feet: Gray, SILT/CLAY, trace sand and gravel; trace organics. Driller adding water to lift cuttings.
185					At 185 feet: As above except few sand and gravel.
190					At 190 feet: Gray, SILT/CLAY, trace sand and gravel; trace organics.
195					At 195 feet: As above. Driller notes formation is fairly hard.

Sampler Type (ST):



2" OD Split Spoon Sampler (SPT)



No Recovery

M - Moisture

Logged by: BAA



3" OD Split Spoon Sampler (D & M)



Ring Sample



Water Level (12/14/06)

Approved by:



Grab Sample



Shelby Tube Sample



Water Level at time of drilling (ATD)

Associated Earth Sciences, Inc.		Geologic & Monitoring Well Construction Log		
		Project Number KG060601A	Well Number MW-11	Sheet 6 of 8
Project Name <u>The Villages</u>		Location <u>Black Diamond, WA</u>		
Elevation (Top of Well Casing) <u>532.95'</u>		Surface Elevation (ft) <u>530.61'</u>		
Water Level Elevation <u>462.26'</u>		Date Start/Finish <u>10/2/06 10/4/06</u>		
Drilling/Equipment <u>Tacoma Pump & Drilling/Air Rotary</u>		Hole Diameter (in) <u>10" to 18 5/8" to TD</u>		
Hammer Weight/Drop <u>N/A</u>				

Depth (ft)	Water Level	WELL CONSTRUCTION	S T	Blows/ 6"	Graphic Symbol	DESCRIPTION
						At 200 feet: Gray, SILT/CLAY, trace sand and gravel (as dropstones); trace organics.
						Driller adding water to lift cuttings.
205						At 205 feet: Gray, SILT/CLAY, few gravel, few sand.
210		6-inch steel blank casing from approximately 2.5 feet ags to 298.46 feet bgs				At 210 feet: Gray, CLAY, few fine to medium sand, trace gravel.
215						At 215 feet: As above.
						Driller notes fine to medium SAND, trace coarse sand with gravel, few silt; few wood at 216 feet, and free water.
220						At 220 feet: Wet, gray, fine to medium SAND, few silt, trace large wood pieces.
225						At 225 feet: As above.
230						At 230 feet: As above.
235						At 235 feet: Wet, gray, fine SAND, few silt; trace wood, trace silt nodules.

Sampler Type (ST):		M - Moisture	Logged by: BAA
☐ 2" OD Split Spoon Sampler (SPT)	☐ No Recovery	☒ Water Level (12/14/06)	Approved by:
☐ 3" OD Split Spoon Sampler (D & M)	☐ Ring Sample	☒ Water Level at time of drilling (ATD)	
☐ Grab Sample	☐ Shelby Tube Sample		

NWELL 060601A.GPJ BORING.GDT 6/9/08



Geologic & Monitoring Well Construction Log

Project Number
KG060601AWell Number
MW-11Sheet
7 of 8

Project Name The Villages
 Elevation (Top of Well Casing) 532.95'
 Water Level Elevation 462.26'
 Drilling/Equipment Tacoma Pump & Drilling/Air Rotary
 Hammer Weight/Drop N/A

Location Black Diamond, WA
 Surface Elevation (ft) 530.61'
 Date Start/Finish 10/2/06 10/4/06
 Hole Diameter (in) 10" to 18 5/8" to TD

Depth (ft)	Water Level	WELL CONSTRUCTION	ST	Blows/ 6"	Graphic Symbol	DESCRIPTION
245		6-inch steel blank casing from approximately 2.5 feet ags to 298.46 feet bgs				At 240 feet: Wet, gray, fine SAND with silt/clay (nodules), trace coarse sand; trace organics.
						At 245 feet: Wet, gray, fine SAND, few silt; trace organics, trace gravel.
250						At 250 feet: Wet, gray, fine SAND with silt/clay (nodules); few organics (wood).
						Increased gravel at ~252 feet.
255						Th - Upper Tertiary Hammer Bluff Formation At 255 feet: Gray, SILT/CLAY, few fine to coarse sand, few gravel. Driller adding water to lift cuttings.
260						At 260 feet: Gray, SILT/CLAY, trace sand and gravel (hard clay nodules are laminated).
265						At 265 feet: As above.
270						At 270 feet: As above.
275						At 275 feet: As above - laminated hard silt/clay nodules.

Sampler Type (ST):



2" OD Split Spoon Sampler (SPT)



No Recovery

M - Moisture

Logged by: BAA



3" OD Split Spoon Sampler (D & M)



Ring Sample



Water Level (12/14/06)

Approved by:



Grab Sample



Shelby Tube Sample



Water Level at time of drilling (ATD)

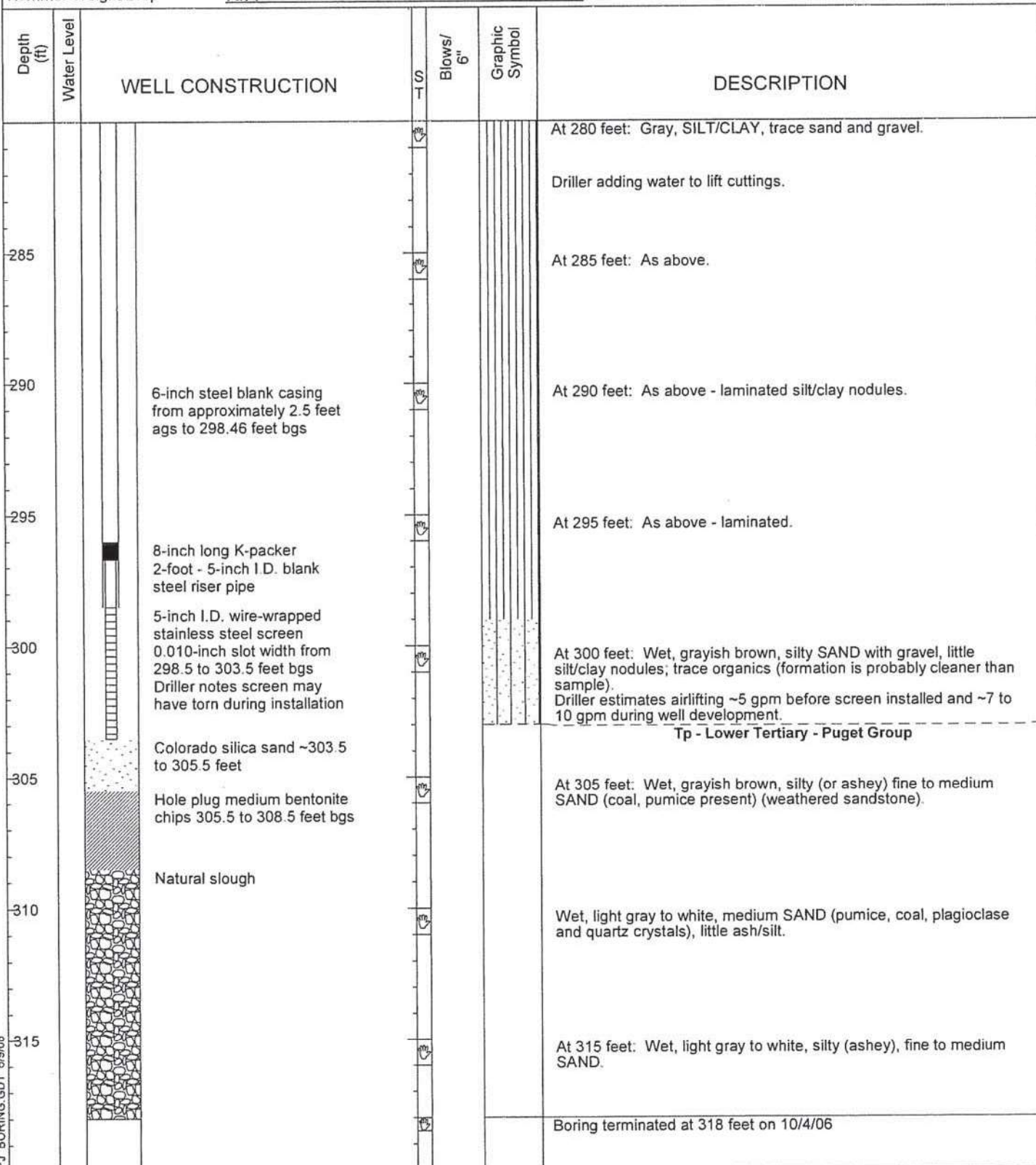


Geologic & Monitoring Well Construction Log

Project Number
KG060601AWell Number
MW-11Sheet
8 of 8

Project Name The Villages
 Elevation (Top of Well Casing) 532.95'
 Water Level Elevation 462.26'
 Drilling/Equipment Tacoma Pump & Drilling/Air Rotary
 Hammer Weight/Drop N/A

Location Black Diamond, WA
 Surface Elevation (ft) 530.61'
 Date Start/Finish 10/2/06 10/4/06
 Hole Diameter (in) 10" to 18'6" to TD



Sampler Type (ST):



2" OD Split Spoon Sampler (SPT)



No Recovery

M - Moisture

Logged by: BAA



3" OD Split Spoon Sampler (D & M)



Ring Sample

Water Level (12/14/06)

Approved by:



Grab Sample



Shelby Tube Sample

Water Level at time of drilling (ATD)



Geologic & Monitoring Well Construction Log

Project Number

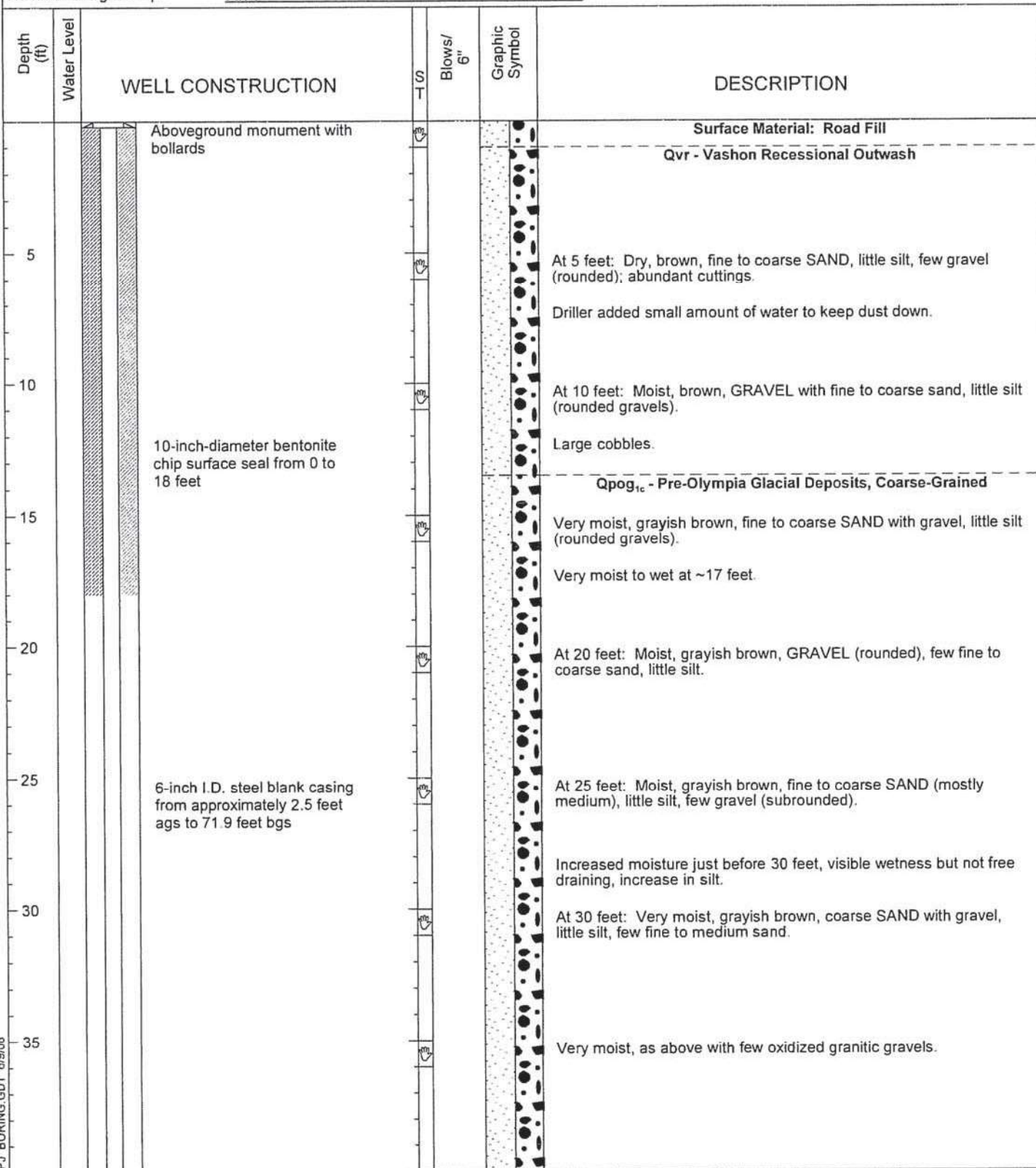
KG060601A

Well Number

MW-12

Sheet

1 of 2

Project Name The VillagesElevation (Top of Well Casing) 532.94'Water Level Elevation 480.63'Drilling/Equipment Tacoma Pump & Drilling/Air RotaryHammer Weight/Drop N/ALocation Black Diamond, WASurface Elevation (ft) 530.52'Date Start/Finish 10/5/06 10/5/06Hole Diameter (in) 10" to 18 1/6" to TD

Sampler Type (ST):



2" OD Split Spoon Sampler (SPT)



No Recovery

M - Moisture

Logged by: BAA



3" OD Split Spoon Sampler (D & M)



Ring Sample



Water Level (12/14/06)

Approved by:



Grab Sample



Shelby Tube Sample

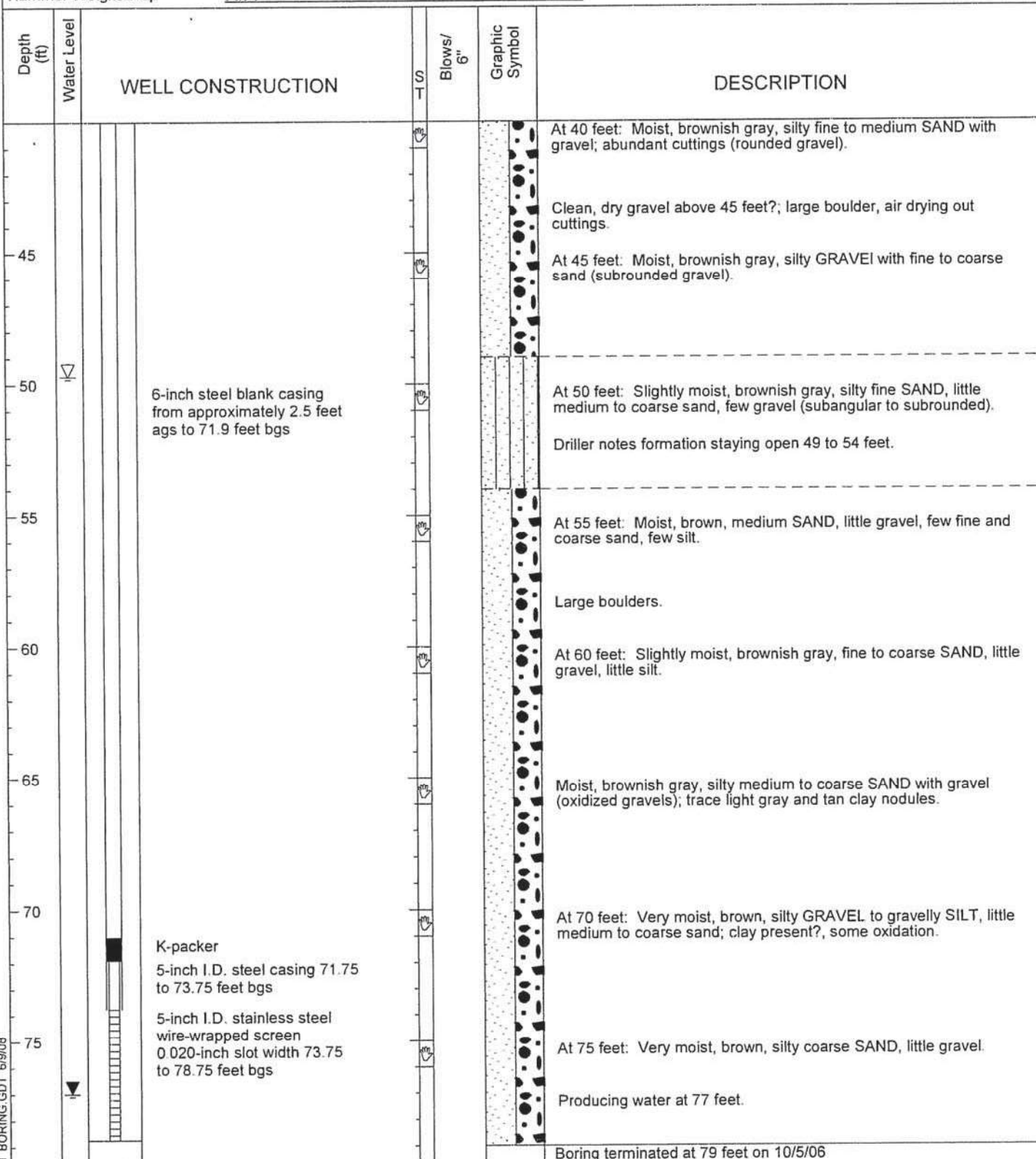


Water Level at time of drilling (ATD)

Project Number
KG060601AWell Number
MW-12Sheet
2 of 2

Project Name The Villages
 Elevation (Top of Well Casing) 532.94'
 Water Level Elevation 480.63'
 Drilling/Equipment Tacoma Pump & Drilling/Air Rotary
 Hammer Weight/Drop N/A

Location Black Diamond, WA
 Surface Elevation (ft) 530.52'
 Date Start/Finish 10/5/06 10/5/06
 Hole Diameter (in) 10" to 18 5/8" to TD



Sampler Type (ST):

- | | |
|-----------------------------------|--------------------|
| 2" OD Split Spoon Sampler (SPT) | No Recovery |
| 3" OD Split Spoon Sampler (D & M) | Ring Sample |
| Grab Sample | Shelby Tube Sample |

M - Moisture

Water Level (12/14/06)

Water Level at time of drilling (ATD)

Logged by: BAA

Approved by:

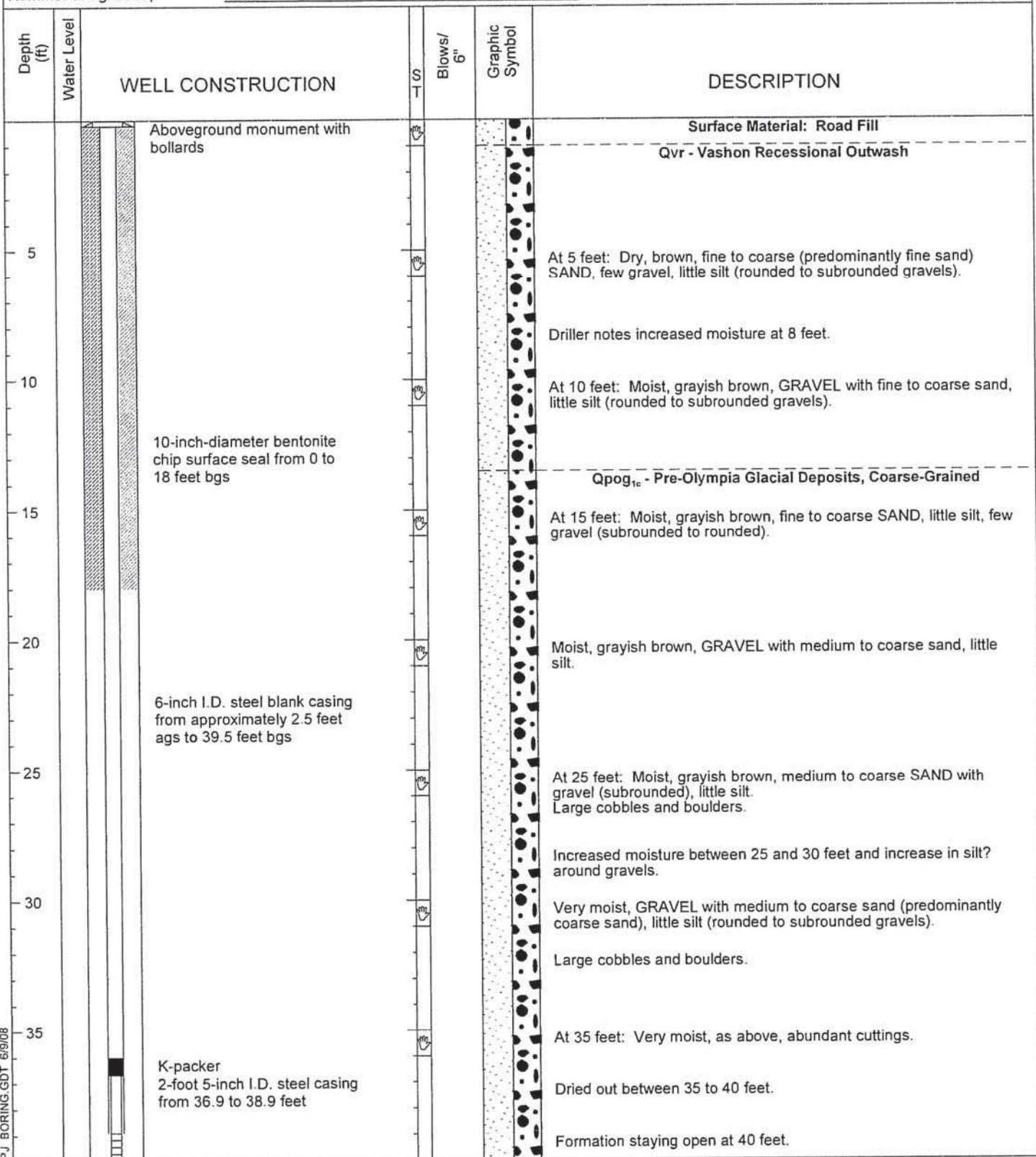


Geologic & Monitoring Well Construction Log

Project Number
KG060601AWell Number
MW-13Sheet
1 of 2

Project Name The Villages
 Elevation (Top of Well Casing) 532.88'
 Water Level Elevation 484.86'
 Drilling/Equipment Tacoma Pump & Drilling/Air Rotary
 Hammer Weight/Drop N/A

Location Black Diamond, WA
 Surface Elevation (ft) 530.41'
 Date Start/Finish 10/6/06, 10/6/06
 Hole Diameter (in) 10" to 18 5/8" to TD



Sampler Type (ST):

- ☐ 2" OD Split Spoon Sampler (SPT)
☐ 3" OD Split Spoon Sampler (D & M)
☒ Grab Sample

- ☐ No Recovery
☐ Ring Sample
☒ Shelby Tube Sample

- M - Moisture
☒ Water Level (12/14/06)
☒ Water Level at time of drilling (ATD)

Logged by: BAA

Approved by:


 Project Number
 KG060601A

 Well Number
 MW-13

 Sheet
 2 of 2

 Project Name The Villages
 Elevation (Top of Well Casing) 532.88'
 Water Level Elevation 484.86'
 Drilling/Equipment Tacoma Pump & Drilling/Air Rotary
 Hammer Weight/Drop N/A

 Location Black Diamond, WA
 Surface Elevation (ft) 530.41'
 Date Start/Finish 10/6/06 10/6/06
 Hole Diameter (in) 10" to 18 1/6" to TD

Depth (ft)	Water Level	WELL CONSTRUCTION	Blows/ 6"	Graphic Symbol	DESCRIPTION
45		Two 5-foot lengths of 5-inch I.D. 0.010-inch slot width wire-wrapped stainless steel screen 38.9 to 48.9 feet			At 40 feet: Slightly moist, brownish gray, GRAVEL with medium to coarse sand, little silt; abundant cuttings. Formation not staying open.
50					At 45 feet: Slightly, moist, brownish gray, medium to coarse SAND with gravel, little silt; possible organics. At 50 feet: Dry, brown (minor oxidation), fine SAND with silt, little gravel, few medium to coarse sand. Formation staying open. Increased oxidation at 50 feet; abundant orange sand, mostly cuttings.
55					Boring terminated at 51 feet on 10/6/06
60					
65					
70					
75					

Sampler Type (ST):



2" OD Split Spoon Sampler (SPT)



No Recovery

M - Moisture

Logged by: BAA



3" OD Split Spoon Sampler (D & M)



Ring Sample



Water Level (12/14/06)

Approved by:



Grab Sample



Shelby Tube Sample



Water Level at time of drilling (ATD)

RECORD OF BOREHOLE MW-27

SHEET 1 of 3

PROJECT: BD Villages/The Villages Project DRILLING METHOD: Hollow Stem Auger
PROJECT NUMBER: 063-1076-001.503 DRILLING DATE: 10/11/10
LOCATION: Black Diamond, WA DRILL RIG: Marooka track-mount

DATUM: MSL
AZIMUTH: N/A
COORDINATES: not surveyed

ELEVATION: 524.18
INCLINATION: -90

DEPTH (ft)	BORING METHOD	SOIL PROFILE				SAMPLES					PENETRATION RESISTANCE BLOWS / ft ■					NOTES WATER LEVELS GRAPHIC				
		DESCRIPTION	USCS	GRAPHIC LOG	ELEV.	NUMBER	TYPE	BLOWS per 6 in 140 lb hammer 30 inch drop	N	REC / ATT	10 20 30 40									
					DEPTH (ft)						WATER CONTENT (PERCENT)									
											W _p	W _L	W _U	W ₁						
0	4.25-inch ID Hollow Stem Auger	0.0 - 17.0 Compact, dark olive gray, slightly stratified, fine to coarse SAND, little fine to coarse gravel, trace silt, damp to moist. (SP) (OUTWASH)	SP												Stick-up monument set in concrete.					
5																				
10																				
15																				
					</															

Log continued on next page

1 in to 3 ft
DRILLING CONTRACTOR: Cascade Drilling, LP
DRILLER: Andy

LOGGED: J. DeKoekkoek
CHECKED: J. Johnson
DATE: 1/6/2011



BOREHOLE RECORD 0631076001.503 BORINGS OCT2010.GPJ GLDR_WA.GDT 10/12/11

SHEET 2 of 3

DATUM: MSL

PROJECT: BD Villages/ The Villages Project DRILLING METHOD: Holo
PROJECT NUMBER: 063-1076-001.503 DRILLING DATE: 10/11/10

AZIMUTH: N/A

INCLINATION: -90

PROJECT NUMBER: 503-1079-001.503
LOCATION: Black Diamond, WA

COORDINATES: not surveyed

1 in to 3 ft
DRILLING CONTRACTOR: Cascade Drilling, LP
DRILLER: Andy

LOGGED: J. DeKoekkoek
CHECKED: J. Johnson
DATE: 1/6/2011



BOREHOLE RECORD 0631076001.503_BORINGS OCT2010.GPJ GLDR_WA.GDT 10/12/11

SHEET 3 of 3

DATUM: MSL
AZIMUTH: N/A
COORDINATES: not surveyed

ELEVATION: 524.18
INCLINATION: -90

BOREHOLE RECORD 0631076001.503_BORINGS OCT2010.GPJ GLDR_WA.GDT 10/12/11

LOGGED: J. DeKoekkoek
CHECKED: J. Johnson
DATE: 1/6/2011



RECORD OF BOREHOLE MW-28

SHEET 1 of 3

PROJECT: BDVillages/The Villages Project DRILLING METHOD: Hollow Stem Auger
PROJECT NUMBER: 063-1076-001.503 DRILLING DATE: 10/11/10
LOCATION: Black Diamond, WA DRILL RIG: Marooka track-mount

DATUM: MSL
AZIMUTH: N/A
COORDINATES: not surveyed

ELEVATION: 507.66
INCLINATION: -90

DEPTH (ft)	BORING METHOD	SOIL PROFILE				SAMPLES					PENETRATION RESISTANCE BLOWS / ft ■					NOTES WATER LEVELS	
		DESCRIPTION	USCS	GRAPHIC LOG	ELEV.	NUMBER	TYPE	BLOWS per 6 in 140 lb hammer 30 inch drop	N	REC / ATT	10 20 30 40				GRAPHIC		
					DEPTH (ft)						WATER CONTENT (PERCENT)						
											W _p	W _L	W _i				
0	4.25-inch ID Hollow Stem Auger	0.0 - 1.0 TOPSOIL			506.7										2.5-ft well stick up. Stick-up monument set in concrete.		
		1.0 - 5.2 Compact, light olive gray to olive gray, stratified, silty fine to medium SAND, damp. (SM) (OUTWASH)	SM		1.0												
					502.5												
		5.2 - 8.0 Becomes fine to coarse SAND, little fine gravel, trace silt, damp to moist. (SP)	SP		5.2	1	SS	6-9-9	18	1.5 1.5							
5					499.7												
		8.0 - 14.0 Becomes orangish gray, fine to medium SAND, trace fine gravel, trace silt. (SW)	SW		8.0												
					493.7												
		14.0 - 18.0 Compact, orangish brown to olive gray, non-stratified, silty fine to coarse GRAVEL, some cobbles, little fine to coarse sand, moist to wet. (GM) (TILL)	GM		14.0												
					489.7												
		18.0 - 23.0 Compact, dark olive gray, non-stratified, fine to coarse GRAVEL, some cobbles, little silt, trace fine to coarse sand, wet. (GP-GM) (TRANSITION UNIT: TILL/ Qpog OUTWASH)	GP-GM		18.0												
20	Log continued on next page																

BOREHOLE RECORD 0631076001.503 BORINGS OCT2010.GPJ GLDR_WA.GDT 10/12/11

1 in to 3 ft
DRILLING CONTRACTOR: Cascade Drilling, LP
DRILLER: Andy

LOGGED: J. DeKoekkoek
CHECKED: J. Johnson
DATE: 1/6/2011



RECORD OF BOREHOLE MW-28

SHEET 2 of 3

PROJECT: BDVillages/The Villages Project DRILLING METHOD: Hollow Stem Auger
PROJECT NUMBER: 063-1076-001.503 DRILLING DATE: 10/11/10
LOCATION: Black Diamond, WA DRILL RIG: Marooka track-mount

DATUM: MSL
AZIMUTH: N/A
COORDINATES: not surveyed

ELEVATION: 507.66
INCLINATION: -90

DEPTH (ft)	BORING METHOD	SOIL PROFILE				SAMPLES				PENETRATION RESISTANCE BLOWS / R ■				NOTES WATER LEVELS					
		DESCRIPTION	USCS	GRAPHIC LOG	ELEV.	NUMBER	TYPE	BLOWS per 6 in 140 lb hammer 30 inch drop	N	REC / ATT	10 20 30 40								
					DEPTH (ft)						WATER CONTENT (PERCENT)								
											W _p	W _L	G _w	W _i					
20	4.25-inch ID Hollow Stem Auger	18.0 - 23.0 Compact, dark olive gray, non-stratified, fine to coarse GRAVEL, some cobbles, little silt, trace fine to coarse sand, wet. (GP-GM) (TRANSITION UNIT: TILL/ Qpog OUTWASH) (Continued)	GP-GM		484.7	4	SS	4-10-10	20	0.4 1.5									
		23.0																	
		23.0 - 28.0 Very dense, olive gray to gray, non-stratified, silty fine to coarse GRAVEL, little fine to coarse sand, moist to wet. (GM) (Qpog OUTWASH)	GM			5	SS	17-26-34	>50	1.1 1.5								>>■	
25																			
		28.0 - 41.0 Becomes fine to coarse GRAVEL, some fine to coarse sand, trace to little silt, wet. (GP-GM) (Qpog OUTWASH)			GP-GM		479.7												
		28.0																	
								6	SS	50/3"	>50	0.5 0.3							
30																			

Log continued on next page

1 in to 3 ft

DRILLING CONTRACTOR: Cascade Drilling, LP

DRILLER: Andy

LOGGED: J. DeKoekkoek

CHECKED: J. Johnson

DATE: 1/6/2011



BOREHOLE RECORD 0631076001.503 BORINGS OCT2010.GPJ GLDR_WA.GDT 10/12/11

RECORD OF BOREHOLE MW-28

SHEET 3 of 3

PROJECT: BDVillages/The Villages Project DRILLING METHOD: Hollow Stem Auger
PROJECT NUMBER: 063-1076-001.503 DRILLING DATE: 10/11/10
LOCATION: Black Diamond, WA DRILL RIG: Marooka track-mount

DATUM: MSL
AZIMUTH: N/A
COORDINATES: not surveyed

ELEVATION: 507.66
INCLINATION: -90

DEPTH (ft)	BORING METHOD	SOIL PROFILE				SAMPLES				PENETRATION RESISTANCE BLOWS / ft ■					NOTES WATER LEVELS GRAPHIC			
		DESCRIPTION	USCS	GRAPHIC LOG	ELEV.	NUMBER	TYPE	BLOWS per 6 in 140 lb hammer 30 inch drop	N	REC / ATT	10 20 30 40							
					DEPTH (ft)						WATER CONTENT (PERCENT)							
											W _p 20 40 60 80 W _L							
40		28.0 - 41.0 Becomes fine to coarse GRAVEL, some fine to coarse sand, trace to little silt, wet. (GP-GM) (Qpog OUTWASH) (Continued) Boring completed at 41.0 ft.	GP-GM		466.7 41.0	8	HD	9-50/6"	>50	0.7 1.0						>>■	Originally logged as BH-02.	
45																		
50																		
55																		
60																		

BOREHOLE RECORD 0631076001.503_BORINGS OCT2010.GPJ GLDR_WA.GDT 10/12/11

1 in to 3 ft
DRILLING CONTRACTOR: Cascade Drilling, LP
DRILLER: Andy

LOGGED: J. DeKoeckkoek
CHECKED: J. Johnson
DATE: 1/6/2011



SHEET 1 of 4

DATUM: MSL
AZIMUTH: N/A
COORDINATES: not surveyed

ELEVATION: 554.27
INCLINATION: -90

4.25-inch ID Hollow Stem Auger

Log continued on next page

1 in to 3 ft
DRILLING CONTRACTOR: Cascade Drilling, LP
DRILLER: Andy

LOGGED: J. DeKoekkoek
CHECKED: J. Johnson
DATE: 1/6/2011



BOREHOLE RECORD 0631076001.503 BORINGS OCT2010.GPJ GLDR_WA.GDT 10/12/11

RECORD OF BOREHOLE MW-29

SHEET 2 of 4

PROJECT: BD Villages/The Villages Project
 PROJECT NUMBER: 063-1076-001.503
 LOCATION: Black Diamond, WA

DRILLING METHOD: Hollow Stem Auger
 DRILLING DATE: 10/13/10
 DRILL RIG: Marooka track-mount

DATUM: MSL
 AZIMUTH: N/A
 COORDINATES: not surveyed

ELEVATION: 554.27
 INCLINATION: -90

DEPTH (ft)	BORING METHOD	SOIL PROFILE				SAMPLES					PENETRATION RESISTANCE BLOWS / ft ■					NOTES WATER LEVELS GRAPHIC	
		DESCRIPTION	USCS	GRAPHIC LOG	ELEV.	NUMBER	TYPE	BLOWS per 6 in 140 lb hammer 30 inch drop	N	REC / ATT	10 20 30 40						
					DEPTH (ft)						WATER CONTENT (PERCENT)						
											W _p	W _L	W _U	W _p	W _L	W _U	
20	4.25-inch ID Hollow Stem Auger	18.0 - 23.0 Becomes olive gray, fine SAND, little silt, damp. (SP-SM) (Continued)	SP-SM		531.3 23.0	4	HD	4-7-16	23	1.2 1.5	○		■			2-inch diameter, PVC pipe embedded in bentonite chips.	
		23.0 - 28.0 Becomes trace silt. (SP)	SP		526.3 28.0	5	HD	8-8-8	16	1.4 1.5	○		■				
25																	
		28.0 - 33.0 Becomes fine to medium SAND, little silt. (SP-SM)	SP-SM		521.3 33.0	6	HD	7-8-10	18	1.3 1.5	○		■				
30																	
		33.0 - 38.0 Becomes fine SAND, little silt. (SP-SM)	SP-SM		516.3 38.0	7	HD	15-12-13	25	1.5 1.5	○		■				
35																	
		38.0 - 43.0 Becomes silty fine to medium SAND. (SM)	SM														
40																	

Log continued on next page

Log continued on next page

1 in to 3 ft

DRILLING CONTRACTOR: Cascade Drilling, LP

DRILLER: Andy

LOGGED: J. DeKoekkoek

CHECKED: J. Johnson

DATE: 1/6/2011



BOREHOLE RECORD 0631076001.503 BORINGS OCT2010.GPJ GLDR_WA.GDT 10/12/11

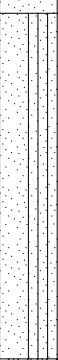
RECORD OF BOREHOLE MW-29

SHEET 3 of 4

PROJECT: BD Villages/The Villages Project DRILLING METHOD: Hollow Stem Auger
PROJECT NUMBER: 063-1076-001.503 DRILLING DATE: 10/13/10
LOCATION: Black Diamond, WA DRILL RIG: Marooka track-mount

DATUM: MSL
AZIMUTH: N/A
COORDINATES: not surveyed

ELEVATION: 554.27
INCLINATION: -90

DEPTH (ft)	BORING METHOD	SOIL PROFILE				SAMPLES					PENETRATION RESISTANCE BLOWS / ft ■				NOTES WATER LEVELS	
		DESCRIPTION	USCS	GRAPHIC LOG	ELEV.	NUMBER	TYPE	BLOWS per 6 in 140 lb hammer 30 inch drop	N	REC / ATT	WATER CONTENT (PERCENT)				GRAPHIC	
					DEPTH (ft)						W _p ----- W _L					
40	4.25-inch ID Hollow Stem Auger	38.0 - 43.0 Becomes silty fine to medium SAND. (SM) <i>(Continued)</i>	SM			8	HD	9-10-10	20	$\frac{1.5}{1.5}$	○	■				
		43.0 - 48.0 Becomes fine to medium SAND, trace silt. (SP)	SP		511.3 43.0											
45																
		48.0 - 52.5 Becomes fine to medium SAND and fine to coarse GRAVEL, little silt. (SP-SM/GP-GM)	SP-SM / GP-GM		506.3 48.0											
50																
	52.5 - 63.0 Very dense, olive gray, non-stratified, fine to coarse SAND and fine to coarse GRAVEL, little silt, trace cobbles, moist. (SP-SM/GP-GM) (TILL)	SP-SM / GP-GM		501.8 52.5												
55																
						11	HD	50/6"	>50	$\frac{0.5}{0.5}$		■	>>			
60																
		Log continued on next page														

BOREHOLE RECORD 0631076001.503 BORINGS OCT2010.GPJ GLDR_WA.GDT 10/12/11

1 in to 3 ft
DRILLING CONTRACTOR: Cascade Drilling, LP
DRILLER: Andy

LOGGED: J. DeKoekkoek
CHECKED: J. Johnson
DATE: 1/6/2011



RECORD OF BOREHOLE MW-29

SHEET 4 of 4

PROJECT: BD Villages/The Villages Project DRILLING METHOD: Hollow Stem Auger
PROJECT NUMBER: 063-1076-001.503 DRILLING DATE: 10/13/10
LOCATION: Black Diamond, WA DRILL RIG: Marooka track-mount

DATUM: MSL
AZIMUTH: N/A
COORDINATES: not surveyed

ELEVATION: 554.27
INCLINATION: -90

DEPTH (ft)	BORING METHOD	SOIL PROFILE				SAMPLES				PENETRATION RESISTANCE BLOWS / ft ■				NOTES WATER LEVELS						
		DESCRIPTION	USCS	GRAPHIC LOG	ELEV.	NUMBER	TYPE	BLOWS per 6 in 140 lb hammer 30 inch drop	N	REC / ATT	WATER CONTENT (PERCENT)									
					DEPTH (ft)						W _p W_L W_U									
60	4.25-inch ID Hollow Stem Auger	52.5 - 63.0 Very dense, olive gray, non-stratified, fine to coarse SAND and fine to coarse GRAVEL, little silt, trace cobbles, moist. (SP-SM/GP-GM) (TILL) (Continued)	SP-SM / GP-GM			12	HD	50/3"	>50	0.0 0.3					>>■	2-inch diameter, 0.01-inch slotted, PVC pipe embedded in sand pack. Originally logged as BH-A.		Groundwater measured 63.20 ft btc, 60.7 ft bgs on 10/15/10. Groundwater measured 63.30 ft btc, 60.8 ft bgs on 10/21/10.		
		60-60.3 No recovery.																		
		63.0 - 70.5 Becomes fine to coarse GRAVEL, little silt, little fine to coarse sand, wet. (GP-GM)	GP-GM																	
65						13	HD	9-50/3"	>50	0.8 0.8										
70																				
		Boring completed at 70.5 ft.			483.8 70.5	14	HD	50/6"	>50	0.5 0.5					>>■					
75																				
80																				

Groundwater measured 63.20 ft b/c. 60.7 ft b/c on 10/15/10.
Groundwater measured 63.30 ft b/c. 60.8 ft b/c on 10/21/10.

BOREHOLE RECORD 0631076001.503_BORINGS OCT2010.GPJ GLDR_WA.GDT 10/12/11

1 in to 3 ft
DRILLING CONTRACTOR: Cascade Drilling, LP
DRILLER: Andy

LOGGED: J. DeKoekoek
CHECKED: J. Johnson
DATE: 1/6/2011



RECORD OF BOREHOLE MW-30

SHEET 1 of 4

PROJECT: BDVillages/The Villages Project DRILLING METHOD: Hollow Stem Auger
PROJECT NUMBER: 063-1076-001.503 DRILLING DATE: 10/15/10
LOCATION: Big A1 Pond DRILL RIG: Marooka track-mount

DATUM: MSL
AZIMUTH: N/A
COORDINATES: not surveyed

ELEVATION: 551.12
INCLINATION: -90

DEPTH (ft)	BORING METHOD	SOIL PROFILE				SAMPLES					PENETRATION RESISTANCE BLOWS / ft ■					NOTES WATER LEVELS		
		DESCRIPTION	USCS	GRAPHIC LOG	ELEV.	NUMBER	TYPE	BLOWS per 6 in 140 lb hammer 30 inch drop	N	REC / ATT	WATER CONTENT (PERCENT)							
					DEPTH (ft)						W _p	W _L	W _U	W _p	W _L	W _U		
0	4.25-inch ID Hollow Stem Auger	0.0 - 12.0 Compact to dense, olive gray to light brown, non-stratified, fine to coarse GRAVEL and medium to coarse SAND, little fine to coarse cobbles, damp but slightly wet at top of sample. (SW/GW) (OUTWASH)	GW/SW													2.55-ft well stick up. Stick-up monument set in concrete. DOE Well Tag BCT 408		
5						1	HD	11-16-16	32	1.0 1.5					■			Overstated blow counts on gravels.
10																		
		12.0 - 17.0 Becomes fine to coarse GRAVEL, little cobbles, little fine to coarse sand, trace silt, wet coating on clasts. (GW)	GW															
					539.1 12.0													
15																		
		17.0 - 22.0 Trace cobbles observed.	GW															
					534.1 17.0													
20																		

Log continued on next page

1 in to 3 ft
DRILLING CONTRACTOR: Cascade Drilling, LP
DRILLER: Andy

LOGGED: J. deLaChapelle
CHECKED: J. Johnson
DATE: 1/6/2011



BOREHOLE RECORD 0631076001.503 BORINGS OCT2010.GPJ GLDR_WA.GDT 10/12/11

RECORD OF BOREHOLE MW-30

SHEET 2 of 4

PROJECT: BD Villages/The Villages Project DRILLING METHOD: Hollow Stem Auger
PROJECT NUMBER: 063-1076-001.503 DRILLING DATE: 10/15/10
LOCATION: Big A1 Pond DRILL RIG: Marooka track-mount

DATUM: MSL
AZIMUTH: N/A
COORDINATES: not surveyed

ELEVATION: 551.12
INCLINATION: -90

DEPTH (ft)	BORING METHOD	SOIL PROFILE				SAMPLES					PENETRATION RESISTANCE BLOWS / ft ■					NOTES WATER LEVELS				
		DESCRIPTION	USCS	GRAPHIC LOG	ELEV.	NUMBER	TYPE	BLOWS per 6 in 140 lb hammer 30 inch drop	N	REC / ATT	10	20	30	40						
					DEPTH (ft)						WATER CONTENT (PERCENT)									
													W _p	I	20	40	60	80	W _i	
20	4.25-inch ID Hollow Stem Auger	17.0 - 22.0 Trace cobbles observed. (Continued)	GW		529.1 22.0	4	HD	8-11-17	28	1.0 1.5										
		22.0 - 27.0 Becomes dense, light brown, non-stratified, fine to medium SAND, some fine to coarse gravel, damp. (SP)	SP		524.1 27.0	5	HD	10-21-18	39	1.0 1.5										
25																				
		27.0 - 32.0 Becomes brown, crudely stratified, fine to coarse GRAVEL, some fine to medium sand, little silt, grading down to fine to medium sand, little silt, damp. (GW)	GW		519.1 32.0	6	HD	6-14-16	30	1.5 1.5										
30																				
		32.0 - 42.0 Becomes light brown, crudely stratified, fine to medium SAND, interbeds of fine to coarse sand, trace to little fine gravel, trace silt, moist. (SP)	SP																	
35									7	HD	8-20-27	47	1.0 1.5							
40						8	HD	6-19-20	39	1.5 1.5										

Log continued on next page

Infiltration test performed at 30 ft bgs. 2-inch diameter, PVC pipe embedded in bentonite chips.

Infiltration test performed at 39 ft bgs.

BOREHOLE RECORD 0631076001.503_BORINGS OCT2010.GPJ GLDR_WA.GDT 10/12/11

1 in to 3 ft
DRILLING CONTRACTOR: Cascade Drilling, LP
DRILLER: Andy

LOGGED: J. deLaChapelle
CHECKED: J. Johnson
DATE: 1/6/2011



RECORD OF BOREHOLE MW-30

SHEET 3 of 4

PROJECT: BD Villages/The Villages Project DRILLING METHOD: Hollow Stem Auger
PROJECT NUMBER: 063-1076-001.503 DRILLING DATE: 10/15/10
LOCATION: Big A1 Pond DRILL RIG: Marooka track-mount

DATUM: MSL
AZIMUTH: N/A
COORDINATES: not surveyed

ELEVATION: 551.12
INCLINATION: -90

DEPTH (ft)	BORING METHOD	SOIL PROFILE				SAMPLES					PENETRATION RESISTANCE BLOWS / ft ■				NOTES WATER LEVELS GRAPHIC		
		DESCRIPTION	USCS	GRAPHIC LOG	ELEV.	NUMBER	TYPE	BLOWS per 6 in 140 lb hammer 30 inch drop	N	REC / ATT	WATER CONTENT (PERCENT)						
					DEPTH (ft)						W _p		W _L	W _i			
40	4.25-inch ID Hollow Stem Auger	32.0 - 42.0 Becomes light brown, crudely stratified, fine to medium SAND, interbeds of fine to coarse sand, trace to little fine gravel, trace silt, moist. (SP) (Continued)	SP		509.1 42.0	8	HD	6-19-20	39	1.5 1.5							Very hard drilling from 43 to 59 ft. <

1 in to 3 ft
DRILLING CONTRACTOR: Cascade Drilling, LP
DRILLER: Andy

LOGGED: J. deLaChapelle
CHECKED: J. Johnson
DATE: 1/6/2011



BOREHOLE RECORD 0631076001.503 BORINGS OCT2010.GPJ GLDR_WA.GDT 10/12/11

RECORD OF BOREHOLE MW-30

SHEET 4 of 4

PROJECT: BDVillages/The Villages Project DRILLING METHOD: Hollow Stem Auger
PROJECT NUMBER: 063-1076-001.503 DRILLING DATE: 10/15/10
LOCATION: Big A1 Pond DRILL RIG: Marooka track-mount

DATUM: MSL
AZIMUTH: N/A
COORDINATES: not surveyed

ELEVATION: 551.12
INCLINATION: -90

DEPTH (ft)	BORING METHOD	SOIL PROFILE				SAMPLES					PENETRATION RESISTANCE BLOWS / ft ■					NOTES WATER LEVELS GRAPHIC	
		DESCRIPTION	USCS	GRAPHIC LOG	ELEV.	NUMBER	TYPE	BLOWS per 6 in 140 lb hammer 30 inch drop	N	REC / ATT	WATER CONTENT (PERCENT)						
					DEPTH (ft)						W _p	W _L	W _U	W _h			
60	4.25-inch ID Hollow Stem Auger	57.0 - 62.0 Dense, olive gray to speckled gray, crudely stratified, silty fine to coarse SAND and fine to coarse GRAVEL, trace fine cobbles, wet. (SM/GM) (ADVANCE OUTWASH) <i>(Continued)</i>	SM/GM		489.1	12	HD	20-35-44	>50	1.5 1.5						2-inch diameter, 0.01-inch slotted, PVC pipe embedded in sand pack. Originally logged as BH-C	
62.0																	
64.5																	
		62.0 - 64.5 Becomes speckled gray, non-stratified, medium to coarse SAND, some fine to coarse gravel, wet. (SP)	SP		486.6												
65		64.5 - 67.0 Dense, brown with bands of orange and black, stratified, silty fine SAND, grading to fine sand silt at tip, dilatant, silt is slightly cohesive, wet. (SM) (GLACIOLACUSTRINE DEPOSIT)	SM		484.1	13	HD	10-15-17	32	1.5 1.5							
		67.0 - 69.5 Becomes soft, gray, stratified, clayey fine SAND and SILT, trace fine gravel, trace coarse sand seams, wet. (SM/ML)	SM/ML		481.6												
70		69.5 - 70.5 Becomes compact, brown to orangish brown, thinly laminated, fine sandy SILT, laminated with silt and silty fine sand, cohesive, non-plastic, wet. (ML)	ML		480.6	14	HD	5-11-11	22	1.5 1.5							
		Boring completed at 70.5 ft.															
											</						

BOREHOLE RECORD 0631076001.503 BORINGS OCT2010.GPJ GLDR_WA.GDT 10/12/11

1 in to 3 ft
DRILLING CONTRACTOR: Cascade Drilling, LP
DRILLER: Andy

LOGGED: J. deLaChapelle
CHECKED: J. Johnson
DATE: 1/6/2011

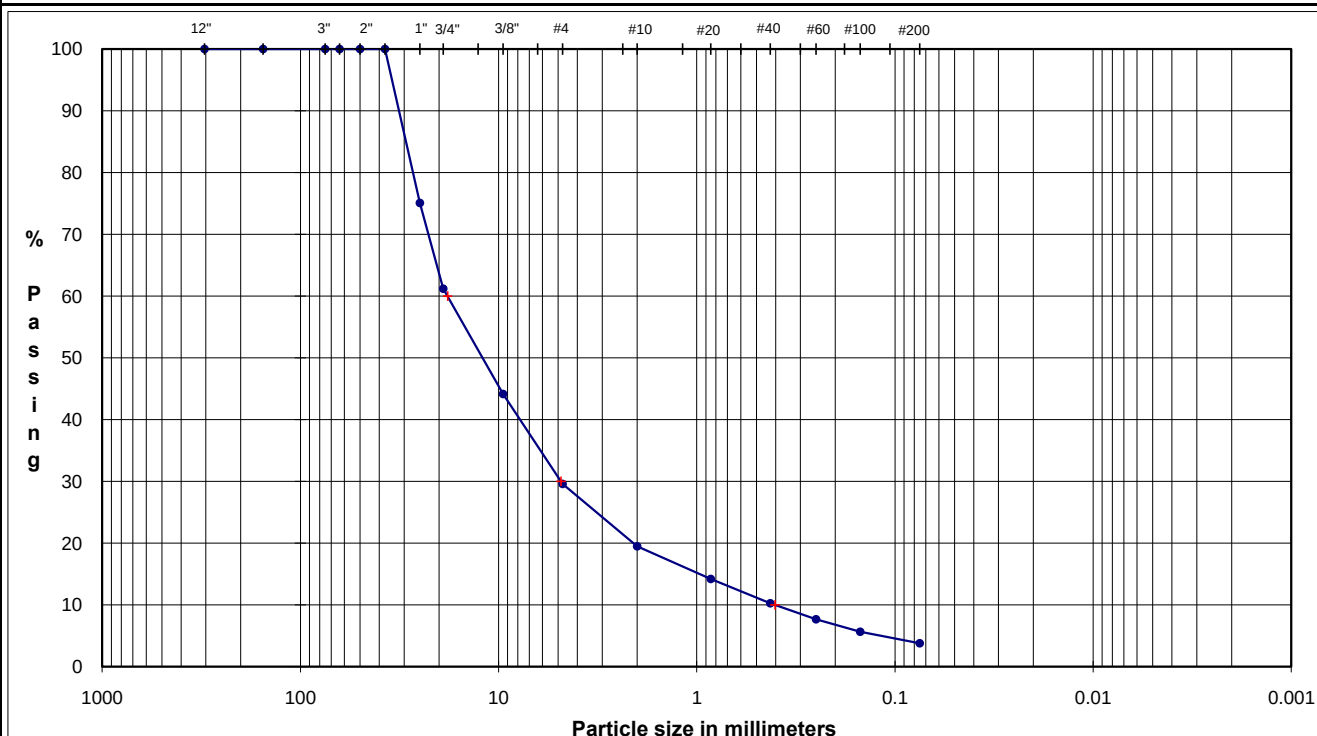


APPENDIX D

Grain-Size Analysis Testing Results

PARTICLE SIZE DISTRIBUTION

ASTM D421, D422, D4318

PROJECT NAME: **BD / The Villages West Pond / WA**SAMPLE ID: **GB-3****S-1**Depth: **5ft**TYPE: **HD**

	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay
COBBLES	GRAVEL		SAND			FINES

U.S. Standard Sieves Sizes and Numbers

Particle Size			Particle Size	
(mm)	% Passing	Classification	Percentage	
12.0"	304.8	100.0	Cobbles	0.0
6.0"	154.2	100.0		
3.0"	75	100.0		
2.5"	63.5	100.0	Coarse Gravel	38.8
2.0"	50	100.0		
1.5"	37.5	100.0		
1.0"	25	75.1		
0.75"	19	61.2		
0.375"	9.5	44.1	Fine Gravel	31.6
#4	4.75	29.6		
#10	2.00	19.5	Coarse Sand	10.1
#20	0.85	14.2	Medium Sand	9.2
#40	0.43	10.3		
#60	0.25	7.6		
#100	0.15	5.6	Fine Sand	6.5
#200	0.075	3.8		
			Fines	3.8

Moisture Content

3.44

$D_{60} = 18.09$	$D_{30} = 4.84$	$D_{10} = 0.40$
------------------	-----------------	-----------------

Cu = $D_{60}/D_{10} = 44.9 > 4$ Cc = $D_{30}^2/(D_{10} \cdot D_{60}) = 3.2 > 3$

DESCRIPTION: fine to coarse GRAVEL
some fine to coarse sand, trace silt

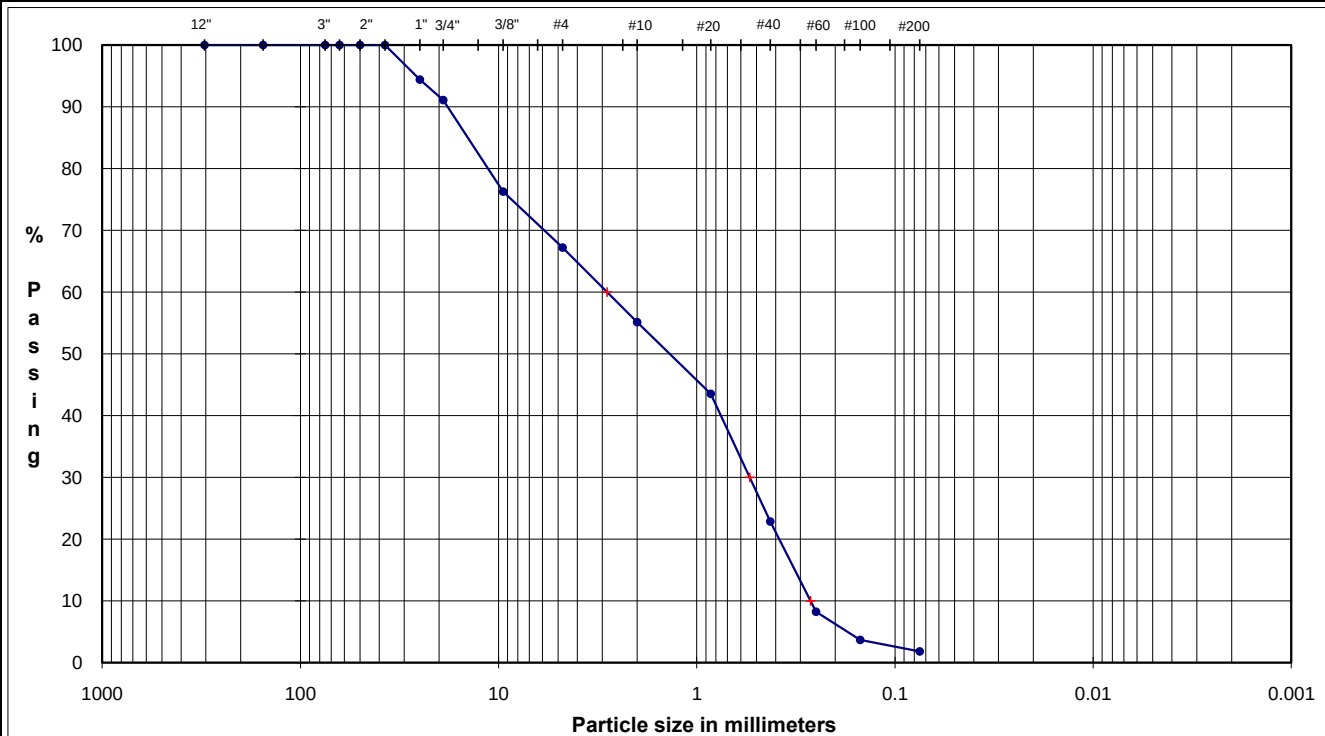
USCS: GW

TECH	TCM
DATE	10/22/10
CHECK	TCM
REVIEW	AJD

PARTICLE SIZE DISTRIBUTION

ASTM D421, D422, D4318

PROJECT NAME: **BD / The Villages West Pond / WA**
 SAMPLE ID: **GB-3**
 TYPE: **HD**

S-2 Depth: **10ft**

	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay
COBBLES	GRAVEL		SAND			FINES

U.S. Standard Sieves Sizes and Numbers	Particle Size			Particle Size	Percentage
	(mm)	% Passing	Classification		
	12.0"	304.8	100.0	Cobbles	0.0
	6.0"	154.2	100.0		
	3.0"	75	100.0		
	2.5"	63.5	100.0		
	2.0"	50	100.0		
	1.5"	37.5	100.0		
	1.0"	25	94.4		
	0.75"	19	91.1		
	0.375"	9.5	76.3	Coarse Gravel	8.9
	#4	4.75	67.2	Fine Gravel	23.9
	#10	2.00	55.1		
	#20	0.85	43.5	Coarse Sand	12.1
	#40	0.43	22.8	Medium Sand	32.3
	#60	0.25	8.2		
	#100	0.15	3.7	Fine Sand	21.0
	#200	0.075	1.8		
Fines				1.8	

Moisture Content

4.57

$D_{60} = 2.84$	$D_{30} = 0.54$	$D_{10} = 0.27$
-----------------	-----------------	-----------------

$C_u = D_{60}/D_{10} =$	10.6	> 6
$C_c = D_{30}^2/(D_{10} \cdot D_{60}) =$	0.4	< 1

DESCRIPTION: fine to coarse SAND and fine to coarse GRAVEL
 trace silt

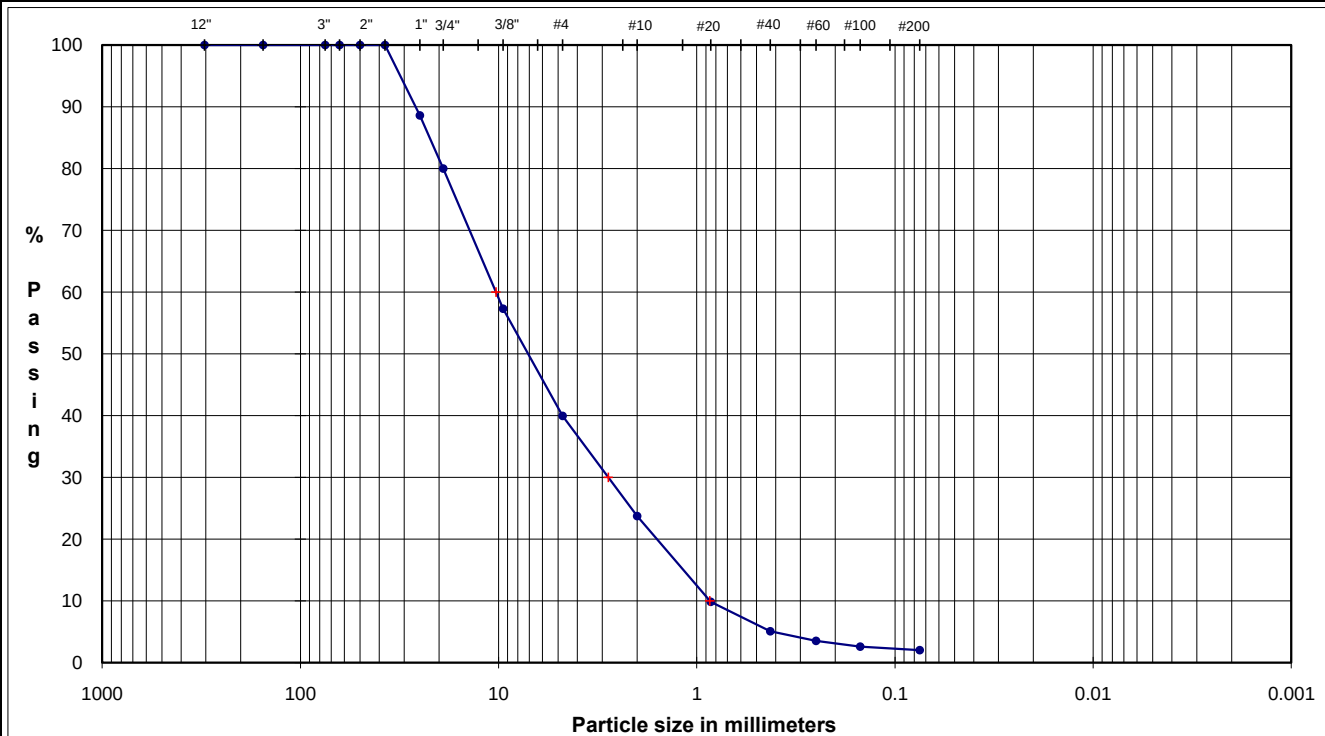
USCS: SW/GW

TECH	TCM
DATE	10/22/10
CHECK	TCM
REVIEW	AJD

PARTICLE SIZE DISTRIBUTION

ASTM D421, D422, D4318

PROJECT NAME: **BD / The Villages West Pond / WA**
 SAMPLE ID: **GB-3**
 TYPE: **HD**

S-3 Depth: **15ft**

	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay
COBBLES	GRAVEL		SAND			FINES

U.S. Standard Sieves Sizes and Numbers	Particle Size			Particle Size	
	(mm)	% Passing	Classification	Percentage	
	12.0"	304.8	100.0	Cobbles	0.0
	6.0"	154.2	100.0		
	3.0"	75	100.0		
	2.5"	63.5	100.0		
	2.0"	50	100.0	Coarse Gravel	20.0
	1.5"	37.5	100.0		
	1.0"	25	88.6		
	0.75"	19	80.0		
	0.375"	9.5	57.3	Fine Gravel	40.1
	#4	4.75	39.9		
	#10	2.00	23.7	Coarse Sand	16.2
	#20	0.85	9.8	Medium Sand	18.6
	#40	0.43	5.1		
	#60	0.25	3.5		
	#100	0.15	2.6		
	#200	0.075	2.0	Fine Sand	3.1
Fines				2.0	

Moisture Content

1.77

$D_{60} = 10.32$	$D_{30} = 2.80$	$D_{10} = 0.86$
------------------	-----------------	-----------------

$C_u = D_{60}/D_{10} =$	12.0	> 4
$C_c = D_{30}^2/(D_{10} \cdot D_{60}) =$	0.9	< 1

DESCRIPTION: fine to coarse GRAVEL and fine to coarse SAND
 trace silt

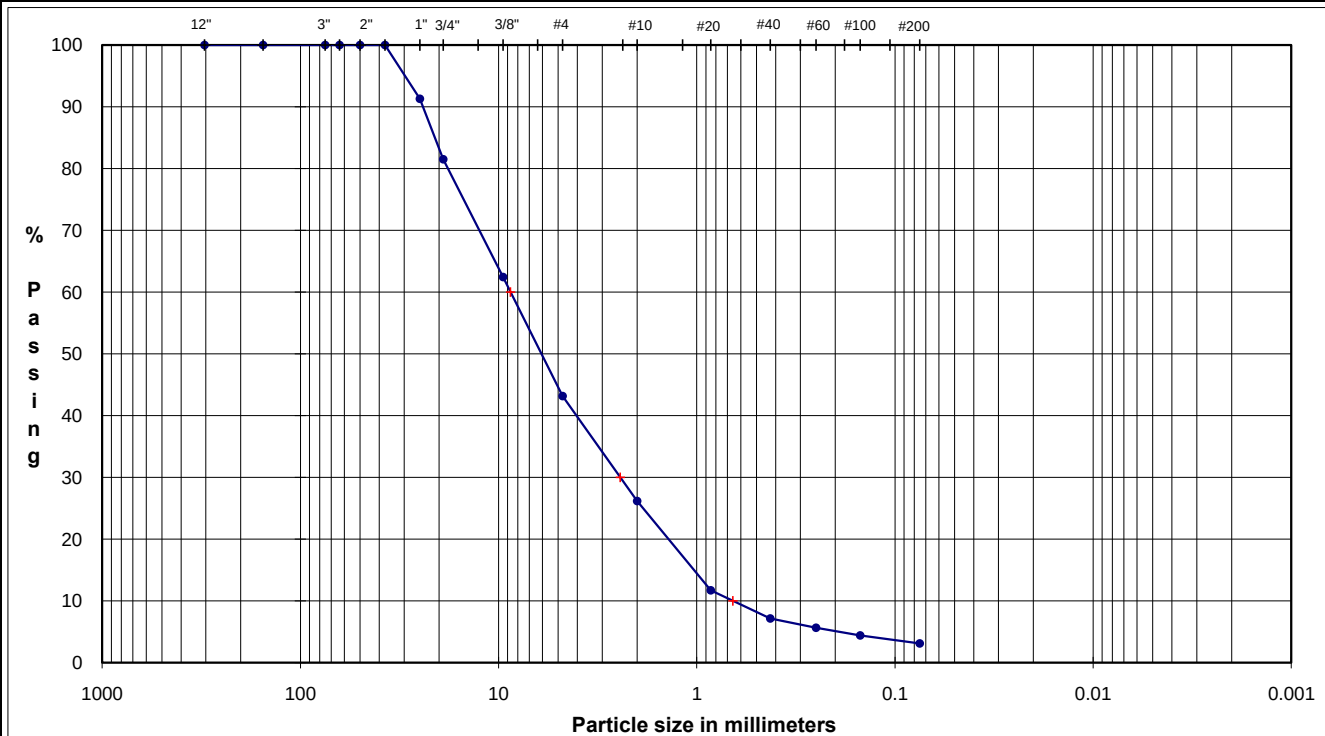
USCS: GW/SW

TECH	TCM
DATE	10/22/10
CHECK	TCM
REVIEW	AJD

PARTICLE SIZE DISTRIBUTION

ASTM D421, D422, D4318

PROJECT NAME: **BD / The Villages West Pond / WA**
 SAMPLE ID: **GB-3**
 TYPE: **HD**

S-4Depth: **20ft**

	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay
COBBLES	GRAVEL		SAND			FINES

U.S. Standard Sieves Sizes and Numbers	Particle Size			Particle Size	
	(mm)	% Passing	Classification	Percentage	
	12.0"	304.8	100.0	Cobbles	0.0
	6.0"	154.2	100.0		
	3.0"	75	100.0		
	2.5"	63.5	100.0		
	2.0"	50	100.0	Coarse Gravel	18.5
	1.5"	37.5	100.0		
	1.0"	25	91.3		
	0.75"	19	81.5		
	0.375"	9.5	62.4	Fine Gravel	38.3
	#4	4.75	43.1		
	#10	2.00	26.2	Coarse Sand	17.0
	#20	0.85	11.7	Medium Sand	19.0
	#40	0.43	7.1		
	#60	0.25	5.6	Fine Sand	4.1
	#100	0.15	4.4		
	#200	0.075	3.1		
Fines					

Moisture Content

4.99

$D_{60} = 8.70$	$D_{30} = 2.43$	$D_{10} = 0.66$
-----------------	-----------------	-----------------

$C_u = D_{60}/D_{10} =$	13.2	> 4
$C_c = D_{30}^2/(D_{10} \cdot D_{60}) =$	1.0	> 1

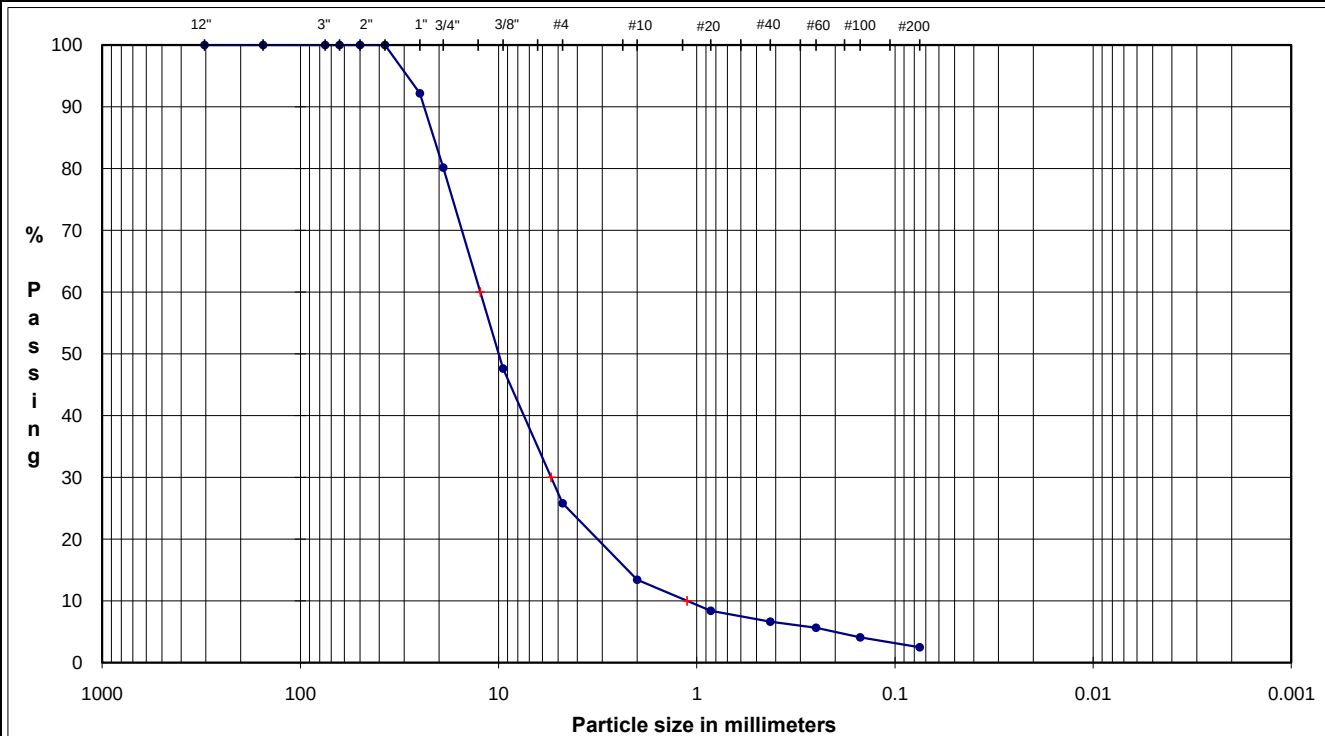
DESCRIPTION: fine to coarse GRAVEL and fine to coarse SAND
 trace silt

USCS: GW/SW

TECH	TCM
DATE	10/22/10
CHECK	TCM
REVIEW	AJD

PARTICLE SIZE DISTRIBUTION

ASTM D421, D422, D4318

PROJECT NAME: **BD / The Villages West Pond / WA**SAMPLE ID: **GB-3****S-5**Depth: **25ft**TYPE: **HD**

	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay
COBBLES	GRAVEL		SAND			FINES

U.S. Standard Sieves Sizes and Numbers	Particle Size			Particle Size	
	(mm)	% Passing	Classification	Percentage	
	12.0"	304.8	100.0	Cobbles	0.0
	6.0"	154.2	100.0		
	3.0"	75	100.0		
	2.5"	63.5	100.0		
	2.0"	50	100.0	Coarse Gravel	19.8
	1.5"	37.5	100.0		
	1.0"	25	92.2		
	0.75"	19	80.2		
	0.375"	9.5	47.6	Fine Gravel	54.4
	#4	4.75	25.8		
	#10	2.00	13.4	Coarse Sand	12.4
	#20	0.85	8.4	Medium Sand	6.8
	#40	0.43	6.6		
	#60	0.25	5.7	Fine Sand	4.2
	#100	0.15	4.1		
	#200	0.075	2.5		
Fines					

Moisture Content

2.42

$D_{60} = 12.37$	$D_{30} = 5.43$	$D_{10} = 1.12$
------------------	-----------------	-----------------

$C_u = D_{60}/D_{10} =$	11.1	> 4
$C_c = D_{30}^2/(D_{10} \cdot D_{60}) =$	2.1	> 1

DESCRIPTION: fine to coarse GRAVEL
some fine to coarse sand, trace silt

USCS: GW

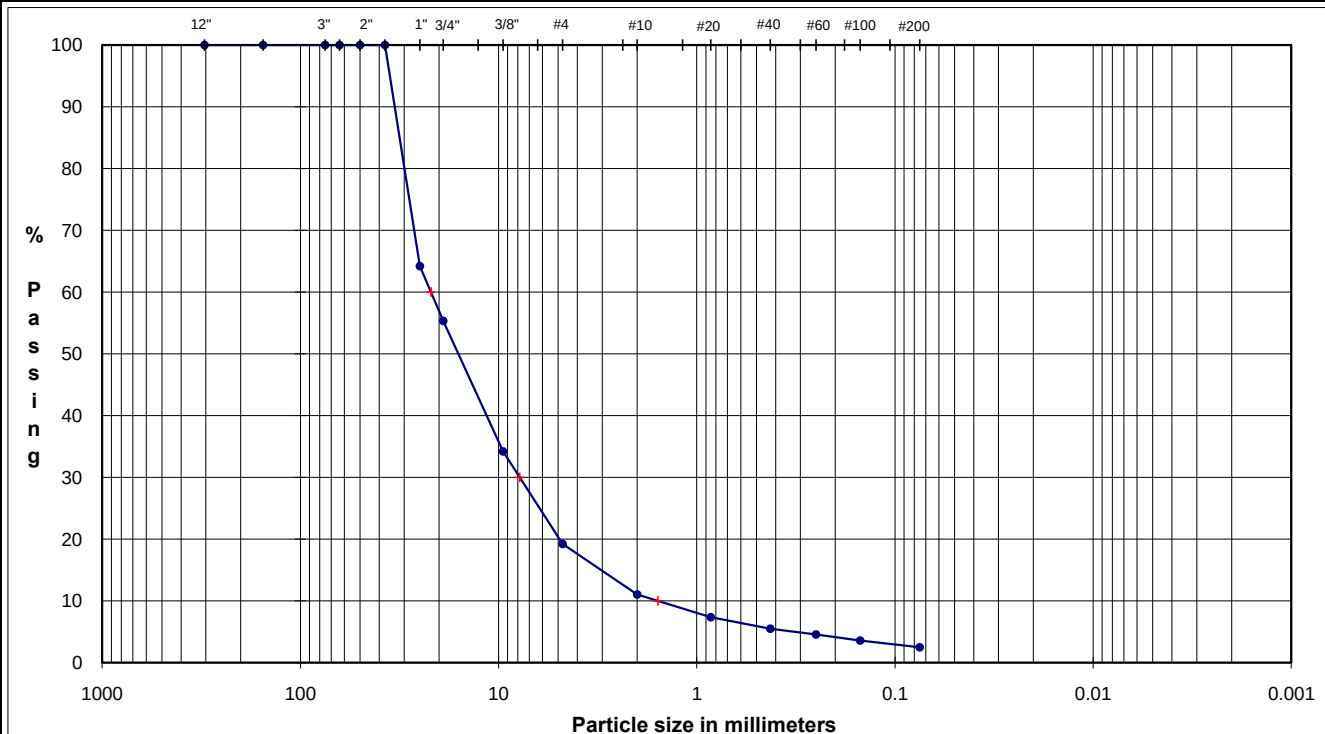
TECH	TCM
DATE	10/22/10
CHECK	TCM
REVIEW	AJD

PARTICLE SIZE DISTRIBUTION

ASTM D421, D422, D4318

PROJECT NAME: **BD / The Villages West Pond / WA**
 SAMPLE ID: **GB-3**
 TYPE: **HD**

S-6

Depth: **30ft**

	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay
COBBLES	GRAVEL		SAND			FINES

U.S. Standard Sieves Sizes and Numbers	Particle Size			Particle Size	
	(mm)	% Passing	Classification	Percentage	
	12.0"	304.8	100.0	Cobbles	0.0
	6.0"	154.2	100.0		
	3.0"	75	100.0		
	2.5"	63.5	100.0		
	2.0"	50	100.0		
	1.5"	37.5	100.0		
	1.0"	25	64.2		
	0.75"	19	55.3		
	0.375"	9.5	34.2	Coarse Gravel	44.7
	#4	4.75	19.2	Fine Gravel	36.1
	#10	2.00	11.0		
	#20	0.85	7.4	Coarse Sand	8.2
	#40	0.43	5.5	Medium Sand	5.6
	#60	0.25	4.5		
	#100	0.15	3.6	Fine Sand	3.0
	#200	0.075	2.5		
Fines					

Moisture Content

3.54

$D_{60} = 21.96$	$D_{30} = 7.82$	$D_{10} = 1.57$
------------------	-----------------	-----------------

$C_u = D_{60}/D_{10} =$	14.0	> 4
$C_c = D_{30}^2/(D_{10} \cdot D_{60}) =$	1.8	> 1

DESCRIPTION: fine to coarse GRAVEL
 some fine to coarse sand, trace silt

USCS: GW

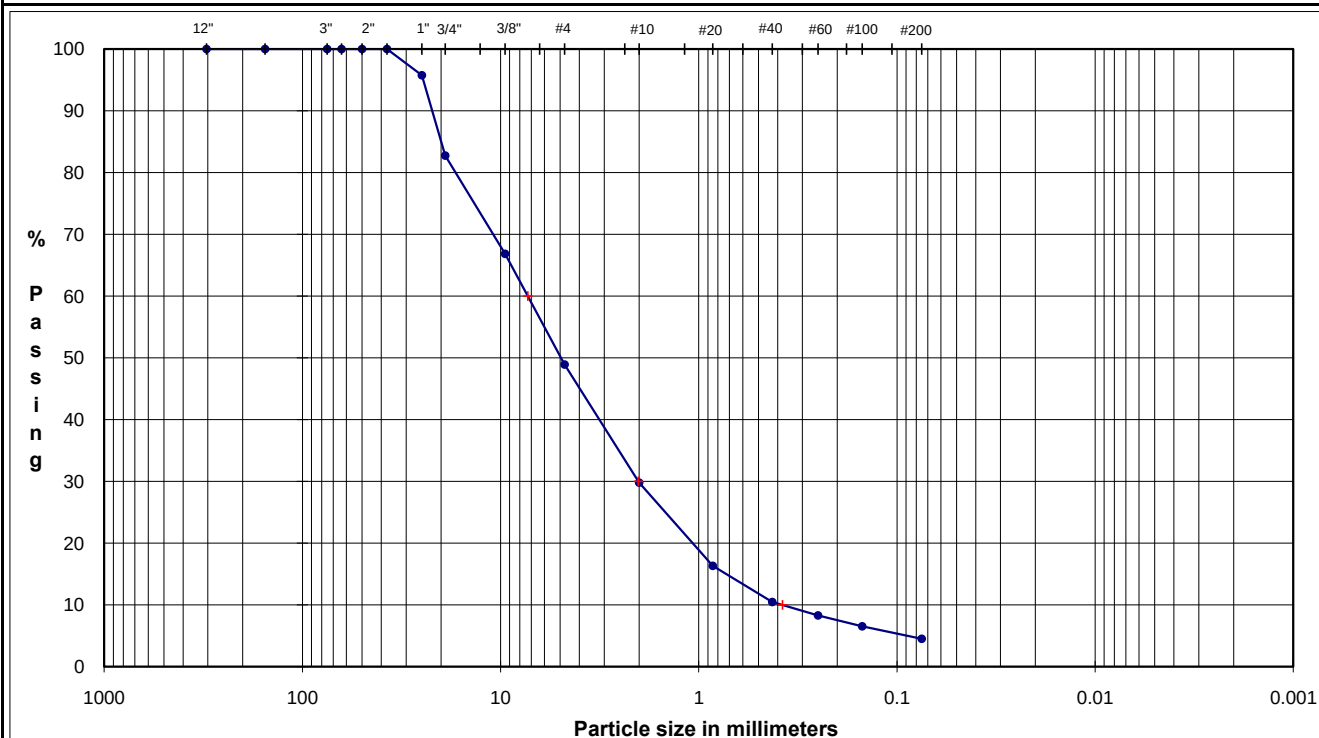
TECH	TCM
DATE	10/22/10
CHECK	TCM
REVIEW	AJD

PARTICLE SIZE DISTRIBUTION

ASTM D421, D422, D4318

PROJECT NAME: **BD / The Villages West Pond / WA**SAMPLE ID: **GB-3**

S-7

Depth: **35ft**TYPE: **HD**

	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay
COBBLES	GRAVEL		SAND			FINES

U.S. Standard Sieves Sizes and Numbers	Particle Size			Particle Size	
	(mm)	% Passing	Classification	Percentage	
	12.0"	304.8	100.0	Cobbles	0.0
	6.0"	154.2	100.0		
	3.0"	75	100.0		
	2.5"	63.5	100.0		
	2.0"	50	100.0	Coarse Gravel	17.3
	1.5"	37.5	100.0		
	1.0"	25	95.7		
	0.75"	19	82.7		
	0.375"	9.5	66.8	Fine Gravel	33.9
	#4	4.75	48.9		
	#10	2.00	29.8	Coarse Sand	19.1
	#20	0.85	16.3	Medium Sand	19.3
	#40	0.43	10.5		
	#60	0.25	8.3		
	#100	0.15	6.5		
	#200	0.075	4.5	Fine Sand	6.0
	Fines				4.5

Moisture Content

3.95

$D_{60} = 7.29$	$D_{30} = 2.02$	$D_{10} = 0.38$
-----------------	-----------------	-----------------

$C_u = D_{60}/D_{10} =$	19.3	> 4
$C_c = D_{30}^2/(D_{10} \cdot D_{60}) =$	1.5	> 1

DESCRIPTION: fine to coarse GRAVEL and fine to coarse SAND
trace silt

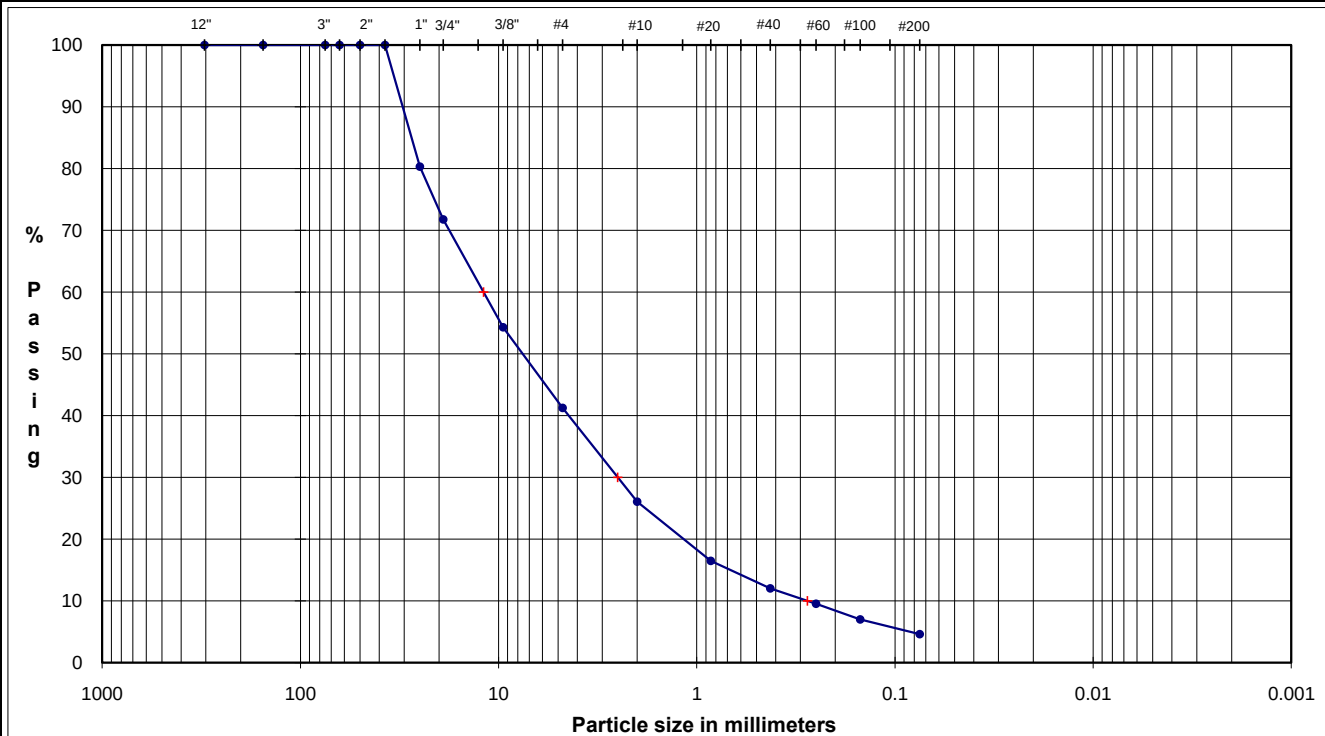
USCS: GW/SW

TECH	TCM
DATE	10/22/10
CHECK	TCM
REVIEW	AJD

PARTICLE SIZE DISTRIBUTION

ASTM D421, D422, D4318

PROJECT NAME: **BD / The Villages West Pond / WA**
 SAMPLE ID: **GB-3**
 TYPE: **HD**

S-8 Depth: **40ft**

	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay
COBBLES	GRAVEL		SAND			FINES

U.S. Standard Sieves Sizes and Numbers	Particle Size			Particle Size	
	(mm)	% Passing	Classification	Percentage	
	12.0"	304.8	100.0	Cobbles	0.0
	6.0"	154.2	100.0		
	3.0"	75	100.0		
	2.5"	63.5	100.0		
	2.0"	50	100.0	Coarse Gravel	28.2
	1.5"	37.5	100.0		
	1.0"	25	80.3		
	0.75"	19	71.8		
	0.375"	9.5	54.3	Fine Gravel	30.5
	#4	4.75	41.2		
	#10	2.00	26.0	Coarse Sand	15.2
	#20	0.85	16.5	Medium Sand	14.0
	#40	0.43	12.0		
	#60	0.25	9.5		
	#100	0.15	7.0		
	#200	0.075	4.6	Fine Sand	7.4
Fines				4.6	

Moisture Content

5.74

$D_{60} = 11.91$	$D_{30} = 2.51$	$D_{10} = 0.28$
------------------	-----------------	-----------------

$C_u = D_{60}/D_{10} =$	43.1	> 4
$C_c = D_{30}^2/(D_{10} \cdot D_{60}) =$	1.9	> 1

DESCRIPTION: fine to coarse GRAVEL and fine to coarse SAND
 trace silt

USCS: GW/SW

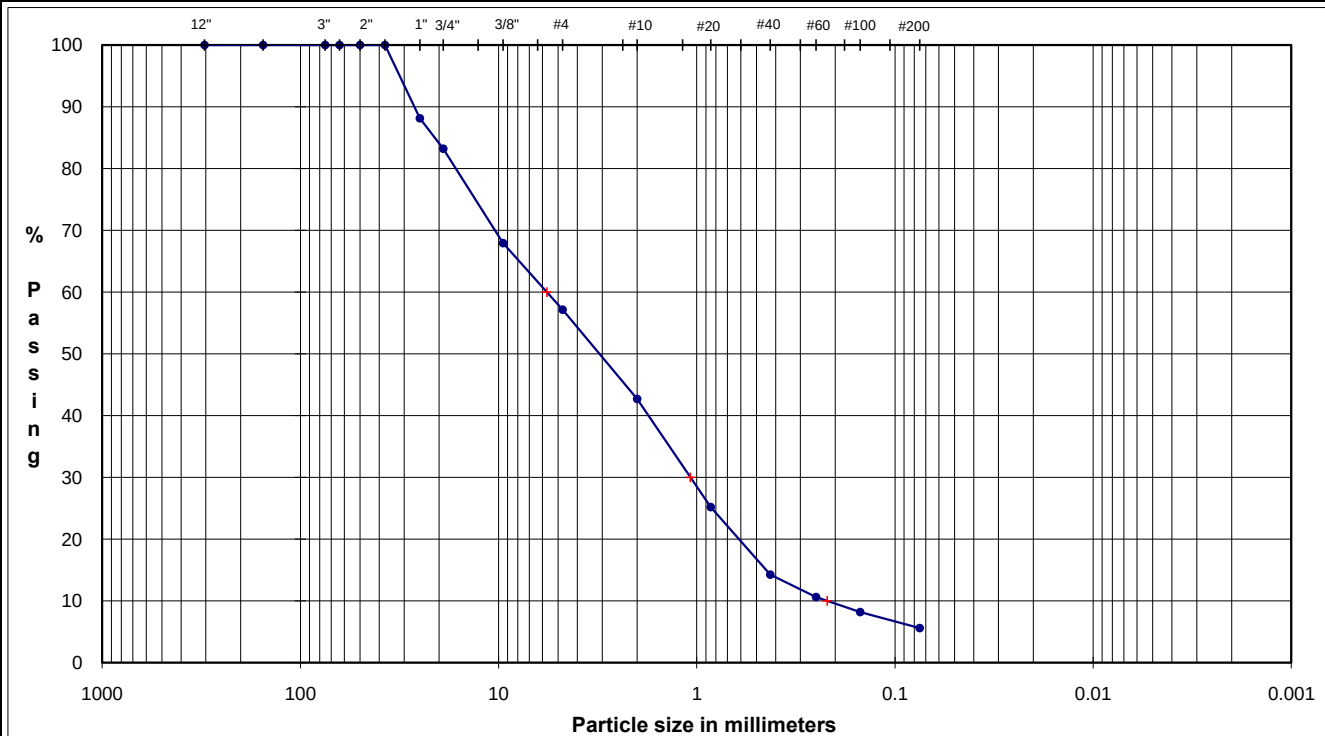
TECH	TCM
DATE	10/22/10
CHECK	TCM
REVIEW	AJD

PARTICLE SIZE DISTRIBUTION

ASTM D421, D422, D4318

PROJECT NAME: **BD / The Villages West Pond / WA**
 SAMPLE ID: **GB-3**
 TYPE: **HD**

S-11 Depth: 55ft



	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay
COBBLES	GRAVEL		SAND			FINES

U.S. Standard Sieves Sizes and Numbers

Particle Size			Particle Size	
	(mm)	% Passing	Classification	Percentage
12.0"	304.8	100.0	Cobbles	0.0
6.0"	154.2	100.0		
3.0"	75	100.0		
2.5"	63.5	100.0		
2.0"	50	100.0	Coarse Gravel	16.8
1.5"	37.5	100.0		
1.0"	25	88.1		
0.75"	19	83.2		
0.375"	9.5	67.9	Fine Gravel	26.1
#4	4.75	57.1		
#10	2.00	42.7	Coarse Sand	14.4
#20	0.85	25.2	Medium Sand	28.5
#40	0.43	14.2		
#60	0.25	10.6		
#100	0.15	8.2	Fine Sand	8.7
#200	0.075	5.6		
			Fines	5.6

Moisture Content

3.25

$D_{60} = 5.71$	$D_{30} = 1.08$	$D_{10} = 0.22$
-----------------	-----------------	-----------------

$$Cu = D_{60}/D_{10} = 26.0 > 6$$

$$Cc = D_{30}^2/(D_{10} \cdot D_{60}) = 0.9 < 1$$

DESCRIPTION: fine to coarse SAND and fine to coarse GRAVEL
 little silt

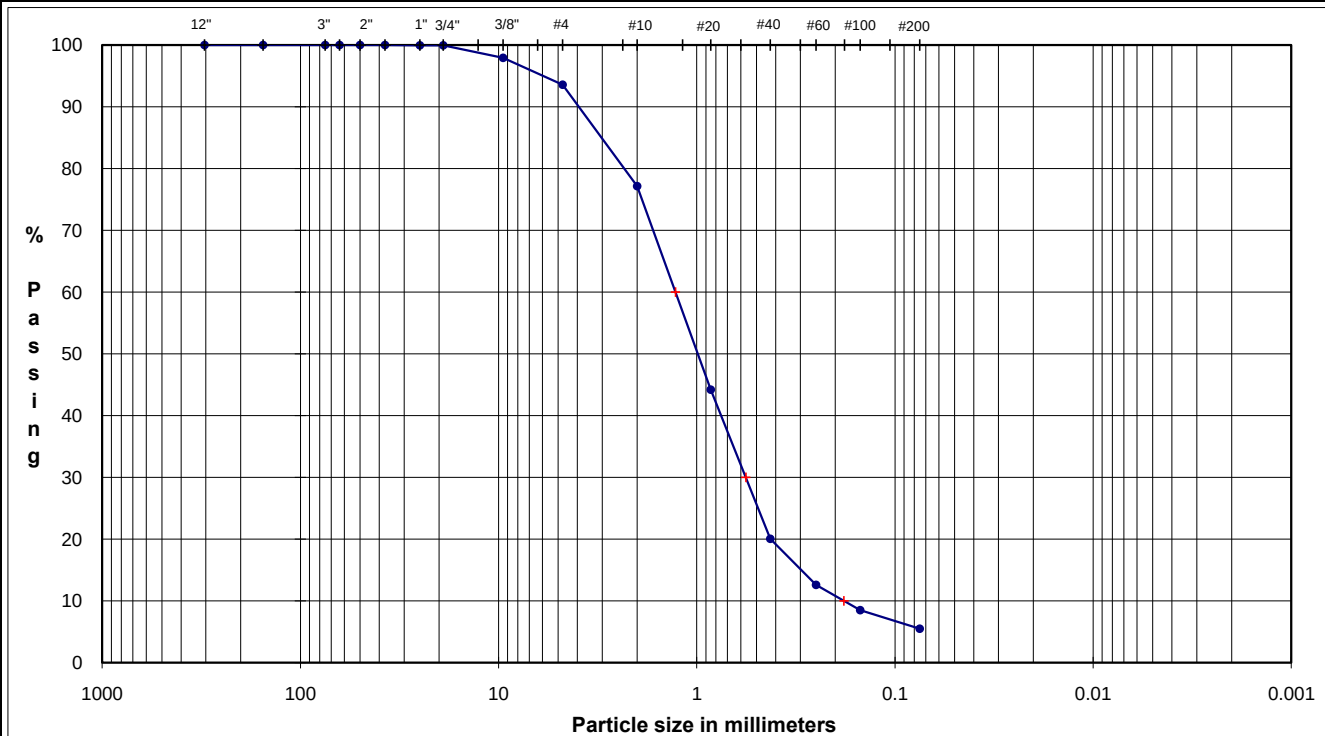
USCS: SW-SM/GW-GM

TECH	TCM
DATE	10/22/10
CHECK	TCM
REVIEW	AJD

PARTICLE SIZE DISTRIBUTION

ASTM D421, D422, D4318

PROJECT NAME: **BD / The Villages West Pond / WA**
 SAMPLE ID: **GB-3**
 TYPE: **HD**

S-12 Depth: **60ft**

	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay
COBBLES	GRAVEL		SAND			FINES

U.S. Standard Sieves Sizes and Numbers	Particle Size		Particle Size	
	(mm)	% Passing	Classification	Percentage
	12.0"	304.8	100.0	
	6.0"	154.2	100.0	
	3.0"	75	100.0	Cobbles
	2.5"	63.5	100.0	
	2.0"	50	100.0	
	1.5"	37.5	100.0	
	1.0"	25	99.9	
	0.75"	19	99.9	Coarse Gravel
	0.375"	9.5	97.9	
	#4	4.75	93.6	Fine Gravel
	#10	2.00	77.2	Coarse Sand
	#20	0.85	44.2	
	#40	0.43	20.0	Medium Sand
	#60	0.25	12.6	
	#100	0.15	8.5	
	#200	0.075	5.5	Fine Sand
			Fines	5.5

Moisture Content

17.38

$D_{60} = 1.28$	$D_{30} = 0.57$	$D_{10} = 0.18$
-----------------	-----------------	-----------------

$$Cu = D_{60}/D_{10} = 7.1 > 6$$

$$Cc = D_{30}^2/(D_{10} \cdot D_{60}) = 1.4 > 1$$

DESCRIPTION: fine to coarse SAND
 little fine gravel, little silt

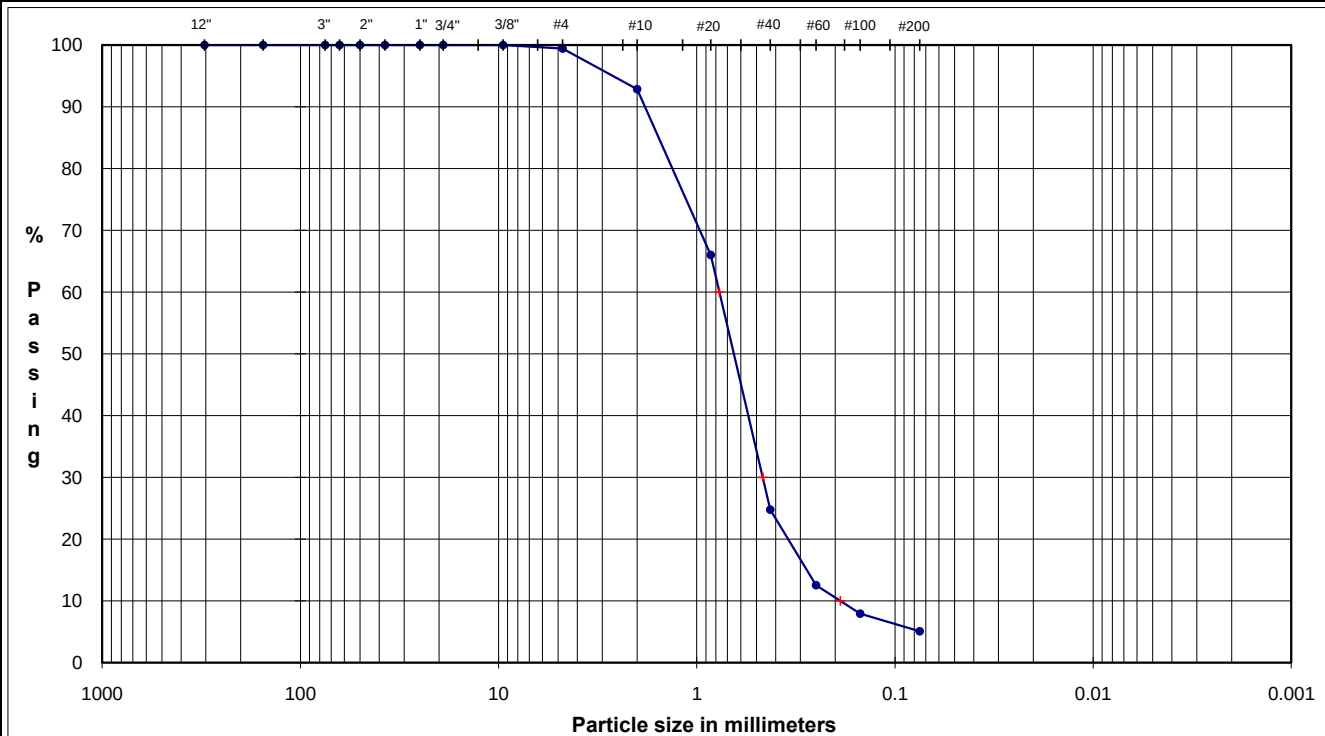
USCS: SW-SM

TECH	TCM
DATE	10/22/10
CHECK	TCM
REVIEW	AJD

PARTICLE SIZE DISTRIBUTION

ASTM D421, D422, D4318

PROJECT NAME: **BD / The Villages West Pond / WA**
 SAMPLE ID: **GB-3**
 TYPE: **HD**

S-13 Depth: **65ft**

	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay
COBBLES	GRAVEL		SAND			FINES

U.S. Standard Sieves Sizes and Numbers	Particle Size		Particle Size	
	(mm)	% Passing	Classification	Percentage
	12.0"	304.8	100.0	
	6.0"	154.2	100.0	
	3.0"	75	100.0	Cobbles
	2.5"	63.5	100.0	
	2.0"	50	100.0	
	1.5"	37.5	100.0	
	1.0"	25	100.0	
	0.75"	19	100.0	Coarse Gravel
	0.375"	9.5	100.0	
	#4	4.75	99.4	Fine Gravel
	#10	2.00	92.8	Coarse Sand
	#20	0.85	66.0	
	#40	0.43	24.7	Medium Sand
	#60	0.25	12.5	
	#100	0.15	7.9	
	#200	0.075	5.1	Fine Sand
			FINES	5.1

Moisture Content

17.82

$D_{60} = 0.77$	$D_{30} = 0.46$	$D_{10} = 0.19$
-----------------	-----------------	-----------------

$C_u = D_{60}/D_{10} =$	4.1	< 6
$C_c = D_{30}^2/(D_{10} \cdot D_{60}) =$	1.5	> 1

DESCRIPTION: fine to coarse SAND
 little silt, trace fine gravel

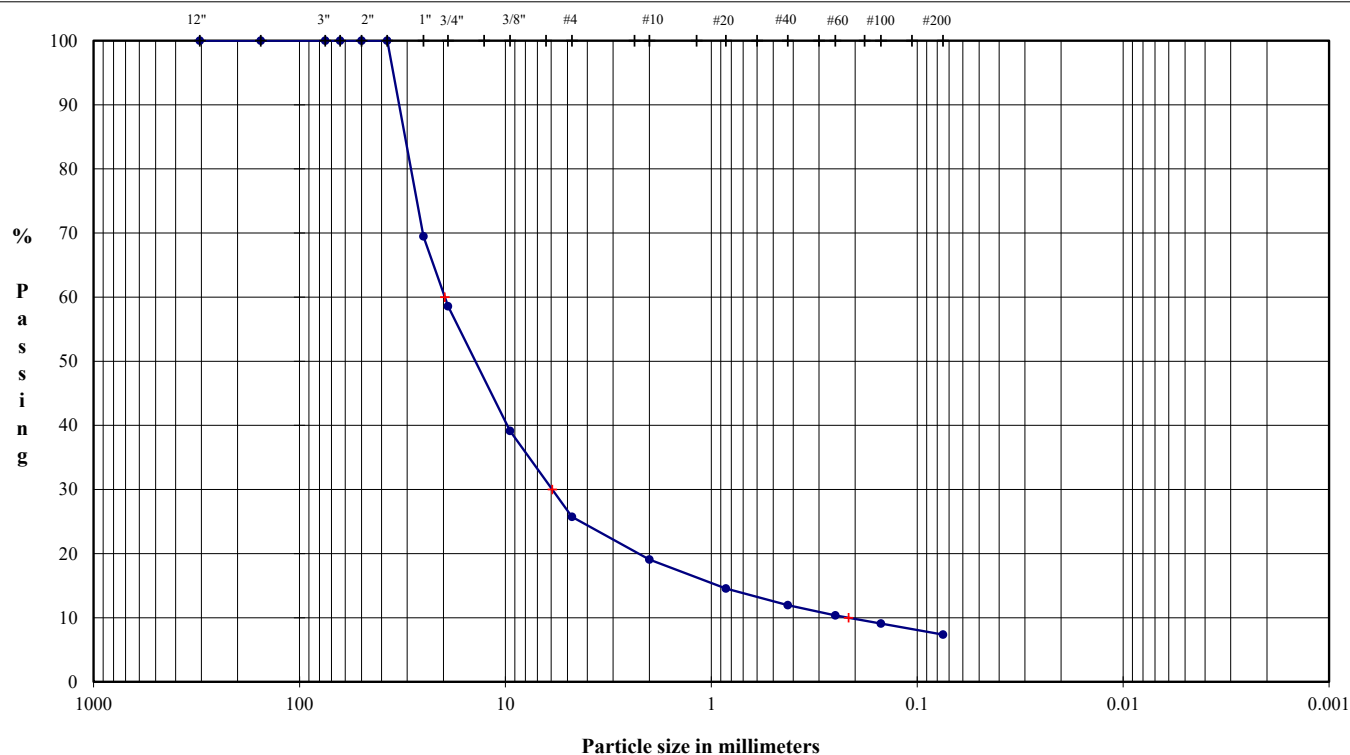
USCS: SP-SM

TECH	TCM
DATE	10/22/10
CHECK	TCM
REVIEW	AJD

PARTICLE SIZE DISTRIBUTION

ASTM D 6913

PROJECT NAME: **Woodlands**
 SAMPLE ID: **GB-4** **20'**
 TYPE: **GRAB**



	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay
COBBLES	GRAVEL		SAND			FINES

U.S. Standard Sieves Sizes and Numbers	Particle Size			Particle Size	
	(mm)	% Passing	Classification	Percentage	
	12.0"	304.8	100.0	Cobbles	0.0
	6.0"	154.2	100.0		
	3.0"	75	100.0		
	2.5"	63.5	100.0		
	2.0"	50	100.0		
	1.5"	37.5	100.0		
	1.0"	25	69.5		
	0.75"	19	58.6		
	0.375"	9.5	39.1	Coarse Gravel	41.4
	#4	4.75	25.7	Fine Gravel	32.8
	#10	2.00	19.1	Coarse Sand	6.7
	#20	0.85	14.5	Medium Sand	7.1
	#40	0.43	12.0		
	#60	0.25	10.4		
	#100	0.15	9.1		
	#200	0.075	7.4		
			Fines	7.4	

Moisture Content

4.14

$D_{60} = 19.69$	$D_{30} = 5.92$	$D_{10} = 0.22$
$C_u = D_{60}/D_{10} = 91.4 > 4$ $C_c = D_{30}^2/(D_{10} \cdot D_{60}) = 8.3 > 3$		

DESCRIPTION: sandy GRAVEL some fines

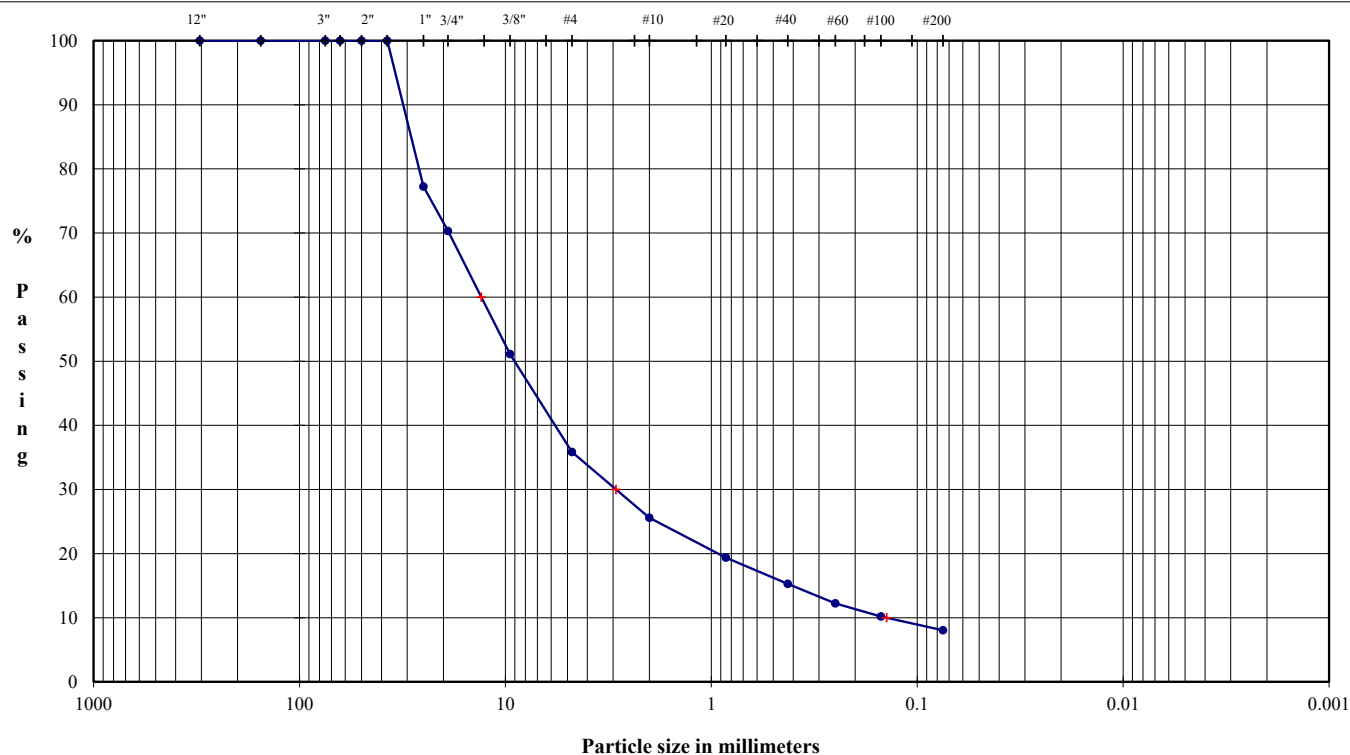
USCS: GP - SP

TECH	RBK
DATE	1/25/2022
CHECK	JTC
REVIEW	3/11/2024

PARTICLE SIZE DISTRIBUTION

ASTM D 6913

PROJECT NAME: **Woodlands**
 SAMPLE ID: **GB-4 25'**
 TYPE: **GRAB**



COBBLES	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay
	GRAVEL		SAND			FINES

U.S. Standard Sieves Sizes and Numbers	Particle Size			Particle Size	
	(mm)	% Passing	Classification	Percentage	
	12.0"	304.8	100.0	Cobbles	0.0
	6.0"	154.2	100.0		
	3.0"	75	100.0		
	2.5"	63.5	100.0		
	2.0"	50	100.0		
	1.5"	37.5	100.0		
	1.0"	25	77.2		
	0.75"	19	70.3		
	0.375"	9.5	51.1	Coarse Gravel	29.7
	#4	4.75	35.8	Fine Gravel	34.4
	#10	2.00	25.6	Coarse Sand	10.3
	#20	0.85	19.4	Medium Sand	10.3
	#40	0.43	15.3		
	#60	0.25	12.2		
#100	0.15	10.2			
#200	0.075	8.0			
			Fines	8.0	

Moisture Content

4.06

$D_{60} = 13.10$	$D_{30} = 2.90$	$D_{10} = 0.14$
$C_u = D_{60}/D_{10} =$		93.1 > 4
$C_c = D_{30}^2/(D_{10} \cdot D_{60}) =$		4.6 > 3

DESCRIPTION: sandy GRAVEL some fines

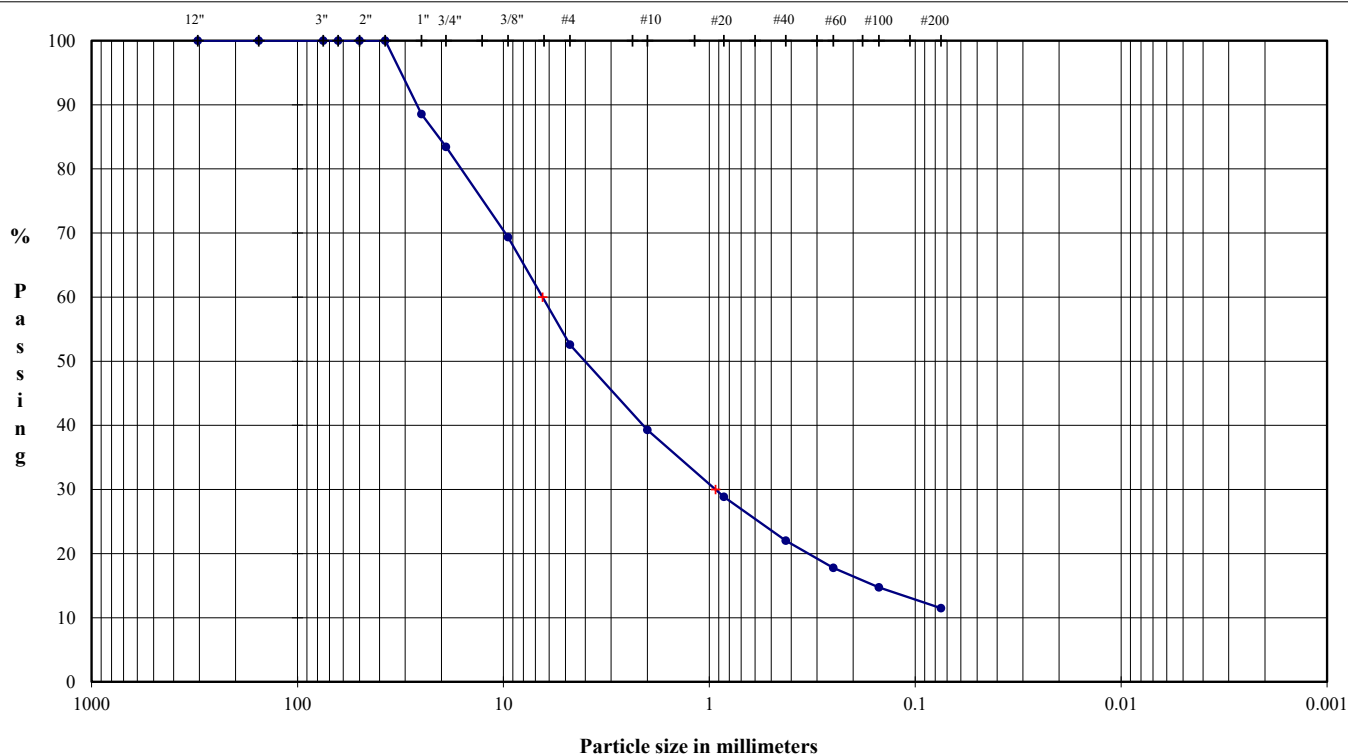
USCS: GP - SP

TECH	RBK
DATE	1/25/22
CHECK	JTC
REVIEW	3/11/2024

PARTICLE SIZE DISTRIBUTION

ASTM D 6913

PROJECT NAME: **Woodlands**
 SAMPLE ID: **GB-4** **30'**
 TYPE: **GRAB**



COBBLES	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay
	GRAVEL		SAND			FINES

U.S. Standard Sieves Sizes and Numbers	Particle Size			Particle Size	
	(mm)	% Passing	Classification	Percentage	
	12.0"	304.8	100.0	Cobbles	0.0
	6.0"	154.2	100.0		
	3.0"	75	100.0		
	2.5"	63.5	100.0		
	2.0"	50	100.0		
	1.5"	37.5	100.0		
	1.0"	25	88.5		
	0.75"	19	83.4		
	0.375"	9.5	69.4	Coarse Gravel	16.6
	#4	4.75	52.6	Fine Gravel	30.8
	#10	2.00	39.3	Coarse Sand	13.3
	#20	0.85	28.9	Medium Sand	17.3
	#40	0.43	22.0		
	#60	0.25	17.8		
	#100	0.15	14.7	Fine Sand	10.5
#200	0.075	11.5			
			Fines	11.5	

Moisture Content

2.70

$D_{60} = 6.45$	$D_{30} = 0.93$	$D_{10} = \#N/A$
$C_u = D_{60}/D_{10} =$		#N/A
$C_c = D_{30}^2/(D_{10} \cdot D_{60}) =$		#N/A

DESCRIPTION: GRAVEL and SAND some fines

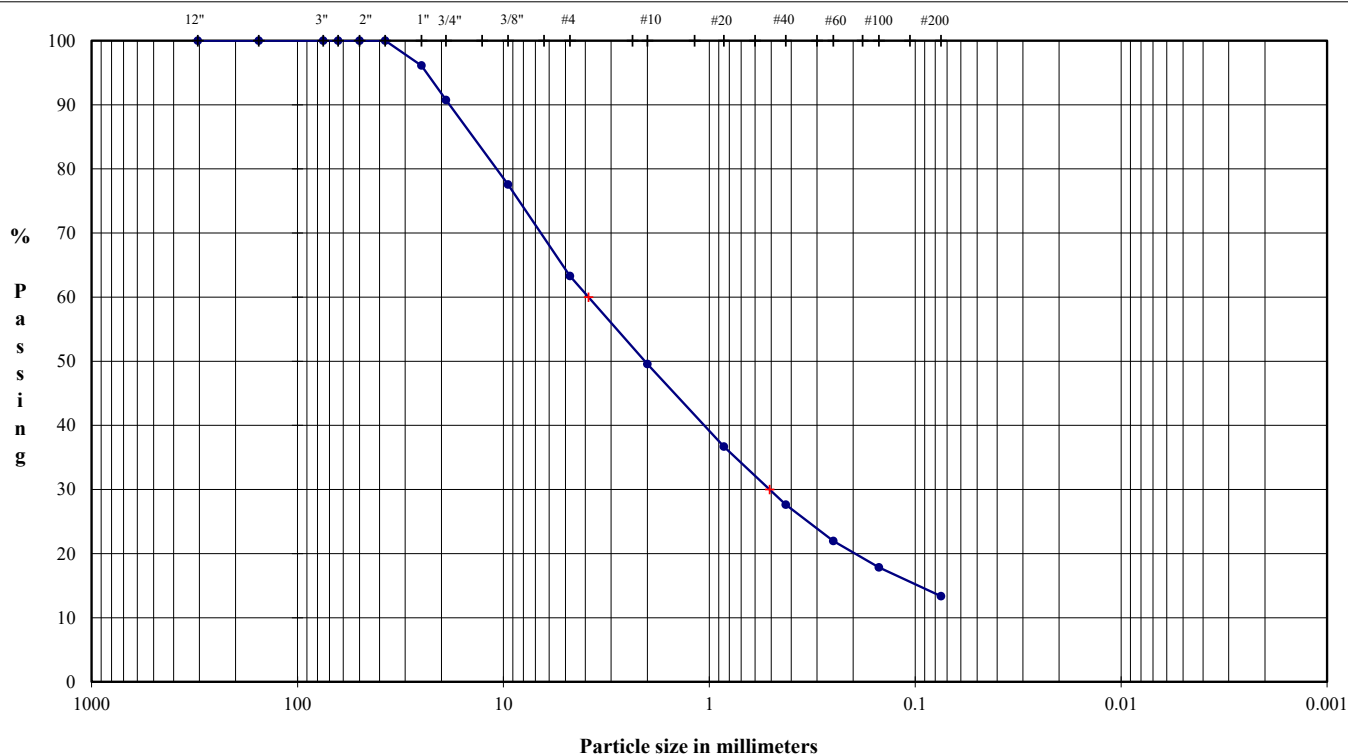
USCS: GP - SP

TECH	RBK
DATE	1/25/22
CHECK	JTC
REVIEW	3/11/2024

PARTICLE SIZE DISTRIBUTION

ASTM D 6913

PROJECT NAME: **Woodlands**
 SAMPLE ID: **GB-4 35'**
 TYPE: **GRAB**



COBBLES	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay
	GRAVEL		SAND			FINES

	Particle Size		% Passing	Classification	Percentage
	(mm)				
U.S. Standard Sieves Sizes and Numbers	12.0"	304.8	100.0	Cobbles	0.0
	6.0"	154.2	100.0		
	3.0"	75	100.0		
	2.5"	63.5	100.0		
	2.0"	50	100.0	Coarse Gravel	9.3
	1.5"	37.5	100.0		
	1.0"	25	96.1		
	0.75"	19	90.7		
	0.375"	9.5	77.6	Fine Gravel	27.4
	#4	4.75	63.3		
	#10	2.00	49.6	Coarse Sand	13.7
	#20	0.85	36.7	Medium Sand	21.9
	#40	0.43	27.6		
	#60	0.25	22.0	Fine Sand	14.3
	#100	0.15	17.9		
	#200	0.075	13.4		
				Fines	13.4

Moisture Content

4.20

$D_{60} = 3.86$	$D_{30} = 0.51$	$D_{10} = \#N/A$
$C_u = D_{60}/D_{10} =$		$\#N/A$
$C_c = D_{30}^2/(D_{10} \cdot D_{60}) =$		$\#N/A$

DESCRIPTION: silty SAND and GRAVEL

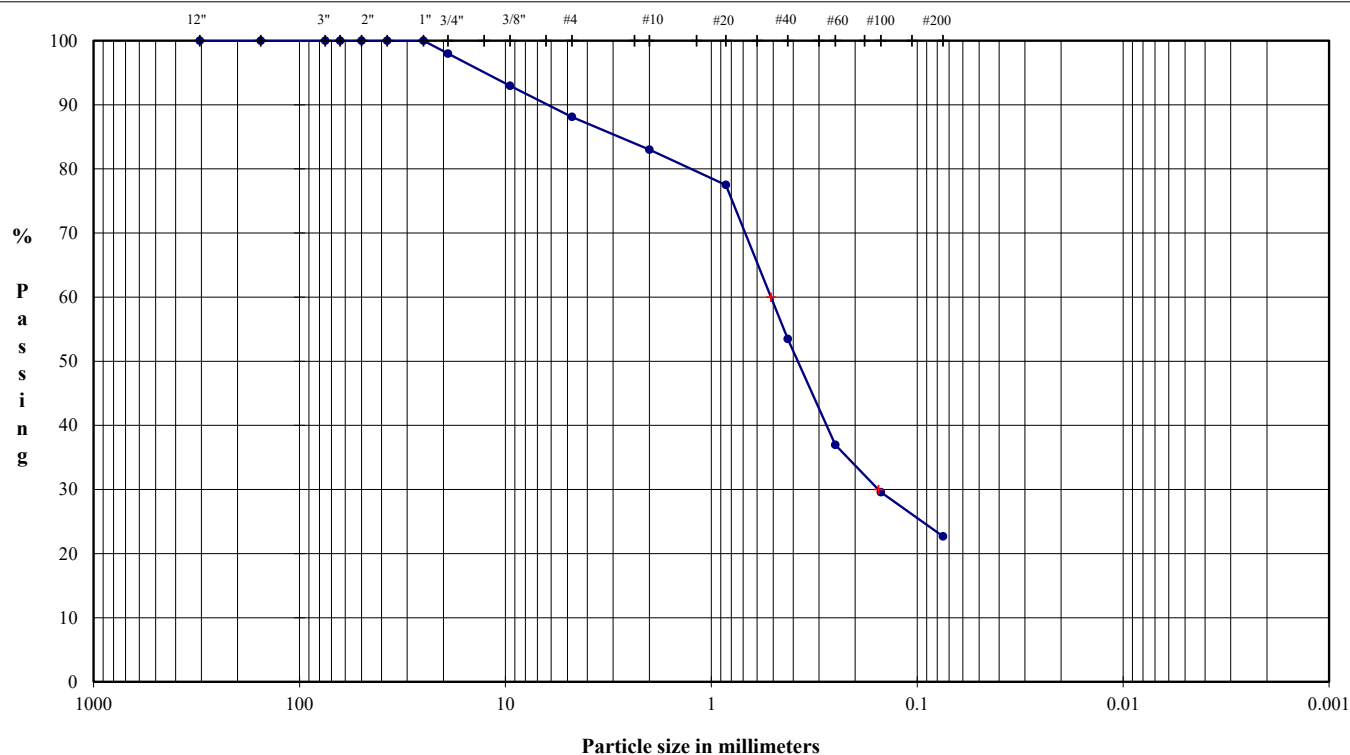
USCS: SP - GP

TECH	RBK
DATE	1/25/22
CHECK	JTC
REVIEW	3/11/2024

PARTICLE SIZE DISTRIBUTION

ASTM D 6913

PROJECT NAME: **Woodlands**
 SAMPLE ID: **GB-4** **40'**
 TYPE: **GRAB**



COBBLES	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay
	GRAVEL		SAND			FINES

U.S. Standard Sieves Sizes and Numbers	Particle Size		% Passing	Classification	Percentage
	(mm)				
	12.0"	304.8	100.0	Cobbles	0.0
	6.0"	152.4	100.0		
	3.0"	75	100.0		
	2.5"	63.5	100.0		
	2.0"	50	100.0	Coarse Gravel	2.0
	1.5"	37.5	100.0		
	1.0"	25	100.0		
	0.75"	19	98.0		
	0.375"	9.5	93.0	Fine Gravel	9.9
	#4	4.75	88.1		
	#10	2.00	83.0	Coarse Sand	5.1
	#20	0.85	77.5	Medium Sand	29.5
	#40	0.43	53.5		
	#60	0.25	37.0		
	#100	0.15	29.6	Fine Sand	30.8
	#200	0.075	22.7		
				Fines	22.7

Moisture Content

4.16

$D_{60} = 0.51$	$D_{30} = 0.15$	$D_{10} = \#N/A$
$C_u = D_{60}/D_{10} =$		$\#N/A$
$C_c = D_{30}^2/(D_{10} \cdot D_{60}) =$		$\#N/A$

DESCRIPTION: silty SAND some gravel

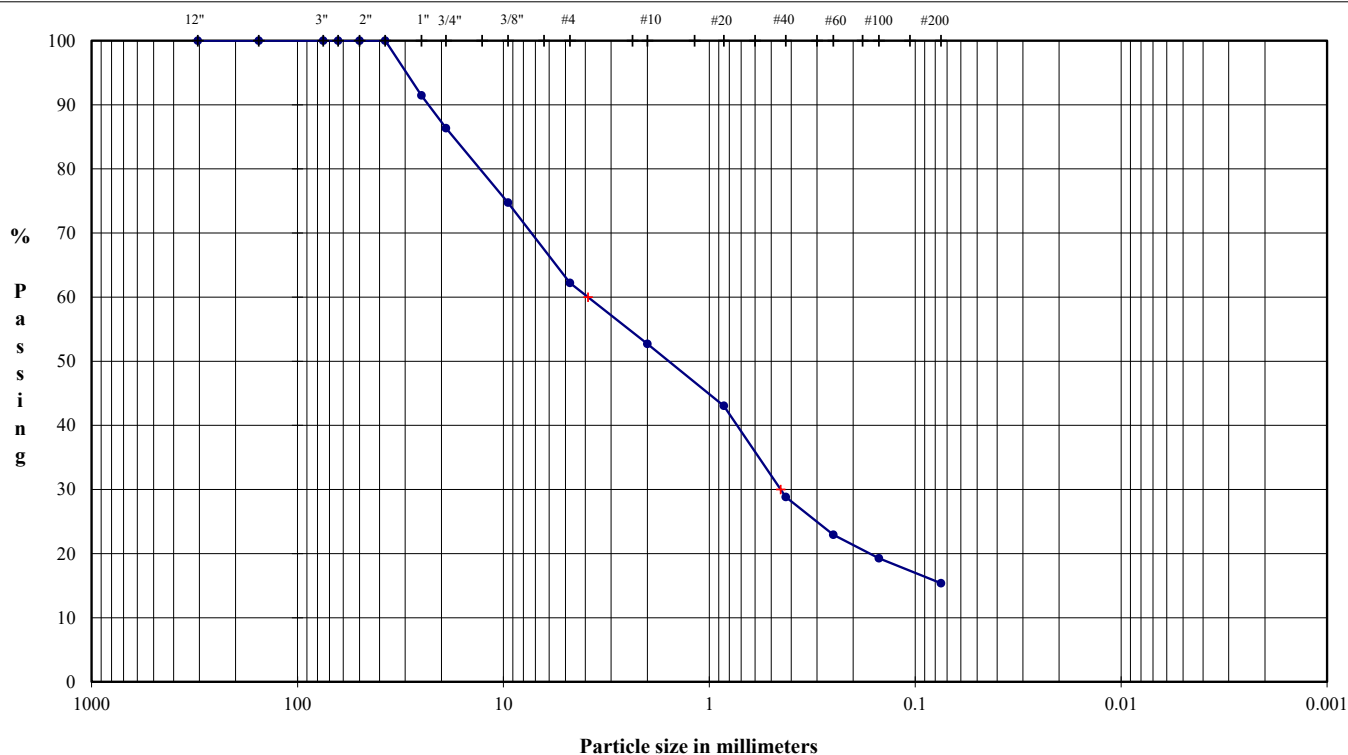
USCS: SM

TECH	RBK
DATE	1/25/22
CHECK	JTC
REVIEW	3/11/2024

PARTICLE SIZE DISTRIBUTION

ASTM D 6913

PROJECT NAME: **Woodlands**
 SAMPLE ID: **GB-4** **50'**
 TYPE: **GRAB**



COBBLES	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay
	GRAVEL		SAND			FINES

U.S. Standard Sieves Sizes and Numbers	Particle Size			Particle Size	
	(mm)	% Passing	Classification	Percentage	
	12.0"	304.8	100.0	Cobbles	0.0
	6.0"	154.2	100.0		
	3.0"	75	100.0		
	2.5"	63.5	100.0		
	2.0"	50	100.0		
	1.5"	37.5	100.0		
	1.0"	25	91.5		
	0.75"	19	86.3		
	0.375"	9.5	74.7	Coarse Gravel	13.7
	#4	4.75	62.2	Fine Gravel	24.1
	#10	2.00	52.7	Coarse Sand	9.5
	#20	0.85	43.0	Medium Sand	23.9
	#40	0.43	28.8		
	#60	0.25	23.0		
	#100	0.15	19.3	Fine Sand	13.4
#200	0.075	15.4			
Fines				15.4	

Moisture Content

2.29

$D_{60} = 3.88$	$D_{30} = 0.45$	$D_{10} = \#N/A$
$C_u = D_{60}/D_{10} =$		#N/A
$C_c = D_{30}^2/(D_{10} \cdot D_{60}) =$		#N/A

DESCRIPTION: silty SAND and Gravel

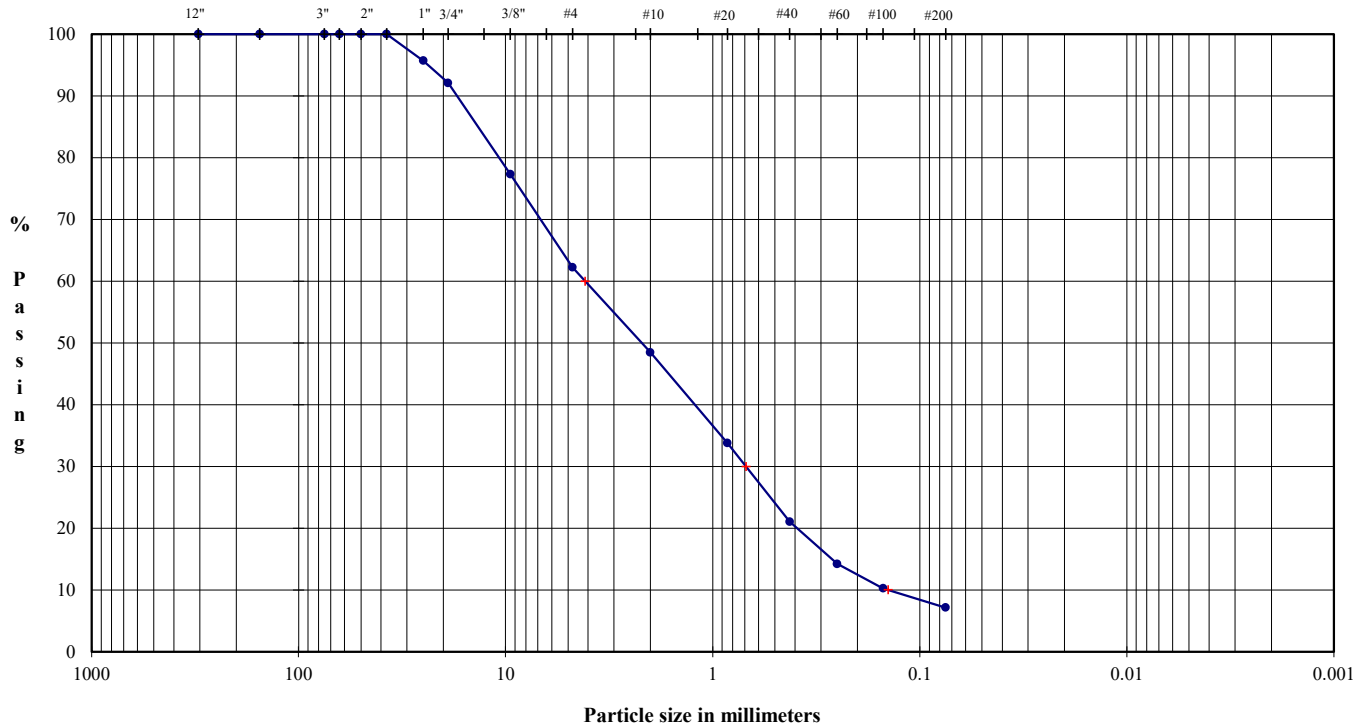
USCS: SM - GM

TECH	RBK
DATE	1/25/22
CHECK	JTC
REVIEW	3/11/2024

PARTICLE SIZE DISTRIBUTION

ASTM D 6913

PROJECT NAME: **Woodlands**
 SAMPLE ID: **GB-5 B-1 22-23'**
 TYPE: **GRAB**



	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay
COBBLES	GRAVEL		SAND			FINES

U.S. Standard Sieves Sizes and Numbers

Particle Size			Particle Size	
	(mm)	% Passing	Classification	Percentage
12.0"	304.8	100.0	Cobbles	0.0
6.0"	154.2	100.0		
3.0"	75	100.0		
2.5"	63.5	100.0		
2.0"	50	100.0		
1.5"	37.5	100.0		
1.0"	25	95.7		
0.75"	19	92.1		
0.375"	9.5	77.3	Coarse Gravel	7.9
#4	4.75	62.2	Fine Gravel	29.9
#10	2.00	48.5	Coarse Sand	13.8
#20	0.85	33.8	Medium Sand	27.4
#40	0.43	21.1		
#60	0.25	14.2		
#100	0.15	10.3	Fine Sand	13.9
#200	0.075	7.2		
			Fines	7.2

Moisture Content
6.68

$D_{60} = 4.13$	$D_{30} = 0.69$	$D_{10} = 0.14$
$C_u = D_{60}/D_{10} =$		29.2 > 6
$C_c = D_{30}^2/(D_{10} \cdot D_{60}) =$		0.8 < 1

DESCRIPTION: SAND and GRAVEL some fines

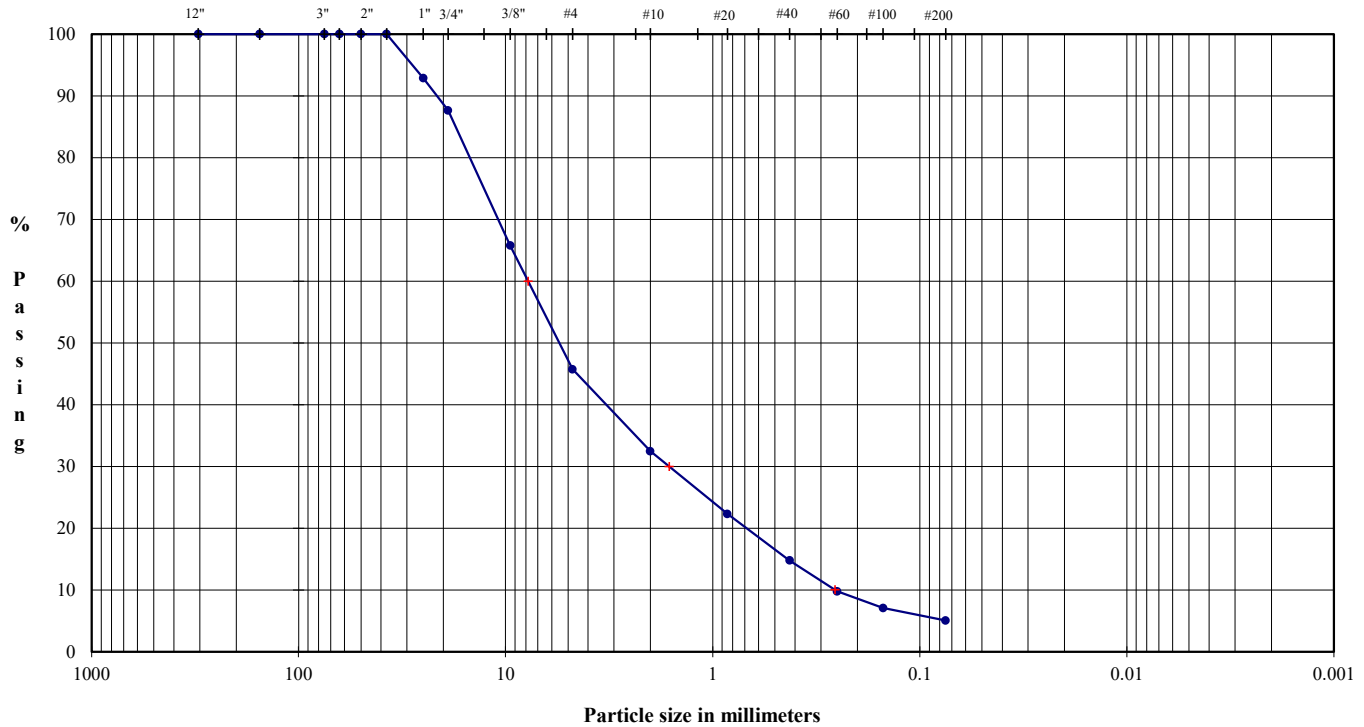
USCS: SW - GW

TECH RBK
 DATE 3/18/22
 CHECK JC
 REVIEW 3/11/2024

PARTICLE SIZE DISTRIBUTION

ASTM D 6913

PROJECT NAME: **Woodlands**
 SAMPLE ID: **GB-5 B-2 24-25'**
 TYPE: **GRAB**



	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay
COBBLES	GRAVEL		SAND			FINES

U.S. Standard Sieves Sizes and Numbers

Particle Size			Particle Size	
	(mm)	% Passing	Classification	Percentage
12.0"	304.8	100.0	Cobbles	0.0
6.0"	154.2	100.0		
3.0"	75	100.0		
2.5"	63.5	100.0	Coarse Gravel	12.4
2.0"	50	100.0		
1.5"	37.5	100.0		
1.0"	25	92.9		
0.75"	19	87.6		
0.375"	9.5	65.7		
#4	4.75	45.7	Fine Gravel	41.9
#10	2.00	32.5	Coarse Sand	13.3
#20	0.85	22.3	Medium Sand	17.7
#40	0.43	14.8		
#60	0.25	9.8		
#100	0.15	7.1	Fine Sand	9.7
#200	0.075	5.1		
			Fines	5.1

Moisture Content

4.27

$D_{60} = 7.78$	$D_{30} = 1.63$	$D_{10} = 0.26$
-----------------	-----------------	-----------------

Cu = $D_{60}/D_{10} = 30.4 > 4$ Cc = $D_{30}^2/(D_{10} \cdot D_{60}) = 1.3 > 1$

DESCRIPTION: GRAVEL and SAND trace fines

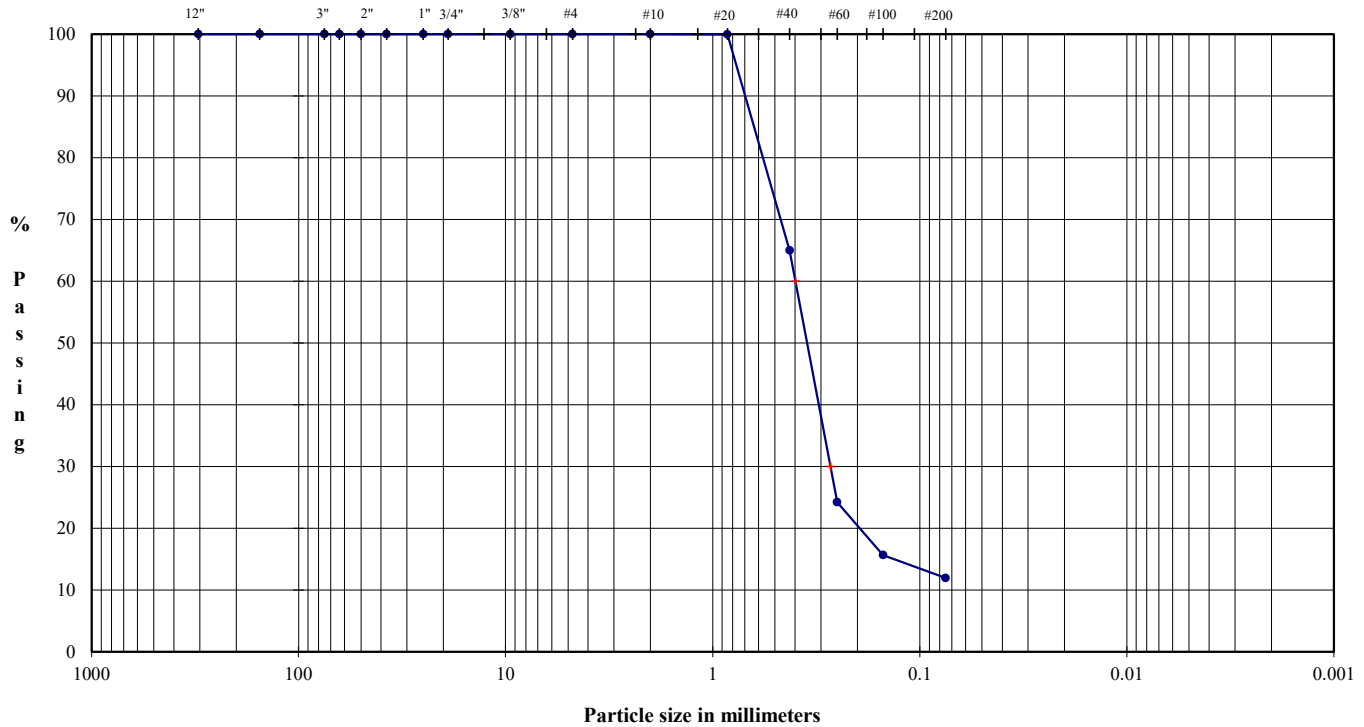
USCS: GP-SW

TECH	RBK
DATE	3/18/22
CHECK	JC
REVIEW	3/11/2024

PARTICLE SIZE DISTRIBUTION

ASTM D 6913

PROJECT NAME: **Woodlands**
 SAMPLE ID: **GB-5 B-3 29-30'**
 TYPE: **GRAB**



	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay
COBBLES	GRAVEL		SAND			FINES

	Particle Size		% Passing	Particle Size	
	(mm)		Classification	Percentage	
U.S. Standard Sieves Sizes and Numbers	12.0"	304.8	100.0	Cobbles	0.0
	6.0"	154.2	100.0		
	3.0"	75	100.0		
	2.5"	63.5	100.0		
	2.0"	50	100.0	Coarse Gravel	0.0
	1.5"	37.5	100.0		
	1.0"	25	100.0		
	0.75"	19	100.0		
	0.375"	9.5	100.0	Fine Gravel	0.0
	#4	4.75	100.0		
	#10	2.00	100.0	Coarse Sand	0.0
	#20	0.85	99.9	Medium Sand	35.0
	#40	0.43	65.0		
	#60	0.25	24.2		
	#100	0.15	15.6		
	#200	0.075	12.0	Fine Sand	53.0
				Fines	12.0

Moisture Content

7.25

$D_{60} = 0.40$	$D_{30} = 0.27$	$D_{10} = \#N/A$
-----------------	-----------------	------------------

Cu = $D_{60}/D_{10} =$ #N/A #N/ACc = $D_{30}^2/(D_{10} \cdot D_{60}) =$ #N/A #N/A

DESCRIPTION: SAND some fines

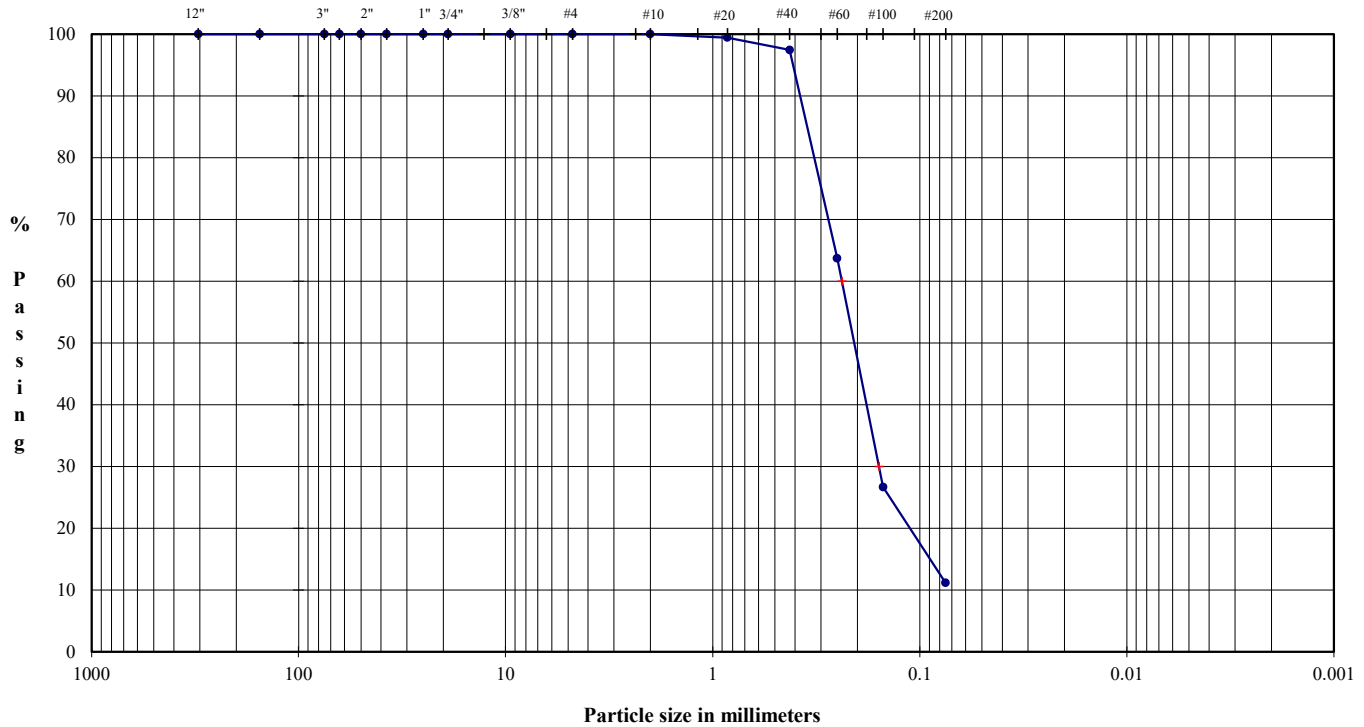
USCS: SW

TECH	RBK
DATE	3/18/22
CHECK	JC
REVIEW	3/11/2024

PARTICLE SIZE DISTRIBUTION

ASTM D 6913

PROJECT NAME: **Woodlands**
 SAMPLE ID: **GB-5 B-4 39-40'**
 TYPE: **GRAB**



	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay
COBBLES	GRAVEL		SAND			FINES

	Particle Size		% Passing	Particle Size	
	(mm)		Classification	Percentage	
U.S. Standard Sieves Sizes and Numbers	12.0"	304.8	100.0	Cobbles	0.0
	6.0"	154.2	100.0		
	3.0"	75	100.0		
	2.5"	63.5	100.0		
	2.0"	50	100.0	Coarse Gravel	0.0
	1.5"	37.5	100.0		
	1.0"	25	100.0		
	0.75"	19	100.0		
	0.375"	9.5	100.0	Fine Gravel	0.0
	#4	4.75	100.0		
	#10	2.00	100.0	Coarse Sand	0.0
	#20	0.85	99.4	Medium Sand	2.6
	#40	0.43	97.4		
	#60	0.25	63.7		
	#100	0.15	26.7		
	#200	0.075	11.2	Fine Sand	86.2
				Fines	11.2

Moisture Content

13.98

$D_{60} = 0.24$	$D_{30} = 0.16$	$D_{10} = \#N/A$
-----------------	-----------------	------------------

Cu = $D_{60}/D_{10} =$ #N/A #N/ACc = $D_{30}^2/(D_{10} \cdot D_{60}) =$ #N/A #N/A

DESCRIPTION: GRAVEL and SAND some fines

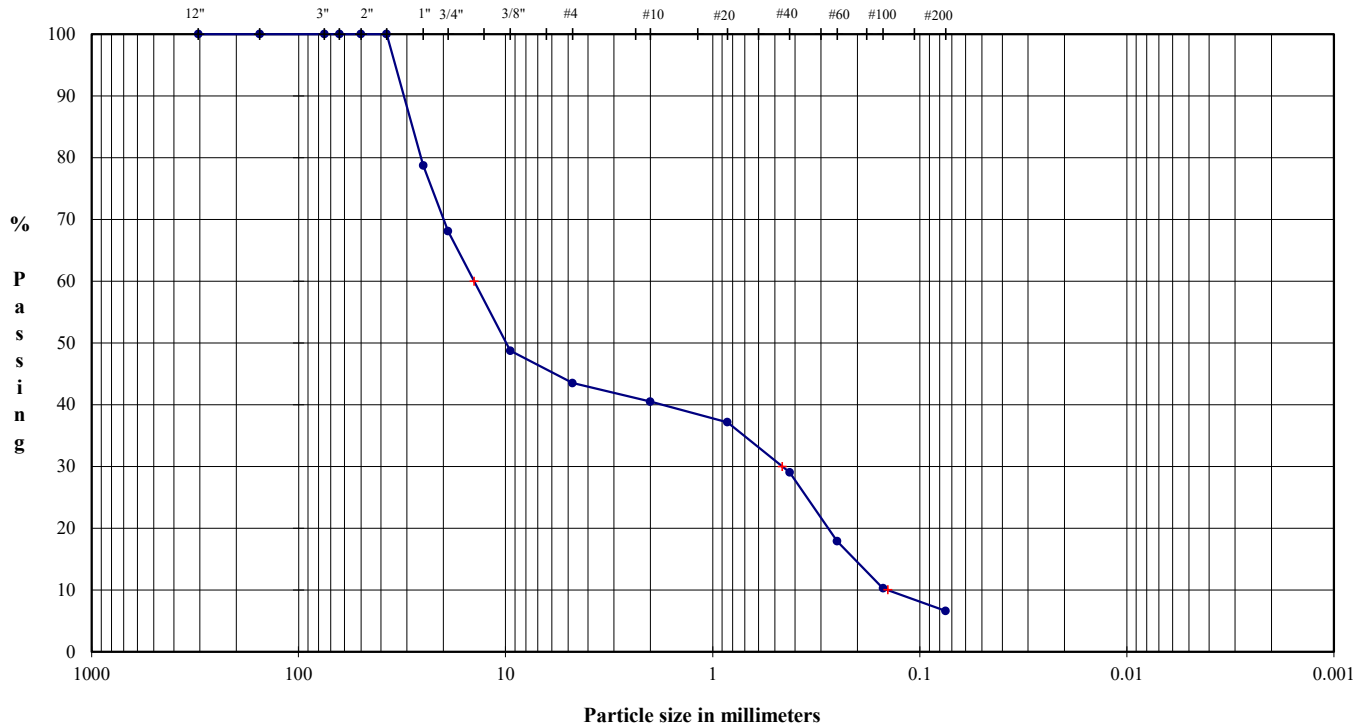
USCS: GP - SP

TECH	RBK
DATE	3/18/22
CHECK	JC
REVIEW	3/11/2024

PARTICLE SIZE DISTRIBUTION

ASTM D 6913

PROJECT NAME: **Woodlands**
 SAMPLE ID: **GB-05 B-5 49-50'**
 TYPE: **GRAB**



	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay
COBBLES	GRAVEL		SAND			FINES

U.S. Standard Sieves Sizes and Numbers

Particle Size			Particle Size	
	(mm)	% Passing	Classification	Percentage
12.0"	304.8	100.0	Cobbles	0.0
6.0"	154.2	100.0		
3.0"	75	100.0		
2.5"	63.5	100.0		
2.0"	50	100.0		
1.5"	37.5	100.0		
1.0"	25	78.8		
0.75"	19	68.1		
0.375"	9.5	48.8	Coarse Gravel	31.9
#4	4.75	43.5	Fine Gravel	24.6
#10	2.00	40.5	Coarse Sand	3.0
#20	0.85	37.2	Medium Sand	11.4
#40	0.43	29.0		
#60	0.25	17.9		
#100	0.15	10.3		
#200	0.075	6.6	Fine Sand	22.4
			Fines	6.6

Moisture Content
4.21

$D_{60} = 14.22$	$D_{30} = 0.46$	$D_{10} = 0.14$
------------------	-----------------	-----------------

$C_u = D_{60}/D_{10} =$	99.9	> 4
$C_c = D_{30}^2/(D_{10} \cdot D_{60}) =$	0.1	< 1

DESCRIPTION: GRAVEL and SAND some fines

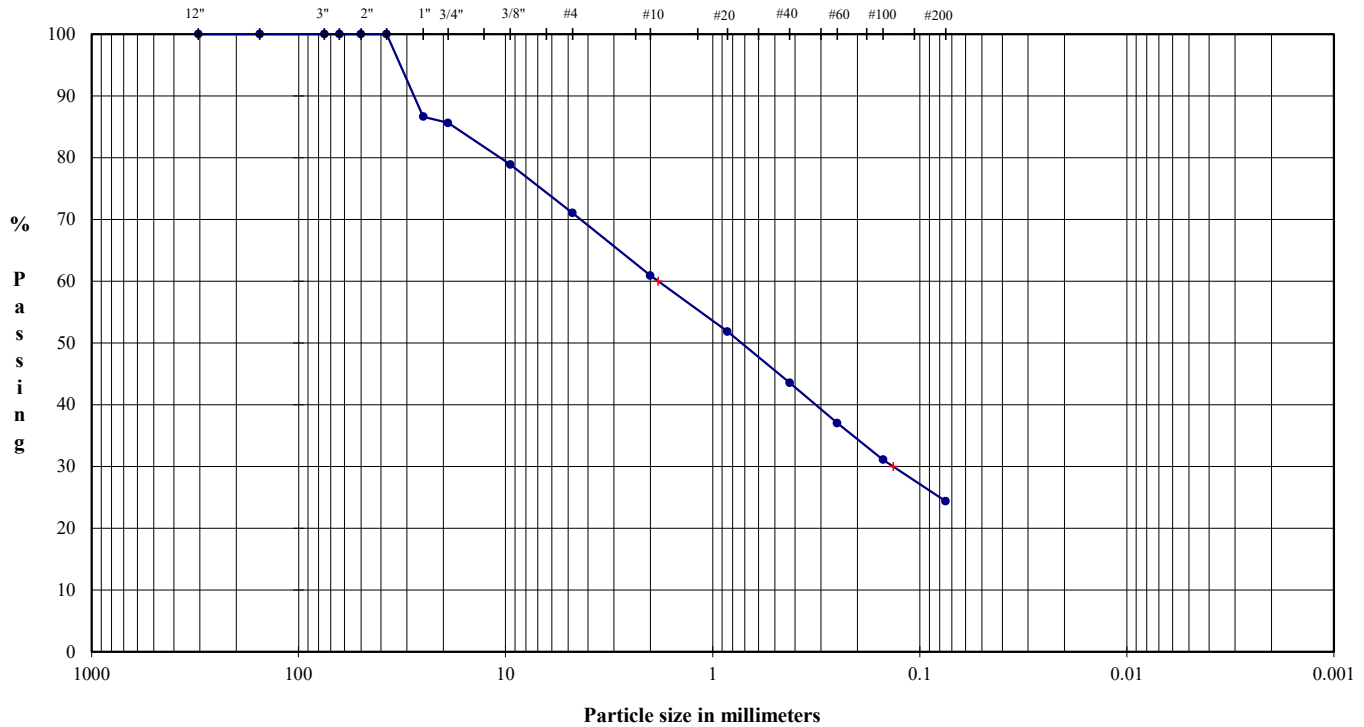
USCS: GW - SW

TECH RBK
 DATE 3/18/22
 CHECK JC
 REVIEW 3/11/2024

PARTICLE SIZE DISTRIBUTION

ASTM D 6913

PROJECT NAME: **Woodlands**
 SAMPLE ID: **GB-5 B-6 59-60'**
 TYPE: **GRAB**



	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay
COBBLES	GRAVEL		SAND			FINES

U.S. Standard Sieves Sizes and Numbers

Particle Size			Particle Size	
	(mm)	% Passing	Classification	Percentage
12.0"	304.8	100.0	Cobbles	0.0
6.0"	154.2	100.0		
3.0"	75	100.0		
2.5"	63.5	100.0	Coarse Gravel	14.4
2.0"	50	100.0		
1.5"	37.5	100.0		
1.0"	25	86.6		
0.75"	19	85.6		
0.375"	9.5	78.9		
#4	4.75	71.0	Fine Gravel	14.6
#10	2.00	60.9	Coarse Sand	10.1
#20	0.85	51.8	Medium Sand	17.4
#40	0.43	43.5		
#60	0.25	37.0		
#100	0.15	31.1	Fine Sand	19.1
#200	0.075	24.4		
			Fines	24.4

Moisture Content

2.48

$D_{60} = 1.83$	$D_{30} = 0.13$	$D_{10} = \#N/A$
-----------------	-----------------	------------------

Cu = $D_{60}/D_{10} =$ #N/A #N/ACc = $D_{30}^2/(D_{10} \cdot D_{60}) =$ #N/A #N/A

DESCRIPTION: gravelly SILTY SAND

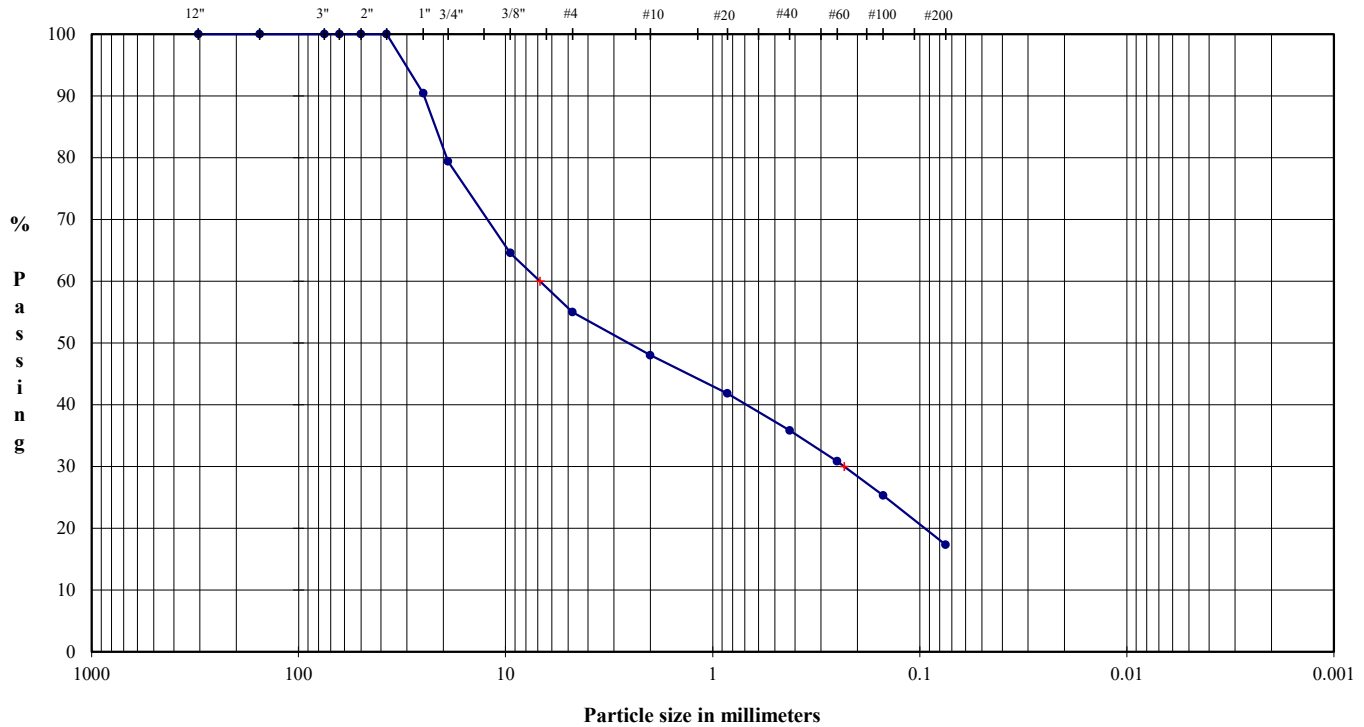
USCS: SM

TECH	RBK
DATE	3/18/22
CHECK	JC
REVIEW	3/11/2024

PARTICLE SIZE DISTRIBUTION

ASTM D 6913

PROJECT NAME: **Woodlands**
 SAMPLE ID: **GB-5 B-7 69-70'**
 TYPE: **GRAB**



	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay
COBBLES	GRAVEL		SAND			FINES

U.S. Standard Sieves Sizes and Numbers

Particle Size			Particle Size	
	(mm)	% Passing	Classification	Percentage
12.0"	304.8	100.0	Cobbles	0.0
6.0"	154.2	100.0		
3.0"	75	100.0		
2.5"	63.5	100.0	Coarse Gravel	20.6
2.0"	50	100.0		
1.5"	37.5	100.0		
1.0"	25	90.4		
0.75"	19	79.4		
0.375"	9.5	64.6		
#4	4.75	55.0	Fine Gravel	24.4
#10	2.00	48.0	Coarse Sand	7.0
#20	0.85	41.8	Medium Sand	12.2
#40	0.43	35.9		
#60	0.25	30.8		
#100	0.15	25.3	Fine Sand	18.5
#200	0.075	17.3		
			Fines	17.3

Moisture Content

6.36

$D_{60} = 6.82$	$D_{30} = 0.23$	$D_{10} = \#N/A$
-----------------	-----------------	------------------

Cu = $D_{60}/D_{10} =$ #N/A #N/ACc = $D_{30}^2/(D_{10} \cdot D_{60}) =$ #N/A #N/A

DESCRIPTION: SILTY GRAVEL and SILTY SAND

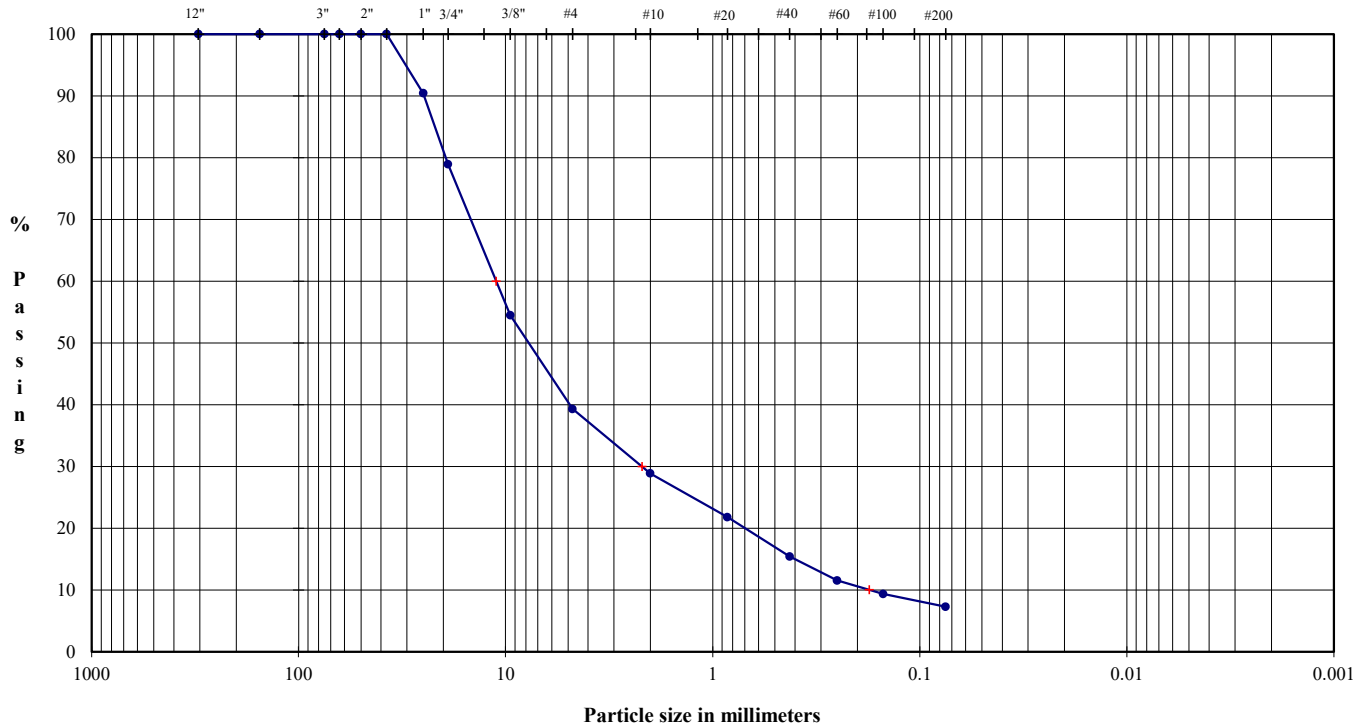
USCS: GM and SM

TECH	RBK
DATE	3/18/22
CHECK	JC
REVIEW	3/11/2024

PARTICLE SIZE DISTRIBUTION

ASTM D 6913

PROJECT NAME: **Woodlands**
 SAMPLE ID: **GB-6 B-1 19-20'**
 TYPE: **GRAB**



	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay
COBBLES	GRAVEL		SAND			FINES

U.S. Standard Sieves Sizes and Numbers

Particle Size			Particle Size	
	(mm)	% Passing	Classification	Percentage
12.0"	304.8	100.0	Cobbles	0.0
6.0"	154.2	100.0		
3.0"	75	100.0		
2.5"	63.5	100.0		
2.0"	50	100.0	Coarse Gravel	21.1
1.5"	37.5	100.0		
1.0"	25	90.4		
0.75"	19	78.9		
0.375"	9.5	54.5	Fine Gravel	39.6
#4	4.75	39.3		
#10	2.00	28.9	Coarse Sand	10.4
#20	0.85	21.8	Medium Sand	13.5
#40	0.43	15.4		
#60	0.25	11.5		
#100	0.15	9.4	Fine Sand	8.1
#200	0.075	7.3		
			Fines	7.3

Moisture Content

5.43

$D_{60} = 11.11$	$D_{30} = 2.19$	$D_{10} = 0.17$
------------------	-----------------	-----------------

Cu = $D_{60}/D_{10} = 63.6 > 4$ Cc = $D_{30}^2/(D_{10} \cdot D_{60}) = 2.5 > 1$

DESCRIPTION: GRAVEL and SAND some fines

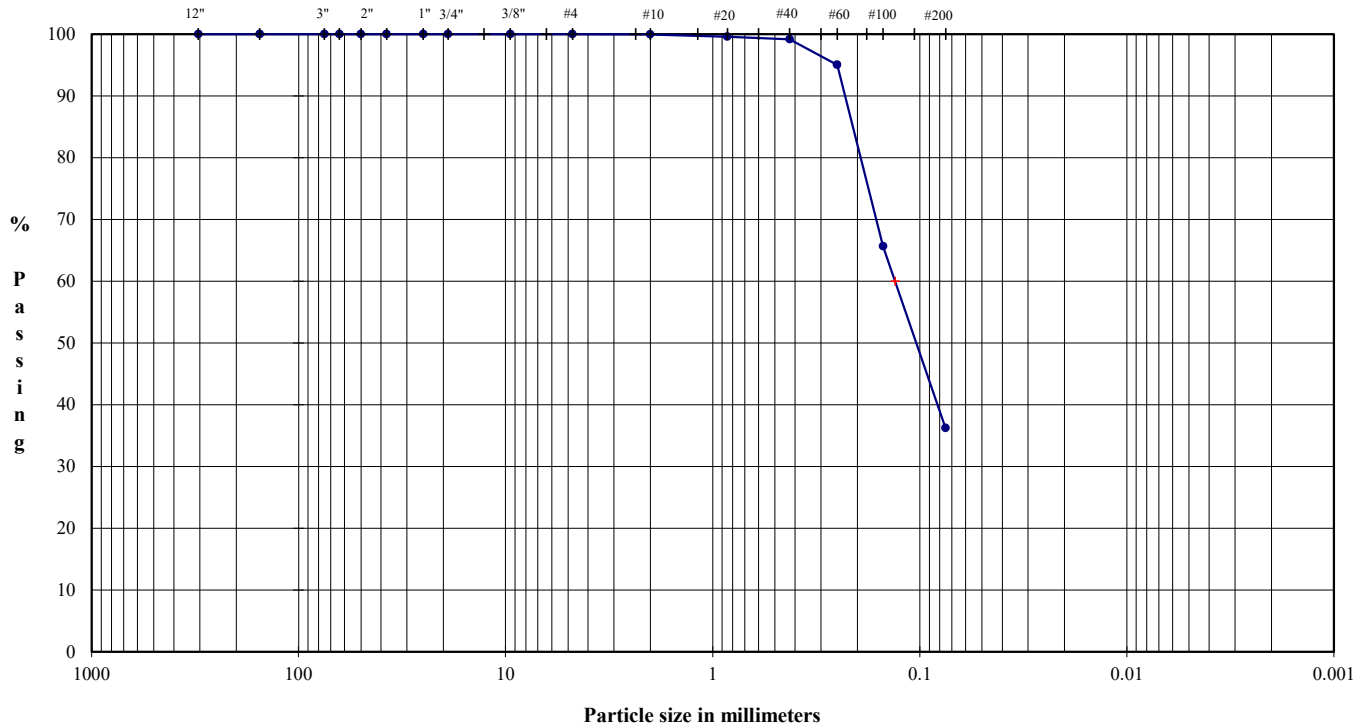
USCS: GP - SP

TECH	RBK
DATE	3/18/22
CHECK	JC
REVIEW	3/11/2024

PARTICLE SIZE DISTRIBUTION

ASTM D 6913

PROJECT NAME: **Woodlands**
 SAMPLE ID: **GB-6 B-2 25-26'**
 TYPE: **GRAB**



	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay
COBBLES	GRAVEL		SAND			FINES

	Particle Size		% Passing	Particle Size	
	(mm)		Classification	Percentage	
U.S. Standard Sieves Sizes and Numbers	12.0"	304.8	100.0	Cobbles	0.0
	6.0"	154.2	100.0		
	3.0"	75	100.0		
	2.5"	63.5	100.0		
	2.0"	50	100.0	Coarse Gravel	0.0
	1.5"	37.5	100.0		
	1.0"	25	100.0		
	0.75"	19	100.0		
	0.375"	9.5	100.0		
	#4	4.75	100.0	Fine Gravel	0.0
	#10	2.00	100.0	Coarse Sand	0.0
	#20	0.85	99.6	Medium Sand	0.8
	#40	0.43	99.2		
	#60	0.25	95.0		
	#100	0.15	65.7		
	#200	0.075	36.3	Fine Sand	62.9
				Fines	36.3

Moisture Content

13.84

$D_{60} = 0.13$	$D_{30} = \#N/A$	$D_{10} = \#N/A$
-----------------	------------------	------------------

Cu = $D_{60}/D_{10} =$ #N/A #N/ACc = $D_{30}^2/(D_{10} \cdot D_{60}) =$ #N/A #N/A

DESCRIPTION: SILTY SAND

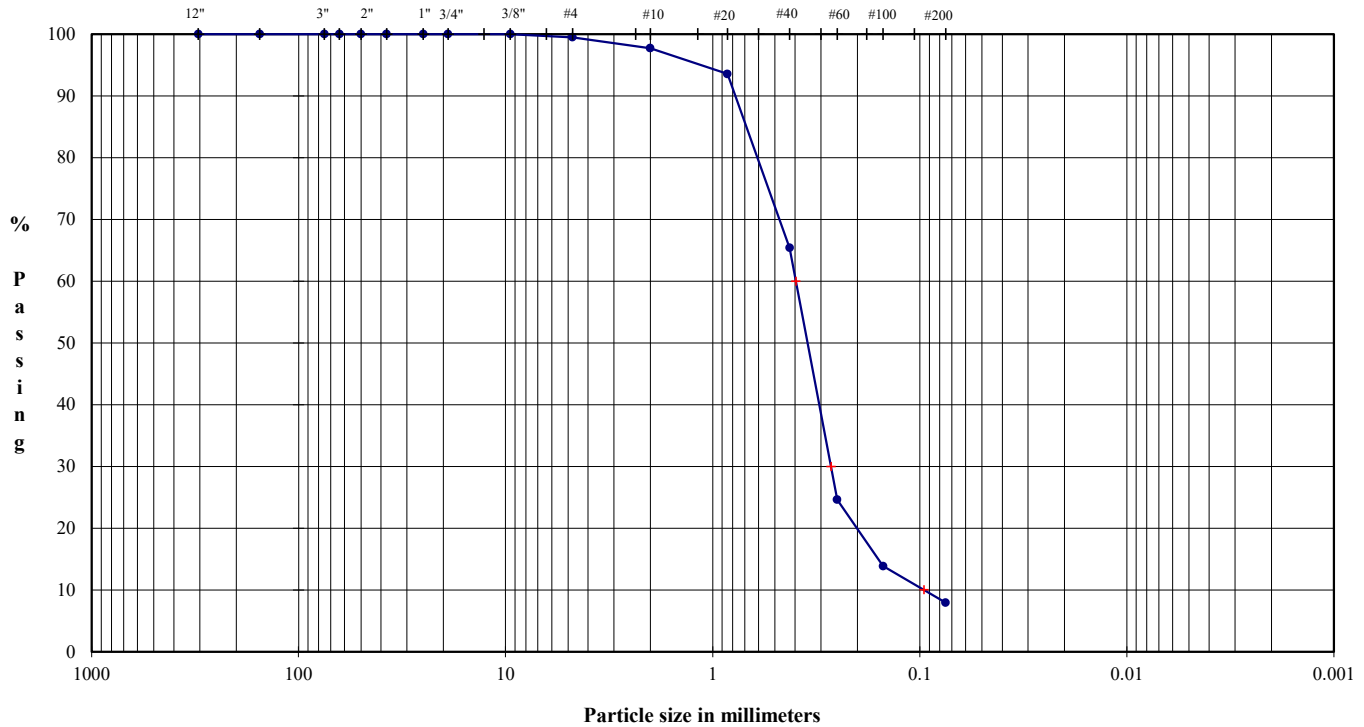
USCS: SM

TECH	RBK
DATE	3/18/22
CHECK	JC
REVIEW	3/11/2024

PARTICLE SIZE DISTRIBUTION

ASTM D 6913

PROJECT NAME: **Woodlands**
 SAMPLE ID: **GB-06 B-3 29-30'**
 TYPE: **GRAB**



	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay
COBBLES	GRAVEL		SAND			FINES

U.S. Standard Sieves Sizes and Numbers	Particle Size		% Passing	Particle Size	
	(mm)			Classification	Percentage
	12.0"	304.8	100.0	Cobbles	0.0
	6.0"	154.2	100.0		
	3.0"	75	100.0		
	2.5"	63.5	100.0		
	2.0"	50	100.0	Coarse Gravel	0.0
	1.5"	37.5	100.0		
	1.0"	25	100.0		
	0.75"	19	100.0		
	0.375"	9.5	100.0	Fine Gravel	0.5
	#4	4.75	99.5		
	#10	2.0	97.7	Coarse Sand	1.8
	#20	0.85	93.5	Medium Sand	32.3
	#40	0.43	65.4		
	#60	0.25	24.6		
	#100	0.15	13.9		
	#200	0.075	8.0	Fine Sand	57.4
				FINES	8.0

Moisture Content

4.02

$D_{60} = 0.40$	$D_{30} = 0.27$	$D_{10} = 0.10$
-----------------	-----------------	-----------------

Cu = $D_{60}/D_{10} = 4.2 < 6$ Cc = $D_{30}^2/(D_{10} \cdot D_{60}) = 1.9 > 1$

DESCRIPTION: SAND some fines, trace gravel

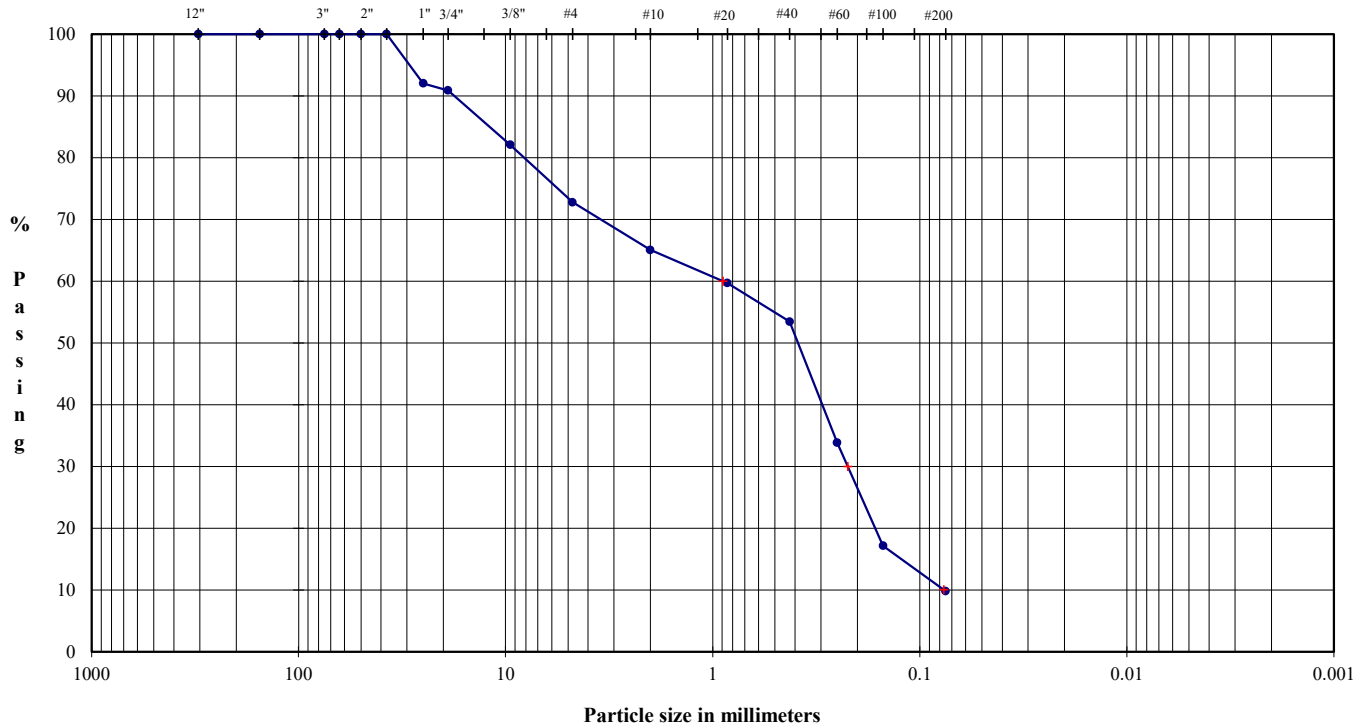
USCS: SW

TECH	RBK
DATE	3/18/22
CHECK	JC
REVIEW	3/11/2024

PARTICLE SIZE DISTRIBUTION

ASTM D 6913

PROJECT NAME: **Woodlands**
 SAMPLE ID: **GB-6 B-4 39-40'**
 TYPE: **GRAB**



	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay
COBBLES	GRAVEL		SAND			FINES

U.S. Standard Sieves Sizes and Numbers

Particle Size			Particle Size	
	(mm)	% Passing	Classification	Percentage
12.0"	304.8	100.0	Cobbles	0.0
6.0"	154.2	100.0		
3.0"	75	100.0		
2.5"	63.5	100.0		
2.0"	50	100.0	Coarse Gravel	9.1
1.5"	37.5	100.0		
1.0"	25	92.0		
0.75"	19	90.9		
0.375"	9.5	82.1	Fine Gravel	18.1
#4	4.75	72.8		
#10	2.00	65.0	Coarse Sand	7.7
#20	0.85	59.7	Medium Sand	11.6
#40	0.43	53.5		
#60	0.25	33.8		
#100	0.15	17.2		
#200	0.075	9.8	Fine Sand	43.6
			Fines	9.8

Moisture Content

5.28

$D_{60} = 0.89$	$D_{30} = 0.22$	$D_{10} = 0.08$
-----------------	-----------------	-----------------

Cu = $D_{60}/D_{10} = 11.7 > 6$ Cc = $D_{30}^2/(D_{10} \cdot D_{60}) = 0.7 < 1$

DESCRIPTION: gravelly SAND some fines

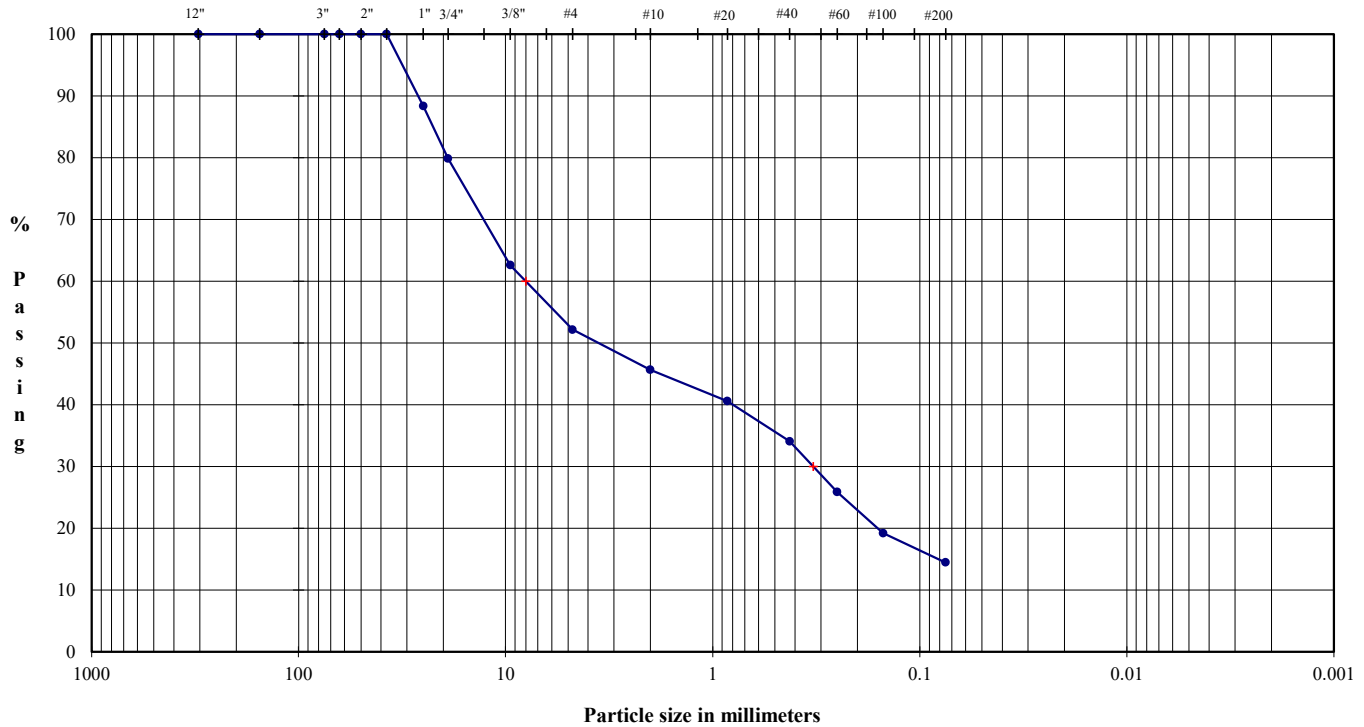
USCS: SW

TECH	RBK
DATE	3/18/22
CHECK	JC
REVIEW	3/11/2024

PARTICLE SIZE DISTRIBUTION

ASTM D 6913

PROJECT NAME: **Woodlands**
 SAMPLE ID: **GB-6 B-5 49-50'**
 TYPE: **GRAB**



	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay
COBBLES	GRAVEL		SAND			FINES

U.S. Standard Sieves Sizes and Numbers

Particle Size			Particle Size	
	(mm)	% Passing	Classification	Percentage
12.0"	304.8	100.0	Cobbles	0.0
6.0"	154.2	100.0		
3.0"	75	100.0		
2.5"	63.5	100.0		
2.0"	50	100.0	Coarse Gravel	20.1
1.5"	37.5	100.0		
1.0"	25	88.4		
0.75"	19	79.9		
0.375"	9.5	62.6		
#4	4.75	52.2	Fine Gravel	27.7
#10	2.00	45.6	Coarse Sand	6.5
#20	0.85	40.6	Medium Sand	11.6
#40	0.43	34.1		
#60	0.25	25.9		
#100	0.15	19.2		
#200	0.075	14.4	Fine Sand	19.6
			Fines	14.4

Moisture Content

3.55

$D_{60} = 7.99$	$D_{30} = 0.33$	$D_{10} = \text{#N/A}$
-----------------	-----------------	------------------------

Cu = $D_{60}/D_{10} =$ #N/A #N/ACc = $D_{30}^2/(D_{10} \cdot D_{60}) =$ #N/A #N/A

DESCRIPTION: SILTY GRAVEL and SAND

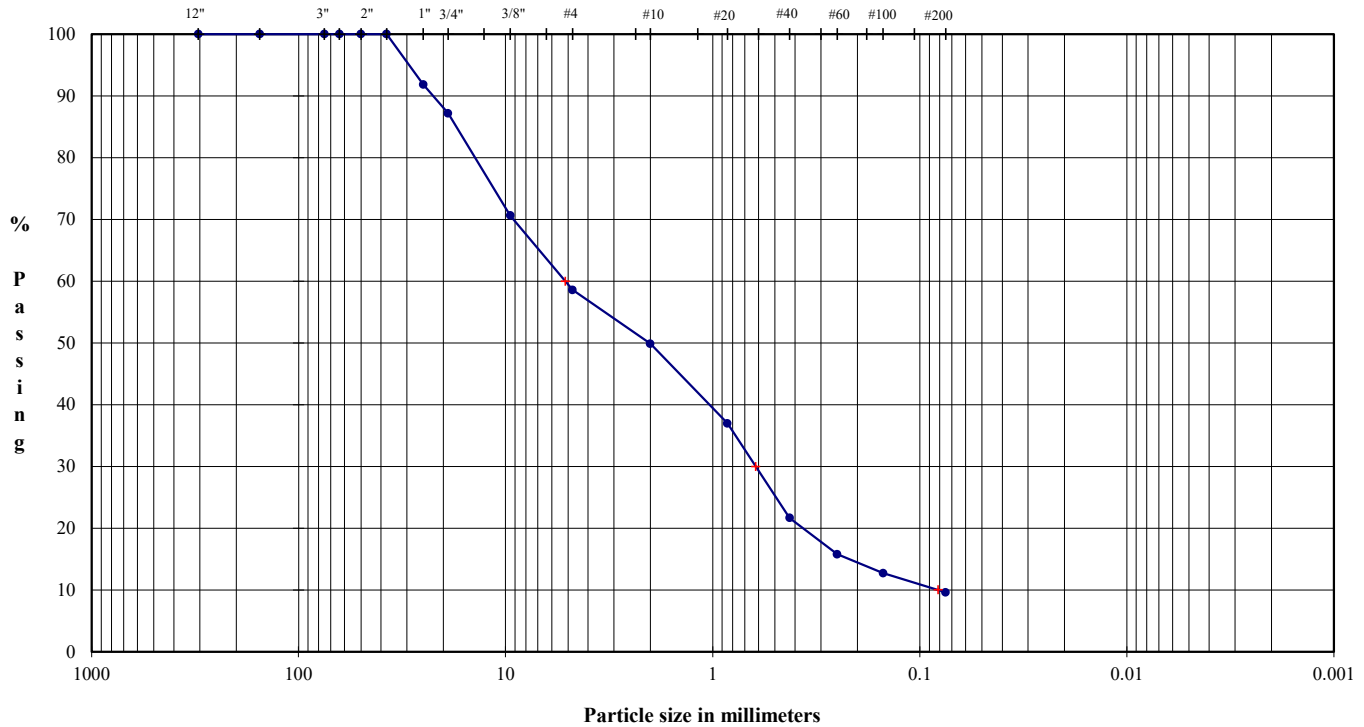
USCS: GM - SM

TECH	RBK
DATE	3/18/22
CHECK	JC
REVIEW	3/11/2024

PARTICLE SIZE DISTRIBUTION

ASTM D 6913

PROJECT NAME: **Woodlands**
 SAMPLE ID: **GB-6 B-6 62-63'**
 TYPE: **GRAB**



	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay
COBBLES	GRAVEL		SAND			FINES

U.S. Standard Sieves Sizes and Numbers

Particle Size			Particle Size	
	(mm)	% Passing	Classification	Percentage
12.0"	304.8	100.0	Cobbles	0.0
6.0"	154.2	100.0		
3.0"	75	100.0		
2.5"	63.5	100.0		
2.0"	50	100.0	Coarse Gravel	12.8
1.5"	37.5	100.0		
1.0"	25	91.8		
0.75"	19	87.2		
0.375"	9.5	70.6		
#4	4.75	58.6		
#10	2.00	49.9	Fine Gravel	28.6
#20	0.85	37.0	Coarse Sand	8.7
#40	0.43	21.7	Medium Sand	28.2
#60	0.25	15.8		
#100	0.15	12.7		
#200	0.075	9.6		
			Fines	9.6

Moisture Content

2.79

$D_{60} = 5.15$	$D_{30} = 0.62$	$D_{10} = 0.08$
-----------------	-----------------	-----------------

Cu = $D_{60}/D_{10} = 63.3 > 6$ Cc = $D_{30}^2/(D_{10} \cdot D_{60}) = 0.9 < 1$

DESCRIPTION: GRAVEL and SAND some fines

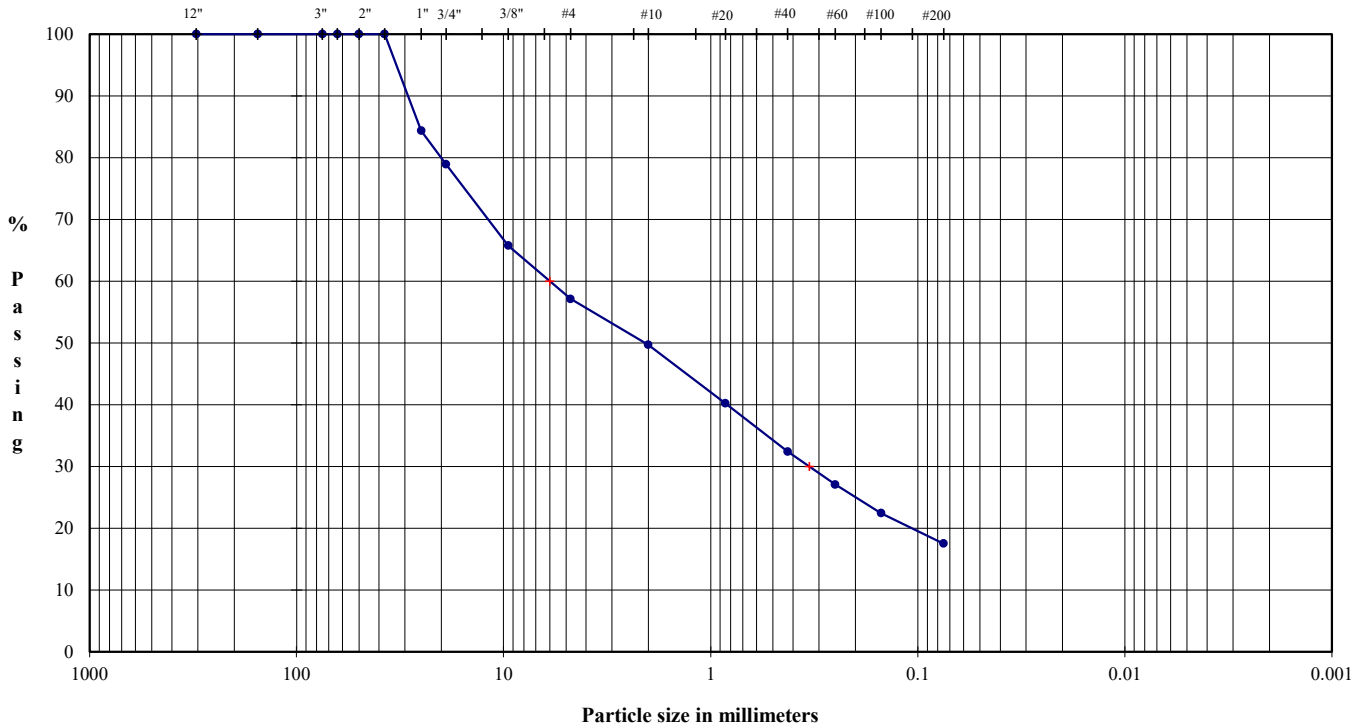
USCS: GP - SP

TECH	RBK
DATE	3/18/22
CHECK	JC
REVIEW	3/11/2024

PARTICLE SIZE DISTRIBUTION

ASTM D 6913

PROJECT NAME: **Woodlands**
 SAMPLE ID: **GB-6 B-7 69-70'**
 TYPE: **GRAB**



	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay
COBBLES	GRAVEL		SAND			FINES

U.S. Standard Sieves Sizes and Numbers

Particle Size			Particle Size	
	(mm)	% Passing	Classification	Percentage
12.0"	304.8	100.0	Cobbles	0.0
6.0"	154.2	100.0		
3.0"	75	100.0		
2.5"	63.5	100.0		
2.0"	50	100.0	Coarse Gravel	21.1
1.5"	37.5	100.0		
1.0"	25	84.4		
0.75"	19	78.9		
0.375"	9.5	65.7		
#4	4.75	57.1	Fine Gravel	21.8
#10	2.00	49.7	Coarse Sand	7.4
#20	0.85	40.2	Medium Sand	17.3
#40	0.43	32.4		
#60	0.25	27.1		
#100	0.15	22.4		
#200	0.075	17.5	Fine Sand	14.9
			Fines	17.5

Moisture Content
4.26

$D_{60} = 5.99$	$D_{30} = 0.33$	$D_{10} = \text{#N/A}$
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$C_u = D_{60}/D_{10} = \text{#N/A}$ #N/A
 $C_c = D_{30}^2/(D_{10} \cdot D_{60}) = \text{#N/A}$ #N/A

DESCRIPTION: SILTY GRAVEL and SAND

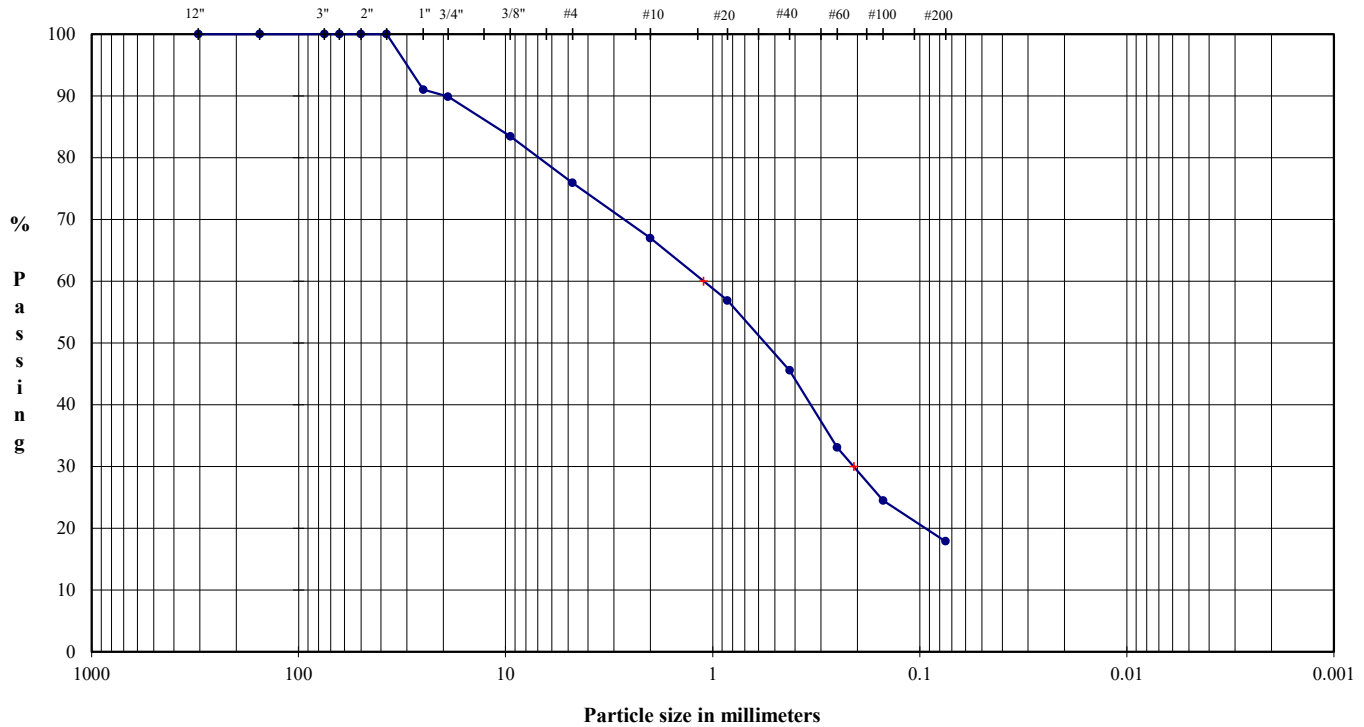
USCS: GM - SM

TECH RBK
 DATE 3/18/22
 CHECK JC
 REVIEW 3/11/2024

PARTICLE SIZE DISTRIBUTION

ASTM D 6913

PROJECT NAME: **Woodlands**
 SAMPLE ID: **GB-6 B-8 79-80'**
 TYPE: **GRAB**



	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay
COBBLES	GRAVEL		SAND			FINES

U.S. Standard Sieves Sizes and Numbers

Particle Size			Particle Size	
	(mm)	% Passing	Classification	Percentage
12.0"	304.8	100.0	Cobbles	0.0
6.0"	154.2	100.0		
3.0"	75	100.0		
2.5"	63.5	100.0	Coarse Gravel	10.1
2.0"	50	100.0		
1.5"	37.5	100.0		
1.0"	25	91.0		
0.75"	19	89.9		
0.375"	9.5	83.4		
#4	4.75	75.9	Fine Gravel	14.0
#10	2.00	67.0	Coarse Sand	8.9
#20	0.85	56.9	Medium Sand	21.4
#40	0.43	45.5		
#60	0.25	33.1		
#100	0.15	24.5		
#200	0.075	17.9	Fine Sand	27.7
			Fines	17.9

Moisture Content

5.29

D ₆₀ = 1.11	D ₃₀ = 0.21	D ₁₀ = #N/A
------------------------	------------------------	------------------------

Cu = D₆₀/D₁₀ = #N/A #N/ACc = D₃₀²/(D₁₀*D₆₀) = #N/A #N/A

DESCRIPTION: gravelly SILTY SAND

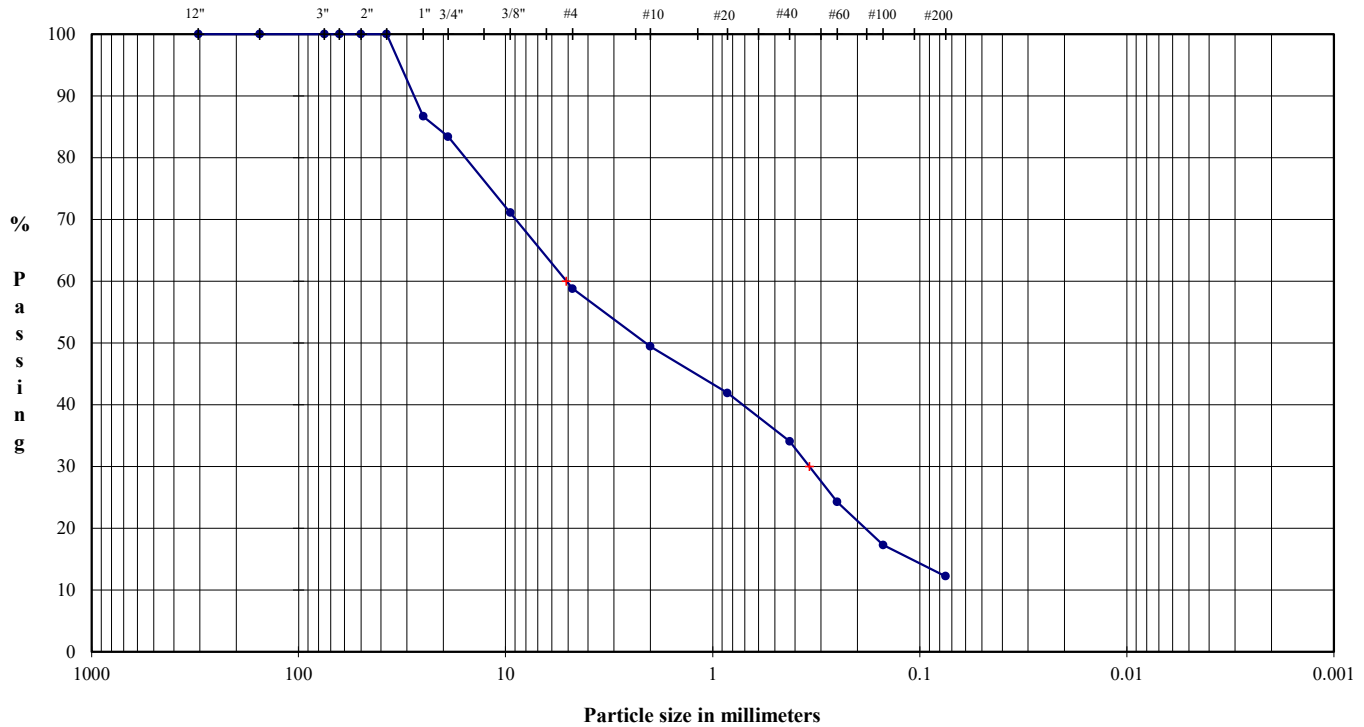
USCS: SM

TECH	RBK
DATE	3/18/22
CHECK	JC
REVIEW	3/11/2024

PARTICLE SIZE DISTRIBUTION

ASTM D 6913

PROJECT NAME: **Woodlands**
 SAMPLE ID: **GB-7 B-1 20-21'**
 TYPE: **GRAB**



	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay
COBBLES	GRAVEL		SAND			FINES

U.S. Standard Sieves Sizes and Numbers

Particle Size			Particle Size	
	(mm)	% Passing	Classification	Percentage
12.0"	304.8	100.0	Cobbles	0.0
6.0"	154.2	100.0		
3.0"	75	100.0		
2.5"	63.5	100.0		
2.0"	50	100.0	Coarse Gravel	16.6
1.5"	37.5	100.0		
1.0"	25	86.7		
0.75"	19	83.4		
0.375"	9.5	71.1		
#4	4.75	58.8	Fine Gravel	24.6
#10	2.00	49.4	Coarse Sand	9.4
#20	0.85	41.9	Medium Sand	15.4
#40	0.43	34.1		
#60	0.25	24.3		
#100	0.15	17.3		
#200	0.075	12.2	Fine Sand	21.8
			Fines	12.2

Moisture Content

4.45

$D_{60} = 5.09$	$D_{30} = 0.34$	$D_{10} = \#N/A$
-----------------	-----------------	------------------

Cu = $D_{60}/D_{10} =$ #N/A #N/ACc = $D_{30}^2/(D_{10} \cdot D_{60}) =$ #N/A #N/A

DESCRIPTION: SILTY SAND and GRAVEL

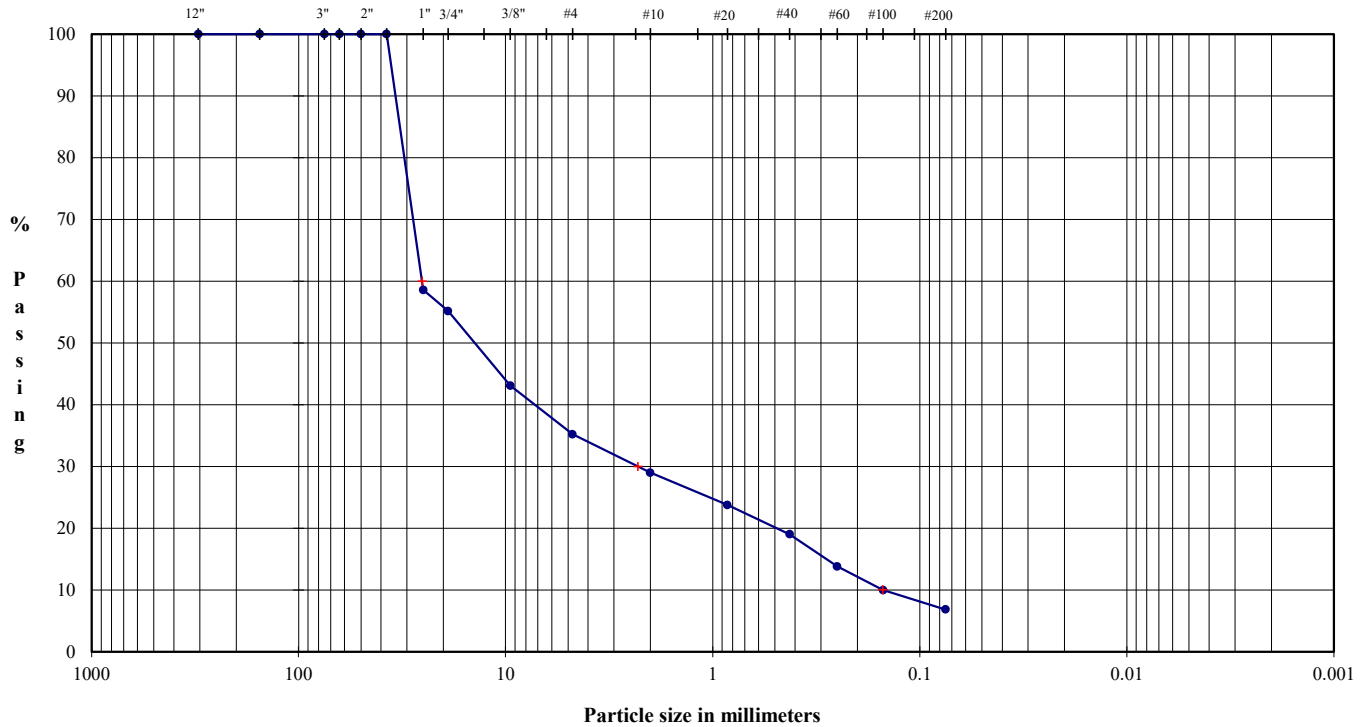
USCS: SM - GM

TECH	RBK
DATE	3/18/22
CHECK	JC
REVIEW	3/11/2024

PARTICLE SIZE DISTRIBUTION

ASTM D 6913

PROJECT NAME: **Woodlands**
 SAMPLE ID: **GB-7 B-2 24-25'**
 TYPE: **GRAB**



	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay
COBBLES	GRAVEL		SAND			FINES

U.S. Standard Sieves Sizes and Numbers

Particle Size			Particle Size	
	(mm)	% Passing	Classification	Percentage
12.0"	304.8	100.0	Cobbles	0.0
6.0"	154.2	100.0		
3.0"	75	100.0		
2.5"	63.5	100.0		
2.0"	50	100.0		
1.5"	37.5	100.0		
1.0"	25	58.6		
0.75"	19	55.2		
0.375"	9.5	43.1	Coarse Gravel	44.8
#4	4.75	35.2	Fine Gravel	20.0
#10	2.00	29.0	Coarse Sand	6.2
#20	0.85	23.8	Medium Sand	10.0
#40	0.43	19.0		
#60	0.25	13.8		
#100	0.15	10.0		
#200	0.075	6.8		
			Fines	6.8

Moisture Content

3.36

$D_{60} = 25.35$	$D_{30} = 2.30$	$D_{10} = 0.15$
------------------	-----------------	-----------------

Cu = $D_{60}/D_{10} = 168.5 > 4$ Cc = $D_{30}^2 / (D_{10} * D_{60}) = 1.4 > 1$

DESCRIPTION: sandy GRAVEL some fines

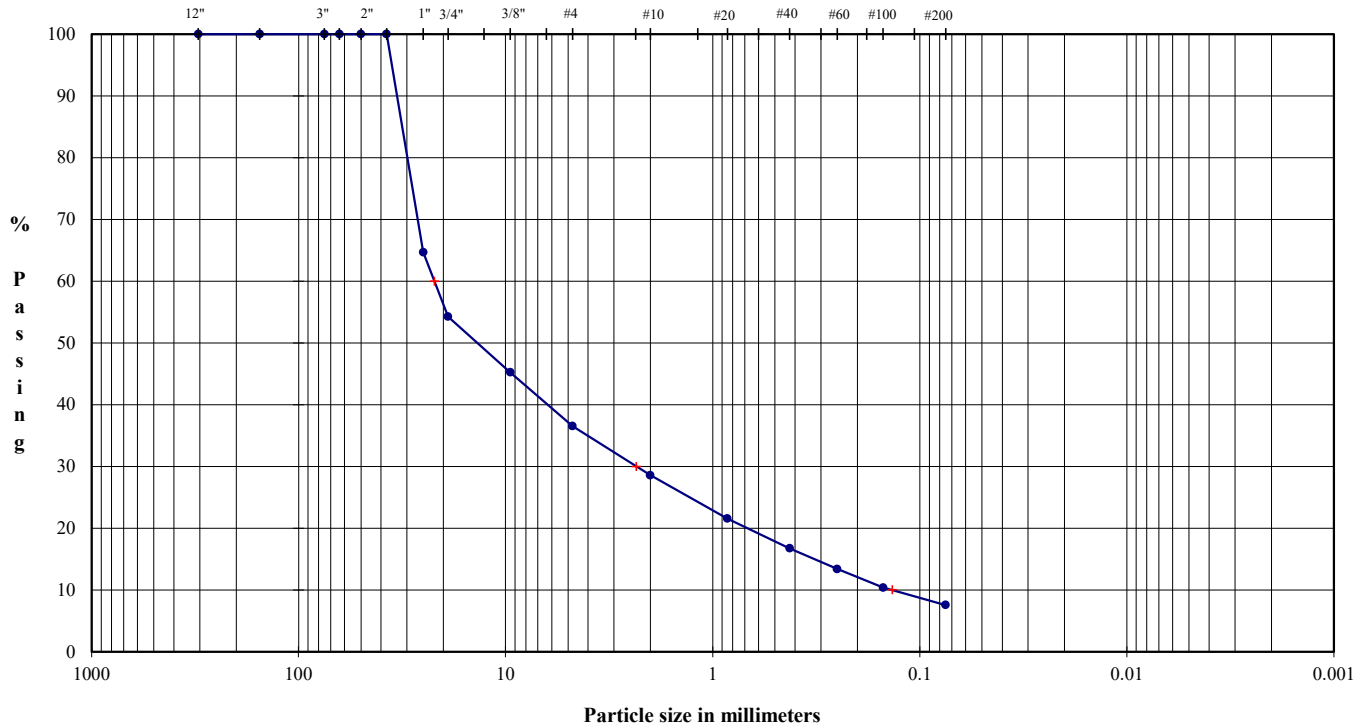
USCS: GW

TECH	RBK
DATE	3/18/22
CHECK	JC
REVIEW	3/11/2024

PARTICLE SIZE DISTRIBUTION

ASTM D 6913

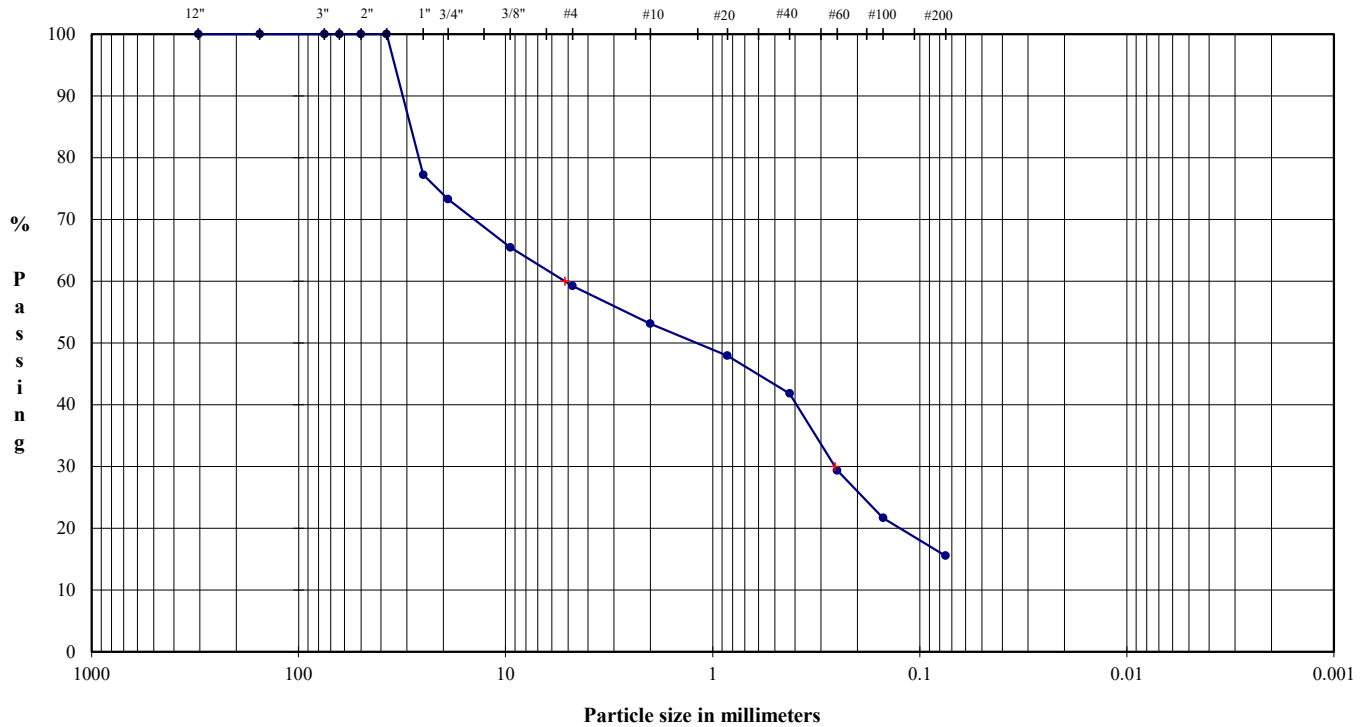
PROJECT NAME: **Woodlands**
 SAMPLE ID: **GB-7 B-3 30-31'**
 TYPE: **GRAB**



PARTICLE SIZE DISTRIBUTION

ASTM D 6913

PROJECT NAME: **Woodlands**
 SAMPLE ID: **GB-7 B-4 39-40'**
 TYPE: **GRAB**



	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay
COBBLES	GRAVEL		SAND			FINES

	Particle Size		% Passing	Classification	Percentage
	(mm)				
U.S. Standard Sieves Sizes and Numbers	12.0"	304.8	100.0	Cobbles	0.0
	6.0"	154.2	100.0		
	3.0"	75	100.0		
	2.5"	63.5	100.0		
	2.0"	50	100.0		
	1.5"	37.5	100.0	Coarse Gravel	26.7
	1.0"	25	77.2		
	0.75"	19	73.3		
	0.375"	9.5	65.5		
	#4	4.75	59.2	Fine Gravel	14.1
	#10	2.00	53.1	Coarse Sand	6.1
	#20	0.85	47.9	Medium Sand	11.3
	#40	0.43	41.8		
	#60	0.25	29.4		
	#100	0.15	21.7		
	#200	0.075	15.6	Fine Sand	26.3
	Fines				15.6

Moisture Content
4.68

$D_{60} = 5.18$	$D_{30} = 0.26$	$D_{10} = \#N/A$
-----------------	-----------------	------------------

$C_u = D_{60}/D_{10} = \#N/A$ $\#N/A$
 $C_c = D_{30}^2/(D_{10} \cdot D_{60}) = \#N/A$ $\#N/A$

DESCRIPTION: SILTY SAND and GRAVEL

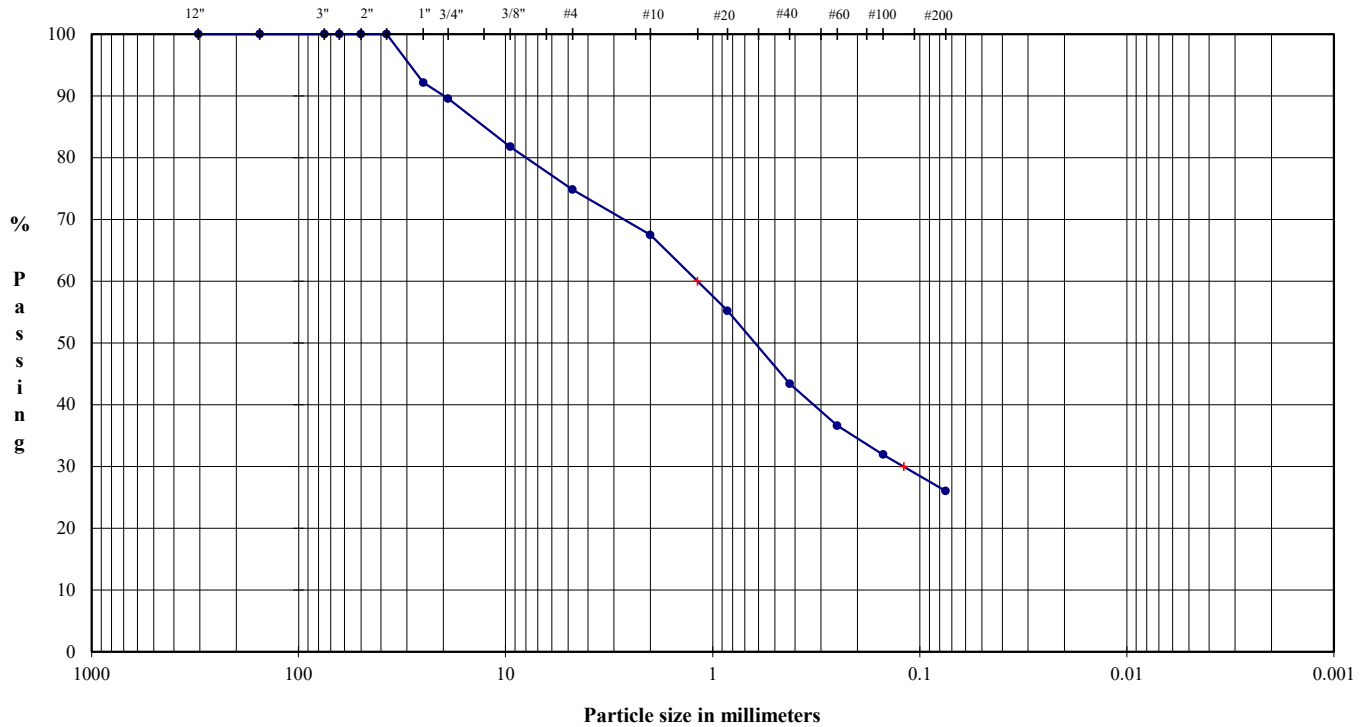
USCS: SM - GM

TECH	RBK
DATE	3/18/22
CHECK	JC
REVIEW	3/11/2024

PARTICLE SIZE DISTRIBUTION

ASTM D 6913

PROJECT NAME: **Woodlands**
 SAMPLE ID: **GB-7 B-6 59-60'**
 TYPE: **GRAB**



	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay
COBBLES	GRAVEL		SAND			FINES

U.S. Standard Sieves Sizes and Numbers

Particle Size			Particle Size	
	(mm)	% Passing	Classification	Percentage
12.0"	304.8	100.0	Cobbles	0.0
6.0"	154.2	100.0		
3.0"	75	100.0		
2.5"	63.5	100.0		
2.0"	50	100.0		
1.5"	37.5	100.0		
1.0"	25	92.2		
0.75"	19	89.6		
0.375"	9.5	81.8	Coarse Gravel	10.4
#4	4.75	74.8	Fine Gravel	14.7
#10	2.00	67.5	Coarse Sand	7.3
#20	0.85	55.2	Medium Sand	24.1
#40	0.43	43.4		
#60	0.25	36.6		
#100	0.15	31.9		
#200	0.075	26.1	Fine Sand	17.3
			Fines	26.1

Moisture Content

3.95

$D_{60} = 1.19$	$D_{30} = 0.12$	$D_{10} = \#N/A$
-----------------	-----------------	------------------

Cu = $D_{60}/D_{10} =$ #N/A #N/ACc = $D_{30}^2/(D_{10} \cdot D_{60}) =$ #N/A #N/A

DESCRIPTION: gravelly SILTY SAND

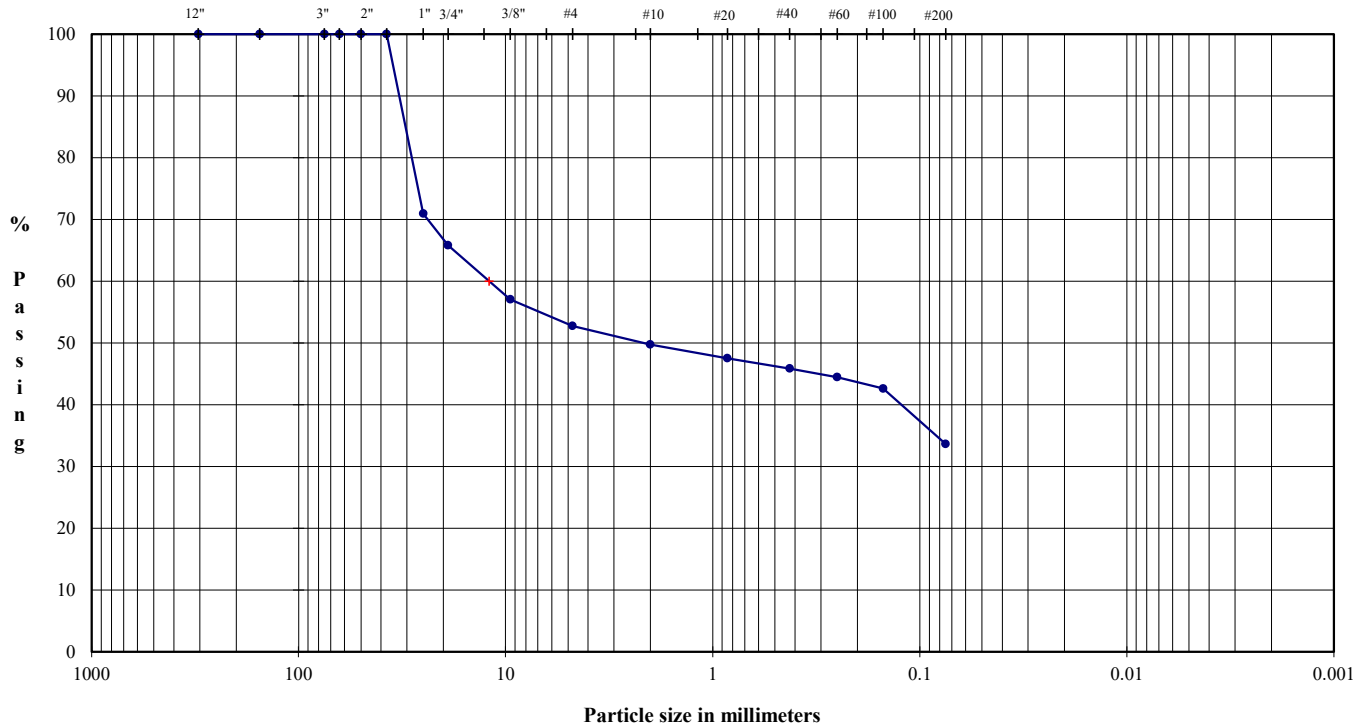
USCS: SM

TECH	RBK
DATE	3/18/22
CHECK	JC
REVIEW	3/11/2024

PARTICLE SIZE DISTRIBUTION

ASTM D 6913

PROJECT NAME: **Woodlands**
 SAMPLE ID: **GB-7 B-7 70-71'**
 TYPE: **GRAB**



	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay
COBBLES	GRAVEL		SAND			FINES

U.S. Standard Sieves Sizes and Numbers

Particle Size			Particle Size	
	(mm)	% Passing	Classification	Percentage
12.0"	304.8	100.0	Cobbles	0.0
6.0"	154.2	100.0		
3.0"	75	100.0		
2.5"	63.5	100.0		
2.0"	50	100.0		
1.5"	37.5	100.0		
1.0"	25	70.9		
0.75"	19	65.8		
0.375"	9.5	57.0	Coarse Gravel	34.2
#4	4.75	52.7	Fine Gravel	13.1
#10	2.00	49.7	Coarse Sand	3.0
#20	0.85	47.5	Medium Sand	3.9
#40	0.43	45.9		
#60	0.25	44.5		
#100	0.15	42.6	Fine Sand	12.2
#200	0.075	33.7		
			Fines	33.7

Moisture Content

16.13

$D_{60} = 12.01$	$D_{30} = \#N/A$	$D_{10} = \#N/A$
------------------	------------------	------------------

 $C_u = D_{60}/D_{10} = \#N/A$
 $C_c = D_{30}^2 / (D_{10} \cdot D_{60}) = \#N/A$

DESCRIPTION: SILTY SAND and SILTY GRAVEL

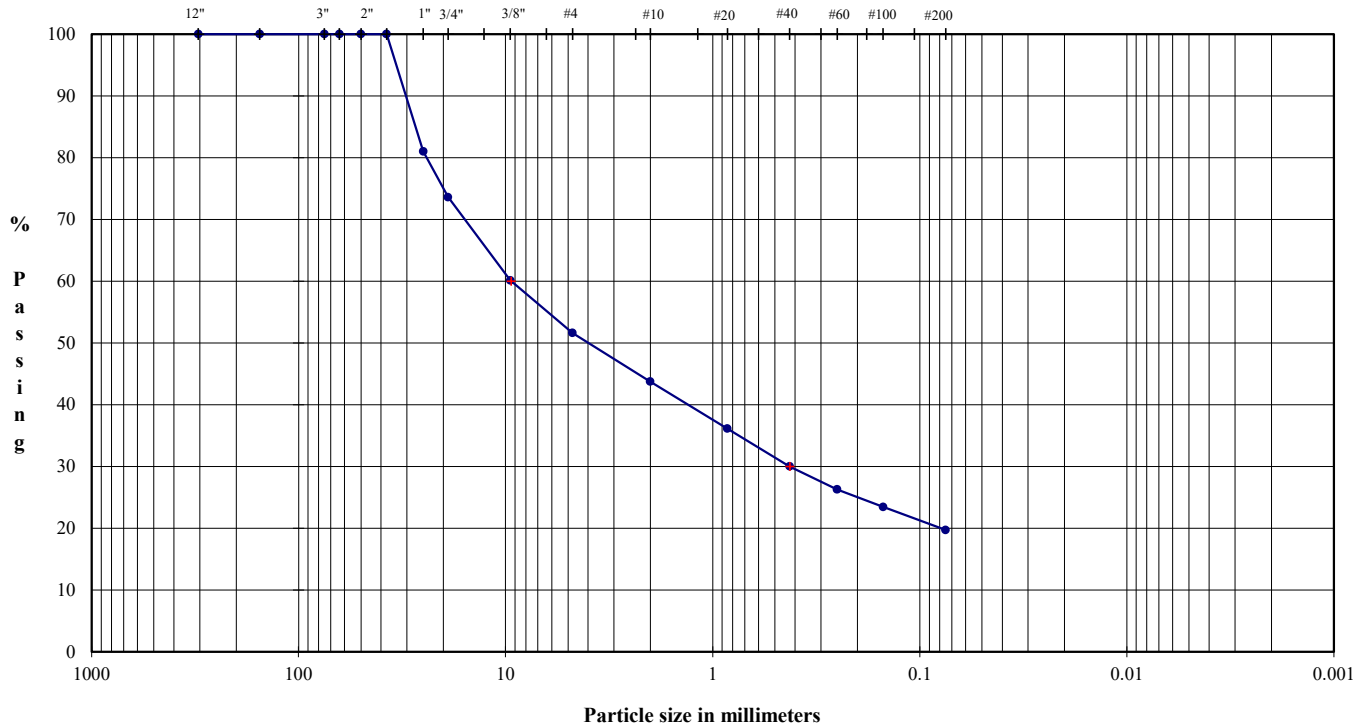
USCS: GM - SM

TECH	RBK
DATE	3/18/22
CHECK	JC
REVIEW	3/11/2024

PARTICLE SIZE DISTRIBUTION

ASTM D 6913

PROJECT NAME: **Woodlands**
 SAMPLE ID: **GB-7 B-8 79-80'**
 TYPE: **GRAB**



	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay
COBBLES	GRAVEL		SAND			FINES

U.S. Standard Sieves Sizes and Numbers

Particle Size			Particle Size	
	(mm)	% Passing	Classification	Percentage
12.0"	304.8	100.0	Cobbles	0.0
6.0"	154.2	100.0		
3.0"	75	100.0		
2.5"	63.5	100.0		
2.0"	50	100.0	Coarse Gravel	26.4
1.5"	37.5	100.0		
1.0"	25	81.0		
0.75"	19	73.6		
0.375"	9.5	60.1	Fine Gravel	22.0
#4	4.75	51.6		
#10	2.00	43.7	Coarse Sand	7.9
#20	0.85	36.1	Medium Sand	13.7
#40	0.43	30.0		
#60	0.25	26.3		
#100	0.15	23.4		
#200	0.075	19.7	Fine Sand	10.3
			Fines	19.7

Moisture Content

4.59

$D_{60} = 9.40$	$D_{30} = 0.42$	$D_{10} = \text{#N/A}$
-----------------	-----------------	------------------------

Cu = $D_{60}/D_{10} =$ #N/A #N/ACc = $D_{30}^2/(D_{10} \cdot D_{60}) =$ #N/A #N/A

DESCRIPTION: SILTY GRAVEL and SILTY SAND

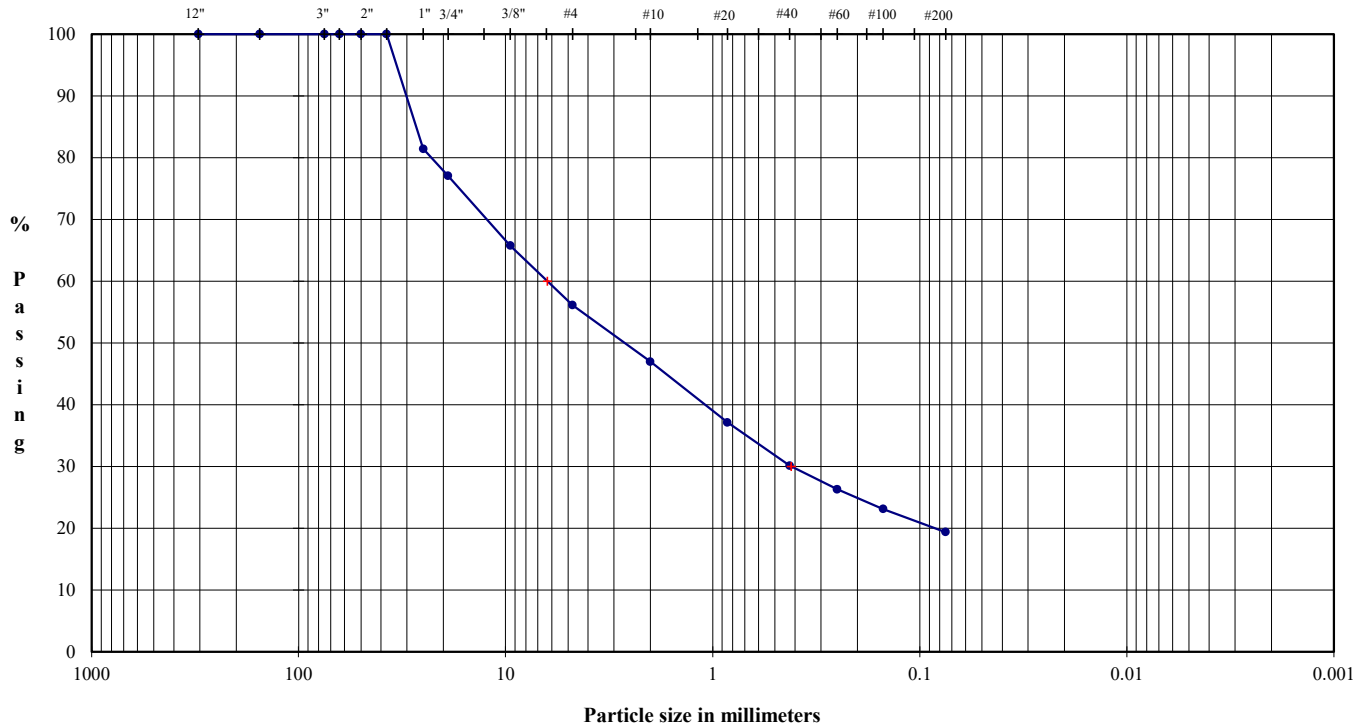
USCS: GM - SM

TECH	RBK
DATE	3/18/22
CHECK	JC
REVIEW	3/11/2024

PARTICLE SIZE DISTRIBUTION

ASTM D 6913

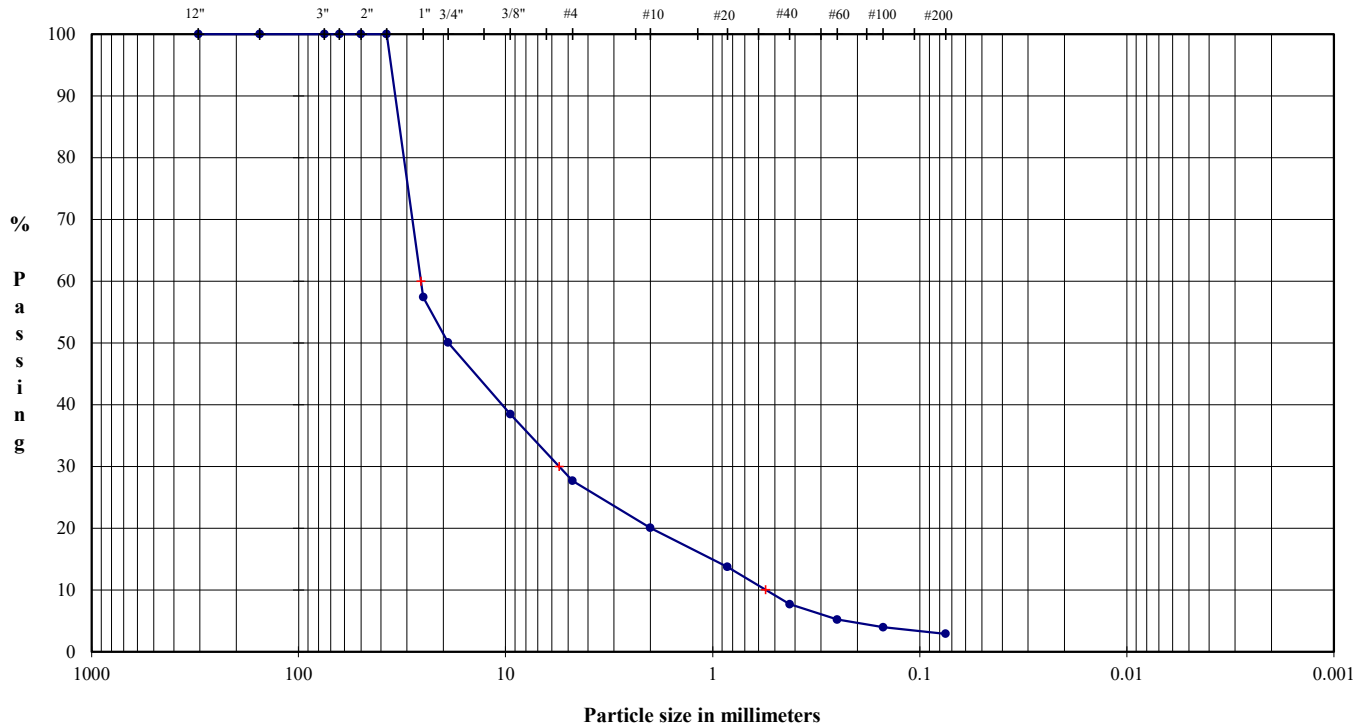
PROJECT NAME: **Woodlands**
 SAMPLE ID: **GB-7 SC-4 49-50'**
 TYPE: **GRAB**



PARTICLE SIZE DISTRIBUTION

ASTM D 6913

PROJECT NAME: **Woodlands**
 SAMPLE ID: **GB-8 B-1 9-10'**
 TYPE: **GRAB**



COBBLES	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay
	GRAVEL		SAND			FINES

	Particle Size		% Passing	Classification	Percentage
	(mm)				
U.S. Standard Sieves Sizes and Numbers	12.0"	304.8	100.0	Cobbles	0.0
	6.0"	154.2	100.0		
	3.0"	75	100.0		
	2.5"	63.5	100.0		
	2.0"	50	100.0		
	1.5"	37.5	100.0	Coarse Gravel	49.9
	1.0"	25	57.4		
	0.75"	19	50.1		
	0.375"	9.5	38.5		
	#4	4.75	27.7	Fine Gravel	22.4
	#10	2.00	20.1	Coarse Sand	7.7
	#20	0.85	13.7	Medium Sand	12.4
	#40	0.43	7.7		
	#60	0.25	5.2		
	#100	0.15	4.0		
	#200	0.075	2.9	Fine Sand	4.8
				Fines	2.9

Moisture Content

2.40

$D_{60} = 25.63$	$D_{30} = 5.51$	$D_{10} = 0.55$
------------------	-----------------	-----------------

 $C_u = D_{60}/D_{10} = 46.3 > 4$
 $C_c = D_{30}^2 / (D_{10} \cdot D_{60}) = 2.1 > 1$

DESCRIPTION: sandy GRAVEL trace fines

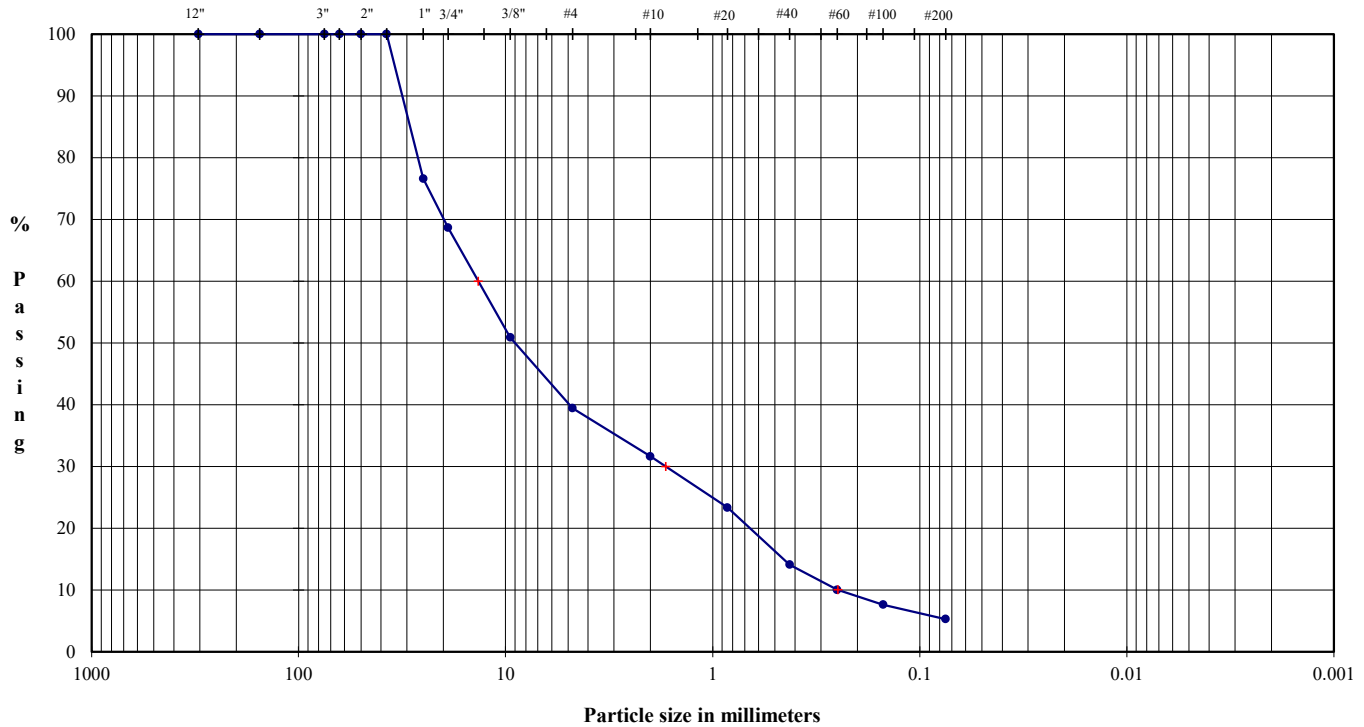
USCS: GP

TECH	RBK
DATE	3/18/22
CHECK	JC
REVIEW	3/11/2024

PARTICLE SIZE DISTRIBUTION

ASTM D 6913

PROJECT NAME: **Woodlands**
 SAMPLE ID: **GB-8 B-2 21-22'**
 TYPE: **GRAB**



	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay
COBBLES	GRAVEL		SAND			FINES

U.S. Standard Sieves Sizes and Numbers

Particle Size			Particle Size	
	(mm)	% Passing	Classification	Percentage
12.0"	304.8	100.0	Cobbles	0.0
6.0"	154.2	100.0		
3.0"	75	100.0		
2.5"	63.5	100.0		
2.0"	50	100.0		
1.5"	37.5	100.0		
1.0"	25	76.6		
0.75"	19	68.7		
0.375"	9.5	50.9	Coarse Gravel	31.3
#4	4.75	39.4	Fine Gravel	29.2
#10	2.00	31.7	Coarse Sand	7.8
#20	0.85	23.3	Medium Sand	17.6
#40	0.43	14.1		
#60	0.25	10.0		
#100	0.15	7.6	Fine Sand	8.8
#200	0.075	5.3		
			Fines	5.3

Moisture Content

4.66

$D_{60} = 13.55$	$D_{30} = 1.68$	$D_{10} = 0.25$
------------------	-----------------	-----------------

Cu = $D_{60}/D_{10} = 54.6 > 4$ Cc = $D_{30}^2/(D_{10} \cdot D_{60}) = 0.8 < 1$

DESCRIPTION: GRAVEL and SAND trace fines

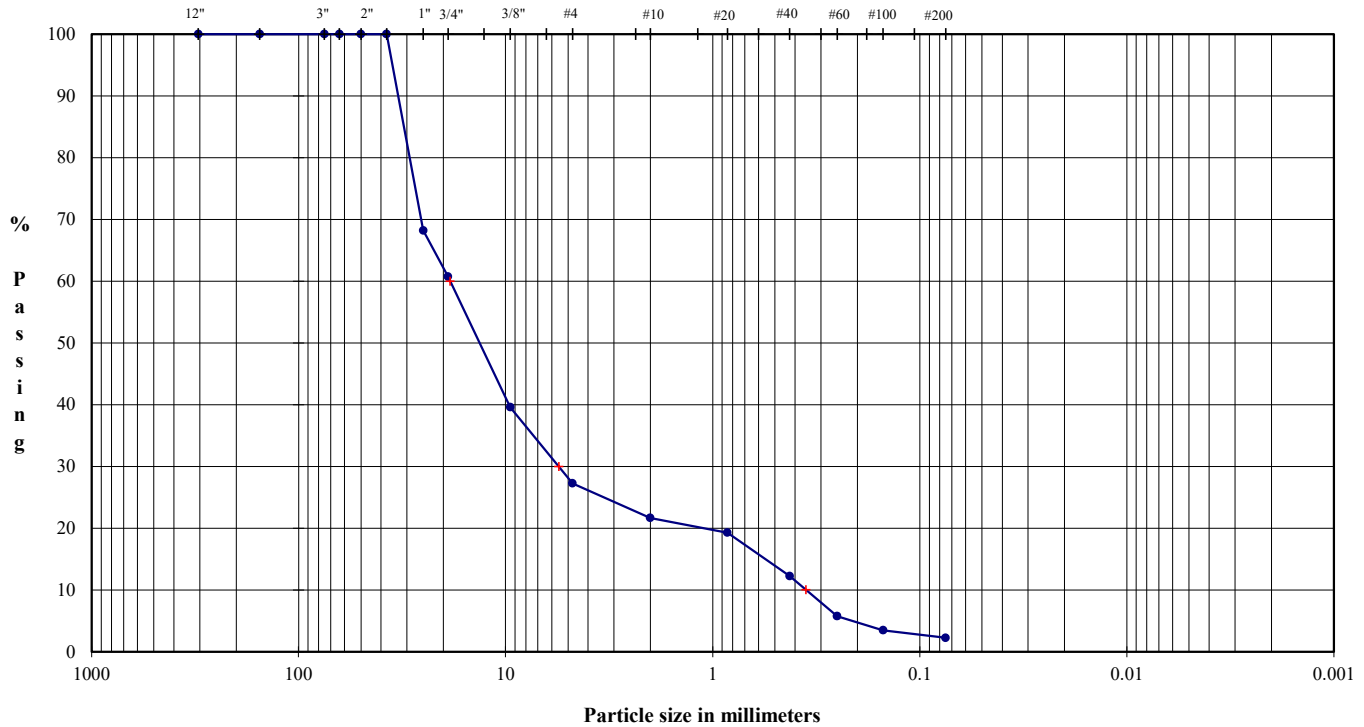
USCS: GP - SP

TECH	RBK
DATE	3/18/22
CHECK	JC
REVIEW	3/11/2024

PARTICLE SIZE DISTRIBUTION

ASTM D 6913

PROJECT NAME: **Woodlands**
 SAMPLE ID: **GB-8 B-3 24-25'**
 TYPE: **GRAB**



	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay
COBBLES	GRAVEL		SAND			FINES

U.S. Standard Sieves Sizes and Numbers

Particle Size			Particle Size	
	(mm)	% Passing	Classification	Percentage
12.0"	304.8	100.0	Cobbles	0.0
6.0"	154.2	100.0		
3.0"	75	100.0		
2.5"	63.5	100.0		
2.0"	50	100.0		
1.5"	37.5	100.0		
1.0"	25	68.2		
0.75"	19	60.7		
0.375"	9.5	39.6	Coarse Gravel	39.3
#4	4.75	27.3	Fine Gravel	33.4
#10	2.00	21.7	Coarse Sand	5.6
#20	0.85	19.3	Medium Sand	9.4
#40	0.43	12.3		
#60	0.25	5.7		
#100	0.15	3.5	Fine Sand	10.0
#200	0.075	2.3		
			Fines	2.3

Moisture Content

2.93

$D_{60} = 18.55$	$D_{30} = 5.53$	$D_{10} = 0.35$
------------------	-----------------	-----------------

 $C_u = D_{60}/D_{10} = 52.5 > 4$
 $C_c = D_{30}^2 / (D_{10} \cdot D_{60}) = 4.7 > 3$

DESCRIPTION: sandy GRAVEL trace fines

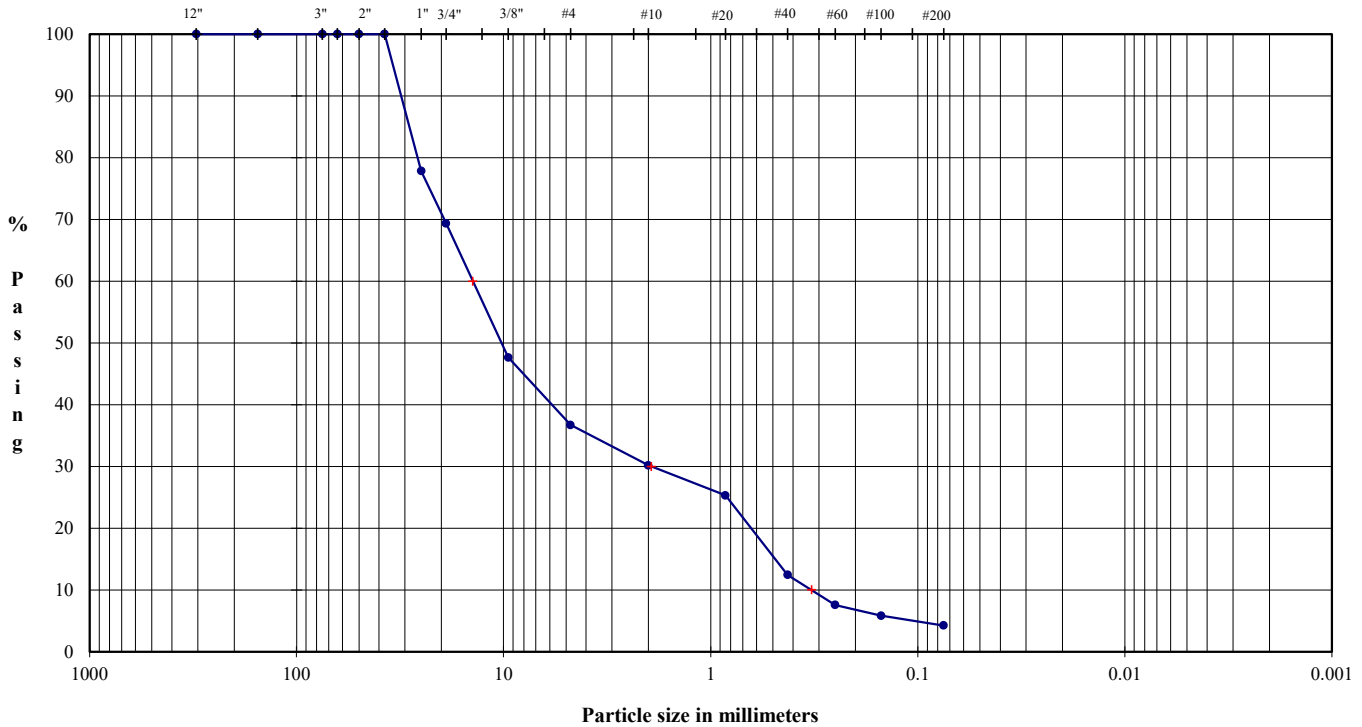
USCS: GP

TECH	RBK
DATE	3/18/22
CHECK	JC
REVIEW	3/11/2024

PARTICLE SIZE DISTRIBUTION

ASTM D 6913

PROJECT NAME: **Woodlands**
 SAMPLE ID: **GB-8 B-4 29-30'**
 TYPE: **GRAB**



	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay
COBBLES	GRAVEL		SAND			FINES

	Particle Size		% Passing	Classification	Percentage
	(mm)				
U.S. Standard Sieves Sizes and Numbers	12.0"	304.8	100.0	Cobbles	0.0
	6.0"	154.2	100.0		
	3.0"	75	100.0		
	2.5"	63.5	100.0		
	2.0"	50	100.0		
	1.5"	37.5	100.0	Coarse Gravel	30.6
	1.0"	25	77.8		
	0.75"	19	69.4		
	0.375"	9.5	47.6		
	#4	4.75	36.7	Fine Gravel	32.6
	#10	2.00	30.2	Coarse Sand	6.5
	#20	0.85	25.3	Medium Sand	17.7
	#40	0.43	12.5		
	#60	0.25	7.6		
	#100	0.15	5.8		
	#200	0.075	4.2	Fine Sand	8.2
				Fines	4.2

Moisture Content

3.10

D ₆₀ = 14.10	D ₃₀ = 1.93	D ₁₀ = 0.33
-------------------------	------------------------	------------------------

Cu = D₆₀/D₁₀ = 43.3 > 4Cc = D₃₀²/(D₁₀*D₆₀) = 0.8 < 1

DESCRIPTION: GRAVEL and SAND trace fines

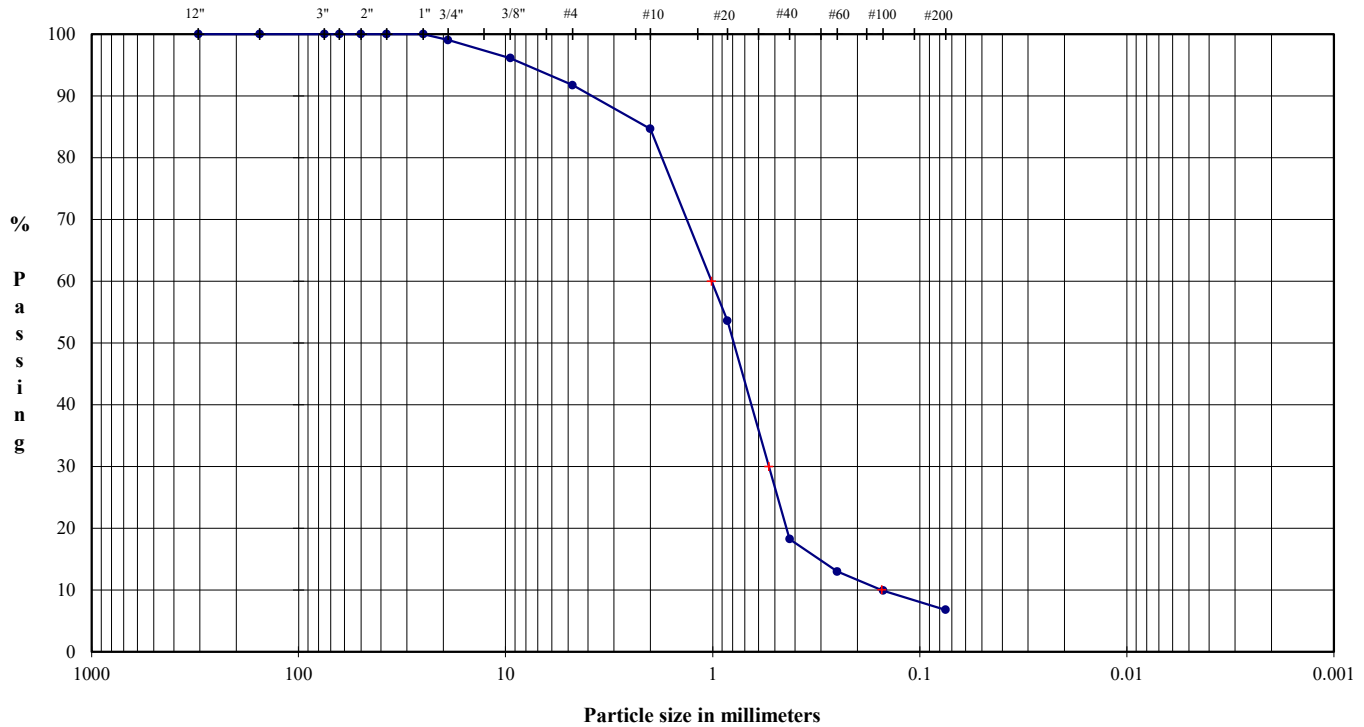
USCS: GP - SP

TECH	RBK
DATE	3/18/22
CHECK	JC
REVIEW	3/11/2024

PARTICLE SIZE DISTRIBUTION

ASTM D 6913

PROJECT NAME: **Woodlands**
 SAMPLE ID: **GB-8 B-5 40-41'**
 TYPE: **GRAB**



	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay
COBBLES	GRAVEL		SAND			FINES

U.S. Standard Sieves Sizes and Numbers

Particle Size			Particle Size	
	(mm)	% Passing	Classification	Percentage
12.0"	304.8	100.0	Cobbles	0.0
6.0"	154.2	100.0		
3.0"	75	100.0		
2.5"	63.5	100.0		
2.0"	50	100.0	Coarse Gravel	1.0
1.5"	37.5	100.0		
1.0"	25	100.0		
0.75"	19	99.0		
0.375"	9.5	96.1	Fine Gravel	7.3
#4	4.75	91.7		
#10	2.00	84.7	Coarse Sand	7.1
#20	0.85	53.6	Medium Sand	66.4
#40	0.43	18.2		
#60	0.25	13.0	Fine Sand	11.5
#100	0.15	9.9		
#200	0.075	6.8		

Moisture Content

5.88

$D_{60} = 1.01$	$D_{30} = 0.54$	$D_{10} = 0.15$
-----------------	-----------------	-----------------

$$Cu = D_{60}/D_{10} = 6.7 > 6$$

$$Cc = D_{30}^2 / (D_{10} \cdot D_{60}) = 1.9 > 1$$

DESCRIPTION: SAND some gravel and fines

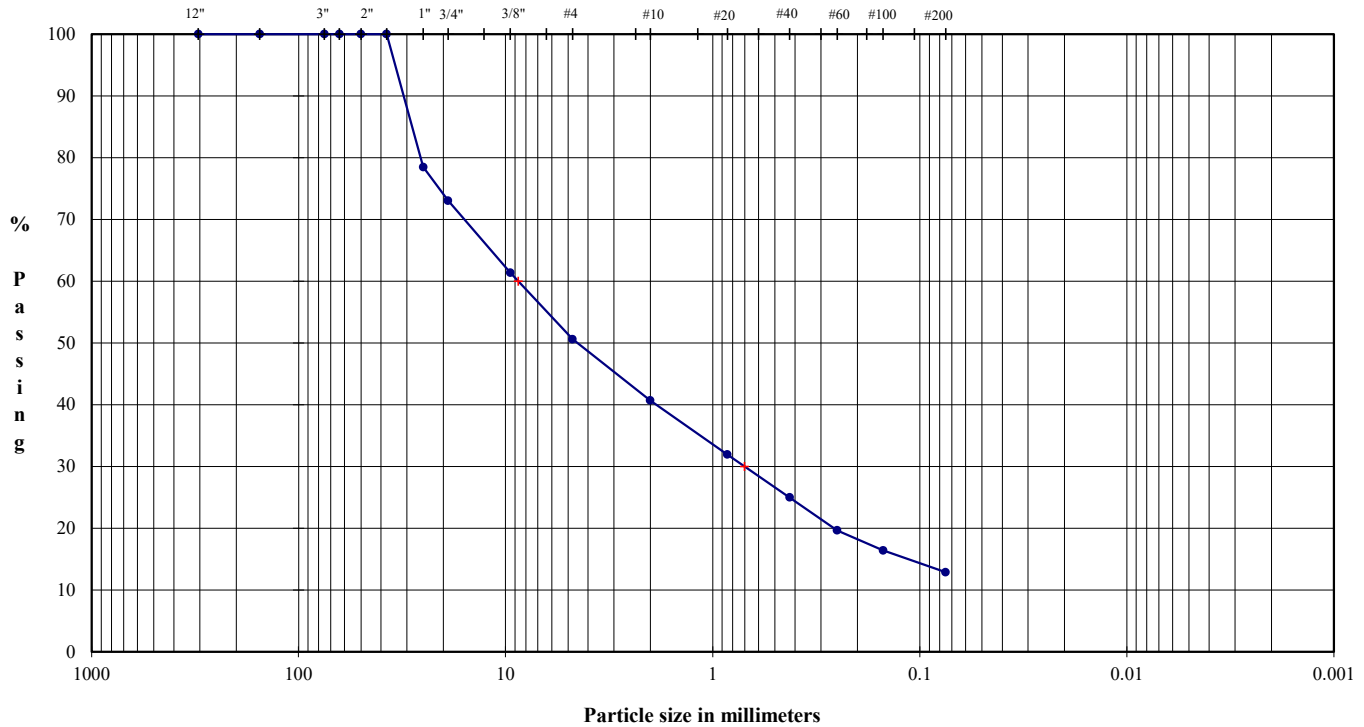
USCS: SP

TECH	RBK
DATE	3/18/22
CHECK	JC
REVIEW	3/11/2024

PARTICLE SIZE DISTRIBUTION

ASTM D 6913

PROJECT NAME: **Woodlands**
 SAMPLE ID: **GB-8 B-6 49-50'**
 TYPE: **GRAB**



	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay
COBBLES	GRAVEL		SAND			FINES

U.S. Standard Sieves Sizes and Numbers

Particle Size			Particle Size	
	(mm)	% Passing	Classification	Percentage
12.0"	304.8	100.0	Cobbles	0.0
6.0"	154.2	100.0		
3.0"	75	100.0		
2.5"	63.5	100.0		
2.0"	50	100.0		
1.5"	37.5	100.0		
1.0"	25	78.5		
0.75"	19	73.1		
0.375"	9.5	61.4		
#4	4.75	50.6	Fine Gravel	22.4
#10	2.00	40.7	Coarse Sand	9.9
#20	0.85	31.9	Medium Sand	15.7
#40	0.43	25.0		
#60	0.25	19.6		
#100	0.15	16.4	Fine Sand	12.1
#200	0.075	12.9		
			Fines	12.9

Moisture Content

2.79

$D_{60} = 8.69$	$D_{30} = 0.70$	$D_{10} = \text{#N/A}$
-----------------	-----------------	------------------------

Cu = $D_{60}/D_{10} =$ #N/A #N/ACc = $D_{30}^2/(D_{10} \cdot D_{60}) =$ #N/A #N/A

DESCRIPTION: SILTY GRAVEL and SAND

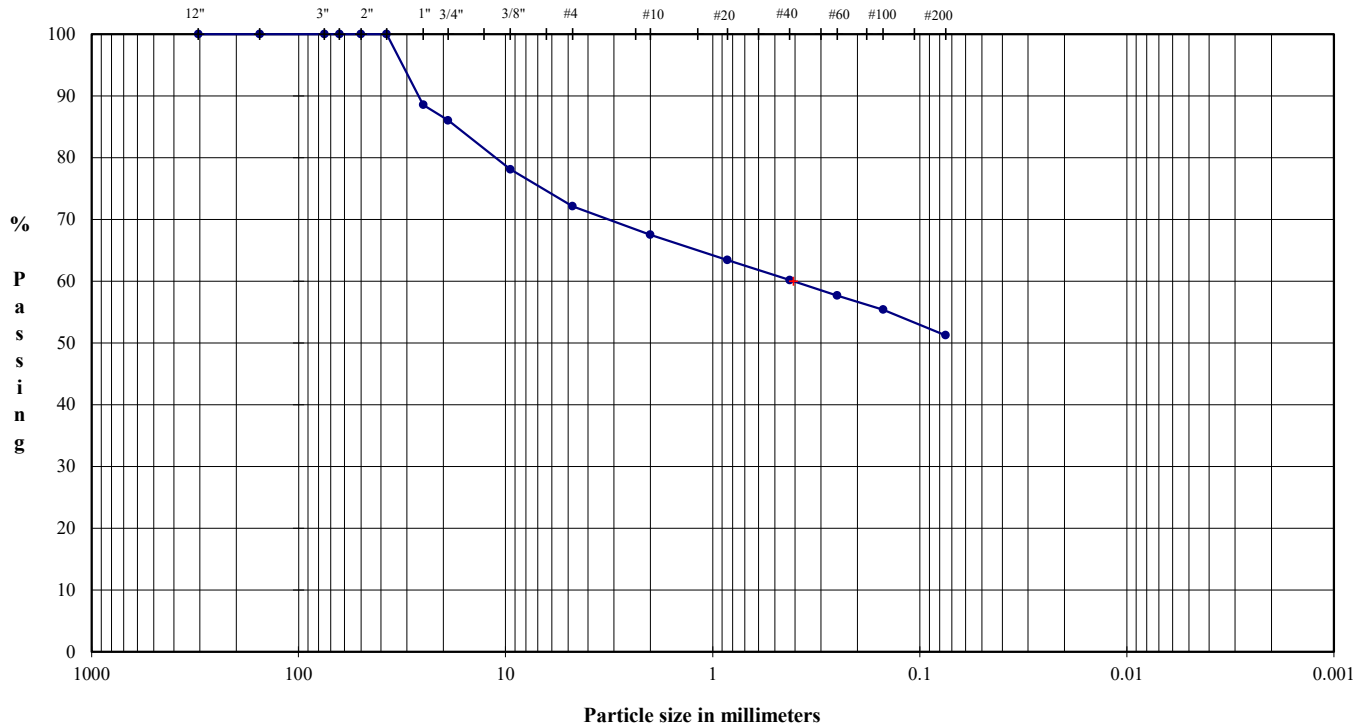
USCS: GM - SM

TECH	RBK
DATE	3/18/22
CHECK	JC
REVIEW	3/11/2024

PARTICLE SIZE DISTRIBUTION

ASTM D 6913

PROJECT NAME: **Woodlands**
 SAMPLE ID: **GB-8 B-7 59'- 60'**
 TYPE: **GRAB**



	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay
COBBLES	GRAVEL		SAND			FINES

U.S. Standard Sieves Sizes and Numbers

Particle Size			Particle Size	
	(mm)	% Passing	Classification	Percentage
12.0"	304.8	100.0	Cobbles	0.0
6.0"	154.2	100.0		
3.0"	75	100.0		
2.5"	63.5	100.0		
2.0"	50	100.0		
1.5"	37.5	100.0		
1.0"	25	88.5		
0.75"	19	86.0		
0.375"	9.5	78.1	Coarse Gravel	14.0
#4	4.75	72.1	Fine Gravel	13.9
#10	2.00	67.5	Coarse Sand	4.6
#20	0.85	63.4	Medium Sand	7.3
#40	0.43	60.2		
#60	0.25	57.7		
#100	0.15	55.4		
#200	0.075	51.2	Fine Sand	9.0
			Fines	51.2

Moisture Content

16.28

$D_{60} = 0.41$	$D_{30} = \#N/A$	$D_{10} = \#N/A$
$C_u = D_{60}/D_{10} =$	#N/A	#N/A
$C_c = D_{30}^2/(D_{10} \cdot D_{60}) =$	#N/A	#N/A

DESCRIPTION: gravelly sandy FINES

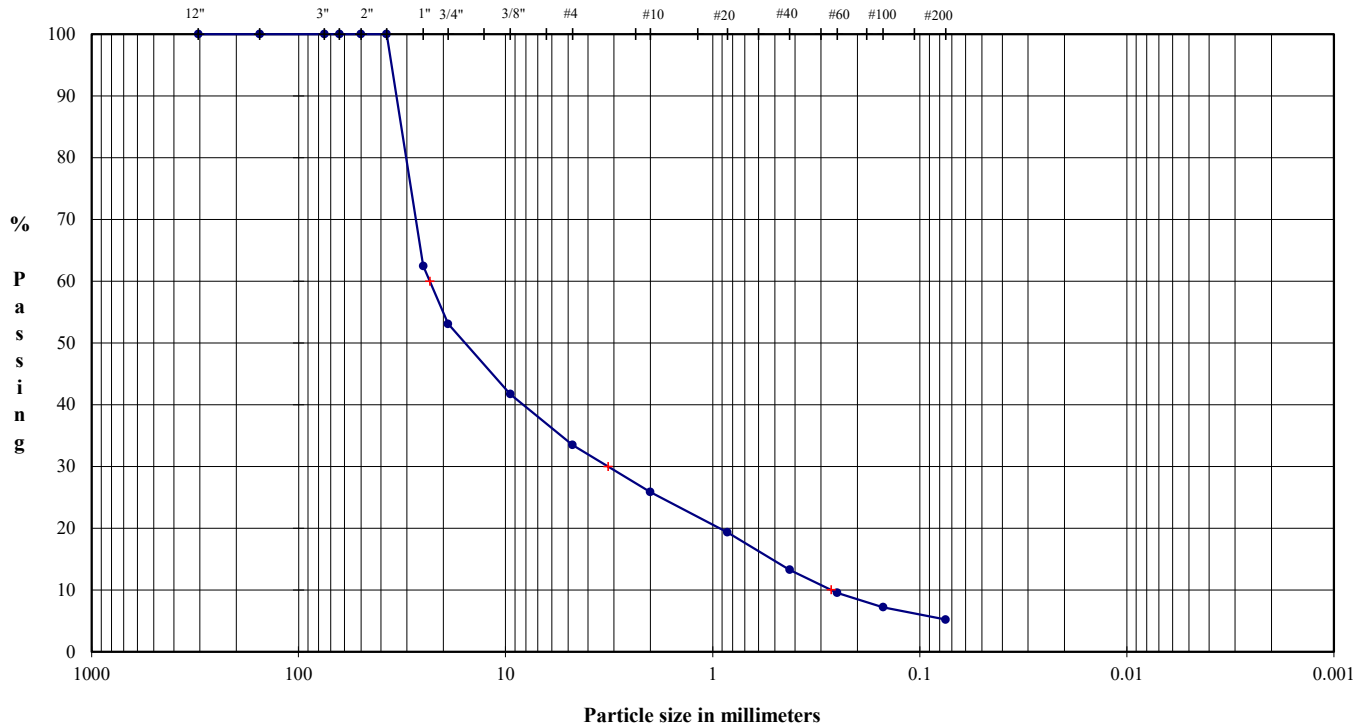
USCS: ML or CH

TECH	RBK
DATE	3/18/22
CHECK	JC
REVIEW	3/11/2024

PARTICLE SIZE DISTRIBUTION

ASTM D 6913

PROJECT NAME: **Woodlands**
 SAMPLE ID: **GB-9 B-1 19-20'**
 TYPE: **GRAB**



	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay
COBBLES	GRAVEL		SAND			FINES

	Particle Size		% Passing	Classification	Percentage
	(mm)				
U.S. Standard Sieves Sizes and Numbers	12.0"	304.8	100.0	Cobbles	0.0
	6.0"	154.2	100.0		
	3.0"	75	100.0		
	2.5"	63.5	100.0		
	2.0"	50	100.0		
	1.5"	37.5	100.0	Coarse Gravel	46.9
	1.0"	25	62.5		
	0.75"	19	53.1		
	0.375"	9.5	41.7		
	#4	4.75	33.5	Fine Gravel	19.6
	#10	2.00	25.9	Coarse Sand	7.6
	#20	0.85	19.4	Medium Sand	12.6
	#40	0.43	13.3		
	#60	0.25	9.6		
	#100	0.15	7.2		
	#200	0.075	5.2	Fine Sand	8.0
				Fines	5.2

Moisture Content

2.64

$D_{60} = 23.26$	$D_{30} = 3.20$	$D_{10} = 0.27$
------------------	-----------------	-----------------

Cu = $D_{60}/D_{10} = 87.3 > 4$ Cc = $D_{30}^2/(D_{10} \cdot D_{60}) = 1.7 > 1$

DESCRIPTION: sandy GRAVEL trace fines

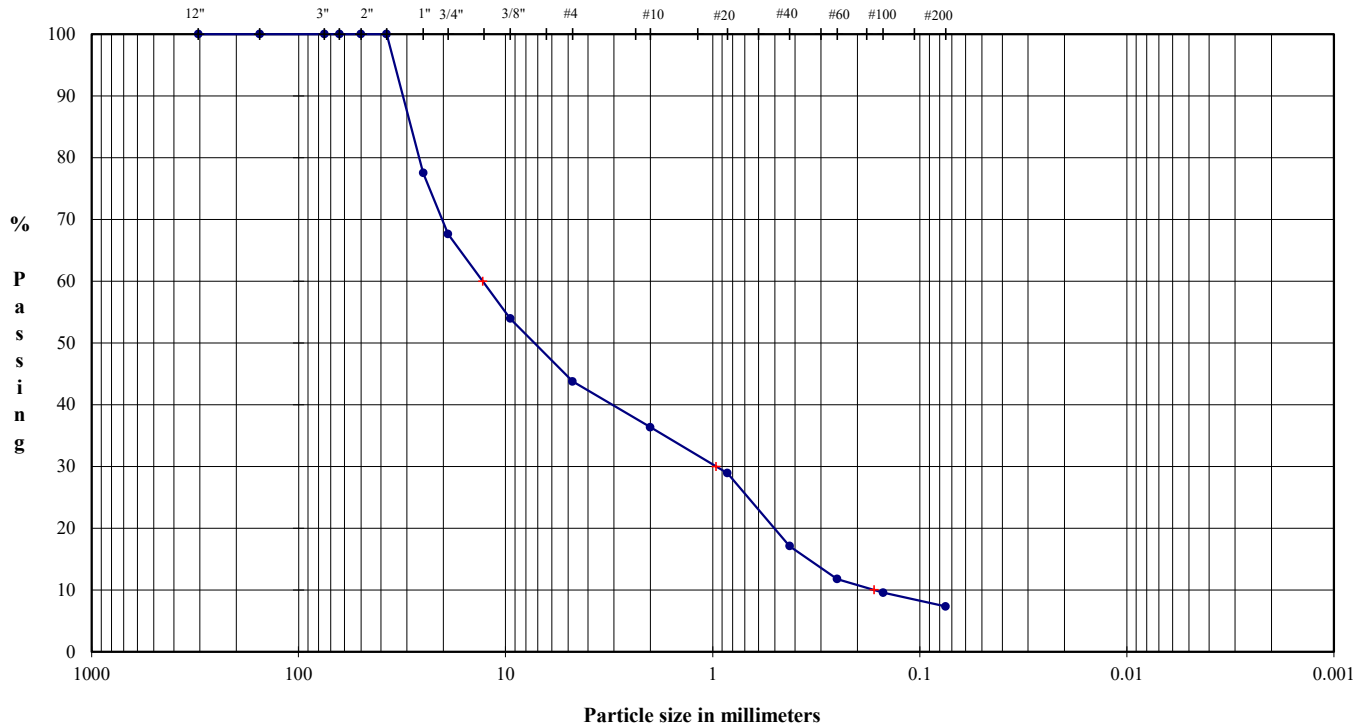
USCS: GP

TECH	RBK
DATE	3/18/22
CHECK	JC
REVIEW	3/11/2024

PARTICLE SIZE DISTRIBUTION

ASTM D 6913

PROJECT NAME: **Woodlands**
 SAMPLE ID: **GB-9 B-2 24-25'**
 TYPE: **GRAB**



	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay
COBBLES	GRAVEL		SAND			FINES

U.S. Standard Sieves Sizes and Numbers	Particle Size			Particle Size	
	(mm)	% Passing	Classification	Percentage	
	12.0"	304.8	100.0	Cobbles	0.0
	6.0"	154.2	100.0		
	3.0"	75	100.0		
	2.5"	63.5	100.0		
	2.0"	50	100.0		
	1.5"	37.5	100.0		
	1.0"	25	77.5		
	0.75"	19	67.6		
	0.375"	9.5	54.0		
	#4	4.75	43.8	Fine Gravel	23.8
	#10	2.00	36.3	Coarse Sand	7.4
	#20	0.85	28.9	Medium Sand	19.2
	#40	0.43	17.1		
	#60	0.25	11.8		
	#100	0.15	9.6	Fine Sand	9.8
#200	0.075	7.3			
			Fines	7.3	

Moisture Content

3.15

$D_{60} = 12.91$	$D_{30} = 0.96$	$D_{10} = 0.17$
------------------	-----------------	-----------------

 $C_u = D_{60}/D_{10} = 78.0 > 4$
 $C_c = D_{30}^2 / (D_{10} \cdot D_{60}) = 0.4 < 1$

DESCRIPTION: GRAVEL and SAND some fines

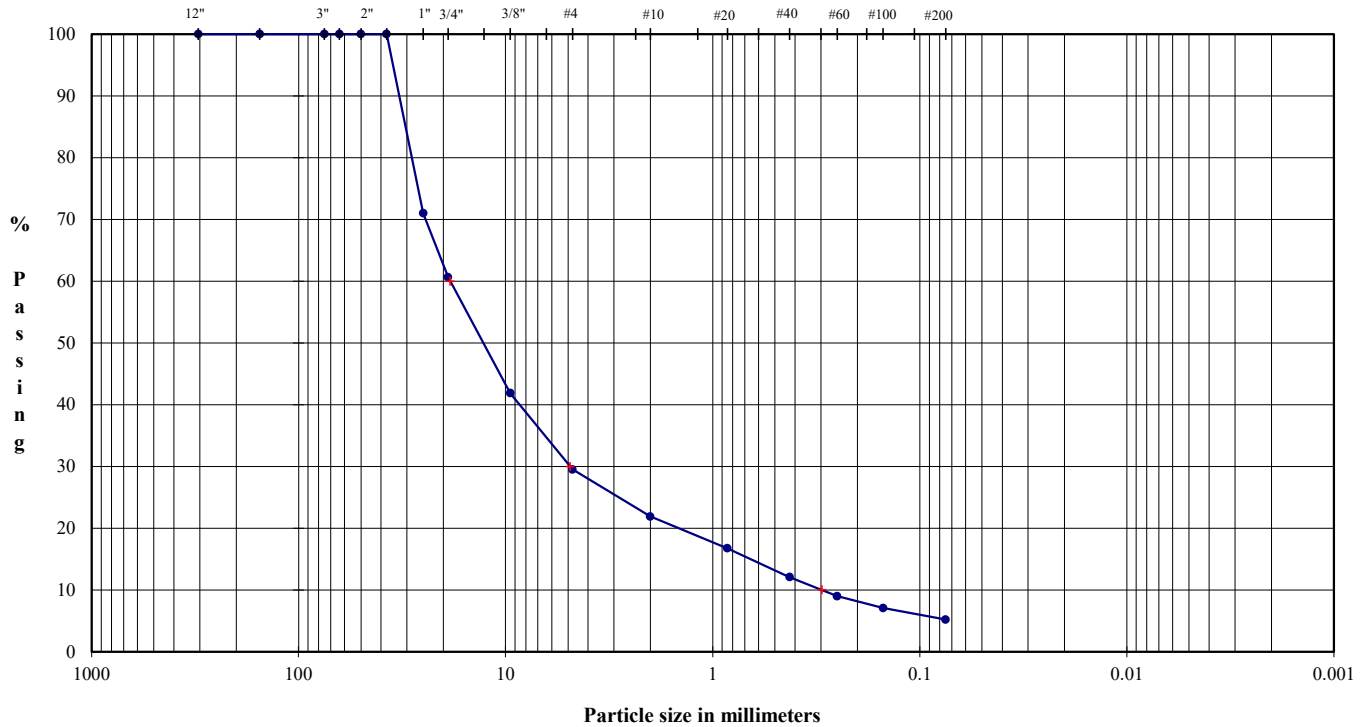
USCS: GW - SW

TECH	RBK
DATE	3/18/22
CHECK	JC
REVIEW	3/11/2024

PARTICLE SIZE DISTRIBUTION

ASTM D 6913

PROJECT NAME: **Woodlands**
 SAMPLE ID: **GB-9 B-3 29-30'**
 TYPE: **GRAB**



COBBLES	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay
	GRAVEL		SAND			FINES

	Particle Size		% Passing	Classification	Percentage
	(mm)				
U.S. Standard Sieves Sizes and Numbers	12.0"	304.8	100.0	Cobbles	0.0
	6.0"	154.2	100.0		
	3.0"	75	100.0		
	2.5"	63.5	100.0		
	2.0"	50	100.0		
	1.5"	37.5	100.0	Coarse Gravel	39.3
	1.0"	25	71.0		
	0.75"	19	60.7		
	0.375"	9.5	41.9		
	#4	4.75	29.5	Fine Gravel	31.2
	#10	2.00	21.9	Coarse Sand	7.6
	#20	0.85	16.7	Medium Sand	9.8
	#40	0.43	12.1		
	#60	0.25	9.0		
	#100	0.15	7.1		
	#200	0.075	5.2	Fine Sand	6.9
Fines					5.2

Moisture Content

3.71

$D_{60} = 18.55$	$D_{30} = 4.88$	$D_{10} = 0.30$
------------------	-----------------	-----------------

 $C_u = D_{60}/D_{10} = 62.6 > 4$
 $C_c = D_{30}^2 / (D_{10} * D_{60}) = 4.3 > 3$

DESCRIPTION: sandy GRAVEL trace fines

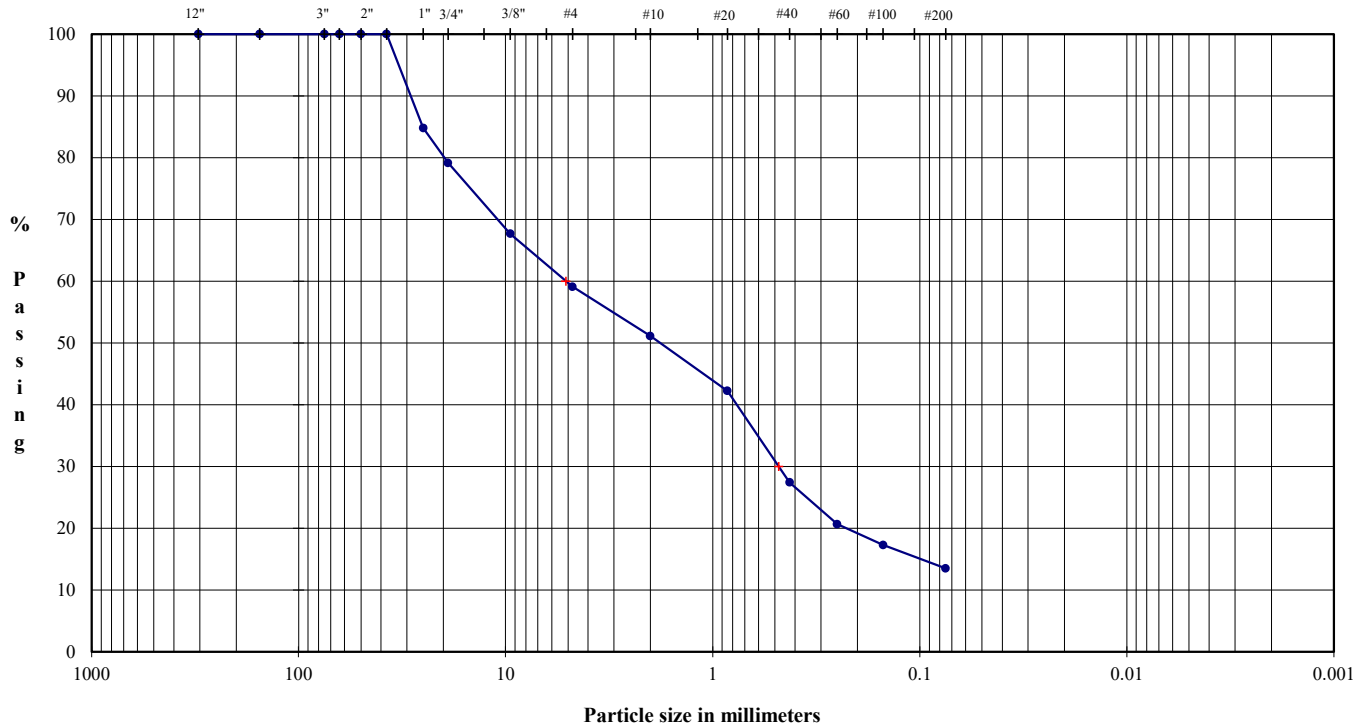
USCS: GP

TECH	RBK
DATE	3/18/22
CHECK	JC
REVIEW	3/11/2024

PARTICLE SIZE DISTRIBUTION

ASTM D 6913

PROJECT NAME: **Woodlands**
 SAMPLE ID: **GB-9 B-4 39-40'**
 TYPE: **GRAB**



	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay
COBBLES	GRAVEL		SAND			FINES

U.S. Standard Sieves Sizes and Numbers

Particle Size			Particle Size	
	(mm)	% Passing	Classification	Percentage
12.0"	304.8	100.0	Cobbles	0.0
6.0"	154.2	100.0		
3.0"	75	100.0		
2.5"	63.5	100.0		
2.0"	50	100.0	Coarse Gravel	20.8
1.5"	37.5	100.0		
1.0"	25	84.8		
0.75"	19	79.2		
0.375"	9.5	67.7	Fine Gravel	20.1
#4	4.75	59.1		
#10	2.00	51.1	Coarse Sand	8.0
#20	0.85	42.2	Medium Sand	23.7
#40	0.43	27.4		
#60	0.25	20.6		
#100	0.15	17.3		
#200	0.075	13.5	Fine Sand	13.9
			Fines	13.5

Moisture Content

3.11

$D_{60} = 5.12$	$D_{30} = 0.48$	$D_{10} = \#N/A$
-----------------	-----------------	------------------

$C_u = D_{60}/D_{10} = \#N/A$ $\#N/A$
 $C_c = D_{30}^2/(D_{10} \cdot D_{60}) = \#N/A$ $\#N/A$

DESCRIPTION: SILTY GRAVEL and SILTY SAND

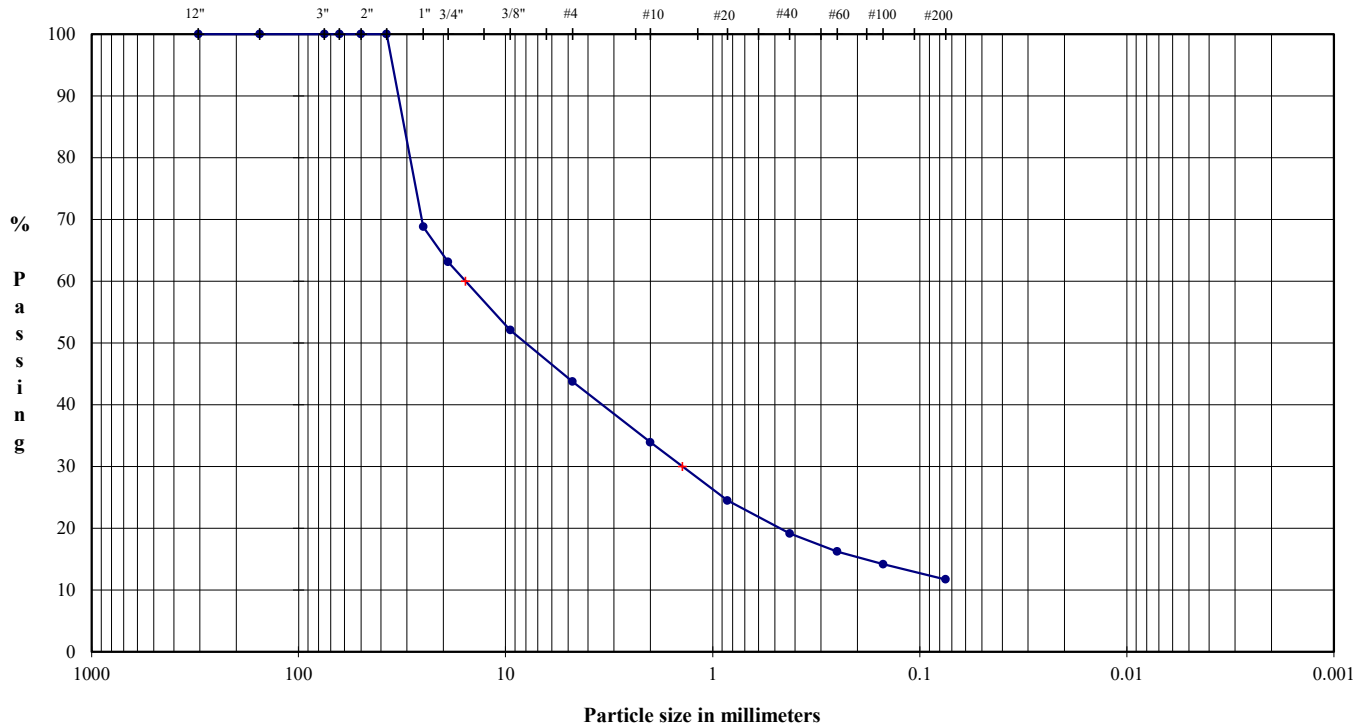
USCS: GM - SM

TECH	RBK
DATE	3/18/22
CHECK	JC
REVIEW	3/11/2024

PARTICLE SIZE DISTRIBUTION

ASTM D 6913

PROJECT NAME: **Woodlands**
 SAMPLE ID: **GB-9 B-5 49-50'**
 TYPE: **GRAB**



	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay
COBBLES	GRAVEL		SAND			FINES

U.S. Standard Sieves Sizes and Numbers

Particle Size			Particle Size	
	(mm)	% Passing	Classification	Percentage
12.0"	304.8	100.0	Cobbles	0.0
6.0"	154.2	100.0		
3.0"	75	100.0		
2.5"	63.5	100.0		
2.0"	50	100.0	Coarse Gravel	36.9
1.5"	37.5	100.0		
1.0"	25	68.8		
0.75"	19	63.1		
0.375"	9.5	52.1	Fine Gravel	19.4
#4	4.75	43.7		
#10	2.00	33.9	Coarse Sand	9.8
#20	0.85	24.5	Medium Sand	14.8
#40	0.43	19.1		
#60	0.25	16.3		
#100	0.15	14.2		
#200	0.075	11.7	Fine Sand	7.4
			Fines	11.7

Moisture Content

5.60

$D_{60} = 15.64$	$D_{30} = 1.40$	$D_{10} = \text{#N/A}$
------------------	-----------------	------------------------

Cu = $D_{60}/D_{10} =$ #N/A #N/ACc = $D_{30}^2/(D_{10} \cdot D_{60}) =$ #N/A #N/A

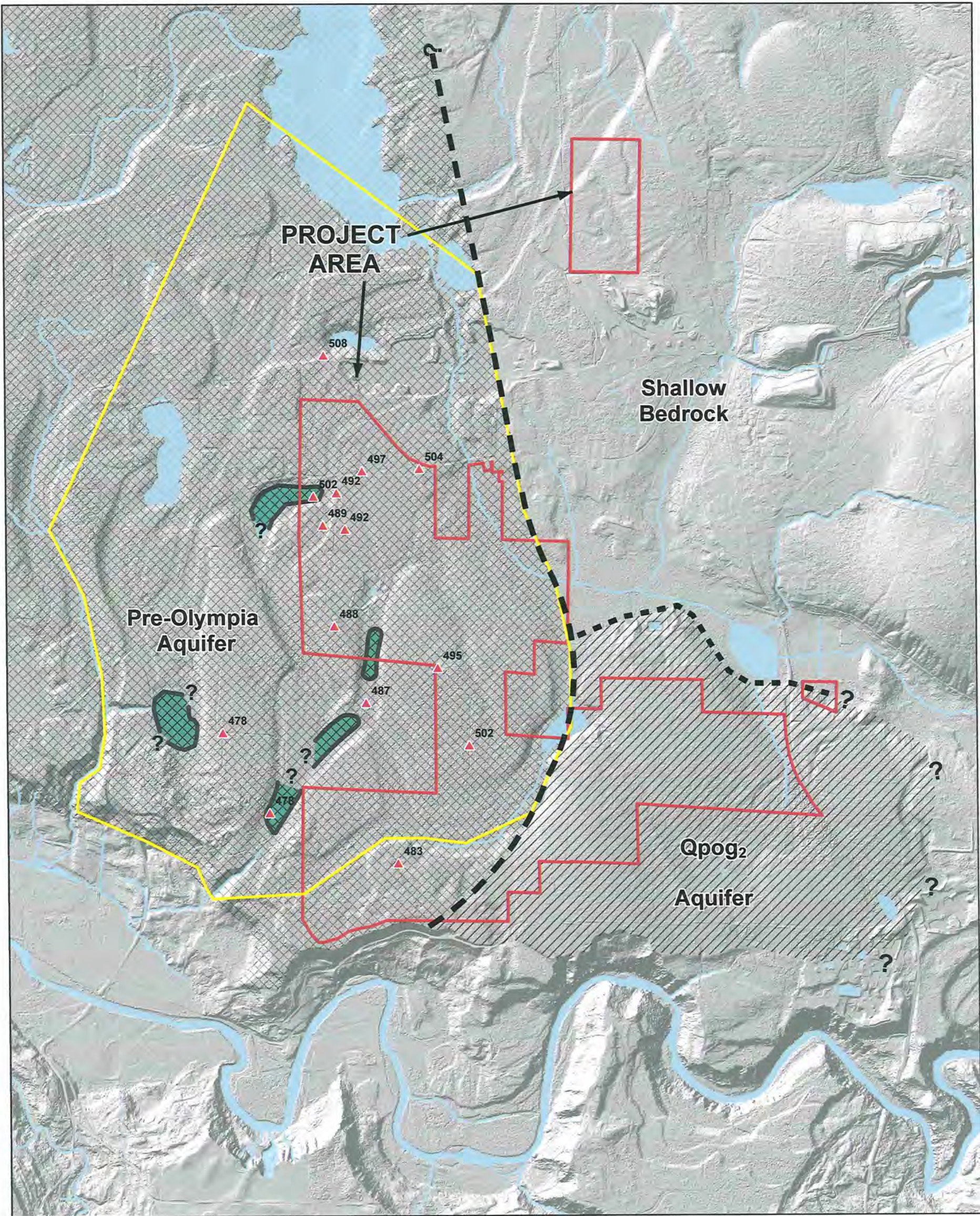
DESCRIPTION: GRAVEL and SAND some fines

USCS: GW - SW

TECH	RBK
DATE	3/18/22
CHECK	JC
REVIEW	3/11/2024

APPENDIX E

**Figure 27 from the EIS Technical Report on
Geology, Soils, and Groundwater (AESI, 2008)**



Legend

- ▲ 514 Pre-Olympia Aquifer Well Location and Water Elevation from June 19, 2008
- Till Window
- Ground Water Flow Direction
- Extent of the Pre-Olympia Aquifer
- Extent of the Qpog2 Aquifer
- Area of Pre-Olympia Aquifer tributary to Crisp Creek Springs and Springs along Green River slope between Crisp Creek and southwest corner of Main Property

0 1,000 2,000 Feet

Reference: parcel outlines, waterbodies, King County GIS Center, acquired 2-08; Shaded relief and contours generated from 1 meter DEM acquired from King County GIS center, 2-08

Associated Earth Sciences, Inc.



PRE-OLYMPIA AQUIFER AND Qpog₂ AQUIFER GROUND WATER DISTRIBUTION AND FLOW MAP
THE VILLAGES
BLACK DIAMOND, WASHINGTON

FIGURE 27

DATE 9/08

PROJ. NO. KG060601A

N:\060601\KG060601\KG060601_Figures_3_08\Draft_Pre_Oly_Aquifer_GW_flow.mxd

APPENDIX F

Groundwater Hydrographs

Figure F-1
Composite Groundwater Elevation Hydrograph

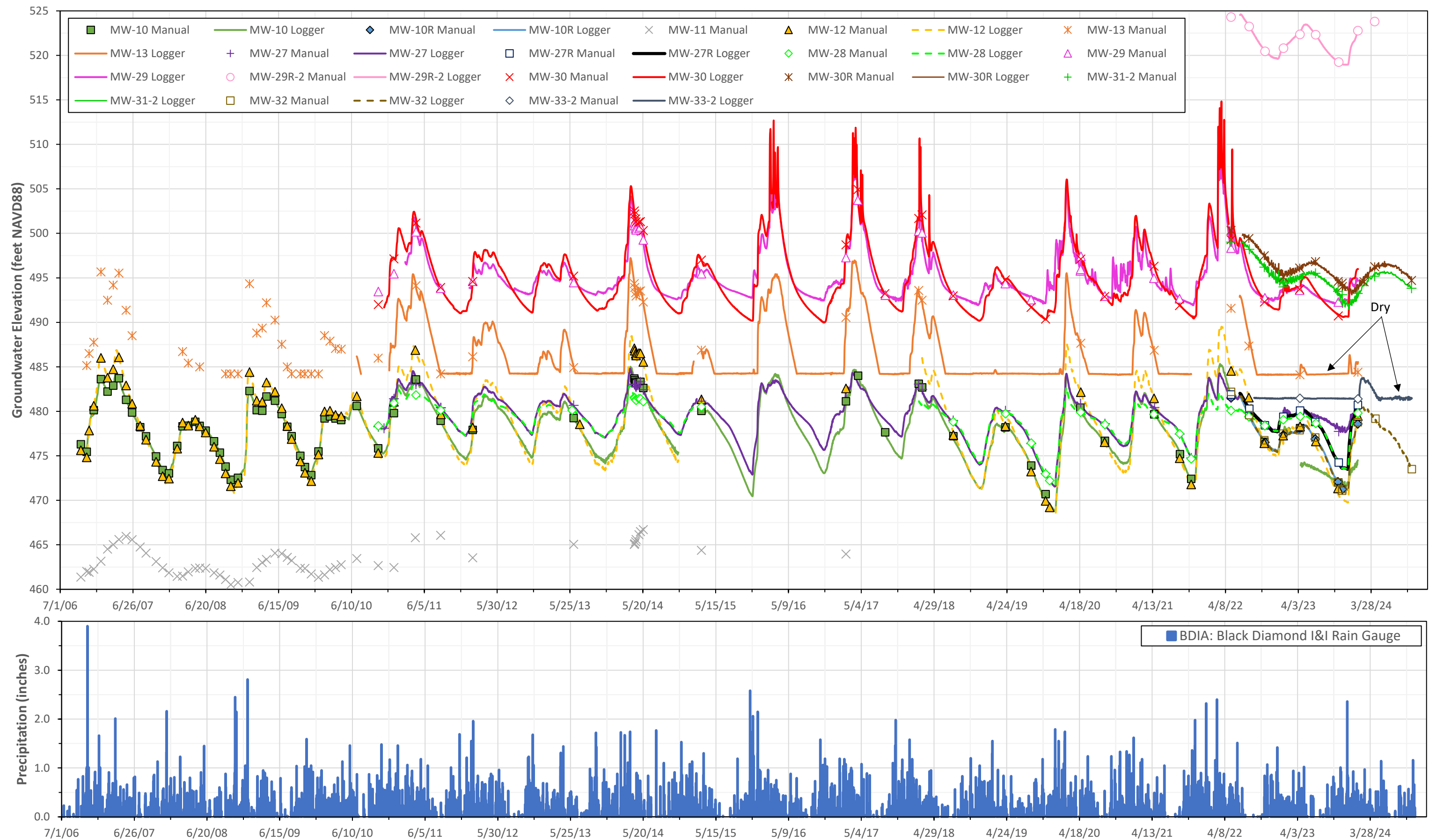


Figure F-2
MW-10 Groundwater Elevation Hydrograph

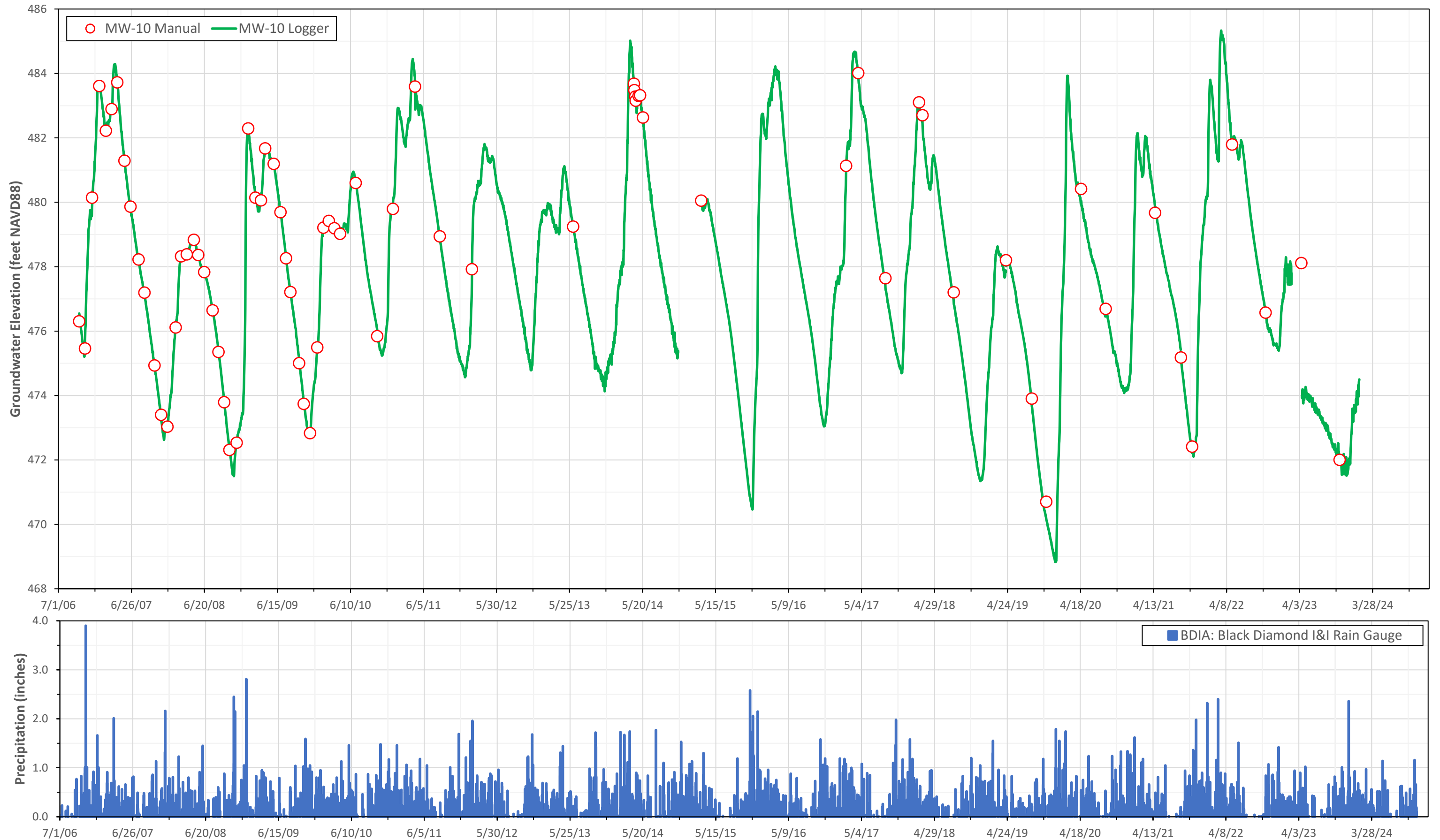


Figure F-3
MW-10R Groundwater Elevation Hydrograph

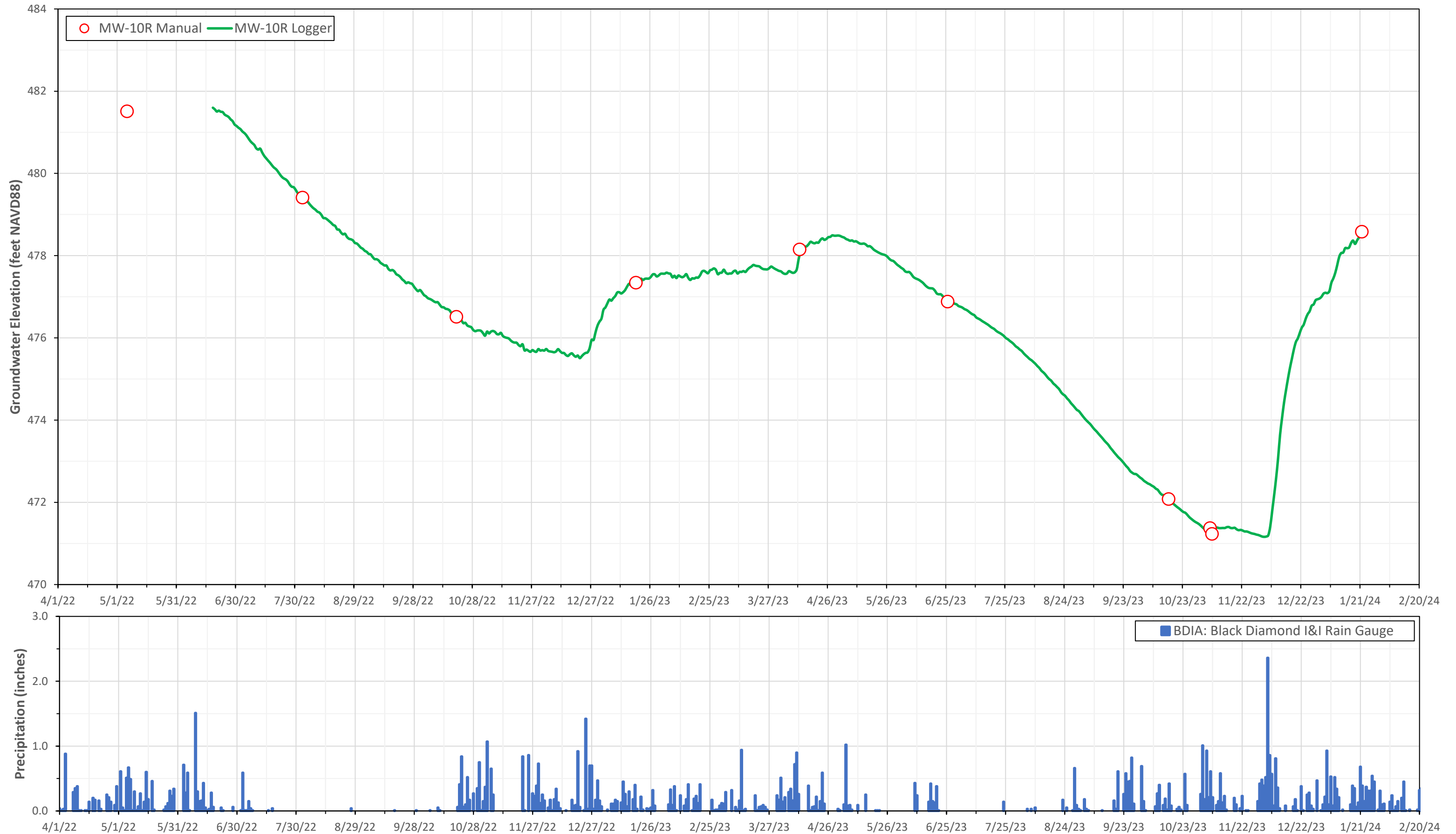


Figure F-4
MW-11 Groundwater Elevation Hydrograph

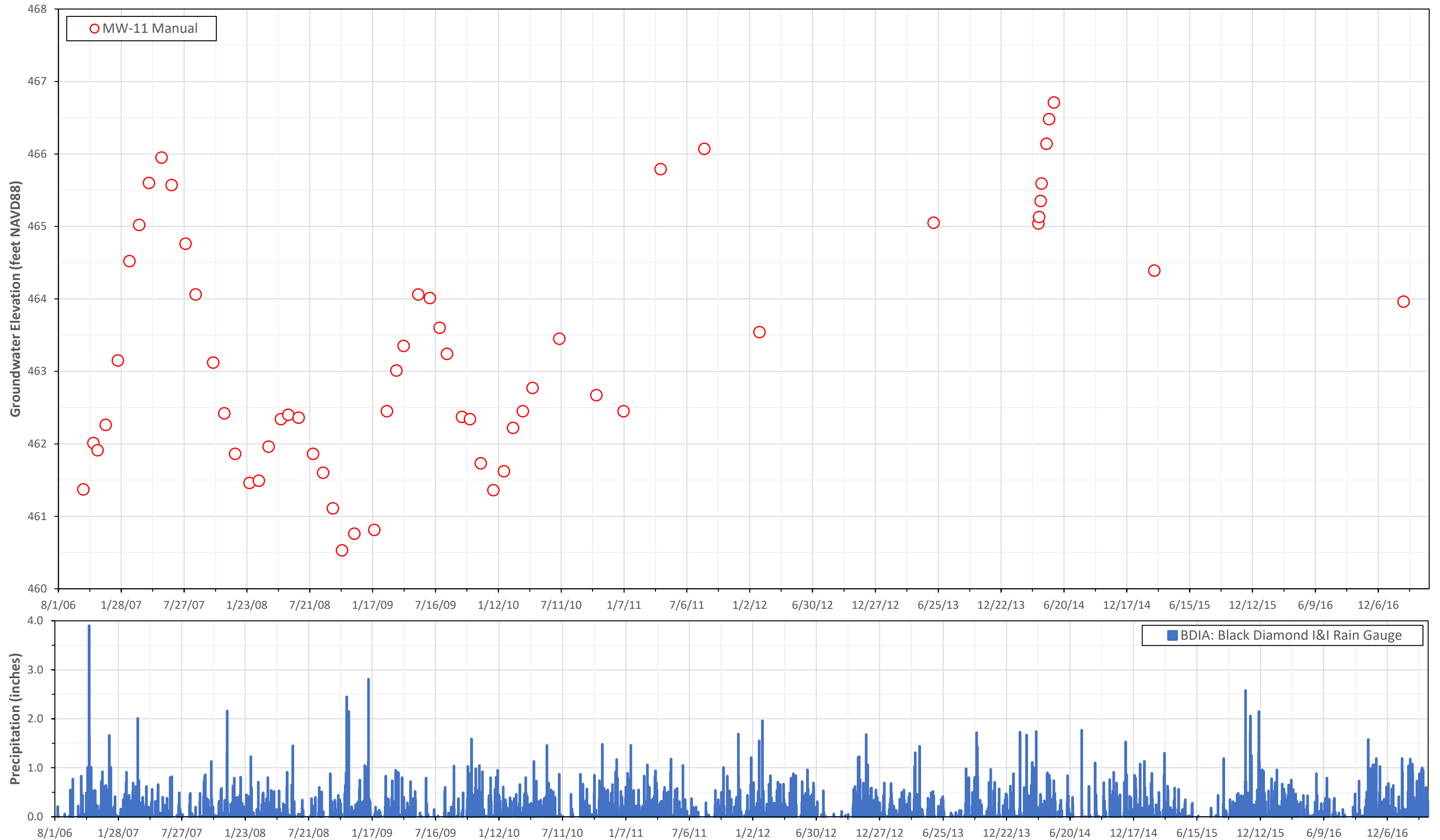


Figure F-5
MW-12 Groundwater Elevation Hydrograph

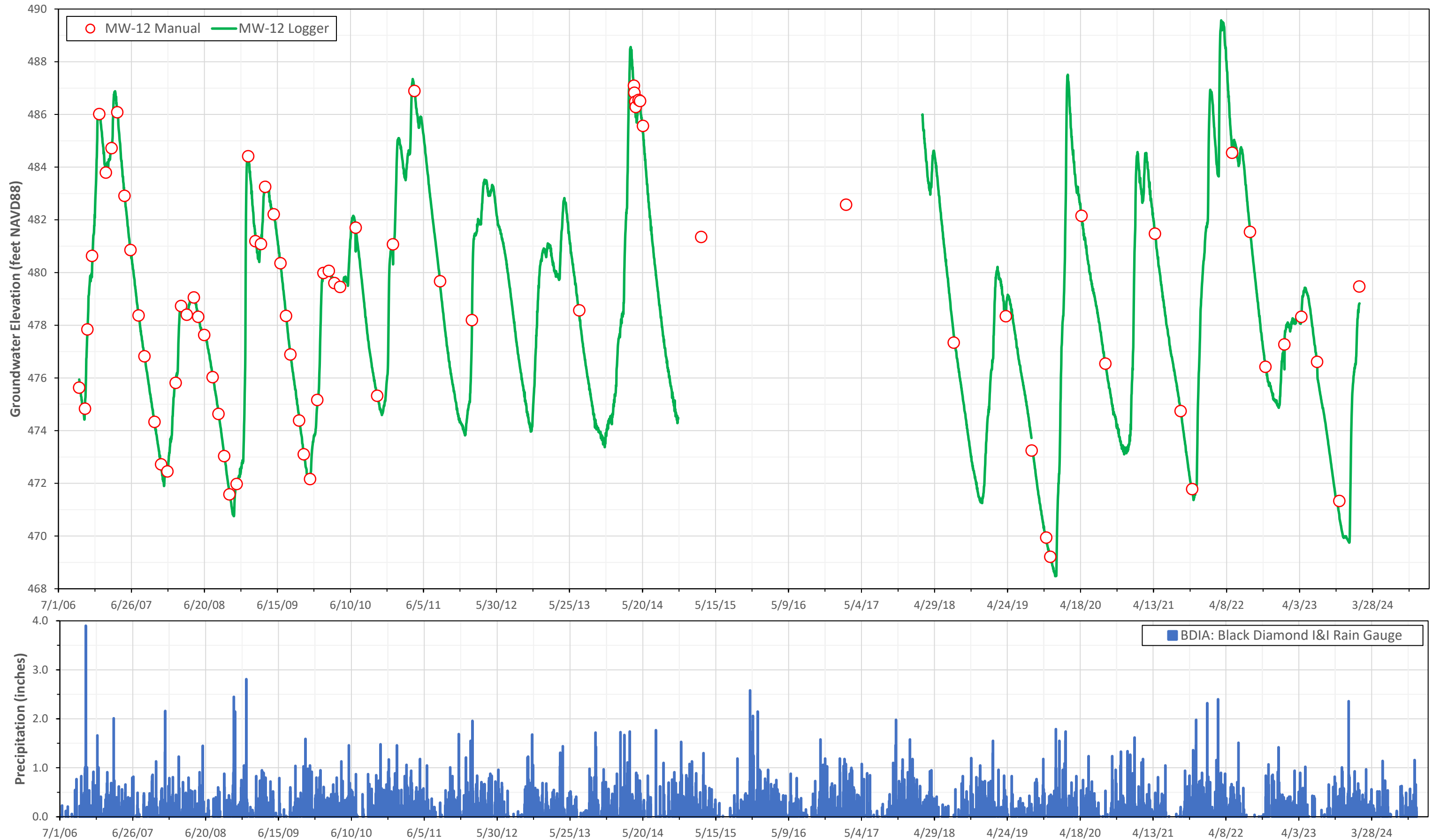


Figure F-6
MW-13 Groundwater Elevation Hydrograph

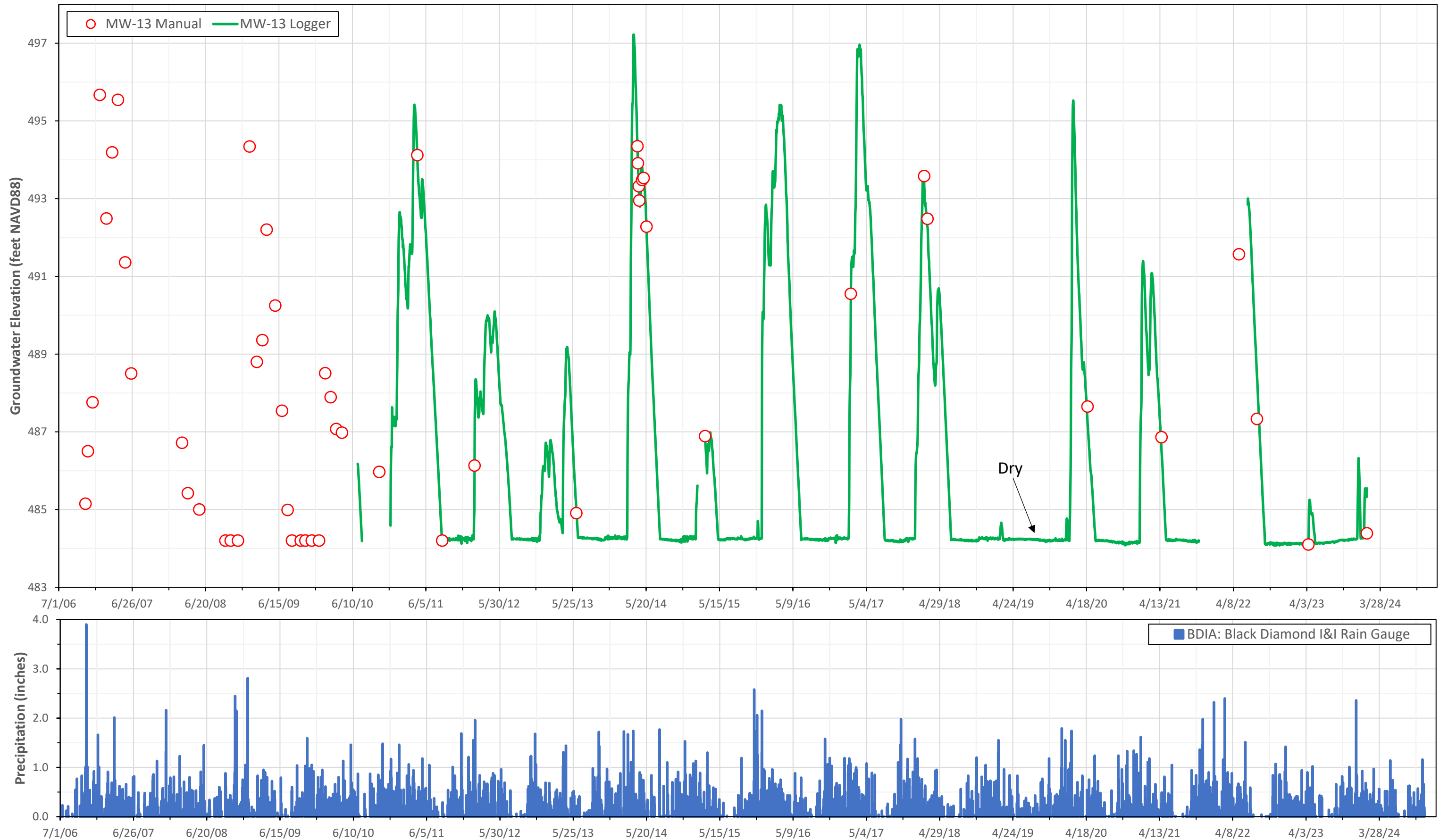


Figure F-7
MW-27 Groundwater Elevation Hydrograph

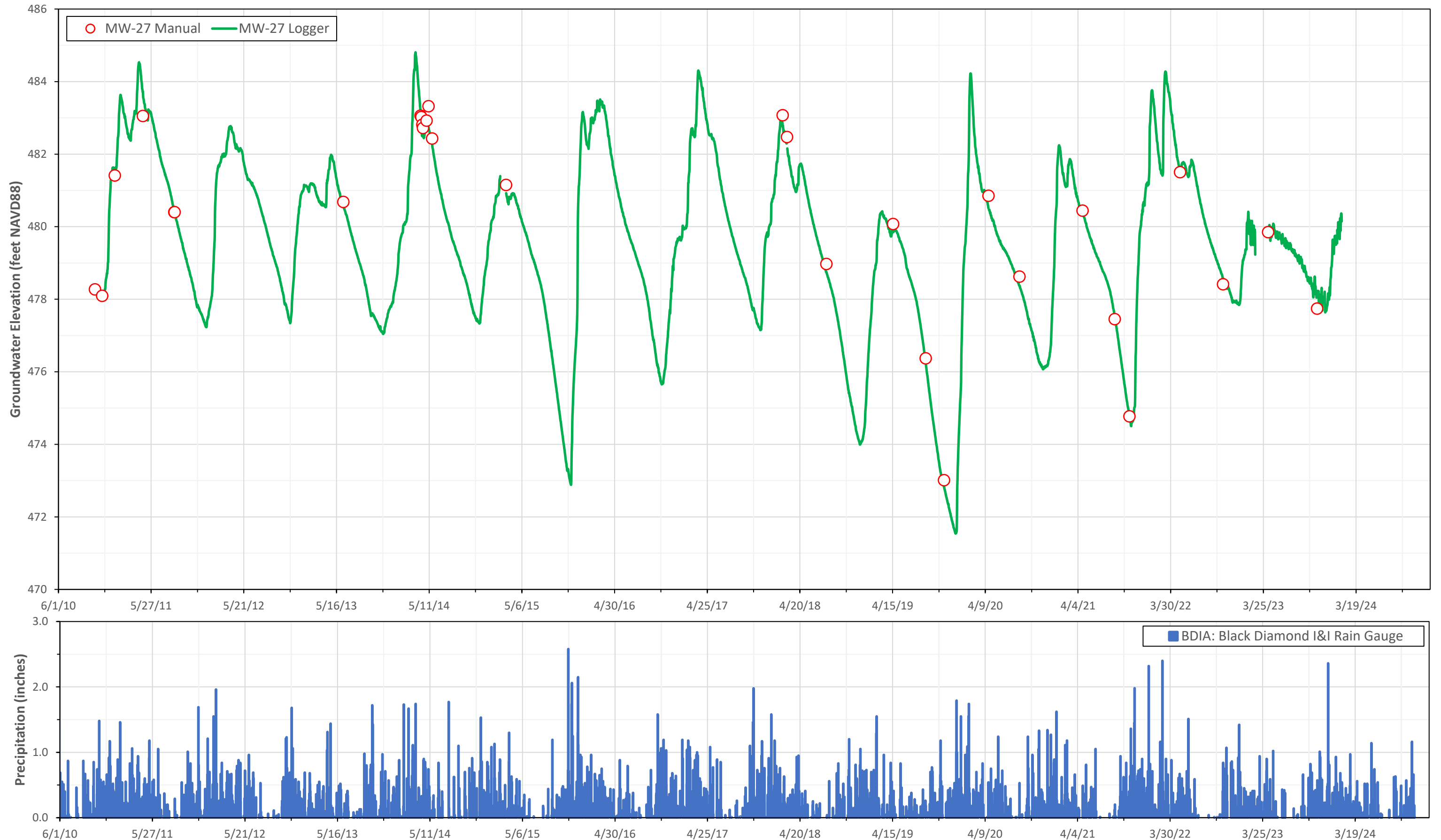


Figure F-8
MW-27R Groundwater Elevation Hydrograph

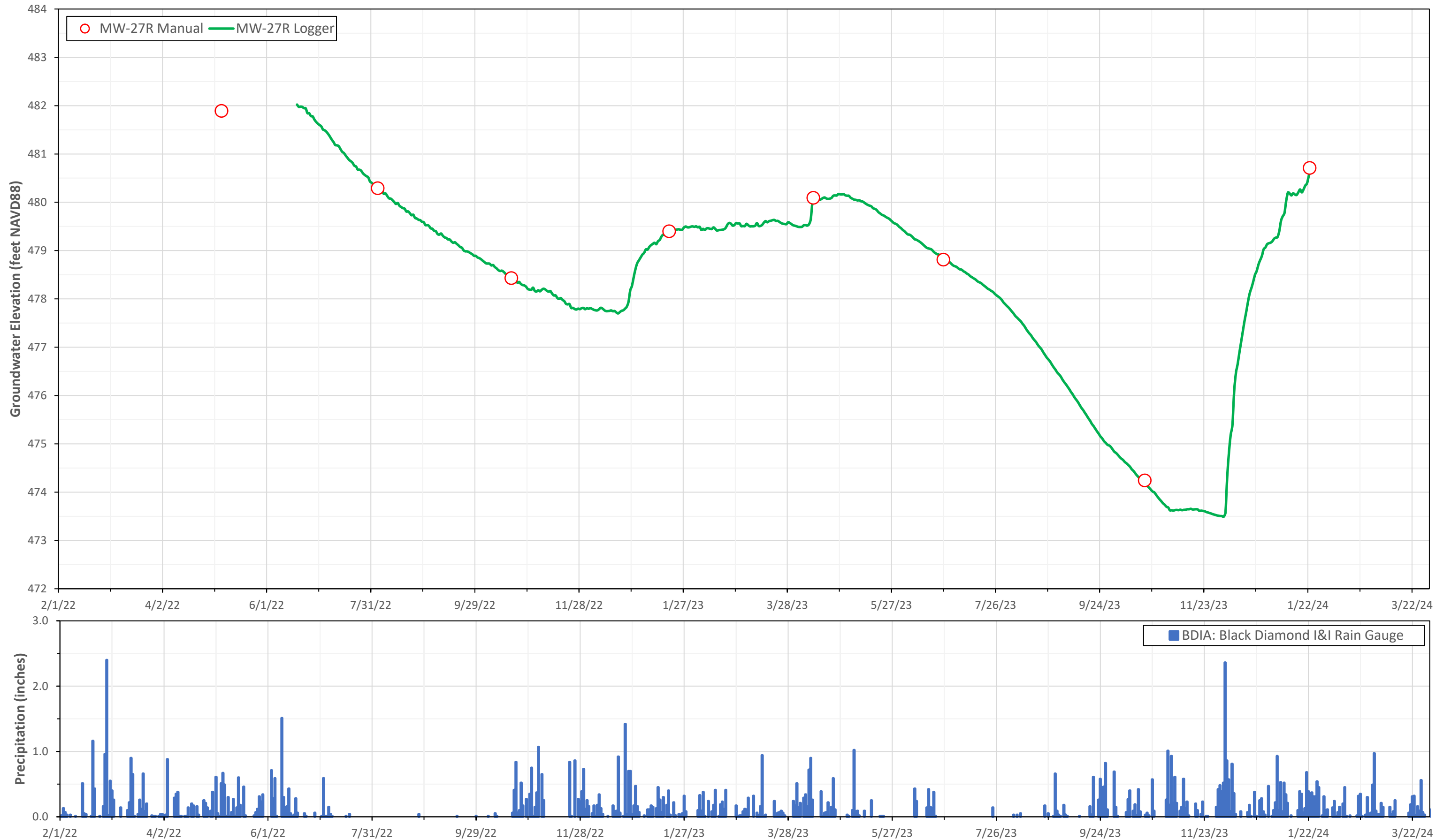


Figure F-9
MW-28 Groundwater Elevation Hydrograph

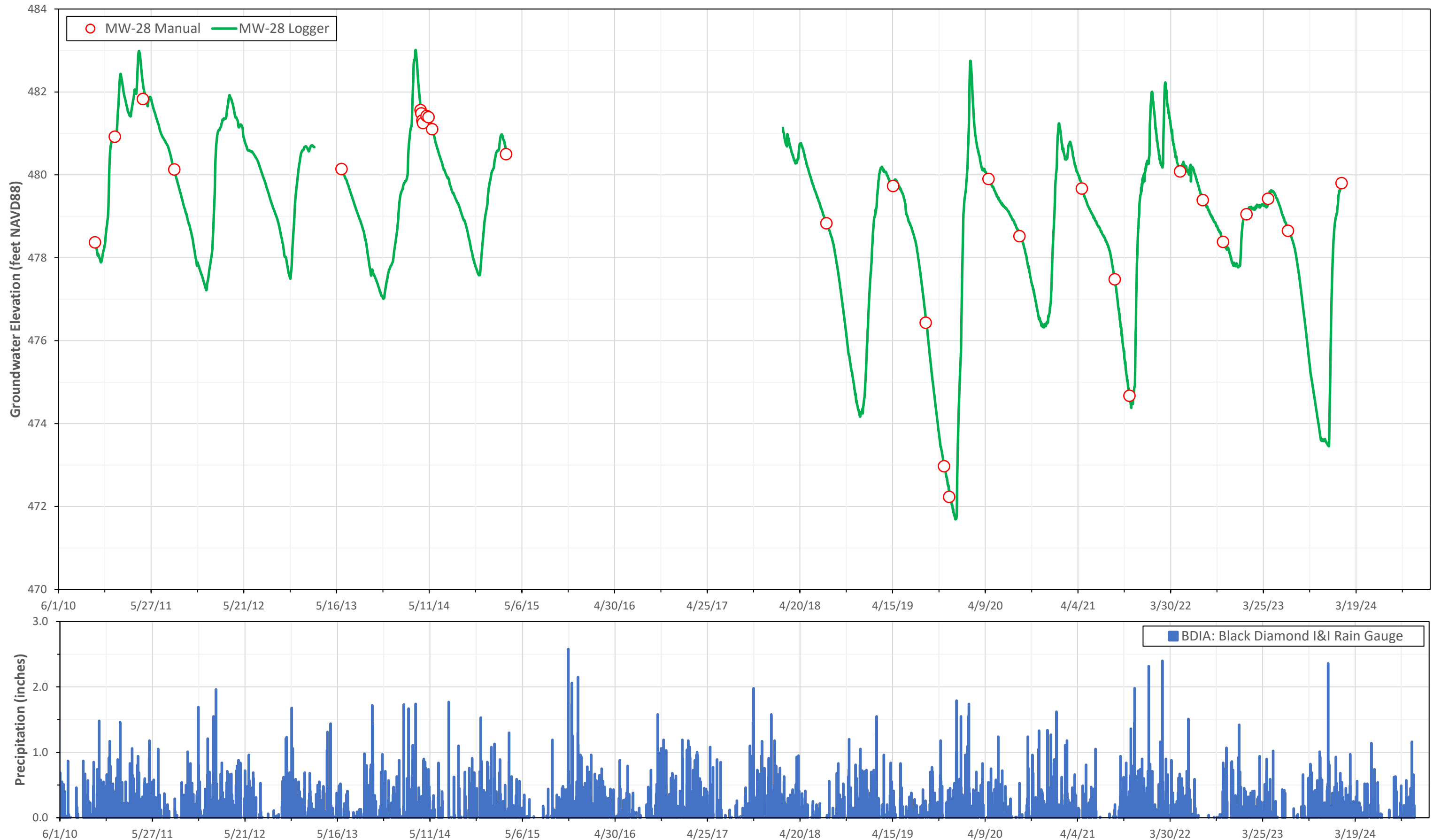


Figure F-10
MW-29 Groundwater Elevation Hydrograph

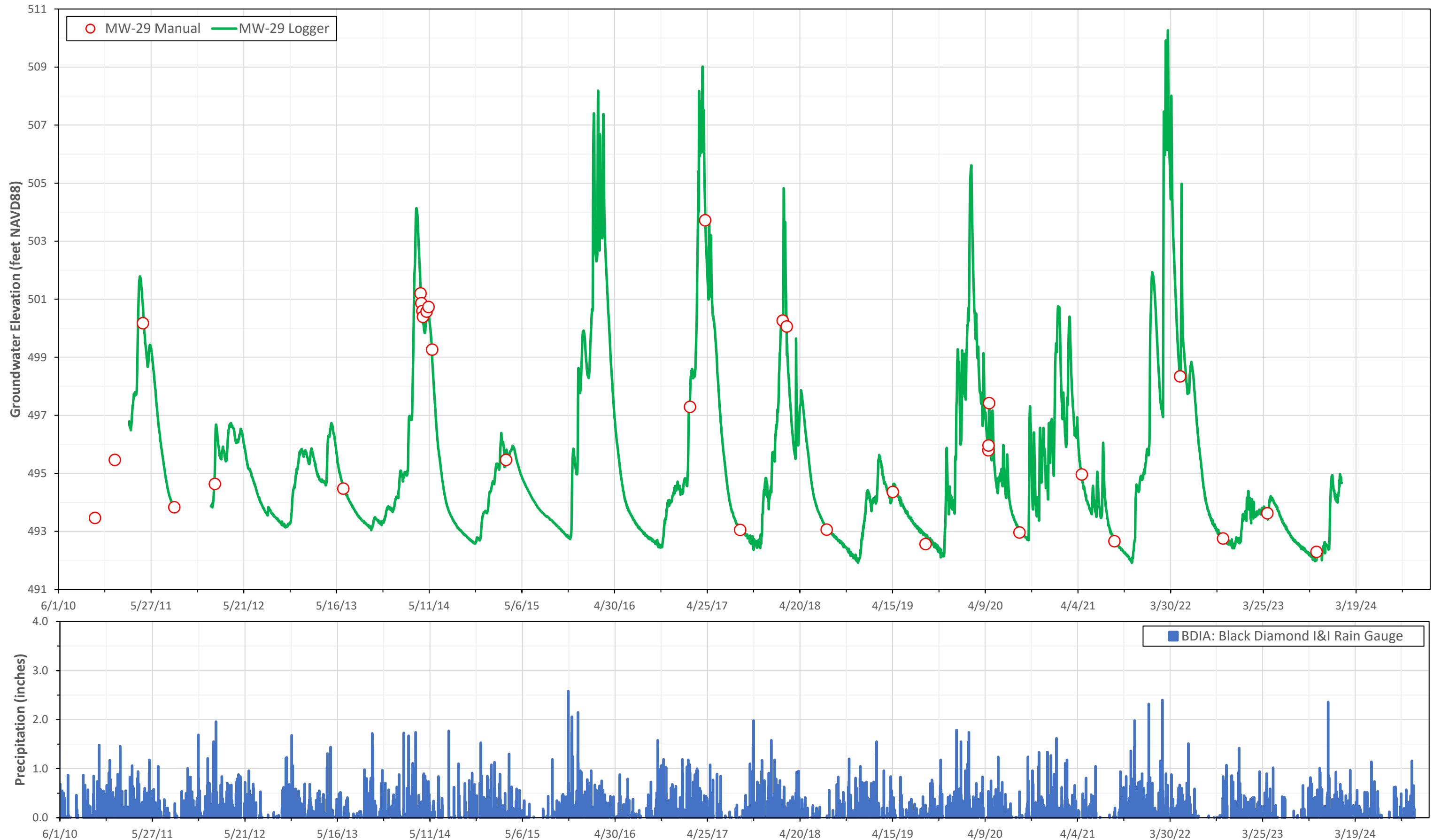


Figure F-11
MW-29R-2 Groundwater Elevation Hydrograph

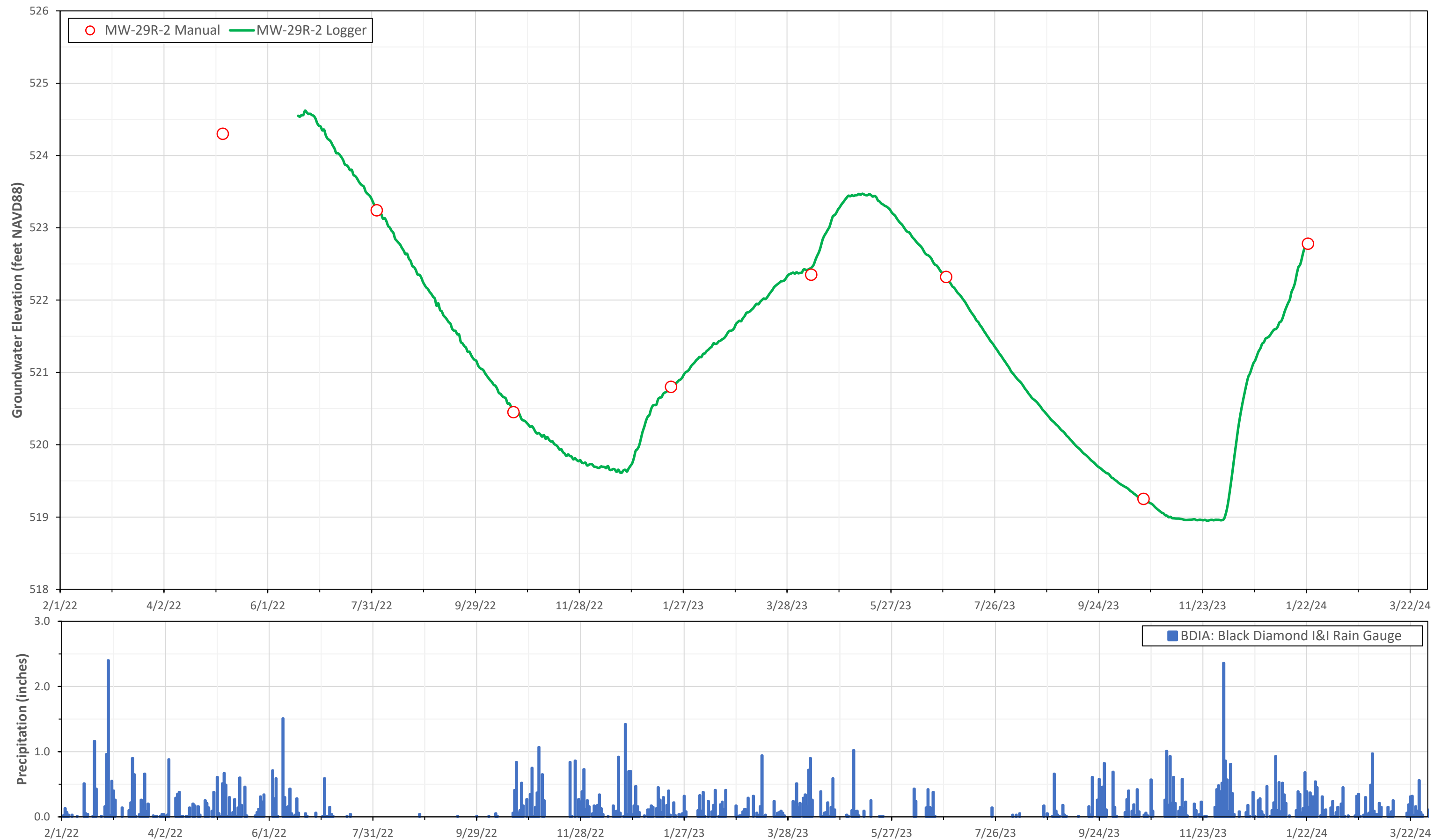


Figure F-12
MW-30 Groundwater Elevation Hydrograph

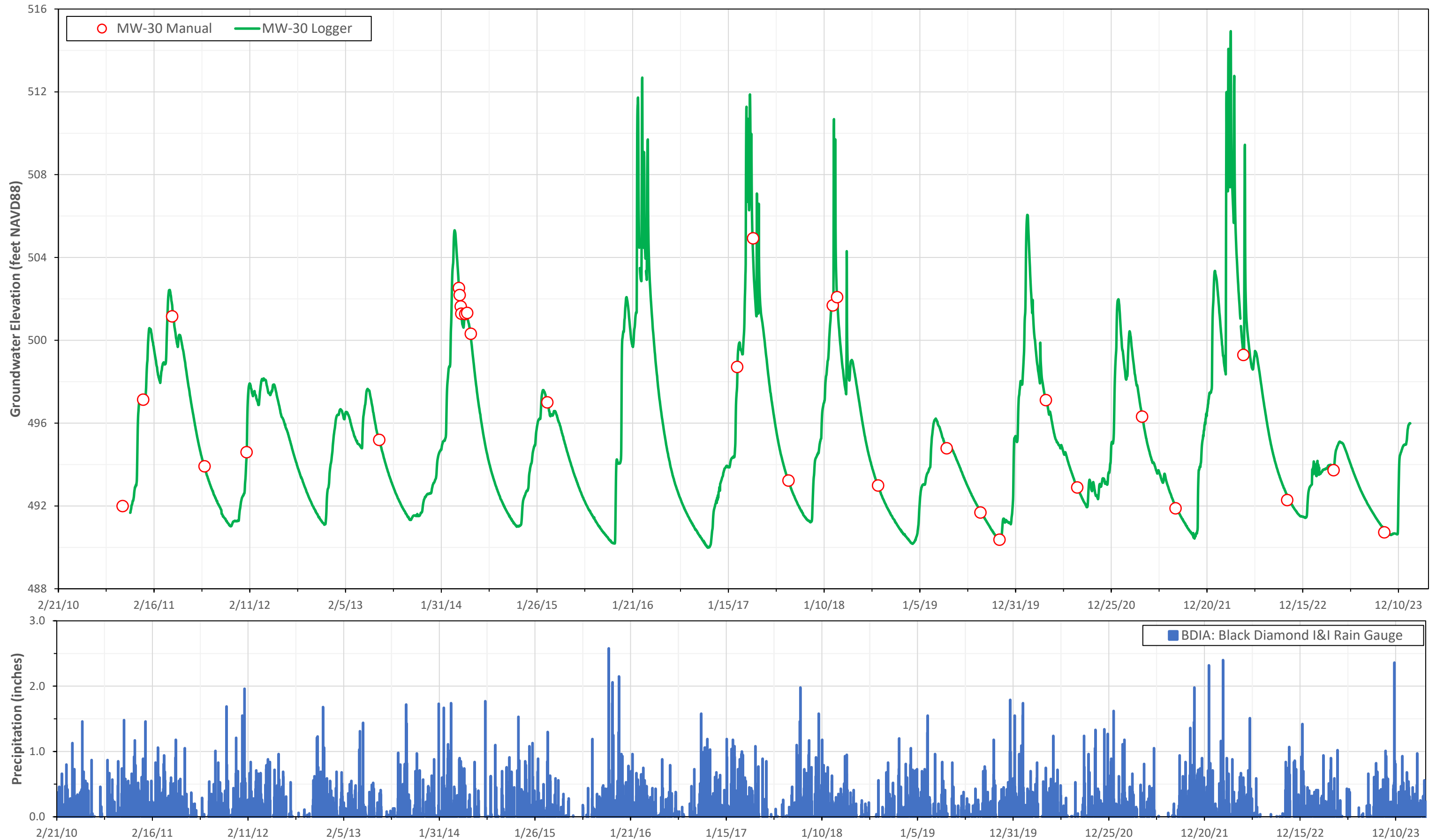


Figure F-13
MW-30R Groundwater Elevation Hydrograph

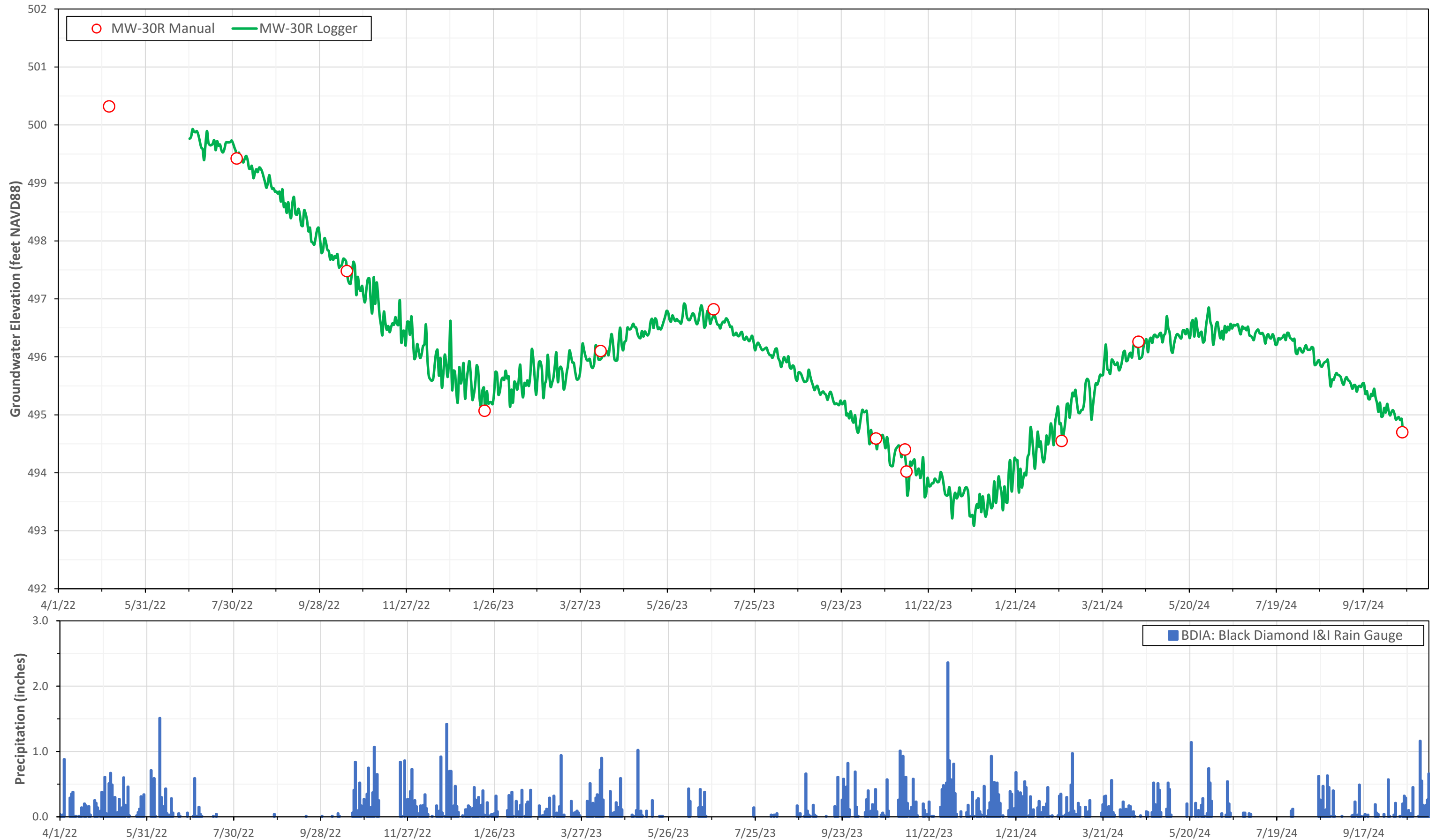


Figure F-14
MW-31-2 Groundwater Elevation Hydrograph

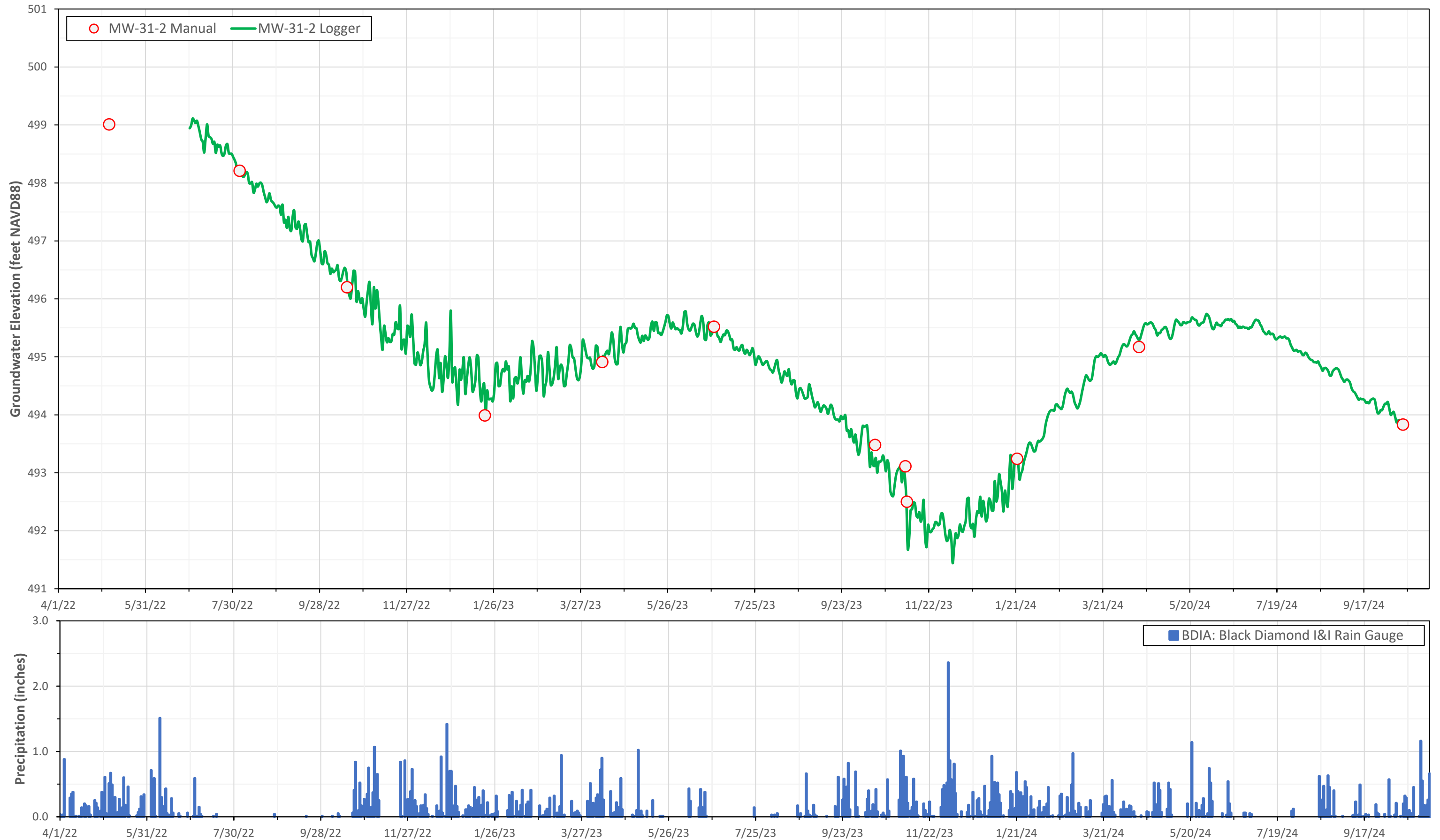


Figure F-15
MW-32 Groundwater Elevation Hydrograph

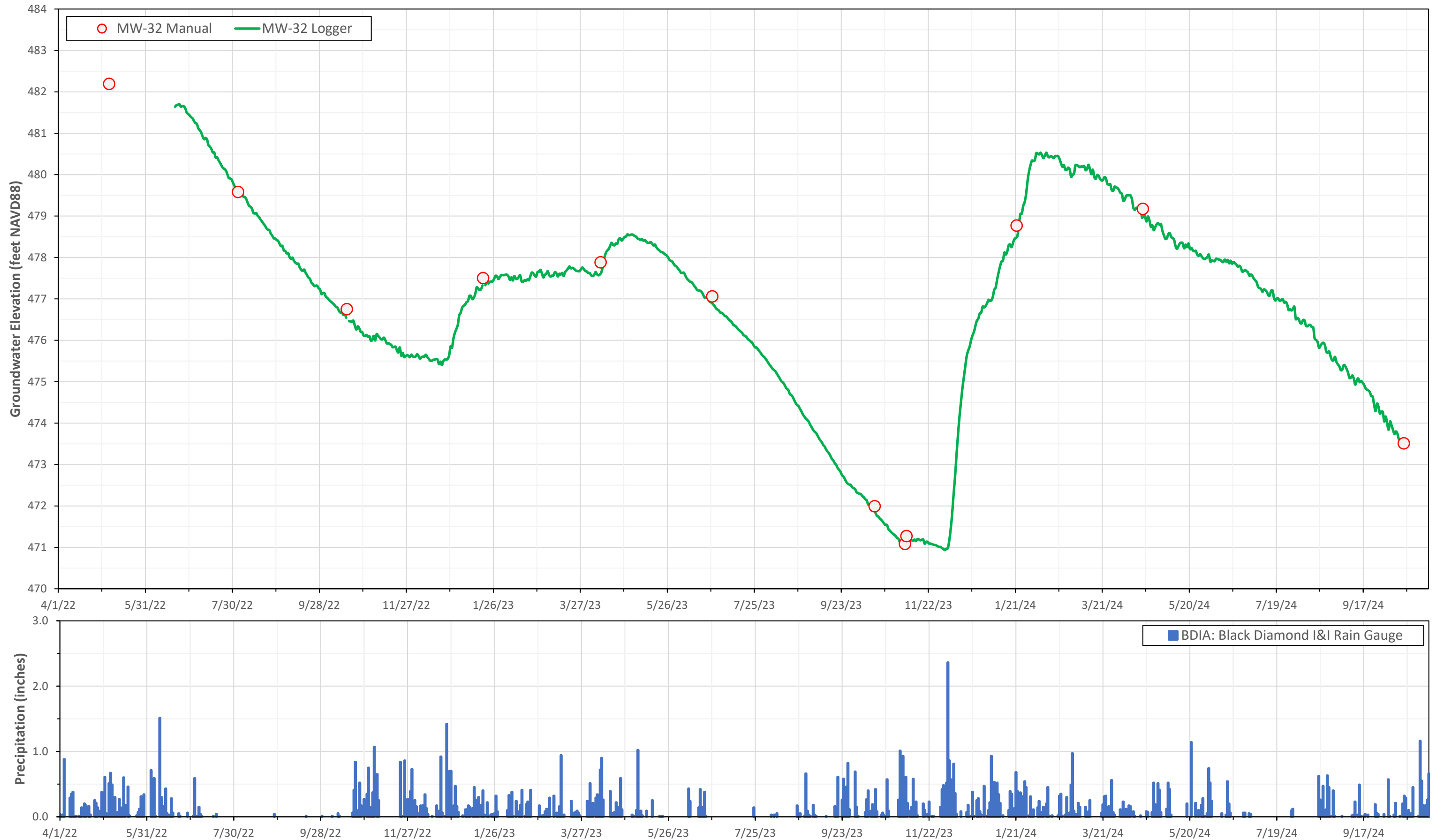
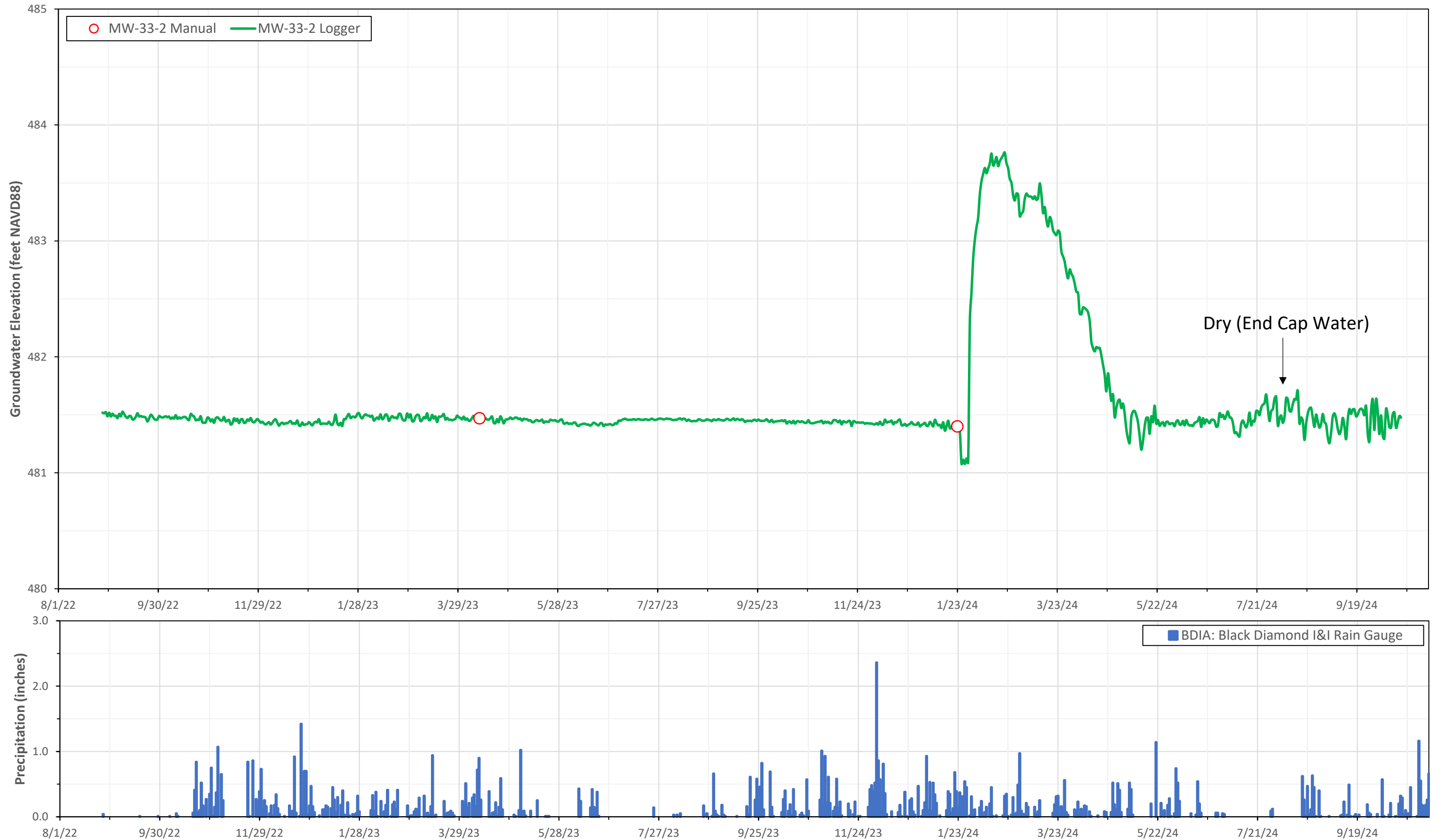


Figure F-16
MW-33-2 Groundwater Elevation Hydrograph



APPENDIX G

Groundwater Mounding Analysis

APPENDIX G GROUNDWATER MOUNDING ANALYSIS

The groundwater mounding analysis was completed to simulate the maximum groundwater mound height and compare it to the design high water elevation (DHWE) in the proposed infiltration facility. Groundwater mounding can occur when water is introduced into an infiltration facility at a higher rate than can be conveyed from the area beneath the facility. The introduced water can “mound” on the groundwater table or on a less-permeable interbed within the receptor soil during a storm event. When the storm event is over and water is not introduced into the system, the mound will normally dissipate. The mounding analysis is used to simulate the maximum groundwater mound beneath the facility during a design storm series.

The MODRET computer program (Wet Weather Software, 2016) was used to model potential groundwater mounding beneath the proposed infiltration facility under two design time series. Infiltration system civil design details and stormwater inflow hydrographs were provided by DEA. The MODRET program utilizes the Greene Ampt method for unsaturated conditions and the U.S. Geological Survey (USGS) MODFLOW model for saturated conditions.

The soil and groundwater input parameters used in the MODRET evaluation were consistent with field/laboratory data and applicable published hydrogeologic literature. The model input parameters are included in this Appendix and an explanation of the basis for all parameters used is included in Table G-1. The civil design and hydrogeologic conceptual model are described below.

Civil Design and Proposed Stormwater Inflow Hydrographs

Stormwater management proposes to use an open basin infiltration facility consisting of three adjacent cells.

- Cell #1: Lined pre-settlement cell with no infiltration.
- Cell #2: Sand filter cell that allows infiltration. All stormwater that flows out of Cell #1 is conveyed to Cell #2.
- Cell #3: Infiltration cell that allows infiltration. Stormwater flows/volumes that exceed the infiltration capacity and storage volume in Cell #2 are conveyed to Cell #3.

The modeled infiltration facility is located in the eastern portion of the Reserve and in the vicinity of wells MW-29 and MW-30 (Golder Associates, 2013). In addition, the modeled infiltration facility footprint encompasses the existing Interim Infiltration Facility constructed to infiltrate water pumped from Horseshoe Lake. This section describes the civil design elements of the facility.

Current preliminary sizing of the infiltration facility for the modeled portion of the facility includes:

- Cell #2: Approximately 295 feet wide by 322 feet long, with 1.5-foot-thick layer of clean sand fill, and a storage volume above the clean sand fill of 865,720 cubic feet. This volume is considered conservative because the pore space volume within the clean sand fill was not included in our model.
- Cell #3: Approximately 283 feet wide by 779 feet long, and a storage volume of 1,860,447 cubic feet.

DEA provided two stormwater hydrographs for the facility: the first from a period that includes the highest flow rate (peak flow) and a second from a period of maximum volume, derived from the Western Washington Hydrology Model, 2012 (WWHM2012) surface water model. DEA's analyses of the simulated rainfall data indicate the period of the 31-day peak flow hydrograph is October 5, 2003 to November 4, 2003, with the peak flow occurring on October 20, 2003. The 30-day date range with the maximum volume is November 2, 2006 to December 1, 2006. The 31-day and 30-day hydrographs are included in this Appendix.

DEA also provided facility elevation and volume parameters for the infiltration facility in a stamped, signed letter, dated October 31, 2024. We estimate for infiltration design considerations that the seasonal high groundwater level would be on the order of elevation 505 at the location of the proposed facility. These facility parameters are included in Table G-1, and DEA's letter is included in this Appendix.

Hydrogeologic Conceptual Model and Aquifer Parameters

As described in section 5.2 *Infiltration* of this report, short-term, emergency pumping from Horseshoe Lake into the Interim Infiltration Facility was used to estimate a design infiltration rate for the Interim Infiltration Facility and Cell #4 (Golder Associates, 2018). A preliminary design rate of 5.1 inches per hour (in/hr) was used for our groundwater mounding analysis.

The preliminary design infiltration rate of 5.1 in/hr can be expressed as 10.2 feet per day (ft/day) and is considered the saturated vertical hydraulic conductivity (Kvs). The model requires input of two hydraulic conductivity values: saturated horizontal hydraulic conductivity (Khs) and unsaturated vertical hydraulic conductivity (Kvu). To derive a value for Khs, we used a relationship of Khs equal to three times the Kvs. This value is generally considered conservative, within the range of published hydraulic conductivity ratio values for sediments deposited by flowing water and is required by jurisdictions such as King County (in Section 5.2.1 of King County's *Surface Water Design Manual*, 2021). Kvu is assumed to be two-thirds the value of Kvs (Andreyev and Wiseman, 1989).

The infiltration design includes a facility bottom elevation for Cell #2 of 527.5 feet and for Cell #3 of 525.0 feet. We assumed a facility bottom elevation of 525 feet for the entire facility (Cells #2 and #3), which is considered conservative.

The bottom of the aquifer was modeled as elevation 450 feet which equates to an aquifer thickness of 55 feet. Based on the information, provided in section 4.0 *Subsurface Conditions*, this bottom of aquifer elevation is considered conservative.

We assumed the seasonal high groundwater level to be 505 feet for the analysis. Table G-1 presents the model input values for the infiltration facility and the basis for these values.

Groundwater Mounding Analysis Results

The results of the MODRET simulation are included in this Appendix and indicate that the modeled infiltration facility will have the capacity to infiltrate the stormwater runoff routed to the facility during the design storm time series hydrographs provided by DEA without reaching the DHWE. Under both the peak flow and maximum volume hydrographs, the maximum groundwater mound elevation was above the facility bottom elevation for Cell #2 of 527.5 feet and for Cell #3 of 525.0 feet and below the DHWE at Cell #2 of 533.5 feet and at Cell #3 of 532.5 feet.

REFERENCES

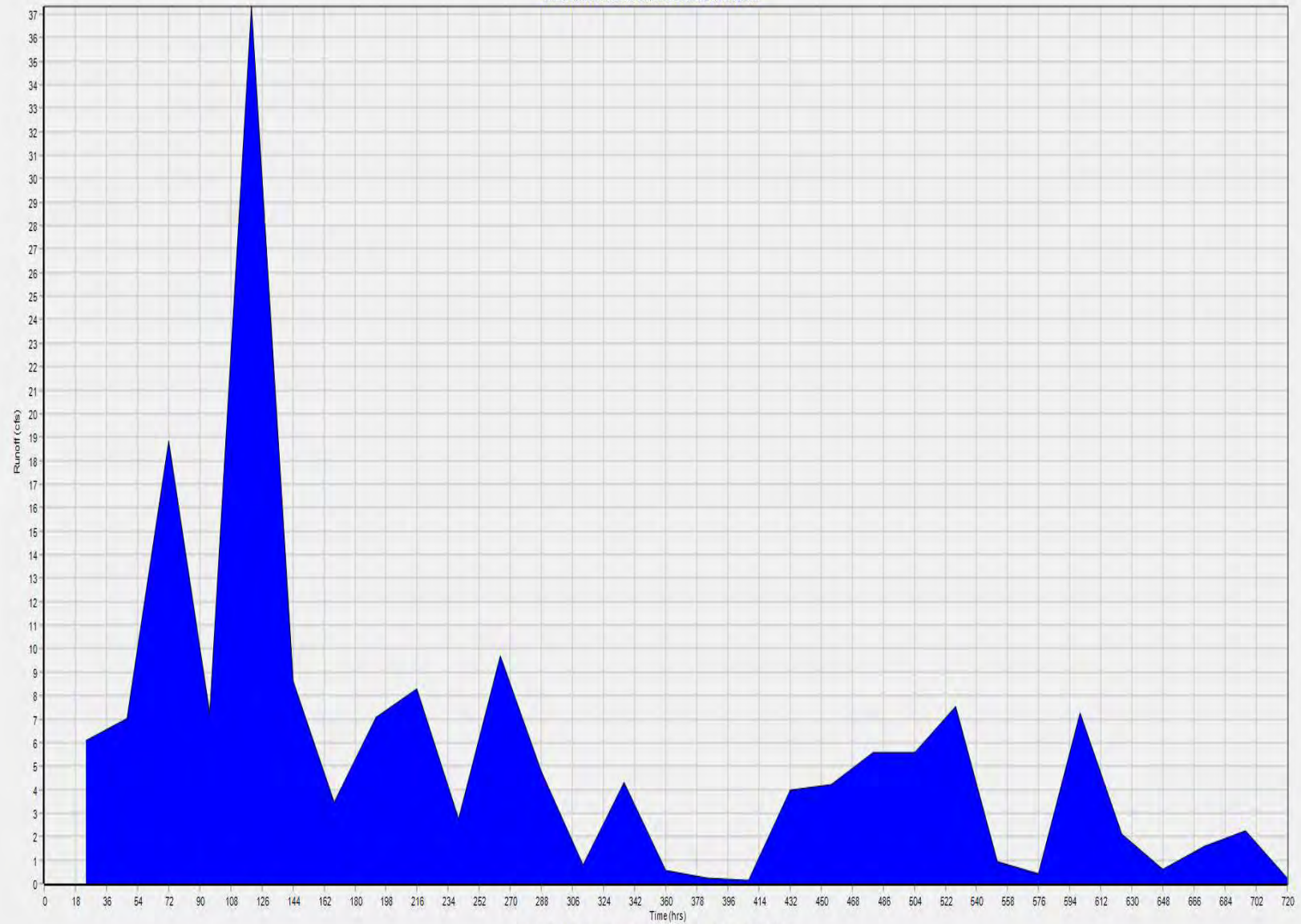
- Andreyev, N.E. and Wiseman, L.P., 1989, Stormwater retention pond infiltration analysis in unconfined aquifers: Prepared for Southwest Florida Water Management District, Brooksville, Florida.
- Golder Associates, 2013, Final geotechnical and infiltration facility evaluation, The Reserve at Woodlands, King County, Washington, August 5, 2013.
- Golder Associates, 2018, Technical memorandum: Reserve at Woodlands – Results of qualifying pump tests, April 30, 2018.
- King County Department of Natural Resources and Parks, 2021, Surface water design manual, July 23, 2021.
- Wet Weather Software, 2016, MODRET 6.1, *For Windows 98/NT/XP*, Copyright 2016.

Table G-1
MODRET Input Parameter Summary

Parameter	Value	Basis
Parameters Provided by Civil Engineer		
Facility Bottom Area (ft ²)	315,639	DEA. Based on combined values for Cells #2 and #3.
Facility Volume Between Bottom and DHWE (ft ³)	2,726,167	DEA. Based on combined values for Cells #2 and #3.
Facility Length to Width Ratio	3.84:1	DEA. Based on combined values for Cells #2 and #3.
Elevation of Starting Water Level (ft)	525	DEA. Elevation for Cell 3.
Elevation of Facility Bottom (ft)	525	DEA. Elevation for Cell 3.
DHWE (ft)	532.5	DEA. DHWE for Cell 3.
Average Effective Storage Coefficient of Facility	1	DEA
Impervious/Pervious Contributing Area (ac)	Not provided	
Parameters Derived by AESI		
Elevation of Effective Aquifer Base	450	AESI. See section 4.0 of this report for aquifer details.
Elevation of Seasonal High Groundwater Table	505	AESI (Appendix G text).
Storage Coefficient of Soil for Unsaturated Analysis	0.25	AESI - Within range of published values for the soil types present.
Unsaturated Vertical Hydraulic Conductivity (Kvu) (ft/day)	6.8	2/3 of Kvs (preliminary design infiltration rate 5.1 in/hr (10.2 ft/day)). See Appendix G text.
Saturated Horizontal Hydraulic Conductivity (Khs) (ft/day)	30.6	3x Kvs. See Appendix D text.
Storage Coefficient of Soil for Saturated Analysis	0.25	AESI - Within range of published values for the soil types present.
Model Default Parameters		
Factor of Safety	2	MODRET default value.
Time Increment During Storm Event (hours)	24	Increments match hydrograph time steps.
Time Increment After Storm Event (hours)	24	Increments match hydrograph time steps.
Total Number of Increments After Storm Event	6	Program default.

AESI = Associated Earth Sciences, Inc.; DEA = David Evans and Associates, Inc.; DHWE = design high water elevation; ft = feet; ft² = square feet; ft³ = cubic feet; ft/day = feet per day; in/hr = inches per hour; ac = acre

Reserve at Woodlands Maximum Volume Hydrograph



Qpeak: 37.3190 cfs Time of peak: 120.0 hrs Vtotal: 14,636,376 ft³

MODRET

SUMMARY OF UNSATURATED & SATURATED INPUT PARAMETERS

PROJECT NAME : Reserve at Woodlands Cells 2 and 3 Max.
HYDROGRAPH RUNOFF DATA USED
UNSATURATED ANALYSIS INCLUDED

Pond Bottom Area	315,639.00 ft ²
Pond Volume between Bottom & DHWL	2,726,167.00 ft ³
Pond Length to Width Ratio (L/W)	3.84
Elevation of Effective Aquifer Base	450.00 ft
Elevation of Seasonal High Groundwater Table	505.00 ft
Elevation of Starting Water Level	525.00 ft
Elevation of Pond Bottom	525.00 ft
Design High Water Level Elevation	532.50 ft
Avg. Effective Storage Coefficient of Soil for Unsaturated Analysis	0.25
Unsaturated Vertical Hydraulic Conductivity	6.80 ft/d
Factor of Safety	2.00
Saturated Horizontal Hydraulic Conductivity	30.60 ft/d
Avg. Effective Storage Coefficient of Soil for Saturated Analysis	0.25
Avg. Effective Storage Coefficient of Pond/Exfiltration Trench	1.00
Time Increment During Storm Event	24.00 hrs
Time Increment After Storm Event	24.00 hrs
Total Number of Increments After Storm Event	6.00

Runoff Hydrograph File Name:

Time of Peak Runoff: 0.00 hrs

Rate of Peak Runoff: 0.00 cfs

Hydraulic Control Features:

Groundwater Control Features - Y/N

Distance to Edge of Pond

Elevation of Water Level

Top	Bottom	Left	Right
N	N	N	N
0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00

Impervious Barrier - Y/N

Elevation of Barrier Bottom

Top	Bottom	Left	Right
N	N	N	N
0.00	0.00	0.00	0.00

MODRET

SUMMARY OF RESULTS

PROJECT NAME : Reserve at Woodlands Cells 2 and 3 Max.

CUMULATIVE TIME (hrs)	WATER ELEVATION (feet)	INSTANTANEOUS INFILTRATION RATE (cfs)	AVERAGE INFILTRATION RATE (cfs)	CUMULATIVE OVERFLOW (ft³)
00.00 - 0.00	505.000	0.000 *		
			0.00000	
0.00	505.000	7.26281		
			8.61584	
96.00	525.258	9.96887		0.00
			10.30712	
120.00	528.107	10.25519		0.00
			10.20325	
144.00	531.142	9.04433		0.00
			7.88540	
168.00	530.706	7.29994		0.00
			6.71447	
192.00	530.364	6.56994		0.00
			6.42542	
216.00	530.662	6.14862		0.00
			5.87182	
240.00	530.578	5.75764		0.00
			5.64347	
264.00	530.718	5.63396		0.00
			5.62446	
288.00	531.101	5.26088		0.00
			4.89730	
312.00	530.598	4.67541		0.00
			4.45351	
336.00	530.146	4.29343		0.00
			4.13334	
360.00	529.742	3.86190		0.00
			3.59047	
384.00	528.986	3.39546		0.00

MODRET

SUMMARY OF RESULTS

PROJECT NAME : Reserve at Woodlands Cells 2 and 3 Max.

CUMULATIVE TIME (hrs)	WATER ELEVATION (feet)	INSTANTANEOUS INFILTRATION RATE (cfs)	AVERAGE INFILTRATION RATE (cfs)	CUMULATIVE OVERFLOW (ft³)
			3.20045	
408.00	528.268	3.19843		0.00
			3.19642	
432.00	527.994	3.31252		0.00
			3.42863	
456.00	528.150	3.52854		0.00
			3.62845	
480.00	528.453	3.73037		0.00
			3.83228	
504.00	528.869	3.96327		0.00
			4.09426	
528.00	529.454	3.99690		0.00
			3.89954	
552.00	529.532	3.58945		0.00
			3.27936	
576.00	528.915	3.35209		0.00
			3.42482	
600.00	529.013	3.50434		0.00
			3.58385	
624.00	529.273	3.36752		0.00
			3.15120	
648.00	528.850	3.01656		0.00
			2.88192	
672.00	528.428	2.85308		0.00
			2.82424	
696.00	528.212	2.64516		0.00
			2.46609	
720.00	527.626	2.35440		0.00

SUMMARY OF RESULTS

PROJECT NAME : Reserve at Woodlands Cells 2 and 3 Max.

[illegible]

Maximum Water Elevation: 531.142 feet @ 144.00 hours

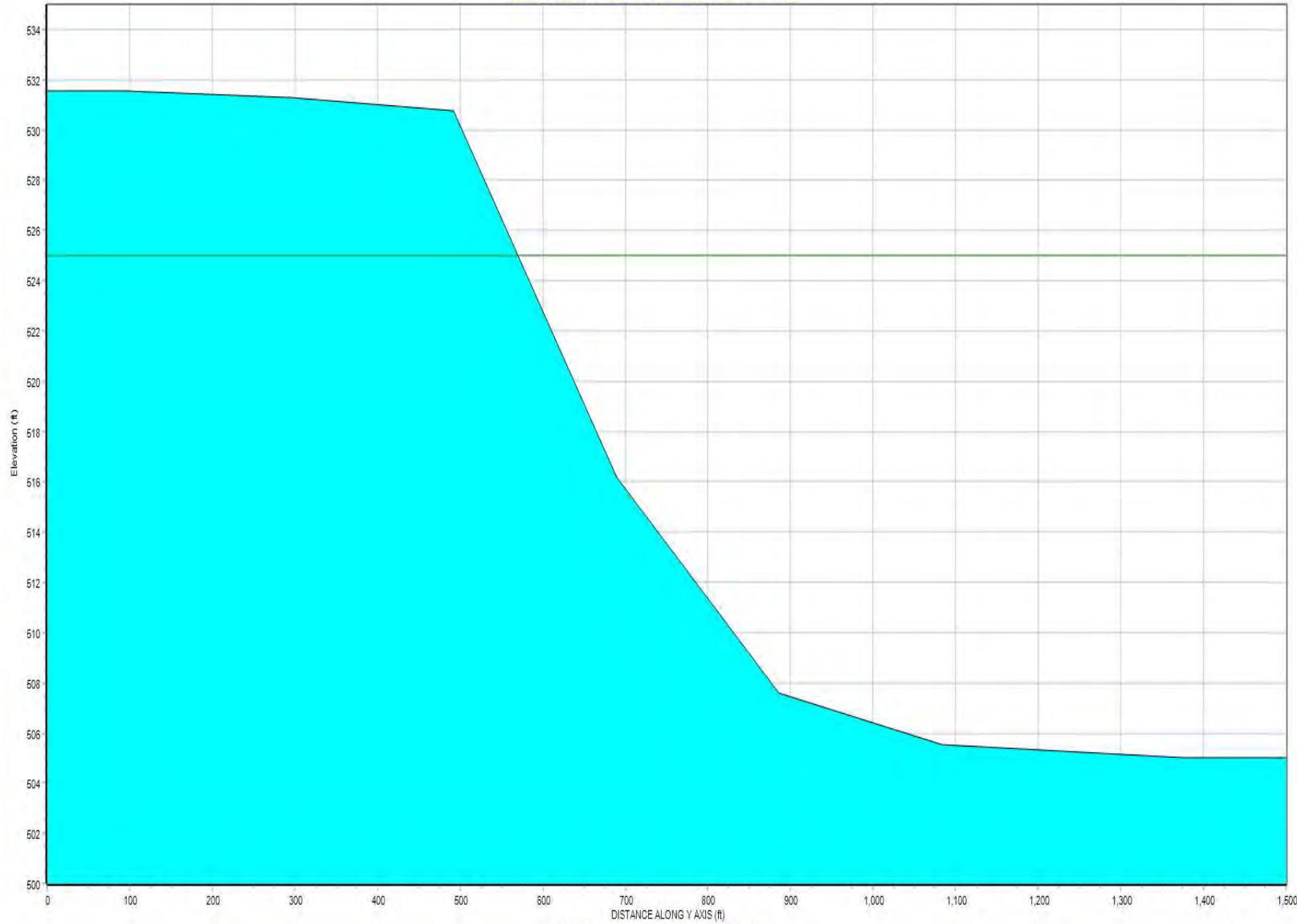
Recovery @ > 840.000 hours

* Time increment when there is no runoff

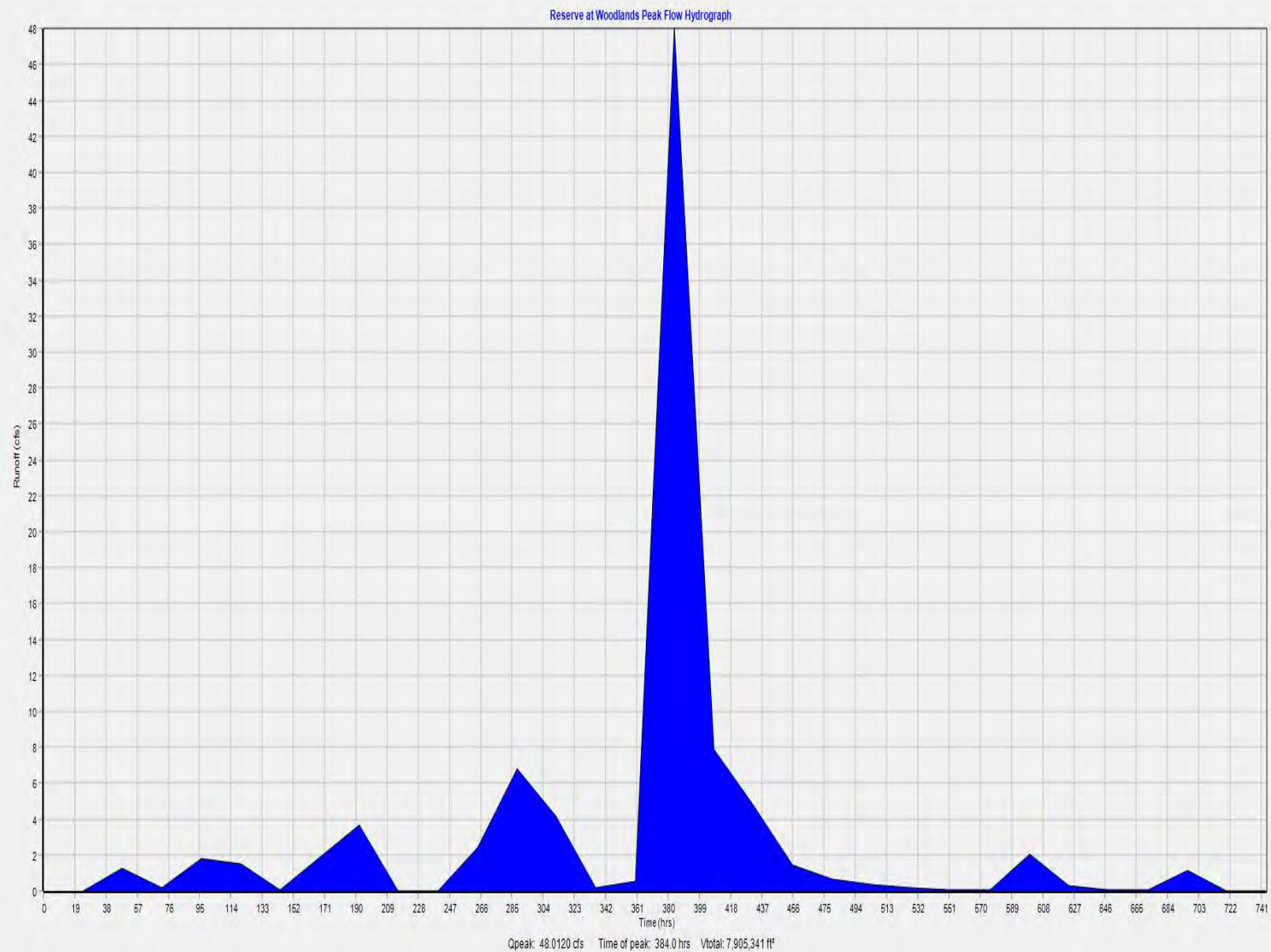
Maximum Infiltration Rate: 2.450 ft/day

Analysis Date: 10/31/2024

CROSS SECTION : Reserve at Woodlands Cells 2 and 3 Max



CROSS SECTION ALONG Y AXIS AT X AXIS = 0.00 ft @ 144 hrs



MODRET

SUMMARY OF UNSATURATED & SATURATED INPUT PARAMETERS

**PROJECT NAME : Reserve at Woodlands Cells 2 and 3 Peak
HYDROGRAPH RUNOFF DATA USED
UNSATURATED ANALYSIS INCLUDED**

Pond Bottom Area	315,639.00 ft ²
Pond Volume between Bottom & DHWL	2,726,167.00 ft ³
Pond Length to Width Ratio (L/W)	3.84
Elevation of Effective Aquifer Base	450.00 ft
Elevation of Seasonal High Groundwater Table	505.00 ft
Elevation of Starting Water Level	525.00 ft
Elevation of Pond Bottom	525.00 ft
Design High Water Level Elevation	532.50 ft
Avg. Effective Storage Coefficient of Soil for Unsaturated Analysis	0.25
Unsaturated Vertical Hydraulic Conductivity	6.80 ft/d
Factor of Safety	2.00
Saturated Horizontal Hydraulic Conductivity	30.60 ft/d
Avg. Effective Storage Coefficient of Soil for Saturated Analysis	0.25
Avg. Effective Storage Coefficient of Pond/Exfiltration Trench	1.00
Time Increment During Storm Event	24.00 hrs
Time Increment After Storm Event	24.00 hrs
Total Number of Increments After Storm Event	6.00

Runoff Hydrograph File Name: ReserveAtWoodlandsMAX.prn

Time of Peak Runoff: 120.00 hrs

Rate of Peak Runoff: 37.32 cfs

Hydraulic Control Features:

Groundwater Control Features - Y/N

Distance to Edge of Pond

Elevation of Water Level

Top	Bottom	Left	Right
N	N	N	N
0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00

Impervious Barrier - Y/N

Elevation of Barrier Bottom

Top	Bottom	Left	Right
N	N	N	N
0.00	0.00	0.00	0.00

MODRET

SUMMARY OF RESULTS

PROJECT NAME : Reserve at Woodlands Cells 2 and 3 Peak

CUMULATIVE TIME (hrs)	WATER ELEVATION (feet)	INSTANTANEOUS INFILTRATION RATE (cfs)	AVERAGE INFILTRATION RATE (cfs)	CUMULATIVE OVERFLOW (ft³)
00.00 - 24.00	505.000	0.000 *		
			0.00000	
24.00	505.000	-0.32625		
			2.61811	
336.00	525.000	5.56247		0.00
			5.78896	
360.00	525.000	6.72815		0.00
			7.66735	
384.00	525.250	8.52266		0.00
			9.37798	
408.00	529.663	8.32132		0.00
			7.26466	
432.00	529.434	6.57699		0.00
			5.88932	
456.00	528.767	5.36576		0.00
			4.84219	
480.00	527.867	4.48077		0.00
			4.11935	
504.00	527.008	3.85203		0.00
			3.58470	
528.00	526.216	3.38126		0.00
			3.17781	
552.00	525.491	3.01486		0.00
			2.85190	
569.76	525.000	2.79458		0.00
			2.73726	
600.00	524.424	2.68016		0.00
			2.62306	
624.00	524.079	2.49133		0.00

MODRET

SUMMARY OF RESULTS

PROJECT NAME : Reserve at Woodlands Cells 2 and 3 Peak

CUMULATIVE TIME (hrs)	WATER ELEVATION (feet)	INSTANTANEOUS INFILTRATION RATE (cfs)	AVERAGE INFILTRATION RATE (cfs)	CUMULATIVE OVERFLOW (ft ³)
			2.35960	
648.00	523.561	2.25741		0.00
			2.15522	
672.00	523.059	2.11422		0.00
			2.07322	
696.00	522.706	2.02859		0.00
			1.98397	
720.00	522.373	0.99198		0.00
			0.00000	
744.00	521.943	0.00000		0.00
			0.00000	
768.00	521.542	0.00000		0.00
			0.00000	
792.00	521.167	0.00000		0.00
			0.00000	
816.00	520.813	0.00000		0.00
			0.00000	
840.00	520.477	0.00000		0.00
			0.00000	
864.00	520.159			0.00

Maximum Water Elevation: 529.663 feet @ 408.00 hours

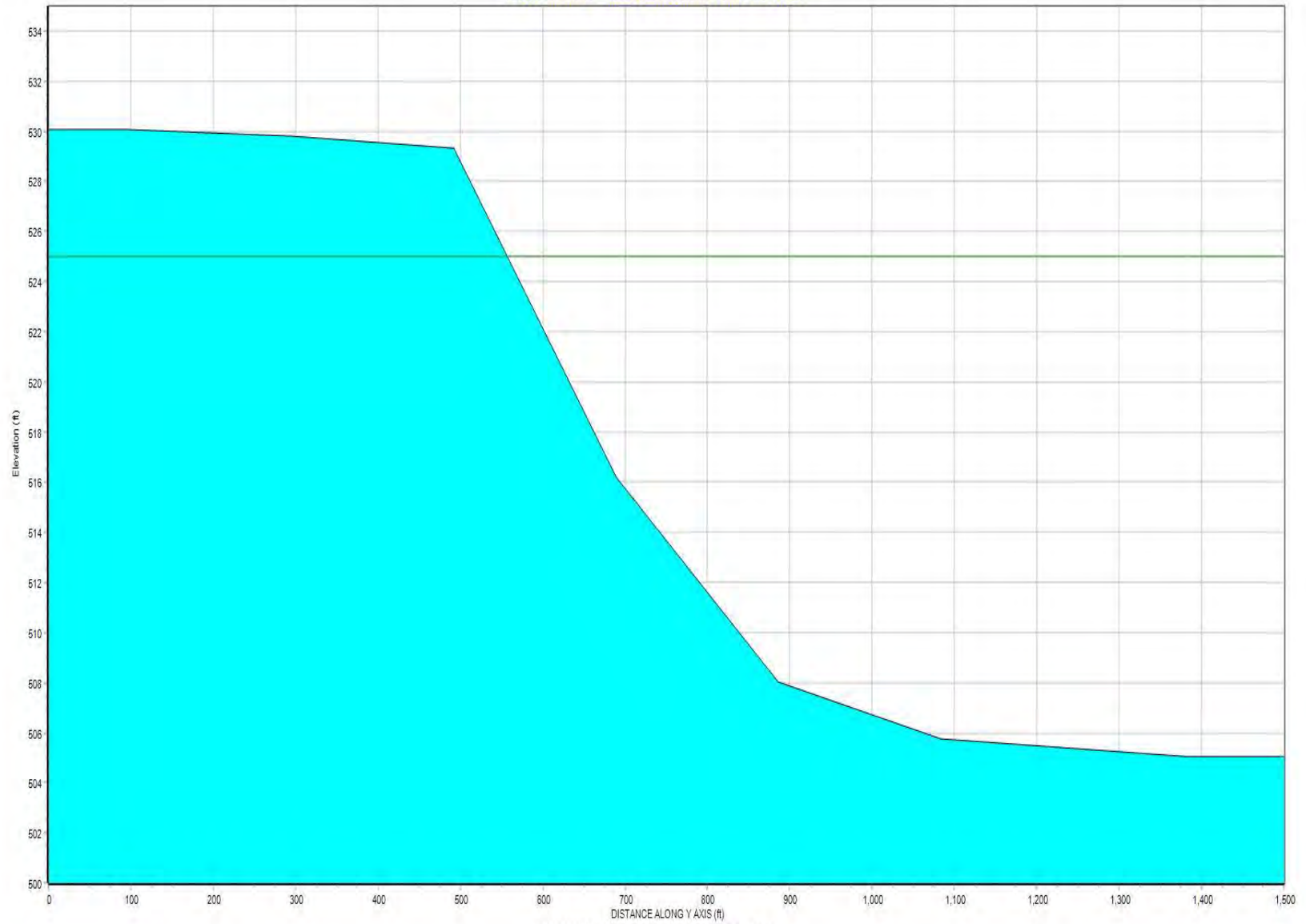
Recovery @ 569.759 hours

* Time increment when there is no runoff

Maximum Infiltration Rate: 2.229 ft/day

Analysis Date: 10/31/2024

CROSS SECTION : Reserve at Woodlands Cells 2 and 3 Peak



CROSS SECTION ALONG Y AXIS AT X AXIS = 0.00 ft @ 408 hrs



October 31, 2024

Jennifer Saltonstall, L.G., L.Hg
Associated Earth Sciences,
Inc 911 5th Avenue
Kirkland, WA 98033

RE: Ten Trails Regional Stormwater Facility
Mounding Analysis



10/31/2024

Dear Jenny:

This letter is provided at your request to document the hydrograph and design parameters provided to you for your use in the analysis of the Regional Stormwater Facility for Ten Trails and the Reserve at Woodlands.

I can confirm that the attached hydrograph data for the maximum flow period and the maximum volume period, was assessing the entire hydrograph. The hydrograph data was generated using WWHM 2012. In addition, the following design parameters should be used in your analysis:

Cell 2: Sand Filter

Live Storage Volume	865,720	cubic feet
Bottom Area:	94,903	square feet
Length to Width Ratio:	1.09	
Length:	322	feet
Width:	295	feet

Cell 3: Infiltration Cell

Live Storage Volume	1,860,447	cubic feet
Bottom Area:	220,736	square feet
Length to Width Ratio:	2.75	
Length:	779	feet
Width:	283	feet

Thank you,

A handwritten signature in black ink, appearing to read 'Adam Stricker'.

Adam Stricker, PE
David Evans and Associates

Enclosures: WWHM Hydrograph Data

Ten Trails Regional Stormwater Facility

Maximum Volume Over 30-day Period				
	<i>Day</i>	<i>Volume (Ac-ft)</i>	<i>Hour</i>	<i>Average Flow (cfs)</i>
1	11/2/2006	12.04724	0	6.074
2	11/3/2006	13.93988	24	7.028
3	11/4/2006	37.31532	48	18.813
4	11/5/2006	14.41322	72	7.267
5	11/6/2006	74.02090	96	37.319
6	11/7/2006	17.10070	120	8.622
7	11/8/2006	6.90465	144	3.481
8	11/9/2006	14.02527	168	7.071
9	11/10/2006	16.43510	192	8.286
10	11/11/2006	5.45741	216	2.751
11	11/12/2006	19.26470	240	9.713
12	11/13/2006	9.43919	264	4.759
13	11/14/2006	1.60124	288	0.807
14	11/15/2006	8.51346	312	4.292
15	11/16/2006	1.14405	336	0.577
16	11/17/2006	0.48082	360	0.242
17	11/18/2006	0.23749	384	0.120
18	11/19/2006	7.87040	408	3.968
19	11/20/2006	8.34278	432	4.206
20	11/21/2006	11.09302	456	5.593
21	11/22/2006	11.05472	480	5.573
22	11/23/2006	14.95576	504	7.540
23	11/24/2006	1.82378	528	0.919
24	11/25/2006	0.87541	552	0.441
25	11/26/2006	14.35532	576	7.237
26	11/27/2006	4.20517	600	2.120
27	11/28/2006	1.24055	624	0.625
28	11/29/2006	3.14157	648	1.584
29	11/30/2006	4.45723	672	2.247
30	12/1/2006	0.50529	696	0.255

Ten Trails Regional Stormwater Facility

Largest Average Daily Flow Rate			
	<i>Day</i>	<i>Hour</i>	<i>Peak Average Flow (cfs)</i>
0	10/5/2003	24	0.000
1	10/6/2003	48	1.294
2	10/7/2003	72	0.188
3	10/8/2003	96	1.803
4	10/9/2003	120	1.485
5	10/10/2003	144	0.078
6	10/11/2003	168	1.873
7	10/12/2003	192	3.650
8	10/13/2003	216	0.028
9	10/14/2003	240	0.003
10	10/15/2003	264	2.407
11	10/16/2003	288	6.793
12	10/17/2003	312	4.171
13	10/18/2003	336	0.206
14	10/19/2003	360	0.559
15	10/20/2003	384	48.012
16	10/21/2003	408	7.873
17	10/22/2003	432	4.731
18	10/23/2003	456	1.435
19	10/24/2003	480	0.677
20	10/25/2003	504	0.337
21	10/26/2003	528	0.168
22	10/27/2003	552	0.083
23	10/28/2003	576	0.040
24	10/29/2003	600	2.043
25	10/30/2003	624	0.300
26	10/31/2003	648	0.055
27	11/1/2003	672	0.034
28	11/2/2003	696	1.141
29	11/3/2003	720	0.026
30	11/4/2003	744	0.008

Ten Trails Regional Stormwater Facility

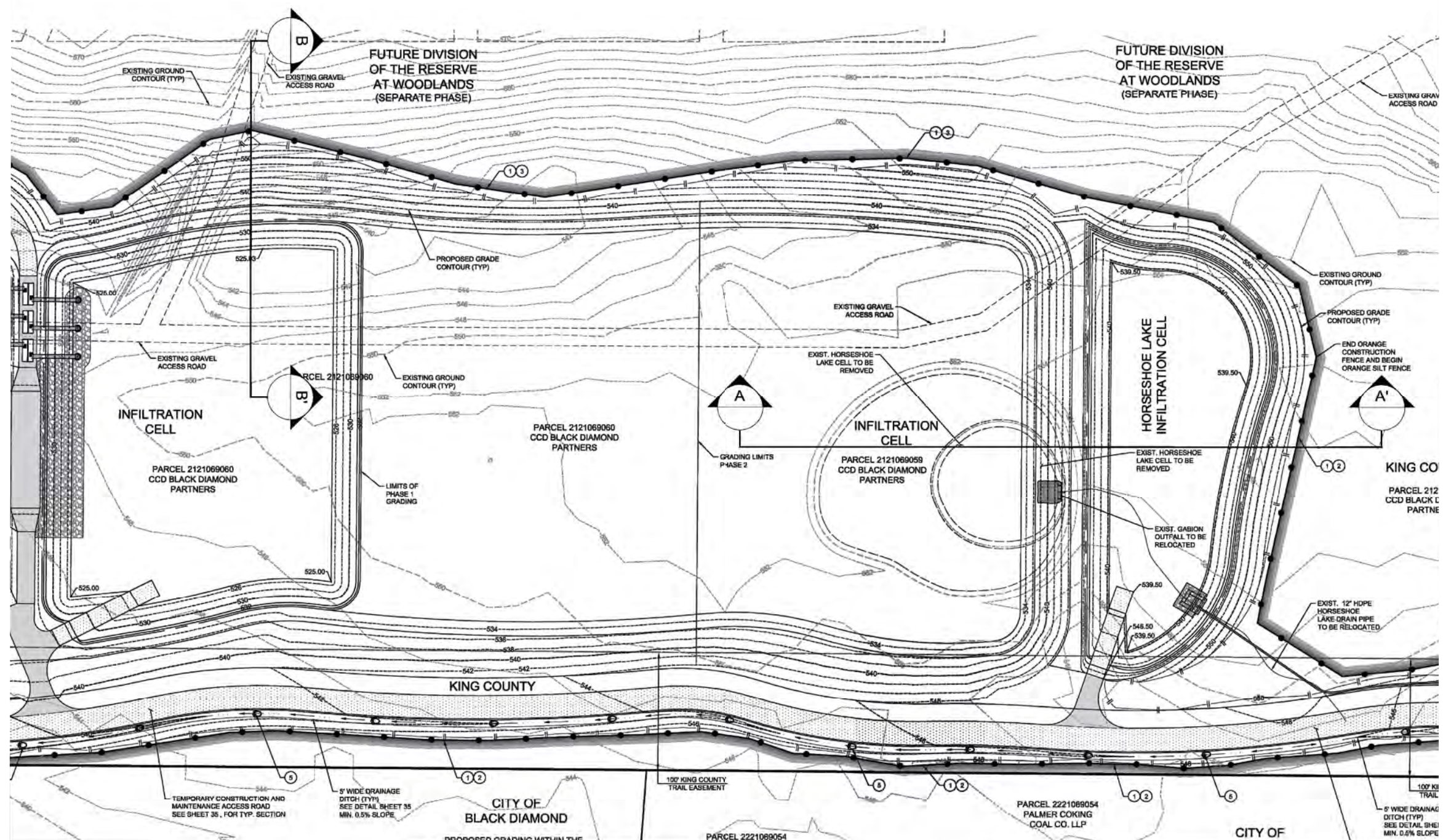
Average Hourly Flow Rate			
	<i>Day</i>	<i>Hour</i>	<i>Average Flow (cfs)</i>
1	10/19/2003	-3	0.122
2	10/19/2003	-2	0.113
3	10/19/2003	-1	0.105
4	10/20/2003	0	0.123
5	10/20/2003	1	1.319
6	10/20/2003	2	7.233
7	10/20/2003	3	26.512
8	10/20/2003	4	44.733
9	10/20/2003	5	21.328
10	10/20/2003	6	9.600
11	10/20/2003	7	7.102
12	10/20/2003	8	13.535
13	10/20/2003	9	53.331
14	10/20/2003	10	44.908
15	10/20/2003	11	84.336
16	10/20/2003	12	121.017
17	10/20/2003	13	41.389
18	10/20/2003	14	38.251
19	10/20/2003	15	102.477
20	10/20/2003	16	83.555
21	10/20/2003	17	109.799
22	10/20/2003	18	104.690
23	10/20/2003	19	81.542
24	10/20/2003	20	69.247
25	10/20/2003	21	43.040
26	10/20/2003	22	23.947
27	10/20/2003	23	19.265
28	10/21/2003	24	25.223
29	10/21/2003	25	17.852
30	10/21/2003	26	11.570

Ten Trails Regional Stormwater Facility

Hourly Volume			
	<i>Day</i>	<i>Hour</i>	<i>Volume (Ac-ft)</i>
1	10/19/2003	-3	0.010
2	10/19/2003	-2	0.009
3	10/19/2003	-1	0.009
4	10/20/2003	0	0.010
5	10/20/2003	1	0.109
6	10/20/2003	2	0.598
7	10/20/2003	3	2.191
8	10/20/2003	4	3.697
9	10/20/2003	5	1.763
10	10/20/2003	6	0.793
11	10/20/2003	7	0.587
12	10/20/2003	8	1.119
13	10/20/2003	9	4.408
14	10/20/2003	10	3.711
15	10/20/2003	11	6.970
16	10/20/2003	12	10.001
17	10/20/2003	13	3.421
18	10/20/2003	14	3.161
19	10/20/2003	15	8.469
20	10/20/2003	16	6.905
21	10/20/2003	17	9.074
22	10/20/2003	18	8.652
23	10/20/2003	19	6.739
24	10/20/2003	20	5.723
25	10/20/2003	21	3.557
26	10/20/2003	22	1.979
27	10/20/2003	23	1.592
28	10/21/2003	24	2.085
29	10/21/2003	25	0.000
30	10/21/2003	26	0.000

APPENDIX H

Global Stability Results



DATA SOURCES/REFERENCES:
DAVID EVENS AND ASSOCIATES, RESERVE AT WOODLANDS
REGIONAL STORMWATER FACILITY PLAN SET, SHEETS 6 AND 7,
AUGUST 16, 2003.

BLACK AND WHITE REPRODUCTION OF THIS COLOR ORIGINAL MAY
REDUCE ITS EFFECTIVENESS AND LEAD TO INCORRECT INTERPRETATION.
LOCATION AND DISTANCES SHOWN ARE APPROXIMATE.

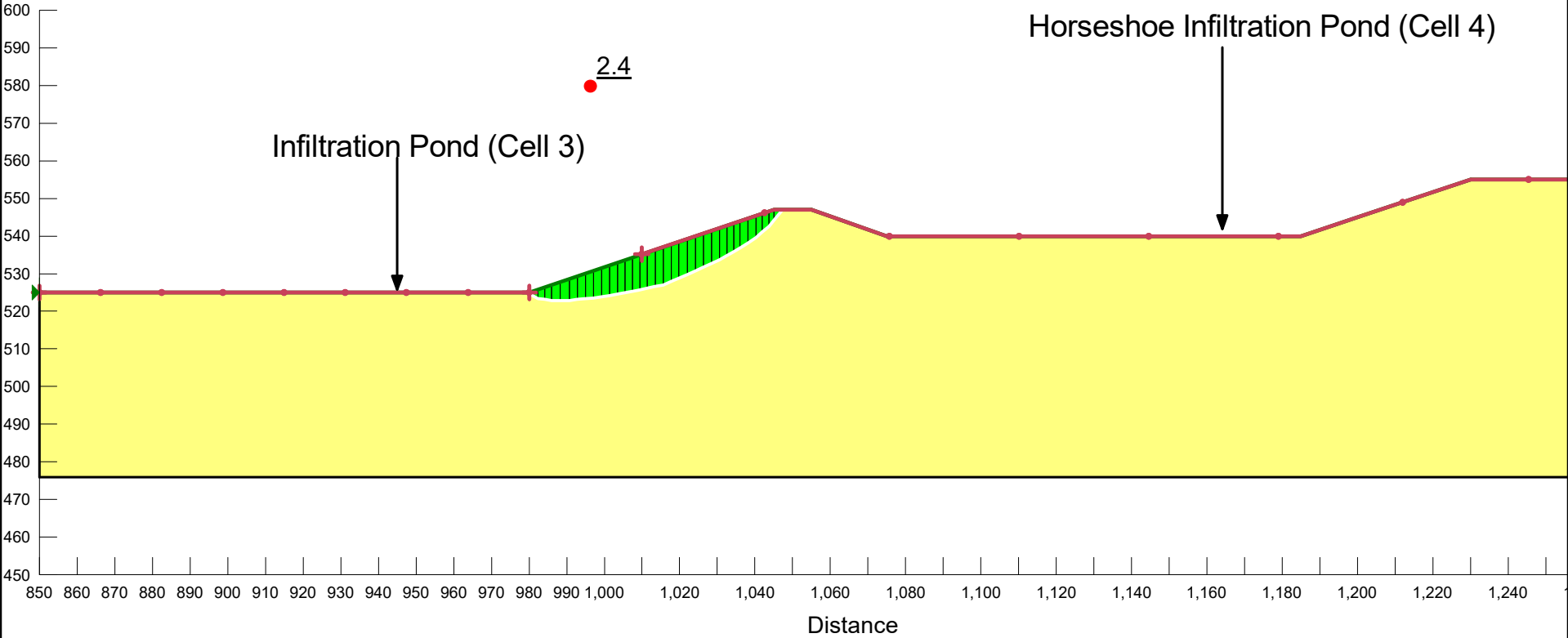


SLOPE STABILITY CROSS-SECTIONS

CCD-RESERVE AT WOODLANDS
KING COUNTY, WASHINGTON

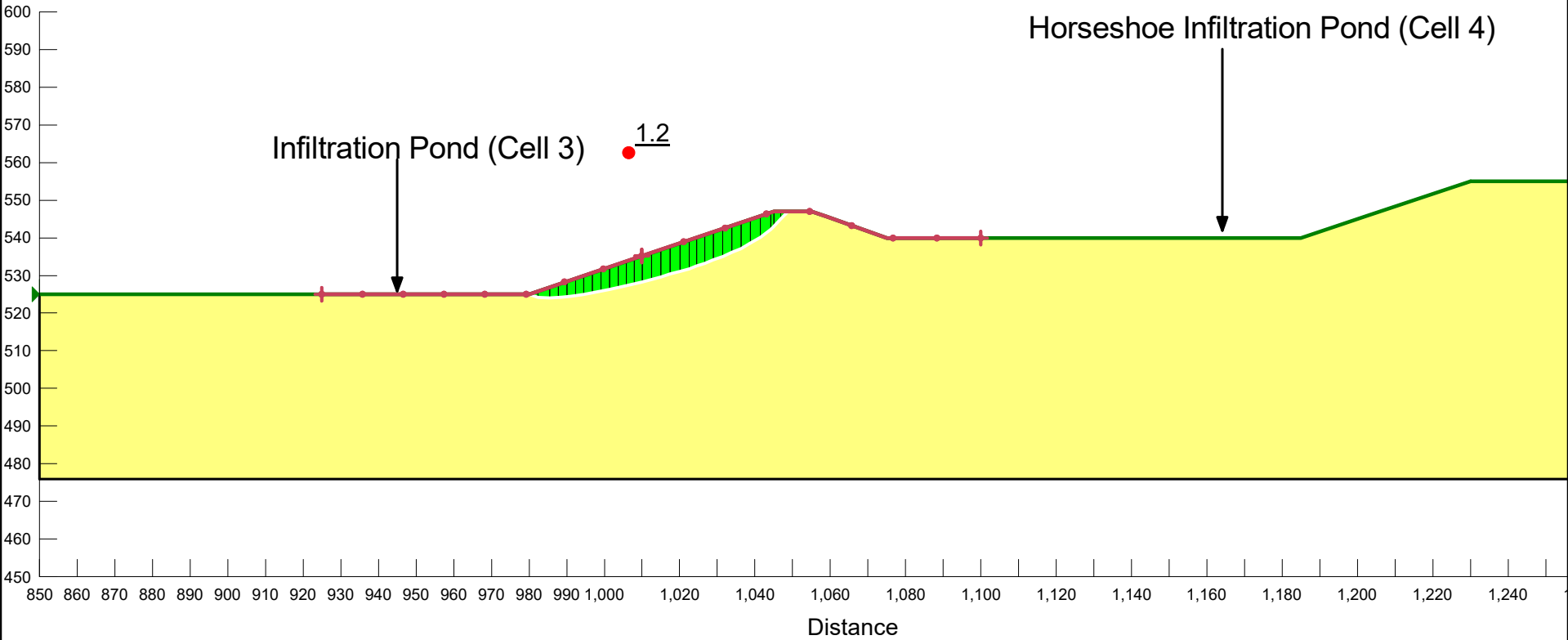
PROJECT NO. 20240186H002	DATE 11/24	FIGURE H-1
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Color	Name	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)
	Recessional Outwash	125	50	34



Color	Name	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)
	Recessional Outwash	125	50	34

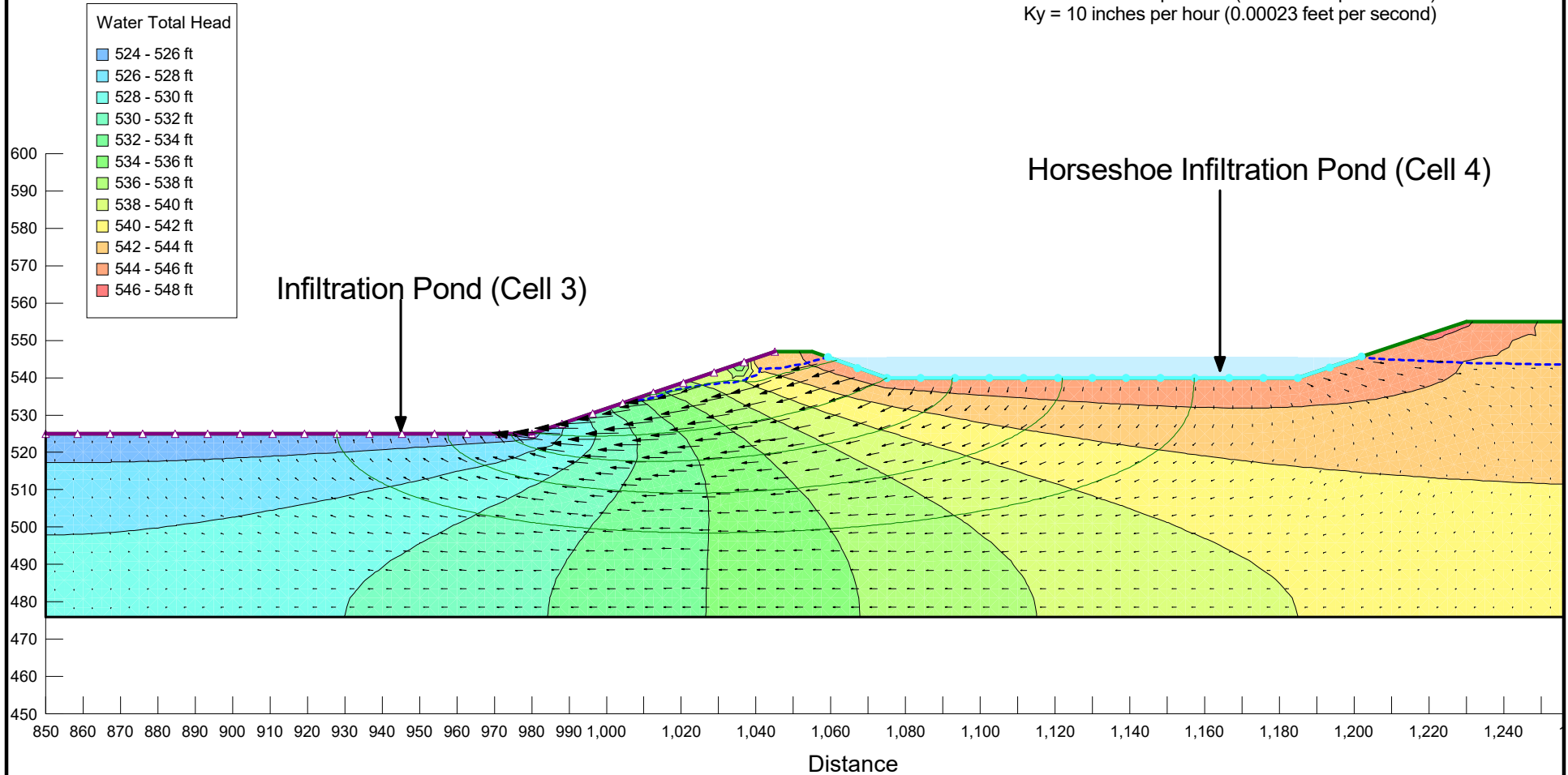
Horizontal Seismic Coefficient 0.28



Color	Name	Category	Kind	Parameters
	Drainage	Hydraulic	Water Rate	0 ft³/sec
	Infiltration Pond (Cell 4)	Hydraulic	Water Total Head	545.5 ft

Color	Name	Ky'/Kx' Ratio	Kz'/Kx' Ratio
	Recessional Outwash	0.1	0.1

Kx = 100 inches per hour (0.0023 feet per second)
Ky = 10 inches per hour (0.00023 feet per second)



Section A-A' Steady-State Seepage

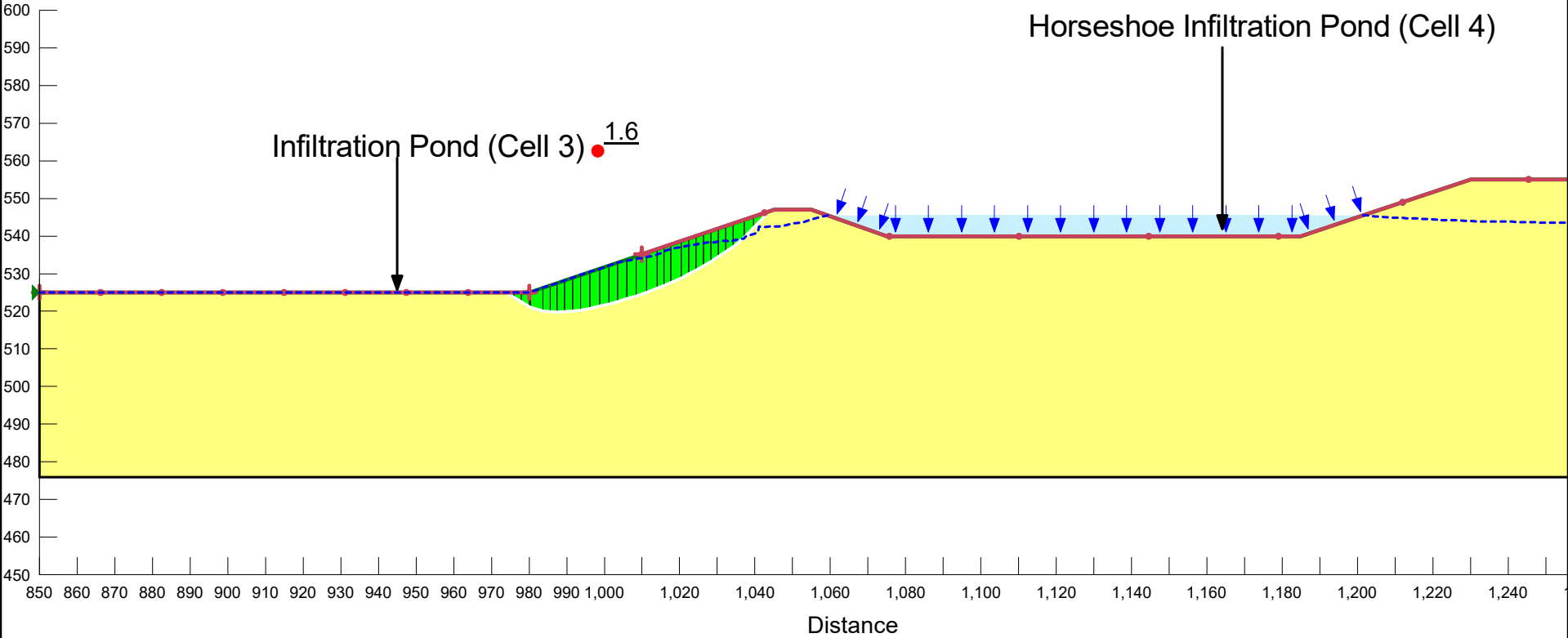
Reserve at Woodlands

11/01/2024

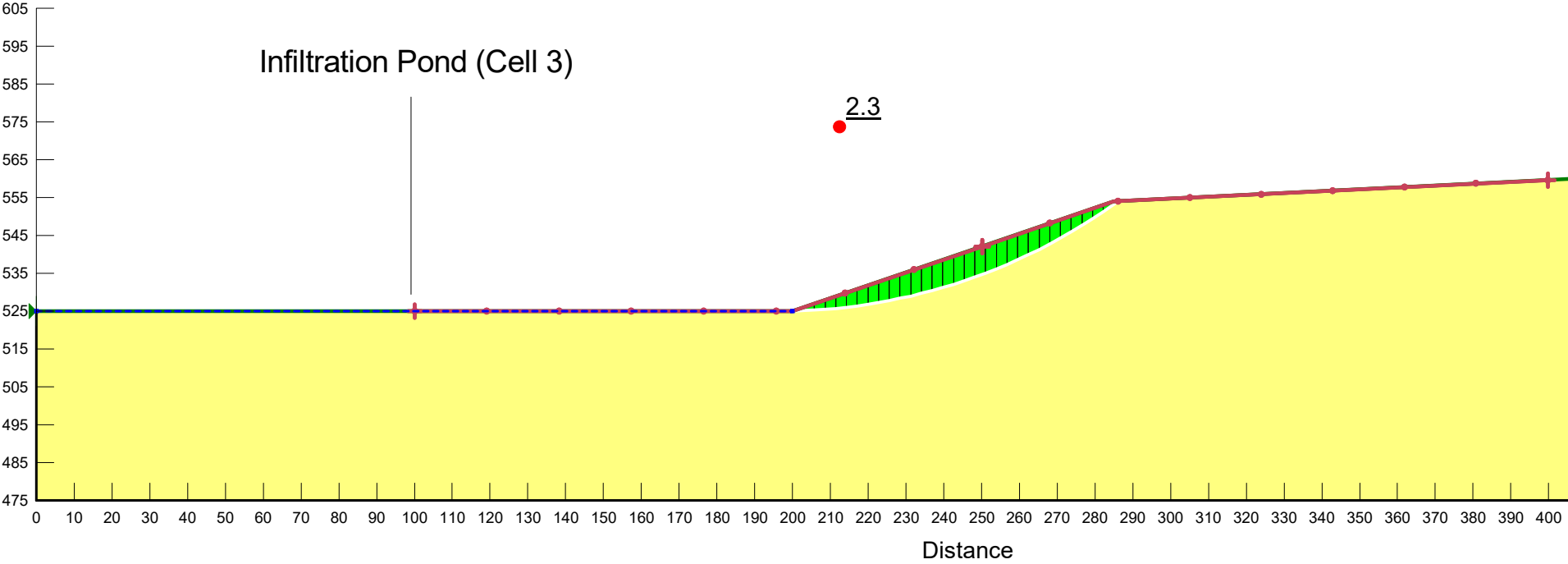
Figure H-4

1:500

Color	Name	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)
	Recessional Outwash	125	50	34



Color	Name	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)
	Recessional Outwash	125	50	34



Color	Name	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)
	Recessional Outwash	125	50	34

Horizontal Seismic Coefficient 0.28

