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Preliminary
Storm Drainage Report

FOR

Bullfrog – Phases M & P-4

Cle Elum, Washington



2026-04-30

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Core No: 26035

B-06

Table of Contents

1. Project Overview 1-1
2. Conditions and Requirement Summary 2-1
    - 2.1 Core Elements 2-1
        - 2.1.1 Core Element #1: Preparation of a Stormwater Site Plan 2-1
        - 2.1.2 Core Element #2: Construction Stormwater Pollution Prevention 2-1
        - 2.1.3 Core Element #3: Source Control of Pollution 2-1
        - 2.1.4 Core Element #4: Preservation of Natural Drainage Systems 2-1
        - 2.1.5 Core Element #5: Runoff Treatment 2-1
        - 2.1.6 Core Element #6: Flow Control 2-1
        - 2.1.7 Core Element #7: Operation and Maintenance 2-2
        - 2.1.8 Core Element #8: Wetlands Protection 2-2
    - 2.2 Additional Protective Measures (APMs) 2-2
        - 2.2.1 APM1: Financial Liability 2-2
        - 2.2.2 APM2: Off-Site Analysis Report 2-2
        - 2.2.3 APM3: Local Requirements 2-2
3. Off-Site Analysis 3-1
4. Permanent Stormwater Control Analysis and Design 4-1
    - 4.1 Proposed Conditions & Impervious Surface Summary 4-1
    - 4.2 Regional Stormwater Facilities Overview 4-1
    - 4.3 Basin Information 4-2
    - 4.4 Bioretention Design 4-2
        - 4.4.1 Modeling Results 4-2
    - 4.5 Infiltration Pond Design 4-3
        - 4.5.1 Snowmelt Adjustment Factor Calculation 4-3
        - 4.5.2 Design Storm 4-4
        - 4.5.3 Modeling Results 4-4
5. Conveyance Capacity Analysis 5-1
6. Construction Stormwater Pollution Prevention Analysis 6-1
7. Operations and Maintenance Manual 7-1

Appendix A – Phase M Public Bioretention Area 6-month WQ HydroCAD Report

Appendix B – Phase M Public Bioretention & Infiltration Area 25-yr HydroCAD Report

Appendix C – Phase P-4 Public Bioretention Area 6-month WQ HydroCAD Report

Appendix D – Phase P-4 Public Bioretention & Infiltration Area 25-yr HydroCAD Report

Appendix E – Phase P-4 Spine Road Temporary Public Bioretention Area 6-month WQ HydroCAD Report

Appendix F – Phase P-4 Spine Road Temporary Public Bioretention Area 25-yr HydroCAD Report

Appendix G – Phase P-4 Private Infiltration Area 25-yr HydroCAD Report

Appendix H – Bullfrog Flats Geotech Report

Appendix I – Operations & Maintenance Manual

B-06

Table of Figures

Figure 1-1 Vicinity Map 1-1
Figure 2-1 Flow Chart for Determining Requirements for New Development 2-3
Figure 2-2 Runoff Treatment BMP Selection Flow Chart 2-4
Figure 3-1 Site Existing Conditions Exhibit 3-2
Figure 4-1 Site Developed Conditions Exhibit 4-5

Table of Tables

Table 4-1 Basin Areas 4-2
Table 4-2 Bioretention Facility Design Geometry 4-2
Table 4-3 Average Daily Snow Depth Calculation 4-3
Table 4-4 Snowmelt Adjustment Factors from the 2024 SWMMEW 4-4
Table 4-5 Design Storm Calculation 4-4
Table 4-6 Infiltration Area Design Geometry 4-4

B-06

1. Project Overview

The Bullfrog project is a mixed-use phased development project located in the western portion of the City of Cle Elum, between Bullfrog Road and SR 903. This report addresses the stormwater design for Phases M & P-4 of the overall project. Phase P-4 will consist of single family detached residential development resulting in 152 individual lots. Phase M will consist of multi-family residential development resulting in 210 individual lots.

Phase P-4 is located within the central region of the overall development, with the future park to the north, Phase P-3 to the southwest, Spine Road to the northwest, and open space to the southeast. Phase M is located in the northwestern portion of the overall development, with Bullfrog Road to the north, and Spine Road and wetland to the south. See Figure 1-1 below for reference.

The existing site of Phase P-4 generally slopes from northwest to southeast at slopes ranging between 1 and 30 percent. The existing site of Phase M generally slopes from west to east at slopes primarily ranging between 0 and 5 percent. All runoff from the site infiltrates prior to leaving the site in the present state, and this will be maintained post development. Basic water quality treatment will be provided by infiltration through bioretention soil mix. Stormwater management and facilities have been designed per the 2024 Stormwater Management Manual for Eastern Washington (SWMMEW).

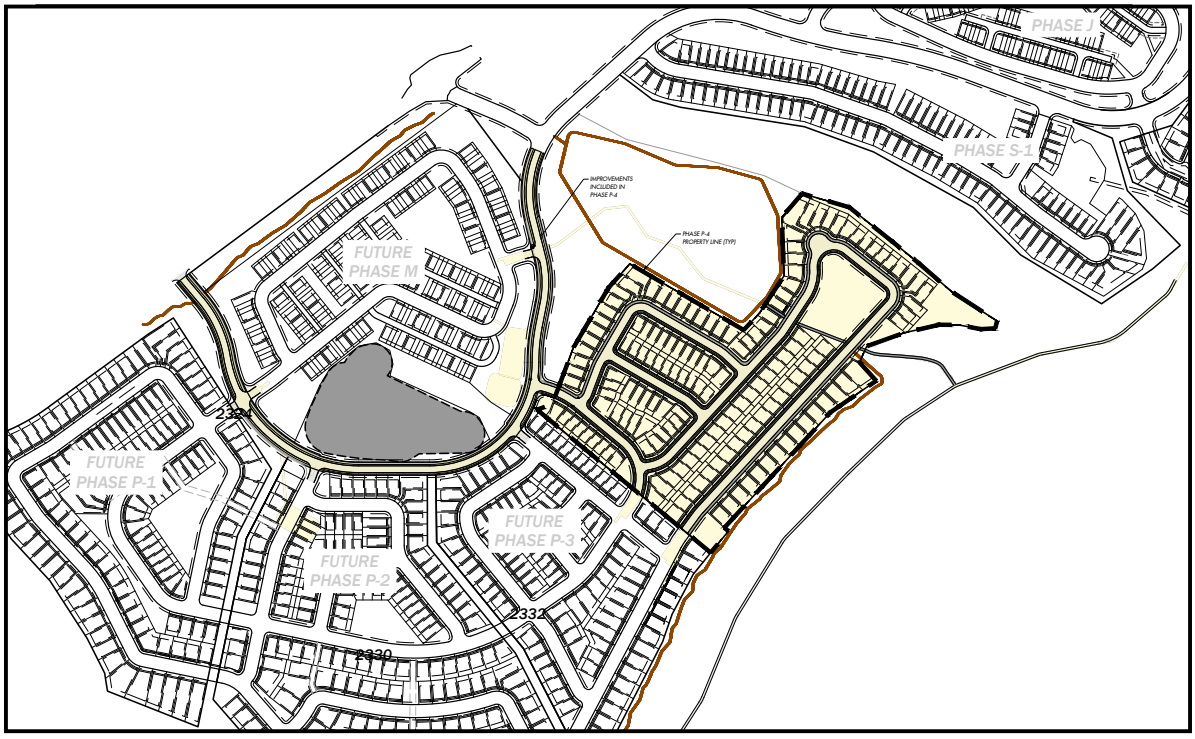


Figure 1-1 Vicinity Map

B-06

2. Conditions and Requirement Summary

This project is considered a new development project and proposes greater than 5,000 square feet of new plus replaced hard surfaces; therefore, per Figure 2.1 of the SWMMEW, provided at the end of this section, Phases P-4 and M are subject to all Core Elements.

2.1 Core Elements

2.1.1 Core Element #1: Preparation of a Stormwater Site Plan

This report, along with the civil plans submitted under separate cover, satisfies this core element.

2.1.2 Core Element #2: Construction Stormwater Pollution Prevention

To reduce the impacts of sediment laden runoff during construction, a Construction Stormwater Pollution Prevention Plan (CSWPPP) has been prepared for the project. It addresses the 13 elements of pollution prevention and designates appropriate BMPs for use onsite.

2.1.3 Core Element #3: Source Control of Pollution

Development of the project site consists of single-family and multi-family residential development and associated roads and utilities. Per Section 8.1 of the 2024 SWMMEW, this level of development is not required to implement Source Control BMPs. As such, this element is considered to have been addressed.

2.1.4 Core Element #4: Preservation of Natural Drainage Systems

Onsite natural drainage patterns consist of dispersion and infiltration of runoff. The project proposes to mimic this condition. In doing such, the project will maintain the natural drainage locations to the maximum extent practicable.

2.1.5 Core Element #5: Runoff Treatment

Runoff treatment for the project will be provided for all pollution generating impervious surfaces (PGIS). Oil control is not required for the proposed level of development. Runoff treatment will be accomplished by filtering through bioretention soil mix prior to surface infiltration. This will occur at a bioretention facility for each drainage basin which includes PGIS.

2.1.6 Core Element #6: Flow Control

Flow control is required for the project site and will be provided through the use of infiltration BMPs, designed to infiltrate 100 percent of the 25-year, 24-hour Type IA storm. Additional information regarding the proposed facilities is included in Section 4 of this report.

2.1.7 Core Element #7: Operation and Maintenance

Appropriate Operations and Maintenance (O&M) information for the proposed stormwater management BMPs is discussed in Section 7 of this report.

2.1.8 Core Element #8: Wetlands Protection

Stormwater discharge from the P-4 site does not flow into a wetland. Existing phase M stormwater infiltrates onsite with little overland dispersed flow into the wetland present on the south end of the site. Because all developed Phase M stormwater runoff will be infiltrated, no additional wetlands protection considerations are necessary.

2.2 Additional Protective Measures (APMs)

The City of Cle Elum does not require the APMs to be applied to project development. However, the project has reviewed the requirements as discussed below, for applicability and relevance.

2.2.1 APM1: Financial Liability

Bonding for the project will be determined if required by the City.

2.2.2 APM2: Off-Site Analysis Report

Section 3 of this report provides discussion of the natural drainage patterns of the project site. In the existing condition, all runoff disperses and infiltrates on site. Therefore, an offsite analysis is not required.

2.2.3 APM3: Local Requirements

No additional Local Requirements per the City of Cle Elum are required.

Figure 2.1: Flow Chart for Determining Requirements for New Development

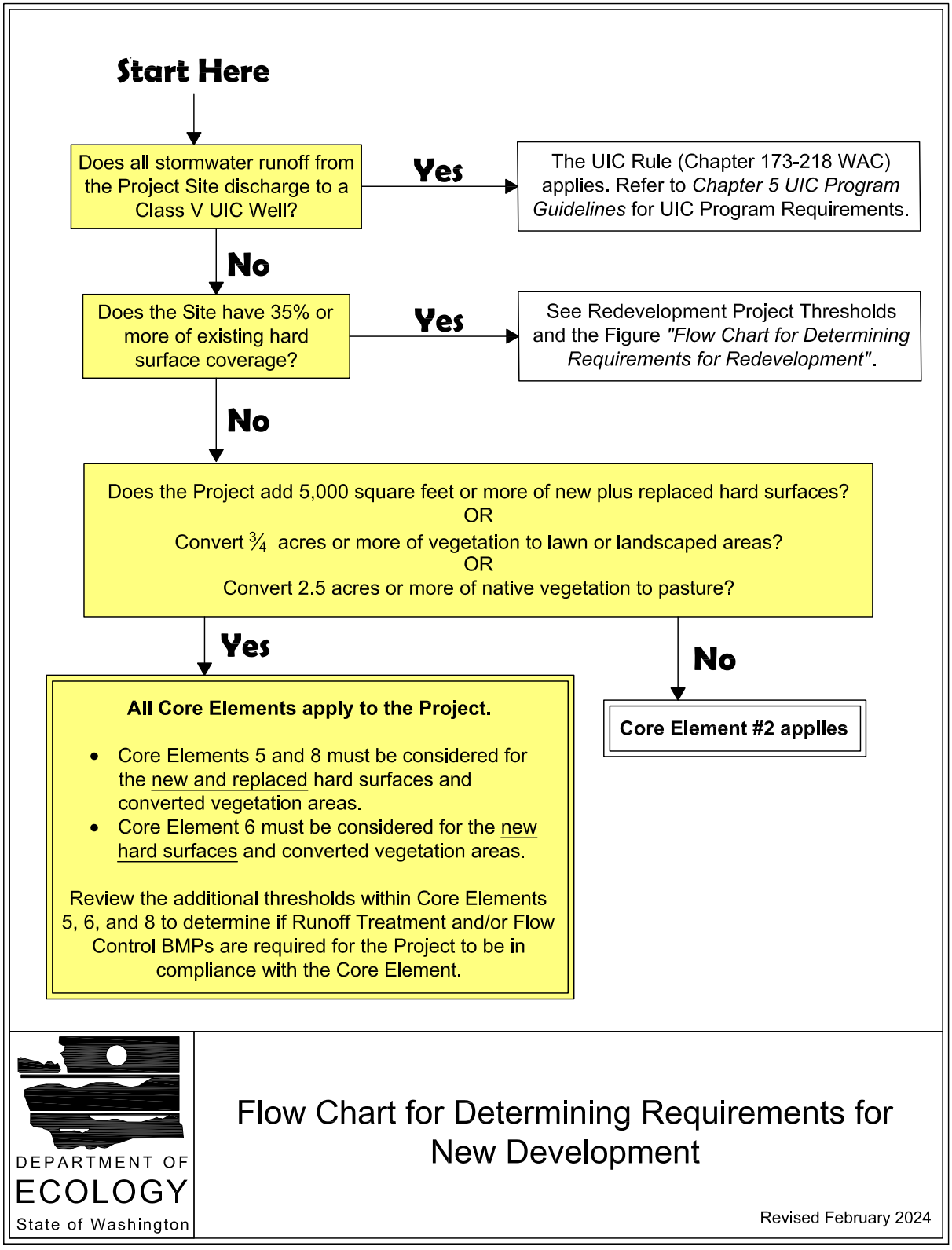
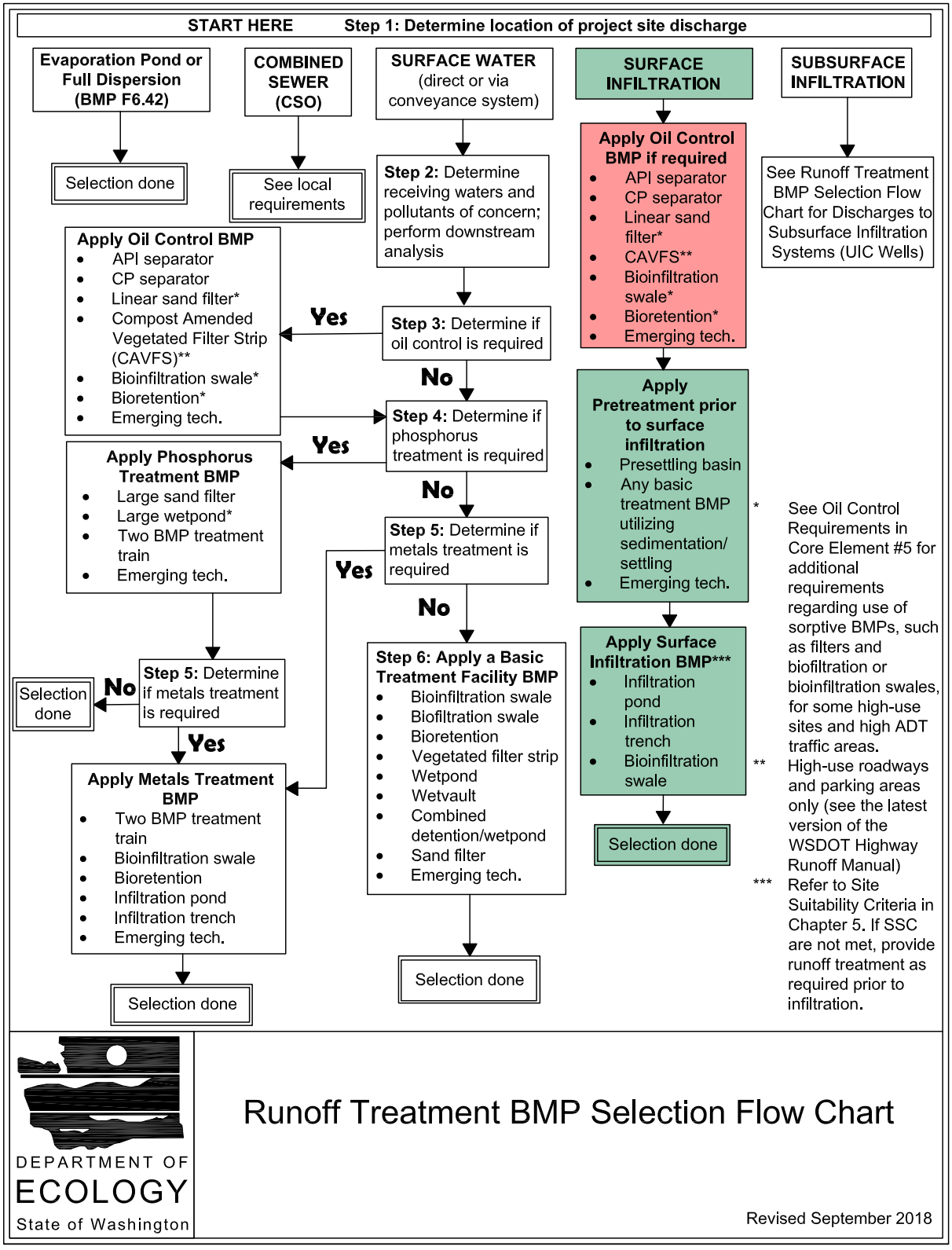


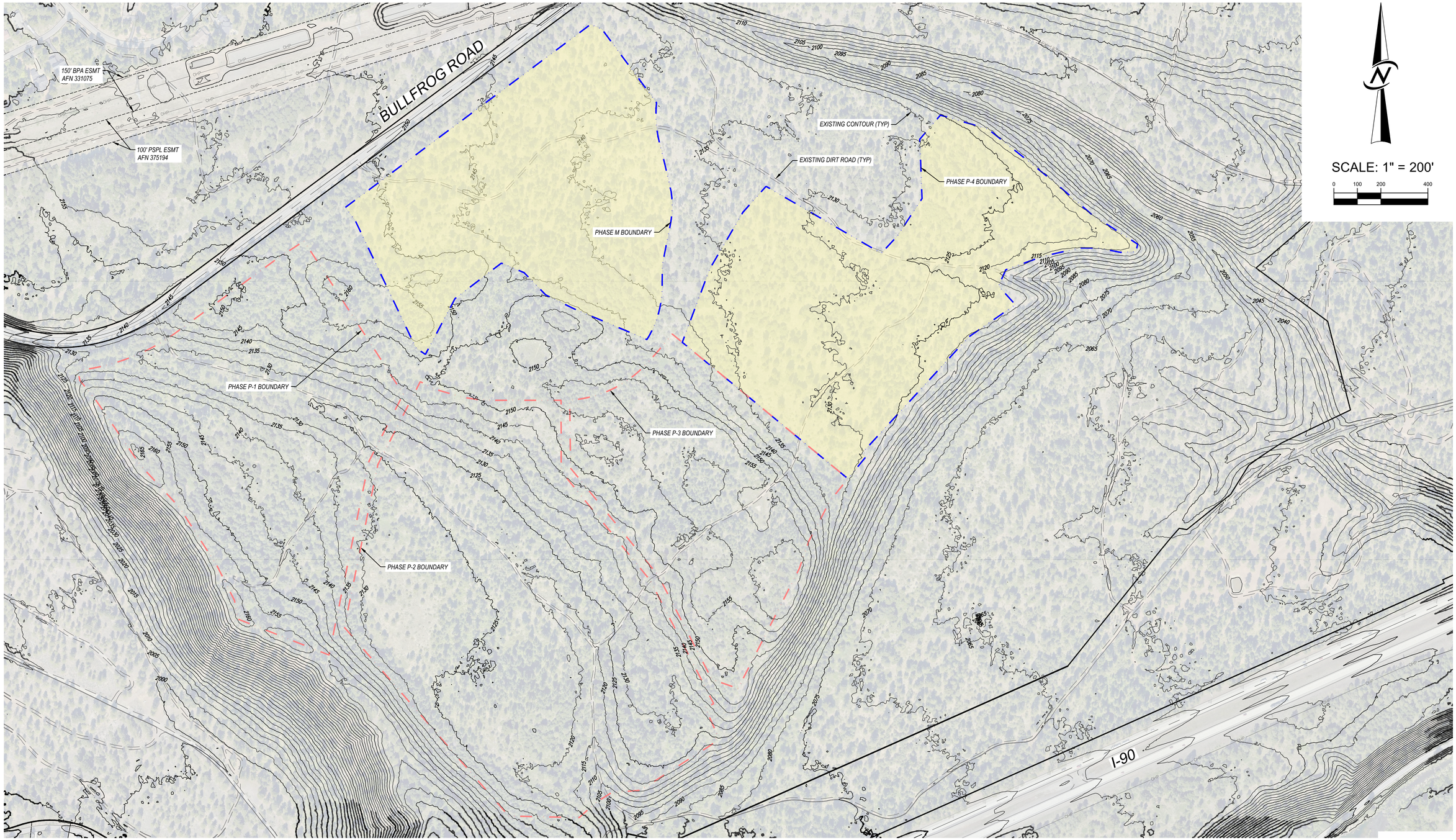
Figure 6.1: Runoff Treatment BMP Selection Flow Chart



3. Off-Site Analysis

Due to the high infiltration rate of onsite soils, this project proposes to infiltrate or disperse 100 percent of the 25-year, 24-hour Type IA storm event plus 24-hour snowmelt. There is no anticipated discharge from the site and no downstream path to analyze. See the Existing Basin Map on the following page for an overview of the existing site.

B-06



BULLFROG - PHASES M & P-4

EXISTING CONDITIONS EXHIBIT

CORE DESIGN
CIVIL ENGINEERING
LANDSCAPE ARCHITECTURE
PLANNING
SURVEYING
12100 NE 195th St, Suite 300 Bothell, Washington 98011 425.885.7877

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4. Permanent Stormwater Control Analysis and Design

4.1 Proposed Conditions & Impervious Surface Summary

This project proposes a variety of different pollution generating and non-pollution generating impervious surface including:

- Asphalt and concrete roadways, gutters and curbs
- Asphalt pedestrian & bicycling pathways
- Concrete sidewalks and ADA ramps
- Gravel maintenance access roads
- Private lot areas including building roofs, concrete driveways, patios, etc.

Based on guidance provided by the project Geotech (AESI) and procedures for stormwater modeling of nearby projects (Suncadia Resort), existing and proposed pervious surfaces are assumed to infiltrate all surface runoff and are not included in the modeling or sizing of any proposed stormwater facilities. Only impervious surfaces in each basin have been delineated and modeled.

The project drainage basins include areas owned by The City of Cle Elum and private property owners. The city of Cle Elum requires all stormwater runoff from private property to be collected and managed separately from public stormwater runoff. To meet this requirement, the project proposes a separate regional infiltration facility to serve all private lot impervious areas.

All impervious surfaces within City right-of-way will flow to regional stormwater facilities owned and maintained by the City of Cle Elum. City owned pedestrian & bicycling pathways that are not located near stormwater collection and conveyance infrastructure will fully disperse runoff within their respective tracts. These surfaces are non-pollution generating as they will not be used by vehicles.

4.2 Regional Stormwater Facilities Overview

To manage stormwater runoff for the developed site, the project proposes construction of three bioretention areas and three infiltration areas. These include one temporary public bioretention area, two permanent public bioretention areas, two public infiltration areas, and one private infiltration area. The temporary bioretention area will be used to mitigate the runoff associated with the public phase P-4 Spine Road area. Future development of Phase P-2 will manage the stormwater runoff from the public P-4 Spine Road area, at which time the temporary public bioretention area will be removed.

The single private infiltration area will be used to mitigate the runoff from private lot areas in Phase P-4. A future facility, which has not been designed or graded at this time, will be used to manage stormwater runoff from Phase M private lot areas. As such, the Phase M private lot runoff is excluded from design considerations in this report. Impervious surfaces within the Phase M right-of-way will flow to a public bioretention area for runoff treatment prior to entering a public infiltration area. Likewise, impervious surfaces within the Phase P-4 right-of-way will flow to a public bioretention area for runoff treatment prior to entering a public infiltration area.

B-06

4.3 Basin Information

All proposed public infiltration areas will be located downstream of bioretention areas. Private stormwater runoff is not pollution-generating and does not require runoff treatment. The basins defined by each of the bioretention and infiltration areas are detailed in Table 4-1 below. The boundaries of these basins are also detailed in the Developed Conditions Exhibit, provided at the end of this section.

Table 4-1 Basin Areas

Subbasin	Total Area (ac)	Impervious Area (ac)	Impervious Area + 15% (ac)
Private P-4 Lot Area	31.578	22.10	25.42
Public P-4 Roadway Area	10.054	7.72	8.88
Public P-4 Spine Road Area	2.610	2.00	2.30
Private M Lot Area	10.740	9.13	10.50
Public M Roadway Area	7.448	5.72	6.58

4.4 Bioretention Design

The proposed bioretention areas have been designed for treatment based on the 6-month Water Quality 24-hour storm – 1.22 inches, as required under the Cle Elum 2024 Construction Standards.

4.4.1 Modeling Results

All bioretention sizing has been determined utilizing Santa Barbara Unit Hydrograph Method. Complete HydroCAD reports are included in the appendices. Preliminary infiltration rates for each facility vary based on testing completed onsite and are included in the table below. Overflow for all bioretention facilities is provided by a weir or outlet pipe, which routes all flows which do not infiltrate within the facility to a downstream infiltration area. Table 4-2 below lists the geometrical design of the proposed bioretention facilities.

Table 4-2 Bioretention Facility Design Geometry

Bioretention Facility:	Public P-4 Roadway Area	Public P-4 Spine Road Area	Public M Roadway Area
Preliminary Infiltration Rate (in/hr)	3	1	3
Bottom Length (ft)	120	110	170
Bottom Width (ft)	50	30	25
Bottom Surface Area (sf)	6,000	3,300	4,250
Max. WQ Stage (ft)	0.99	0.70	0.98
Facility Depth (ft)	1	5	1
Side Slope	3H:1V	3H:1V	3H:1V

B-06

4.5 Infiltration Pond Design

The proposed infiltration areas have been designed using Santa Barbara Unit Hydrograph Method to fully infiltrate the Type IA, 25-year, 24-hour storm event including 24-hour snow melt for the region. The precipitation depth excluding snowmelt is 3.48 inches per the 2024 City of Cle Elum Design Standards. Snowmelt was based on the average daily snow depth, utilizing the methodology presented in Table 4.9 of the 2024 SWMMEW. This calculation is provided below for reference.

4.5.1 Snowmelt Adjustment Factor Calculation

According to the 2024 SWMMEW, the project site is located within Climate Region 1. No snowfall data for the project location is provided in the 2024 SWMMEW. As a result, the closest data available in Wenatchee was used to determine the average daily snow depth in Cle Elum.

The average annual precipitation for Wenatchee, per Figure 4.1 of the 2024 SWMMEW, is 10 inches. The average annual precipitation for Cle Elum from the same figure is 26 inches. The estimated average daily snow depth for Cle Elum was determined by multiplying the ratio of average annual precipitation between Cle Elum and Wenatchee against the average daily snow depth in Wenatchee.

$$S_{Cle\ Elum} = S_{Wenatchee} * \frac{P_{Cle\ Elum}}{P_{Wenatchee}}$$

Where: S_{City} is the average daily snow depth of that city in inches, and
P_{City} is the average annual precipitation of that city in inches.

The calculated Average Daily Snow Depth of Cle Elum is 6.94 inches. A summary of the values used for this calculation is provided in Table 4-3 below.

Table 4-3 Average Daily Snow Depth Calculation

$P_{Wenatchee}$	10 in
$P_{Cle\ Elum}$	26 in
$P_{Cle\ Elum}$ / $P_{Wenatchee}$	2.6
$S_{Wenatchee}$	2.67 in
$S_{Cle\ Elum}$	6.94 in

The equivalent snowmelt depth was determined utilizing a 20 percent snow moisture content, matching the relationships presented in Table 4.9 of the 2024 SWMMEW. As such, the Cle Elum Snowmelt 24-hour Adjustment utilized in sizing the infiltration pond was found to be 1.39 inches. See Table 4-4 for the referenced and calculated snowmelt factors.

Table 4-4 Snowmelt Adjustment Factors from the 2024 SWMMEW

Location	Average Daily Snow Depth (inches)	Water Equivalent (inches) 24-Hour Storm Precipitation Adjustment
Wenatchee	2.67	0.53
*Cle Elum**	*6.94*	*1.39*
**Per calculations provided above*		

4.5.2 Design Storm

To determine the total design storm depth, the 24-hour storm depth was combined with the Cle Elum 24-hour snowmelt depth. This resulted in a 25-year design storm depth of 4.87 inches. See Table 4-5 below for a summary of this calculation.

Table 4-5 Design Storm Calculation

Snowmelt Adjustment	1.39 in
25-yr, 24-hr Depth	3.48 in
Design Storm Depth	4.87 in

4.5.3 Modeling Results

All infiltration area sizing has been determined utilizing the Santa Barbara Unit Hydrograph Method. Complete HydroCAD reports are included in the appendices of this report. The preliminary infiltration rate for each infiltration area was set at 15 in/hr. The model has been set up such that the overflows from all tributary bioretention areas are routed directly to proposed infiltration areas. Geometry and backfill of the proposed facilities vary based on the constraints at each facility's location. Hydrographs produced by HydroCAD show that all runoff routed to the infiltration areas during the 25-year storm event is infiltrated within 30 hours, which is less than the required 72 hours. Emergency overflow conveyance pathways from each facility have been sized to accommodate the 100-year storm event. Geometry and design information for each proposed infiltration area is provided in Table 4-6 below.

Table 4-6 Infiltration Area Design Geometry

Infiltration Facility:	Private P-4 Lot Area	Public P-4 Roadway Area	Public M Roadway Area
Bottom Length (ft)	240	40	45
Bottom Width (ft)	50	30	35
Bottom Surface Area (sf)	12,000	1,200	1,575
25 Year Storm Stage (ft)	5.00	4.94	3.92
Facility Depth (ft)	5	5	4
Side Slope	3H:1V	3H:1V	3H:1V
Storage Volume (cf)	84,000	13,500	11,292

B-06

LEGEND

- PRIVATE P-4 LOT AREA
- PUBLIC P-4 ROADWAY AREA
- PUBLIC P-4 SPINE ROAD AREA
- PRIVATE M LOT AREA
- PUBLIC M ROADWAY AREA

BULLFROG ROAD

PHASE M

M PUBLIC BIORETENTION AREA

M PUBLIC INFILTRATION AREA

WETLAND AND BUFFER

FUTURE DEVELOPMENT PHASE P-1

SPINE ROAD TEMPORARY PUBLIC BIORETENTION AREA

FUTURE DEVELOPMENT PHASE P-2

FUTURE DEVELOPMENT PHASE P-3

PHASE P-4

P-4 PRIVATE INFILTRATION AREA

P-4 PUBLIC INFILTRATION AREA

P-4 PUBLIC BIORETENTION AREA

PREVIOUS PHASE S-1

10' EXISTING CONTOUR (TYP)

5' PROPOSED CONTOUR (TYP)

PRIVATE STORM PIPE, (TYP)

PUBLIC STORM PIPE, (TYP)

I-90

SCALE: 1" = 150'

0 75 150 300

BULLFROG - PHASES M & P-4

DEVELOPED CONDITIONS EXHIBIT

CORE DESIGN
CIVIL ENGINEERING
LANDSCAPE ARCHITECTURE
PLANNING
SURVEYING
12100 NE 195th St, Suite 300 Bothell, Washington 98011 425.885.7877

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5. Conveyance Capacity Analysis

A conveyance capacity analysis will be completed at final design.

B-06

B-06

6. Construction Stormwater Pollution Prevention Analysis

Temporary Erosion and sediment control for the project will be provided per the requirements of the 2024 SWMMEW. A CSWPPP is provided with the Civil Project Plans on the General Notes sheet, C1.02.

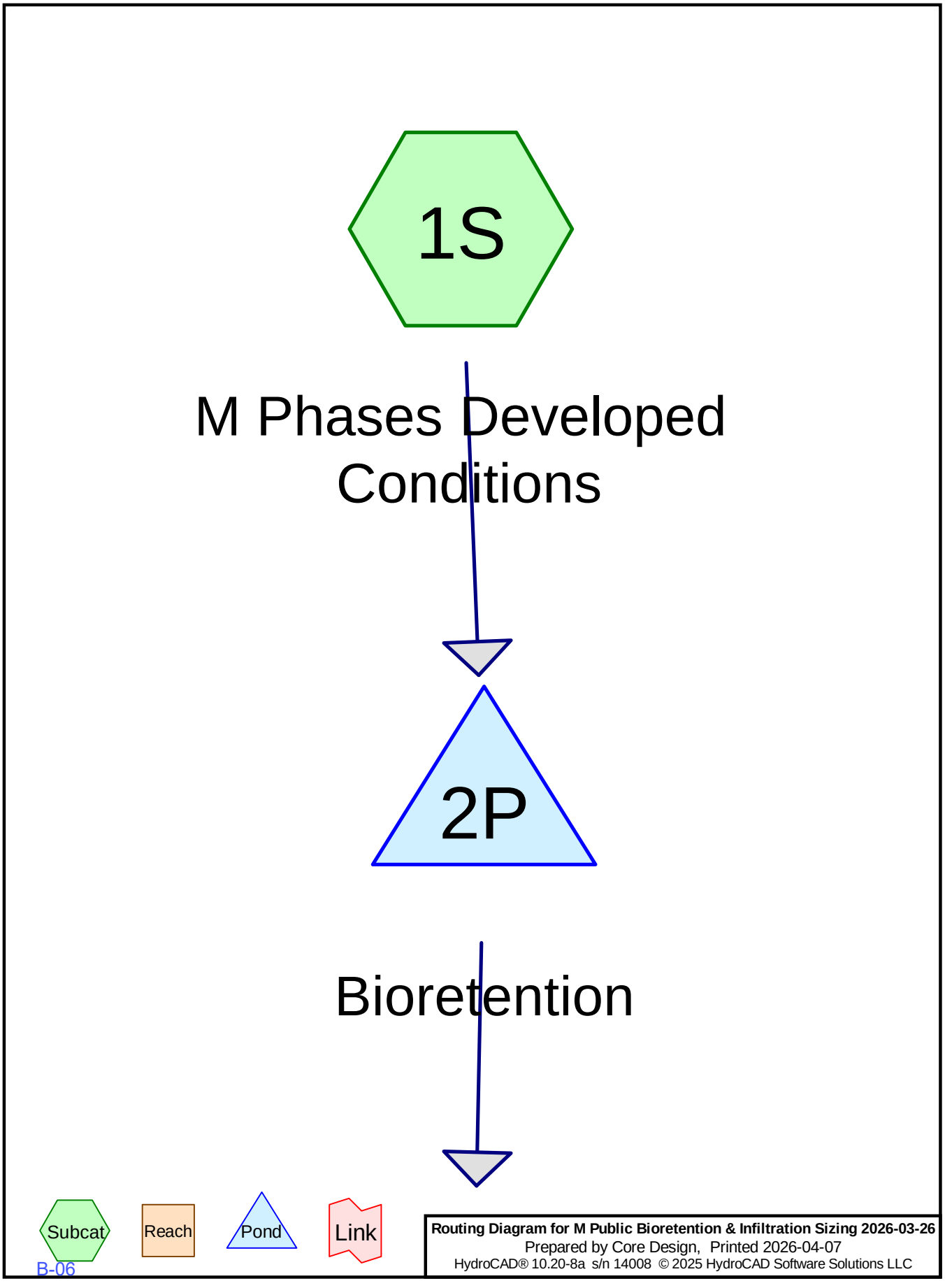
B-06

7. Operations and Maintenance Manual

Operations and maintenance details for the proposed stormwater facilities are provided from the 2024 SWMMEW as Appendix I - Operations & Maintenance Manual.

B-06

Appendix A – Phase M Public Bioretention Area 6-month WQ HydroCAD Report



Routing Diagram for M Public Bioretention & Infiltration Sizing 2026-03-26
Prepared by Core Design, Printed 2026-04-07
HydroCAD® 10.20-8a s/n 14008 © 2025 HydroCAD Software Solutions LLC

Rainfall Events Listing (selected events)

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	6 Month	Type IA 24-hr		Default	24.00	1	1.22	2

Area Listing (selected nodes)

Area (acres)	CN	Description (subcatchment-numbers)
6.580	98	Total Public Impervious Area (1S)
6.580	**98**	**TOTAL AREA**

Soil Listing (selected nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.000	HSG B	
0.000	HSG C	
0.000	HSG D	
6.580	Other	1S
6.580		**TOTAL AREA**

Ground Covers (selected nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.000	0.000	0.000	0.000	6.580	6.580	Total Public Impervious Area	1S
0.000	**0.000**	**0.000**	**0.000**	**6.580**	**6.580**	**TOTAL AREA**	

Pipe Listing (selected nodes)

Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Width (inches)	Diam/Height (inches)	Inside-Fill (inches)	Node Name
1	2P	2,131.00	2,125.00	20.0	0.3000	0.013	0.0	18.0	0.0	

Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 points
Runoff by SBUH method, Split Pervious/Imperv.
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1S: M Phases Developed Runoff Area=6.580 ac 100.00% Impervious Runoff Depth=1.01"
Tc=5.0 min CN=0/98 Runoff=1.71 cfs 0.551 af

Pond 2P: Bioretention Peak Elev=2,130.98' Storage=0.109 af Inflow=1.71 cfs 0.551 af
Discarded=0.38 cfs 0.551 af Primary=0.00 cfs 0.000 af Outflow=0.38 cfs 0.551 af

Total Runoff Area = 6.580 ac Runoff Volume = 0.551 af Average Runoff Depth = 1.01"
0.00% Pervious = 0.000 ac 100.00% Impervious = 6.580 ac

Summary for Subcatchment 1S: M Phases Developed Conditions

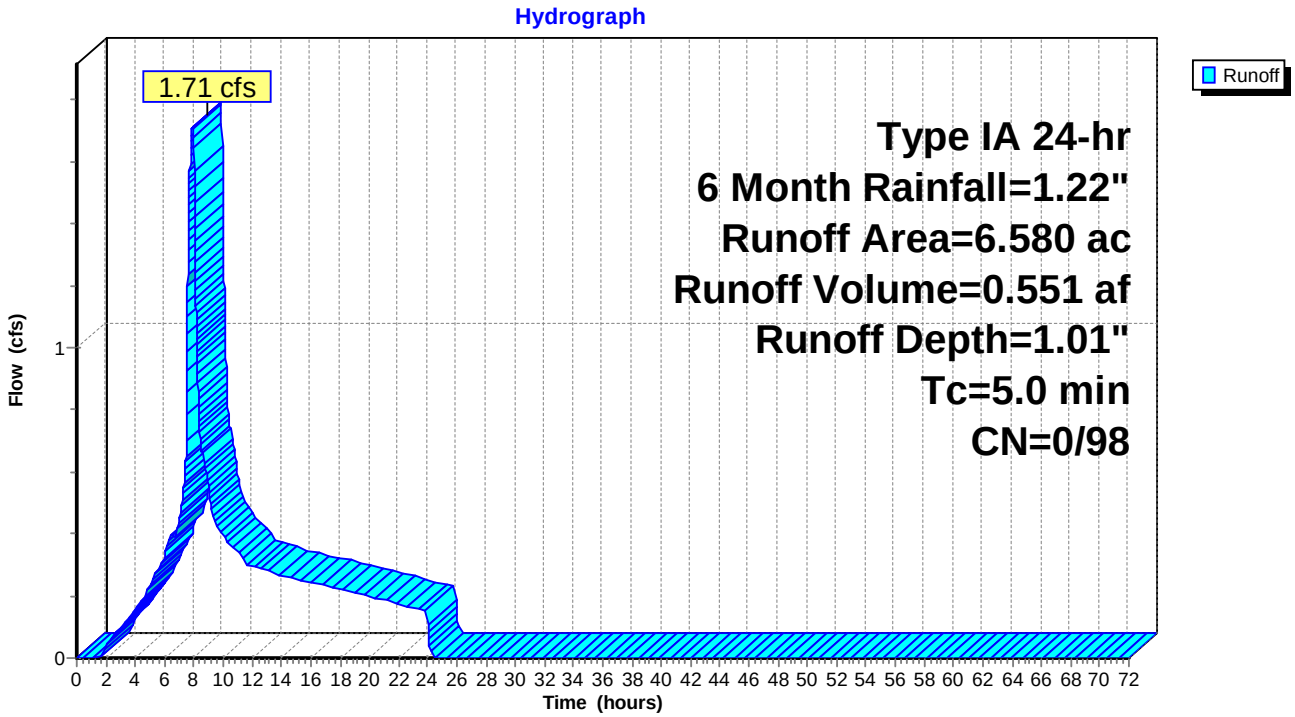
Runoff = 1.71 cfs @ 7.89 hrs, Volume= 0.551 af, Depth= 1.01"
Routed to Pond 2P : Bioretention

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type IA 24-hr 6 Month Rainfall=1.22"

	Area (ac)	CN	Description
*	6.580	98	Total Public Impervious Area
	6.580	98	100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment 1S: M Phases Developed Conditions



Summary for Pond 2P: Bioretention

Inflow Area = 6.580 ac,100.00% Impervious, Inflow Depth = 1.01" for 6 Month event
Inflow = 1.71 cfs @ 7.89 hrs, Volume= 0.551 af
Outflow = 0.38 cfs @ 10.19 hrs, Volume= 0.551 af, Atten= 78%, Lag= 138.0 min
Discarded = 0.38 cfs @ 10.19 hrs, Volume= 0.551 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Routed to Pond 3P : Infiltration

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 2,130.98' @ 10.19 hrs Surf.Area= 0.125 ac Storage= 0.109 af

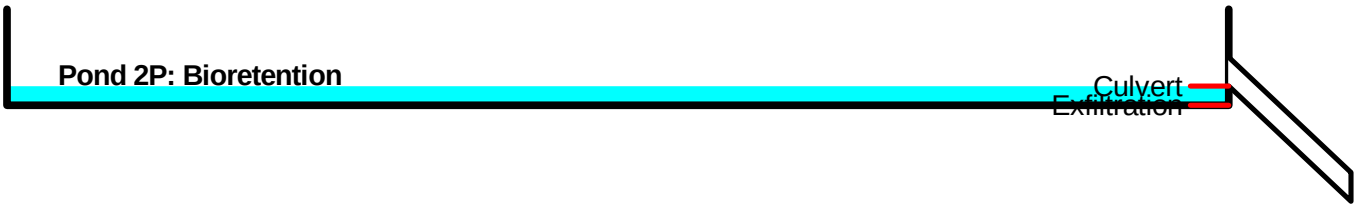
Plug-Flow detention time= 114.8 min calculated for 0.551 af (100% of inflow)
Center-of-Mass det. time= 114.8 min (816.8 - 702.1)

Volume	Invert	Avail.Storage	Storage Description
#1	2,130.00'	0.858 af	**25.00'W x 170.00'L x 5.00'H Prismatoid Z=3.0**

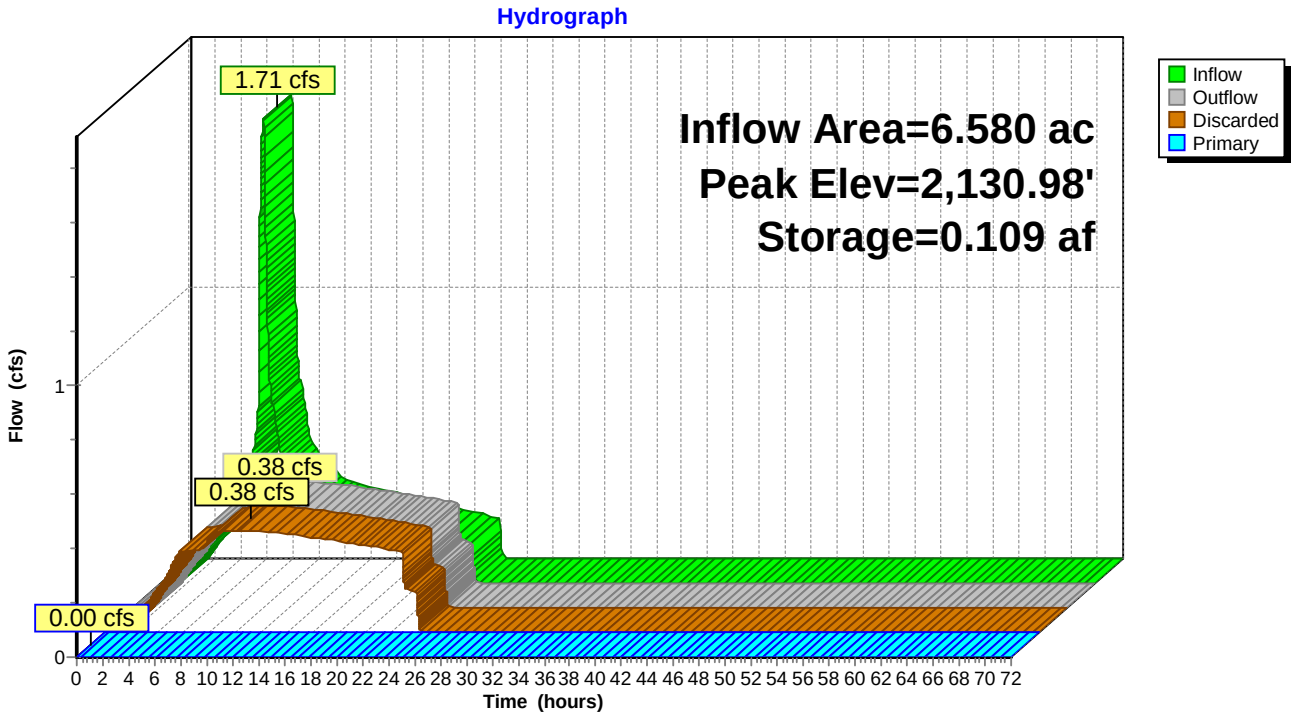
Device	Routing	Invert	Outlet Devices
#1	Discarded	2,130.00'	**3.000 in/hr Exfiltration over Horizontal area** Phase-In= 0.01'
#2	Primary	2,131.00'	**18.0" Round Culvert** L= 20.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 2,131.00' / 2,125.00' S= 0.3000 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.77 sf

Discarded OutFlow Max=0.38 cfs @ 10.19 hrs HW=2,130.98' (Free Discharge)
↳**1=Exfiltration** (Exfiltration Controls 0.38 cfs)

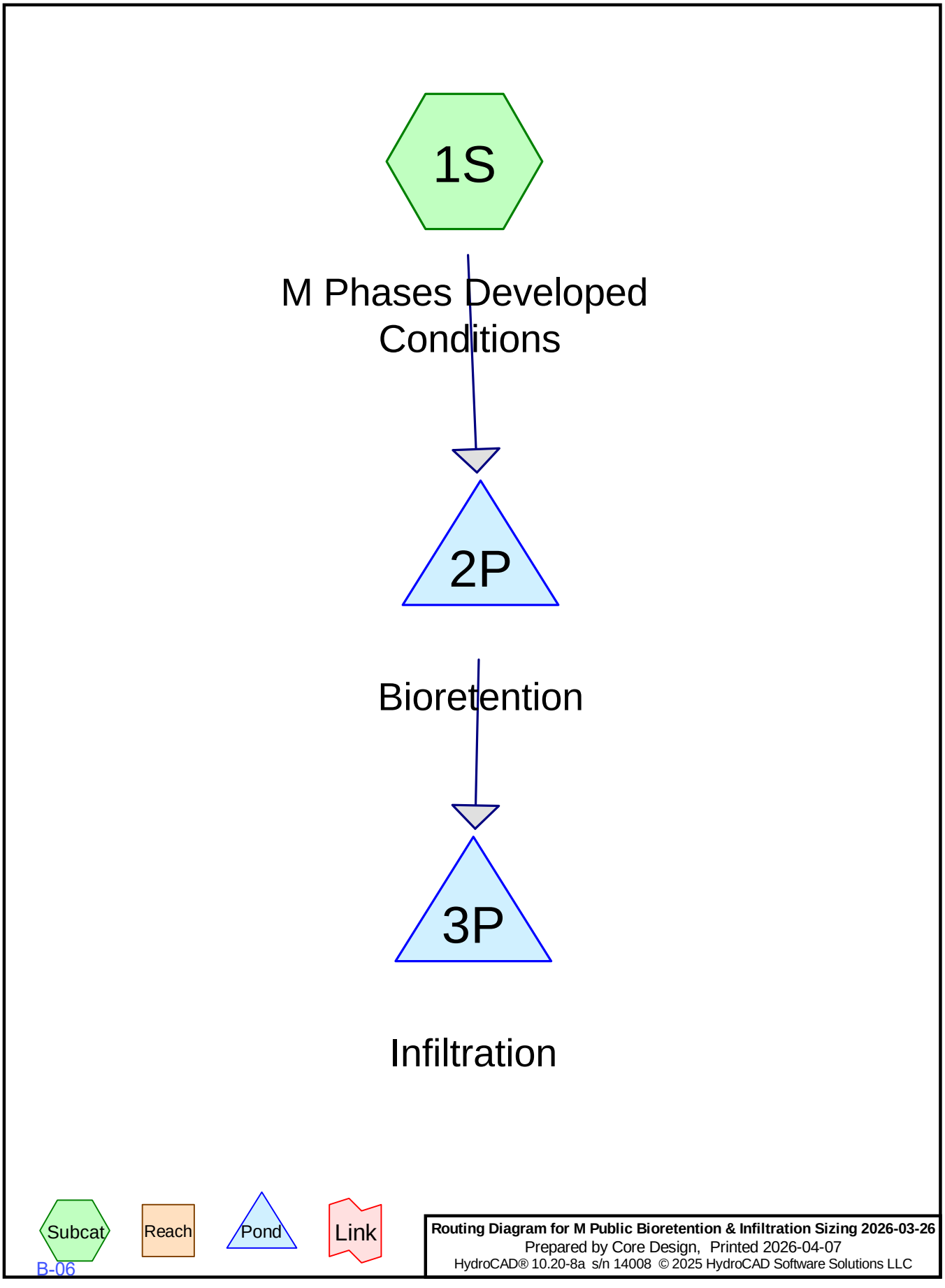
Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=2,130.00' TW=2,129.00' (Dynamic Tailwater)
↳**2=Culvert** (Controls 0.00 cfs)



Pond 2P: Bioretention



Appendix B – Phase M Public Bioretention & Infiltration Area 25-yr HydroCAD Report



Routing Diagram for M Public Bioretention & Infiltration Sizing 2026-03-26
Prepared by Core Design, Printed 2026-04-07
HydroCAD® 10.20-8a s/n 14008 © 2025 HydroCAD Software Solutions LLC

Rainfall Events Listing (selected events)

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	25 Year + Snowmelt	Type IA 24-hr		Default	24.00	1	4.87	2

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
6.580	98	Total Public Impervious Area (1S)
6.580	**98**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.000	HSG B	
0.000	HSG C	
0.000	HSG D	
6.580	Other	1S
6.580		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.000	0.000	0.000	0.000	6.580	6.580	Total Public Impervious Area	1S
0.000	**0.000**	**0.000**	**0.000**	**6.580**	**6.580**	**TOTAL AREA**	

Pipe Listing (all nodes)

Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Width (inches)	Diam/Height (inches)	Inside-Fill (inches)	Node Name
1	2P	2,131.00	2,125.00	20.0	0.3000	0.013	0.0	18.0	0.0	

Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 points
Runoff by SBUH method, Split Pervious/Imperv.
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1S: M Phases Developed Runoff Area=6.580 ac 100.00% Impervious Runoff Depth=4.63"
Tc=5.0 min CN=0/98 Runoff=7.57 cfs 2.541 af

Pond 2P: Bioretention Peak Elev=2,132.97' Storage=0.415 af Inflow=7.57 cfs 2.541 af
Discarded=0.56 cfs 0.983 af Primary=3.62 cfs 1.557 af Outflow=4.11 cfs 2.541 af

Pond 3P: Infiltration Peak Elev=2,132.92' Storage=0.243 af Inflow=3.62 cfs 1.557 af
Discarded=1.39 cfs 1.557 af Primary=0.00 cfs 0.000 af Outflow=1.39 cfs 1.557 af

Total Runoff Area = 6.580 ac Runoff Volume = 2.541 af Average Runoff Depth = 4.63"
0.00% Pervious = 0.000 ac 100.00% Impervious = 6.580 ac

Summary for Subcatchment 1S: M Phases Developed Conditions

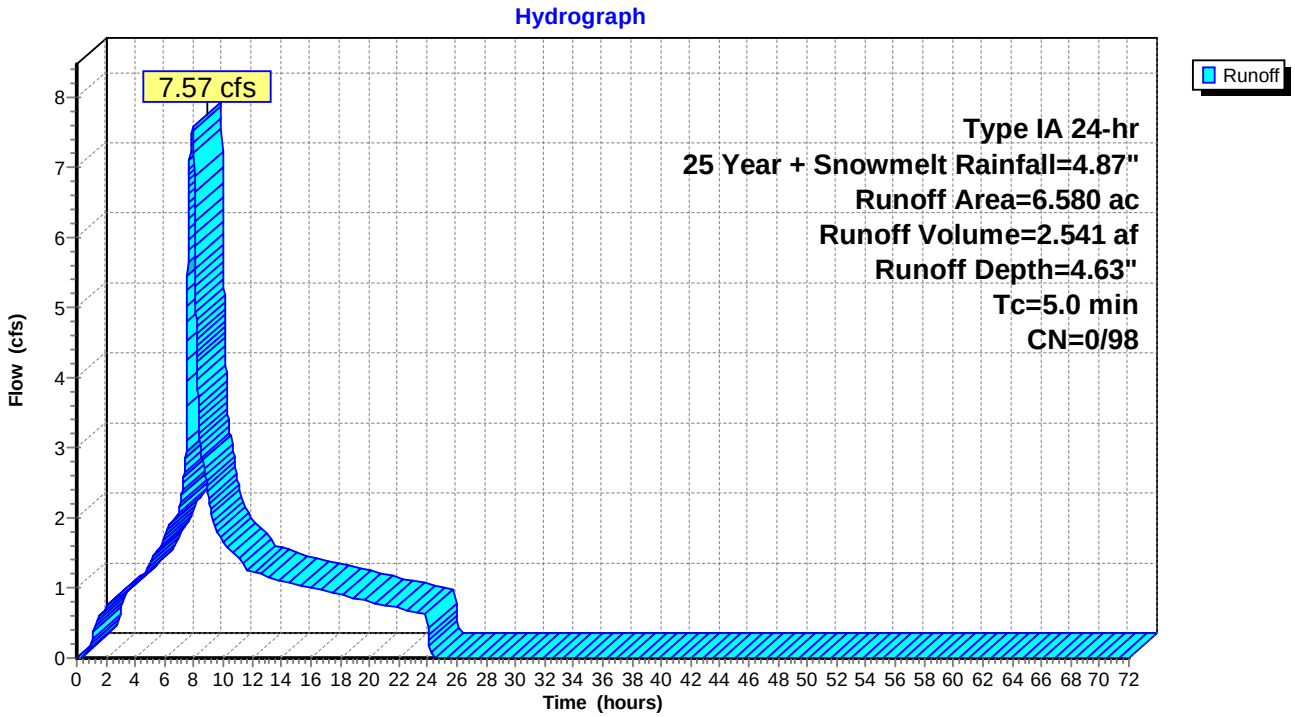
Runoff = 7.57 cfs @ 7.88 hrs, Volume= 2.541 af, Depth= 4.63"
Routed to Pond 2P : Bioretention

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type IA 24-hr 25 Year + Snowmelt Rainfall=4.87"

	Area (ac)	CN	Description
*	6.580	98	Total Public Impervious Area
	6.580	98	100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment 1S: M Phases Developed Conditions



Summary for Pond 2P: Bioretention

Inflow Area = 6.580 ac,100.00% Impervious, Inflow Depth = 4.63" for 25 Year + Snowmelt event
Inflow = 7.57 cfs @ 7.88 hrs, Volume= 2.541 af
Outflow = 4.11 cfs @ 7.83 hrs, Volume= 2.541 af, Atten= 46%, Lag= 0.0 min
Discarded = 0.56 cfs @ 9.28 hrs, Volume= 0.983 af
Primary = 3.62 cfs @ 7.83 hrs, Volume= 1.557 af
Routed to Pond 3P : Infiltration

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 2,132.97' @ 9.28 hrs Surf.Area= 0.185 ac Storage= 0.415 af

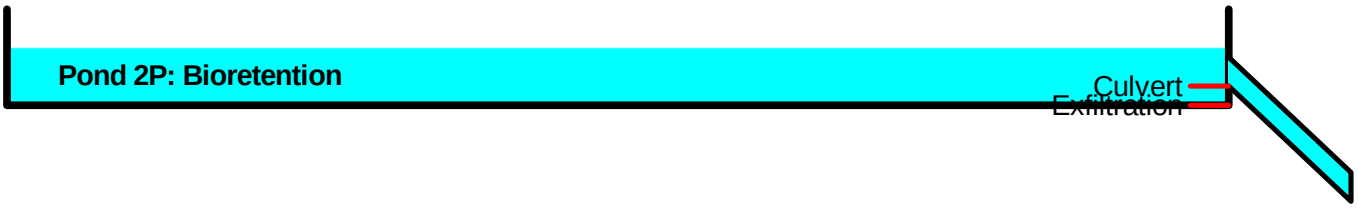
Plug-Flow detention time= 123.8 min calculated for 2.540 af (100% of inflow)
Center-of-Mass det. time= 123.8 min (779.0 - 655.2)

Volume	Invert	Avail.Storage	Storage Description
#1	2,130.00'	0.858 af	**25.00'W x 170.00'L x 5.00'H Prismatoid Z=3.0**

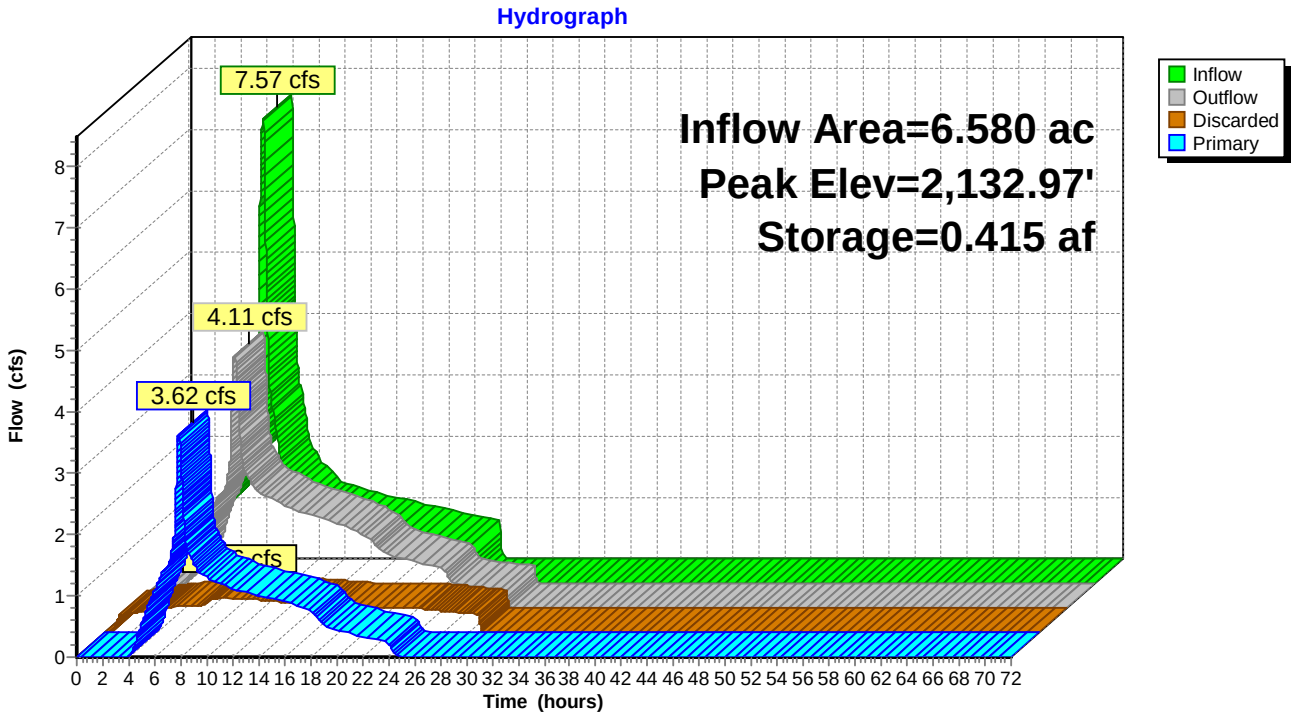
Device	Routing	Invert	Outlet Devices
#1	Discarded	2,130.00'	**3.000 in/hr Exfiltration over Horizontal area** Phase-In= 0.01'
#2	Primary	2,131.00'	**18.0" Round Culvert** L= 20.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 2,131.00' / 2,125.00' S= 0.3000 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.77 sf

Discarded OutFlow Max=0.56 cfs @ 9.28 hrs HW=2,132.97' (Free Discharge)
↳**1=Exfiltration** (Exfiltration Controls 0.56 cfs)

Primary OutFlow Max=3.49 cfs @ 7.83 hrs HW=2,132.21' TW=2,131.85' (Dynamic Tailwater)
↳**2=Culvert** (Inlet Controls 3.49 cfs @ 2.29 fps)



Pond 2P: Bioretention



Summary for Pond 3P: Infiltration

Inflow Area = 6.580 ac,100.00% Impervious, Inflow Depth = 2.84" for 25 Year + Snowmelt event
Inflow = 3.62 cfs @ 7.83 hrs, Volume= 1.557 af
Outflow = 1.39 cfs @ 9.34 hrs, Volume= 1.557 af, Atten= 62%, Lag= 90.8 min
Discarded = 1.39 cfs @ 9.34 hrs, Volume= 1.557 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 2,132.92' @ 9.34 hrs Surf.Area= 0.092 ac Storage= 0.243 af

Plug-Flow detention time= 89.6 min calculated for 1.557 af (100% of inflow)
Center-of-Mass det. time= 89.6 min (810.2 - 720.6)

Volume	Invert	Avail.Storage	Storage Description
#1	2,129.00'	1.188 af	**45.00'W x 35.00'L x 10.00'H Prismatoid Z=3.0**

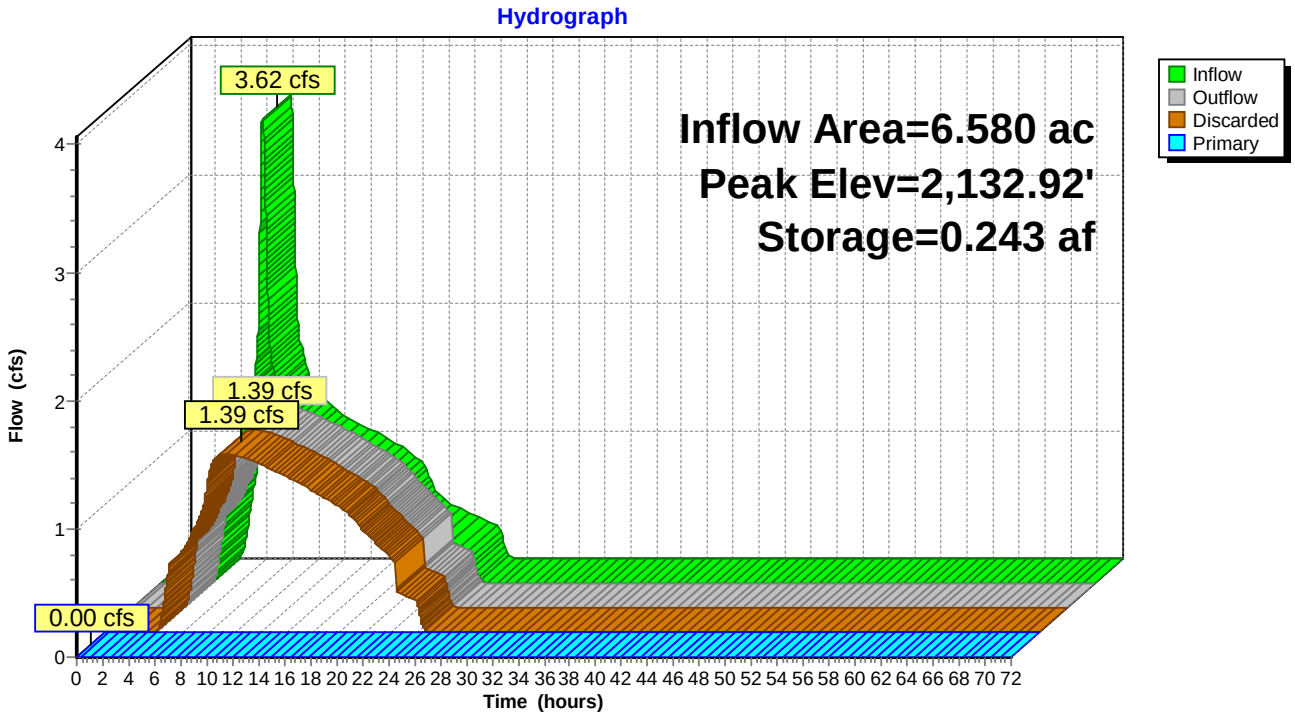
Device	Routing	Invert	Outlet Devices
#1	Primary	2,133.00'	**36.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Discarded	2,129.00'	**15.000 in/hr Exfiltration over Horizontal area** Phase-In= 0.01'

Discarded OutFlow Max=1.39 cfs @ 9.34 hrs HW=2,132.92' (Free Discharge)
↳**2=Exfiltration** (Exfiltration Controls 1.39 cfs)

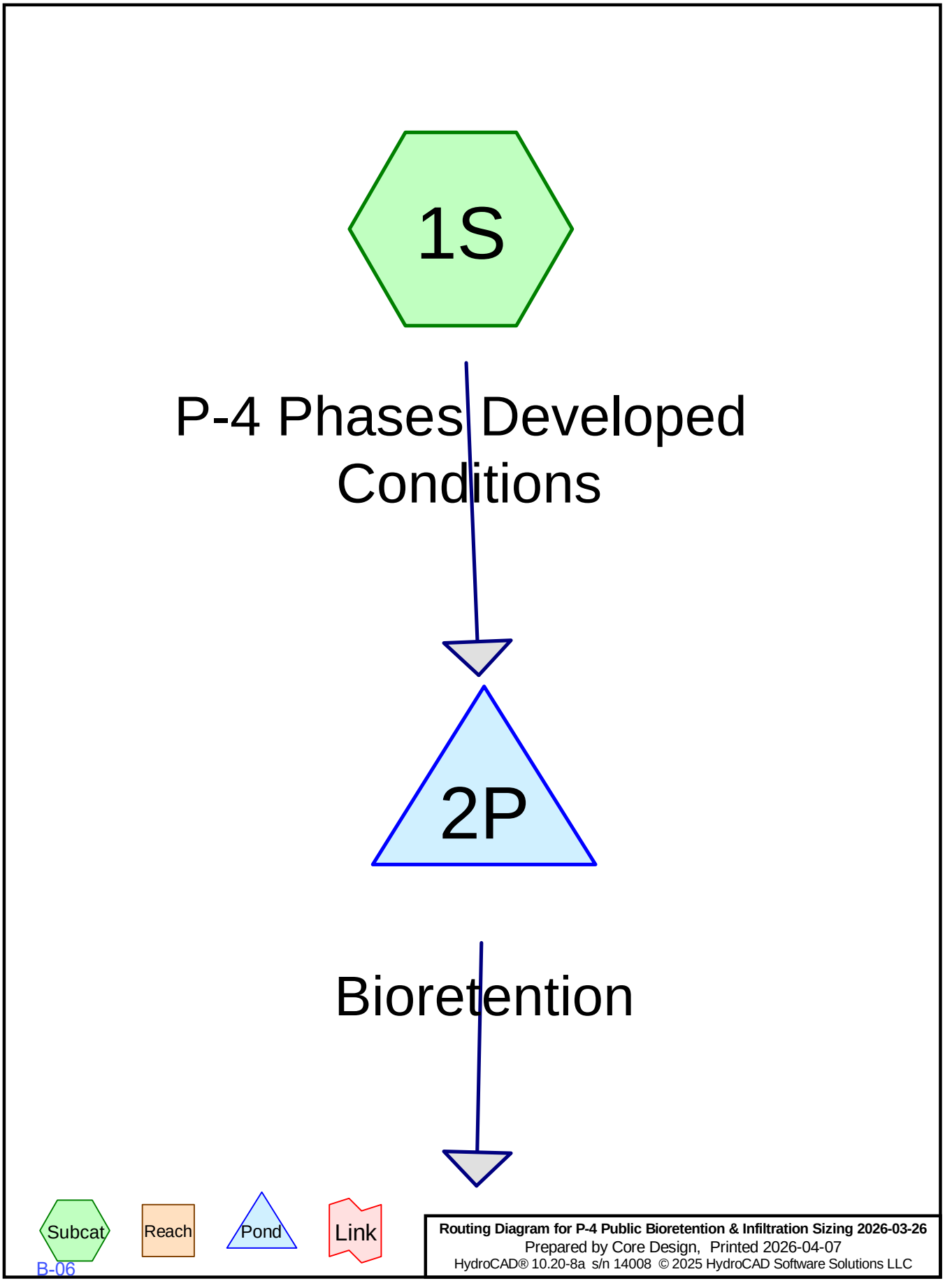
Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=2,129.00' (Free Discharge)
↳**1=Orifice/Grate** (Controls 0.00 cfs)



Pond 3P: Infiltration



Appendix C – Phase P-4 Public Bioretention Area 6-month WQ HydroCAD Report



Routing Diagram for P-4 Public Bioretention & Infiltration Sizing 2026-03-26
Prepared by Core Design, Printed 2026-04-07
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Rainfall Events Listing (selected events)

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	6 Month	Type IA 24-hr		Default	24.00	1	1.22	2

Area Listing (selected nodes)

Area (acres)	CN	Description (subcatchment-numbers)
8.880	98	Total Impervious Area (1S)
8.880	**98**	**TOTAL AREA**

Soil Listing (selected nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.000	HSG B	
0.000	HSG C	
0.000	HSG D	
8.880	Other	1S
8.880		**TOTAL AREA**

Ground Covers (selected nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.000	0.000	0.000	0.000	8.880	8.880	Total Impervious Area	1S
0.000	**0.000**	**0.000**	**0.000**	**8.880**	**8.880**	**TOTAL AREA**	

Pipe Listing (selected nodes)

Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Width (inches)	Diam/Height (inches)	Inside-Fill (inches)	Node Name
1	2P	2,110.00	2,108.00	20.0	0.1000	0.013	0.0	24.0	0.0	

Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 points
Runoff by SBUH method, Split Pervious/Imperv.
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1S: P-4 Phases Developed Runoff Area=8.880 ac 100.00% Impervious Runoff Depth=1.01"
Tc=5.0 min CN=0/98 Runoff=2.31 cfs 0.744 af

Pond 2P: Bioretention Peak Elev=2,109.99' Storage=0.148 af Inflow=2.31 cfs 0.744 af
Discarded=0.49 cfs 0.744 af Primary=0.00 cfs 0.000 af Outflow=0.49 cfs 0.744 af

Total Runoff Area = 8.880 ac Runoff Volume = 0.744 af Average Runoff Depth = 1.01"
0.00% Pervious = 0.000 ac 100.00% Impervious = 8.880 ac

Summary for Subcatchment 1S: P-4 Phases Developed Conditions

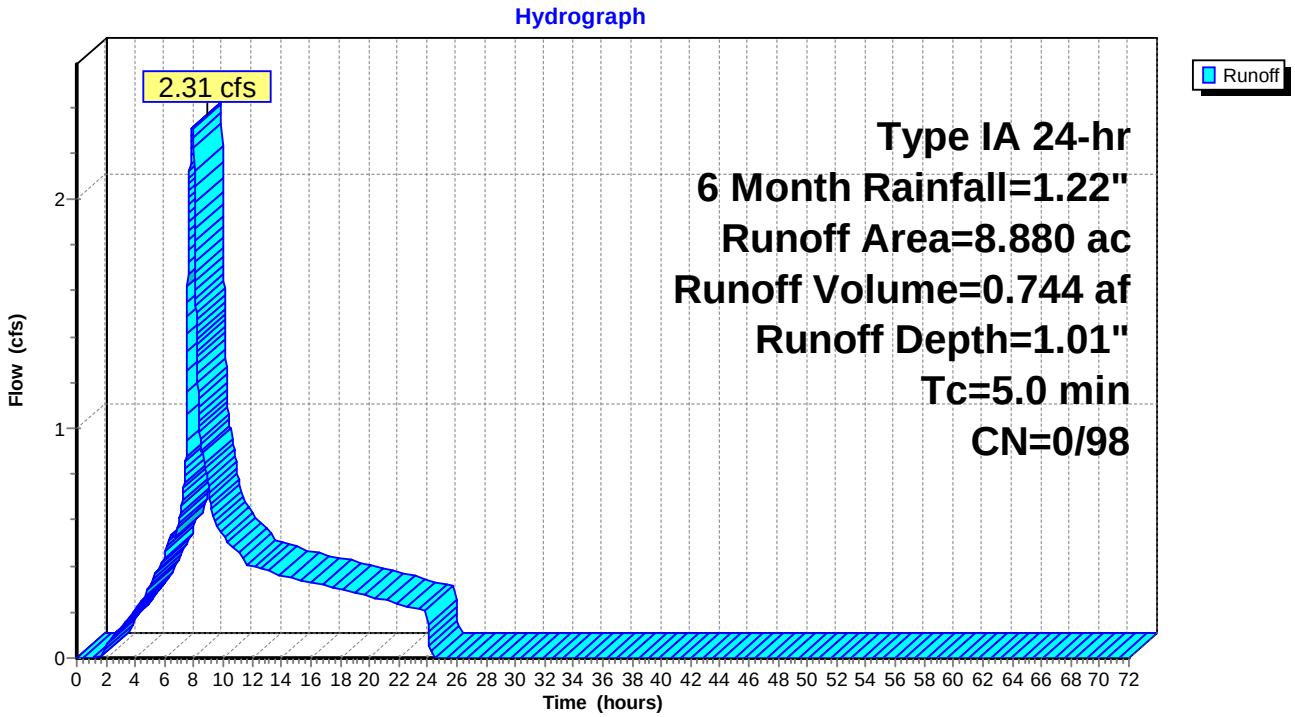
Runoff = 2.31 cfs @ 7.89 hrs, Volume= 0.744 af, Depth= 1.01"
Routed to Pond 2P : Bioretention

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type IA 24-hr 6 Month Rainfall=1.22"

	Area (ac)	CN	Description
*	8.880	98	Total Impervious Area
	8.880	98	100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment 1S: P-4 Phases Developed Conditions



Summary for Pond 2P: Bioretention

Inflow Area = 8.880 ac,100.00% Impervious, Inflow Depth = 1.01" for 6 Month event
Inflow = 2.31 cfs @ 7.89 hrs, Volume= 0.744 af
Outflow = 0.49 cfs @ 10.42 hrs, Volume= 0.744 af, Atten= 79%, Lag= 151.8 min
Discarded = 0.49 cfs @ 10.42 hrs, Volume= 0.744 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Routed to Pond 3P : Infiltration

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 2,109.99' @ 10.42 hrs Surf.Area= 0.162 ac Storage= 0.148 af

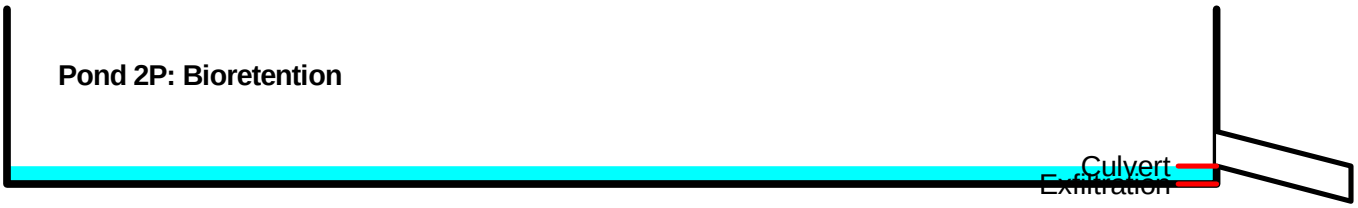
Plug-Flow detention time= 120.5 min calculated for 0.744 af (100% of inflow)
Center-of-Mass det. time= 120.5 min (822.5 - 702.1)

Volume	Invert	Avail.Storage	Storage Description
#1	2,109.00'	2.824 af	**50.00'W x 120.00'L x 10.00'H Prismatoid Z=3.0**

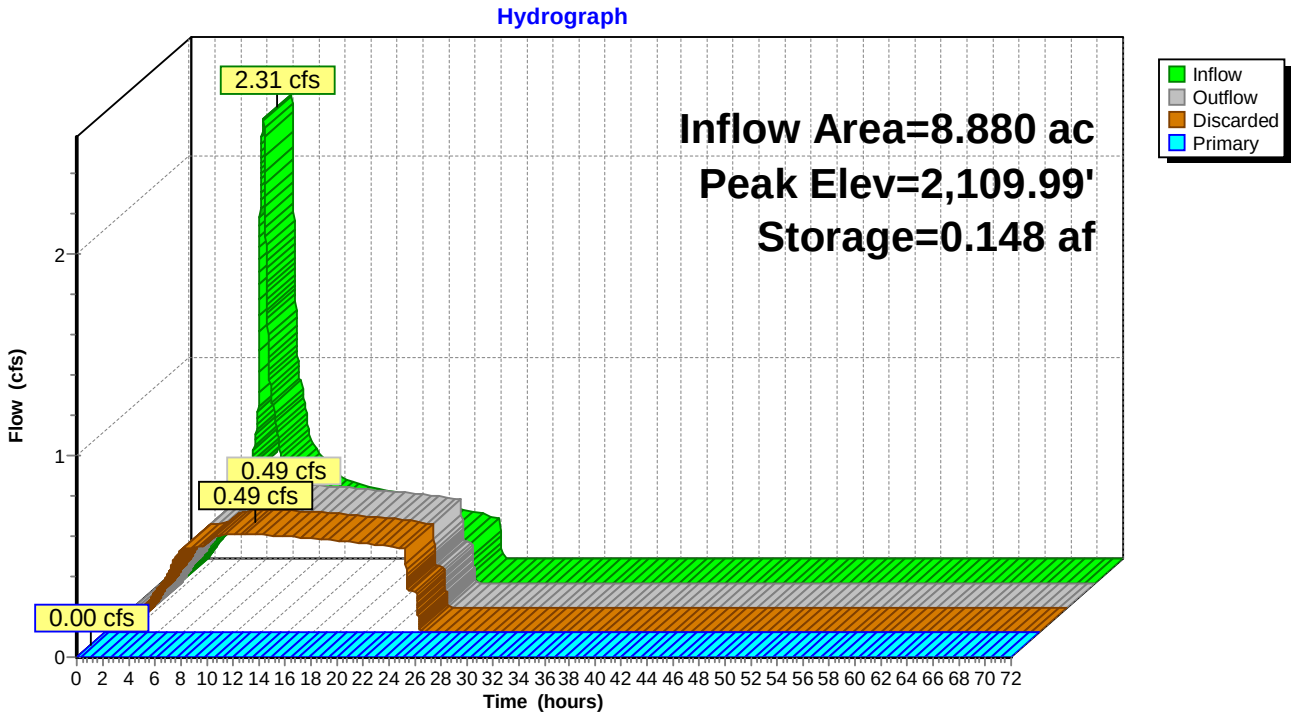
Device	Routing	Invert	Outlet Devices
#1	Discarded	2,109.00'	**3.000 in/hr Exfiltration over Horizontal area** Phase-In= 0.01'
#2	Primary	2,110.00'	**24.0" Round Culvert** L= 20.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 2,110.00' / 2,108.00' S= 0.1000 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 3.14 sf

Discarded OutFlow Max=0.49 cfs @ 10.42 hrs HW=2,109.99' (Free Discharge)
↳**1=Exfiltration** (Exfiltration Controls 0.49 cfs)

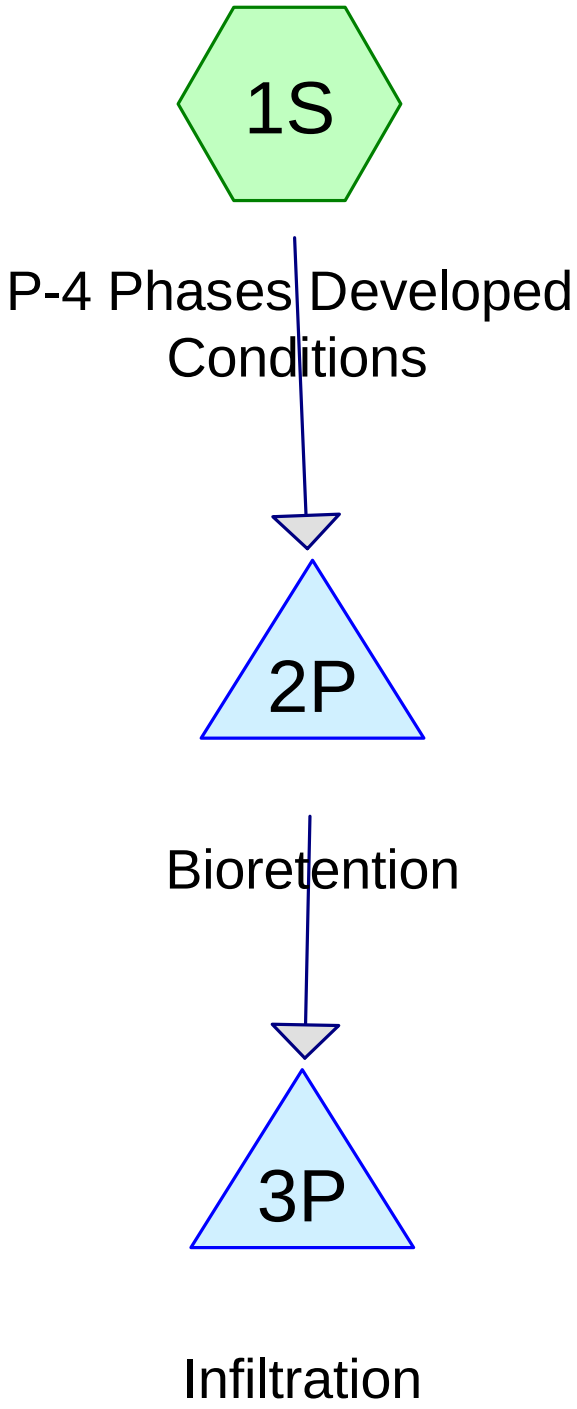
Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=2,109.00' TW=2,108.00' (Dynamic Tailwater)
↳**2=Culvert** (Controls 0.00 cfs)



Pond 2P: Bioretention



Appendix D – Phase P-4 Public Bioretention & Infiltration Area 25-yr HydroCAD Report



Subcat Reach Pond Link

Routing Diagram for P-4 Public Bioretention & Infiltration Sizing 2026-03-26
Prepared by Core Design, Printed 2026-04-07
HydroCAD® 10.20-8a s/n 14008 © 2025 HydroCAD Software Solutions LLC

Rainfall Events Listing (selected events)

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	25 Year + Snowmelt	Type IA 24-hr		Default	24.00	1	4.87	2

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
8.880	98	Total Impervious Area (1S)
8.880	**98**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.000	HSG B	
0.000	HSG C	
0.000	HSG D	
8.880	Other	1S
8.880		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.000	0.000	0.000	0.000	8.880	8.880	Total Impervious Area	1S
0.000	**0.000**	**0.000**	**0.000**	**8.880**	**8.880**	**TOTAL AREA**	

Pipe Listing (all nodes)

Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Width (inches)	Diam/Height (inches)	Inside-Fill (inches)	Node Name
1	2P	2,110.00	2,108.00	20.0	0.1000	0.013	0.0	24.0	0.0	

Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 points
Runoff by SBUH method, Split Pervious/Imperv.
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1S: P-4 Phases Developed Runoff Area=8.880 ac 100.00% Impervious Runoff Depth=4.63"
Tc=5.0 min CN=0/98 Runoff=10.22 cfs 3.429 af

Pond 2P: Bioretention Peak Elev=2,112.95' Storage=0.744 af Inflow=10.22 cfs 3.429 af
Discarded=0.74 cfs 1.410 af Primary=3.45 cfs 2.019 af Outflow=4.10 cfs 3.429 af

Pond 3P: Infiltration Peak Elev=2,112.94' Storage=0.287 af Inflow=3.45 cfs 2.019 af
Discarded=1.44 cfs 2.019 af Primary=0.00 cfs 0.000 af Outflow=1.44 cfs 2.019 af

Total Runoff Area = 8.880 ac Runoff Volume = 3.429 af Average Runoff Depth = 4.63"
0.00% Pervious = 0.000 ac 100.00% Impervious = 8.880 ac

Summary for Subcatchment 1S: P-4 Phases Developed Conditions

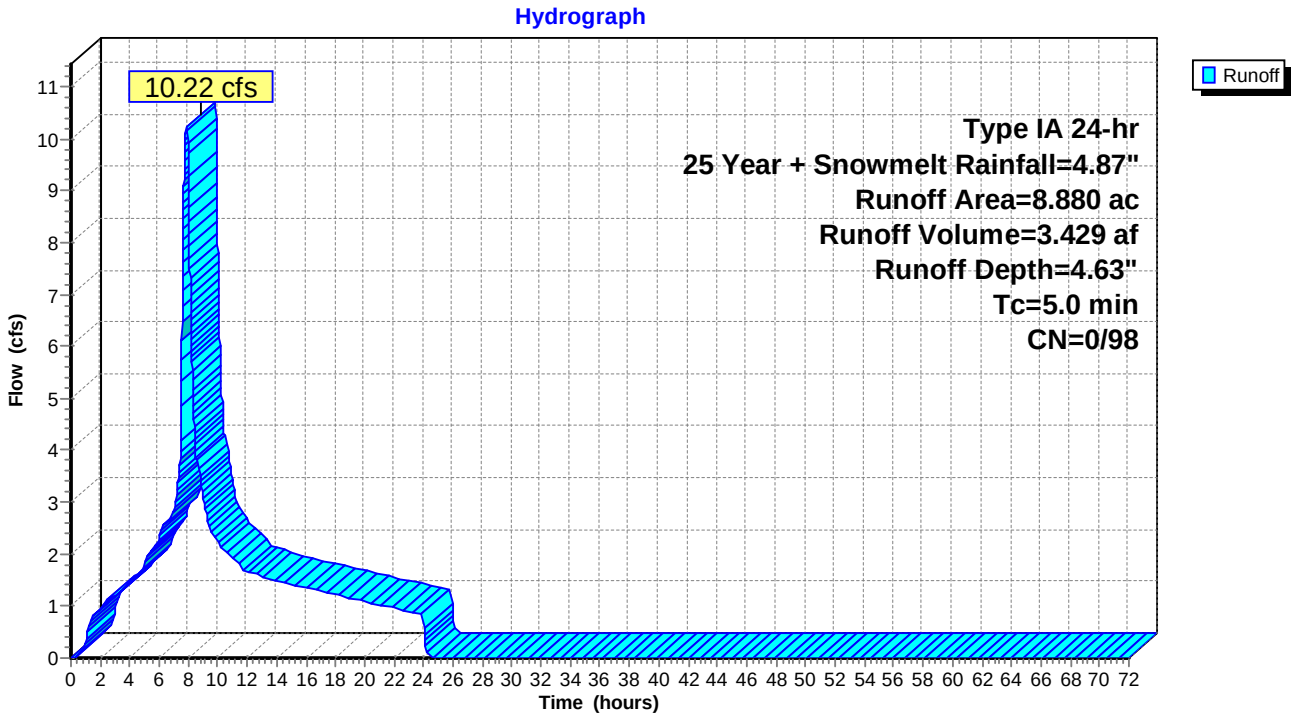
Runoff = 10.22 cfs @ 7.88 hrs, Volume= 3.429 af, Depth= 4.63"
Routed to Pond 2P : Bioretention

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type IA 24-hr 25 Year + Snowmelt Rainfall=4.87"

	Area (ac)	CN	Description
*	8.880	98	Total Impervious Area
	8.880	98	100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment 1S: P-4 Phases Developed Conditions



Summary for Pond 2P: Bioretention

Inflow Area = 8.880 ac,100.00% Impervious, Inflow Depth = 4.63" for 25 Year + Snowmelt event
Inflow = 10.22 cfs @ 7.88 hrs, Volume= 3.429 af
Outflow = 4.10 cfs @ 7.90 hrs, Volume= 3.429 af, Atten= 60%, Lag= 1.3 min
Discarded = 0.74 cfs @ 10.12 hrs, Volume= 1.410 af
Primary = 3.45 cfs @ 7.89 hrs, Volume= 2.019 af
Routed to Pond 3P : Infiltration

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 2,112.95' @ 10.12 hrs Surf.Area= 0.243 ac Storage= 0.744 af

Plug-Flow detention time= 191.2 min calculated for 3.428 af (100% of inflow)
Center-of-Mass det. time= 191.2 min (846.5 - 655.2)

Volume	Invert	Avail.Storage	Storage Description
#1	2,109.00'	2.824 af	**50.00'W x 120.00'L x 10.00'H Prismatoid Z=3.0**

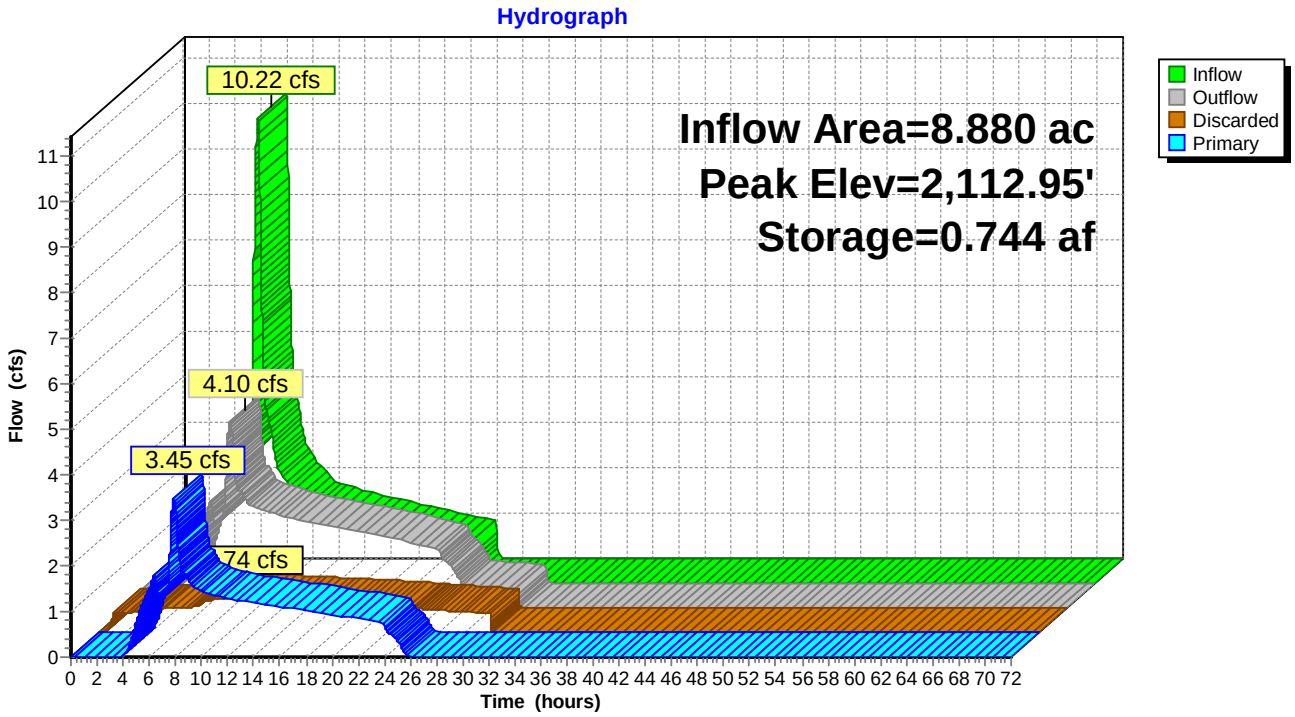
Device	Routing	Invert	Outlet Devices
#1	Discarded	2,109.00'	**3.000 in/hr Exfiltration over Horizontal area** Phase-In= 0.01'
#2	Primary	2,110.00'	**24.0" Round Culvert** L= 20.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 2,110.00' / 2,108.00' S= 0.1000 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 3.14 sf

Discarded OutFlow Max=0.74 cfs @ 10.12 hrs HW=2,112.95' (Free Discharge)
↳**1=Exfiltration** (Exfiltration Controls 0.74 cfs)

Primary OutFlow Max=2.92 cfs @ 7.89 hrs HW=2,111.92' TW=2,111.86' (Dynamic Tailwater)
↳**2=Culvert** (Inlet Controls 2.92 cfs @ 0.94 fps)



Pond 2P: Bioretention



Summary for Pond 3P: Infiltration

Inflow Area = 8.880 ac,100.00% Impervious, Inflow Depth = 2.73" for 25 Year + Snowmelt event
Inflow = 3.45 cfs @ 7.89 hrs, Volume= 2.019 af
Outflow = 1.44 cfs @ 10.13 hrs, Volume= 2.019 af, Atten= 58%, Lag= 134.6 min
Discarded = 1.44 cfs @ 10.13 hrs, Volume= 2.019 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 2,112.94' @ 10.13 hrs Surf.Area= 0.095 ac Storage= 0.287 af

Plug-Flow detention time= 117.1 min calculated for 2.018 af (100% of inflow)
Center-of-Mass det. time= 117.1 min (917.0 - 799.9)

Volume	Invert	Avail.Storage	Storage Description
#1	2,108.00'	1.033 af	**30.00'W x 40.00'L x 10.00'H Prismatoid Z=3.0**

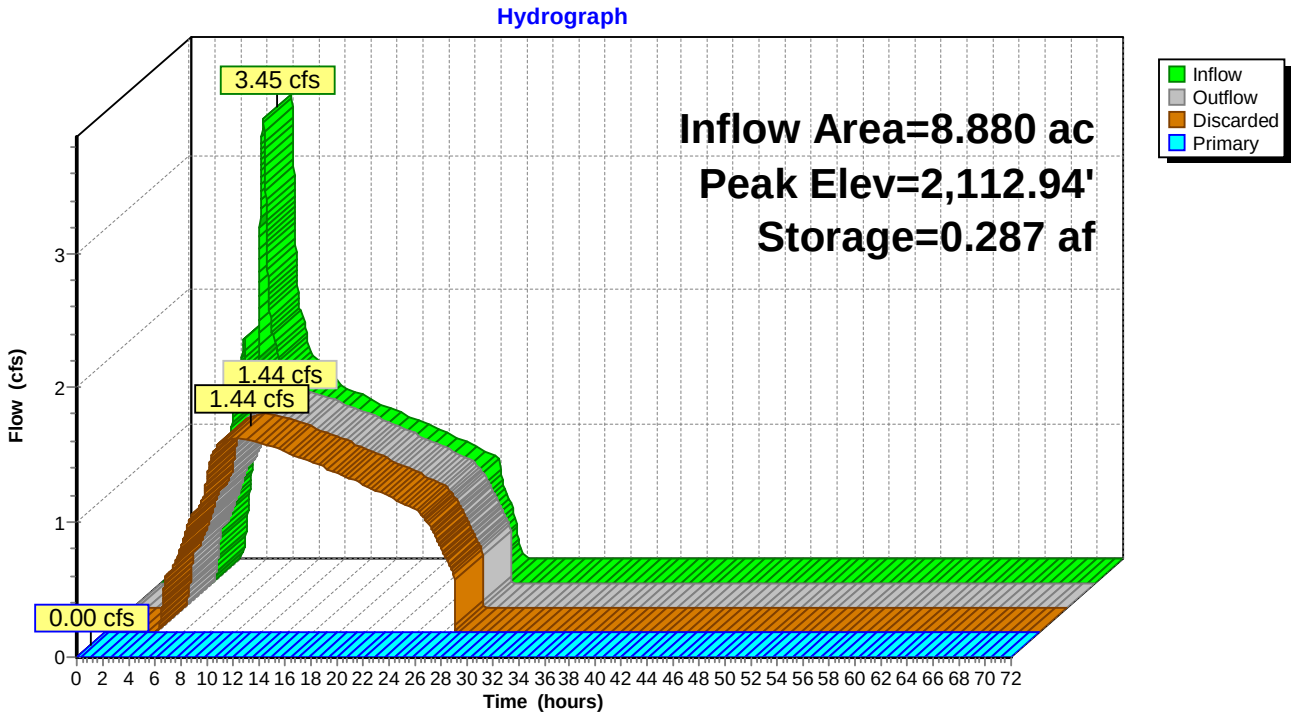
Device	Routing	Invert	Outlet Devices
#1	Primary	2,113.00'	**36.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Discarded	2,108.00'	**15.000 in/hr Exfiltration over Horizontal area** Phase-In= 0.01'

Discarded OutFlow Max=1.44 cfs @ 10.13 hrs HW=2,112.94' (Free Discharge)
↳**2=Exfiltration** (Exfiltration Controls 1.44 cfs)

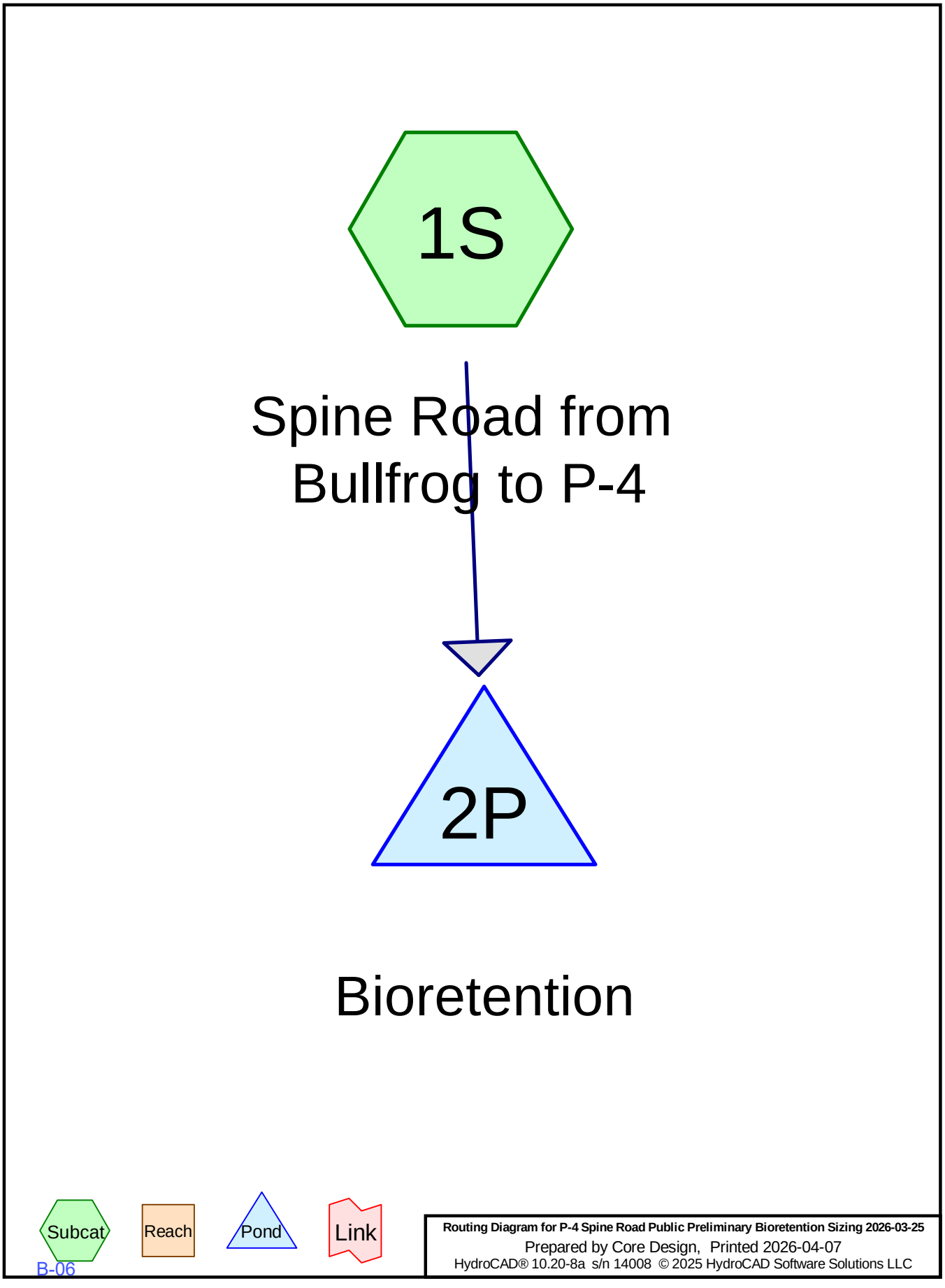
Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=2,108.00' (Free Discharge)
↳**1=Orifice/Grate** (Controls 0.00 cfs)



Pond 3P: Infiltration



Appendix E – Phase P-4 Spine Road Temporary Public Bioretention Area 6-month WQ HydroCAD Report



Routing Diagram for P-4 Spine Road Public Preliminary Bioretention Sizing 2026-03-25
Prepared by Core Design, Printed 2026-04-07
HydroCAD® 10.20-8a s/n 14008 © 2025 HydroCAD Software Solutions LLC

Rainfall Events Listing (selected events)

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	6 Month	Type IA 24-hr		Default	24.00	1	1.22	2

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
2.300	98	Total Impervious Area (1S)
2.300	**98**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.000	HSG B	
0.000	HSG C	
0.000	HSG D	
2.300	Other	1S
2.300		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.000	0.000	0.000	0.000	2.300	2.300	Total Impervious Area	1S
0.000	**0.000**	**0.000**	**0.000**	**2.300**	**2.300**	**TOTAL AREA**	

Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 points
Runoff by SBUH method, Split Pervious/Imperv.
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1S: Spine Road from Bullfrog Runoff Area=2.300 ac 100.00% Impervious Runoff Depth=1.01"
Tc=5.0 min CN=0/98 Runoff=0.60 cfs 0.193 af

Pond 2P: Bioretention Peak Elev=2,116.70' Storage=0.058 af Inflow=0.60 cfs 0.193 af
Discarded=0.09 cfs 0.193 af Primary=0.00 cfs 0.000 af Outflow=0.09 cfs 0.193 af

Total Runoff Area = 2.300 ac Runoff Volume = 0.193 af Average Runoff Depth = 1.01"
0.00% Pervious = 0.000 ac 100.00% Impervious = 2.300 ac

Summary for Subcatchment 1S: Spine Road from Bullfrog to P-4

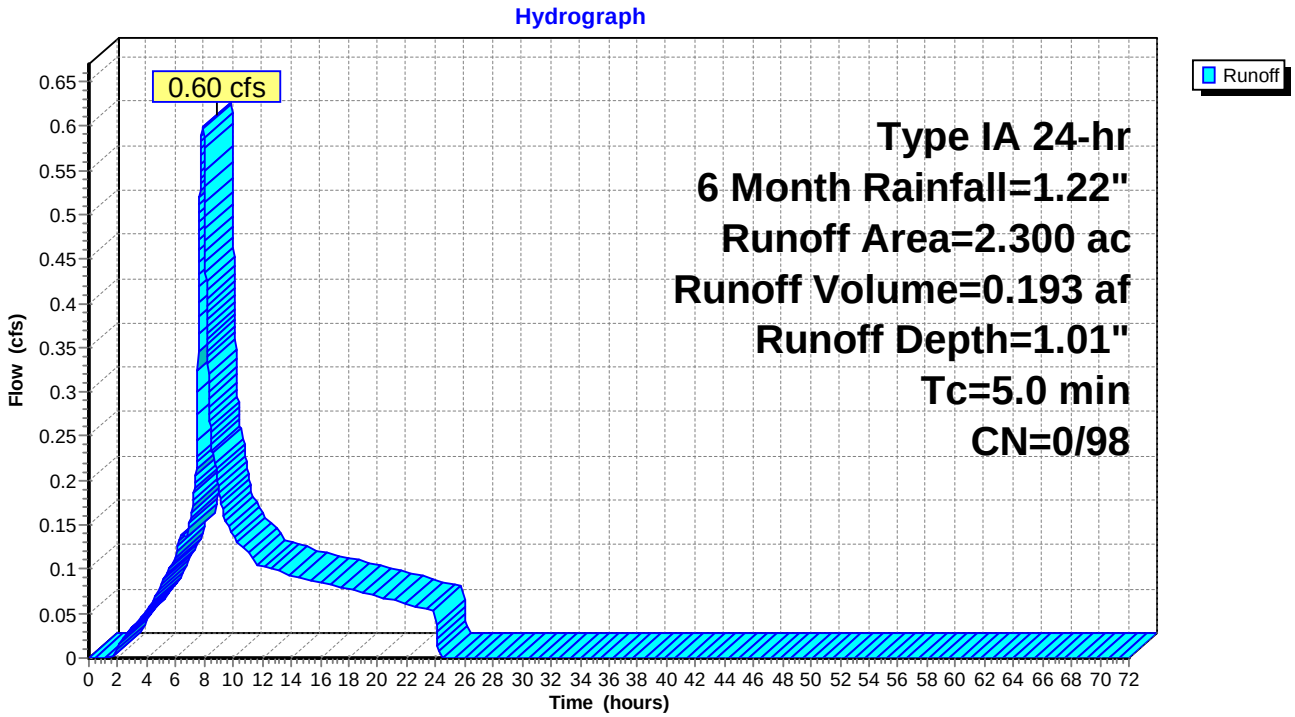
Runoff = 0.60 cfs @ 7.89 hrs, Volume= 0.193 af, Depth= 1.01"
Routed to Pond 2P : Bioretention

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type IA 24-hr 6 Month Rainfall=1.22"

	Area (ac)	CN	Description
*	2.300	98	Total Impervious Area
	2.300	98	100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment 1S: Spine Road from Bullfrog to P-4



Summary for Pond 2P: Bioretention

Inflow Area = 2.300 ac,100.00% Impervious, Inflow Depth = 1.01" for 6 Month event
Inflow = 0.60 cfs @ 7.89 hrs, Volume= 0.193 af
Outflow = 0.09 cfs @ 14.67 hrs, Volume= 0.193 af, Atten= 85%, Lag= 406.4 min
Discarded = 0.09 cfs @ 14.67 hrs, Volume= 0.193 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Routed to nonexistent node 3P

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 2,116.70' @ 14.67 hrs Surf.Area= 0.090 ac Storage= 0.058 af

Plug-Flow detention time= 315.4 min calculated for 0.193 af (100% of inflow)
Center-of-Mass det. time= 315.4 min (1,017.4 - 702.1)

Volume	Invert	Avail.Storage	Storage Description
#1	2,116.00'	0.861 af	**110.00'W x 30.00'L x 6.00'H Prismatoid Z=3.0**

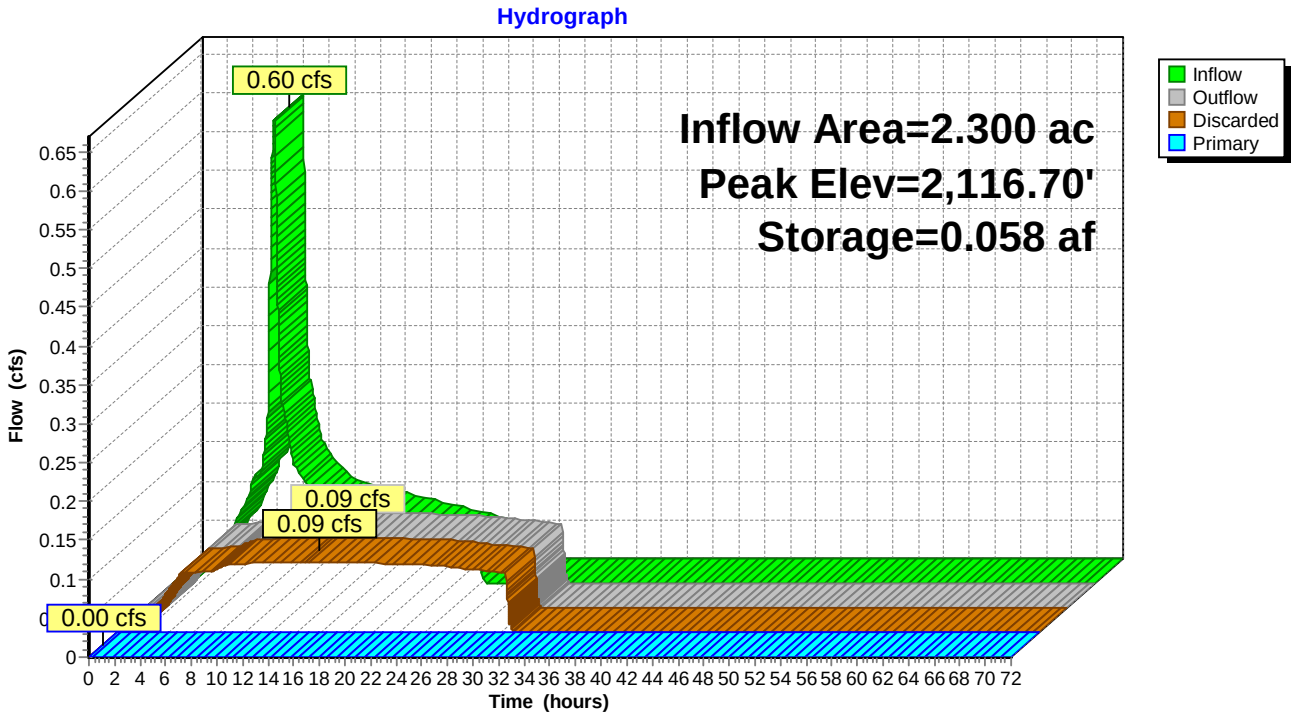
Device	Routing	Invert	Outlet Devices
#1	Discarded	2,116.00'	**1.000 in/hr Exfiltration over Horizontal area** Phase-In= 0.01'
#2	Primary	2,121.00'	**36.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.09 cfs @ 14.67 hrs HW=2,116.70' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.09 cfs)

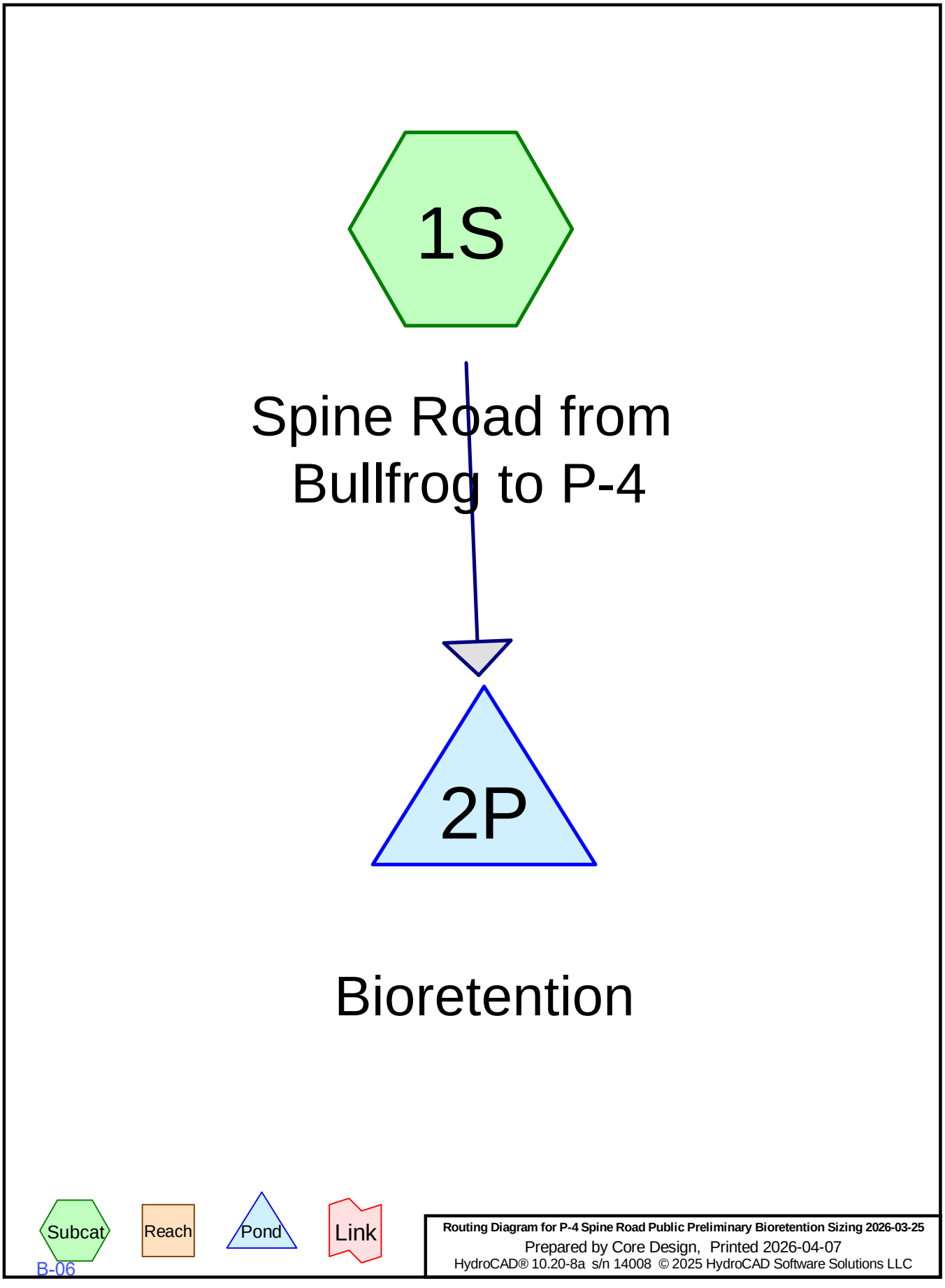
Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=2,116.00' (Free Discharge)
↑—**2=Orifice/Grate** (Controls 0.00 cfs)



Pond 2P: Bioretention



Appendix F – Phase P-4 Spine Road Temporary Public Bioretention Area 25-yr HydroCAD Report



Routing Diagram for P-4 Spine Road Public Preliminary Bioretention Sizing 2026-03-25
Prepared by Core Design, Printed 2026-04-07
HydroCAD® 10.20-8a s/n 14008 © 2025 HydroCAD Software Solutions LLC

Rainfall Events Listing (selected events)

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	25 Year + Snowmelt	Type IA 24-hr		Default	24.00	1	4.87	2

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
2.300	98	Total Impervious Area (1S)
2.300	**98**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.000	HSG B	
0.000	HSG C	
0.000	HSG D	
2.300	Other	1S
2.300		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.000	0.000	0.000	0.000	2.300	2.300	Total Impervious Area	1S
0.000	**0.000**	**0.000**	**0.000**	**2.300**	**2.300**	**TOTAL AREA**	

Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 points
Runoff by SBUH method, Split Pervious/Imperv.
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1S: Spine Road from Bullfrog Runoff Area=2.300 ac 100.00% Impervious Runoff Depth=4.63"
Tc=5.0 min CN=0/98 Runoff=2.65 cfs 0.888 af

Pond 2P: Bioretention Peak Elev=2,120.72' Storage=0.602 af Inflow=2.65 cfs 0.888 af
Discarded=0.19 cfs 0.828 af Primary=0.00 cfs 0.000 af Outflow=0.19 cfs 0.828 af

Total Runoff Area = 2.300 ac Runoff Volume = 0.888 af Average Runoff Depth = 4.63"
0.00% Pervious = 0.000 ac 100.00% Impervious = 2.300 ac

Summary for Subcatchment 1S: Spine Road from Bullfrog to P-4

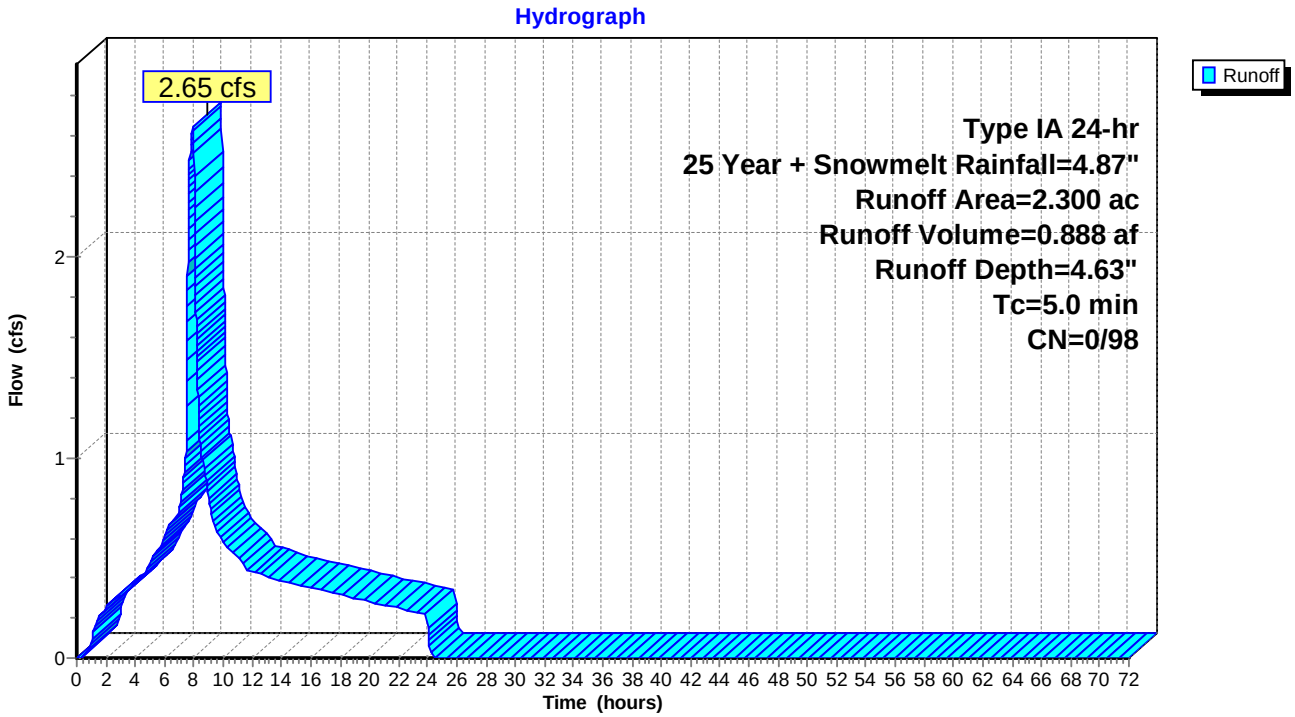
Runoff = 2.65 cfs @ 7.88 hrs, Volume= 0.888 af, Depth= 4.63"
Routed to Pond 2P : Bioretention

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type IA 24-hr 25 Year + Snowmelt Rainfall=4.87"

	Area (ac)	CN	Description
*	2.300	98	Total Impervious Area
	2.300	98	100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment 1S: Spine Road from Bullfrog to P-4



Summary for Pond 2P: Bioretention

Inflow Area = 2.300 ac,100.00% Impervious, Inflow Depth = 4.63" for 25 Year + Snowmelt event
Inflow = 2.65 cfs @ 7.88 hrs, Volume= 0.888 af
Outflow = 0.19 cfs @ 24.02 hrs, Volume= 0.828 af, Atten= 93%, Lag= 968.5 min
Discarded = 0.19 cfs @ 24.02 hrs, Volume= 0.828 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Routed to nonexistent node 3P

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 2,120.72' @ 24.02 hrs Surf.Area= 0.185 ac Storage= 0.602 af

Plug-Flow detention time= 1,463.8 min calculated for 0.828 af (93% of inflow)
Center-of-Mass det. time= 1,413.0 min (2,068.3 - 655.2)

Volume	Invert	Avail.Storage	Storage Description
#1	2,116.00'	0.861 af	**110.00'W x 30.00'L x 6.00'H Prismatoid Z=3.0**

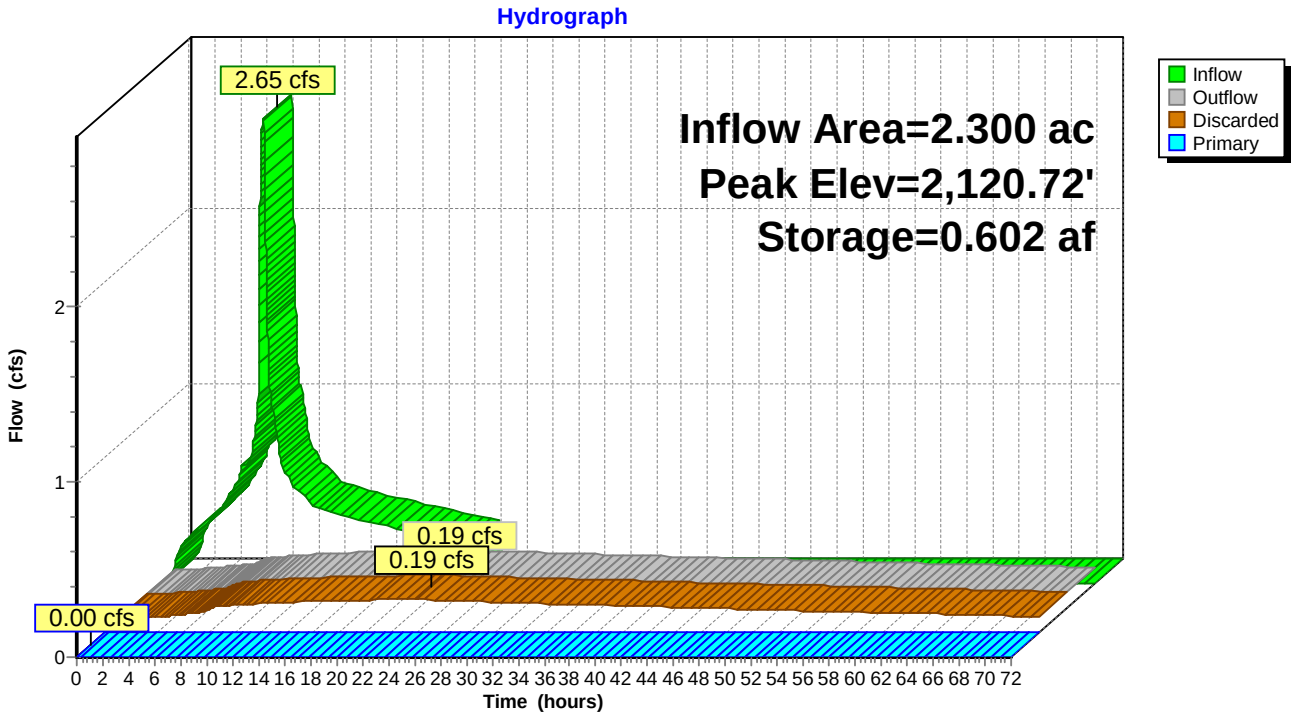
Device	Routing	Invert	Outlet Devices
#1	Discarded	2,116.00'	**1.000 in/hr Exfiltration over Horizontal area** Phase-In= 0.01'
#2	Primary	2,121.00'	**36.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.19 cfs @ 24.02 hrs HW=2,120.72' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.19 cfs)

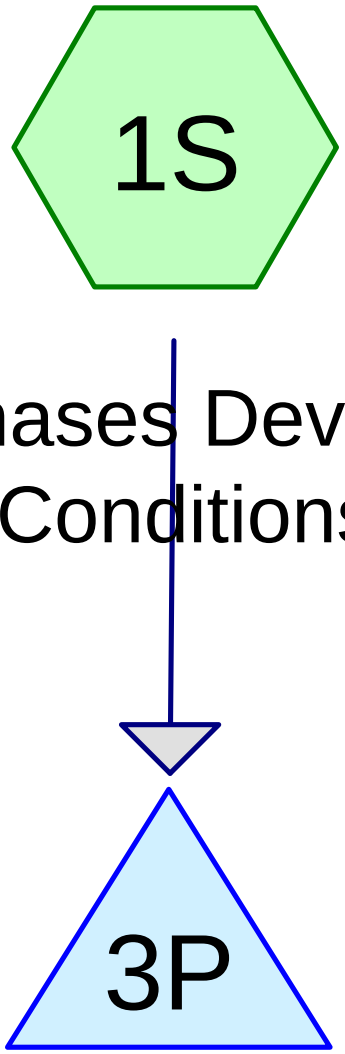
Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=2,116.00' (Free Discharge)
↑—**2=Orifice/Grate** (Controls 0.00 cfs)



Pond 2P: Bioretention



Appendix G – Phase P-4 Private Infiltration Area 25-yr HydroCAD Report



Subcat Reach Pond Link

Routing Diagram for P-4 Private Infiltration Sizing 2026-03-26
Prepared by Core Design, Printed 2026-04-07
HydroCAD® 10.20-8a s/n 14008 © 2025 HydroCAD Software Solutions LLC

Rainfall Events Listing (selected events)

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	25 Year + Snowmelt	Type IA 24-hr		Default	24.00	1	4.87	2

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
25.420	98	Total Impervious Area (1S)
25.420	**98**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.000	HSG B	
0.000	HSG C	
0.000	HSG D	
25.420	Other	1S
25.420		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.000	0.000	0.000	0.000	25.420	25.420	Total Impervious Area	1S
0.000	**0.000**	**0.000**	**0.000**	**25.420**	**25.420**	**TOTAL AREA**	

Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 points
Runoff by SBUH method, Split Pervious/Imperv.
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1S: P-4 Phases Developed Runoff Area=25.420 ac 100.00% Impervious Runoff Depth=4.63"
Tc=5.0 min CN=0/98 Runoff=29.24 cfs 9.815 af

Pond 3P: Infiltration Peak Elev=2,113.00' Storage=1.911 af Inflow=29.24 cfs 9.815 af
Discarded=7.50 cfs 9.815 af Primary=0.00 cfs 0.000 af Outflow=7.50 cfs 9.815 af

Total Runoff Area = 25.420 ac Runoff Volume = 9.815 af Average Runoff Depth = 4.63"
0.00% Pervious = 0.000 ac 100.00% Impervious = 25.420 ac

Summary for Subcatchment 1S: P-4 Phases Developed Conditions

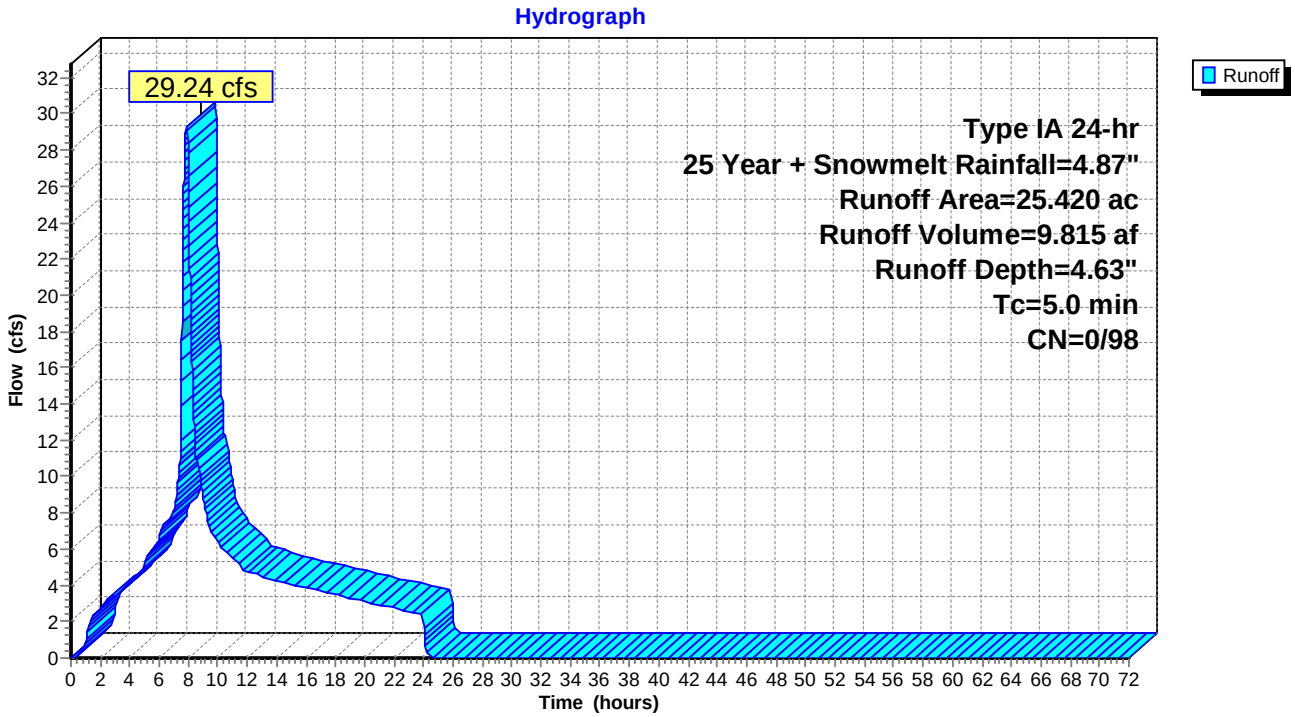
Runoff = 29.24 cfs @ 7.88 hrs, Volume= 9.815 af, Depth= 4.63"
Routed to Pond 3P : Infiltration

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type IA 24-hr 25 Year + Snowmelt Rainfall=4.87"

	Area (ac)	CN	Description
*	25.420	98	Total Impervious Area
	25.420	98	100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment 1S: P-4 Phases Developed Conditions



Summary for Pond 3P: Infiltration

Inflow Area = 25.420 ac,100.00% Impervious, Inflow Depth = 4.63" for 25 Year + Snowmelt event
Inflow = 29.24 cfs @ 7.88 hrs, Volume= 9.815 af
Outflow = 7.50 cfs @ 9.31 hrs, Volume= 9.815 af, Atten= 74%, Lag= 86.0 min
Discarded = 7.50 cfs @ 9.31 hrs, Volume= 9.815 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 2,113.00' @ 9.31 hrs Surf.Area= 0.496 ac Storage= 1.911 af

Plug-Flow detention time= 95.8 min calculated for 9.814 af (100% of inflow)
Center-of-Mass det. time= 95.8 min (751.1 - 655.2)

Volume	Invert	Avail.Storage	Storage Description
#1	2,108.00'	5.028 af	**50.00'W x 240.00'L x 10.00'H Prismatoid Z=3.0**

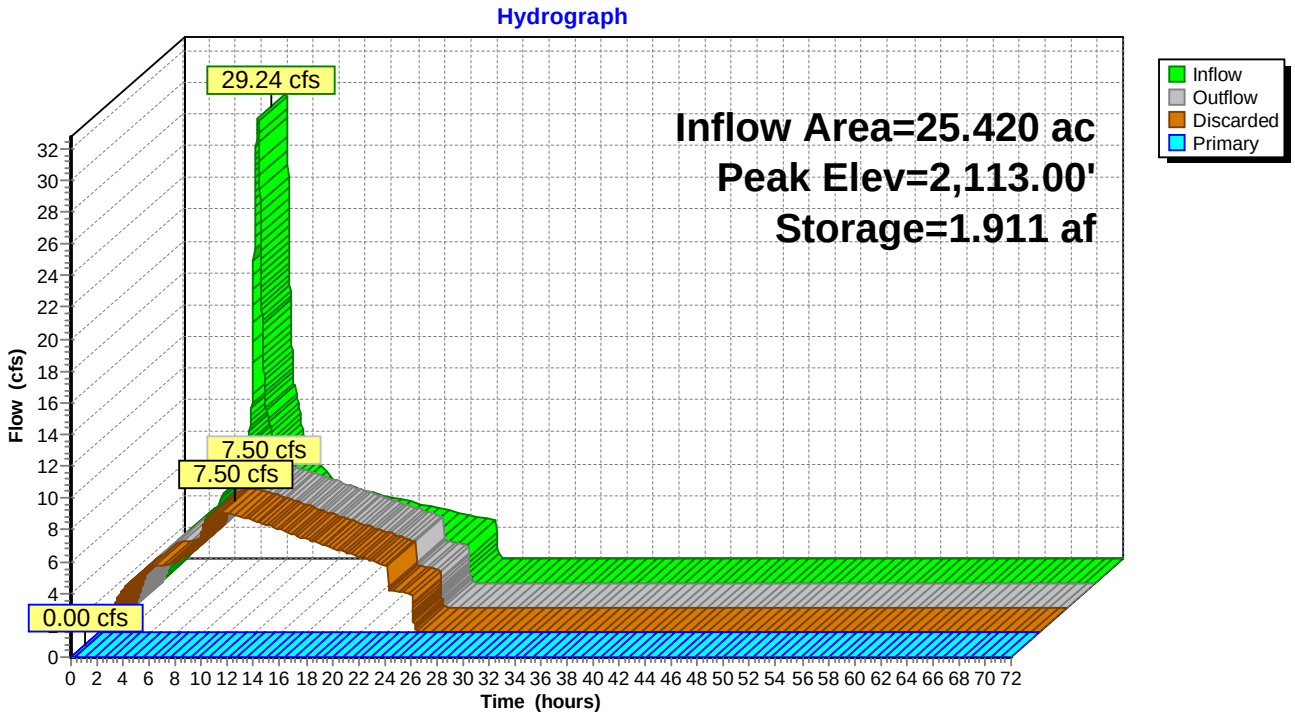
Device	Routing	Invert	Outlet Devices
#1	Primary	2,113.00'	**36.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Discarded	2,108.00'	**15.000 in/hr Exfiltration over Horizontal area** Phase-In= 0.01'

Discarded OutFlow Max=7.50 cfs @ 9.31 hrs HW=2,113.00' (Free Discharge)
└**2=Exfiltration** (Exfiltration Controls 7.50 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=2,108.00' (Free Discharge)
└**1=Orifice/Grate** (Controls 0.00 cfs)



Pond 3P: Infiltration



Appendix H – Bullfrog Flats Geotech Report

associated
earth sciences
incorporated



Subsurface Exploration, Geologic Hazard, and Preliminary Geotechnical Engineering Report

BULLFROG FLATS, PHASES J, S1, AND S2

Cle Elum, Washington

Prepared For:

BLUE FERN DEVELOPMENT

Project No. 20240155E001
November 1, 2024



Associated Earth Sciences, Inc.

www.aesgeo.com

Kirkland | Mount Vernon | Tacoma

associated earth sciences incorporated

November 1, 2024
Project No. 20240155E001

Blue Fern Development
18300 Redmond Way, Suite 120
Redmond, Washington 98052

Attention: Ms. Anna Drumheller, MUEP

Subject: Subsurface Exploration, Geologic Hazard, Infiltration Feasibility, and Preliminary Geotechnical Engineering Report
Bullfrog Flats, Phases J, S1, and S2
13606 NE 104th Street
Kirkland, Washington

Dear Ms. Drumheller:

We are pleased to present this geotechnical engineering report for the subject site. This report summarizes the results of our subsurface exploration, geologic hazard, and geotechnical engineering studies, and offers preliminary recommendations for the design and development of the proposed project. Our recommendations are preliminary because project plans and construction details were not completed at the time this report was written. We should be allowed to review the recommendations presented in this report and modify them, if needed, once final project plans have been formulated.

We have enjoyed working with you on this study and are confident that the recommendations presented in this report will aid in the successful completion of your project. If you should have any questions or if we can be of additional help to you, please do not hesitate to call.

Sincerely,
ASSOCIATED EARTH SCIENCES, INC.
Kirkland, Washington

Timothy J. Peter, L.E.G., L.Hg.
Senior Engineering Geologist

TJP/jh – 20240155E001-002

B-06

SUBSURFACE EXPLORATION, GEOLOGIC HAZARD, INFILTRATION FEASIBILITY, AND PRELIMINARY GEOTECHNICAL ENGINEERING REPORT

BULLFROG FLATS, PHASES J, S1, AND S2

Cle Elum, Washington

Prepared for:
Blue Fern Development
18300 Redmond Way, Suite 120
Redmond, Washington 98052

Prepared by:
Associated Earth Sciences, Inc.
911 5th Avenue
Kirkland, Washington 98033
425-827-7701

November 1, 2024
Project No. 20240155E001

TABLE OF CONTENTS

TABLE OF CONTENTS 1
I. PROJECT AND SITE CONDITIONS 3
1.0 INTRODUCTION 3
1.1 Purpose and Scope 3
1.2 Authorization 3
2.0 PROJECT AND SITE DESCRIPTION 4
3.0 SUBSURFACE EXPLORATION 5
3.1 Exploration Pits 5
3.2 Previous Explorations and Studies 5
3.3 Laboratory Testing 6
3.4 Infiltration Testing Procedures 8
4.0 SUBSURFACE CONDITIONS 9
4.1 Geologic Mapping 9
4.2 Soil Mapping 9
4.3 Stratigraphy 10
4.4 Groundwater 11
II. GEOLOGIC HAZARDS AND MITIGATIONS 14
5.0 LANDSLIDE HAZARDS AND RECOMMENDED MITIGATION 14
5.1 Cle Elum Municipal Code Requirements 14
5.2 Slope Reconnaissance 16
5.3 LIDAR Mapping 16
5.4 Topographic Mapping 16
5.5 Landslide Hazard Mitigation 16
5.6 Fire Access Road Setbacks 17
6.0 SEISMIC HAZARDS AND RECOMMENDED MITIGATION 17
6.1 Surficial Ground Rupture 17
6.2 Seismically Induced Landslides 18
6.3 Liquefaction 18
6.4 Ground Motion/Seismic Site Class (2021 *International Building Code*) 18
7.0 COAL MINE HAZARDS 19
8.0 EROSION HAZARDS AND RECOMMENDED MITIGATION 20
III. PRELIMINARY DESIGN RECOMMENDATIONS 22
9.0 INTRODUCTION 22
10.0 SITE PREPARATION 22
10.1 Temporary and Permanent Cut Slopes 22
10.2 Site Disturbance 22
11.0 STRUCTURAL FILL 23
11.1 Subgrade Compaction 23
11.2 Structural Fill Compaction 24
11.3 Moisture-Sensitive Fill 24

11.4 Structural Fill Testing 24
12.0 FOUNDATIONS 25
12.1 Footing Depths 25
12.2 Footings Adjacent to Cuts 25
12.3 Frozen Subgrades 25
12.4 Footing Settlement 26
12.5 Footing Subgrade Bearing Verification 26
12.6 Foundation Drainage 26
13.0 LATERAL WALL PRESSURES 26
13.1 Wall Backfill 26
13.2 Wall Drainage 26
12.3 Passive Resistance and Friction Factor 27
13.4 Seismic Surcharge 27
14.0 FLOOR SUPPORT 27
15.0 DRAINAGE CONSIDERATIONS 27
15.1 Wall/Foundation Drains 28
16.0 SHALLOW INFILTRATION TESTING AND DESIGN RECOMMENDATIONS 28
16.1 Grain-size Analysis Infiltration Rate Results 29
16.2 Field Infiltration Rate Testing Results 30
16.3 Design Infiltration Rate Determination 30
16.4 Recommended Design Infiltration Rates 33
16.5 General Infiltration BMP Subgrade Recommendations 34
16.6 Recommendations for Future Infiltration-Related Study 35
17.0 PAVEMENT DESIGN AND RECOMMENDATIONS 35
17.1 Design Criteria 35
17.2 Construction Details 36
18.0 PROJECT DESIGN AND CONSTRUCTION MONITORING 37
IV. REFERENCES 39

I. PROJECT AND SITE CONDITIONS

1.0 INTRODUCTION

This report, prepared by Associated Earth Sciences, Inc. (AESI), presents the results of our subsurface exploration, geologic hazard, infiltration feasibility, and preliminary geotechnical engineering study for the subject project. Our recommendations are preliminary because project plans were not completed at the time of our study. Our understanding of the project is based on our conversations with the Client, and review of preliminary site plans prepared by Core Design, titled "Bullfrog Flats – Phase J," "Bullfrog Flats – Phase S-1," "Bullfrog Flats – Phase S-2," Dated August 13, 2024, and "Infiltration Testing Locations," dated July 30, 2024. The site location is shown on the "Vicinity Map," Figure 1. The approximate locations of the explorations completed for this study are shown on the "Site and Exploration Plan," Figure 2. Copies of the exploration logs are included in Appendix A.

1.1 Purpose and Scope

The purpose of this study was to provide subsurface data to be used in the preliminary design and development of the subject project. Our study included reviewing available geologic literature, reviewing previous studies completed in the project vicinity, excavating 60 exploration pits, and performing geologic studies to assess the type, thickness, distribution, and physical properties of the subsurface sediments and groundwater conditions. Geotechnical engineering studies were completed to assess geologic hazards and to formulate geotechnical recommendations for geologic hazard mitigation, site preparation, grading, building foundations and floor slabs, allowable foundation soil bearing pressures, anticipated foundation settlement, and drainage considerations. As part of our study, we completed four Pilot Infiltration Tests (PITs) to evaluate stormwater infiltration feasibility and provide recommended design infiltration rates for each of the 10 proposed infiltration facilities at the site. This report summarizes our fieldwork and offers preliminary recommendations based on our present understanding of the project. We recommend that we be allowed to review the recommendations presented in this report and revise them, if needed, when the project design has been finalized.

1.2 Authorization

Our study was accomplished in general accordance with our scope of work and cost proposal, dated July 17, 2024. This report has been prepared for the exclusive use of Blue Fern Development and their agents for specific application to this project. Within the limitations of scope, schedule, and budget, our services have been performed in accordance with generally

accepted geotechnical engineering and engineering geology practices in effect in this area at the time our report was prepared. No other warranty, express or implied, is made.

2.0 PROJECT AND SITE DESCRIPTION

The subject site consists of three Phases, J, S-1, and S-2 of the 47 Degrees North development, located on the southeast side of Bullfrog Road near its intersection with Suncadia Trail in Cle Elum, Washington (Kittitas County Parcel ID #18704). Phases J, S1, and S2 occupy reported areas of 20.47, 18.61, and 27.5 acres, respectively. The subject site, known as Bullfrog Flats, is located on a gently sloping terrace above the Yakima River valley. The site is located approximately 1 mile east of the Cle Elum River, and approximately 0.75 miles north of the Yakima River. Topography at the subject site generally slopes down towards the southeast, with slope inclinations ranging from 1 to 10 percent and a total vertical relief of approximately 40 to 60 feet. Along the south and west margins of the site, slope inclinations increase to 30 to 40 percent with slope heights ranging from approximately 30 to 40 feet. Three drainage ravines of varying size are present crossing the subject site, generally trending northwest to southeast. During our site reconnaissance and exploration, all three were observed to be dry and well vegetated with no exposed streambed or other indications of seasonal flow. No other surface water features were noted at the site during our current study.

The site is bound by undeveloped parcels to the north, east and west. The parcel to the south of the site is occupied by the Washington State Horse Park. The site is largely undeveloped and vegetated by second- and third-growth forest. Existing roadways and utilities include unmaintained gravel roads, Puget Sound Energy (PSE) powerline and utility easements, and a sanitary sewer easement. A PSE powerline and utility easement is located along the northern margins of the site and crosses bullfrog road before continuing northeast towards the substation and the Cle Elum Wastewater Treatment Plant. The sanitary sewer easement enters the site from bullfrog road near the northwest corner of Phase S-1 then runs southeast towards the Washington State Horse Park where it exits the property. The sanitary sewer easement includes several laterals which enter the site from the south. A second powerline easement is located about 0.25 miles east of Phase S-2 which crosses Interstate 90 and continues north towards the substation and the Cle Elum Wastewater Treatment Plant.

Based on our conversations with the Client and our review of the current plans, we understand that the project will include development of the subject parcel in three phases. Development will include 32 townhouse buildings in Phase J, 94 single-family homes in Phase S-1, and 144 single-family homes in Phase S-2, along with associated roads and utilities for each. Additionally, the proposed project includes 10 stormwater infiltration facilities consisting of both bioretention and infiltration areas. We understand that stormwater from all three phases will be infiltrated onsite.

3.0 SUBSURFACE EXPLORATION

Our current field study included excavating 60 exploration pits and 4 infiltration test pits to gain subsurface information about the site. The various types of materials, as well as the depths where characteristics of the materials changed, are indicated on the exploration logs presented in Appendix A. The depths indicated on the logs where conditions changed may represent gradational variations between material types in the field. The approximate locations of the exploration pits are shown on Figure 2, Figure 3, Figure 4, and Figure 5.

The conclusions and recommendations presented in this report are based, in part, on the exploration pits completed for this study. The number, locations, and depths of the explorations were completed within site and budgetary constraints. Because of the nature of exploratory work below ground, interpolation of subsurface conditions between field explorations is necessary. It should be noted that subsurface conditions differing from those depicted on the logs may be present at the site due to the random nature of deposition and the alteration of topography by past grading and/or filling. The nature and extent of variations between the field explorations may not become fully evident until construction. If variations are observed at that time, it may be necessary to re-evaluate specific recommendations in this report and make appropriate changes.

3.1 Exploration Pits

The 60 exploration pits and 4 infiltration test pits completed for our study were excavated with a track-mounted excavator under subcontract to AESI. The pits permitted direct, visual observation of subsurface conditions. Materials encountered in the exploration pits were studied and classified in the field by a geologist from our firm. The exploration pits were backfilled after examination and logging. Samples collected from the exploration pits were classified in the field and representative portions placed in watertight containers. The samples were then transported to our laboratory for further visual classification.

3.2 Previous Explorations and Studies

Subsurface information obtained from our current study was supplemented by previous studies at the subject site which include exploration pits, borings, and groundwater monitoring wells. These previous studies included the following:

- Ten exploration pits and six observation wells advanced on the subject site and adjacent properties in 1997 and 1998 by AESI for the 1999 MountainStar Master Planned Resort Environmental Impact Study (1999 EIS).

- Forty-seven exploration pits and four exploration borings were advanced on the subject site and adjacent properties in 2019 by AESI for the 47 Degrees North Supplemental Environmental Impact Study (2019 SEIS).
- Thirty-five test pits and six hand-auger borings advanced on the subject site and the adjacent properties by AGI for the 2001 Draft UGA EIS (Draft UGA EIS).
- A study titled "Pleistocene glaciation in the southern part of the North Cascade Range, Washington," published in the Geological Society of America Bulletin (Porter, 1976) discusses the stratigraphic relationships of glacial deposits in the project region during the Pleistocene.

These studies indicate that the site is generally underlain by glacial outwash consisting of gravel with variable silt, sand, and cobble content. The existing exploration data indicates that the outwash is overlain by topsoil and windblown silt (loess). The upper several feet of the outwash gravel is typically silty due to intrusion of the loess into the outwash. Copies of the exploration logs for the previous studies are included in Appendix B. A cross section of the site was completed as part of the 2019 SEIS and is included in Appendix C. The location of previous explorations within the current project area are included on Figure 2 through Figure 5.

3.3 Laboratory Testing

ASTM Gradation Testing

AESI submitted representative samples to our laboratory for grain-size analysis in accordance with *ASTM International* (ASTM) procedures. The laboratory testing data sheets are contained in Appendix D. The grain-size analyses presented below were utilized to estimate infiltration rates at the subject site as discussed in the "Shallow Infiltration Testing and Design Recommendations" section of this report. Samples used to estimate infiltration rates were collected in accordance with the sampling methods detailed in the 2024 Washington State Department of Ecology (Ecology) *Stormwater Management Manual for Eastern Washington* (2024 SMMEW). Table 1 summarizes the observed sediments at each sample location and depth, based on ASTM D-2487: *Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System [USCS])*.

Table 1
Summary of Laboratory Testing

No.	Facility No.	Test Depth (feet)	Interpreted Geologic Unit	Soil Classification (USCS)	USCS	% Gravel	% Sand	% Silt
EP-49	IA-4	5	Glacial Outwash	very sandy GRAVEL, trace silt (GP)	GP	48.6	47.8	3.6
EP-50	IA-4	5	Glacial Outwash	very sandy GRAVEL,	GW	61.6	35.6	2.8

No.	Facility No.	Test Depth (feet)	Interpreted Geologic Unit	Soil Classification (USCS)	USCS	% Gravel	% Sand	% Silt
				trace silt (GW)				
EP-51	BA-6	2	Glacial Outwash	silty, gravelly SAND (SM)	SM	23.7	52.1	24.2
EP-48	IA-4	5	Glacial Outwash	very sandy GRAVEL, trace silt, cobbles present (GP)	GP	57.0	35.9	4.1
EP-52	BA-6	2	Glacial Outwash	silty, very gravelly SAND (SM)	SM	35.0	41.6	23.4
EP-53	BA-6	2	Glacial Outwash	silty, sandy GRAVEL (GM)	GM	52.0	26.3	21.7
EP-57	BA-5	5	Glacial Outwash	very sandy GRAVEL, trace silt (GP)	GP	58.6	37.6	3.8
EP-58	BA-5	5	Glacial Outwash	very sandy GRAVEL, trace silt (GP)	GP	64.1	32.4	3.5
EP-59	BA-5	6	Glacial Outwash	very sandy GRAVEL, trace silt (GW)	GW	55.7	40.7	3.6
EP-62	IA-3	3	Glacial Outwash	silty, very gravelly SAND (SM)	SM	43.1	44.6	12.3
EP-62	IA-3	13	Glacial Outwash	very sandy GRAVEL, trace silt (GP)	GP	65.4	32.6	2.0
EP-63	IA-3	7	Glacial Outwash	very sandy GRAVEL, trace silt (GP)	GP	60.5	36.4	3.1
EP-69	BA-4	3	Glacial Outwash	very sandy GRAVEL, some silt (GW-GM)	GW-GM	60.6	32.3	7.1
EP-70	BA-4	7	Glacial Outwash	very sandy GRAVEL, some silt (GW-GM)	GW-GM	55.1	38.7	6.2
EP-71	BA-4	3	Glacial Outwash	silty, gravelly SAND (SM)	SM	16.0	54.8	29.2
EP-73	BA-2	4	Glacial Outwash	silty, very sandy GRAVEL (GM)	GM	54.4	32.8	12.8
EP-74	BA-2	9	Glacial Outwash	very sandy GRAVEL, trace silt (GP)	GP	61.5	35.4	3.1
EP-75	BA-2	4	Glacial Outwash	silty, very sandy GRAVEL (GM)	GM	44.9	41.5	13.6
EP-78	IA-1	14	Glacial Outwash	very sandy GRAVEL, trace silt (GW)	GW	66.9	30.8	2.3
EP-81	BA-1	2	Glacial Outwash	silty, very sandy GRAVEL (GM)	GM	43.2	40.9	15.9
EP-82	BA-1	5	Glacial Outwash	very gravelly SAND, some silt (SW-SM)	SW-SM	45.3	49.6	5.1
EP-83	BA-1	2	Glacial Outwash	very sandy GRAVEL, some silt (GW-GM)	GW-GM	50.3	43.8	5.9
EP-87	BA-3	7	Glacial Outwash	very gravelly SAND, trace silt (SP)	SP	47.6	48.5	3.9
EP-88	BA-3	7	Glacial Outwash	very gravelly SAND, trace silt (SP)	SP	43.2	53.2	3.6
EP-89	BA-3	7	Glacial Outwash	very sandy GRAVEL, trace silt (GP)	GP	53.8	41.9	4.3
EP-90	IA-2	11	Glacial Outwash	very sandy GRAVEL, trace silt (GP)	GP	53.8	43.5	2.7
EP-91	IA-2	18	Glacial Outwash	very sandy GRAVEL, trace silt (GW)	GW	58.3	39.0	2.7
EP-92	IA-2	11	Glacial Outwash	very sandy GRAVEL, trace silt (GP)	GP	48.7	47.8	3.5
EP-105	BA-4	8	Glacial Outwash	very sandy GRAVEL, trace silt (GW)	GW	59.7	37.6	2.7

No.	Facility No.	Test Depth (feet)	Interpreted Geologic Unit	Soil Classification (USCS)	USCS	% Gravel	% Sand	% Silt
IT-1	BA-6	3	Glacial Outwash	sandy GRAVEL, some silt (GW-GM)	GW-GM	63.0	29.0	8.0
IT-1	BA-6	12	Glacial Outwash	very sandy GRAVEL, trace silt (GW)	GW	62.2	34.8	3.0
IT-2	IA-3	5	Glacial Outwash	very sandy GRAVEL, trace silt (GW)	GW	59.1	37.6	3.3
IT-2	IA-3	9	Glacial Outwash	very sandy GRAVEL, trace silt (GW)	GW	62.9	33.5	3.6
IT-3	BA-3	7	Glacial Outwash	very sandy GRAVEL, trace silt (GW)	GW	60.2	36.6	3.2
IT-3	BA-3	11	Glacial Outwash	very sandy GRAVEL, trace silt (GW)	GW	58.3	39.0	2.7
IT-4	IA-1	9	Glacial Outwash	sandy GRAVEL, trace silt (GW)	GW	69.0	28.3	2.7
IT-4	IA-1	12	Glacial Outwash	very sandy GRAVEL, trace silt (GP)	GP	53.9	43.3	2.8

USCS = Unified Soil Classification System

3.4 Infiltration Testing Procedures

Infiltration testing was conducted to obtain representative field infiltration rates for the proposed infiltration systems using methods that generally correspond to the Small-Scale Pilot Infiltration Test (PIT) as specified in the 2024 Washington State Department of Ecology (Ecology) *Stormwater Management Manual for Eastern Washington* (2024 SMMEW) Chapter *6.5.4 Determining Design Infiltration Rate of the Native Soils*. Four low-head PITs were completed, noted as IT-1 through IT-4, within a currently proposed infiltration facility. The test base areas generally ranged from 15 to 18 square feet. Infiltration testing locations along with the proposed infiltration facility locations are displayed on Figure 2 through Figure 5.

Water for infiltration testing was obtained from a 4000-gallon water truck and a 500-gallon water trailer. Water for the tests was conveyed with 2-inch-diameter hose through an electronic flow meter assembly with instantaneous flow rate and total flow volume readouts into each infiltration test pit. Every 10 to 15 minutes, flow rates were recorded, and water levels were measured with a staff gauge marked in 0.01-foot increments that was placed in the test pit prior to testing.

AESI generally conducted infiltration tests as follows: during the initial portion of infiltration testing, water was discharged onto the pit base through a diffuser for a "soaking period" of 6 hours to allow the receptor soils in the immediate vicinity of the pit to become saturated. During the 6-hour soaking period, inflow was briefly interrupted, as necessary, to change water sources. After completion of the soaking period, the water level in the pit was maintained at a constant low head with constant inflow rates for an additional hour. After 7 hours, the inflow was disconnected and the falling water level was monitored and recorded for at least 1 hour, or until water level was too low to measure. Once the infiltration test was completed, the base of

the test pit was over-excavated to note the subsurface conditions below the testing depth. The exploration pits were backfilled after examination and logging.

Analyses of infiltration testing data are discussed in the "Shallow Infiltration Testing and Design Recommendations" section of this report.

4.0 SUBSURFACE CONDITIONS

Subsurface conditions at the project site were inferred from the field explorations accomplished for this study and previous studies, our visual reconnaissance of the site, and review of selected geologic literature. Detailed descriptions of the materials encountered in the explorations are provided on the exploration logs in Appendix A. The following sections describe observed site stratigraphy, regional geology, and local groundwater conditions.

4.1 Geologic Mapping

Review of the regional geologic map of the area title *Geologic Map of the Wenatchee 1:100,000 Quadrangle, Central Washington* (Tabor, 1982) indicates that the site is underlain by Lakedake Drift, which is subdivided into mainstream alluvium (Qlbm) within the project area. This unit is described as consisting of a mixed-lithology cobble gravel and includes a discontinuous mantle of loess. Previous geologic mapping of the area by AESI in our 2019 SEIS report indicates that the project area is underlain by glacial outwash (Qow).

Review "Pleistocene glaciation in the southern part of the North Cascade Range, Washington," (Porter, 1976) indicates that three major glacial advances have been identified in the project region. From youngest to oldest, the sediments associated with these glacial advances are known as the Lakedale, Kittitas, and Thorp Drifts. The Lakedale Drift was subdivided by Porter into four members. From youngest to oldest, these include the Hyak, Domerie, Ronald, and Bullfrog members. The furthest glacial advance during Lakedale time was the Bullfrog advance, as indicated by the Bullfrog Moraine, which consists of an elevated area to the west of the site. Our interpretation of the sediments encountered in our explorations is in general agreement with the regional geologic map and our previous mapping of the area.

4.2 Soil Mapping

Review of regional soils mapping (*Soil Survey of Kittitas County Area, Washington*, U.S. Department of Agriculture [USDA], Soils Conservation Service [SCS] now referred to as Natural Resources Conservation Service [NRCS]) on the NRCS *Web Soil Survey* indicates that the subject site is underlain by Roslyn ashy sandy loam, 0 to 5 percent slopes. The Roslyn soils are formed from the weathering of glacial drift with a mantle of loess and volcanic ash. Our interpretation of the materials encountered in our explorations is generally consistent with the regional soils map. The NRCS indicates that the erosion hazard rating of the Roslyn soil is slight, but we

anticipate that the erodibility of these soils will be elevated where they are present on more steeply sloping portions of the site.

4.3 Stratigraphy

The explorations completed at the subject site generally encountered granular glacial outwash overlain by windblown silt (loess) ranging in thickness from approximately 0.5 to 6.5 feet. The following section presents more detailed subsurface information organized from the shallowest (youngest) to the deepest (oldest) sediment types.

Alluvium/Colluvium (Qal)

Sediments generally consisting of soft or loose, sandy silt ranging to silty fine sand with minor quantities of gravel were encountered directly below the surface in exploration pits EP-62, EP-72, EP-106, EP-107 and IT-4. These exploration pits were generally excavated at the base of drainage ravines, below sloping terrain. We interpret these sediments to be representative of alluvium and/or colluvium. Colluvium is common on the faces of steep slopes in the project region and consists of sediments eroded from upslope areas and deposited downslope under the influence of gravity. Alluvium consists of sediments which are deposited by flowing streams or intermittent surface flow. While no evidence of existing stream flow was observed at these locations, the geomorphology of the area suggests that some flow was present within the ravine previously following deglaciation of the project area (AESI, 1999). Where encountered, the alluvium/colluvium extended to depths of approximately 3 to 5 feet. We anticipate that deposits of alluvium and colluvium will be limited to areas of steeply sloping terrain, or the base of drainage ravines on the subject site.

Loess (Qlo)

The majority of the site is underlain by sediments generally consisting of loose to medium stiff, tan to brown, silt and silty fine sand. These sediments were generally massively bedded and contained fine roots which extended through the deposits. We interpret these sediments to be representative of loess deposits. The loess was deposited by wind deflation of glacial outwash sediments during the Lakedale glacial advance (Porter, 1976). Because of its fine-grained texture, the loess exhibits a low permeability. Although the distribution of loess at the site is widespread, it is also discontinuous, and its depth can vary significantly across short distances. Where encountered, the loess generally extended to depths ranging from approximately 0.5 to 3 feet but was occasionally observed to depths of up to 6.5 feet.

The soft to medium stiff loess sediments are not considered suitable for foundation support and will require remedial preparation below paved areas. Excavated loess is not considered suitable for reuse as structural fill. Because the loess contains a large percentage of fine-grained (silt-sized) sediments, it is highly moisture sensitive and subject to disturbance when wet.

Glacial Outwash (Qow)

Sediments encountered either directly below the ground surface or below the surficial loess deposits generally consisted of medium dense, stratified sand and gravel with abundant cobbles, scattered boulders, and minor to moderate silt and clay content. We interpret these sediments to be representative of glacial outwash. The glacial outwash consists of sediments deposited by meltwater streams flowing off the glacial ice during the Lakedale glacial advance (Porter, 1976). Although the glacial outwash generally contains minor quantities of fine-grained sediments (silt and clay), areas of silty outwash were encountered in our explorations. This was typically limited to the upper several feet of the outwash where it appeared to be mixed with loess. Localized silty strata within the outwash were also observed in some locations. In each of the exploration pits completed for this study, the outwash sediments extended beyond the maximum depths explored. Based on previous exploration data, the maximum thickness of the outwash underlying the subject site is about 250 feet based on previous exploration borings in the project vicinity.

The medium dense outwash sediments are suitable for foundation and roadway support. Excavated outwash is suitable for reuse as structural fill provided that it is free of roots and other deleterious materials and exhibits a moisture content compatible with achieving the specified level of compaction. Where outwash sediments were observed to contain a large percentage of fine-grained (silt-sized) sediments, it should be considered moisture sensitive and subject to disturbance when wet.

4.4 Groundwater

The following is a summary of regional and site-specific groundwater conditions. Our understanding of these conditions is based on review of previous studies at the subject site and the explorations completed as part of our current study.

Regional Groundwater:

As discussed in the 2019 SEIS, groundwater is generally present within the recent alluvium (Qal), glacial outwash (Qow), undifferentiated glacial deposits (Qu), and in the bedrock (Tr, Tt) underlying the site and surrounding area. The groundwater in the shallow alluvium and glacial outwash is in hydraulic continuity with the Cle Elum and Yakima Rivers located to the south and west of the subject site. Groundwater is also present in fractures and low-permeability pore spaces within the bedrock underlying the region.

Although no observation wells are located on the subject site, several observation wells were installed in nearby areas during work completed for the 1999 MountainStar EIS, as referenced in the 2001 Draft UGA EIS. The closest of these wells are OW-1, OW-4, OW-5, and OW-9, completed in the outwash (Qow) on the Suncadia property approximately 1,500 to 4,500 feet

north of Bullfrog Road, and wells OW-7 and OW-8, both of which are completed in the outwash (Qow/Qu) approximately 300 to 1,000 feet south of the subject site on the Washington State Horse Park property. In addition to these observation wells, additional subsurface information was obtained from water well reports obtained from Ecology for wells installed south of Interstate 90 at the Cle Elum fish hatchery. The exploration logs for these explorations are included in Appendix B. A summary of the maximum and minimum groundwater levels is presented below in Table 2.

Table 2
Summary of Maximum and Minimum Groundwater Levels

Well ID	Ground Surface Elevation (feet)	Maximum Water Level			Minimum Water Level		
		Date	Elevation (feet)	Depth bgs (feet)	Date	Elevation (feet)	Depth bgs (feet)
OW-1	2,161.54	12/11/97	1,992.30	169.24	7/10/02	1,985.71	175.83
OW-4	2,244.28	9/11/98	2,021.33	222.95	6/6/02	2,016.01	228.27
OW-5	2,197.24	8/25/99	2,045.74	151.50	5/6/02	2,044.94	152.30
OW-7	2,041.73	10/15/19	1,942.01	99.72	9/21/02	1,896.53	145.20
OW-8	2,049.62	4/22/99	1,940.62	109.00	7/31/01	1,898.94	150.68
OW-9	2,162.39	6/8/99	2,033.76	128.63	3/22/02	2,014.43	147.96

bgs = below ground surface

Groundwater flow below the site, inferred from area water level data collected for the 1999 MountainStar EIS, and referenced in the 2001 Draft UGA EIS, is generally toward the south (toward the Yakima and Cle Elum Rivers).

Site-Specific Groundwater:

No groundwater seepage was encountered in the exploration pits completed for this study, and no emergent groundwater or springs were observed during our reconnaissance of the site. Three drainage ravines are present crossing the subject site, generally trending northwest to southeast. During our site reconnaissance and exploration, all three drainage ravines were observed to be dry and well vegetated with no exposed streambed or other indications of seasonal flow. No other surface water features were noted at the subject site during our study.

Based on the groundwater information displayed above in Table 2, we can establish that groundwater underlying the site is on the order of approximately 100 to 150 feet below existing grades. The groundwater elevations generally indicate that there is a slight gradient to the groundwater surface, dipping towards the south of the site and the Yakima River. Due to the depth of seasonal groundwater levels underlying the site, there is no evidence indicating the regional groundwater table will be encountered during construction. Additionally, the data demonstrate there is adequate vertical separation between the base of the proposed infiltration facilities and the regional aquifer to avoid impacting facility performance.

It should be noted that the depth or occurrence of shallow groundwater seepage below the site may vary in response to such factors as changes in season, precipitation, and on- and off-site use. Explorations for this study were conducted in August and September when groundwater levels are typically near the seasonal low.

II. GEOLOGIC HAZARDS AND MITIGATIONS

The following discussion of potential geologic hazards is based on the geologic conditions as observed and discussed herein.

5.0 LANDSLIDE HAZARDS AND RECOMMENDED MITIGATION

5.1 Cle Elum Municipal Code Requirements

Section 18.01.030.F.2 of the *Cle Elum Municipal Code* (CEMC) defines Landslide Hazard Areas as follows:

Landslide hazard areas are areas potentially subject to landslides based on a combination of geologic, topographic, and hydrologic factors. They include areas susceptible because of any combination of bedrock, soil, slope (gradient), slope aspect, structure, hydrology, or other factors, and include, at a minimum, the following (per WAC 365-190-120(6)):

a. Areas of historic failures, such as:

> i. Those areas delineated by the U.S. Department of Agriculture Natural Resources Conservation Service as having a significant limitation for building site development;
>
> ii. Those coastal areas mapped as class u (unstable), uos (unstable old slides), and urs (unstable recent slides) in the Ecology coastal atlas; or
>
> iii. Areas designated as quaternary slumps, earthflows, mudflows, lahars, or landslides on maps published by the United States Geological Survey or Washington Department of Natural Resources.

b. Areas with all three of the following characteristics:

> i. Slopes steeper than fifteen percent;
>
> ii. Hillsides intersecting geologic contacts with a relatively permeable sediment overlying a relatively impermeable sediment or bedrock; and
>
> iii. Springs or groundwater seepage.

c. Areas that have shown movement during the Holocene epoch (from ten thousand years ago to the present) or which are underlain or covered by mass wastage debris of this epoch;

d. Slopes that are parallel or subparallel to planes of weakness (such as bedding planes, joint systems, and fault planes) in subsurface materials;

e. Slopes having gradients steeper than eighty percent subject to rockfall during seismic shaking;

f. Areas potentially unstable as a result of rapid stream incision, stream bank erosion, and undercutting by wave action, including stream channel migration zones;

g. Areas that show evidence of, or are at risk from, snow avalanches;

h. Areas located in a canyon or on an active alluvial fan, presently or potentially subject to inundation by debris flows or catastrophic flooding; and

i. Any area with a slope of forty percent or steeper and with a vertical relief of ten or more feet except areas composed of bedrock. A slope is delineated by establishing its toe and top and measured by averaging the inclination over at least ten feet of vertical relief.

j. Any area with a slope of forty percent or steeper and with a vertical relief of ten or more feet except areas composed of bedrock. A slope is delineated by establishing its toe and top and measured by averaging the inclination over at least ten feet of vertical relief.

k. Known landslide areas documented by the Washington State Department of Natural Resources (DNR) (2020) and those areas with slopes greater than thirty-five percent.

l. Known mass wasting areas identified in the 2005 Landslide Hazard Zonation Project – Mass Wasting Assessment prepared by Powell, L.

Section 18.01.070.E.2 of the CEMC requires that a buffer be established from all edges of landslide hazard areas. The minimum prescriptive buffer width is equal to the height of the slope or 50 feet, whichever is greater. The buffer may be reduced to a minimum of 10 feet based on a finding by the City following review of the geotechnical report recommendations that the reduction will adequately protect the proposed development, adjacent developments and uses, and the subject critical area. The buffer may also be increased where based on a finding by the City following review of the geotechnical report determines a larger buffer is necessary to prevent risk of damage to proposed and existing development.
Section 18.01.070.E.3 of the CEMC states that a building setback of twenty feet shall be provided from all edges of the geological hazard area buffers. The building setback may be reduced based on a finding by the City following review of the geotechnical report recommendations that the reduction will adequately protect the proposed development, adjacent developments and uses, and the subject critical area. Alteration or development in Landslide Hazard Areas is generally prohibited but exceptions are allowed in some cases as discussed in section 18.01.070.E.4 of the CEMC.

5.2 Slope Reconnaissance

We completed a reconnaissance of the steeply sloping portions of the site at the time of our explorations in August and September 2024. The following is a summary of our observations.

- During our reconnaissance we did not observe any geomorphic indications of historic landslide activity such as slide scarps, tension cracks, reversed slope benches, hummocky topography, or unusually deformed tree trunks.
- Inclinations of onsite slopes visually appeared to be consistent with the topographic contours shown on Figure 2.
- No springs or emergent seepages were observed on the site.
- No water or evidence of seasonal flow was observed in the base of the ravines located on the subject site.
- No streams or other surface water bodies subject to streambank erosion, incision, or undercutting by wave action were observed on or adjacent to the property.

5.3 LIDAR Mapping

Light Detection and Ranging (LIDAR) is a remote sensing technology that can be used to generate a detailed expression of ground surface topography even in densely vegetated areas. For this reason, LIDAR-based topographic imagery can be helpful in distinguishing surface features (such as old landslide features) that may otherwise not be easily recognizable. A LIDAR-based shaded relief map of the subject site and surrounding area is included on Figure 2. We did not observe any geomorphic indications of historic landslide activity during our review of the LIDAR-based-shaded relief map.

5.4 Topographic Mapping

The topographic contours shown on Figure 2 indicate that inclinations on the gently sloping portions of the site range from 1 to 10 percent, and inclinations on the more steeply sloping terrain, present along the drainage ravines and the southern margins of the site, generally range from approximately 30 to 40 percent over heights of approximately 30 to 40 feet. The portions of the site with inclinations of 40 percent or more classify as Landslide Hazard Areas under the CEMC.

5.5 Landslide Hazard Mitigation

Based on our study, the site contains slopes which qualify as Landslide Lazard Areas under Section 18.01.030.F.2 of the CEMC based on existing slope geometry. Any area with a slope of

40 percent or more with a vertical relief of 10 feet or more is considered a Landslide Hazard Area. Within these areas and other more moderately sloping portions of the site, no evidence of historic landslide activity was observed during our study. In our opinion, the risk of damage to the proposed development by landslide is low under both static and seismic conditions. In order to mitigate landslide risks associated with the steep slopes at the subject site, we recommend a minimum top of slope buffer of 10 feet with a minimum building setback of 10 feet beyond the edge of the buffer in accordance with Section 18.01.070.E.2 of the CEMC.

5.6 Fire Access Road Setbacks

Project plans include a gravel surfaced fire access road along the southwest portion of Phase S-1. According to our conversations with the client and design team, the proposed fire access road would be set along the top of the slope in this area. Inclinations along the adjacent slope range from approximately 34 to 39 percent over heights of 40 to 50 feet. The road will be set back from the top of the slope approximately 3 feet.

Grading and clearing at the subject site is subject to the conditions of the vested development agreement which states that no vegetation shall be removed from slopes in excess of 25 percent, and that all clearing and grading shall be set back a minimum of 25 feet from the top of the slope, or a greater distance if the City Engineer determines a greater distance is necessary to protect slope stability. The development agreement also states that the City Engineer may permit clearing and grading to the top of the slope if a geotechnical report demonstrates that such work will not adversely affect slope stability. Based on our study and reconnaissance of the area, it is our opinion that the proposed gravel fire access road will not decrease slope stability provided surface runoff from the roadway is dispersed and not concentrated to a single discharge point onto the slope.

6.0 SEISMIC HAZARDS AND RECOMMENDED MITIGATION

The following discussion is a general assessment of seismic hazards that is intended to be useful to the project design team in terms of understanding seismic issues, and to the structural engineer for design. Generally, there are four types of potential geologic hazards associated with large seismic events: 1) surficial ground rupture, 2) seismically induced landslides or lateral spreading, 3) liquefaction, 4) ground motion. The potential for each of these hazards to adversely impact the proposed project is discussed below.

6.1 Surficial Ground Rupture

Based on current knowledge, the subject site is not located near known active surface faults. Therefore, based on current information, the risk of damage to planned improvements as a result of surface rupture due to faulting is low, in our opinion.

6.2 Seismically Induced Landslides

It is our opinion that the potential risk of damage to the proposed development by seismically induced slope failure is low provided the recommendations in this report are properly followed. A more thorough discussion of landslide risks under both static and seismic conditions is presented in the "Landslide Hazards and Recommended Mitigation" section of this report.

6.3 Liquefaction

Liquefaction is a process through which unconsolidated soil loses strength as a result of vibrations, such as those which occur during a seismic event. During normal conditions, the weight of the soil is supported by both grain-to-grain contacts and by the fluid pressure within the pore spaces of the soil below the water table. Extreme vibratory shaking can disrupt the grain-to-grain contact, increase the pore pressure, and result in a temporary decrease in soil shear strength. The soil is said to be liquefied when nearly all of the weight of the soil is supported by pore pressure alone. Liquefaction can result in deformation of the sediment and settlement of overlying structures.

Areas most susceptible to liquefaction include those areas underlain by coarse silt and clean sand with low relative densities, accompanied by a shallow water table. Because overburden pressures increase with increasing depth, soil density also tends to increase with depth. For this reason, liquefaction risk also tends to decrease with depth. Recent studies (Cetin et al., 2009; Ishihara et al., 2015) have demonstrated that the impact of post-seismic differential settlement due to reconsolidation of liquefied soil deposits on shallow foundations is negligible for layers deeper than approximately 50 feet. Previous explorations completed in the project vicinity indicate that groundwater is present in the glacial outwash sediments underlying the site and based on the groundwater levels observed in area monitoring wells, the depth to the groundwater below the area proposed for development is in excess of 100 feet. Due to the lack of adverse groundwater conditions, it is our opinion that the risk of liquefaction in this area is low, and no mitigation of liquefaction hazards is warranted.

6.4 Ground Motion/Seismic Site Class (2021 *International Building Code*)

It is our opinion that earthquake damage to the proposed structures when founded on suitable bearing strata in accordance with the recommendations contained herein, will likely be caused by the intensity and acceleration associated with the event. We understand the project will be designed in accordance with the 2021 International Building Code (IBC) as adopted by the CEMC, which references ASCE 7-22 Minimum Design Loads and Associated Criteria for Buildings and Other Structures (ASCE 7-22). The Washington State Building Code allows the use of either ASCE 7-22, or its predecessor, ASCE 7-16. Structural design of the structures should follow 2021 IBC standards using Site Class "D" as defined in Table 20.3-1 of ASCE 7-16. A ground motion hazard analysis was not completed for this project.

7.0 COAL MINE HAZARDS

Section 18.01.030.F.4 of the CEMC defines Mine Hazard Areas as "those areas underlain by, adjacent to, or affected by mine workings such as adits, gangways, tunnels, drifts, or air shafts. Factors which should be considered include: proximity to development, depth from ground surface to the mine working, and geologic material."

Coal seams in the Roslyn Formation were mined in the Cle Elum-Roslyn area beginning in the late 1800s, extending into the early 1960s. A coal mine hazard assessment was prepared for the 1999 MountainStar EIS by Icicle Creek Engineers, Inc. (ICE), which identified the presence of abandoned coal mine workings related to mining of the Roslyn Seam below the subject site. The depths of the workings below the property are estimated to range from approximately 600 to 2,000 feet below the existing ground surface. A figure from our 2019 SEIS report displaying the depth to coal mine workings below the subject site is included in Appendix E.

In their study of coal mine hazards in the project area, ICE divided coal mine hazards into High and Low Coal Mine Hazard Areas. Low Coal Mine Hazard Areas are areas where the underground mine workings are greater than 200 feet below the ground surface. Based on our review of these documents, this includes the subject site, where mine workings underly the site at depths ranging from approximately 600 to 2,000 feet below existing grades. Low Coal Mine Hazard Areas can be susceptible to regional subsidence of the ground surface. Regional subsidence is caused by plastic deformation of the strata overlying the mine workings as the roof sags into the mine. Subsidence typically occurs within a few days to years following mine abandonment. A study by Knuppe and Sisson (1923) noted that ground subsidence was more apparent in areas where underground mine workings are located within 400 feet of the ground surface and damage to structures in the Cle Elum area where mine workings are greater than 500 feet below ground surface is relatively small. Such damage was noted to typically be limited to cracks in building walls, pavement, and sidewalks. This type of structural damage is also typical of damage resulting from poor subgrade preparation and it is possible that the reported cracking identified in the study was not related to mining-related subsidence. No evidence of regional subsidence was observed during our reconnaissance of the site.

Based on the available data, it is our opinion that the risk of damage to the proposed structures from subsidence of underground mine workings is low. Mitigation of this risk could be achieved by using building methods and construction materials that would reduce the risk of structural damage such as:

- Reinforce concrete foundations supporting a flexible superstructure (e.g., wood framing or other flexible building materials).
- Use of flexible (asphalt) pavement for road construction.
- Use of flexible pipes, couplings, and fittings for underground utilities.

8.0 EROSION HAZARDS AND RECOMMENDED MITIGATION

The loess and outwash sediments which underlie the proposed development area contain significant quantities of silt and fine sand and are considered to be highly sensitive to erosion when wet and where it is present below sloping areas. The NRCS has mapped the soils on the site as Roslyn ashy sandy loam, 0 to 5 percent slopes. The NRCS indicates that the erosion hazard rating of the Roslyn soil is slight, but we anticipate that the erodibility of these soils will be elevated where they are present on more steeply sloping portions of the site.

In order to mitigate erosion hazards and the potential for off-site sediment transport, we recommend the following best management practices (BMPs):

1. To the extent practical, earthwork should be avoided during the wet season, typically October 1st through April 30th.

2. The winter performance of a site is dependent on a well-conceived plan for control of site erosion and stormwater runoff. The site plan should include ground-cover measures and staging areas. The contractor should be prepared to implement and maintain the required measures to reduce the amount of exposed ground.

3. Temporary erosion and sedimentation control (TESC) elements and perimeter flow control should be established prior to the start of grading.

4. During the wetter months of the year, or when significant storm events are predicted during the summer months, the work area should be stabilized so that if showers do occur, it can receive the rainfall without excessive erosion or sediment transport. The stabilization process should include establishing temporary stormwater conveyance channels through work areas to route runoff to the approved treatment/discharge facilities.

5. All areas of disturbed soil should be revegetated as soon as possible. If it is outside of the growing season, the disturbed areas should be covered with mulch. Straw mulch provides a cost-effective cover measure and can be made wind-resistant with the application of a tackifier after it is placed.

6. Surface runoff and discharge should be controlled during and following development. Uncontrolled discharge may promote erosion and sediment transport.

7. Soils that are to be reused around the site should be stored in such a manner as to reduce erosion from the stockpile. Protective measures may include, but are not limited to, covering stockpiles with plastic sheeting, or the use of silt fences around pile perimeters.

8. As the area of development will cover an area greater than 1 acre in size, it will be required to obtain a Construction Stormwater General Permit per the Washington State

Department of Ecology (Ecology). Under this permit, a Certified Erosion and Sediment Control Lead (CESCL) will be required to make weekly site visits to monitor erosion control, BMPs, and levels for turbidity and pH. AESI is available to help prepare permit application documents and can provide CESCL monitoring as requested.

It is our opinion that with the proper implementation of the TESC plans and by field-adjusting appropriate erosion mitigation (BMPs) throughout construction, the potential adverse impacts from erosion hazards on the project may be mitigated.

III. PRELIMINARY DESIGN RECOMMENDATIONS

9.0 INTRODUCTION

Our explorations indicate that, from a geotechnical engineering standpoint, the proposed project is feasible provided the recommendations contained herein are properly followed. Sediments suitable for foundation support were encountered in our explorations at a relatively shallow depth and conventional spread footings may be used for foundation support. Stormwater infiltration at the site appears feasible, infiltration rate testing details and recommended design infiltration rates are included below.

10.0 SITE PREPARATION

Site preparation within the proposed building and roadway areas should include removal of all vegetation, topsoil, and any other deleterious materials. Any existing fill beneath planned footing and floor slab areas should be removed. Any depressions below planned final grades resulting from demolition activities should be backfilled with structural fill, as discussed under the "Structural Fill" section of this report. After stripping of the surficial sod/topsoil horizon has been completed, any remaining roots and stumps should be removed from structural areas. All soils disturbed by stripping and grubbing operations should be recompacted as described below for structural fill.

10.1 Temporary and Permanent Cut Slopes

In our opinion, stable construction slopes should be the responsibility of the contractor and should be determined during construction based on the local conditions encountered at that time. For planning purposes, we anticipate that all temporary, unsupported cut slopes in areas of loess and glacial outwash can be made at a maximum slope of 1.5H:1V (Horizontal:Vertical). Temporary vertical cuts up to 4 feet in height may be planned in these materials. Flatter inclinations may be recommended in areas of seepage. As is typical with earthwork operations, some sloughing and raveling may occur, and cut slopes may have to be adjusted in the field. In addition, WISHA/OSHA regulations should be followed at all times.

Permanent cut slopes should not exceed an inclination of 2H:1V.

10.2 Site Disturbance

The surficial loess deposits and portions of the glacial outwash underlying the proposed development area contain a high percentage of fine-grained (silt- and clay-sized) material. These soils are considered to be highly moisture-sensitive and subject to disturbance when wet. The contractor must use care during site preparation and excavation operations so that the

underlying soils are not softened. If disturbance occurs, the softened soils should be removed, and the area brought to grade with structural fill.

Consideration should be given to protecting access and staging areas with an appropriate section of crushed rock or asphalt treated base (ATB). If crushed rock is considered for the access and staging areas, it should be underlain by engineering stabilization fabric (such as Mirafi® 500X or approved equivalent) to reduce the potential of fine-grained materials pumping up through the crushed rock during wet weather and turning the area to mud. The fabric will also aid in supporting construction equipment, thus reducing the amount of crushed rock required. We recommend that at least 10 inches of crushed rock be placed over the fabric. Crushed rock used for access and staging areas should have a particle size of at least 2 inches.

11.0 STRUCTURAL FILL

Placement of structural fill may be necessary to establish desired grades in some areas or to backfill utility trenches. All references to structural fill in this report refer to subgrade preparation, fill type, and placement and compaction of materials as discussed in this section. If a percentage of compaction is specified under another section of this report, the value given in that section should be used.

In general, near surface sediments at the subject site will consist of loess, silty glacial outwash, and sandy outwash. For structural fill applications, the reuse of loess is not recommended as compaction of this sediment to a suitable condition is labor intensive and inconsistent. Excavated loess may be stockpiled for reuse in non-structural areas such as landscaping, but should not be incorporated into fills below foundations, roadways, sidewalks, or other structural areas. The glacial outwash sediments are considered suitable for reuse as structural fill when prepared according to the recommendations provided below.

11.1 Subgrade Compaction

After overexcavation/stripping has been performed to the satisfaction of the geotechnical engineer/engineering geologist, the exposed ground should be recompacted to a firm and unyielding condition. Where loess deposits are present below foundations, it should be removed and replaced with structural fill. If the subgrade contains too much moisture, suitable recompaction may be difficult or impossible to attain and should probably not be attempted. In lieu of recompaction, the area to receive fill should be blanketed with washed rock or quarry spalls to act as a capillary break between the new fill and the wet subgrade. Where the exposed ground remains soft and further overexcavation is impractical, placement of an engineering stabilization fabric may be necessary to prevent contamination of the free-draining layer by silt migration from below.

After the exposed ground is approved, or a free-draining rock course is laid, structural fill may be placed to attain desired grades.

11.2 Structural Fill Compaction

Structural fill is defined as non-organic soil, acceptable to the geotechnical engineer, placed in maximum 8-inch loose lifts, with each lift being compacted to at least 95 percent of the modified Proctor maximum dry density using *ASTM International* (ASTM) D-1557 as the standard. Utility trench backfill should be placed and compacted in accordance with applicable municipal codes and standards. The top of the compacted fill should extend horizontally a minimum distance of 3 feet beyond footings or pavement edges before sloping down at an angle no steeper than 2H:1V. Fill slopes should either be overbuilt and trimmed back to final grade or surface-compacted to the specified density.

11.3 Moisture-Sensitive Fill

Soils in which the amount of fine-grained material (smaller than No. 200 sieve) is greater than approximately 5 percent (measured on the minus No. 4 sieve size) should be considered moisture-sensitive. The use of moisture-sensitive soil in structural fills should be limited to favorable dry weather conditions. Excavated loess sediments are highly moisture sensitive and are not considered suitable for structural fill applications. Excavated glacial outwash sediments are generally suitable for use as structural fill provided that they are free of roots, oversized rocks, and other deleterious materials and exhibit a moisture content at the time of construction compatible with achieving the recommended compaction specification. Because the upper portion of the glacial outwash sediments contain a high percentage of silt, compaction of these sediments to the recommended minimum density may only be achievable over a narrow range of moisture contents. If the moisture content of the glacial outwash is over optimum at the time of construction, moisture-conditioning could be achieved by aerating the soil during periods of warm, dry weather. During the summer months, the contractor should be prepared to add water to the glacial outwash while backfilling. Maximum rock size for structural fill applications should be limited to diameters of approximately 6 inches or less.

Construction equipment traversing the site when the silty on-site sediments are very moist or wet can cause considerable disturbance. If fill is placed during wet weather or if proper compaction of the natural materials cannot be attained, a select import material consisting of a clean, free-draining gravel and/or sand should be used. Free-draining fill consists of non-organic soil with the amount of fine-grained material limited to 5 percent by weight when measured on the minus No. 4 sieve fraction.

11.4 Structural Fill Testing

The contractor should note that any proposed fill soils must be evaluated by AESI prior to their use in fills. This would require that we have a sample of the material at least 3 business days in advance to perform a Proctor test and determine its field compaction standard.

A representative from our firm should observe the stripped subgrade and be present during placement of structural fill to observe the work and perform a representative number of in-place density tests. In this way, the adequacy of the earthwork may be evaluated as filling progresses and any problem areas may be corrected at that time. It is important to understand that taking random compaction tests on a part-time basis will not assure uniformity or acceptable performance of a fill. As such, we are available to aid the owner in developing a suitable monitoring and testing frequency.

12.0 FOUNDATIONS

Spread footings may be used for building support when founded either directly on the medium dense glacial outwash, or on structural fill placed over these sediments. If structural fill is placed below footing areas, it should extend horizontally beyond the footing edges a distance equal to or greater than the thickness of the fill placed below the footings or 2 feet, whichever is less. We recommend that an allowable foundation soil bearing pressure of 3,000 psf be used for design purposes, including both dead and live loads. An increase in the allowable bearing pressure of one-third may be used for short-term wind or seismic loading.

12.1 Footing Depths

Perimeter footings for the proposed homes should be buried a minimum of 24 inches into the surrounding soil for frost protection. No minimum burial depth is required for interior footings; however, all footings must penetrate to the prescribed stratum, and no footings should be founded in or above loose, organic, or existing fill soils.

12.2 Footings Adjacent to Cuts

The area bounded by lines extending downward at 1H:1V from any footing must not intersect another footing or intersect a filled area that has not been compacted to at least 95 percent of ASTM D-1557. In addition, a 1.5H:1V line extending down from any footing must not daylight because sloughing or raveling may eventually undermine the footing. Thus, footings should not be placed near the edges of steps or cuts in the bearing soils.

12.3 Frozen Subgrades

If earthwork takes place during freezing conditions, all exposed subgrades should be allowed to thaw, and then be recompacted prior to placing subsequent lifts of structural fill. Alternatively, the frozen material could be stripped from the subgrade to reveal unfrozen soil prior to placing subsequent lifts of fill. The frozen soil should not be reused as structural fill until allowed to thaw and adjusted to the proper moisture content, which may not be possible during winter months. Failure to remediate frozen subgrades will generally lead to settlement of foundations and hardscapes.

12.4 Footing Settlement

Anticipated settlement of footings founded as described above should be on the order of 1 inch or less. However, disturbed soil not removed from footing excavations prior to footing placement could result in increased settlements.

12.5 Footing Subgrade Bearing Verification

All footing subgrade areas should be observed by AESI prior to footing placement. Foundation bearing verification may be required by the City of Cle Elum.

12.6 Foundation Drainage

Perimeter footing drains should be provided as discussed under the "Drainage Considerations" section of this report.

13.0 LATERAL WALL PRESSURES

All backfill behind walls or around foundations should be placed following our recommendations for structural fill and as described in this section of the report. Horizontally backfilled walls, that are free to yield laterally at least 0.1 percent of their height, may be designed using an equivalent fluid equal to 35 pcf. Fully restrained, horizontally backfilled, rigid walls that cannot yield should be designed for an equivalent fluid of 55 pcf. Walls that retain sloping backfill at a maximum angle of 50 percent should be designed for 50 pcf for yielding conditions and 65 pcf for restrained conditions. If parking areas or driveways are adjacent to walls, a surcharge equivalent to 2 feet of retained soil should be added to the wall height in determining lateral design forces.

13.1 Wall Backfill

The lateral pressures presented above are based on the conditions of a uniform backfill consisting of imported sand and gravel compacted to 90 to 95 percent of ASTM D-1557. A higher degree of compaction is not recommended, as this will increase the pressure acting on the walls. A lower compaction may result in unacceptable settlement behind the walls. Thus, the compaction level is critical and must be tested by our firm during placement.

13.2 Wall Drainage

It is imperative that proper drainage be provided so that hydrostatic pressures do not develop against the walls. This would involve installation of a minimum 1-foot-wide blanket drain for the full wall height using imported, washed gravel against the walls.

12.3 Passive Resistance and Friction Factor

Lateral loads can be resisted by friction between the foundation and the supporting sediments, or by passive earth pressure acting on the buried portions of the foundations. The foundations must be backfilled with compacted structural fill to achieve the passive resistance provided below. We recommend the following design parameters:

- Passive equivalent fluid = 250 pcf
- Coefficient of friction = 0.30

The above values are allowable.

13.4 Seismic Surcharge

As required by the 2021 IBC, retaining wall design should include a seismic surcharge pressure in addition to the equivalent fluid pressures presented above. We recommend a seismic surcharge pressure of 6H and 9H psf where H is the wall height in feet for the "active" and "at-rest" loading conditions, respectively. The seismic surcharge should be modeled as a rectangular distribution with the resultant applied at the midpoint of the wall.

14.0 FLOOR SUPPORT

Slab-on-grade floors may be constructed either directly on the medium dense glacial outwash sediments or on structural fill placed over these materials. Where loess is present below proposed slab-on-grade floors, it should be removed and replaced with structural fill. Areas of the slab subgrade that are disturbed (loosened) during construction should be recompacted to an unyielding condition prior to placing the pea gravel as described below. If moisture intrusion through floor slabs is to be limited, we recommend that the floor slabs be constructed atop a capillary break consisting of a minimum thickness of 4 inches of washed pea gravel. The pea gravel should be overlain by a 10-mil (minimum thickness) plastic vapor retarder.

15.0 DRAINAGE CONSIDERATIONS

The loess and silty glacial outwash sediments underlying the site contain significant amounts of silt and are considered to be highly moisture-sensitive. Traffic from vehicles and construction equipment across these sediments when they are very moist or wet will result in disturbance of the otherwise firm stratum. Therefore, prior to site work and construction, the contractor should be prepared to provide drainage and subgrade protection, as necessary.

15.1 Wall/Foundation Drains

All retaining and perimeter footing walls should be provided with a drain at the footing elevation. The drains should consist of rigid, perforated, polyvinyl chloride (PVC) pipe surrounded by washed gravel. The level of the perforations in the pipe should be set approximately 2 inches below the bottom of the footing, and the drains should be constructed with sufficient gradient to allow gravity discharge away from the buildings. All retaining walls should be lined with a minimum, 12-inch-thick washed gravel blanket provided to within 1 foot of finish grade and which ties into the footing drain. Roof and surface runoff should not discharge into the footing drain system but should be handled by a separate, rigid, tightline drain.

Exterior grades adjacent to walls should be sloped downward away from these structures to achieve surface drainage. Final exterior grades should promote free and positive drainage away from the buildings at all times. Water must not be allowed to pond or to collect adjacent to the foundation or within the immediate building area. It is recommended that a gradient of at least 3 percent for a minimum distance of 10 feet from the building perimeter be provided, except in paved locations. In paved locations, a minimum gradient of 1 percent should be provided unless provisions are included for collection and disposal of surface water adjacent to the structure. Additionally, pavement subgrades should be crowned to provide drainage toward catch basins and pavement edges.

16.0 SHALLOW INFILTRATION TESTING AND DESIGN RECOMMENDATIONS

Based on our study, shallow infiltration of stormwater at the subject site appears feasible. It is our understanding that project plans include 10 infiltration facilities consisting of a combination of both bioretention and infiltration areas. The infiltration facility locations are designated as Bioretention Areas (BA-1 though BA-6) and Infiltration Areas (IA-1 through IA-4) on Figure 2 through Figure 5. To determine design infiltration rates for the proposed infiltration facilities, AESI completed a grain-size (sieve) based assessment of infiltration rates supplemented by field infiltration rate testing. From on our conversations with the City of Cle Elum, the grain-size based infiltration analysis and the required exploration depths should be completed in accordance with the 2019 SMMEW. The field infiltration testing and subsequent infiltration design should be completed in accordance with the 2024 SMMEW.

The feasibility of stormwater infiltration at the subject site is dependent upon the presence of a suitable native receptor soil of sufficient thickness, extent, permeability, and vertical separation from groundwater. The explorations completed for our study generally encountered sediments consisting of loess and silty glacial outwash underlain by sandy glacial outwash deposits that extended to the maximum depth explored. The glacial outwash is a suitable receptor horizon, provided that the minimum required vertical separation from seasonal high groundwater is

feasible. Exploration borings completed as part of previous studies at the subject site indicate that groundwater underlying the site ranges from approximately 100 to 150 feet below existing grades. A more detailed discussion of groundwater underlying the site is included in the "Groundwater" section of this report.

The results of our infiltration feasibility and infiltration rate testing studies are included below.

16.1 Grain-size Analysis Infiltration Rate Results

As part of our study, AESI completed a sieve-based assessment of infiltration rates. The estimated saturated hydraulic conductivity of the infiltration receptor sediments was calculated using the Massmann equation (2008) which correlates grain-size distribution to saturated hydraulic conductivity for sediments unconsolidated by glacial advance, such as the on-site loess and glacial outwash deposits. This approach is detailed in Chapter 6, Appendix B, "*6.B.4 Recommended Laboratory Test Procedures,*" of the 2019 SMMEW. Unlike the 2024 SMMEW, the 2019 SMMEW approach does not require additional corrections which account for gradation.

Laboratory grain-size (sieve) analyses were performed by AESI on samples selected from our most recent exploration pits. A total of 37 grain-size analyses, attached in Appendix D, were used to calculate an initial saturated hydraulic conductivity using the Massmann (2008) equation. Details including soil descriptions, test depth, grainsize, and correction factors are included on Table F-1 in Appendix F. A summary of the uncorrected rates organized by infiltration facility is provided below in Table 3. The range of values presented in Table 3 is a result of the variability in the grain size distribution between samples taken within the facility.

Table 3
Grain-size Analysis Infiltration Rate Summary (Uncorrected)

Infiltration Facility No.	Massmann Uncorrected Infiltration Rates (in/hr)
BA-1	7 – 38
BA-2	8 – 256
BA-3	48 – 247
BA-4	7 – 135
BA-5	122 – 493
BA-6	5 – 146
IA-1	92 – 534
IA-2	121 – 331
IA-3	15 – 547
IA-4	58 – 150

16.2 Field Infiltration Rate Testing Results

Four Small-Scale PITs (IT-1 through IT-4) were conducted on September 10 through September 13, 2024. Each PIT was conducted at the approximate location and depth of a proposed infiltration system based on facility locations and depths provided to us by the client and the project civil engineer. Field infiltration rate testing was completed as described in the "Infiltration Testing Procedures" section of this report. These PITs were conducted to obtain representative field infiltration rates for design of the infiltration facilities and comparison to estimated infiltration rates based on laboratory grain-size analysis. Field-testing data sheets are included in Appendix F. Details regarding the infiltration tests are provided below in Table 4, "Small-Scale Pilot Infiltration Test Summary."

Table 4
Small-Scale Pilot Infiltration Test Summary (Uncorrected)

Test Number	Infiltration Facility	Test Depth (feet)	Test Area (square feet)	Average Flow Rate during Final Hour of Testing (gallons per minute)	Field (Uncorrected) Constant-Head Infiltration Rate (inches/hour)	Field (Uncorrected) Falling-Head Infiltration Rate (inches/hour)
IT-1	BA-6	3	15	1.4	9.6	6.7
IT-2	IA-3	5	17.5	6.5	35.3	17.0
IT-3	BA-3	7	15	8.4	53.2	67.7
IT-4	IA-1	9	18	28	149.6	109.2

Upon completion of each test, infiltration tests were deepened to: 1) document the types of soils the water infiltrated through, and 2) identify any soil layers that would restrict the downward flow of infiltrating water. The material beneath the test surface consisted of generally similar coarse-grained glacial outwash sediments, extending beyond the maximum explored depth. AESI observed increased moisture content below the infiltration test depth, indicating that the test water infiltrated downward to at least the total depth explored.

16.3 Design Infiltration Rate Determination

The infiltration rates presented above in Table 3 and Table 4 are uncorrected and are therefore non-conservative for design purposes. The Ecology Manual requires that the infiltration rates must have various correction factors applied to account for site variability, number of tests conducted, type of field test, the potential for long-term clogging due to siltation and bio-buildup, and the type of subgrade material. Based on our conversations with the City of Cle Elum, the sieve-based infiltration rates will be corrected in accordance with the 2019 SMMEW, and the field-based infiltration rates will be corrected in accordance with the 2024 SMMEW.

The correction factors used in the calculation are presented in *Table 6.4: Correction Factors for In-Situ Ksat Measurements to Estimate Long-Term Design Infiltration Rates of Subgrade Soils Underlying Infiltration BMP's* of the 2019 SMMEW, and *Table 6.22: Correction Factors for In-Situ Ksat Measurements to Estimate Long-Term Design Infiltration Rates of Subgrade Soils* of the 2024 SMMEW. The correction factors and the resulting K_{sat} Design rates are described below for the grain-size analysis method and field infiltration rate methods.

Grain-size Analysis Design Rates (2019 SMMEW):

Total Correction Factor, $CF_T = CF_V * CF_t * CF_m * CF_b$

The design infiltration rate (K_{sat}design) is calculated by multiplying the K_{sat} by the total correction factor:

K_{sat}design = K_{sat}initial * CF_T

K_{sat}design: Represents the long-term design infiltration rate.

K_{sat}initial: Represents the uncorrected grain-size based infiltration rate.

Site variability and number of locations tested (CF_v): Based on the relatively uniform subsurface conditions observed in our explorations in the proposed infiltration areas, we consider the uncertainty at the site to be low and partial correction factors of 0.7 to 1.0 were selected.

Test method (CF_t): Based on the testing method, a partial correction factor of 0.4 to 0.75 is defined based on the percent passing the U.S. No. 200 sieve.

Degree of influent control to prevent siltation and bio-buildup (CF_m): A partial correction factor of 0.9 and 1.0 is defined for infiltration and bioretention BMPs, respectively.

Quality of pavement aggregate base material (CF_b): For all BMPs other than permeable pavement, a correction factor of 1.0 is defined.

The resultant range of corrected infiltration rates for the grain-size based analysis are presented below in Table 5. Details regarding the grain-sized based infiltration rates including soil descriptions, test depth, grainsize, and correction factors are included on Table F-1 in Appendix F. At infiltration facility locations where field infiltration rate testing was completed, the field rate will be selected as the recommended design infiltration rate over the grain-sized based rates. The recommended infiltration rates for each infiltration facility are presented below in section "16.4 Recommended Design Infiltration Rates."

Table 5
Grain-size Analysis Design Infiltration Rate Summary (Corrected)

Infiltration Facility No.	Massmann Design Infiltration Rates (in/hr)
BA-1	1.7 – 11.9
BA-2	3.1 – 172.6
BA-3	32.4 – 166.4
BA-4	1.9 – 64.0
BA-5	82.6 – 332.8
BA-6	1.8 – 98.4
IA-1	61.8 – 360.3
IA-2	81.4 – 223.6
IA-3	5.4 – 368.9
IA-4	39.3 – 101.2

Field-Infiltration Testing Design Rates (2024 SMMEW):

Total Correction Factor, $CF_T = CF_V * CF_t * CF_m * CF_b$

The design infiltration rate (K_{sat}design) is calculated by multiplying the K_{sat} by the total correction factor:

$$K_{sat}design = K_{sat}initial * CF_T$$

K_{sat}design: Represents the long-term design infiltration rate.

K_{sat}initial: Represents the uncorrected field-measured infiltration rate.

Site variability and number of locations tested (CF_v): Based on the relatively uniform subsurface conditions observed in our explorations in the proposed infiltration areas, we consider the uncertainty at the site to be low and a partial correction factor of 0.6 was selected.

Test method (CF_t): Based on the use of a Small-Scale PIT, a partial correction factor of 0.5 is defined.

Degree of influent control to prevent siltation and bio-buildup (CF_m): A partial correction factor of 0.9 and 1.0 is defined for infiltration and bioretention BMPs, respectively.

Quality of pavement aggregate base material (CF_b): For all BMPs other than permeable pavement, a correction factor of 1.0 is defined.

When determining the K_{sat}initial value at each test we elected to use the lower value of the two field infiltration rates, either the constant-head infiltration rate or the falling-head infiltration rate, as these provide more conservative design infiltration rates. The resultant field-based design infiltration rates are presented in Table 6. The recommended infiltration rates for each infiltration facility are presented below in section "16.4 Recommended Design Infiltration Rates."

Table 6
Small-Scale Pilot Design Infiltration Rate Summary (Corrected)

Test Number	Infiltration Facility	Initial Infiltration Rate (inches/hour)	Design Infiltration Rate (inches/hour)
IT-1	BA-6	6.7	2.3
IT-2	IA-3	17.0	5.4
IT-3	BA-3	53.2	18.6
IT-4	IA-1	109.2	34.4

16.4 Recommended Design Infiltration Rates

The following section presents our **recommended design infiltration rates** for each infiltration facility. The rates presented in Table 7 were selected to be conservatively low and represent the results of both the sieve-based and field-based infiltration rates. Where a field infiltration rate test was completed, the field-based design infiltration rate was selected over the sieve-based design infiltration rate.

Table 7
Recommended Design Infiltration Rates

Infiltration Facility No.	Massmann Design Infiltration Rates (in/hr)	
BA-1	1.7	2
BA-2	3.1	4
BA-3	18.6	BA-3 7
BA-4	1.9	3
BA-5	82.6	6
BA-6	2.3	BA-6 3
IA-1	34.4	IA-1 9
IA-2	81.4	11
IA-3	5.4	IA-3 5
IA-4	39.3	5

The correction factors and resulting design infiltration rates presented in Table 7 apply only to infiltration facilities at the testing or sampling locations and where unsaturated sediments consistent with the tested material is present at the base of any proposed infiltration BMP.

16.5 General Infiltration BMP Subgrade Recommendations

From our subsurface exploration, our laboratory testing results, and our Small-Scale PIT results, stormwater infiltration is feasible at this site. It should be noted that the glacial outwash receptor was encountered at a shallow depth and extended the full depth of our explorations.

The base of the infiltration BMPs should be situated at least 2 feet into the target receptor, generally the receptor will consist of silty glacial outwash or sandy glacial outwash. From preliminary project plans and discussions with the client, we understand that significant excavation will be necessary to reach some BMP subgrades. AESI should confirm the required embedment into the infiltration receptor horizon at the time of construction.

Due to natural variability of the subsurface conditions, the potential for field adjustments should be anticipated based on actual conditions encountered during construction. The infiltration subgrade will need to be protected from siltation and sand by proper TESC practices and management of the imported materials stockpile during construction. The BMP facilities shall not be used as part of the TESC plan. Turbid stormwater or silt must not be allowed into the infiltration system. Turbid water t will clog the receptor soil and make the facility inoperable.

The BMP-specific design infiltration rate is based upon the field infiltration testing, grain-size distribution testing, subsurface exploration, groundwater level data, and AESI's experience on projects with similar site conditions.

The design infiltration rates given require that a representative of AESI is present during the excavation of the infiltration BMP to observe the subgrade. In addition, the infiltration system must remain off-line during construction to avoid siltation. Stormwater runoff must not be routed to the infiltration BMP until the site is stabilized and runoff is clear.

The recommended design infiltration rates assume that permeable natural sediments consistent with those tested will be encountered at the subgrades of the proposed infiltration BMPs.

We recommend an overflow path be specified such that runoff above the BMP's design capacity does not cause flooding of a building or emergency access, erosion, or downstream sedimentation, or slope failure.

16.6 Recommendations for Future Infiltration-Related Study

Our recommendations presented in this report are based on the project plans available at the time of our study, specifically the location and depth of the proposed infiltration BMPs. If changes are made to the layout of the infiltration BMPs as the design progresses, we should be allowed to review the changes and modify our recommendations, as necessary. Changes outside of our current scope of work may require additional studies and testing to confirm that infiltration is still feasible based on the new design.

17.0 PAVEMENT DESIGN AND RECOMMENDATIONS

We understand that conventional flexible (asphaltic) pavements will be used for new roadways on the subject site. The following comments and recommendations are given for pavement design and construction purposes.

17.1 Design Criteria

Soil Design Values: Soil conditions for pavement design can be defined by a California Bearing Ratio (CBR), which quantitatively predicts the effects of wheel loads imposed on a saturated subgrade. As part of our study, AESI collected six representative samples of onsite soils for CBR testing. The selected CBR samples included loess, silty glacial outwash, and sandy glacial outwash sediments to provide a range of values and materials for pavement design. Laboratory testing for the CBR's was conducted by HWA Geosciences Inc., a local materials testing lab. The CBR values and the corresponding soil support values (S) are summarized below in Table 3. The lab testing data is included in Appendix G.

Table 8
Summary of California Bearing Ratio and Soil Support Values

Exploration No.	Sample Depth (ft)	California Bearing Ratio Value (CBR)	Soil Support Value (S)	Material Description and Geologic Unit
EP-54	1	8.5	5.7	Silty SAND (Loess)
EP-65	1	25	7.7	Silty SAND (Loess)
EP-76	1	13	6.5	Silty SAND (Loess and Outwash)
EP-84	1	7	5.4	Silty SAND with gravel (Loess and Outwash)
EP-95	3.5	21	7.4	Silty SAND with gravel (Loess and Outwash)
EP-95	5	70	9.6	SAND with silt and gravel (Outwash)

Traffic Design Values: Traffic conditions can be defined by Equivalent Single-Axle Load (ESAL) which quantifies the combined effects of projected car and truck traffic. A traffic study for the

site was completed by Transportation Engineering Northwest (TENW) which states that the estimated average daily trips (ADT) for Phases S1, S2, and J, ranges from 2,000 to 2,500 vehicles daily. The ADT breakdown includes 97 percent passenger vehicles and 3 percent trucks. This ADT range corresponds to an ESAL value of about 1,040,000.

Flexible Pavement Sections: A flexible pavement section typically comprises an asphalt concrete pavement (ACP) over a crushed aggregate base (CAB) over a granular subbase (GSB). Additionally, pavement design may incorporate a layer of asphalt treated base (ATB) above the CAB which functions as a working surface during construction and is then overlayed with ACP near the end of the project. Our recommended minimum thicknesses for a flexible pavement section are shown below. This section was derived from AASHTO design methodologies, using the aforementioned preliminary design values and a 20-year lifespan.

Minimum Pavement Section (Includes ATB)

Asphalt Concrete Pavement (ACP):	2 inches
Asphalt Treated Base (ATB):	4 inches
Crushed Aggregate Base Course (CAB):	6 inches

Minimum Pavement Section (Does not include ATB)

Asphalt Concrete Pavement (ACP):	4 inches
Crushed Aggregate Base Course (CAB):	4 inches
Granular Subbase Course (GSB):	8 inches

Pavement Life and Maintenance: It should be realized that conventional asphaltic pavements are not maintenance-free. The foregoing pavement sections represent our minimum recommendations for an average level of performance during a 20-year design life; therefore, an average level of maintenance will likely be required. Furthermore, a 20-year pavement life typically assumes that an overlay will be placed after about 10 years. Thicker asphalt, base, and subbase courses would offer better long-term performance, but would cost more initially; thinner courses would be more susceptible to "alligator" cracking and other failure modes. As such, pavement design can be considered a compromise between a high initial cost and low maintenance costs versus a low initial cost and higher maintenance costs.

17.2 Construction Details

Subgrade Preparation: All pavement subgrades should be compacted to a firm and unyielding condition before any pavement layers are placed. We recommend using a heavy vibratory-drum roller for granular (sand and gravel) subgrades. The resulting subgrade condition should then be verified by proof-rolling with a loaded dump truck or other heavy construction vehicle, in the presence of an AESI representative. Any localized zones of soft, organic-rich, or debris-laden soils disclosed during proof-rolling should be overexcavated and replaced with structural fill material.

Granular Subbase: For the GSB, we suggest using an on-site or imported, well-graded mixture of sand and gravel, such as "Ballast" per WSDOT 9-03.9(1) or "Gravel Borrow" per WSDOT 9-03.14. On-site soils that have textures similar to these WSDOT materials can be evaluated on a case-by-case basis. Regardless of source or composition, all GSB material should be compacted to a minimum density of 95 percent based on the modified Proctor maximum dry density (per ASTM D-1557). Where native soils meeting the characteristics of the GSB are encountered, the surface should be proof rolled to a firm and unyielding condition rather than removing and replacing the existing sediments.

Crushed Aggregate Base: We recommend that all CAB material conform to the criteria for "Crushed Surfacing Base Course" per WSDOT 9-03.9(3). All CAB material should be compacted to a minimum density of 95 percent based on the modified Proctor maximum dry density (per ASTM D-1557).

Asphalt Treated Base: We recommend that ATB be compacted to a target average density of 80 percent, based on the Rice theoretical maximum density for that material (per ASTM D-2041).

Asphalt Concrete Pavement: We recommend that the ACP be compacted to a target average density of 92 percent, with a minimum of 90 percent and a maximum of 96 percent, based on the Rice theoretical maximum density for that material (per ASTM D-2041).

18.0 PROJECT DESIGN AND CONSTRUCTION MONITORING

Because project plans were not available at the time of our study, this report is considered to be preliminary. We recommend that we be allowed to review project plans when they are completed and to revise the recommendations presented in this report, if appropriate. We are also available to provide geotechnical engineering and monitoring services during construction. The integrity of the foundation system depends on proper site preparation and construction procedures. In addition, engineering decisions may have to be made in the field in the event that variations in subsurface conditions become apparent.

We have enjoyed working with you on this study and are confident these recommendations will aid in the successful completion of your project. If you should have any questions or require further assistance, please do not hesitate to call.

Sincerely,
ASSOCIATED EARTH SCIENCES, INC.
Kirkland, Washington

Peter E. Linton, L.G.
Project Geologist



Timothy J. Peter, L.E.G., L.Hg.
Senior Engineering Geologist

Matthew A. Miller, P.E.
Principal Geotechnical Engineer

Attachments:

	Figure 1:	Vicinity Map
	Figure 2:	Site and Exploration Plan
	Figure 3:	Grading Plan Phase J
	Figure 4:	Grading Plan Phase S-1
	Figure 5:	Grading Plan Phase S-2
	Appendix A:	Exploration Logs (AESI, 2024)
	Appendix B:	Previous Exploration Logs (AESI 1999 and 2019, AGI 1999)
	Appendix C:	Geologic Cross Section (2019 SEIS)
	Appendix D:	Grain-size Laboratory Testing Data
	Appendix E:	Coal Mine Hazard Depths (2019 SEIS)
	Appendix F:	Infiltration Testing Data
	Appendix G:	CBR Laboratory Testing Data

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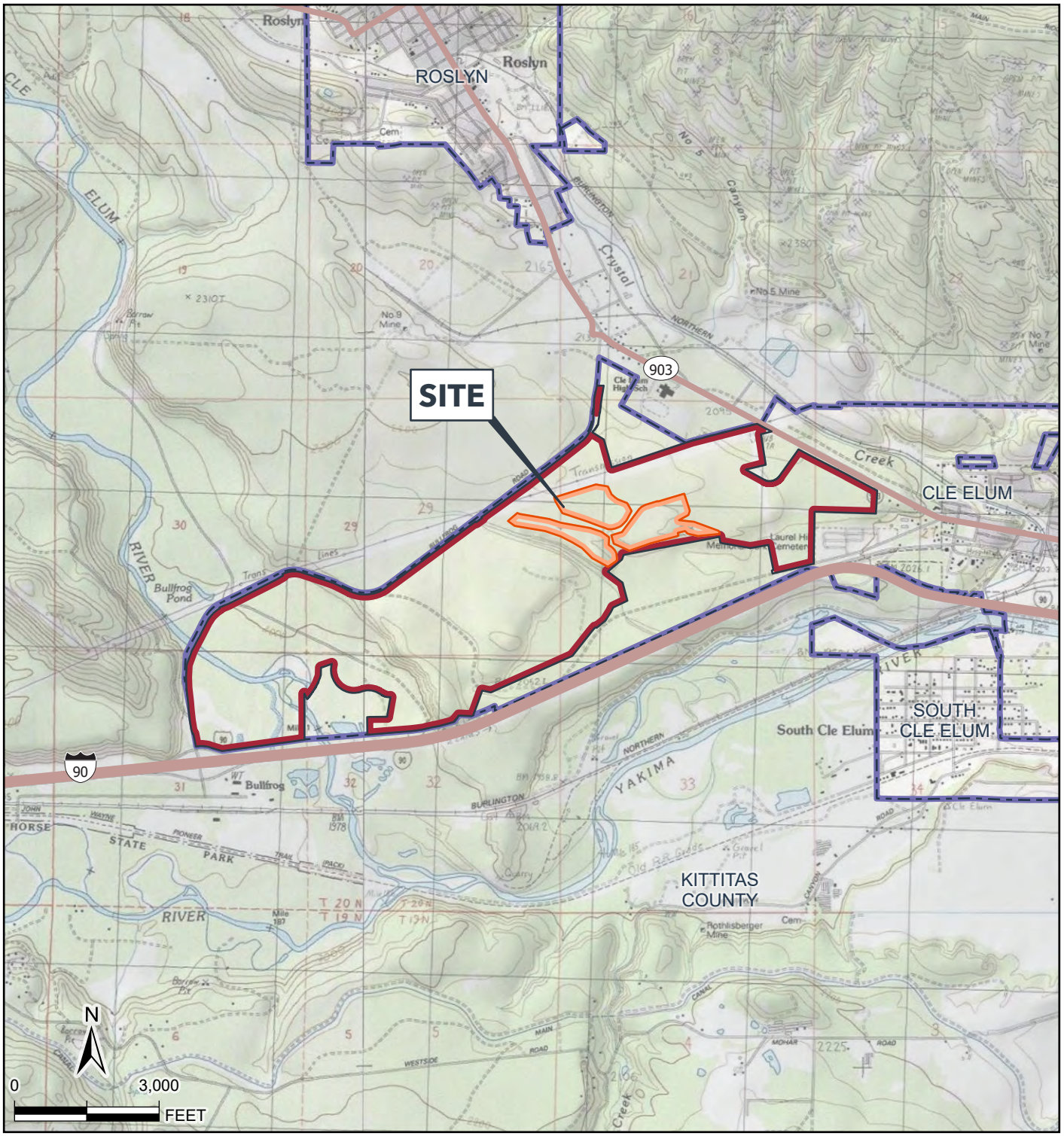
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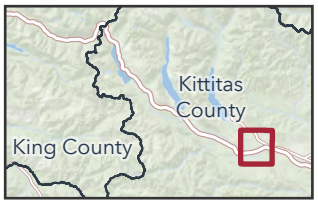
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COUNTY LOCALE



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

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

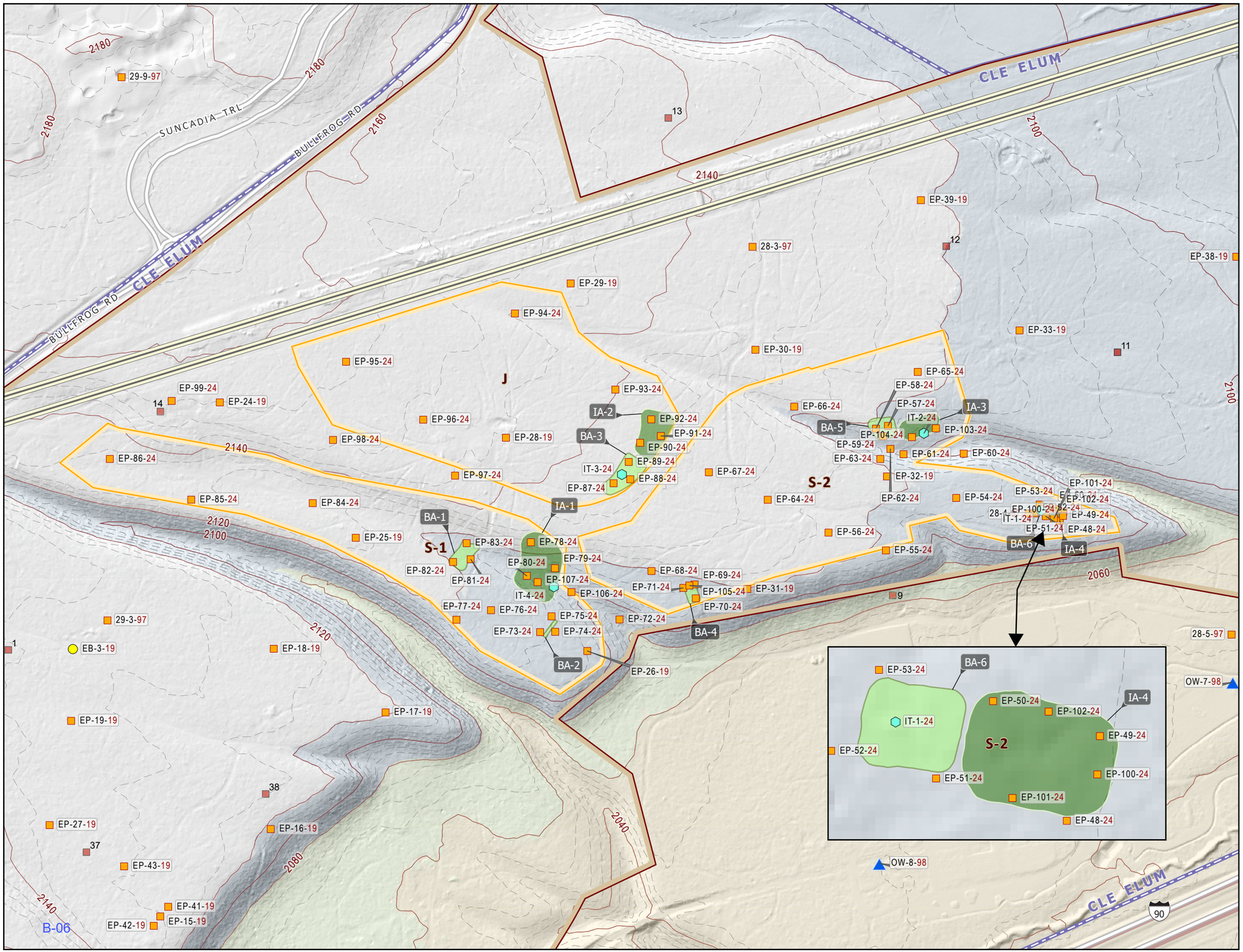
associated earth sciences incorporated

VICINITY MAP

BULLFROG FLATS
CLE ELUM, WASHINGTON

PROJECT NO.	DATE	FIGURE
20240155E001	10/24	1

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DATA SOURCES/REFERENCES:
KITTITAS COUNTY: ROADS, PARCELS, AND CITY BOUNDARY (8/24). WADOT STATE ROUTES 24K (12/20). IMAGERY: HEXAGON, WATECH, KITTITAS COUNTY GIS (2021). WA DNR LIDAR: YAKIMA 2014, METADATA UNKNOWN, 3' CELL SIZE. CONTOURS DERIVED FROM LIDAR.

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

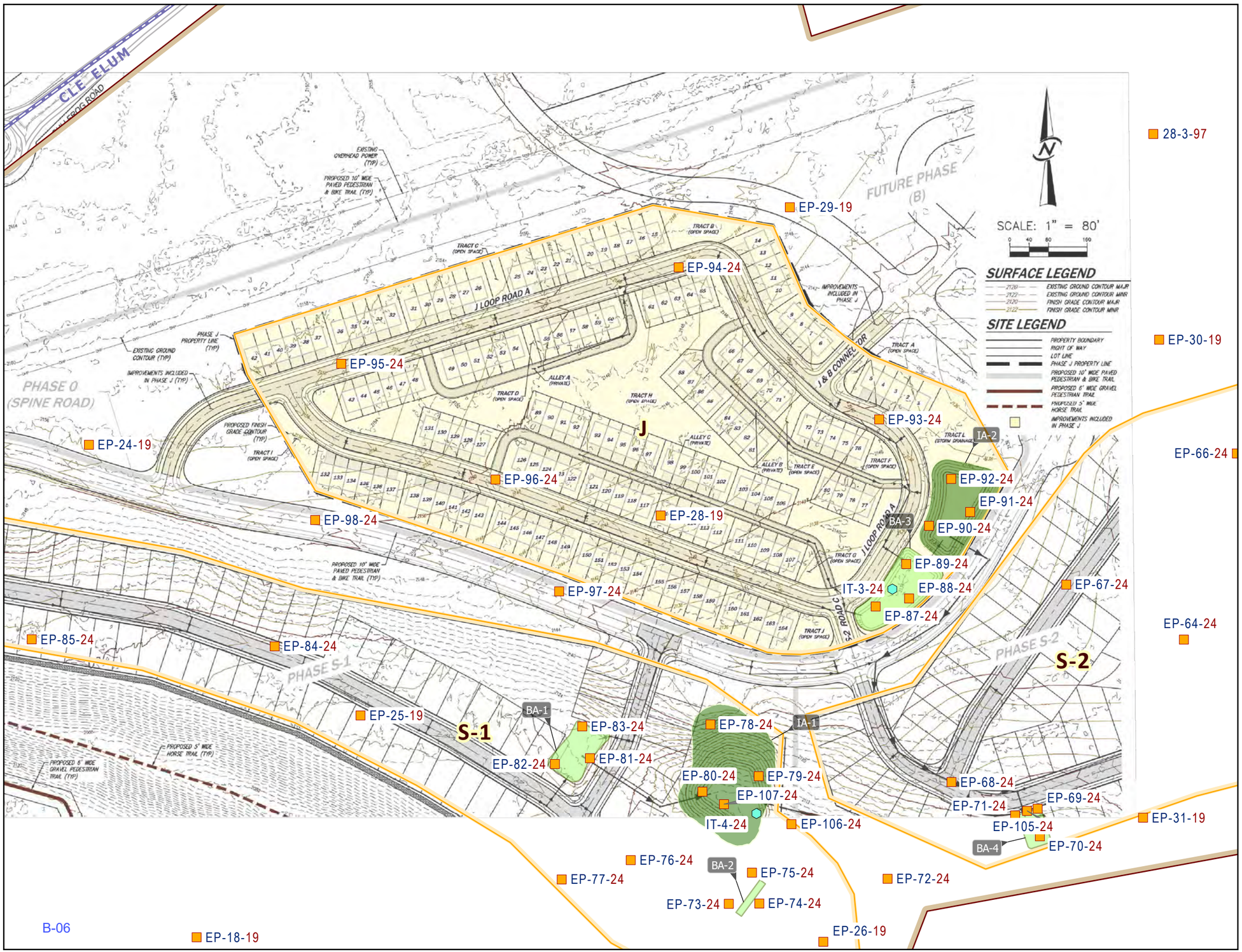
associated earth sciences incorporated

EXISTING SITE AND EXPLORATIONS

BULLFROG FLATS
CLE ELUM, WASHINGTON

PROJECT NO.	DATE	FIGURE
20240155E001	10/24	2

G:\GIS_Projects\2024\240155 47 Degrees North_aprx\GT102\240155E001 F2 ES_BF.aprx | 20240155E001 F2 ES_BF | 2024-10-31 | mtrop



SITE
BULLFROG FLATS PHASE BOUNDARY
EXPLORATION TYPE - YEAR:
EXPLORATION PIT
INFILTRATION TEST
INFILTRATION TYPE:
BIORETENTION AREA
INFILTRATION AREA
CITY BOUNDARY

N
0 200
FEET

DATA SOURCES/REFERENCES:
KITTITAS COUNTY: ROADS, PARCELS, AND CITY BOUNDARY (8/24).
CORE ENGINEERING: GRADING PLAN SITES J, S-1, S-2 C03.00, SHEET 9,108/13/24.WA DNR LIDAR: YAKIMA 2014, METADATA UNKNOWN, 3' CELL SIZE. CONTOURS DERIVED FROM LIDAR.

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

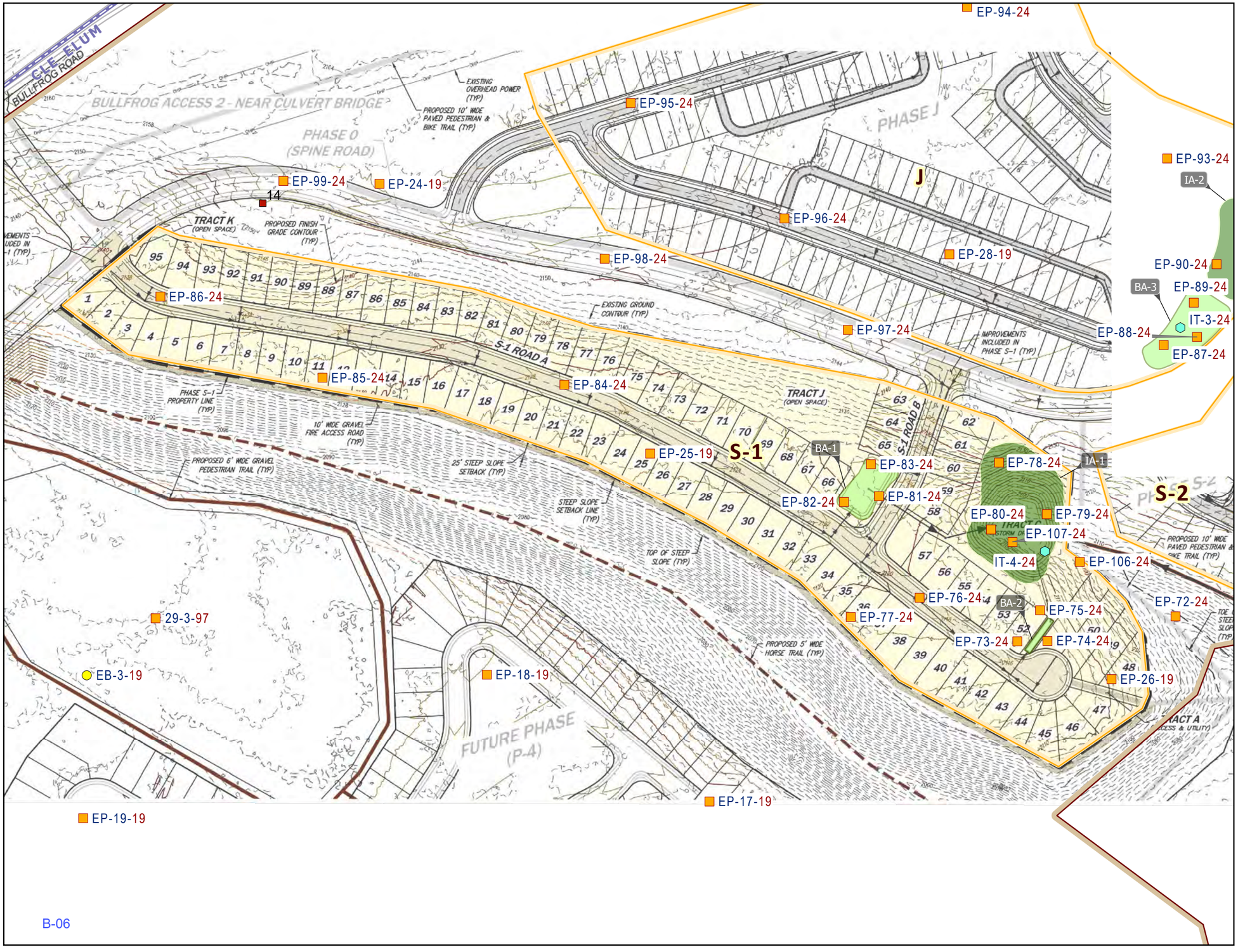
associated earth sciences incorporated

GRADING PLAN
PHASE J

BULLFROG FLATS
CLE ELUM, WASHINGTON

PROJECT NO.	DATE	FIGURE
20240155E001	10/24	3

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SITE

BULLFROG FLATS PHASE BOUNDARY

EXPLORATION TYPE - YEAR:

- EXPLORATION BORING
- EXPLORATION PIT
- INFILTRATION TEST
- EXPLORAION PIT (AGI, 1999)

INFILTRATION TYPE:

- BIORETENTION AREA
- INFILTRATION AREA
- CITY BOUNDARY

N

0 200

FEET

DATA SOURCES/REFERENCES:
KITTITAS COUNTY: ROADS, PARCELS, AND CITY BOUNDARY (8/24).
CORE ENGINEERING: GRADING PLAN SITES J, S-1, S-2 C03.00, SHEET 9,108/13/24.WA DNR LIDAR: YAKIMA 2014, METADATA UNKNOWN, 3' CELL SIZE. CONTOURS DERIVED FROM LIDAR.

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

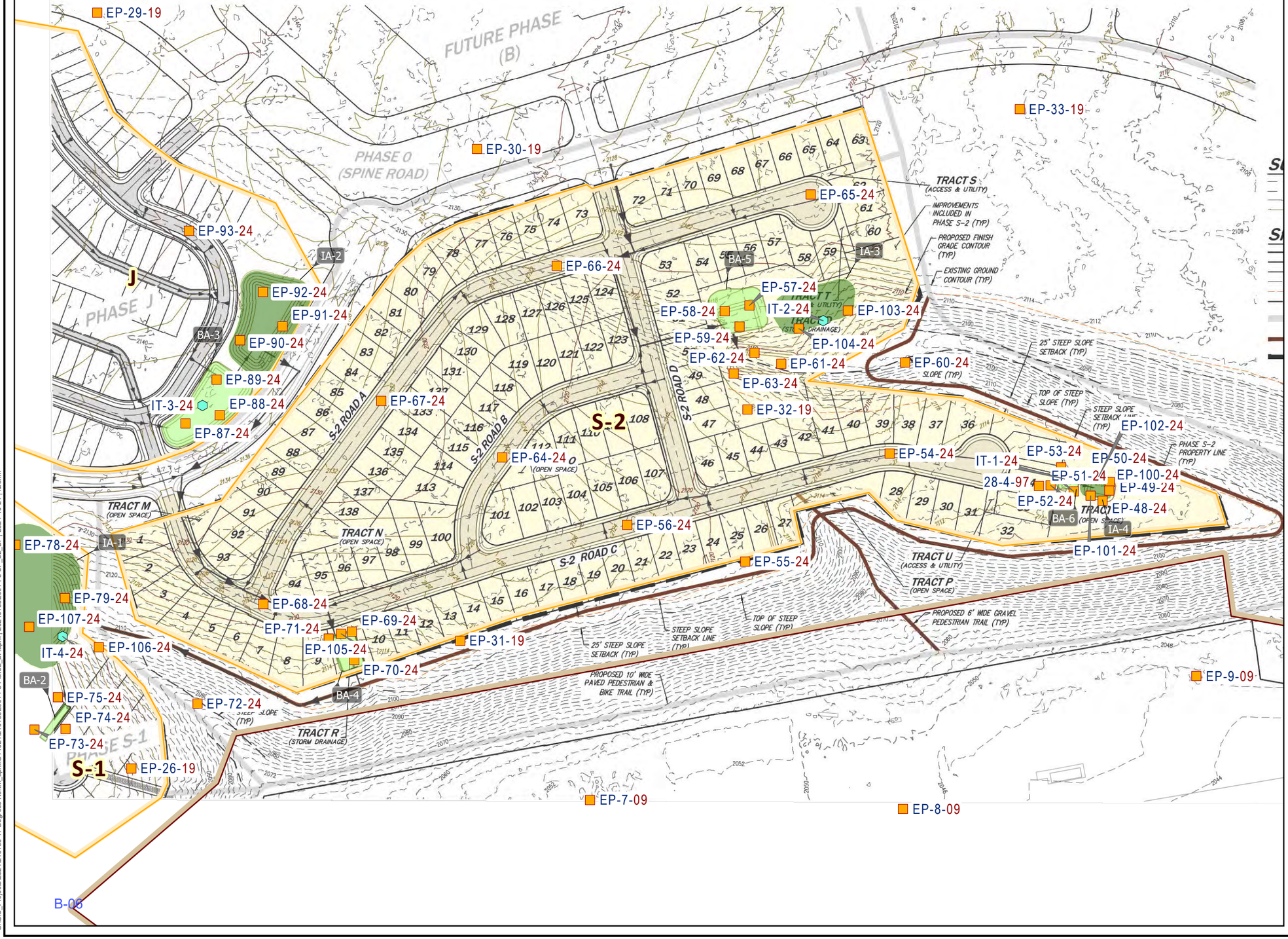
associated earth sciences incorporated

GRADING PLAN
PHASE S-1

BULLFROG FLATS
CLE ELUM, WASHINGTON

PROJECT NO.	DATE	FIGURE
20240155E001	10/24	4

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SITE

BULLFROG FLATS PHASE BOUNDARY

EXPLORATION TYPE - YEAR:

EXPLORATION PIT

INFILTRATION TEST

INFILTRATION TYPE:

BIORETENTION AREA

INFILTRATION AREA

CITY BOUNDARY

N

0 200

FEET

DATA SOURCES/REFERENCES:
KITTITAS COUNTY: ROADS, PARCELS, AND CITY BOUNDARY (8/24).
CORE ENGINEERING: GRADING PLAN SITES J, S-1, S-2 C03.00, SHEET 9,108/13/24.WA DNR LIDAR: YAKIMA 2014, METADATA UNKNOWN, 3' CELL SIZE. CONTOURS DERIVED FROM LIDAR.

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

associated earth sciences incorporated

GRADING PLAN
PHASE S-2

BULLFROG FLATS
CLE ELUM, WASHINGTON

PROJECT NO.	DATE	FIGURE
20240155E001	10/24	5

G:\GIS_Projects\2024\240155 47 Degrees North_aprx\GT1024\240155E001 F5 PlatS2_BF.aprx | 20240155E001 F5 SP_S2_BF | 2024-10-24 | kbehrn

APPENDIX A

Exploration Logs (AESI, 2024)

Coarse-Grained Soils - More than 50%[1] Retained on No. 200 Sieve	Gravels - More than 50%[1] of Coarse Fraction Retained on No. 4 Sieve	≤5% Fines[2]	GW	Well-graded gravel and gravel with sand, little to no fines
			GP	Poorly-graded gravel and gravel with sand, little to no fines
		≥12% Fines[2]	GM	Silty gravel and silty gravel with sand
			GC	Clayey gravel and clayey gravel with sand
	Sands - 50%[1] or More of Coarse Fraction Passes No. 4 Sieve	≤5% Fines[2]	SW	Well-graded sand and sand with gravel, little to no fines
			SP	Poorly-graded sand and sand with gravel, little to no fines
		≥12% Fines[2]	SM	Silty sand and silty sand with gravel
			SC	Clayey sand and clayey sand with gravel
Fine-Grained Soils - 50%[1] or More Passes No. 200 Sieve	Silts and Clays Liquid Limit Less than 50		ML	Silt, sandy silt, gravelly silt, silt with sand or gravel
			CL	Clay of low to medium plasticity; silty, sandy, or gravelly clay, lean clay
			OL	Organic clay or silt of low plasticity
	Silts and Clays Liquid Limit 50 or More		MH	Elastic silt, clayey silt, silt with micaceous or diatomaceous fine sand or silt
			CH	Clay of high plasticity, sandy or gravelly clay, fat clay with sand or gravel
			OH	Organic clay or silt of medium to high plasticity
Highly Organic Soils			PT	Peat, muck and other highly organic soils

Terms Describing Relative Density and Consistency

Coarse-Grained Soils	Density	SPT[3] blows/foot
	Very Loose	0 to 4
	Loose	4 to 10
	Medium Dense	10 to 30
	Dense	30 to 50
	Very Dense	>50

Fine-Grained Soils	Consistency	SPT[3] blows/foot
	Very Soft	0 to 2
	Soft	2 to 4
	Medium Stiff	4 to 8
	Stiff	8 to 15
	Very Stiff	15 to 30
	Hard	>30

Test Symbols

G = Grain Size
M = Moisture Content
A = Atterberg Limits
C = Chemical
DD = Dry Density
K = Permeability

Component Definitions

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

[4] Estimated Percentage

Component	Percentage by Weight
Trace	<5
Some	5 to <12
Modifier (silty, sandy, gravelly)	12 to <30
Very *modifier* (silty, sandy, gravelly)	30 to <50

Moisture Content

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

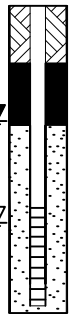
Symbols

Sampler Type and Description

- Blows/6" or portion of 6"
- Split-Spoon Sampler (SPT)
- California Sampler
- Ring Sampler
- Continuous Sampling
- Grab Sample
- Portion not recovered

Groundwater depth

- ATD At time of drilling
- Static water level (date)



- Cement grout surface seal
- Bentonite seal
- Filter pack with blank casing section
- Screened casing or Hydrotip with filter pack
- End cap

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

(1) Percentage by dry weight
(2) Combined USCS symbols used for fines between 5% and 12%
(3) (SPT) Standard Penetration Test (ASTM D-1586)
(4) In General Accordance with Standard Practice for Description and Identification of Soils (ASTM D-2488)

B-08

associated earth sciences incorporated

EXPLORATION LOG KEY

FIGURE: A1

Blocks\ dwg \ log_key 2022.dwg LAYOUT: Layout 5 - 2022 Logdraft

associated earth sciences incorporated

Exploration Pit EP-48

Bullfrog Flats Sheet: 1 of 1

Cle Elum, WA	Date: 8-12-24	Logged By: PL
20240155E001	Total Depth (ft): 13	Approved By: JHS

Depth (ft)	Description	USCS
	Elev.: ≈2110 ft NAVD88	
0	**Grass and Topsoil - 2 inches**	
	Loess Medium stiff, moist, light brown, SILT; massive; small roots (ML).	
2.5	Silt and gravel contact dips to the north approximately.	
	Outwash Medium dense, moist, light brown, very sandy, fine to coarse GRAVEL, trace silt; stratified (GP).	
5		
7.5		
10		
12.5	Medium dense, moist, brown, sandy, fine to coarse GRAVEL, trace silt; stratified (GW).	
	No seepage. Moderate caving 4 to 13 feet.	
15		
17.5		
20		

B-06

10/24/2024

20240155E001

associated earth sciences incorporated

Exploration Pit EP-49

Bullfrog Flats Sheet: 1 of 1

Cle Elum, WA	Date: 8-12-24	Logged By: PL
20240155E001	Total Depth (ft): 15	Approved By: JHS

Depth (ft)	Description Elev.: ≈2110 ft NAVD88	USCS
0	**Grass and Topsoil - 2 inches**	
	Loess Medium stiff, moist, brown, SILT (ML).	
2.5		
	Outwash Medium dense, slightly moist, light brown, very sandy, fine to coarse GRAVEL, trace silt; stratified; abundant cobbles and boulders (GW).	
5		
7.5		
10	Medium dense, moist to very moist, brown, very sandy, fine to coarse GRAVEL, trace silt; stratified (GW).	
12.5		
15	No seepage. Moderate caving 3 to 15 feet.	
17.5		
20	B-06	

10/24/2024

20240155E001

associated earth sciences incorporated

Exploration Pit EP-50

Bullfrog Flats Sheet: 1 of 1

Cle Elum, WA	Date: 8-12-24	Logged By: PL
20240155E001	Total Depth (ft): 15	Approved By: JHS

Depth (ft)	Description	USCS
0	Elev.: ≈2112 ft NAVD88	
	Grass and Topsoil - 2 inches	
	Loess	
	Loose to medium stiff, moist, brown, SILT (ML).	
2.5		
	Outwash	
	Medium dense, moist, brown, sandy, fine to coarse GRAVEL, some silt; stratified; abundant cobbles and boulders (GW-GM).	
5	Medium dense, moist, brown, very sandy, fine to coarse GRAVEL, trace silt; stratified; abundant cobbles and boulders (GW).	
7.5		
10		
12.5	Medium dense, moist to very moist, brown, fine to coarse GRAVEL, some sand, trace silt; stratified; increase in coarse sand; silty coating on gravel (GW).	
15	No seepage. Slight caving 0 to 15 feet.	
17.5		
20	B-06	

10/24/2024

20240155E001

associated earth sciences incorporated

Exploration Pit EP-51

Bullfrog Flats Sheet: 1 of 1

Cle Elum, WA	Date: 8-12-24	Logged By: PL
20240155E001	Total Depth (ft): 12	Approved By: JHS

Depth (ft)	Description	USCS
	Elev.: ≈2111 ft NAVD88	
0	**Grass and Topsoil - 2 inches**	
	Loess	
	Loose, slightly moist, brown, SILT (ML).	
2.5	**Outwash**	
	Medium dense, slightly moist, light brown, gravelly, silty, fine SAND; faintly stratified; scattered cobbles (SM).	
	Medium dense, moist, brown, sandy, fine to coarse GRAVEL, some silt; stratified; abundant cobbles and boulders; fine roots (GW-GM).	
5		
7.5		
10	Increase in coarse sand.	
12.5	No seepage. Slight caving 0 to 12 feet.	
15		
17.5		
20		

B-06

10/24/2024

20240155E001

associated earth sciences incorporated

Exploration Pit EP-52

Bullfrog Flats Sheet: 1 of 1

Cle Elum, WA	Date: 8-12-24	Logged By: PL
20240155E001	Total Depth (ft): 12	Approved By: JHS

Depth (ft)	Description	USCS
	Elev.: ≈2112 ft NAVD88	
0	**Grass and Topsoil - 2 inches**	
	Loess	
	Loose, moist, brown and light brown, SILT (ML).	
2.5	**Outwash**	
	Medium dense, moist, brown and light brown, very gravelly, silty, fine SAND; faintly stratified; abundant cobbles (SM).	
5	Medium dense, moist, brown, sandy, fine to coarse GRAVEL, trace silt; abundant cobbles; fine roots (GW).	
7.5		
10	Less roots.	
12.5	No seepage. Minor caving 0 to 12 feet.	
15		
17.5		
20		

B-06

10/24/2024

20240155E001

associated earth sciences incorporated

Exploration Pit EP-53

Bullfrog Flats Sheet: 1 of 1

Cle Elum, WA	Date: 8-12-24	Logged By: PL
20240155E001	Total Depth (ft): 14	Approved By: JHS

Depth (ft)	Description	USCS
	Elev.: ≈2112 ft NAVD88	
0	**Grass and Topsoil - 2 inches**	
	Loess	
	Soft, moist, brown and light brown, SILT (ML).	
2.5	**Outwash**	
	Medium dense, moist, light brown, sandy, silty, fine to coarse GRAVEL; faintly stratified; abundant cobbles (GM).	
5	Medium dense, moist, brown, sandy, fine to coarse GRAVEL, trace silt; abundant cobbles; fine roots (GW).	
7.5		
10	Medium dense, moist to very moist, brown, very sandy, fine to coarse GRAVEL, trace silt; scattered cobbles (GW).	
12.5		
	No seepage. Minor caving 0 to 14 feet.	
15		
17.5		
20		

B-06

10/24/2024

20240155E001

associated earth sciences incorporated

Exploration Pit EP-54

Bullfrog Flats Sheet: 1 of 1

Cle Elum, WA	Date: 8-12-24	Logged By: PL
20240155E001	Total Depth (ft): 14	Approved By: JHS

Depth (ft)	Description	USCS
	Elev.: ≈2117 ft NAVD88	
0	**Grass and Topsoil - 2 inches**	
	Loess Soft to medium stiff, moist, orangish brown, SILT (ML).	
2.5	**Outwash** Medium dense, moist, brown, sandy, fine to coarse GRAVEL, some silt; faintly stratified; abundant cobbles; fine roots (GW-GM).	
	Medium dense, moist, brown, sandy, fine to coarse GRAVEL, trace silt; stratified; abundant cobbles (GW).	
5		
7.5	Fewer roots.	
10	Medium dense, moist, brown to grayish brown, very sandy, fine to coarse GRAVEL, trace silt; stratified; scattered cobbles (GW).	
12.5		
	No seepage. Slight to moderate caving 4 to 14 feet.	
15		
17.5		
20	B-06	

10/24/2024

20240155E001

associated earth sciences incorporated

Exploration Pit EP-55

Bullfrog Flats Sheet: 1 of 1

Cle Elum, WA	Date: 8-12-24	Logged By: PL
20240155E001	Total Depth (ft): 15	Approved By: JHS

Depth (ft)	Description Elev.: ≈2118 ft NAVD88	USCS
0	**Grass and Topsoil - 2 inches**	
	Loess	
	Soft to medium stiff, slightly moist, light brown, SILT (ML).	
	Outwash	
2.5	Medium dense, moist, light brown, silty, sandy, fine to coarse GRAVEL; faintly stratified; abundant cobbles; fine roots (GM).	
5	Medium dense, moist, brown, sandy, fine to coarse GRAVEL, trace silt; stratified; abundant cobbles; fine roots (GW).	
7.5		
10		
12.5	Medium dense, moist, brown, very sandy, fine to coarse GRAVEL, trace silt; stratified (GP).	
15	No seepage. Slight to moderate caving 4 to 14 feet.	
17.5		
20	B-06	

10/24/2024

20240155E001

associated earth sciences incorporated

Exploration Pit EP-56

Bullfrog Flats Sheet: 1 of 1

Cle Elum, WA	Date: 8-12-24	Logged By: PL
20240155E001	Total Depth (ft): 14	Approved By: JHS

Elev.: ≈2124 ft NAVD88

Depth (ft)	Description	USCS
0	**Grass and Topsoil - 2 inches**	
	Loess Soft to medium stiff, slightly moist, light brown, SILT; massive (ML).	
	Outwash Medium dense, slightly moist, light brown, silty, fine to coarse GRAVEL, some sand; faintly stratified; abundant cobbles (GM).	
2.5		
	Fine roots.	
5		
	Medium dense, moist, brown, sandy, fine to coarse GRAVEL, trace silt; faintly stratified; abundant cobbles (GW).	
7.5		
10	Less roots.	
	Medium dense, moist, brown, very sandy, fine to coarse GRAVEL, trace silt; stratified; scattered cobbles (GW).	
12.5		
	No seepage. Minor caving 0 to 14 feet.	
15		
17.5		
20	B-06	

10/24/2024

20240155E001

associated earth sciences incorporated

Exploration Pit EP-57

Bullfrog Flats Sheet: 1 of 1

Cle Elum, WA	Date: 8-12-24	Logged By: PL
20240155E001	Total Depth (ft): 14	Approved By: JHS

Elev.: ≈2117 ft NAVD88

Depth (ft)	Description	USCS
0	**Grass and Topsoil - 2 inches**	
	Loess	
	Soft, slightly moist, light brown, SILT (ML).	
2.5	**Outwash**	
	Medium dense, slightly moist, light brown, very silty, fine to coarse GRAVEL, trace silt; faintly stratified; abundant cobbles; fine roots (GM).	
5	Medium dense, moist, brown, very sandy, fine to coarse GRAVEL, trace silt; faintly stratified; abundant cobbles (GP).	
7.5	Bed (12 inches thick) of medium stiff, moist, brownish gray, sandy, SILT; stratified (ML).	
	Medium dense, moist, grayish brown, very sandy, fine to coarse GRAVEL, trace silt; stratified; scattered cobbles (GW).	
10		
12.5		
	No seepage. Minor caving 0 to 14 feet.	
15		
17.5		
20	B-06	

10/24/2024

20240155E001

associated earth sciences incorporated

Exploration Pit EP-58

Bullfrog Flats Sheet: 1 of 1

Cle Elum, WA	Date: 8-12-24	Logged By: PL
20240155E001	Total Depth (ft): 14	Approved By: JHS

Depth (ft)	Description Elev.: ≈2118 ft NAVD88	USCS
0	**Grass and Topsoil - 2 inches**	
	Loess Medium stiff, slightly moist, light brown, SILT (ML).	
2.5	**Outwash** Medium dense, slightly moist, light brown, very silty, fine to coarse GRAVEL, trace sand; faintly stratified; abundant cobbles and boulders (GM).	
5	Medium dense, moist, brown, very sandy, fine to coarse GRAVEL, trace silt; faintly stratified; abundant cobbles (GW).	
7.5		
10	Medium dense, moist, brown, very sandy, fine to coarse GRAVEL, trace silt; stratified; scattered cobbles (GW).	
12.5	Moist to very moist.	
15	No seepage. Minor caving 0 to 14 feet.	
17.5		
20	B-06	

10/24/2024

20240155E001

associated earth sciences incorporated

Exploration Pit EP-59

Bullfrog Flats Sheet: 1 of 1

Cle Elum, WA	Date: 8-12-24	Logged By: PL
20240155E001	Total Depth (ft): 15	Approved By: JHS

Depth (ft)	Description Elev.: ≈2114 ft NAVD88	USCS
0	**Grass and Topsoil - 2 inches**	
	Outwash Medium dense, slightly moist, light brown, silty, fine to coarse GRAVEL, trace sand; faintly stratified; abundant cobbles (GM).	
2.5	Medium dense, slightly moist, light brown, sandy, fine to coarse GRAVEL, some silt; stratified; abundant cobbles; fine roots (GW-GM).	
5		
	Medium dense, moist, brown, very sandy, fine to coarse GRAVEL, trace silt; stratified; abundant cobbles, rare boulders (GW).	
7.5		
10		
12.5		
15	No seepage. Minor caving 0 to 15 feet.	
17.5		
20	B-06	

10/24/2024

20240155E001

associated earth sciences incorporated

Exploration Pit EP-60

Bullfrog Flats Sheet: 1 of 1

Cle Elum, WA	Date: 8-12-24	Logged By: PL
20240155E001	Total Depth (ft): 14	Approved By: JHS

Depth (ft)	Description	USCS
	Elev.: ≈2099 ft NAVD88	
0	**Grass and Topsoil - 2 inches**	
	Loess	
	Soft, slightly moist, light brown, SILT (ML).	
2.5	**Outwash**	
	Medium dense, slightly moist, light brown, silty, fine to coarse GRAVEL, some sand; stratified; abundant cobbles and boulders (GM).	
5		
7.5	Medium dense, moist, brown, sandy, fine to coarse GRAVEL, trace silt; stratified (GW).	
10	Medium dense, moist, brown, very sandy, fine to coarse GRAVEL, trace silt; stratified (GW).	
12.5	Becomes moist to very moist, slight silt coating on gravels.	
	No seepage. No caving.	
15		
17.5		
20		

B-06

10/24/2024

20240155E001

associated earth sciences incorporated

Exploration Pit EP-61

Bullfrog Flats Sheet: 1 of 1

Cle Elum, WA	Date: 8-12-24	Logged By: PL
20240155E001	Total Depth (ft): 16	Approved By: JHS

Depth (ft)	Description Elev.: ≈2103 ft NAVD88	USCS
0	**Grass and Topsoil - 2 inches**	
	Loess	
	Soft, slightly moist, light brown, SILT (ML).	
	Outwash	
2.5	Medium dense, slightly moist, light brown, silty, fine to coarse GRAVEL, some sand; stratified; abundant cobbles (GM).	
	Medium dense, moist, brown, sandy, fine to coarse GRAVEL, trace silt; stratified; abundant cobbles (GW).	
5		
7.5	Medium dense, moist, brown, silty, sandy, fine to coarse GRAVEL; stratified; thin beds (4 inches thick) of loess at 7 feet (GM).	
	Medium dense, moist, brown, sandy, fine to coarse GRAVEL, trace silt; stratified (GW).	
10		
	Sandy to very sandy.	
12.5		
15		
	No seepage. Minor caving 0 to 16 feet.	
17.5		
20	B-06	

10/24/2024

20240155E001

associated earth sciences incorporated

Exploration Pit EP-62

Bullfrog Flats Sheet: 1 of 1

Cle Elum, WA	Date: 8-12-24	Logged By: PL
20240155E001	Total Depth (ft): 16	Approved By: JHS

Depth (ft)	Description Elev.: ≈2104 ft NAVD88	USCS
0	**Grass and Topsoil - 2 inches**	
	Alluvium/Colluvium Loose, slightly moist, light brown, very gravelly, silty, fine SAND; unsorted (SM).	
2.5		
5	**Outwash** Medium dense, slightly moist, light brown, silty, fine to coarse GRAVEL, some sand; stratified; abundant cobbles (GM).	
7.5	Medium dense, moist, brown, sandy, fine to coarse GRAVEL, trace silt; stratified (GW).	
10	Medium dense, moist, brown, sandy, fine to coarse GRAVEL; stratified, some silt; highly cemented (GW-GM).	
12.5	Medium dense, moist, brown, very sandy, fine to coarse GRAVEL, trace silt; stratified (GW).	
15		
	No seepage. Minor caving 0 to 16 feet.	
17.5		
20	B-06	

10/24/2024

20240155E001

associated earth sciences incorporated

Exploration Pit EP-63

Bullfrog Flats Sheet: 1 of 1

Cle Elum, WA	Date: 8-12-24	Logged By: PL
20240155E001	Total Depth (ft): 16	Approved By: JHS

Depth (ft)	Description	USCS
	Elev.: ≈2117 ft NAVD88	
0	**Grass and Topsoil - 2 inches**	
	Outwash	
	Medium dense, slightly moist, light brown, silty, fine to coarse GRAVEL, some sand; stratified; abundant cobbles, scattered boulders (GM).	
2.5		
	Medium dense, moist, brown, sandy, fine to coarse GRAVEL, trace silt; stratified; abundant cobbles, scattered boulders (GW).	
5		
	Becomes very sandy (GP).	
7.5		
10		
12.5		
	Becomes very moist.	
15		
	No seepage. Slight caving 0 to 14 feet. Moderate caving 14 to 16 feet.	
17.5		
20		

B-06

10/24/2024

20240155E001

associated earth sciences incorporated

Exploration Pit EP-64

Bullfrog Flats Sheet: 1 of 1

Cle Elum, WA	Date: 8-12-24	Logged By: PL
20240155E001	Total Depth (ft): 14	Approved By: JHS

Depth (ft)	Description	USCS
	Elev.: ≈2127 ft NAVD88	
0	**Grass and Topsoil - 6 inches**	
	Outwash Medium dense, slightly moist, light brown, silty, fine to coarse GRAVEL, some sand; stratified; abundant cobbles, scattered boulders (GM).	
2.5		
5	Medium dense, moist, brown, sandy, fine to coarse GRAVEL, trace silt; stratified; abundant cobbles, scattered boulders (GW).	
7.5		
10	Becomes very sandy.	
12.5		
	No seepage. Minor caving 0 to 14 feet.	
15		
17.5		
20	B-06	

10/24/2024

20240155E001

associated earth sciences incorporated

Exploration Pit EP-65

Bullfrog Flats Sheet: 1 of 1

Cle Elum, WA	Date: 8-12-24	Logged By: PL
20240155E001	Total Depth (ft): 15	Approved By: JHS

Depth (ft)	Description Elev.: ≈2122 ft NAVD88	USCS
0	**Grass and Topsoil - 4 inches**	
	Loess Soft, slightly moist, light brown, SILT; fine roots (ML).	
2.5		
5	**Outwash** Medium dense, slightly moist, light brown, silty, fine to coarse GRAVEL, some sand; faintly stratified; abundant cobbles (GM).	
	Medium dense, moist, brown, sandy, fine to coarse GRAVEL, trace silt; stratified; abundant cobbles (GW).	
7.5		
10	Becomes very sandy.	
12.5	Interbedded (approximately 6 inches thick) sand and gravel.	
15	No seepage. Minor caving 0 to 15 feet.	
17.5		
20	B-06	

10/24/2024

20240155E001

associated earth sciences incorporated

Exploration Pit EP-66

Bullfrog Flats Sheet: 1 of 1

Cle Elum, WA	Date: 8-12-24	Logged By: PL
20240155E001	Total Depth (ft): 14	Approved By: JHS

Depth (ft) | Description | USCS

Elev.: ≈2122 ft NAVD88

0

Grass and Topsoil - 4 inches

Loess

Soft, slightly moist, light brown, SILT; unsorted (ML).

Outwash

Medium dense, slightly moist, light brown, silty, fine to coarse GRAVEL, some sand; faintly stratified; abundant cobbles and boulders (GM).

2.5

Medium dense, moist, brown, sandy, fine to coarse SAND, trace to some silt; stratified; abundant cobbles, scattered boulders (GW-GM).

5

7.5

10

Medium dense, moist, grayish brown, very sandy, fine to coarse GRAVEL, trace silt; stratified; abundant cobbles, scattered boulders (GW).

12.5

No seepage. Minor caving 0 to 14 feet.

15

17.5

20

B-06

10/24/2024

20240155E001

associated earth sciences incorporated

Exploration Pit EP-67

Bullfrog Flats Sheet: 1 of 1

Cle Elum, WA	Date: 8-12-24	Logged By: PL
20240155E001	Total Depth (ft): 15	Approved By: JHS

Depth (ft)	Description Elev.: ≈2132 ft NAVD88	USCS
0	**Grass and Topsoil - 6 inches**	
	Loess Soft to medium stiff, slightly moist, light brown, SILT; fine roots (ML).	
2.5		
	Outwash Medium dense, slightly moist, light brown, silty, fine to coarse GRAVEL, some sand; faintly stratified; abundant cobbles, scattered boulders (GM).	
5		
7.5	Medium dense, moist, brown, sandy, fine to coarse GRAVEL, trace to some silt; stratified; abundant cobbles, scattered boulders (GW-GM).	
10		
	Medium dense, moist, grayish brown and brown, very sandy, fine to coarse GRAVEL, trace silt; abundant cobbles, stratified (GW).	
12.5		
15	No seepage. Minor caving 0 to 15 feet.	
17.5		
20		

B-06

10/24/2024

20240155E001

associated earth sciences incorporated

Exploration Pit EP-68

Bullfrog Flats Sheet: 1 of 1

Cle Elum, WA	Date: 8-12-24	Logged By: PL
20240155E001	Total Depth (ft): 15	Approved By: JHS

Depth (ft)	Description Elev.: ≈2119 ft NAVD88	USCS
0	**Grass and Topsoil - 6 inches**	
	Loess Soft, slightly moist, light brown, SILT (ML).	
2.5	**Outwash** Medium dense, slightly moist, brown, silty, fine to coarse GRAVEL, some sand; faintly stratified; abundant cobbles, scattered boulders (GM).	
5		
7.5		
10	Medium dense, moist, brown, sandy, fine to coarse GRAVEL, some silt; abundant cobbles, scattered boulders (GW-GM).	
12.5	Medium dense, moist, brown, sandy, fine to coarse GRAVEL, trace silt; abundant cobbles, scattered boulders (GW).	
15	No seepage. Minor caving 0 to 15 feet.	
17.5		
20	B-06	

10/24/2024

20240155E001

associated earth sciences incorporated

Exploration Pit EP-69

Bullfrog Flats Sheet: 1 of 1

Cle Elum, WA	Date: 8-12-24	Logged By: PL
20240155E001	Total Depth (ft): 13	Approved By: JHS

Depth (ft)	Description Elev.: ≈2117 ft NAVD88	USCS
0	**Grass and Topsoil - 4 inches**	
	Loess Soft, slightly moist, light brown, SILT; fine roots (ML).	
2.5		
	Outwash Medium dense, slightly moist, light brown, very sandy, fine to coarse GRAVEL, some silt; faintly stratified; abundant cobbles, scattered boulders (GW-GM).	
5		
7.5		
10		
	Medium dense, moist, grayish brown, sandy, fine to coarse GRAVEL, trace silt; stratified (GW).	
12.5		
	No seepage. Minor caving 0 to 13 feet.	
15		
17.5		
20		

B-06

10/24/2024

20240155E001

associated earth sciences incorporated

Exploration Pit EP-70

Bullfrog Flats Sheet: 1 of 1

Cle Elum, WA	Date: 8-12-24	Logged By: PL
20240155E001	Total Depth (ft): 13	Approved By: JHS

Depth (ft)	Description Elev.: ≈2113 ft NAVD88	USCS
0	**Grass and Topsoil - 4 inches**	
	Loess Soft, slightly moist, light brown, SILT (ML).	
2.5	**Outwash** Medium dense, slightly moist, light brown, silty, fine to coarse GRAVEL, some sand; faintly stratified; abundant cobbles, scattered boulders (GM).	
5		
7.5	Medium dense, moist, brown, sandy, fine to coarse GRAVEL, some silt; stratified; abundant cobbles, scattered boulders (GW-GM).	
10	Medium dense, moist, brown and grayish brown, sandy, fine to coarse GRAVEL, trace silt; stratified; abundant cobbles, scattered boulders (GW).	
12.5	No seepage. Minor caving 0 to 13 feet.	
15		
17.5		
20	B-06	

10/24/2024

20240155E001

associated earth sciences incorporated

Exploration Pit EP-71

Bullfrog Flats Sheet: 1 of 1

Cle Elum, WA	Date: 8-12-24	Logged By: PL
20240155E001	Total Depth (ft): 14	Approved By: JHS

Depth (ft)	Description	USCS
	Elev.: ≈2115 ft NAVD88	
0	**Grass and Topsoil - 6 inches**	
	Loess Soft, slightly moist, light brown, SILT; fine roots (ML).	
2.5		
	Outwash Medium dense, slightly moist, light brown, gravelly, silty, fine SAND; faintly stratified; scattered cobbles (SM).	
	Medium dense, slightly moist, light brown, silty, fine to coarse GRAVEL, some sand; faintly stratified; abundant cobbles, scattered boulders (GM).	
5		
	Medium dense, moist, brown, sandy, fine to coarse GRAVEL, some silt; stratified; abundant cobbles, scattered boulders (GW-GM).	
7.5		
10	Medium dense, moist, brown and grayish brown, sandy, fine to coarse GRAVEL, trace silt; stratified; abundant cobbles (GW).	
	Medium dense, moist, grayish brown, fine to coarse GRAVEL, some silt, some sand; stratified; silt coating on gravel (GW-GM).	
12.5		
	No seepage. Minor caving 0 to 12 feet.	
15		
17.5		
20		
	B-06	

10/24/2024

20240155E001

associated earth sciences incorporated

Exploration Pit EP-72

Bullfrog Flats Sheet: 1 of 1

Cle Elum, WA	Date: 8-12-24	Logged By: PL
20240155E001	Total Depth (ft): 14	Approved By: JHS

Depth (ft)	Description	USCS
	Elev.: ≈2085 ft NAVD88	
0	**Grass and Topsoil - 2 inches**	
	Alluvium/Colluvium Soft, slightly moist, orangish brown and light brown, very gravelly, sandy, SILT; unsorted; scattered cobbles (ML).	
2.5		
	Outwash Medium dense, slightly moist, light brown, very silty, sandy, fine to coarse GRAVEL, some sand; faintly stratified; abundant cobbles (GM).	
5		
7.5	Medium dense, moist, brown, sandy, fine to coarse GRAVEL, some silt; stratified; abundant cobbles, scattered boulders (GW-GM).	
10	Becomes trace silt, slight silt coating on gravel (GW).	
12.5		
	No seepage. Minor caving 0 to 14 feet.	
15		
17.5		
20	B-06	

10/24/2024

20240155E001

associated earth sciences incorporated

Exploration Pit EP-73

Bullfrog Flats Sheet: 1 of 1

Cle Elum, WA	Date: 8-12-24	Logged By: PL
20240155E001	Total Depth (ft): 12	Approved By: JHS

Depth (ft)	Description Elev.: ≈2115 ft NAVD88	USCS
0	**Grass and Topsoil - 4 inches**	
	Loess Soft, slightly moist, light brown, SILT; fine roots (ML).	
2.5		
	Outwash Medium dense, slightly moist, light brown, very sandy, silty, fine to coarse GRAVEL; stratified; abundant cobbles and boulders (GM).	
5		
	Medium dense, moist, brown, sandy, fine to coarse GRAVEL, trace silt; stratified; abundant cobbles, scattered boulders (GW).	
7.5		
10		
12.5	No seepage. Minor caving 6 to 12 feet.	
15		
17.5		
20		

B-06

10/24/2024

20240155E001

associated earth sciences incorporated

Exploration Pit EP-74

Bullfrog Flats Sheet: 1 of 1

Cle Elum, WA	Date: 8/12/24	Logged By: PL
20240155E001	Total Depth (ft): 15	Approved By: JHS

Depth (ft)	Description Elev.: ≈2115 ft NAVD88	USCS
0	**Grass and Topsoil - 3 inches**	
	Loess Soft, slightly moist, light brown, SILT (ML).	
2.5	**Outwash** Medium dense, slightly moist, light brown, very silty, fine to coarse GRAVEL, trace sand; faintly stratified (GM).	
	Medium dense, moist, brown, sandy, fine to coarse GRAVEL, trace to some silt; stratified; abundant cobbles; scattered boulders (GW-GM).	
5		
7.5		
	Medium dense, moist, brown, very sandy, fine to coarse GRAVEL, trace silt; stratified (GP).	
10		
12.5	Medium dense, very moist, grayish brown, silty, sandy, fine to coarse GRAVEL; stratified; silt coating on coarse sand and gravel (GM).	
15	No seepage. Minor caving 9 to 15 feet.	
17.5		
20	B-06	

10/24/2024

20240155E001

associated earth sciences incorporated

Exploration Pit EP-75

Bullfrog Flats Sheet: 1 of 1

Cle Elum, WA	Date: 8/12/24	Logged By: PL
20240155E001	Total Depth (ft): 14	Approved By: JHS

Depth (ft)	Description	USCS
	Elev.: ≈2115 ft NAVD88	
0	**Grass and Topsoil - 3 inches**	
	Loess Soft to medium stiff, slightly moist, light brown, SILT (ML).	
2.5		
	Outwash Medium dense, slightly moist, light brown, very sandy, silty, fine to coarse GRAVEL; stratified; abundant cobbles; occasional boulders (GM).	
5		
7.5	Medium dense, moist, grayish brown, sandy, fine to coarse GRAVEL, some silt; stratified; abundant cobbles (GW-GM).	
10	Becomes trace silt (GW).	
	Becomes some silt; silt coating on gravel (GW-GM).	
12.5		
	No seepage. Minor caving 0 to 8 feet, moderate caving 8 to 14 feet.	
15		
17.5		
20	B-06	

10/24/2024

20240155E001

associated earth sciences incorporated

Exploration Pit EP-76

Bullfrog Flats Sheet: 1 of 1

Cle Elum, WA	Date: 8/12/24	Logged By: PL
20240155E001	Total Depth (ft): 15	Approved By: JHS

Depth (ft)	Description Elev.: ≈2118 ft NAVD88	USCS
0	**Grass and Topsoil - 3 inches**	
	Loess Soft to medium stiff, slightly moist, light brown, SILT (ML).	
2.5		
	Outwash Medium dense, slightly moist, light brown, silty, fine to coarse GRAVEL, some sand; stratified; abundant cobbles (GM).	
5		
	Medium dense, moist, brown, sandy, fine to coarse GRAVEL, some silt; stratified; abundant cobbles and boulders (GW-GM).	
7.5		
10	Becomes trace silt (GW).	
12.5	Becomes silty; silt coating on sand and gravel (GM).	
15	No seepage. Minor caving 0 to 13 feet.	
17.5		
20	B-06	

10/24/2024

20240155E001

associated earth sciences incorporated

Exploration Pit EP-77

Bullfrog Flats Sheet: 1 of 1

Cle Elum, WA	Date: 8/12/24	Logged By: PL
20240155E001	Total Depth (ft): 14	Approved By: JHS

Depth (ft)	Description Elev.: ≈2118 ft NAVD88	USCS
0	**Grass and Topsoil - 6 inches**	
	Loess Soft, slightly moist, light brown, SILT (ML).	
2.5		
5	**Outwash** Medium dense, slightly moist, light brown, silty to very silty, fine to coarse GRAVEL, some sand; faintly stratified; abundant cobbles; occasional boulders (GM).	
7.5	Becomes brown, sandy, some silt (GW-GM).	
10	Becomes moist, trace silt (GW).	
12.5	Thin beds of very moist, sand, some silt.	
15	No seepage. Minor caving 0 to 14 feet.	
17.5		
20	B-06	

10/24/2024

20240155E001

associated earth sciences incorporated

Exploration Pit EP-78

Bullfrog Flats Sheet: 1 of 1

Cle Elum, WA	Date: 8/12/24	Logged By: PL
20240155E001	Total Depth (ft): 20	Approved By: JHS

Elev.: ≈2129 ft NAVD88

Depth (ft)	Description	USCS
0	**Grass and Topsoil - 3 inches**	
	Outwash	
	Medium dense, slightly moist, light brown, silty, fine to coarse GRAVEL, some sand; stratified; abundant cobbles (GM).	
2.5	Becomes moist, brown, sandy; trace silt; abundant cobbles; occasional boulders; stratified (GW).	
5		
7.5	Becomes grayish brown and brown.	
10		
12.5	Becomes very moist, grayish brown, very sandy; silty coating on sand and gravel; stratified (GW-GM).	
15		
17.5	Becomes silty (GM).	
	Medium dense to dense, very moist, grayish brown, very gravelly, silty, coarse SAND; silt and clay matrix (SM).	
20	No seepage. Moderate caving 8 to 19 feet.	
	B-06	

10/24/2024

20240155E001

associated earth sciences incorporated

Exploration Pit EP-79

Bullfrog Flats Sheet: 1 of 1

Cle Elum, WA	Date: 8/12/24	Logged By: PL
20240155E001	Total Depth (ft): 20	Approved By: JHS

Depth (ft)	Description Elev.: ≈2112 ft NAVD88	USCS
0	**Grass and Topsoil - 3 inches**	
	Loess	
	Soft, slightly moist, light brown, SILT (ML).	
	Outwash	
2.5	Medium dense, slightly moist, light brown, silty, fine to coarse GRAVEL, some sand; stratified; abundant cobbles; scattered boulders (GM).	
	Becomes brown, sandy; some silt (GW-GM).	
5		
7.5	Becomes moist.	
10		
12.5	Becomes very moist, silty; sand is mostly coarse (GM).	
15	Thin beds of silty, clayey, fine to coarse GRAVEL.	
17.5		
20	No seepage. Minor caving 0 to 20 feet.	

B-06

10/24/2024

20240155E001

associated earth sciences incorporated

Exploration Pit EP-80

Bullfrog Flats Sheet: 1 of 1

Cle Elum, WA	Date: 8/12/24	Logged By: PL
20240155E001	Total Depth (ft): 20	Approved By: JHS

Depth (ft)	Description Elev.: ≈2110 ft NAVD88	USCS
0	**Grass and Topsoil - 6 inches**	
	Loess Soft, slightly moist, light brown, SILT (ML).	
2.5	**Outwash** Medium dense, slightly moist, light brown, silty, fine to coarse GRAVEL, some sand; faintly stratified; abundant cobbles; scattered boulders (GM).	
	Beds of fine to coarse sand.	
5		
7.5	Medium dense, moist, brown, sandy, fine to coarse GRAVEL, trace silt; stratified; abundant cobbles (GW).	
10		
12.5	Becomes very moist, some silt; sand is mostly coarse (GW-GM).	
15		
17.5	Becomes grayish brown, silty (GM).	
20	No seepage. Minor caving 0 to 20 feet.	

B-06

10/24/2024

20240155E001

associated earth sciences incorporated

Exploration Pit EP-81

Bullfrog Flats Sheet: 1 of 1

Cle Elum, WA	Date: 8/12/24	Logged By: PL
20240155E001	Total Depth (ft): 11	Approved By: JHS

Depth (ft)	Description Elev.: ≈2117 ft NAVD88	USCS
0	**Grass and Topsoil - 4 inches**	
	Loess Soft, slightly moist, light brown, SILT (ML).	
2.5	**Outwash** Medium dense, slightly moist, light brown, very sandy, silty, fine to coarse GRAVEL; faintly stratified; abundant cobbles; scattered boulders (GM).	
5		
	Becomes moist, brown, sandy, some silt (GW-GM).	
7.5		
	Becomes moist to very moist; increase in silt; some silt to silty (GW-GM).	
10		
	No seepage. Minor caving.	
12.5		
15		
17.5		
20		

B-06

10/24/2024

20240155E001

associated earth sciences incorporated

Exploration Pit EP-82

Bullfrog Flats Sheet: 1 of 1

Cle Elum, WA	Date: 8/12/24	Logged By: PL
20240155E001	Total Depth (ft): 11	Approved By: JHS

Depth (ft) | Description | USCS

Elev.: ≈2120 ft NAVD88

0

Grass and Topsoil - 3 inches

Loess

Soft, slightly moist, light brown, SILT (ML).

Outwash

Medium dense, slightly moist, light brown, very silty, fine to coarse GRAVEL, some sand; faintly stratified; abundant cobbles; fine roots (GM).

2.5

5

Becomes moist, brown, very gravelly, SAND, some silt (SP-SM).

7.5

Becomes sandy, fine to coarse GRAVEL, some silt (GW-GM).

10

No seepage. Minor caving 0 to 11 feet.

12.5

15

17.5

20

B-06

10/24/2024

20240155E001

associated earth sciences incorporated

Exploration Pit EP-83

Bullfrog Flats Sheet: 1 of 1

Cle Elum, WA	Date: 8/12/24	Logged By: PL
20240155E001	Total Depth (ft): 11	Approved By: JHS

Depth (ft)	Description	USCS
	Elev.: ≈2117 ft NAVD88	
0	**Grass and Topsoil - 6 inches**	
	Outwash Medium dense, slightly moist, light brown, silty, fine to coarse GRAVEL, some sand; stratified (GM).	
2.5	Becomes very sandy, some silt; abundant cobbles (GW-GM).	
5	Becomes moist, brown, trace silt (GW).	
	Thin beds (4 to 6 inches thick) of fine to coarse sand.	
7.5	Slight increase in moisture; moist to very moist.	
	Increase in cobbles.	
10		
	No seepage. Minor caving 0 to 11 feet.	
12.5		
15		
17.5		
20	B-06	

10/24/2024

20240155E001

associated earth sciences incorporated

Exploration Pit EP-84

Bullfrog Flats Sheet: 1 of 1

Cle Elum, WA	Date: 8/12/24	Logged By: PL
20240155E001	Total Depth (ft): 12	Approved By: JHS

Depth (ft)	Description Elev.: ≈2126 ft NAVD88	USCS
0	**Grass and Topsoil - 6 inches**	
	Loess Soft, slightly moist, light brown, SILT (ML).	
2.5	**Outwash** Medium dense, slightly moist, light brown, silty, fine to coarse GRAVEL, some sand to sandy; stratified; abundant cobbles (GM).	
5	Medium dense, moist, brown, sandy, fine to coarse GRAVEL, some to trace silt; abundant cobbles; stratified (GW-GM).	
	Medium dense, moist, light brown, very fine SAND, some silt and silty, very fine SAND; interbedded; stratified (SP-SM/SM).	
7.5	**Loess** Medium dense to dense, moist, light brown, sandy, SILT, some gravel; unsorted to faintly stratified; cemented (ML).	
	Outwash Medium dense to dense, moist, brown, fine to coarse SAND, some gravel; cemented (SP-SM).	
10	Medium dense, moist, brown, sandy, fine to coarse GRAVEL, trace silt; stratified (GW).	
12.5	No seepage. Minor caving 0 to 12.	
15		
17.5		
20		

B-06

10/24/2024

20240155E001

associated earth sciences incorporated

Exploration Pit EP-85

Bullfrog Flats Sheet: 1 of 1

Cle Elum, WA	Date: 8/12/24	Logged By: PL
20240155E001	Total Depth (ft): 14	Approved By: JHS

Depth (ft)	Description Elev.: ≈2132 ft NAVD88	USCS
0	**Grass and Topsoil - 3 inches**	
	Loess Soft, slightly moist, light brown, SILT (ML).	
2.5		
	Outwash Medium dense, slightly moist, light brown, silty, fine to coarse GRAVEL, some sand; stratified (GM).	
5	Becomes brown, sandy, some silt; abundant cobbles (GW-GM).	
7.5	Becomes grayish brown, some silt to silty; silt coating on gravel (GW-GM).	
10	Medium dense, moist to very moist, brown and grayish brown, fine SAND, some silt; stratified (SP-SM).	
12.5		
	No seepage. Minor caving 0 to 14 feet.	
15		
17.5		
20	B-06	

10/24/2024

20240155E001

associated earth sciences incorporated

Exploration Pit EP-86

Bullfrog Flats Sheet: 1 of 1

Cle Elum, WA	Date: 8/12/24	Logged By: PL
20240155E001	Total Depth (ft): 14	Approved By: JHS

Depth (ft)	Description	USCS
	Elev.: ≈2134 ft NAVD88	
0	**Grass and Topsoil - 3 inches**	
	Loess	
	Soft, slightly moist, light brown, SILT (ML).	
2.5	Trace gravel.	
5		
	Outwash	
	Medium dense, slightly moist, light brown, very silty, fine to coarse GRAVEL, some sand; faintly stratified (GM).	
7.5	Medium dense, slightly moist, grayish brown, sandy, fine to coarse GRAVEL, trace silt; stratified (GW).	
10	Becomes moist, very sandy.	
12.5		
	No seepage. Slight caving 0 to 8 feet, moderate caving 8 to 14 feet.	
15		
17.5		
20	B-06	

10/24/2024

20240155E001

associated earth sciences incorporated

Exploration Pit EP-87

Bullfrog Flats Sheet: 1 of 1

Cle Elum, WA	Date: 8/12/24	Logged By: PL
20240155E001	Total Depth (ft): 14	Approved By: JHS

Depth (ft)	Description	USCS
0	Elev.: ≈2137 ft NAVD88 **Grass and Topsoil - 6 inches**	
	Outwash Medium dense, slightly moist, light brown, silty, fine to coarse GRAVEL, some sand; faintly stratified; abundant cobbles; scattered boulders (GM).	
2.5	Medium dense, slightly moist, brown, sandy, fine to coarse GRAVEL, trace silt (GW).	
5		
7.5	Medium dense, moist, brown, very gravelly, medium to coarse SAND, trace silt; interbedded (SP).	
	Becomes very sandy, fine to coarse GRAVEL, trace silt (GW).	
10		
12.5		
15	No seepage. Minor caving 0 to 14 feet.	
17.5		
20	B-06	

10/24/2024

20240155E001

associated earth sciences incorporated

Exploration Pit EP-88

Bullfrog Flats Sheet: 1 of 1

Cle Elum, WA	Date: 8/12/24	Logged By: PL
20240155E001	Total Depth (ft): 14	Approved By: JHS

Depth (ft) | Description | USCS

Elev.: ≈2037 ft NAVD88

0

Grass and Topsoil - 4 inches

Loess

Soft, slightly moist, light brown, SILT (ML).

2.5

Outwash

Medium dense, slightly moist, light brown, very silty, fine to coarse GRAVEL, some sand; faintly stratified; abundant cobbles; scattered boulders (GM).

5

Medium dense, slightly moist, brown, sandy, fine to coarse, GRAVEL, trace silt; stratified; abundant cobbles; occasional boulders (GW).

Medium dense, slightly moist, brown, very gravelly, medium to coarse SAND, trace silt; interbedded (SP).

7.5

10

Becomes moist, very sandy, fine to coarse GRAVEL, trace silt (GW).

12.5

No seepage. Minor caving 0 to 14 feet.

15

17.5

20

B-06

10/24/2024

20240155E001

associated earth sciences incorporated

Exploration Pit EP-89

Bullfrog Flats Sheet: 1 of 1

Cle Elum, WA	Date: 8/12/24	Logged By: PL
20240155E001	Total Depth (ft): 14	Approved By: JHS

Depth (ft)	Description Elev.: ≈2138 ft NAVD88	USCS
0	**Grass and Topsoil - 6 inches**	
	Loess Soft, slightly moist, light brown, SILT (ML).	
2.5	**Outwash** Medium dense, slightly moist, light brown, silty, fine to coarse GRAVEL, some sand; abundant cobbles; stratified; scattered boulders (GM).	
	Becomes brown, sandy, trace silt (GW).	
5		
	Becomes very sandy (GP).	
7.5		
	Becomes moist and grayish brown.	
10		
12.5		
	No seepage. Minor caving 0 to 14 feet.	
15		
17.5		
20	B-06	

10/24/2024

20240155E001

associated earth sciences incorporated

Exploration Pit EP-90

Bullfrog Flats Sheet: 1 of 2

Cle Elum, WA	Date: 8/12/24	Logged By: PL
20240155E001	Total Depth (ft): 22	Approved By: JHS

Depth (ft)	Description Elev.: ≈2137 ft NAVD88	USCS
0	**Grass and Topsoil - 6 inches**	
	Outwash Medium dense, slightly moist, light brown, very silty, fine to coarse GRAVEL, trace sand; faintly stratified; abundant cobbles; scattered boulders (GM).	
2.5	Becomes brown, sandy, trace silt (GW).	
5		
7.5	Thin interbeds of fine to coarse sand within gravel and cobbles.	
10	Becomes moist.	
12.5	Becomes very sandy (GP).	
15		
17.5	Becomes very moist, slight silt coating on cobbles and gravel.	
20		

B-06

10/24/2024

20240155E001

associated earth sciences incorporated

Exploration Pit EP-90

Bullfrog Flats Sheet: 2 of 2

Cle Elum, WA	Date: 8/12/24	Logged By: PL
20240155E001	Total Depth (ft): 22	Approved By: JHS

Depth (ft)	Description Elev.: ≈2137 ft NAVD88	USCS
22.5	No seepage. Minor caving 0 to 22 feet.	
25		
27.5		
30		
32.5		
35		
37.5		
40		
42.5	B-06	

10/24/2024

20240155E001

associated earth sciences incorporated

Exploration Pit EP-91

Bullfrog Flats Sheet: 1 of 2

Cle Elum, WA	Date: 8/12/24	Logged By: PL
20240155E001	Total Depth (ft): 22	Approved By: JHS

Depth (ft)	Description Elev.: ≈2137 ft NAVD88	USCS
0	**Grass and Topsoil - 6 inches**	
	Loess Soft, slightly moist, light brown, SILT (ML).	
2.5	**Outwash** Medium dense, slightly moist, light brown, very silty, fine to coarse GRAVEL, trace to some sand; abundant cobbles; scattered boulders; stratified (GM).	
	Becomes brown, sandy, trace silt (GW).	
5	Interbedded sand and gravel; predominantly gravel.	
7.5		
	Becomes moist.	
10		
12.5		
	Thin silty interbeds; appears discontinuous.	
15		
17.5		
	Becomes very moist, grayish brown, very sandy; silt coating on gravel; more fine gravel (GW-GM).	
20	Thin interbeds of brown, silty, fine sand to very fine sand, some silt.	

B-06

10/24/2024

20240155E001

associated earth sciences incorporated

Exploration Pit EP-91

Bullfrog Flats Sheet: 2 of 2

Cle Elum, WA	Date: 8/12/24	Logged By: PL
20240155E001	Total Depth (ft): 22	Approved By: JHS

Depth (ft)	Description Elev.: ≈2137 ft NAVD88	USCS
22.5	No seepage. Minor caving 0 to 22 feet.	
25		
27.5		
30		
32.5		
35		
37.5		
40		
42.5	B-06	

10/24/2024

20240155E001

associated earth sciences incorporated

Exploration Pit EP-92

Bullfrog Flats Sheet: 1 of 2

Cle Elum, WA	Date: 8/12/24	Logged By: PL
20240155E001	Total Depth (ft): 22	Approved By: JHS

Depth (ft)	Description Elev.: ≈2137 ft NAVD88	USCS
0	**Grass and Topsoil - 6 inches**	
	Outwash Medium dense, slightly moist, light brown, very silty, fine to coarse GRAVEL, trace sand; faintly stratified; abundant cobbles; scattered boulders; fine roots (GM).	
2.5	Medium dense, slightly moist, brown, sandy, fine to coarse GRAVEL, some silt; stratified (GW-GM).	
5	Bed of tan silt with some gravel; underlain by fine to coarse sand; breaks off in chunks; cemented; faintly stratified.	
7.5	Medium dense, moist, brown to grayish brown, very sandy, fine to coarse GRAVEL, trace silt; stratified; abundant cobbles; scattered boulders (GW).	
10		
12.5	Thin beds of sandy, fine to coarse GRAVEL, some silt.	
	Becomes very sandy, possible interbeds of fine sand.	
15		
17.5		
20	B-06 Becomes very moist, sandy, thin silt coating on sand and gravel.	

10/24/2024

20240155E001

associated earth sciences incorporated

Exploration Pit EP-92

Bullfrog Flats Sheet: 2 of 2

Cle Elum, WA	Date: 8/12/24	Logged By: PL
20240155E001	Total Depth (ft): 22	Approved By: JHS

Depth (ft)	Description Elev.: ≈2137 ft NAVD88	USCS
22.5	No seepage. Minor caving 0 to 22 feet.	
25		
27.5		
30		
32.5		
35		
37.5		
40		
42.5	B-06	

10/24/2024

20240155E001

associated earth sciences incorporated

Exploration Pit EP-93

Bullfrog Flats Sheet: 1 of 1

Cle Elum, WA	Date: 8/12/24	Logged By: PL
20240155E001	Total Depth (ft): 14	Approved By: JHS

Elev.: ≈2140 ft NAVD88

Depth (ft)	Description	USCS
0	**Grass and Topsoil - 4 inches**	
	Outwash	
	Medium dense, slightly moist, silty, fine to coarse GRAVEL, some sand; faintly stratified; abundant cobbles; scattered boulders; fine roots (GM).	
2.5	Becomes brown, sandy, trace silt (GW).	
5		
7.5	Becomes moist.	
10	Thin beds (2 to 3 inches thick) of light brownish gray, silt at 10 feet.	
	Becomes very sandy.	
12.5		
	No seepage. Minor caving 0 to 14 feet.	
15		
17.5		
20	B-06	

10/24/2024

20240155E001

associated earth sciences incorporated

Exploration Pit EP-94

Bullfrog Flats Sheet: 1 of 1

Cle Elum, WA	Date: 8/12/24	Logged By: PL
20240155E001	Total Depth (ft): 12	Approved By: JHS

Depth (ft)	Description	USCS
	Elev.: ≈2145 ft NAVD88	
0	**Grass and Topsoil - 6 inches**	
	Outwash Medium dense, slightly moist, light brown, silty, fine to coarse GRAVEL, some to trace sand; stratified; abundant cobbles (GM).	
2.5	Becomes sandy, some silt (GW-GM).	
	Occasional boulders.	
5	Becomes moist, brown, trace silt (GW).	
7.5	Becomes very sandy.	
10		
12.5	No seepage. Minor caving 0 to 12 feet.	
15		
17.5		
20	B-06	

10/24/2024

20240155E001

associated earth sciences incorporated

Exploration Pit EP-95

Bullfrog Flats Sheet: 1 of 1

Cle Elum, WA	Date: 8/12/24	Logged By: PL
20240155E001	Total Depth (ft): 14	Approved By: JHS

Depth (ft)	Description Elev.: ≈2156 ft NAVD88	USCS
0	**Grass and Topsoil - 6 inches**	
	Loess Soft, slightly moist, light brown, SILT; fine roots (ML).	
2.5		
	Outwash Medium dense, slightly moist, light brown, silty, fine to coarse GRAVEL, some sand; stratified; abundant cobbles; scattered boulders (GM).	
5	Becomes moist, brown, sandy, trace silt (GW).	
7.5	Becomes grayish brown.	
10		
12.5		
	No seepage. Minor caving 0 to 14 feet.	
15		
17.5		
20	B-06	

10/24/2024

20240155E001

associated earth sciences incorporated

Exploration Pit EP-96

Bullfrog Flats Sheet: 1 of 1

Cle Elum, WA	Date: 8/12/24	Logged By: PL
20240155E001	Total Depth (ft): 14	Approved By: JHS

Depth (ft)	Description	USCS
	Elev.: ≈2148 ft NAVD88	
0	**Grass and Topsoil - 4 inches**	
	Outwash	
	Medium dense, slightly moist, light brown, silty, fine to coarse GRAVEL, trace to some sand; faintly stratified; abundant cobbles; scattered boulders (GW).	
2.5	Becomes brown, sandy, trace silt; stratified (GW).	
5		
7.5	Becomes moist.	
10	Becomes grayish brown, slight increase in moisture.	
12.5		
	No seepage. Minor caving 0 to 14 feet.	
15		
17.5		
20		

B-06

10/24/2024

20240155E001

associated earth sciences incorporated

Exploration Pit EP-97

Bullfrog Flats Sheet: 1 of 1

Cle Elum, WA	Date: 8/12/24	Logged By: PL
20240155E001	Total Depth (ft): 14	Approved By: JHS

Depth (ft) | Description | USCS

Elev.: ≈2145 ft NAVD88

0

Grass and Topsoil - 4 inches

Loess

Soft, slightly moist, light brown, SILT; unsorted (ML).

Outwash

Medium dense, slightly moist, light brown, silty, fine to coarse GRAVEL, trace to some sand; faintly stratified; abundant cobbles; scattered boulders (GM).

2.5

Becomes brown, sandy, trace silt (GW).

5

7.5

Becomes moist.

10

12.5

No seepage. Minor caving 0 to 14 feet.

15

17.5

20

B-06

10/24/2024

20240155E001

associated earth sciences incorporated

Exploration Pit EP-98

Bullfrog Flats Sheet: 1 of 1

Cle Elum, WA	Date: 8/12/24	Logged By: PL
20240155E001	Total Depth (ft): 12	Approved By: JHS

Depth (ft)	Description Elev.: ≈2150 ft NAVD88	USCS
0	**Grass and Topsoil - 4 inches**	
	Loess	
	Soft, slightly moist, light brown, SILT (ML).	
	Outwash	
	Medium dense, slightly moist, light brown, silty, fine to coarse GRAVEL; faintly stratified; abundant cobbles; scattered boulders (GM).	
2.5		
5	Becomes brown, sandy, trace silt (GW).	
	Lens (12 inches thick) of moist, medium dense, fine to medium SAND, trace silt (SP).	
	Medium dense, moist, brown, sandy, fine to coarse GRAVEL, trace silt; abundant cobbles; scattered boulders (GW).	
7.5		
10	Becomes grayish brown.	
12.5	No seepage. Minor caving 0 to 12 feet.	
15		
17.5		
20		

B-06

10/24/2024

20240155E001

associated earth sciences incorporated

Exploration Pit EP-99

Bullfrog Flats Sheet: 1 of 1

Cle Elum, WA	Date: 8/12/24	Logged By: PL
20240155E001	Total Depth (ft): 14	Approved By: JHS

Depth (ft)	Description	USCS
	Elev.: ≈2156 ft NAVD88	
0	**Grass and Topsoil - 3 inches**	
	Outwash	
	Medium dense, slightly moist, light brown, silty, fine to coarse GRAVEL, some sand; abundant cobbles; scattered boulders; faintly stratified (GM).	
2.5	Becomes brown, sandy, trace silt; fine roots; occasional lenses of fine to medium sand (GW).	
5	Becomes moist.	
7.5	Becomes very sandy; increase in coarse sand.	
10	Occasional beds of very moist sand.	
12.5		
	No seepage. Minor caving 0 to 14 feet.	
15		
17.5		
20	B-06	

10/24/2024

20240155E001

associated earth sciences incorporated

Exploration Pit EP-100

Bullfrog Flats Sheet: 1 of 1

Cle Elum, WA	Date: 9/10/24	Logged By: PL
20240155E001	Total Depth (ft): 20	Approved By: JHS

Elev.: ≈2110 ft NAVD88

Depth (ft)	Description	USCS
0	**Grass and Topsoil - 4 inches**	
	Loess Soft, slightly moist, light brown, sandy, SILT; massive (ML).	
2.5	**Outwash** Medium dense, slightly moist, light brown, silty, fine to coarse GRAVEL, some sand; faintly stratified; abundant cobbles; scattered boulders (GM).	
5	Medium dense, slightly moist, brown, sandy, fine to coarse GRAVEL, trace silt; stratified; abundant cobbles; scattered boulders (GW).	
7.5		
10		
12.5	Medium dense, moist, brown and grayish brown, very sandy, fine to coarse GRAVEL, trace silt; stratified; silt coating on sand and gravel; increase in moisture; thin beds of gravel with some silt between 15 and 17 feet (GW).	
15		
17.5	Medium dense, moist to very moist, brownish gray, silty, sandy, fine to coarse GRAVEL; stratified (GM).	
20	No seepage. Minor caving 0 to 20 feet. B-06	

10/24/2024

20240155E001

associated earth sciences incorporated

Exploration Pit EP-101

Bullfrog Flats Sheet: 1 of 1

Cle Elum, WA	Date: 9/10/24	Logged By: PL
20240155E001	Total Depth (ft): 20	Approved By: JHS

Elev.: ≈2110 ft NAVD88

Depth (ft)	Description	USCS
0	**Grass and Topsoil - 6 inches**	
	Loess Soft, slightly moist, light brown, sandy, SILT (ML).	
2.5	**Outwash** Medium dense, slightly moist, light brown, silty, fine to coarse GRAVEL, some sand to sandy; faintly stratified; abundant cobbles (GM).	
5	Medium dense, slightly moist, brown, sandy to very sandy, fine to coarse GRAVEL, trace silt; stratified; abundant cobbles (GW).	
7.5	Becomes moist.	
10		
12.5	Becomes some silt; silt coating on gravel (GW-GM).	
15	Becomes grayish brown. Interbeds of very sandy, gravel and gravelly, sand between 16 and 20 feet.	
17.5	Becomes moist to very moist.	
20	No seepage. Minor caving 0 to 20 feet. B-06	

10/24/2024

20240155E001

associated earth sciences incorporated

Exploration Pit EP-102

Bullfrog Flats Sheet: 1 of 1

Cle Elum, WA	Date: 9/10/24	Logged By: PL
20240155E001	Total Depth (ft): 20	Approved By: JHS

Depth (ft)	Description	USCS
	Elev.: ≈2110 ft NAVD88	
0	**Grass and Topsoil - 6 inches**	
	Loess Soft, slightly moist, light brown, sandy, SILT (ML).	
2.5	**Outwash** Medium dense, slightly moist, light brown, silty, sandy, fine to coarse GRAVEL; faintly stratified; abundant cobbles; scattered boulders (GM).	
5	Becomes trace silt (GW).	
7.5		
10	Becomes moist, brown, very sandy (GW).	
12.5		
	Silt coating on sand and gravel.	
15		
	Interbeds of very fine to coarse sand and gravel between 16 and 20 feet; trace to some silt (GW-GM/SP-SM).	
17.5		
20	No seepage. Minor caving 0 to 20 feet.	
	B-06	

10/24/2024

20240155E001

associated earth sciences incorporated

Exploration Pit EP-103

Bullfrog Flats Sheet: 1 of 1

Cle Elum, WA	Date: 9/11/24	Logged By: PL
20240155E001	Total Depth (ft): 18	Approved By: JHS

Elev.: ≈2106 ft NAVD88

Depth (ft)	Description	USCS
0	**Grass and Topsoil - 4 inches**	
	Loess Soft, slightly moist, light brown, sandy, SILT (ML).	
2.5	**Outwash** Medium dense, slightly moist, light brown, silty, sandy, fine to coarse GRAVEL; faintly stratified; abundant cobbles; scattered boulders (GM).	
5	Medium dense, slightly moist, brown, sandy, fine to coarse GRAVEL, trace silt; stratified; abundant cobbles; scattered boulders (GW).	
7.5		
10		
12.5	Becomes moist, some silt; silt coating on sand and gravel (GW-GM).	
15		
17.5		
	No seepage. Minor caving 0 to 18 feet.	
20		

B-06

10/24/2024

20240155E001

associated earth sciences incorporated

Exploration Pit EP-104

Bullfrog Flats Sheet: 1 of 1

Cle Elum, WA	Date: 9/11/24	Logged By: PL
20240155E001	Total Depth (ft): 18	Approved By: JHS

Depth (ft)	Description Elev.: ≈2109 ft NAVD88	USCS
0	**Grass and Topsoil - 4 inches**	
	Outwash Medium dense, slightly moist, light brown, silty, sandy, fine to coarse GRAVEL; abundant cobbles; scattered boulders; stratified (GM).	
2.5	Becomes trace silt (GW).	
	Bed of medium dense, slightly moist, tan and light brown, silty, GRAVEL, some sand; cemented (GM).	
5	Discontinuous bed (4 to 6 inches thick) of sand.	
	Becomes moist, brown (GW). Interbedded sand and gravel; beds 8 to 12 inches thick.	
7.5		
10	Becomes moist to very moist; some silt; silt coating on gravel and sand (GW-GM).	
12.5	Occasional lenses of cemented gravel.	
15	Becomes very moist, grayish brown, silty (GM).	
17.5	No seepage. Minor caving.	
20	B-06	

10/24/2024

20240155E001

associated earth sciences incorporated

Exploration Pit EP-105

Bullfrog Flats Sheet: 1 of 1

Cle Elum, WA	Date: 9/12/24	Logged By: PL
20240155E001	Total Depth (ft): 14	Approved By: JHS

Depth (ft)	Description	USCS
0	Elev.: ≈2115 ft NAVD88 **Grass and Topsoil - 6 inches**	
2.5	**Loess** Soft, slightly moist, light brown, sandy, SILT (ML).	
5		
7.5	**Outwash** Medium dense, slightly moist, light brown, silty, very sandy, fine to coarse GRAVEL; stratified (GM).	
10	Becomes grayish brown, trace silt (GW).	
12.5		
15	No seepage. Minor caving 0 to 14 feet.	
17.5		
20	B-06	

10/24/2024

20240155E001

associated earth sciences incorporated

Exploration Pit EP-106

Bullfrog Flats Sheet: 1 of 1

Cle Elum, WA	Date: 9/13/24	Logged By: PL
20240155E001	Total Depth (ft): 20	Approved By: JHS

Depth (ft)	Description Elev.: ≈2105 ft NAVD88	USCS
0	**Grass and Topsoil - 4 inches**	
	Alluvium/Colluvium Soft, slightly moist, light brownish, sandy, SILT, trace gravel; unsorted (ML).	
2.5	**Outwash** Medium dense, slightly moist, light brown, silty, sandy, fine to coarse GRAVEL; stratified; abundant cobbles; scattered boulders (GM).	
5		
	Becomes grayish brown, trace silt (GW).	
7.5		
10		
12.5	Becomes moist.	
15		
17.5	Becomes some silt.	
20	No seepage. No seepage from adjacent infiltration test. Minor caving 0 to 20 feet. B-06	

10/24/2024

20240155E001

associated earth sciences incorporated

Exploration Pit EP-107

Bullfrog Flats Sheet: 1 of 1

Cle Elum, WA	Date: 9/13/24	Logged By: PL
20240155E001	Total Depth (ft): 20	Approved By: JHS

Depth (ft)	Description	USCS
	Elev.: ≈2105 ft NAVD88	
0	**Grass and Topsoil - 6 inches**	
	Alluvium/Colluvium Soft, slightly moist, light brown, sandy, SILT; trace gravel (ML).	
2.5		
	Outwash Medium dense, slightly moist, light brown, silty, sandy, fine to coarse GRAVEL; stratified; abundant cobbles; scattered boulders (GM).	
5		
	Becomes grayish brown, trace silt (GW).	
7.5		
	Becomes moist.	
10		
12.5		
	Becomes some silt; silt coating on sand and gravel (GW-GM).	
15		
17.5		
	Discontinuous bed at approximately 18 feet of silty, gravel; cemented.	
20	No seepage. Minor caving 0 to 20 feet.	
	B-06	

10/24/2024

20240155E001

associated earth sciences incorporated

Exploration Pit IT-1

Bullfrog Flats Sheet: 1 of 1

Cle Elum, WA	Date: 9/10/24	Logged By: PL
20240155E001	Total Depth (ft): 18	Approved By: JHS

Depth (ft)	Description Elev.: ≈2112 ft NAVD88	USCS
0	**Grass and Topsoil - 2 inches**	
	Loess Soft to medium stiff, slightly moist, light brown, SILT, some sand, trace gravel (ML).	
2.5	**Outwash** Medium dense, slightly moist, light brown, sandy, fine to coarse GRAVEL, some silt; faintly stratified; abundant cobbles (GW-GM). Infiltration test performed at 3 feet.	
5	Medium dense, very moist, brown, sandy, fine to coarse GRAVEL, trace silt; stratified; beds of sand and gravel (GW).	
7.5	Portions of trench at side of infiltration test area are moist.	
10	Becomes moist to very moist; interbedded sand and gravel 11 to 18 feet (SP-GW).	
12.5	Becomes very moist in gravel beds.	
15	Silt coating on gravel; becomes grayish brown.	
17.5	No seepage. Moderate caving 2 to 10 feet, minor caving 10 to 18 feet. Infiltration test performed at 3 feet.	
20	B-06	

10/24/2024

20240155E001

associated earth sciences incorporated

Exploration Pit IT-2

Bullfrog Flats Sheet: 1 of 1

Cle Elum, WA	Date: 9/11/24	Logged By: PL
20240155E001	Total Depth (ft): 18	Approved By: JHS

Depth (ft)	Description Elev.: ≈2106 ft NAVD88	USCS
0	**Grass and Topsoil - 4 inches**	
	Loess	
	Soft, slightly moist, light brown, sandy, SILT (ML).	
	Outwash	
	Medium dense, slightly moist, light brown, silty, sandy, fine to coarse GRAVEL; stratified; abundant cobbles (GM).	
2.5		
	Medium dense, slightly moist, brown, very sandy, fine to coarse GRAVEL, trace silt; abundant cobbles; scattered boulders (GW).	
5	Infiltration test performed at 5 feet.	
	Becomes very moist, grayish brown below testing depth.	
7.5		
	Silt coating on gravel.	
10		
	Increase in silt, trace to some silt (GW-GM).	
12.5		
15		
17.5		
	Minor seepage at 8 to 9 feet post infiltration test. Minor caving 0 to 18 feet. Infiltration test performed at 5 feet.	
20		
	B-06	

10/24/2024

20240155E001

associated earth sciences incorporated

Exploration Pit IT-3

Bullfrog Flats Sheet: 1 of 1

Cle Elum, WA	Date: 9/12/24	Logged By: PL
20240155E001	Total Depth (ft): 18	Approved By: JHS

Depth (ft)	Description	USCS
	Elev.: ≈2137 ft NAVD88	
0	**Grass and Topsoil - 8 inches**	
	Loess Soft, slightly moist, light brown, sandy, SILT (ML).	
2.5	**Outwash** Medium dense, slightly moist, light brown, silty, very sandy, fine to coarse GRAVEL; stratified; abundant cobbles (GM).	
	Becomes brown, trace silt (GW).	
5		
	Infiltration test performed at 7 feet.	
7.5	Becomes very moist.	
10		
12.5		
	Silt coating on gravel and sand.	
15		
17.5		
	No seepage. Minor caving 0 to 18 feet. Infiltration test performed at 7 feet.	
20		
	B-06	

10/24/2024

20240155E001

associated earth sciences incorporated

Exploration Pit IT-4

Bullfrog Flats Sheet: 1 of 1

Cle Elum, WA	Date: 9/13/24	Logged By: PL
20240155E001	Total Depth (ft): 20	Approved By: JHS

Depth (ft)	Description Elev.: ≈2105 ft NAVD88	USCS
0	**Grass and Topsoil - 6 inches**	
	Alluvium/Colluvium Soft, slightly moist, light brown, sandy, SILT; trace gravel (ML).	
2.5		
	Outwash Medium dense, slightly moist, light brown, silty, sandy, fine to coarse GRAVEL; stratified; abundant cobbles; scattered boulders (GM).	
5		
	Becomes grayish brown, trace silt (GW).	
7.5		
	Infiltration test performed at 9 feet. Becomes wet.	
10	Becomes very moist.	
	Becomes wet, very sandy (GP).	
12.5		
	Seepage from beds of gravel.	
15		
	Pooling water at 16 feet.	
	Moderate seepage from bed of gravel above sand bed at 17 feet.	
17.5		
20	Moderate seepage 12 to 20 feet. Seepage pooling in base of excavation. Minor caving 0 to 20 feet. Infiltration test completed at 9 feet.	

B-06

10/24/2024

20240155E001

APPENDIX B

Exploration Logs (AESI 1999 and 2019, AGI 1999)

associated earth sciences incorporated

Exploration Boring

Project Number	Exploration Number	Sheet
190414H001	EB-1	1 of 1

Project Name	47° North	Ground Surface Elevation (ft)	2124
Location	Cle Elum, WA	Datum	NAVD 88
Driller/Equipment	Holt / Sonic Drill Rig	Date Start/Finish	10/28/19,10/28/19
Hammer Weight/Drop	N/A	Hole Diameter (in)	6

Depth (ft)	ST	Samples	Graphic Symbol	DESCRIPTION	Well Completion	Water Level	Blows/6"	Blows/Foot (10 20 30 40)	Other Tests
				Topsoil					
				Loess Moist, reddish tan to tan, fine sandy, SILT, trace gravel; nonplastic (ML).					
5				**Outwash** Moist, reddish brown, silty, GRAVEL, some sand (GM).					
				Becomes grayish brown, some silt with abundant cobbles (GW-GM).					
10				Moist, reddish brown, silty, gravelly, SAND (SM).					
15				Moist, reddish brown, very gravelly, fine to medium SAND, trace silt; contains interbeds (~3 to 10 inches thick) of very moist silt (SP).					
20				Very moist, brown, sandy, SILT, trace fine gravel (ML).					
25				Moist, grayish brown, silty, very gravelly, SAND (SM). Becomes silty to very silty; stratified.					
30				Very moist, brown, SILT; laminated; thin lenses (<2 inches thick) of gravelly, silty, sand (ML).					
35									
40				Moist, grayish brown, very sandy, GRAVEL, some silt (GW-GM). Becomes silty below 40 feet (GM).					
45				Some silt below 43 feet (GM-GW).					
50				Very moist, brown, very gravelly, silty, SAND (SM).					
				Bottom of exploration boring at 50 feet No groundwater encountered.					

Sampler Type (ST):

- B-06 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 ()
- Water Level at time of drilling (ATD)

Logged by: TJP
Approved by: CJK

AESIBOR 190414H001.GPJ April 17, 2020

associated earth sciences incorporated

Exploration Boring

Project Number	Exploration Number	Sheet
190414H001	EB-2	1 of 1

Project Name	47° North	Ground Surface Elevation (ft)	2120
Location	Cle Elum, WA	Datum	NAVD 88
Driller/Equipment	Holt / Sonic Drill Rig	Date Start/Finish	10/29/19,10/29/19
Hammer Weight/Drop	N/A	Hole Diameter (in)	6

Depth (ft)	ST	Samples	Graphic Symbol	DESCRIPTION	Well Completion	Water Level	Blows/6"	Blows/Foot (10 20 30 40)	Other Tests
				Topsoil					
				Outwash Slightly moist, reddish tan, silty, GRAVEL, some sand; scattered cobbles and boulders (GW).					
5									
				Alpine Till Very moist, brown, very silty, very gravelly, SAND; with cobbles; nonstratified (SM). Easy drilling.					
10									
15									
20									
25									
30									
				Becomes moist, grayish brown, and silty.					
35				Becomes very moist, brown, and very silty.					
40									
45									
50				Bottom of exploration boring at 50 feet No groundwater encountered.					

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 ()
- Water Level at time of drilling (ATD)

Logged by: TJP

Approved by: CJK

B-06

AESIBOR 190414H001.GPJ April 17, 2020

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Exploration Boring

Project Number	Exploration Number	Sheet
190414H001	EB-3	1 of 1

Project Name	47° North	Ground Surface Elevation (ft)	2133
Location	Cle Elum, WA	Datum	NAVD 88
Driller/Equipment	Holt / Sonic Drill Rig	Date Start/Finish	10/28/19,10/28/19
Hammer Weight/Drop	N/A	Hole Diameter (in)	6

Depth (ft)	ST	Samples	Graphic Symbol	DESCRIPTION	Well Completion	Water Level	Blows/6"	Blows/Foot (10 20 30 40)	Other Tests
				Topsoil					
				Loess					
				Moist to slightly moist, reddish tan, fine sandy, SILT (ML).					
				Outwash					
5				Moist, reddish tan, silty, GRAVEL, some sand; contains abundant cobbles (inferred from drilling action) (GM). Becomes slightly moist and tan below 4 feet.					
10				Becomes moist, reddish brown, and sandy below 8.5 feet.					
				Boulder at ~12 to 13 feet.					
15				Moist, grayish brown, very gravelly, fine to medium SAND, trace silt (SP).					
				Moist, grayish brown, very sandy, GRAVEL, trace silt (GW).					
20				Moist, grayish brown, silty, sandy, GRAVEL (GM). Trace silt (GW) below 20 feet.					
				Some silt (GW-GM) below 23 feet.					
25				Moist, grayish brown, very gravelly, fine to medium SAND, trace silt (SP).					
				Moist, grayish brown, very sandy, GRAVEL, trace silt; abundant cobbles (GW).					
30				Some silt (GW-GM).					
				Becomes silty (GM) at ~32 to 33 feet. Some silt (GW-GM) below 33 feet.					
35									
40				Moist, brownish gray, very gravelly, fine to medium SAND, trace silt (SP).					
				Moist, grayish brown, very sandy, GRAVEL, some silt (GW-GM).					
45									
50				Bottom of exploration boring at 50 feet No groundwater encountered.					

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 ()
- Water Level at time of drilling (ATD)

Logged by: TJP

Approved by: CJK

associated earth sciences incorporated

Exploration Boring

Project Number	Exploration Number	Sheet
190414H001	EB-4	1 of 1

Project Name	47° North	Ground Surface Elevation (ft)	2144
Location	Cle Elum, WA	Datum	NAVD 88
Driller/Equipment	Holt / Sonic Drill Rig	Date Start/Finish	10/29/19,10/29/19
Hammer Weight/Drop	N/A	Hole Diameter (in)	6

Depth (ft)	ST	Samples	Graphic Symbol	DESCRIPTION	Well Completion	Water Level	Blows/6"	Blows/Foot (10 20 30 40)	Other Tests
				Topsoil					
				Outwash					
				Slightly moist, reddish tan to tan, silty, GRAVEL, some sand (GM).					
5									
10				Slightly moist, orangish brown, very gravelly, fine to medium SAND, trace silt (SP).					
				Moist, grayish brown, sandy, GRAVEL, some silt (GW-GM).					
				Very moist, grayish brown, silty, GRAVEL, some sand (GM).					
15									
20				Increased gravel content; abundant cobbles.					
25				Very moist, brown, very gravelly, silty, SAND (SM).					
				Very moist, brown, silty, GRAVEL, some sand (GM).					
30				Becomes sandy with some silt below 29 feet.					
				Moist, grayish brown, very gravelly, well graded SAND, trace silt (SW).					
35				Very moist, brown, very gravelly, silty, SAND (SM).					
				Some silt (SW-SM) below 36.5 feet.					
40				Becomes silty (SM) below 40 feet.					
45									
50				Bottom of exploration boring at 50 feet No groundwater encountered.					

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 ()
- Water Level at time of drilling (ATD)

Logged by: TJP

Approved by: CJK

B-06

AESIBOR 190414H001.GPJ April 17, 2020

EXPLORATION PIT NO. EP-1

Depth (ft)	This log is part of the report prepared by Associated Earth Sciences, Inc. (AESI) for the named project and should be read together with that report for complete interpretation. This summary applies only to the location of this trench at the time of excavation. Subsurface conditions may change at this location with the passage of time. The data presented are a simplfication of actual conditions encountered. **DESCRIPTION**
	Topsoil
1	
	Loess
	Very stiff, slightly moist, light tan, SILT; non-plastic (ML).
2	
	Alpine Till
	Medium dense, slightly moist, light tan, gravelly, very silty, SAND; nonstratified (SM).
3	
4	Becomes very dense, contains scattered cobbles.
5	
6	Becomes moist and brown below 6 feet.
7	
8	
9	
10	
11	
12	
13	
14	
	Bottom of exploration pit at depth 14 feet No seepage. No caving.
15	
16	
17	
18	
19	
20	

KCTP3 190414H001.GPJ April 17, 2020

47° North
Cle Elum, WA

B-06

Logged by: TJP

Approved by: CJK

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Project No. 190414H001

10/21/19

EXPLORATION PIT NO. EP-2

Depth (ft)	This log is part of the report prepared by Associated Earth Sciences, Inc. (AESI) for the named project and should be read together with that report for complete interpretation. This summary applies only to the location of this trench at the time of excavation. Subsurface conditions may change at this location with the passage of time. The data presented are a simplfication of actual conditions encountered. **DESCRIPTION**
	Topsoil
1	
	Alpine Till
2	Medium dense, slightly moist, light tan, very silty, gravelly, SAND; scattered cobbles and boulders; nonstratified (SM).
3	Abundant roots 0 to 3 feet.
4	
5	
6	Becomes very dense, slightly moist to moist, brown and very gravelly below 5.5 feet. Cobbles and boulders at north end of pit.
7	
8	
9	
10	
11	
12	
13	
14	Bottom of exploration pit at depth 13 feet No seepage. No caving.
15	
16	
17	
18	
19	
20	

47° North
Cle Elum, WA

B-06

Logged by: TJP

Approved by: CJK

associated earth sciences incorporated

Project No. 190414H001

10/21/19

KCTP3 190414H001.GPJ April 17, 2020

EXPLORATION PIT NO. EP-3

Depth (ft)	This log is part of the report prepared by Associated Earth Sciences, Inc. (AESI) for the named project and should be read together with that report for complete interpretation. This summary applies only to the location of this trench at the time of excavation. Subsurface conditions may change at this location with the passage of time. The data presented are a simplfication of actual conditions encountered. **DESCRIPTION**
	Topsoil
1	**Loess**
2	Very stiff to hard, slightly moist, light tan, SILT, some gravel below 2 feet; non-plastic (ML).
3	**Alpine Till**
4	Medium dense, slightly moist, light tan, very silty, gravelly, SAND; nonstratified (SM).
5	
6	Becomes very dense and brown with scattered cobbles and boulders.
7	
8	Becomes moist below 8 feet.
9	
10	
11	
12	
13	Becomes very moist below ~13 feet.
14	
15	
16	Bottom of exploration pit at depth 15 feet No seepage. No caving.
17	
18	
19	
20	

47° North
Cle Elum, WA

B-06

Logged by: TJP

Approved by: CJK

associated earth sciences incorporated

Project No. 190414H001

10/21/19

KCTP3 190414H001.GPJ April 17, 2020

EXPLORATION PIT NO. EP-4

Depth (ft)	This log is part of the report prepared by Associated Earth Sciences, Inc. (AESI) for the named project and should be read together with that report for complete interpretation. This summary applies only to the location of this trench at the time of excavation. Subsurface conditions may change at this location with the passage of time. The data presented are a simplfication of actual conditions encountered. **DESCRIPTION**
1	**Topsoil**
2	**Loess** Very stiff to hard, slightly moist, tan, SILT; non-plastic (ML).
3	
4	Some gravel below ~4 feet.
5	
6	**Outwash** Medium dense, slightly moist, tan, very sandy, GRAVEL, trace silt; abundant cobbles; stratified (GW).
7	
8	Trace to some silt below 8 feet (GW/GM).
9	
10	
11	
12	
13	
14	Bottom of exploration pit at depth 13 feet No seepage. Minor caving throughout.
15	
16	
17	
18	
19	
20	

47° North
Cle Elum, WA

B-06

Logged by: TJP

Approved by: CJK

associated earth sciences incorporated

Project No. 190414H001

10/21/19

KCTP3 190414H001.GPJ April 17, 2020

EXPLORATION PIT NO. EP-5

Depth (ft)	This log is part of the report prepared by Associated Earth Sciences, Inc. (AESI) for the named project and should be read together with that report for complete interpretation. This summary applies only to the location of this trench at the time of excavation. Subsurface conditions may change at this location with the passage of time. The data presented are a simplfication of actual conditions encountered. **DESCRIPTION**
	Topsoil - 10 inches
1	**Loess**
2	Very stiff to hard, slightly moist, tan, SILT; non-plastic (ML).
3	
4	
5	
6	**Outwash**
7	Medium dense, slightly moist, grayish tan, sandy, GRAVEL, some silt; abundant cobbles; contains lenses of fine gravel; stratified (GW-GM).
8	Trace silt below 7 feet (GW).
9	
10	
11	
12	
13	
14	Bottom of exploration pit at depth 13 feet No seepage. No caving.
15	
16	
17	
18	
19	
20	

47° North
Cle Elum, WA

B-06

Logged by: TJP

Approved by: CJK

associated earth sciences incorporated

Project No. 190414H001

10/21/19

KCTP3 190414H001.GPJ April 17, 2020

EXPLORATION PIT NO. EP-6

Depth (ft)

This log is part of the report prepared by Associated Earth Sciences, Inc. (AESI) for the named project and should be read together with that report for complete interpretation. This summary applies only to the location of this trench at the time of excavation. Subsurface conditions may change at this location with the passage of time. The data presented are a simplfication of actual conditions encountered.

DESCRIPTION

Topsoil

1

Loess

Very stiff to hard, slightly moist, tan, SILT; non-plastic (ML).

2 3 4 5 6 7 8 9 10 11

12

Alpine Till

Very dense, slightly moist, tan, gravelly, very silty, SAND; scattered cobbles; nonstratified (SM).

13

14

Bottom of exploration pit at depth 14 feet
No seepage. No caving.

15 16 17 18 19 20

47° North
Cle Elum, WA

B-06

Logged by: TJP

Approved by: CJK

associated earth sciences incorporated

Project No. 190414H001

10/21/19

KCTP3 190414H001.GPJ April 17, 2020

EXPLORATION PIT NO. EP-7

Depth (ft)	DESCRIPTION
	This log is part of the report prepared by Associated Earth Sciences, Inc. (AESI) for the named project and should be read together with that report for complete interpretation. This summary applies only to the location of this trench at the time of excavation. Subsurface conditions may change at this location with the passage of time. The data presented are a simplfication of actual conditions encountered.
	Topsoil
1	
	Loess
2	Very stiff, slightly moist, tan, SILT; non-plastic (ML).
3	
4	
5	
6	
7	
8	
	Alpine Till
9	Dense to very dense, slightly moist, tan, very gravelly, very silty, SAND; nonstratified (SM).
10	
11	
12	Abundant cobbles and boulders above 12 feet Some gravel below 12 feet.
13	
14	Bottom of exploration pit at depth 13 feet No seepage. No caving.
15	
16	
17	
18	
19	
20	

47° North
Cle Elum, WA

B-06
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Project No. 190414H001

10/21/19

KCTP3 190414H001.GPJ April 17, 2020

EXPLORATION PIT NO. EP-8

Depth (ft)	This log is part of the report prepared by Associated Earth Sciences, Inc. (AESI) for the named project and should be read together with that report for complete interpretation. This summary applies only to the location of this trench at the time of excavation. Subsurface conditions may change at this location with the passage of time. The data presented are a simplfication of actual conditions encountered. **DESCRIPTION**
	Topsoil
1	**Outwash**
2	Medium dense, slightly moist, tan, gravelly, silty, SAND (SM).
3	
4	
5	
6	Medium dense, slightly moist, grayish tan, very sandy, GRAVEL, some silt; abundant cobbles; stratified (GW-GM).
7	
8	
9	
10	Becomes silty below 10 feet.
11	
12	
13	Bottom of exploration pit at depth 12 feet No seepage. Minor caving throughout.
14	
15	
16	
17	
18	
19	
20	

47° North
Cle Elum, WA

B-06

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Project No. 190414H001

10/21/19

KCTP3 190414H001.GPJ April 17, 2020

EXPLORATION PIT NO. EP-9

Depth (ft)

This log is part of the report prepared by Associated Earth Sciences, Inc. (AESI) for the named project and should be read together with that report for complete interpretation. This summary applies only to the location of this trench at the time of excavation. Subsurface conditions may change at this location with the passage of time. The data presented are a simplfication of actual conditions encountered.

DESCRIPTION

Topsoil

1

Loess

Very stiff, slightly moist, tan, SILT; non-plastic (ML).

2

3

4

5

Alpine Till

6

Dense, slightly moist, tan, gravelly, very silty, SAND; scattered cobbles; nonstratified (SM).

7

8

9

10

11

Bottom of exploration pit at depth 11 feet
No seepage. No caving.

12

13

14

15

16

17

18

19

20

KCTP3 190414H001.GPJ April 17, 2020

47° North
Cle Elum, WA

B-06

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Project No. 190414H001

10/21/19

EXPLORATION PIT NO. EP-10

Depth (ft)	This log is part of the report prepared by Associated Earth Sciences, Inc. (AESI) for the named project and should be read together with that report for complete interpretation. This summary applies only to the location of this trench at the time of excavation. Subsurface conditions may change at this location with the passage of time. The data presented are a simplfication of actual conditions encountered. **DESCRIPTION**
	Topsoil
1	**Outwash**
2	Medium dense, slightly moist, tan, gravelly, very silty, SAND (SM).
3	
4	
5	Medium dense, slightly moist, grayish tan, sandy, GRAVEL, some silt to silty (GM-GW).
6	
7	Dense, slightly moist, tan, gravelly, very silty, SAND; till-like (SM).
8	Medium dense to dense, slightly moist, tan, silty, GRAVEL, some sand; abundant cobbles; scattered boulders (GM).
9	
10	
11	Bottom of exploration pit at depth 10 feet No seepage. No caving.
12	
13	
14	
15	
16	
17	
18	
19	
20	

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B-06

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Project No. 190414H001

10/21/19

KCTP3 190414H001.GPJ April 17, 2020

EXPLORATION PIT NO. EP-11

Depth (ft)

This log is part of the report prepared by Associated Earth Sciences, Inc. (AESI) for the named project and should be read together with that report for complete interpretation. This summary applies only to the location of this trench at the time of excavation. Subsurface conditions may change at this location with the passage of time. The data presented are a simplfication of actual conditions encountered.

DESCRIPTION

Topsoil

1

Loess

Medium dense, slightly moist, light brown to tan, SILT, trace fine sand; minor rootlets; non-cohesive (ML).

2

Alpine Till

3

Medium dense, slightly moist to moist, light brownish gray to brown, very silty, fine to medium SAND, some gravel; occasional cobbles; small void spaces above 3 feet; unsorted (SM).

4

Harder digging at ~3 feet.

5

Very hard digging at 5 feet.

6

7

Becomes moist and slightly darker brown 6.5 to 7 feet.

8

9

10

11

12

Bottom of exploration pit at depth 12 feet
No seepage. No caving.

13

14

15

16

17

18

19

20

KCTP3 190414H001.GPJ April 17, 2020

47° North
Cle Elum, WA

B-06

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Project No. 190414H001

10/22/19

EXPLORATION PIT NO. EP-12

Depth (ft)

This log is part of the report prepared by Associated Earth Sciences, Inc. (AESI) for the named project and should be read together with that report for complete interpretation. This summary applies only to the location of this trench at the time of excavation. Subsurface conditions may change at this location with the passage of time. The data presented are a simplfication of actual conditions encountered.

DESCRIPTION

Topsoil

1

Alpine Till

2

Loose, slightly moist, light brown to light brownish gray, very silty, fine to medium SAND, some gravel; occasional cobbles; minor rootlets; unsorted (SM).

3

4

Occasional boulders 3 to 5 feet.

5

Becomes brown with some coarse sand in till matrix.

6

Harder digging at 6 feet.

7

8

Increase in moisture at ~8 feet.

9

Becomes slightly darker brown with more gravel.

10

11

Color turns slightly lighter.

12

Contains interbeds of hard, moist, light brownish gray, laminated, SILT (ML) and dense, fine to medium SAND, some silt (SP-SM).

13

14

15

16

17

Bottom of exploration pit at depth 16.5 feet
No seepage. No caving.

18

19

20

KCTP3 190414H001.GPJ April 17, 2020

47° North
Cle Elum, WA

B-06

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Project No. 190414H001

10/22/19

EXPLORATION PIT NO. EP-13

Depth (ft)

This log is part of the report prepared by Associated Earth Sciences, Inc. (AESI) for the named project and should be read together with that report for complete interpretation. This summary applies only to the location of this trench at the time of excavation. Subsurface conditions may change at this location with the passage of time. The data presented are a simplfication of actual conditions encountered.

DESCRIPTION

Topsoil

Outwash

Medium dense, slightly moist, brown to brownish gray, very gravelly, silty, fine to coarse SAND (SM) to very sandy, silty, GRAVEL (GM); minor rootlets; frequent cobbles; moderate stratification.

Material gets siltier with less gravel and more fine sand, frequent cemented clasts and occasional cobbles.

Increase in moisture at ~8 feet.

Layer (~2 feet thick) of till-like material.

Sand and gravel are coated with silt/clay with occasional silt and clay lenses containing higher moisture.

Bottom of exploration pit at depth 15 feet
No seepage. Minimal caving 0 to 15 feet.

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20

47° North
Cle Elum, WA

B-06

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Project No. 190414H001

10/22/19

KCTP3 190414H001.GPJ April 17, 2020

EXPLORATION PIT NO. EP-14

Depth (ft)

This log is part of the report prepared by Associated Earth Sciences, Inc. (AESI) for the named project and should be read together with that report for complete interpretation. This summary applies only to the location of this trench at the time of excavation. Subsurface conditions may change at this location with the passage of time. The data presented are a simplfication of actual conditions encountered.

DESCRIPTION

Topsoil

1

Loess

Very stiff, slightly moist, light tan, SILT; non-plastic (ML).

2

3

Alpine Till

Very dense, slightly moist, tan, very gravelly, very silty, SAND; abundant cobbles and boulders (up to ~3 feet in diameter); nonstratified (SM).

4

5

6

7

8

Bottom of exploration pit at depth 8 feet
No seepage. No caving.

9

10

11

12

13

14

15

16

17

18

19

20

KCTP3 190414H001.GPJ April 17, 2020

47° North
Cle Elum, WA

B-06

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Project No. 190414H001

10/22/19

EXPLORATION PIT NO. EP-15

Depth (ft)

This log is part of the report prepared by Associated Earth Sciences, Inc. (AESI) for the named project and should be read together with that report for complete interpretation. This summary applies only to the location of this trench at the time of excavation. Subsurface conditions may change at this location with the passage of time. The data presented are a simplfication of actual conditions encountered.

DESCRIPTION

Rocky Topsoil

1

Glacial Erratic

Highly fractured, hard, pink brown, volcanic rock; rock is in a silty matrix from 1 to 2 feet.

2

Non-rippable with John Deere 135 G below 3 feet.

3

Bottom of exploration pit at depth 3 feet
No seepage. No caving.

4

5

6

7

8

9

10

11

12

13

14

15

16

17

18

19

20

KCTP3 190414H001.GPJ April 17, 2020

47° North
Cle Elum, WA

B-06

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Project No. 190414H001

10/22/19

EXPLORATION PIT NO. EP-16

Depth (ft)

This log is part of the report prepared by Associated Earth Sciences, Inc. (AESI) for the named project and should be read together with that report for complete interpretation. This summary applies only to the location of this trench at the time of excavation. Subsurface conditions may change at this location with the passage of time. The data presented are a simplfication of actual conditions encountered.

DESCRIPTION

Topsoil

Outwash

Medium dense, slightly moist, silty, GRAVEL, some sand; abundant cobbles; scattered boulders; contains lenses of clean fine gravel; stratified (GM).

Becomes sandy with trace silt below 4 feet (GW).

Bottom of exploration pit at depth 14 feet
No seepage. Minor caving throughout.

47° North
Cle Elum, WA

B-06

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Project No. 190414H001

10/22/19

KCTP3 190414H001.GPJ April 17, 2020

EXPLORATION PIT NO. EP-17

Depth (ft)

This log is part of the report prepared by Associated Earth Sciences, Inc. (AESI) for the named project and should be read together with that report for complete interpretation. This summary applies only to the location of this trench at the time of excavation. Subsurface conditions may change at this location with the passage of time. The data presented are a simplfication of actual conditions encountered.

DESCRIPTION

Topsoil

1

Outwash

2 Medium dense to dense, slightly moist, tan, very gravelly, very silty, SAND; abundant cobbles; stratified (SM).

3

4 Becomes silty below 4 feet.

5

6

7

8 Medium dense, slightly moist, grayish tan, sandy, GRAVEL, trace to some silt; abundant cobbles; scattered boulders (GW-GM).

9

10 Becomes sandy to very sandy with trace silt below 10 feet.

11

12

13

14

Bottom of exploration pit at depth 14 feet
15 No seepage. No caving.

16

17

18

19

20

KCTP3 190414H001.GPJ April 17, 2020

47° North
Cle Elum, WA

B-06

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Project No. 190414H001

10/22/19

EXPLORATION PIT NO. EP-18

Depth (ft)

This log is part of the report prepared by Associated Earth Sciences, Inc. (AESI) for the named project and should be read together with that report for complete interpretation. This summary applies only to the location of this trench at the time of excavation. Subsurface conditions may change at this location with the passage of time. The data presented are a simplfication of actual conditions encountered.

DESCRIPTION

Topsoil - 10 inches

1

Loess

Very stiff, slightly moist, tan, SILT, trace gravel; moderately abundant roots; non-plastic (ML).

2

3

4

Outwash

Medium dense, slightly moist, tan, silty, GRAVEL, some sand; stratified (GM).

5

Medium dense, slightly moist, grayish tan, sandy, GRAVEL, trace silt; abundant cobbles and small boulders (GW).

6

7

8

9

10

Becomes grayish brown below 10 feet.

11

12

13

14

15

Bottom of exploration pit at depth 15 feet
No seepage. Minor caving throughout.

16

17

18

19

20

KCTP3 190414H001.GPJ April 17, 2020

47° North
Cle Elum, WA

B-06

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Project No. 190414H001

10/22/19

EXPLORATION PIT NO. EP-19

Depth (ft)	This log is part of the report prepared by Associated Earth Sciences, Inc. (AESI) for the named project and should be read together with that report for complete interpretation. This summary applies only to the location of this trench at the time of excavation. Subsurface conditions may change at this location with the passage of time. The data presented are a simplfication of actual conditions encountered. **DESCRIPTION**
1	**Topsoil**
2	**Loess** Very stiff, slightly moist, tan, SILT, trace gravel; non-plastic (ML).
3	**Outwash**
4	Medium dense, slightly moist, tan, silty, GRAVEL, some sand (GM).
5	Medium dense, slightly moist, grayish brown, sandy, GRAVEL, trace silt; abundant cobbles and scattered small boulders; stratified (GW).
6	
7	
8	
9	
10	
11	
12	
13	
14	
15	
16	Bottom of exploration pit at depth 15 feet No seepage. Moderately severe caving.
17	
18	
19	
20	

47° North
Cle Elum, WA

B-06

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Project No. 190414H001

10/22/19

KCTP3 190414H001.GPJ April 17, 2020

EXPLORATION PIT NO. EP-20

Depth (ft)

This log is part of the report prepared by Associated Earth Sciences, Inc. (AESI) for the named project and should be read together with that report for complete interpretation. This summary applies only to the location of this trench at the time of excavation. Subsurface conditions may change at this location with the passage of time. The data presented are a simplfication of actual conditions encountered.

DESCRIPTION

Topsoil

1

Alpine Till

2

Medium dense, slightly moist, light brown to light brownish gray, very silty, fine to medium SAND, some gravel; minor rootlets; unsorted (SM).

3

4

5

Harder digging at ~5 feet. Becomes very gravelly with occasional cobbles (up to ~12 inches in diameter).

6

7

Becomes moist, brown, and gravelly with some coarser sand.

8

9

10

Occasional boulders 9 to 10 feet.

11

12

13

Bottom of exploration pit at depth 13 feet
No seepage. No caving.

14

15

16

17

18

19

20

KCTP3 190414H001.GPJ April 17, 2020

47° North
Cle Elum, WA

B-06

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Project No. 190414H001

10/22/19

EXPLORATION PIT NO. EP-21

Depth (ft)	This log is part of the report prepared by Associated Earth Sciences, Inc. (AESI) for the named project and should be read together with that report for complete interpretation. This summary applies only to the location of this trench at the time of excavation. Subsurface conditions may change at this location with the passage of time. The data presented are a simplfication of actual conditions encountered. **DESCRIPTION**
	Topsoil
1	**Loess**
2	Loose, slightly moist, light brown to tan, SILT, some fine to medium sand, trace gravel; minor rootlets; non-cohesive (ML).
3	**Outwash**
4	Medium dense, slightly moist, brownish gray to brown, very fine to coarse very sandy, GRAVEL, some silt; frequent cobbles; moderately stratified (GW-GM).
5	
6	
7	Becomes moist ~7 to 8 feet.
8	
9	
10	
11	
12	Occasional boulders ~12 to 15 feet.
13	
14	Slightly increased moisture and becomes silty at ~14 feet.
15	
16	Bottom of exploration pit at depth 15 feet No seepage. Minimal caving 0 to 3 feet. Moderate caving 3 to 15 feet.
17	
18	
19	
20	

47° North
Cle Elum, WA

B-06

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Project No. 190414H001

10/22/19

KCTP3 190414H001.GPJ April 17, 2020

EXPLORATION PIT NO. EP-22

Depth (ft)

This log is part of the report prepared by Associated Earth Sciences, Inc. (AESI) for the named project and should be read together with that report for complete interpretation. This summary applies only to the location of this trench at the time of excavation. Subsurface conditions may change at this location with the passage of time. The data presented are a simplfication of actual conditions encountered.

DESCRIPTION

Topsoil

Loess

Loose, slightly moist, light brown to brown, SILT, some fine sand, trace gravel; minor rootlets; noncohesive (ML).

Outwash

Medium dense, slightly moist, very fine to coarse sandy, GRAVEL, trace silt; frequent cobbles (up to 18 inches in diameter); moderately stratified (GW).

Increased moisture at ~8 feet.

Medium dense, moist to very moist, brownish gray, very gravelly, silty, fine to coarse SAND; occasional cobbles; silt/clay coated gravels; moderately stratified (SM).

Becomes less silty with frequent cobbles 11 to 12 feet.

Medium dense, moist, brown to brownish gray, very sandy, GRAVEL, trace to some silt; frequent cobbles; moderately stratified (GP-GM).

Bottom of exploration pit at depth 15 feet
No seepage. Minimal caving 0 to 3 feet. Moderate caving 3 to 15 feet.

47° North
Cle Elum, WA

B-06

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Project No. 190414H001

10/22/19

KCTP3 190414H001.GPJ April 17, 2020

EXPLORATION PIT NO. EP-23

Depth (ft)

This log is part of the report prepared by Associated Earth Sciences, Inc. (AESI) for the named project and should be read together with that report for complete interpretation. This summary applies only to the location of this trench at the time of excavation. Subsurface conditions may change at this location with the passage of time. The data presented are a simplfication of actual conditions encountered.

DESCRIPTION

Topsoil

1

Loess

2

Loose, slightly moist, light brown to tan, SILT, some fine to medium sand, trace gravel; minor rootlets; non-cohesive (ML).

3

Outwash

4

Digging becomes gravelly at 3.5 feet, contact is indistinct.

Medium dense, slightly moist, light brown, silty, very gravelly, fine to coarse SAND (SM), to very sandy GRAVEL, some silt; frequent cobbles (GP-GM); moderately stratified.

5

6

7

Medium dense, slightly moist, light brown, very sandy, GRAVEL, trace silt; moderately stratified (GW).

8

Becomes moist at ~8 feet with frequent large cobbles.

9

10

Occasional boulders 9 to 11 feet.

11

12

13

14

15

Bottom of exploration pit at depth 15 feet

16

Seepage?? Minimal caving 0 to 5 feet. Moderate caving 5 to 15 feet.

17

18

19

20

KCTP3 190414H001.GPJ April 17, 2020

47° North
Cle Elum, WA

B-06

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Project No. 190414H001

10/22/19

EXPLORATION PIT NO. EP-24

Depth (ft)	This log is part of the report prepared by Associated Earth Sciences, Inc. (AESI) for the named project and should be read together with that report for complete interpretation. This summary applies only to the location of this trench at the time of excavation. Subsurface conditions may change at this location with the passage of time. The data presented are a simplfication of actual conditions encountered. **DESCRIPTION**
	Gravelly Topsoil
1	
	Outwash
2	Medium dense, slightly moist, light tan, silty, GRAVEL, some sand (GM).
3	
4	
5	Medium dense, slightly moist, grayish tan, sandy, GRAVEL, trace silt; abundant cobbles and scattered boulders (up to ~2.5 feet in diameter); stratified (GW).
6	
7	
8	
9	
10	
11	Becomes grayish brown and very sandy below 11 feet.
12	
13	
14	
15	Bottom of exploration pit at depth 14 feet No seepage. Minor caving throughout.
16	
17	
18	
19	
20	

47° North
Cle Elum, WA

B-06

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Project No. 190414H001

10/22/19

KCTP3 190414H001.GPJ April 17, 2020

EXPLORATION PIT NO. EP-25

Depth (ft)	This log is part of the report prepared by Associated Earth Sciences, Inc. (AESI) for the named project and should be read together with that report for complete interpretation. This summary applies only to the location of this trench at the time of excavation. Subsurface conditions may change at this location with the passage of time. The data presented are a simplfication of actual conditions encountered. **DESCRIPTION**
1	**Topsoil** Abundant roots.
2	**Outwash**
3	Medium dense, slightly moist, tan, silty, GRAVEL, some sand (GM).
4	
5	
6	Medium dense, slightly moist, grayish tan, sandy, GRAVEL, trace silt; contains abundant cobbles and scattered boulders (up to ~2 feet in diameter); stratified (GW).
7	
8	
9	
10	
11	Becomes grayish brown below 10.5 feet.
12	
13	
14	Bottom of exploration pit at depth 14 feet No seepage. Minor caving throughout.
15	
16	
17	
18	
19	
20	

47° North
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B-06
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Project No. 190414H001

10/22/19

KCTP3 190414H001.GPJ April 17, 2020

EXPLORATION PIT NO. EP-26

Depth (ft)

This log is part of the report prepared by Associated Earth Sciences, Inc. (AESI) for the named project and should be read together with that report for complete interpretation. This summary applies only to the location of this trench at the time of excavation. Subsurface conditions may change at this location with the passage of time. The data presented are a simplfication of actual conditions encountered.

DESCRIPTION

Gravelly Topsoil

1

Outwash

2 Medium dense, slightly moist, tan, silty, GRAVEL, some sand; abundant cobbles (GM).

3 Scattered roots 0 to 3 feet.

4

5 Medium dense, slightly moist, tan, sandy, GRAVEL, some silt; abundant cobbles; scattered boulders (up to ~18 inches in diameter); stratified (GW-GM).

6

7

8

9

10

11

12

13

14 Becomes moist to very moist and silty to some silt below ~13.5 feet.

15

16 Bottom of exploration pit at depth 15 feet
No seepage. No caving.

17

18

19

20

47° North
Cle Elum, WA

B-06

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Project No. 190414H001

10/22/19

KCTP3 190414H001.GPJ April 17, 2020

EXPLORATION PIT NO. EP-27

Depth (ft)

This log is part of the report prepared by Associated Earth Sciences, Inc. (AESI) for the named project and should be read together with that report for complete interpretation. This summary applies only to the location of this trench at the time of excavation. Subsurface conditions may change at this location with the passage of time. The data presented are a simplfication of actual conditions encountered.

DESCRIPTION

Topsoil

1

Loess

Loose, slightly moist, light brown to tan, SILT, some fine sand, trace gravel; minor rootlets; non-cohesive (ML).

2

3

Outwash

4

Medium dense, slightly moist, brownish gray, sandy, silty, GRAVEL; frequent cobbles; moderately stratified (GM).

5

6

7

Becomes moist at 7 feet.

8

Less cobbles 8 to 11 feet.

9

10

11

Becomes very sandy with more fine gravel at 11 feet.

12

13

Medium dense, moist, brown, very gravelly, fine to coarse SAND, some silt (SP-SM) ranging to very sandy, GRAVEL, some silt (GP-GM); moderately stratified.

14

Bottom of exploration pit at depth 14 feet
No seepage. Minimal caving 0 to 3 feet. Moderate caving 3 to 14 feet.

15

16

17

18

19

20

KCTP3 190414H001.GPJ April 17, 2020

47° North
Cle Elum, WA

B-06

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Project No. 190414H001

10/22/19

EXPLORATION PIT NO. EP-28

Depth (ft)

This log is part of the report prepared by Associated Earth Sciences, Inc. (AESI) for the named project and should be read together with that report for complete interpretation. This summary applies only to the location of this trench at the time of excavation. Subsurface conditions may change at this location with the passage of time. The data presented are a simplfication of actual conditions encountered.

DESCRIPTION

Topsoil

1

Loess

Very stiff, slightly moist to moist, reddish tan to tan, SILT, trace gravel; non-plastic (ML).

2

Outwash

Medium dense, slightly moist, tan, silty, GRAVEL, some sand (GM).

3

4

5

6

7

Medium dense, slightly moist, grayish tan, sandy, GRAVEL, trace silt; contains abundant cobbles and scattered boulders (up to ~18 inches in diameter) (GW).

8

9

10

11

12

Becomes moist and grayish brown below ~12 feet.

13

14

15

Bottom of exploration pit at depth 14.5 feet
No seepage. Minor caving throughout. Note: fill soil present in eastern corner of pit to ~5 feet.

16

17

18

19

20

KCTP3 190414H001.GPJ April 17, 2020

47° North
Cle Elum, WA

B-06

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Project No. 190414H001

10/22/19

EXPLORATION PIT NO. EP-29

Depth (ft)

This log is part of the report prepared by Associated Earth Sciences, Inc. (AESI) for the named project and should be read together with that report for complete interpretation. This summary applies only to the location of this trench at the time of excavation. Subsurface conditions may change at this location with the passage of time. The data presented are a simplfication of actual conditions encountered.

DESCRIPTION

Topsoil

Loess

Very stiff, slightly moist, light tan, SILT, trace gravel; non-plastic; abundant roots (ML).

Outwash

Medium dense, slightly moist, tan, silty, GRAVEL, some sand (GM).

Medium dense, slightly moist, grayish tan, very sandy, GRAVEL, trace to some silt; abundant cobbles and scattered boulders; stratified (GW-GM).

Becomes grayish brown below 11 feet.

Bottom of exploration pit at depth 14.5 feet
No seepage. Minor caving throughout.

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20

47° North
Cle Elum, WA

B-06

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Project No. 190414H001

10/23/19

KCTP3 190414H001.GPJ April 17, 2020

EXPLORATION PIT NO. EP-30

Depth (ft)	This log is part of the report prepared by Associated Earth Sciences, Inc. (AESI) for the named project and should be read together with that report for complete interpretation. This summary applies only to the location of this trench at the time of excavation. Subsurface conditions may change at this location with the passage of time. The data presented are a simplfication of actual conditions encountered. **DESCRIPTION**
	Topsoil - 10 inches
1	**Outwash**
2	Medium dense, moist, brown, silty, GRAVEL, some sand (GM). Abundant roots 0 to 2 feet.
3	Becomes slightly moist and tan below 2 feet.
4	
5	
6	Abundant cobbles, scattered small boulders, and scattered large roots to 6 feet. Medium dense, slightly moist, grayish tan, very sandy, GRAVEL, trace silt; abundant cobbles; scattered small boulders; stratified (GW).
7	
8	
9	
10	
11	
12	Becomes grayish brown and a slight increase in moisture content below ~12 feet.
13	
14	
15	
16	Bottom of exploration pit at depth 15 feet No seepage. Minor caving throughout.
17	
18	
19	
20	

47° North
Cle Elum, WA

B-06
Logged by: TJP
Approved by: CJK

associated earth sciences incorporated

Project No. 190414H001

10/23/19

KCTP3 190414H001.GPJ April 17, 2020

EXPLORATION PIT NO. EP-31

This log is part of the report prepared by Associated Earth Sciences, Inc. (AESI) for the named project and should be read together with that report for complete interpretation. This summary applies only to the location of this trench at the time of excavation. Subsurface conditions may change at this location with the passage of time. The data presented are a simplfication of actual conditions encountered.

Depth (ft)	DESCRIPTION
	Gravelly Topsoil
1	**Outwash**
2	Medium dense, moist, brown, very silty, GRAVEL, some sand; abundant cobbles; scattered small boulders (GM).
3	Abundant roots 0 to 2 feet.
	Becomes slightly moist and tan below 2 feet.
4	Becomes silty and sandy below ~4 feet.
5	
6	
7	
8	
9	
10	
11	Becomes slightly more moist and grayish brown with some silt (GM-GW) below 11 feet.
12	Becomes moist with trace clay below 12 feet
13	
14	
15	Becomes very moist and silty below 15 feet.
16	
17	Bottom of exploration pit at depth 16 feet No seepage. Minor caving throughout.
18	
19	
20	

47° North
Cle Elum, WA

B-06

Logged by: TJP

Approved by: CJK

associated earth sciences incorporated

Project No. 190414H001

10/23/19

KCTP3 190414H001.GPJ April 17, 2020

EXPLORATION PIT NO. EP-32

Depth (ft)

This log is part of the report prepared by Associated Earth Sciences, Inc. (AESI) for the named project and should be read together with that report for complete interpretation. This summary applies only to the location of this trench at the time of excavation. Subsurface conditions may change at this location with the passage of time. The data presented are a simplfication of actual conditions encountered.

DESCRIPTION

Forest Duff / Topsoil

Outwash

Medium dense, slightly moist, light brown to light brownish gray, very sandy, GRAVEL, some silt; minor rootlets; moderately stratified (GW-GM).

Frequent large cobbles with trace silt (GP) at 5 feet.

Becomes moist and brownish gray at ~7 feet.

Ranges to sandy, gravel, trace silt with increased gravel and cobbles (GW) at 8 feet.

Increases to some silt (GP-GM) at 12 feet.

Ranges to very moist at 14 feet.

Bottom of exploration pit at depth 16 feet
No seepage. Minimal caving 0 to 2 feet. Moderate caving 2 to 16 feet.

47° North
Cle Elum, WA

B-06

Logged by: TG

Approved by: CJK

associated earth sciences incorporated

Project No. 190414H001

10/23/19

KCTP3 190414H001.GPJ April 17, 2020

EXPLORATION PIT NO. EP-33

Depth (ft)	This log is part of the report prepared by Associated Earth Sciences, Inc. (AESI) for the named project and should be read together with that report for complete interpretation. This summary applies only to the location of this trench at the time of excavation. Subsurface conditions may change at this location with the passage of time. The data presented are a simplfication of actual conditions encountered. **DESCRIPTION**
1	**Topsoil**
2	**Outwash**
3	Medium dense, dry to slightly moist, light brown, very fine to medium sandy, silty, GRAVEL; minor rootlets; moderately stratified (GM).
4	
5	Material is brownish gray and contains less silt with occasional cobbles (GW-GM) at 5 feet.
6	
7	
8	Slightly increased moisture with less silt (GW) 8 to 9 feet.
9	
10	Frequent cobbles at 10 feet.
11	
12	
13	
14	
15	Material is moist with some silt (GP-GM) at 15 feet.
16	
17	Bottom of exploration pit at depth 16 feet No seepage. Minimal caving 0 to 2 feet. Moderate caving 2 to 16 feet.
18	
19	
20	

47° North
Cle Elum, WA

B-06

Logged by: TG

Approved by: CJK

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Project No. 190414H001

10/23/19

KCTP3 190414H001.GPJ April 17, 2020

EXPLORATION PIT NO. EP-34

Depth (ft)	This log is part of the report prepared by Associated Earth Sciences, Inc. (AESI) for the named project and should be read together with that report for complete interpretation. This summary applies only to the location of this trench at the time of excavation. Subsurface conditions may change at this location with the passage of time. The data presented are a simplfication of actual conditions encountered. **DESCRIPTION**
	Forest Duff / Topsoil
1	**Outwash**
2	Medium dense, slightly moist, light brown, very fine sandy, silty, GRAVEL; minor rootlets; faintly stratified (GM).
3	
4	Color turns brownish gray, silt decreases, frequent cobbles, ranges to sandy, and becomes moderately stratified (GW) at 4 feet.
5	
6	Frequent large cobbles ~6 to 7 feet.
7	
8	
9	Becomes moist and very sandy with some silt at ~9 feet.
10	
11	
12	
13	
14	Ranges from moist to very moist and slightly increased silt content at 14 feet.
15	
16	
17	Bottom of exploration pit at depth 16.5 feet No seepage. Minor caving 0 to 2 feet. Moderate caving 2 to 16.5 feet.
18	
19	
20	

47° North
Cle Elum, WA

B-06

Logged by: TG

Approved by: CJK

associated earth sciences incorporated

Project No. 190414H001

10/23/19

KCTP3 190414H001.GPJ April 17, 2020

EXPLORATION PIT NO. EP-35

Depth (ft)	This log is part of the report prepared by Associated Earth Sciences, Inc. (AESI) for the named project and should be read together with that report for complete interpretation. This summary applies only to the location of this trench at the time of excavation. Subsurface conditions may change at this location with the passage of time. The data presented are a simplfication of actual conditions encountered. **DESCRIPTION**
1	**Forest Duff / Topsoil**
2	**Outwash**
3	Medium dense, dry to slightly moist, light brown to tan, very silty, fine SAND, some gravel; minor rootlets; cemented; massive (SM).
4	
5	
6	Sand grain size ranges to medium with slightly more gravel; cemented.
7	Medium dense, slightly moist, light brown to light brownish gray, very fine to coarse sandy, GRAVEL, some silt; occasional cobbles; moderately stratified (GW-GM).
8	
9	Less silt with frequent cobbles (GW) at 9 feet.
10	
11	Becomes moist with more sand ranging to very sandy gravel (GP) to very gravelly sand (SP).
12	
13	
14	Becomes moist to very moist and increases to some silt (GP-GM).
15	
16	
17	
18	Bottom of exploration pit at depth 17 feet No seepage. Minor caving 0 to 7 feet. Moderate caving 7 to 17 feet.
19	
20	

47° North
Cle Elum, WA

B-06

Logged by: TG

Approved by: CJK

associated earth sciences incorporated

Project No. 190414H001

10/23/19

KCTP3 190414H001.GPJ April 17, 2020

EXPLORATION PIT NO. EP-36

Depth (ft)

This log is part of the report prepared by Associated Earth Sciences, Inc. (AESI) for the named project and should be read together with that report for complete interpretation. This summary applies only to the location of this trench at the time of excavation. Subsurface conditions may change at this location with the passage of time. The data presented are a simplfication of actual conditions encountered.

DESCRIPTION

Topsoil

1

Outwash

Medium dense, dry to slightly moist, light brown to brownish gray, sandy, GRAVEL, some silt; minor rootlets; frequent cobbles (up to ~24 inches in diameter); faintly stratified (GW-GM).

2

3

4

5

Color turns more gray, becomes moderately stratified.

6

7

8

Becomes moist to very moist and very fine to coarse sandy.

9

10

11

12

13

Very moist 12 to 13 feet.

14

15

16

Bottom of exploration pit at depth 15.5 feet
No seepage. Minor caving 0 to 1 feet. Moderate caving 0 to 15.5 feet.

17

18

19

20

KCTP3 190414H001.GPJ April 17, 2020

47° North
Cle Elum, WA

B-06

Logged by: TG

Approved by: CJK

associated earth sciences incorporated

Project No. 190414H001

10/23/19

EXPLORATION PIT NO. EP-37

Depth (ft)

This log is part of the report prepared by Associated Earth Sciences, Inc. (AESI) for the named project and should be read together with that report for complete interpretation. This summary applies only to the location of this trench at the time of excavation. Subsurface conditions may change at this location with the passage of time. The data presented are a simplfication of actual conditions encountered.

DESCRIPTION

Forest Duff / Topsoil

1

Loess

2

Loose, dry to slightly moist, light brown to tan, SILT, some fine sand, trace gravel; minor rootlets; non-cohesive (ML).

3

Outwash

4

Loose to medium dense, slightly moist, brownish gray, very fine to coarse very sandy, GRAVEL, some silt; frequent cobbles; moderately stratified (GW-GM).

5

6

7

Becomes moist and color becomes darker at 7 feet.

8

9

10

Color ranges to dark brownish gray to black.

11

12

Becomes moist to very moist at 12 feet.

13

Bottom of exploration pit at depth 13 feet
No seepage. Minor caving 0 to 3 feet. Moderate caving 3 to 13 feet.

14

15

16

17

18

19

20

KCTP3 190414H001.GPJ April 17, 2020

47° North
Cle Elum, WA

B-06

Logged by: TG

Approved by: CJK

associated earth sciences incorporated

Project No. 190414H001

10/23/19

EXPLORATION PIT NO. EP-38

Depth (ft)	This log is part of the report prepared by Associated Earth Sciences, Inc. (AESI) for the named project and should be read together with that report for complete interpretation. This summary applies only to the location of this trench at the time of excavation. Subsurface conditions may change at this location with the passage of time. The data presented are a simplfication of actual conditions encountered. **DESCRIPTION**
	Forest Duff / Topsoil
1	**Outwash**
2	Medium dense, dry to slightly moist, light brown to light brownish gray, very fine to coarse sandy, GRAVEL, some silt; frequent cobbles; minor rootlets; faintly stratified (GW-GM).
3	
4	Moderately stratified at 4 feet.
5	
6	
7	
8	Becomes slightly moist to moist and trace silt (GW) at 8 feet.
9	
10	Increases to some silt (GW-GM) at 10 feet.
11	
12	Color turns darker with less silt (GW) at 12 feet.
13	
14	Becomes some silt (GW-GM) 13 to 14 feet.
15	Bottom of exploration pit at depth 14 feet No seepage. Minor caving 0 to 2 feet. Moderate caving 2 to 14 feet.
16	
17	
18	
19	
20	

47° North
Cle Elum, WA

B-06

Logged by: TG

Approved by: CJK

associated earth sciences incorporated

Project No. 190414H001

10/23/19

KCTP3 190414H001.GPJ April 17, 2020

EXPLORATION PIT NO. EP-39

Depth (ft)

This log is part of the report prepared by Associated Earth Sciences, Inc. (AESI) for the named project and should be read together with that report for complete interpretation. This summary applies only to the location of this trench at the time of excavation. Subsurface conditions may change at this location with the passage of time. The data presented are a simplfication of actual conditions encountered.

DESCRIPTION

Forest Duff / Topsoil

1

Outwash

2

Medium dense, dry to slightly moist, light brown, very fine sandy, silty, GRAVEL; frequent cobbles; minor rootlets; faintly stratified (GM).

3

4

5

6

Color turns more gray, becomes medium to coarse sand and moderately stratified at ~6 feet.

7

Becomes some silt (GW) at 7 to 8 feet.

8

9

10

Increased moisture, color turns darker and less silt (GW) at 10 feet.

11

12

13

Becomes moist to very moist at 13 feet.

14

15

Bottom of exploration pit at depth 15 feet
No seepage. Minor caving 0 to 2 feet. Moderate caving 2 to 15 feet.

16

17

18

19

20

KCTP3 190414H001.GPJ April 17, 2020

47° North
Cle Elum, WA

B-06

Logged by: TG

Approved by: CJK

associated earth sciences incorporated

Project No. 190414H001

10/23/19

EXPLORATION PIT NO. EP-40

Depth (ft)	This log is part of the report prepared by Associated Earth Sciences, Inc. (AESI) for the named project and should be read together with that report for complete interpretation. This summary applies only to the location of this trench at the time of excavation. Subsurface conditions may change at this location with the passage of time. The data presented are a simplfication of actual conditions encountered. **DESCRIPTION**
	Topsoil
1	**Loess**
2	
3	Loose, dry to slightly moist, light brown to brown, SILT, some fine to medium sand; minor rootlets; non-cohesive (ML).
4	**Outwash**
5	Medium dense, slightly moist to moist, light brown to light brownish gray, very fine to medium sandy, gravelly, SILT; minor rootlets; unsorted (ML).
6	
7	
8	Dense, moist, light brownish gray with minor oxidation, very silty, gravelly, fine to medium SAND, some coarse sand (SM).
9	
10	
11	Ranges to sandy, silty, GRAVEL (GM).
12	Occasional boulders (up to ~4 feet in diameter) 11 to 12 feet.
13	Bottom of exploration pit at depth 12.5 feet No seepage. No caving.
14	
15	
16	
17	
18	
19	
20	

47° North
Cle Elum, WA

B-06

Logged by: TG

Approved by: CJK

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Project No. 190414H001

10/24/19

KCTP3 190414H001.GPJ April 17, 2020

EXPLORATION PIT NO. EP-41

Depth (ft)

This log is part of the report prepared by Associated Earth Sciences, Inc. (AESI) for the named project and should be read together with that report for complete interpretation. This summary applies only to the location of this trench at the time of excavation. Subsurface conditions may change at this location with the passage of time. The data presented are a simplfication of actual conditions encountered.

DESCRIPTION

Gravelly Topsoil

1

Alpine Till

2 Medium dense, moist, grayish brown to brown, very silty, SAND, some gravel (SM).

3

4 Becomes dense to very dense below 3.5 feet.

5

6

Outwash

7 Medium dense to dense, slightly moist, sandy, silty, GRAVEL; stratified (GM).

8

9

10

11

12

13

14

15

16 Bottom of exploration pit at depth 15 feet
No seepage. No caving.

17

18

19

20

47° North
Cle Elum, WA

B-06

Logged by: TJP

Approved by: CJK

associated earth sciences incorporated

Project No. 190414H001

10/24/19

KCTP3 190414H001.GPJ April 17, 2020

EXPLORATION PIT NO. EP-42

Depth (ft)

This log is part of the report prepared by Associated Earth Sciences, Inc. (AESI) for the named project and should be read together with that report for complete interpretation. This summary applies only to the location of this trench at the time of excavation. Subsurface conditions may change at this location with the passage of time. The data presented are a simplfication of actual conditions encountered.

DESCRIPTION

Topsoil

1

Loess

Very stiff, moist, tan, fine sandy, SILT (ML).

2

Alpine Till

Medium dense, slightly moist, very silty, SAND, some gravel; non stratified (SM).

3

4

Becomes gravelly below 4 feet.

5

6

7

8

Becomes medium dense to dense below ~8 feet.

9

10

Contains scattered cobbles and boulders and becomes very dense below ~10 feet.

11

12

13

14

Bottom of exploration pit at depth 14 feet
No seepage. No caving.

15

16

17

18

19

20

KCTP3 190414H001.GPJ April 17, 2020

47° North
Cle Elum, WA

B-06

Logged by: TJP

Approved by: CJK

associated earth sciences incorporated

Project No. 190414H001

10/24/19

EXPLORATION PIT NO. EP-43

Depth (ft)	This log is part of the report prepared by Associated Earth Sciences, Inc. (AESI) for the named project and should be read together with that report for complete interpretation. This summary applies only to the location of this trench at the time of excavation. Subsurface conditions may change at this location with the passage of time. The data presented are a simplfication of actual conditions encountered. **DESCRIPTION**
	Topsoil
1	**Loess**
2	Loose, slightly moist to moist, light brown to brown, SILT, some fine sand; minor rootlets; non-cohesive (ML).
3	**Outwash**
4	Medium dense, slightly moist, light brown, very fine to medium sandy, GRAVEL, some silt; minor rootlets; frequent cobbles; moderately stratified (GW-GM).
5	
6	
7	
8	Color turns more brownish gray, more coarse sand, and frequent large cobbles (up to ~24 inches in diameter).
9	
10	
11	
12	
13	
14	Moisture increases and more fine gravel at 13 feet.
15	Bottom of exploration pit at depth 14 feet No seepage. Minimal caving 0 to 3 feet. Moderate caving 3 to 14 feet.
16	
17	
18	
19	
20	

47° North
Cle Elum, WA

B-06

Logged by: TG

Approved by: CJK

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Project No. 190414H001

10/24/19

KCTP3 190414H001.GPJ April 17, 2020

EXPLORATION PIT NO. EP-44

Depth (ft)	This log is part of the report prepared by Associated Earth Sciences, Inc. (AESI) for the named project and should be read together with that report for complete interpretation. This summary applies only to the location of this trench at the time of excavation. Subsurface conditions may change at this location with the passage of time. The data presented are a simplfication of actual conditions encountered. **DESCRIPTION**
1	**Topsoil**
2	**Alpine Till**
3	Medium dense, slightly moist to moist, light brownish gray, sandy, SILT, some gravel; minor rootlets; unsorted (ML).
4	
5	Becomes moist, darker brown, and harder digging at 5 feet.
6	
7	
8	Dense, moist, brownish gray, very silty, gravelly, fine to coarse SAND; occasional cobbles; unsorted (SM).
9	
10	
11	
12	
13	Becomes very sandy.
14	
15	Bottom of exploration pit at depth 14 feet No seepage. No caving.
16	
17	
18	
19	
20	

47° North
Cle Elum, WA

B-06

Logged by: TG

Approved by: CJK

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Project No. 190414H001

10/24/19

KCTP3 190414H001.GPJ April 17, 2020

EXPLORATION PIT NO. EP-45

Depth (ft)	This log is part of the report prepared by Associated Earth Sciences, Inc. (AESI) for the named project and should be read together with that report for complete interpretation. This summary applies only to the location of this trench at the time of excavation. Subsurface conditions may change at this location with the passage of time. The data presented are a simplfication of actual conditions encountered. **DESCRIPTION**
	Topsoil
1	**Loess**
2	Very stiff, slightly moist to moist, SILT; non-plastic (ML).
3	
4	**Outwash**
5	Moist, tan, very gravelly, silty, SAND (SM).
6	
7	
8	Medium dense, slightly moist, grayish tan, very sandy, GRAVEL, trace to some silt; stratified (GM-GW).
9	
10	Becomes slightly more moist and grayish brown with trace silt below 10 feet (GW).
11	
12	Contains abundant cobbles and scattered small boulders and becomes moist below 12 feet.
13	Becomes very moist below 13 feet.
14	
15	Trace clay below 15 feet; sticky.
16	Bottom of exploration pit at depth 15.5 feet No seepage. No caving.
17	
18	
19	
20	

47° North
Cle Elum, WA

B-06

Logged by: TJP

Approved by: CJK

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Project No. 190414H001

10/24/19

KCTP3 190414H001.GPJ April 17, 2020

EXPLORATION PIT NO. EP-46

Depth (ft)

This log is part of the report prepared by Associated Earth Sciences, Inc. (AESI) for the named project and should be read together with that report for complete interpretation. This summary applies only to the location of this trench at the time of excavation. Subsurface conditions may change at this location with the passage of time. The data presented are a simplfication of actual conditions encountered.

DESCRIPTION

Topsoil

1

Loess

Very stiff, slightly moist to moist, tan to brown, SILT, trace gravel; non-plastic (ML).

2

3

4

Outwash

Medium dense, slightly moit, tan, silty, GRAVEL, some sand (GM).

5

6

7

8

9

10

Medium dense, slightly moist, grayish brown, very sandy, GRAVEL, trace silt; stratified (GW).

11

Medium dense, moist to very moist, brown, gravelly, very silty, SAND; till-like (SM).

12

13

14

Medium dense, wet, grayish brown, very gravelly, fine to medium SAND, trace silt (SP).

15

Bottom of exploration pit at depth 15 feet
No seepage. Minor caving throughout.

16

17

18

19

20

KCTP3 190414H001.GPJ April 17, 2020

47° North
Cle Elum, WA

B-06

Logged by: TJP

Approved by: CJK

associated earth sciences incorporated

Project No. 190414H001

10/24/19

EXPLORATION PIT NO. EP-47

Depth (ft)	This log is part of the report prepared by Associated Earth Sciences, Inc. (AESI) for the named project and should be read together with that report for complete interpretation. This summary applies only to the location of this trench at the time of excavation. Subsurface conditions may change at this location with the passage of time. The data presented are a simplfication of actual conditions encountered. **DESCRIPTION**
1	**Topsoil**
2	**Loess** Loose, slightly moist, light brown to brown, SILT, trace fine sand; minor rootlets; non-cohesive (ML).
3	**Outwash**
4	Medium dense, dry to slightly moist, light brown, very fine to coarse sandy, GRAVEL, trace silt; moderately stratified (GW).
5	Turns to gravelly, fine to medium sand with trace silt (SP).
6	
7	Medium dense, moist, light brown to tan, silty, fine SAND, trace medium sand; stratified (SM).
8	
9	
10	Medium dense to dense, moist, brown to brownish gray, very silty, very gravelly, fine to coarse SAND (SM) ranging to silty, GRAVEL (GM); unsorted; till-like.
11	
12	Medium dense, moist to very moist, brownish gray to dark brownish gray, silty, very sandy, GRAVEL; gravels are silt/clay coated; moderately stratified (GM).
13	
14	Bottom of exploration pit at depth 13 feet No seepage. Minimal caving 0 to 10 feet. Moderate caving 10 to 13 feet.
15	
16	
17	
18	
19	
20	

47° North
Cle Elum, WA

B-06
Logged by: TG
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Project No. 190414H001

10/24/19

KCTP3 190414H001.GPJ April 17, 2020

LEGEND

- Sandy gravel with cobbles
- Sandy gravel
- Poorly sorted sand
- Well sorted sand
- Bedrock
- Diamicton
- Peat
- Silt-clay
- Silt

Project Name: Mountain Star
Project Number: KG97186D
Drilling Method: Tubex Air-Rotary, Portadrill Rig/IRT3W
Sampling Method: Grab
Elevation: 2161.54'
Boring Diameter: 6 inch
Drilling Contractor: Bach Drilling Company/Cascade Drilling, Inc.
Page 1 of 5 Boring No. *OW-1*

Water Level	169.00'	171.42	
Date	12/11/97	10/7/98	
Time	3:45 pm	1051	

Strata	Depth	Description	Well Compl..
		Brown SAND with silt, occasional gravel	*Bentonite slurry sanitary surface seal*
	10	Brown, silty, sandy, sub-rounded GRAVEL (Glacial Outwash)	*10" borehole 0 - 18'*
	20	Brown, sandy, sub-rounded GRAVEL with silt	
		grades to gray	*6" Steel Casing*
	30		
	40	occasional cobbles	
	50	Gray, rounded GRAVEL with sand and silt	

NOTES: X = sample location

Drilling started: November 7, 1997 (Bach Drilling)
Well completed: November 18, 1997 (Bach Drilling)

Heave (native sand) detected in well.
Well rehibilitation started: August 25, 1998 (Cascade Drilling)
Well reconstruction completed: August 26, 1998 (Cascade Drilling)

ASSOCIATED EARTH SCIENCES, INC

B-06

Drilling Log

LEGEND

- Sandy gravel with cobbles
- Sandy gravel
- Poorly sorted sand
- Well sorted sand
- Bedrock
- Diamicton
- Peat
- Silt-clay
- Silt

Project Name: Mountain Star
Project Number: KG97186D
Drilling Method: Tubex Air-Rotary, Portadrill Rig/IRT3W
Sampling Method: Grab
Elevation: 2161.54'
Boring Diameter: 6 inch
Drilling Contractor: Bach Drilling Company/Cascade Drilling, Inc.

Boring No. *OW-1*

Water Level	
Date	
Time	

Strata	Depth	Description	Well Compl..
	X 60		
	X 70		6" Steel Casing →
	X 80	Gray, rounded GRAVEL with sand	
	X 90	grading to gray SAND with gravel	
	X 100	Gray, rounded GRAVEL with sand	

NOTES: X = sample location

ASSOCIATED EARTH SCIENCES, INC

B-06

Drilling Log

LEGEND

- Sandy gravel with cobbles
- Sandy gravel
- Poorly sorted sand
- Well sorted sand
- Bedrock
- Diamicton
- Peat
- Silt-clay
- Silt

Project Name: Mountain Star
Project Number: KG97186D
Drilling Method: Tubex Air-Rotary, Portadrill Rig/IRT3W
Sampling Method: Grab
Elevation: 2161.54'
Boring Diameter: 6 inch
Drilling Contractor: Bach Drilling Company/Cascade Drilling Inc.
Page 3 of 5 Boring No. *OW-1*

Water Level	
Date	
Time	

Strata	Depth	Description	Well Compl..
		Gray SAND with gravel	
	110	Gray, sub-rounded GRAVEL with sand	
		Gray, sandy, sub-rounded GRAVEL	*6" Steel Casing* →
	120	Gray, sub-rounded GRAVEL with silt and sand	
		Gray, fine to medium SAND with gravel, trace silt	
	130	Gray, fine to medium SAND with trace gravel	
		Gray, rounded GRAVEL with sand	
	140	grading to gray, sandy, sub-rounded GRAVEL	
	150		

NOTES: X = sample location

ASSOCIATED EARTH SCIENCES, INC

B-06

Drilling Log

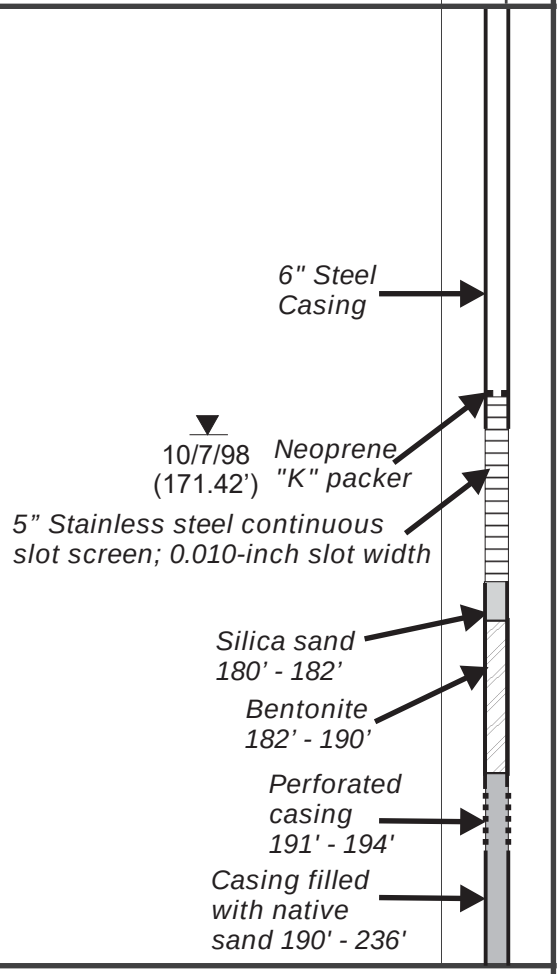
LEGEND

- Sandy gravel with cobbles
- Sandy gravel
- Poorly sorted sand
- Well sorted sand
- Bedrock
- Diamicton
- Peat
- Silt-clay
- Silt

Project Name: Mountain Star
Project Number: KG97186D
Drilling Method: Tubex Air-Rotary, Portadrill Rig/IRT3W
Sampling Method: Grab
Elevation: 2161.54'
Boring Diameter: 6 inch
Drilling Contractor: Bach Drilling Company/Cascade Drilling Inc.
Page 4 of 5 **Boring No.** *OW-1*

Water Level	
Date	
Time	

Strata	Depth	Description	Well Compl..
	160	Gray, medium to coarse SAND, trace small gravel	
		grading to fine to medium SAND	
	170	Gray, sandy, sub-rounded GRAVEL	
	180	Brownish-gray, fine SAND	
	190		
	200		



NOTES: X = sample location

Bottom of casing filled with native fine sand with silt due to "heaving" soil conditions.
Casing cut at 180' and lifted to 172' to recomplete the well. Well screen interval: 170' - 180'.

ASSOCIATED EARTH SCIENCES, INC

B-06

Drilling Log

LEGEND

- Sandy gravel with cobbles
- Sandy gravel
- Poorly sorted sand
- Well sorted sand
- Bedrock
- Diamicton
- Peat
- Silt-clay
- Silt

Project Name: Mountain Star
Project Number: KG97186D
Drilling Method: Tubex Air-Rotary, Portadrill Rig/IRT3W
Sampling Method: Grab
Elevation: 2161.54'
Boring Diameter: 6 inch
Drilling Contractor: Bach Drilling Company/Cascade Drilling Inc.
Page 5 of 5 Boring No. *OW-1*

Water Level	
Date	
Time	

Strata	Depth	Description	Well Compl..
	210	Brownish-gray, very fine to fine SAND, trace silt	
	220	Brownish-gray, sandy SILT (Glaciolacustrine Deposits)	*6" Steel casing filled with native sand*
	230	Brownish-gray, silty, fine SAND	
	240	BOH @ 236'	*Open bottom*
	250		

NOTES: X = sample location
Bottom of casing filled with native fine sand with silt due to "heaving" soil conditions.

ASSOCIATED EARTH SCIENCES, INC

Drilling Log

LEGEND

- Sandy gravel with cobbles
- Sandy gravel
- Poorly sorted sand
- Well sorted sand
- Bedrock
- Diamicton
- Peat
- Silt-clay
- Silt

Project Name: Mountain Star
Project Number: KG97186D
Drilling Method: Air Rotary (IR T3W)
Sampling Method: Grab
Elevation: 2244.28'
Boring Diameter: 6 inch
Drilling Contractor: Cascade Drilling Inc.
Page 1 of 7 Boring No. *OW-4*

Water Level	229'	223.06'
Date	8/27/98	10/8/98
Time	1745	

Strata	Depth	Description	Well Compl..
		Damp, brown, gravelly SAND with silt; grades to sandy, sub-rounded GRAVEL with silt.	*Bentonite slurry sanitary surface seal*
	10	becomes moist, occasional cobbles and boulders	*10" borehole 0 - 30'*
	20	Damp, brown, silty, sandy, sub-rounded GRAVEL, occasional cobbles and boulders	
	30	Moist, brown, sandy, sub-rounded GRAVEL with silt, occasional cobbles and boulders	
		Moist, brown, sandy, sub-rounded GRAVEL with silt	*6" Steel Casing*
	40	grades to gray	
		boulder at 48'	
	50	decreasing sand content	

NOTES: X = sample location
Drilling started August 10, 1998
Well completed August 31, 1998

ASSOCIATED EARTH SCIENCES, INC

B-06

Drilling Log

LEGEND

- Sandy gravel with cobbles
- Sandy gravel
- Poorly sorted sand
- Well sorted sand
- Bedrock
- Diamicton
- Peat
- Silt-clay
- Silt

Project Name: Mountain Star
Project Number: KG97186D
Drilling Method: Air-Rotary (IR T3W)
Sampling Method: Grab
Elevation: 2244.28'
Boring Diameter: 6 inch
Drilling Contractor: Cascade Drilling Inc.
Page 2 of 7 Boring No. *OW-4*

Water Level		
Date		
Time		

Strata	Depth	Description	Well Compl..
		Moist, gray, sub-rounded GRAVEL with sand and silt	
	60		*6" Steel Casing* →
		grades to trace silt	
	70		
	80		
	90		
	100		

NOTES: X = sample location

ASSOCIATED EARTH SCIENCES, INC

B-06

Drilling Log

LEGEND

- Sandy gravel with cobbles
- Sandy gravel
- Poorly sorted sand
- Well sorted sand
- Bedrock
- Diamicton
- Peat
- Silt-clay
- Silt

Project Name: Mountain Star
Project Number: KG97186D
Drilling Method: Air Rotary (IR T3W)
Sampling Method: Grab
Elevation: 2244.28'
Boring Diameter: 6 inch
Drilling Contractor: Cascade Drilling Inc.
Page 3 of 7 Boring No. *OW-4*

Water Level		
Date		
Time		

Strata	Depth	Description	Well Compl..
	110	Gray, sub-rounded GRAVEL with sand, trace silt	*6" Steel Casing* →
	120		
	130		
	140		
	150		

NOTES: X = sample location

ASSOCIATED EARTH SCIENCES, INC

B-06

Drilling Log

LEGEND

- Sandy gravel with cobbles
- Sandy gravel
- Poorly sorted sand
- Well sorted sand
- Bedrock
- Diamicton
- Peat
- Silt-clay
- Silt

Project Name: Mountain Star
Project Number: KG97186D
Drilling Method: Air Rotary (IR T3W)
Sampling Method: Grab
Elevation: 2244.28'
Boring Diameter: 6 inch
Drilling Contractor: Cascade Drilling Inc.
Page 4 of 7 Boring No. *OW-4*

Water Level		
Date		
Time		

Strata	Depth	Description	Well Compl..
	160	Gray, sandy, sub-rounded GRAVEL, trace silt	*6" Steel Casing* →
		Gray, sub-rounded GRAVEL with sand, trace silt	
	170		
	180		
	190	thin lense of tan silty gravel with sand 195' - 196'	
	200	Gray, gravelly, medium to coarse SAND, trace silt	

NOTES: X = sample location

ASSOCIATED EARTH SCIENCES, INC

Drilling Log

LEGEND

- Sandy gravel with cobbles
- Sandy gravel
- Poorly sorted sand
- Well sorted sand
- Bedrock
- Diamicton
- Peat
- Silt-clay
- Silt

Project Name: Mountain Star
Project Number: KG97186D
Drilling Method: Air Rotary (IR T3W)
Sampling Method: Grab
Elevation: 2244.28'
Boring Diameter: 6 inch
Drilling Contractor: Cascade Drilling Inc.
Page 5 of 7 Boring No. *OW-4*

Water Level		
Date		
Time		

Strata	Depth	Description	Well Compl..
		decreasing gravel content	
	210	Gray, fine to medium SAND, occasional gravel, trace silt	*6" Steel Casing*
		Tan-gray, silty, fine SAND.	
	220		10/8/98 (223.06')
	230	Gray, fine to medium SAND with silt	
	240	Gray, fine to medium SAND, trace silt	*Bottom of casing at 244'*
			Neoprene "K" packer
		Tan, fine SAND.	*5" Stainless steel continuous slot screen; 0.010 slot width*
	250		

NOTES: X = sample location

Casing extends to 244.
Well screen interval: 242.5' - 252.5'.

ASSOCIATED EARTH SCIENCES, INC

B-06

Drilling Log

LEGEND

- Sandy gravel with cobbles
- Sandy gravel
- Poorly sorted sand
- Well sorted sand
- Bedrock
- Diamicton
- Peat
- Silt-clay
- Silt

Project Name: Mountain Star
Project Number: KG97186D
Drilling Method: Air Rotary (IR T3W)
Sampling Method: Grab
Elevation: 2244.28'
Boring Diameter: 6 inch
Drilling Contractor: Cascade Drilling Inc.
Page 6 of 7 Boring No. *OW-4*

Water Level		
Date		
Time		

Strata	Depth	Description	Well Compl..
	260	increasing silt content	
		Gray, silty, fine SAND	
X	270		
X			
	280		
X		Gray, sandy SILT	
	290	occasional wood fragments	
X			
	300		

Borehole collapsed to 252-1/2'

NOTES: X = sample location

ASSOCIATED EARTH SCIENCES, INC

B-06

Drilling Log

LEGEND

- Sandy gravel with cobbles
- Sandy gravel
- Poorly sorted sand
- Well sorted sand
- Bedrock
- Diamicton
- Peat
- Silt-clay
- Silt

Project Name: Mountain Star
Project Number: KG97186D
Drilling Method: Air Rotary (IR T3W)
Sampling Method: Grab
Elevation: 2244.28'
Boring Diameter: 6 inch
Drilling Contractor: Cascade Drilling Inc.
Page 7 of 7 Boring No. *OW-4*

Water Level		
Date		
Time		

Strata	Depth	Description	Well Compl..
	310	Gray SILT/CLAY (Glaciolacustrine Deposits)	
	320	*Borehole collapsed to 252-1/2'* →	
	330		
	340	BOH @ 330' on 8/17/98	
	350		

NOTES: X = sample location

ASSOCIATED EARTH SCIENCES, INC

Drilling Log

LEGEND

- Sandy gravel with cobbles
- Sandy gravel
- Poorly sorted sand
- Well sorted sand
- Bedrock
- Diamicton
- Peat
- Silt-clay
- Silt

Project Name: Mountain Star
Project Number: KG97186D
Drilling Method: Air-Rotary (IR T3W)
Sampling Method: Grab
Elevation: 2197.24'
Boring Diameter: 6 inch
Drilling Contractor: Cascade Drilling Inc.
Page 1 of 5 Boring No. *OW-5*

Water Level	154.5'	151.91'
Date	8/27/98	10/7/98
Time	1720	1041

Strata	Depth	Description	Well Compl..
		Damp, brown, sandy, sub-rounded GRAVEL with silt, occasional cobbles and boulders.	*Bentonite slurry sanitary surface seal*
	10		*10" borehole 0 - 20'*
	20	Moist, gray to brown, sub-rounded GRAVEL with sand and silt.	
		increasing sand content	
	30	Moist, brown to gray, sandy, sub-rounded GRAVEL with silt	*6" Steel Casing*
		Moist, gray, gravelly, medium SAND with silt	
	40	Moist, gray, sandy, sub-rounded GRAVEL with silt	
	50		

NOTES: X = sample location
Drilling started: August 17, 1998
Well completed: September 3, 1998

ASSOCIATED EARTH SCIENCES, INC

B-06

Drilling Log

LEGEND

- Sandy gravel with cobbles
- Sandy gravel
- Poorly sorted sand
- Well sorted sand
- Bedrock
- Diamicton
- Peat
- Silt-clay
- Silt

Project Name: Mountain Star
Project Number: KG97186D
Drilling Method: Air-Rotary (IR T3W)
Sampling Method: Grab
Elevation: 2197.24'
Boring Diameter: 6 inch
Drilling Contractor: Cascade Drilling Inc.
Page 2 of 5 Boring No. *OW-5*

Water Level	
Date	
Time	

Strata	Depth	Description	Well Compl..
	60		6" Steel Casing
	70		
	80	Gray, sub-rounded GRAVEL with sand, trace silt	
	90		
	100		

NOTES: X = sample location

ASSOCIATED EARTH SCIENCES, INC

B-06

Drilling Log

LEGEND

- Sandy gravel with cobbles
- Sandy gravel
- Poorly sorted sand
- Well sorted sand
- Bedrock
- Diamicton
- Peat
- Silt-clay
- Silt

Project Name: Mountain Star
Project Number: KG97186D
Drilling Method: Air-Rotary (IR T3W)
Sampling Method: Grab
Elevation: 2197.24'
Boring Diameter: 6 inch
Drilling Contractor: Cascade Drilling Inc.
Page 3 of 5 Boring No. *OW-5*

Water Level		
Date		
Time		

Strata	Depth	Description	Well Compl..
	110	increasing sand and silt content	*6" Steel Casing to 160'*
	120	decreasing sand and silt content	
	130	Gray, medium SAND, occasional gravel, trace silt	
	140	increasing gravel and silt contect	
		Gray, gravelly, medium SAND with silt	
	150	Gray, sandy, sub-rounded GRAVEL, trace silt	*Perforated casing (148' - 158')*

NOTES: X = sample location
Perforated casing: 148'-158'.

ASSOCIATED EARTH SCIENCES, INC

B-06

Drilling Log

LEGEND

- Sandy gravel with cobbles
- Sandy gravel
- Poorly sorted sand
- Well sorted sand
- Bedrock
- Diamicton
- Peat
- Silt-clay
- Silt

Project Name: Mountain Star
Project Number: KG97186D
Drilling Method: Air-Rotary (IR T3W)
Sampling Method: Grab
Elevation: 2197.24'
Boring Diameter: 6 inch
Drilling Contractor: Cascade Drilling Inc.
Page 4 of 5 Boring No. *OW-5*

Water Level		
Date		
Time		

Strata	Depth	Description	Well Compl..
		10/7/98 (151.91')	*Perforated Casing 148' - 158'*
		Tan-gray, silty, sub-rounded GRAVEL with sand	
	160	Gray silt/clay	*Silica sand 160' - 162'*
			Bentonite 162' - 166-1/2'
		Gray, gravelly SILT with sand	
	170		
		boulder at 175'-177'	
	180	Gray, sandy SILT with gravel	
			Borehole collapsed to 166-1/2'
	190		
	200		

NOTES: X = sample location

Casing perforated: 148' - 158'
Casing extends to 160'.
Drilled open-hole air rotary from 160' to 230'.

ASSOCIATED EARTH SCIENCES, INC

B-06

Drilling Log

LEGEND

- Sandy gravel with cobbles
- Sandy gravel
- Poorly sorted sand
- Well sorted sand
- Bedrock
- Diamicton
- Peat
- Silt-clay
- Silt

Project Name: Mountain Star
Project Number: KG97186D
Drilling Method: Air-Rotary (IR T3W)
Sampling Method: Grab
Elevation: 2197.24'
Boring Diameter: 6 inch
Drilling Contractor: Cascade Drilling Inc.
Page 5 of 5 Boring No. *OW-5*

Water Level		
Date		
Time		

Strata	Depth	Description	Well Compl..
	210	*Borehole collapsed to 166-1/2'* →	
		Brown to gray, gravelly, sandy SILT	
	220		
	230		
		BOH @ 230'	
	240		
	250		

NOTES: X = sample location
BOH @ 230' on 8/18/98

ASSOCIATED EARTH SCIENCES, INC

B-06

Drilling Log

LEGEND

- Sandy gravel with cobbles
- Sandy gravel
- Poorly sorted sand
- Well sorted sand
- Bedrock
- Diamicton
- Peat
- Silt-clay
- Silt

Project Name: Mountain Star
Project Number: KG97186D
Drilling Method: Air-Rotary (IR T3W)
Sampling Method: Grab
Elevation: Approx. 2041.73'
Boring Diameter: 6 inch
Drilling Contractor: Cascade Drilling Inc.
Page 1 of 4 Boring No. *OW-7*

Water Level	105.6	112.12'
Date	8/27/98	10/8/98
Time	1820	0730

Strata	Depth	Description	Well Compl..
		Damp, brown, sandy, sub-rounded GRAVEL with silt	*Bentonite slurry sanitary surface seal*
	10		
		Moist, gray to brown, sandy, sub-rounded GRAVEL with silt, occasional cobbles	*10" borehole 0 - 20'*
	20		
		grades to gray	
	30		
			6" Steel Casing
	40		
	50		

NOTES: X = sample location
Drilling started: August 19, 1998
Well completed: August 20, 1998

ASSOCIATED EARTH SCIENCES, INC

B-06

Drilling Log

LEGEND

- Sandy gravel with cobbles
- Sandy gravel
- Poorly sorted sand
- Well sorted sand
- Bedrock
- Diamicton
- Peat
- Silt-clay
- Silt

Project Name: Mountain Star
Project Number: KG97186D
Drilling Method: Air-Rotary (IR T3W)
Sampling Method: Grab
Elevation: Approx. 2041.73'
Boring Diameter: 6 inch
Drilling Contractor: Cascade Drilling Inc.
Page 2 of 4 Boring No. *OW-7*

Water Level	
Date	
Time	

Strata	Depth	Description	Well Compl..
	60	Gray, sub-rounded GRAVEL with sand, trace silt	
	70		6" Steel Casing →
	80		
	90		
	100		

NOTES: X = sample location

ASSOCIATED EARTH SCIENCES, INC

B-06

Drilling Log

LEGEND

- Sandy gravel with cobbles
- Sandy gravel
- Poorly sorted sand
- Well sorted sand
- Bedrock
- Diamicton
- Peat
- Silt-clay
- Silt

Project Name: Mountain Star
Project Number: KG97186D
Drilling Method: Air-Rotary (IR T3W)
Sampling Method: Grab
Elevation: Approx. 2041.73'
Boring Diameter: 6 inch
Drilling Contractor: Cascade Drilling Inc.
Page 3 of 4 Boring No. *OW-7*

Water Level	
Date	
Time	

Strata	Depth	Description	Well Compl..
		Gray to brown, sub-rounded GRAVEL with sand and silt (Older Glacial Deposits)	
	110		
		10/8/98 (112.12')	
	120	saturated	
		6" Steel Casing →	
	130		
	140		
		Saturated, gray to brown, sandy, sub-rounded GRAVEL with silt	
	100		

NOTES: X = sample location

ASSOCIATED EARTH SCIENCES, INC

B-06

Drilling Log

LEGEND

- Sandy gravel with cobbles
- Sandy gravel
- Poorly sorted sand
- Well sorted sand
- Bedrock
- Diamicton
- Peat
- Silt-clay
- Silt

Project Name: Mountain Star
Project Number: KG97186D
Drilling Method: Air-Rotary (IR T3W)
Sampling Method: Grab
Elevation: Approx. 2041.73'
Boring Diameter: 6 inch
Drilling Contractor: Cascade Drilling Inc.
Page 4 of 4 Boring No. *OW-7*

Water Level	
Date	
Time	

Strata	Depth	Description	Well Compl..
	160	Brown to gray, medium to coarse SAND with gravel and silt	
		grades to medium sand	
	170	Gray, gravelly, medium to coarse SAND with silt	
	180	Brown to gray, fine to medium, micaceous SAND with gravel and silt	
	190		
	200	BOH @ 198'	

6" Steel Casing

Neoprene "K" packer

Bottom of casing at 191'

5" Stainless steel continuous slot screen; 0.010-inch slot width

X

NOTES: X = sample location

Well screen interval: 188' - 198'.

ASSOCIATED EARTH SCIENCES, INC

B-06

Drilling Log

LEGEND

- Sandy gravel with cobbles
- Sandy gravel
- Poorly sorted sand
- Well sorted sand
- Bedrock
- Diamicton
- Peat
- Silt-clay
- Silt

Project Name: Mountain Star
Project Number: KG97186D
Drilling Method: Air-Rotary (IR T3W)
Sampling Method: Grab
Elevation: Approx. 2049.62'
Boring Diameter: 6 inch
Drilling Contractor: Cascade Drilling Inc.
Page 1 of 4 Boring No. *OW-8*

Water Level	128.5	116.52'
Date	8/27/98	10/8/98
Time	1810	0715

Strata	Depth	Description	Well Compl..
		Damp, brown, sandy, sub-rounded GRAVEL with silt, occasional cobbles, and boulders	*Bentonite slurry surface seal*
	10		
		Moist, brown, silty, sandy, sub-rounded GRAVEL	*10" borehole 0 - 30'*
	20	Moist, brown, sandy, sub-rounded GRAVEL with silt, occasional cobbles and boulders	
		grades to gray	
	30	no boulders	*6" Steel Casing*
	40		
	50		

NOTES: X = sample location
Drilling started: August 20, 1998
Well completed: August 24, 1998

ASSOCIATED EARTH SCIENCES, INC

B-06

Drilling Log

LEGEND

- Sandy gravel with cobbles
- Sandy gravel
- Poorly sorted sand
- Well sorted sand
- Bedrock
- Diamicton
- Peat
- Silt-clay
- Silt

Project Name: Mountain Star
Project Number: KG97186D
Drilling Method: Air-Rotary (IR T3W)
Sampling Method: Grab
Elevation: Approx. 2049.62'
Boring Diameter: 6 inch
Drilling Contractor: Cascade Drilling Inc.
Page 2 of 4 Boring No. *OW-8*

Water Level	
Date	
Time	

Strata	Depth	Description	Well Compl..
		Gray, sandy, sub-rounded GRAVEL with silt	
	60		
	70	Tan to gray, fine SAND with silt, occasional gravel (Older Glacial Deposits)	*6" Steel Casing* →
		Gray, silty, fine SAND	
	80		
	90	Gray, sandy SILT	
	100	occasional wood fragments	

NOTES: X = sample location

ASSOCIATED EARTH SCIENCES, INC

B-06

Drilling Log

LEGEND

- Sandy gravel with cobbles
- Sandy gravel
- Poorly sorted sand
- Well sorted sand
- Bedrock
- Diamicton
- Peat
- Silt-clay
- Silt

Project Name: Mountain Star
Project Number: KG97186D
Drilling Method: Air-Rotary (IR T3W)
Sampling Method: Grab
Elevation: Approx. 2049.62'
Boring Diameter: 6 inch
Drilling Contractor: Cascade Drilling Inc.
Page 3 of 4 Boring No. *OW-8*

Water Level	
Date	
Time	

Strata	Depth	Description	Well Compl..
		Gray, silty CLAY	
	110		
	120		
	130		
	140	Gray, sandy, silty CLAY	
		Gray, silty CLAY with gravel, occasional sand (Lodgement Till)	
	100		

10/8/98
(116.52')

6" Steel Casing

NOTES: X = sample location

ASSOCIATED EARTH SCIENCES, INC

B-06

Drilling Log

LEGEND

- Sandy gravel with cobbles
- Sandy gravel
- Poorly sorted sand
- Well sorted sand
- Bedrock
- Diamicton
- Peat
- Silt-clay
- Silt

Project Name: Mountain Star
Project Number: KG97186D
Drilling Method: Air-Rotary (IR T3W)
Sampling Method: Grab
Elevation: Approx. 2049.62'
Boring Diameter: 6 inch
Drilling Contractor: Cascade Drilling Inc.
Page 4 of 4 Boring No. *OW-8*

Water Level	
Date	
Time	

Strata	Depth	Description	Well Compl..
	160	Gray, silty CLAY	*6" Steel Casing*
	170	Gray, sandy SILT, occasional gravel	*Neoprene "K" packer*; *Bottom of Casing at 174-1/2'*
	180	Gray, silty, fine to medium quartz and basaltic SAND	*5" Stainless steel continuous slot screen; 0.010-inch slot width*
		BOH @ 180'	
	190		
	200		

X

NOTES: X = sample location

Well screen interval: 174' - 179'.

ASSOCIATED EARTH SCIENCES, INC

B-06

Drilling Log

LEGEND

- Sandy gravel with cobbles
- Sandy gravel
- Poorly sorted sand
- Well sorted sand
- Bedrock
- Diamicton
- Peat
- Silt-clay
- Silt

Project Name: Mountain Star
Project Number: KG97186D
Drilling Method: Air-Rotary (IR T3W)
Sampling Method: Grab
Elevation: Approx. 2162.39'
Boring Diameter: 6 inch
Drilling Contractor: Cascade Drilling Inc.
Page 1 of 4 Boring No. *OW-9*

Water Level	130.9	132.10'
Date	8/28/98	10/7/98
Time	0705	1159

Strata	Depth	Description	Well Compl..
			Bentonite slurry sanitary surface seal →
	10	Damp, brown, sandy, sub-rounded GRAVEL with silt, occasional cobbles and boulders	*10" borehole 0 - 30'* →
		increases silt content	
	20	Moist, gray, sandy, sub-rounded GRAVEL with silt	
		@ 24'-26' Moist, gray, gravelly SAND with silt	
	30	increasing silt content	
		Gray, sandy, sub-rounded GRAVEL with silt	*6" Steel Casing* →
	40		
	50		

NOTES: X = sample location
Drilling started: August 26, 1998
Well completed: August 27, 1998

ASSOCIATED EARTH SCIENCES, INC

B-06

Drilling Log

LEGEND

- Sandy gravel with cobbles
- Sandy gravel
- Poorly sorted sand
- Well sorted sand
- Bedrock
- Diamicton
- Peat
- Silt-clay
- Silt

Project Name: Mountain Star
Project Number: KG97186D
Drilling Method: Air-Rotary (IR T3W)
Sampling Method: Grab (Cyclone)
Elevation: Approx. 2162.39'
Boring Diameter: 6 inch
Drilling Contractor: Cascade Drilling Inc.
Page 2 of 4 Boring No. *OW-9*

Water Level	
Date	
Time	

Strata	Depth	Description	Well Compl..
	60	Moist, gray, sandy, sub-rounded GRAVEL with silt	
	70		*6" Steel Casing* →
	80		
	90		
	100		

NOTES: X = sample location

ASSOCIATED EARTH SCIENCES, INC

B-06

Drilling Log

LEGEND

- Sandy gravel with cobbles
- Sandy gravel
- Poorly sorted sand
- Well sorted sand
- Bedrock
- Diamicton
- Peat
- Silt-clay
- Silt

Project Name: Mountain Star
Project Number: KG97186D
Drilling Method: Air-Rotary (IR T3W)
Sampling Method: Grab
Elevation: Approx. 2162.39'
Boring Diameter: 6 inch
Drilling Contractor: Cascade Drilling Inc.
Page 3 of 4 Boring No. *OW-9*

Water Level	
Date	
Time	

Strata	Depth	Description	Well Compl..
		Moist, gray, sandy, sub-rounded GRAVEL with silt	
	110		
	120		
			6" Steel Casing →
	130	Gray, silty SAND with gravel	▼ 10/7/98 (132.10')
		Gray, sandy, sub-rounded GRAVEL with silt	
	140		
	150		

NOTES: X = sample location

ASSOCIATED EARTH SCIENCES, INC

B-06

Drilling Log

LEGEND

- Sandy gravel with cobbles
- Sandy gravel
- Poorly sorted sand
- Well sorted sand
- Bedrock
- Diamicton
- Peat
- Silt-clay
- Silt

Project Name: Mountain Star
Project Number: KG97186D
Drilling Method: Air-Rotary (IR T3W)
Sampling Method: Grab
Elevation: Approx. 2162.39'
Boring Diameter: 6 inch
Drilling Contractor: Cascade Drilling Inc.
Page 4 of 4 Boring No. *OW-9*

Water Level	
Date	
Time	

Strata	Depth	Description	Well Compl..
	160	Green-gray SILTSTONE.	Neoprene "K" packer; Bottom of casing 152'; 5" Stainless steel continuous slot screen; 0.010-inch slot width; Silica sand
		Coal	
	170	Gray/greenSILTSTONE (Roslyn Formation)	Bentonite
	180	BOH @ 180'	
	190		
	200		

X

NOTES: X = sample location

Drilled open-hole air rotary from 160' - 180'.
Well screen interval: 151' - 156'.

ASSOCIATED EARTH SCIENCES, INC

B-06

Drilling Log

EXPLORATION PIT LOG

Number EP-28-1

0 – 2	Soft, dry, reddish-brown to yellowish-brown, sandy SILT with gravel and cobbles. (Loess and Glacial Outwash)
2 – 4	Loose to medium dense, dry, reddish-brown to brown, sandy GRAVEL with cobbles, few boulders; poorly sorted. (Glacial Outwash)
4 – 12	Medium dense, dry grading to moist, yellowish-brown to brown, silty, sandy GRAVEL with cobbles, boulders; subangular to subrounded; very poorly sorted. (Glacial Outwash)
12 – 14	Medium dense, moist, light brown, coarse-grained SAND with silt, gravel; subrounded. (Glacial Outwash)
14	BOH @ 13-1/2'
16 – 26	

Subsurface conditions depicted represent our observation at the time and location of this exploratory hole, modified by geologic interpretation, engineering analysis, and judgment. They are not necessarily representative of other times and location. We will not accept responsibility for the use or interpretation by others of information presented on this log.

Reviewed By

ASSOCIATED EARTH SCIENCES, INC

B-06

MountainStar MPR
Kittitas County, Washington
Project No. H97186A
September-November 1997

EXPLORATION PIT LOG

Number EP-28-2

0
2
4
6
8
10
12
14
16
18
20
22
24
26

Forest Duff/Topsoil.

Stiff, dry, reddish-brown SILT with sand and few gravels. (Loess)

Medium dense, dry, reddish-brown to brown, sandy GRAVEL with cobbles, boulders; subangular to subrounded; poorly sorted. (Glacial Outwash)

Medium dense, moist, brown, medium-grained to coarse-grained sandy GRAVEL with cobbles, few boulders; poorly sorted. (Glacial Outwash)

BOH @ 14-1/2'

Subsurface conditions depicted represent our observation at the time and location of this exploratory hole, modified by geologic interpretation, engineering analysis, and judgment. They are not necessarily representative of other times and location. We will not accept responsibility for the use or interpretation by others of information presented on this log.

Reviewed By

ASSOCIATED EARTH SCIENCES, INC

B-06

MountainStar MPR
Kittitas County, Washington
Project No. H97186A
September-November 1997

EXPLORATION PIT LOG

Number EP-28-3

0
Forest Duff/Topsoil.

Soft, dry, yellowish-brown, clayey SILT with sand, few gravel and cobbles.
(Loess and Glacial Outwash)

2

4
Loose, dry, yellowish-brown, silty, sandy GRAVEL wtih cobbles, boulders; subangular to subrounded; poorly sorted. (Glacial Outwash)

6

8
Loose to medium dense, moist, brown, sandy GRAVEL with cobbles, boulders; subangular to subrounded; poorly sorted. (Glacial Outwash)

10

12
BOH @ 13'

14

16

18

20

22

24

26

Subsurface conditions depicted represent our observation at the time and location of this exploratory hole, modified by geologic interpretation, engineering analysis, and judgment. They are not necessarily representative of other times and location. We will not accept responsibility for the use or interpretation by others of information presented on this log.

Reviewed By

ASSOCIATED EARTH SCIENCES, INC

B-06

MountainStar MPR
Kittitas County, Washington
Project No. H97186A
September-November 1997

EXPLORATION PIT LOG

Number EP-28-4

0
2
4
6
8
10
12
14
16
18
20
22
24
26

Forest Duff/Topsoil.

Soft, dry, yellowish-brown, clayey SILT with sand, few gravel and cobbles.
(Loess and Glacial Outwash)

Loose, dry, yellowish-brown, silty, sandy GRAVEL with cobbles, boulders; subangular to subrounded; poorly sorted. (Glacial Outwash)

Loose to medium dense, moist, brown, sandy GRAVEL with cobbles and boulders; subangular to subrounded; poorly sorted. (Glacial Outwash)

BOH @ 11'

Subsurface conditions depicted represent our observation at the time and location of this exploratory hole, modified by geologic interpretation, engineering analysis, and judgment. They are not necessarily representative of other times and location. We will not accept responsibility for the use or interpretation by others of information presented on this log.

Reviewed By

ASSOCIATED EARTH SCIENCES, INC

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MountainStar MPR
Kittitas County, Washington
Project No. H97186A
September-November 1997

EXPLORATION PIT LOG

Number EP-28-5

0 — Forest Duff/Topsoil.

Soft, dry, yellowish-brown, sandy, clayey SILT with few gravels, cobbles. (Loess)

2

Loose, dry, yellowish-brown, silty, sandy GRAVEL with cobbles and few boulders; subangular to subrounded; poorly sorted. (Glacial Outwash)

4

6

8

Loose to medium dense, moist, brown, sandy GRAVEL with cobbles; subangular to subrounded; poorly sorted. (Glacial Outwash)

10

12

14

BOH @ 14-1/2'

16

18

20

22

24

26

Subsurface conditions depicted represent our observation at the time and location of this exploratory hole, modified by geologic interpretation, engineering analysis, and judgment. They are not necessarily representative of other times and location. We will not accept responsibility for the use or interpretation by others of information presented on this log.

Reviewed By

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MountainStar MPR
Kittitas County, Washington
Project No. H97186A
September-November 1997

EXPLORATION PIT LOG

Number EP-29-1

0 — Forest Duff/Topsoil.

2 — Dense to very dense, dry to moist, reddish-brown, silty, fine-grained to coarse-grained SAND with gravel, few cobbles and boulders; very poorly sorted. (Lodgement Till)

4

6

8 — Very stiff to hard, moist, brown, sandy SILT with gravel. (Lodgement Till)

10 — Dense to very dense, dry to moist, reddish-brown, silty, fine-grained to coarse-grained SAND with gravel, few cobbles and boulders; very poorly sorted. (Lodgement Till)

12 — Stiff to hard, moist, reddish-brown, sandy SILT with gravel, few cobbles and boulders. (Lodgement Till)

14 — BOH @ 14-1/2'

16

18

20

22

24

26

Subsurface conditions depicted represent our observation at the time and location of this exploratory hole, modified by geologic interpretation, engineering analysis, and judgment. They are not necessarily representative of other times and location. We will not accept responsibility for the use or interpretation by others of information presented on this log.

Reviewed By

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B-06

MountainStar MPR
Kittitas County, Washington
Project No. H97186A
September-November 1997

EXPLORATION PIT LOG

Number EP-29-2

0 — Forest Duff/Topsoil.

2 — Loose, dry grading to moist, reddish-brown, silty, fine-grained SAND. (Loess)

4

6 — Medium dense, moist, dark reddish-brown, silty, medium-grained SAND with gravel, cobbles, boulders; poorly sorted. (Glacial Outwash)

8

10

12 — Medium dense, moist to wet, brown, fine-grained to coarse-grained SAND with silt, gravel; poorly sorted; seepage observed at 10-1/2'. (Glacial Outwash)

14

16 — Loose, wet (saturated), brown, coarse-grained sandy GRAVEL; well sorted. (Glacial Outwash)

BOH @ 16-1/2'

18

20

22

24

26

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Reviewed By

ASSOCIATED EARTH SCIENCES, INC

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MountainStar MPR
Kittitas County, Washington
Project No. H97186A
September-November 1997

EXPLORATION PIT LOG

Number EP-29-3

0
Forest Duff/Topsoil.

Soft, dry, reddish-brown, sandy SILT with trace gravel. (Loess)

2

Loose, dry to moist, reddish-brown, silty GRAVEL with fine-grained to medium-grained sand, few cobbles and boulders; subangular to subrounded; poorly sorted. (Glacial Outwash)

4

Medium dense, moist, brown, fine-grained to medium-grained sandy GRAVEL with silt, cobbles, boulders; very poorly sorted. (Glacial Outwash)

6

8

10

12
grading to less silt; increasing moisture

BOH @ 12-1/2'

14

16

18

20

22

24

26

Subsurface conditions depicted represent our observation at the time and location of this exploratory hole, modified by geologic interpretation, engineering analysis, and judgment. They are not necessarily representative of other times and location. We will not accept responsibility for the use or interpretation by others of information presented on this log.

Reviewed By

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ASSOCIATED EARTH SCIENCES, INC

MountainStar MPR
Kittitas County, Washington
Project No. H97186A
September-November 1997

EXPLORATION PIT LOG

Number EP-29-7

0 — Forest Duff/Topsoil.

2 — Medium stiff to very stiff/medium dense to dense, dry grading to moist, light reddish-brown, very fine-grained sandy SILT to silty SAND with trace gravel. (Loess)

4

6 — Medium dense, moist, yellowish-brown, silty, fine-grained to medium-grained sandy GRAVEL with cobbles; subangular to subrounded; poorly sorted. (Glacial Outwash)

8 — Medium dense, moist, brown, gravelly, medium-grained to coarse-grained SAND with few cobbles; subangular to subrounded; moderately well sorted. (Glacial Outwash)

10

12

14

16 — layer of sandy gravel @ 16' to 16-1/2'

BOH @ 16-1/2'

18

20

22

24

26

Subsurface conditions depicted represent our observation at the time and location of this exploratory hole, modified by geologic interpretation, engineering analysis, and judgment. They are not necessarily representative of other times and location. We will not accept responsibility for the use or interpretation by others of information presented on this log.

Reviewed By

ASSOCIATED EARTH SCIENCES, INC

B-06

MountainStar MPR
Kittitas County, Washington
Project No. H97186A
September-November 1997

EXPLORATION PIT LOG

Number EP-32-1

0 — Forest Duff/Topsoil.

Soft to stiff, dry, yellowish-brown, sandy SILT with gravel, cobbles, boulders; poorly sorted. (Loess and Glacial Outwash)

2

4

(gradational contact)

6

Loose to medium dense, dry, brown, silty, fine-grained SAND with gravel, cobbles, boulders; poorly sorted. (Glacial Outwash)

8

10

Medium dense, moist, brown, medium-grained to coarse-grained sandy GRAVEL with cobbles; subangular to rounded; poorly sorted. (Glacial Outwash)

12

14

BOH @ 14'

16

18

20

22

24

26

Subsurface conditions depicted represent our observation at the time and location of this exploratory hole, modified by geologic interpretation, engineering analysis, and judgment. They are not necessarily representative of other times and location. We will not accept responsibility for the use or interpretation by others of information presented on this log.

Reviewed By

ASSOCIATED EARTH SCIENCES, INC

B-06

MountainStar MPR
Kittitas County, Washington
Project No. H97186A
September-November 1997

The Department of Ecology does NOT Warranty the Data and/or the Information on this Well Report.

File Original and First Copy with Department of Ecology
Second Copy — Owner's Copy
Third Copy — Driller's Copy

52135

WATER WELL REPORT

STATE OF WASHINGTON

Start Card No. W072137
UNIQUE WELL I.D. # ACK 141
Water Right Permit No:

OWNER: Name BPA Address N/A SE

(2) LOCATION OF WELL: County Kittitas ~~NE~~ 1/4 SE 1/4 Sec 28 T. 19 N., R. 15 E.W.M.

(2a) STREET ADDRESS OF WELL (or nearest address) Cle Elum Hatchery CE 2A 20

(3) PROPOSED USE: ☐ Domestic ☐ Industrial ☐ Municipal ☐ ☐ Irrigation ☐ Test Well ☐ Other ☒ ☐ DeWater

(4) TYPE OF WORK: Owner's number of well (If more than one) CE 2A

Abandoned ☐ New well ☒ Method: Dug ☐ Bored ☐ Deepened ☐ Cable ☒ Driven ☐ Reconditioned ☐ Rotary ☐ Jetted ☐

(5) DIMENSIONS: Diameter of well 16" inches. Drilled 255 feet. Depth of completed well 215 ft.

(6) CONSTRUCTION DETAILS:

Casing Installed: 16" Diam. from +2 ft. to 152 ft.
Welded ☒ " Diam. from ft. to ft.
Liner installed ☐ " Diam. from ft. to ft.
Threaded ☐

Perforations: Yes ☐ No ☒
Type of perforator used
SIZE of perforations in. by in.
perforations from ft. to ft.
perforations from ft. to ft.
perforations from ft. to ft.

Screens: Yes ☒ No ☐
Manufacturer's Name Cook
Type 304 Model No.
Diam. 14 Slot size 125 from 155 ft. to 205 ft.
Diam. Slot size from ft. to ft.

Gravel packed: Yes ☐ No ☒ Size of gravel
Gravel placed from ft. to ft.

Surface seal: Yes ☒ No ☐ To what depth? 65' ft.
Material used in seal Bentonite
Did any strata contain unusable water? Yes ☐ No ☐
Type of water? Depth of strata
Method of sealing strata off

(7) PUMP: Manufacturer's Name
Type: H.P.

(8) WATER LEVELS: Land-surface elevation above mean sea level 1925.53 ft.
Static level Flowing ft. below top of well Date
Artesian pressure Approx 10 PSI lbs. per square inch Date
Artesian water is controlled by (Cap, valve, etc.)

(9) WELL TESTS: Drawdown is amount water level is lowered below static level
Was a pump test made? Yes ☒ No ☐ If yes, by whom? Driller
Yield: 1600 gal./min. with 95 ft. drawdown after 24 hrs.
" " " "
" " " "

Recovery data (time taken as zero when pump turned off) (water level measured from well top to water level)

Time	Water Level	Time	Water Level	Time	Water Level

Date of test
Bailer test B-06 gal./min. with ft. drawdown after hrs.
Airtest gal./min. with stem set at ft. for hrs.
Artesian flow g.p.m. Date
Temperature of water 47 Was a chemical analysis made? Yes ☐ No ☒

(10) WELL LOG or ABANDONMENT PROCEDURE DESCRIPTION

Formation: Describe by color, character, size of material and structure, and show thickness of aquifers and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of information.

MATERIAL	FROM	TO
Brown sand + gravel	0	18
Gray silt + clay	18	45
Silty sand + gravel	45	70
Sand + gravel some silt	70	102
Gray silt	102	110
Sand + gravel sandy layers	110	165
Fine sand some gravel	165	180
sand + gravel sandy layers	180	215
Fine silty dirty sand	215	255
Northing 678066.00		
Easting 1884277.95		

RECEIVED JAN 24 1997 DEPARTMENT OF ECOLOGY CENTRAL REGION OFFICE

Work Started 8-1-96 19. Completed 10-1-96 19

WELL CONSTRUCTOR CERTIFICATION:

I constructed and/or accept responsibility for construction of this well, and its compliance with all Washington well construction standards. Materials used and the information reported above are true to my best knowledge and belief.

NAME Holt Drilling Inc (PERSON, FIRM, OR CORPORATION) (TYPE OR PRINT)
Address 10621 Todd Rd E
(Signed) Rudy Holt (WELL DRILLER) License No. 1099
Contractor's Registration No. HOLDI 1360G Date 12-12-96 19

(USE ADDITIONAL SHEETS IF NECESSARY)

Ecology is an Equal Opportunity and Affirmative Action employer. For special accommodation needs, contact the Water Resources Program at (206) 407-6600. The TDD number is (206) 407-6006.

ECY 050-1-20 (9/93) * * f

File Original and First Copy with Department of Ecology
Second Copy — Owner's Copy
Third Copy — Driller's Copy

WATER WELL REPORT
STATE OF WASHINGTON

Start Card No. N072150
UNIQUE WELL I.D. # ACK-139
Water Right Permit No.

(1) OWNER: Name BPA Address N/A Ski

(2) LOCATION OF WELL: County Kittitas - NE 1/4 SE 1/4 Sec 28 T. 19 N. R. 15 W.M.

(2a) STREET ADDRESS OF WELL (or nearest address) Cle Elum Hatchery CE 4A 20

(3) PROPOSED USE: ☐ Domestic ☐ Industrial ☐ Municipal ☐ ☐ Irrigation ☐ Test Well ☐ Other ☒ ☐ DeWater

(4) TYPE OF WORK: Owner's number of well (if more than one) CE 4
Abandoned ☐ New well ☒ Method: Dug ☐ Bored ☐ Deepened ☐ Cable ☒ Driven ☐ Reconditioned ☐ Rotary ☐ Jetted ☐

(5) DIMENSIONS: Diameter of well 16" inches. Drilled 173 feet. Depth of completed well 160 ft.

(6) CONSTRUCTION DETAILS:
Casing Installed: 16" Diam. from +2 ft. to 96 ft.
Welded ☒ Liner installed ☐ Threaded ☐ " Diam. from ft. to ft.
" Diam. from ft. to ft.

Perforations: Yes ☐ No ☒
Type of perforator used
SIZE of perforations in. by in.
perforations from ft. to ft.
perforations from ft. to ft.
perforations from ft. to ft.

Screens: Yes ☒ No ☐
Manufacturer's Name Cook
Type 304 Model No.
Diam. 14 Slot size 200 from 100 ft. to 125 ft.
Diam. 14 Slot size 100 from 125 ft. to 150 ft.

Gravel packed: Yes ☐ No ☒ Size of gravel
Gravel placed from ft. to ft.

Surface seal: Yes ☒ No ☐ To what depth? 40' ft.
Material used in seal Bentonite
Did any strata contain unusable water? Yes ☐ No ☒
Type of water? Depth of strata
Method of sealing strata off

(7) PUMP: Manufacturer's Name
Type: H.P.

(8) WATER LEVELS: Land-surface elevation above mean sea level 1934.85 ft.
Static level Flowing ft. below top of well Date
Artesian pressure Approx 10 PSI lbs. per square inch Date
Artesian water is controlled by (Cap, valve, etc.)

(9) WELL TESTS: Drawdown is amount water level is lowered below static level
Was a pump test made? Yes ☒ No ☐ If yes, by whom? Driller
Yield: 1460 gal./min. with 67 ft. drawdown after 24 hrs.
" " " "
" " " "

Recovery data (time taken as zero when pump turned off) (water level measured from well top to water level)

Time	Water Level	Time	Water Level	Time	Water Level

Date of test
Bailer test gal./min. with ft. drawdown after hrs.
Airtest B-06 gal./min. with stem set at ft. for hrs.
Artesian flow g.p.m. Date
Temperature of water 48.5 Was a chemical analysis made? Yes ☐ No ☒

(10) WELL LOG or ABANDONMENT PROCEDURE DESCRIPTION

Formation: Describe by color, character, size of material and structure, and show thickness of aquifers and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of information.

MATERIAL	FROM	TO
Brown + Blue Silt	0	25
Gray clay	25	63
Sand + gravel sand layers	63	150
Silty sand	150	173
Northing 677863.59		
Easting 1882946.96		

RECEIVED DEC 19 1996
DEPARTMENT OF ECOLOGY CENTRAL REGION OFFICE

Work Started 9-15-96 19. Completed 11-15-96 19

WELL CONSTRUCTOR CERTIFICATION:

I constructed and/or accept responsibility for construction of this well, and its compliance with all Washington well construction standards. Materials used and the information reported above are true to my best knowledge and belief.

NAME Holt Drilling Inc (PERSON, FIRM, OR CORPORATION) (TYPE OR PRINT)
Address 1062 Todd Rd E
(Signed) (WELL DRILLER) License No. 1099
Contractor's Registration No. HOLDI 136 06 Date 12-12 19 96

(USE ADDITIONAL SHEETS IF NECESSARY)

Ecology is an Equal Opportunity and Affirmative Action employer. For special accommodation needs, contact the Water Resources Program at (206) 407-6600. The TDD number is (206) 407-6006.

ECY 050-1-20 (9/93) * * *

The Department of Ecology does NOT Warranty the Data and/or the Information on this Well Report.



Well Report Change Form

IMPORTANT: GET AS MUCH INFORMATION AS POSSIBLE. THIS FORM WILL BE USED TO FIND THE WELL REPORT. ALL REQUIRED FIELDS MUST BE FILLED IN. USE INK PEN ONLY WHEN FILLING OUT THIS FORM.

(REQUIRED) This Well Report has been changed on (Date) ____/____/____

(Required) Person Requesting Change _____

(Required) Contact Phone No. (____) _____

(REQUIRED) ☒ Not in NITS ☐ NITS Log ID# _____

Regional Office: ☐ CRO ☐ ERO ☐ NWRO ☐ SWRO

Well Type: ☐ Water Well ☐ Resource Protection Well

Notice of Intent #: _____ Unique Ecy Well ID Tag No: _____

(Required) Original Owner Name: _____

Well Street Address: _____

City: _____ County: _____ Zip Code: _____

Geographic Location:

(Required) ____ 1/4 ____ of the ____ 1/4 Section ____ Township ____ Range ____ EWM or WWM *(circle one)*

(Optional) Lat Degrees _____ Lat Time _____

Long Degrees _____ Long Time _____ Horizontal collection method code _____

Tax Parcel No (include all zeros and dashes): _____

Type of Work: ☐ New Well ☐ Reconditioned ☐ Deepened

Well Report Recvd Date: ____/____/____ Well Completed Date: ____/____/____

Well Diameter (in): _____ Well Depth (ft): _____ Other: _____

Driller License No: _____ Trainee License No: _____

Other (Specify): _____

(Required) Reason for Change image/record NOT changed

B-06

(Required) Tracker Signature: JMRamsey

The Department of Ecology does NOT Warranty the Data and/or the Information on this Well Report.

The Department of Ecology does NOT Warranty the Data and/or the Information on this Well Report.

File Original and First Copy with Department of Ecology
Second Copy — Owner's Copy
Third Copy — Driller's Copy

52143

WATER WELL REPORT

STATE OF WASHINGTON

Start Card No. W 072146

UNIQUE WELL I.D. # _____

Water Right Permit No. _____

OWNER: Name BPA Address N/A NW NE 20

(2) LOCATION OF WELL: County Kittitas NE 1/4 SE 1/4 Sec 33 T. 19 N., R. 15 EWM

(2a) STREET ADDRESS OF WELL (or nearest address) CleElum Fish Hatchery TH 2 B

(3) PROPOSED USE: ☐ Domestic ☐ Industrial ☐ Municipal ☐ ☐ Irrigation ☐ Test Well ☒ Other ☐ ☐ DeWater

(4) TYPE OF WORK: Owner's number of well (If more than one) TH-2

Abandoned ☐ New well ☐ Method: Dug ☐ Bored ☐ Deepened ☐ Cable ☐ Driven ☐ Reconditioned ☐ Rotary ☒ Jetted ☐

(5) DIMENSIONS: Diameter of well 8" inches. Drilled 260 feet. Depth of completed well 260 ft.

(6) CONSTRUCTION DETAILS:

Casing installed: 8" Diam. from +2 ft. to 260 ft.
Welded ☒ Liner installed ☐ Threaded ☐
_____" Diam. from _____ ft. to _____ ft.
_____" Diam. from _____ ft. to _____ ft.

Perforations: Yes ☐ No ☒
Type of perforator used _____
SIZE of perforations _____ in. by _____ in.
_____ perforations from _____ ft. to _____ ft.
_____ perforations from _____ ft. to _____ ft.
_____ perforations from _____ ft. to _____ ft.

Screens: Yes ☐ No ☒
Manufacturer's Name _____
Type _____ Model No. _____
Diam. _____ Slot size _____ from _____ ft. to _____ ft.
Diam. _____ Slot size _____ from _____ ft. to _____ ft.

Gravel packed: Yes ☐ No ☒ Size of gravel _____
Gravel placed from _____ ft. to _____ ft.

Surface seal: Yes ☐ No ☒ To what depth? _____ ft.
Material used in seal _____
Did any strata contain unusable water? Yes ☐ No ☒
Type of water? _____ Depth of strata _____
Method of sealing strata off _____

(7) PUMP: Manufacturer's Name _____
Type: _____ H.P. _____

(8) WATER LEVELS: Land-surface elevation above mean sea level 1928.83 ft.
Static level N/A ft. below top of well Date _____
Artesian pressure _____ lbs. per square inch Date _____
Artesian water is controlled by _____ (Cap, valve, etc.)

(9) WELL TESTS: Drawdown is amount water level is lowered below static level
Was a pump test made? Yes ☐ No ☒ If yes, by whom? _____
Yield: _____ gal./min. with _____ ft. drawdown after _____ hrs.
" " " "
" " " "

Recovery data (time taken as zero when pump turned off) (water level measured from well top to water level)

Time	Water Level	Time	Water Level	Time	Water Level
	N/A				

Date of test _____
Bailer test B-06 gal./min. with _____ ft. drawdown after _____ hrs.
Airtest _____ gal./min. with stem set at _____ ft. for _____ hrs.
Artesian flow _____ g.p.m. Date _____
Temperature of water _____ Was a chemical analysis made? Yes ☐ No ☒

(10) WELL LOG or ABANDONMENT PROCEDURE DESCRIPTION

Formation: Describe by color, character, size of material and structure, and show thickness of aquifers and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of information.

MATERIAL	FROM	TO
Silt	0	3
well graded gravel	3	12
clay + silt	12	167
silty gravel	167	199
well graded gravel with silty layers	199	245
silty Sand	245	260

RECEIVED
JAN 24 1997
DEPARTMENT OF ECOLOGY
CENTRAL REGION OFFICE

Northing 677264.79

Easting 1883060.53

Work Started 8-20-96 19. Completed 9-20-96 19

WELL CONSTRUCTOR CERTIFICATION:

I constructed and/or accept responsibility for construction of this well, and its compliance with all Washington well construction standards. Materials used and the information reported above are true to my best knowledge and belief.

NAME Holt Drilling Inc (PERSON, FIRM, OR CORPORATION) (TYPE OR PRINT)

Address 10621 Todd Rd E

(Signed) _____ (WELL DRILLER) License No. 1099

Contractor's Registration No. HOLTDT 1360G Date 1-20-97 19

(USE ADDITIONAL SHEETS IF NECESSARY)

Ecology is an Equal Opportunity and Affirmative Action employer. For special accommodation needs, contact the Water Resources Program at (206) 407-6600. The TDD number is (206) 407-6006.

ECY 050-1-20 (9/93) * * f

The Department of Ecology does NOT Warranty the Data and/or the Information on this Well Report.

File Original and First Copy with Department of Ecology
Second Copy — Owner's Copy
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52142

WATER WELL REPORT

STATE OF WASHINGTON

Start Card No. W072145

UNIQUE WELL I.D. # _____

Water Right Permit No. _____

OWNER: Name BPA Address N/A NE NE

(2) LOCATION OF WELL: County Kittitas NW 1/4 SE 1/4 Sec 33 T. 19 N., R. 15 E. WM.

(2a) STREET ADDRESS OF WELL (or nearest address) Cle Elum Fish Hatchery TH 3 20

(3) PROPOSED USE: ☐ Domestic ☐ Industrial ☐ Municipal ☐ ☐ Irrigation ☐ Test Well ☒ Other ☐ ☐ DeWater

(4) TYPE OF WORK: Owner's number of well (If more than one) TH 3

Abandoned ☐ New well ☐ Method: Dug ☐ Bored ☐ Deepened ☐ Cable ☐ Driven ☐ Reconditioned ☐ Rotary ☒ Jetted ☐

(5) DIMENSIONS: Diameter of well 8 inches. Drilled 261 feet. Depth of completed well 261 ft.

(6) CONSTRUCTION DETAILS:

Casing installed: 8" Diam. from +2 ft. to 261 ft.
Welded ☒
Liner installed ☐ " Diam. from ____ ft. to ____ ft.
Threaded ☐ " Diam. from ____ ft. to ____ ft.

Perforations: Yes ☐ No ☒
Type of perforator used ____
SIZE of perforations ____ in. by ____ in.
____ perforations from ____ ft. to ____ ft.
____ perforations from ____ ft. to ____ ft.
____ perforations from ____ ft. to ____ ft.

Screens: Yes ☐ No ☒
Manufacturer's Name ____
Type ____ Model No. ____
Diam. ____ Slot size ____ from ____ ft. to ____ ft.
Diam. ____ Slot size ____ from ____ ft. to ____ ft.

Gravel packed: Yes ☐ No ☒ Size of gravel ____
Gravel placed from ____ ft. to ____ ft.

Surface seal: Yes ☐ No ☒ To what depth? ____ ft.
Material used in seal ____
Did any strata contain unusable water? Yes ☐ No ☐
Type of water? ____ Depth of strata ____
Method of sealing strata off ____

(7) PUMP: Manufacturer's Name ____
Type: ____ H.P. ____

(8) WATER LEVELS: Land-surface elevation above mean sea level 1928.26 ft.
Static level N/A ft. below top of well Date ____
Artesian pressure ____ lbs. per square inch Date ____
Artesian water is controlled by ____ (Cap, valve, etc.)

(9) WELL TESTS: Drawdown is amount water level is lowered below static level
Was a pump test made? Yes ☐ No ☒ If yes, by whom? ____
Yield: ____ gal./min. with ____ ft. drawdown after ____ hrs.
" " " "
" " " "

Recovery data (time taken as zero when pump turned off) (water level measured from well top to water level)

Time	Water Level	Time	Water Level	Time	Water Level
	N/A				

Date of test ____
Bailer test B-06 gal./min. with ____ ft. drawdown after ____ hrs.
Airtest ____ gal./min. with stem set at ____ ft. for ____ hrs.
Artesian flow ____ g.p.m. Date ____
Temperature of water ____ Was a chemical analysis made? Yes ☐ No ☒

(10) WELL LOG or ABANDONMENT PROCEDURE DESCRIPTION

Formation: Describe by color, character, size of material and structure, and show thickness of aquifers and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of information.

MATERIAL	FROM	TO
sand + gravel silt	0	14
clay + silt	14	190
sand + gravel silty layers	190	252
clay + silt	252	261

RECEIVED
JAN 24 1997
DEPARTMENT OF ECOLOGY
CENTRAL REGION OFFICE

Northing 677095.61

Easting 1883964.81

Work Started 8-20-96 19. Completed 9-20-96 19

WELL CONSTRUCTOR CERTIFICATION:

I constructed and/or accept responsibility for construction of this well, and its compliance with all Washington well construction standards. Materials used and the information reported above are true to my best knowledge and belief.

NAME Hoff Drilling Inc (PERSON, FIRM, OR CORPORATION) (TYPE OR PRINT)

Address 10621 Todd Rd E

(Signed) Rudy Hoff (WELL DRILLER) License No. 1099

Contractor's Registration No. HOLYDI 1360G Date 1-20 19 97

(USE ADDITIONAL SHEETS IF NECESSARY)

Ecology is an Equal Opportunity and Affirmative Action employer. For special accommodation needs, contact the Water Resources Program at (206) 407-6600. The TDD number is (206) 407-6006.

ECY 050-1-20 (9/93) * * f

R026901

File Original and First Copy with Department of Ecology
Second Copy — Owner's Copy
Third Copy — Driller's Copy

12654

WATER WELL REPORT

STATE OF WASHINGTON

Start Card No. ~~100721~~
UNIQUE WELL I.D. # ~~100721~~ ACK 128
Water Right Permit No.

OWNER: Name BPA Address N/A NE NE 33 20

(2) LOCATION OF WELL: County Kittitas ~~SE~~ 1/4 ~~SE~~ 1/4 Sec 27 T. 19 N., R 15 E.W.

(2a) STREET ADDRESS OF WELL (or nearest address) Cle Elum Fish Hatchery TH 6

(3) PROPOSED USE: ☐ Domestic ☐ Industrial ☐ Municipal ☐ ☐ Irrigation ☒ Test Well ☐ Other ☐ ☐ DeWater

(4) TYPE OF WORK: Owner's number of well (If more than one) TH-6

Abandoned ☐ New well ☒ Method: Dug ☐ Bored ☐ Deepened ☐ Cable ☐ Driven ☐ Reconditioned ☐ Rotary ☒ Jetted ☐

(5) DIMENSIONS: Diameter of well 8" inches. Drilled 260 feet. Depth of completed well 237 ft.

(6) CONSTRUCTION DETAILS:

Casing installed: 2" Diam. from 42 ft. to 237 ft.
Welded ☐ Liner installed ☐ Threaded ☒ " Diam. from ft. to ft.
" Diam. from ft. to ft.

Perforations: Yes ☐ No ☒
Type of perforator used
SIZE of perforations in. by in.
perforations from ft. to ft.
perforations from ft. to ft.
perforations from ft. to ft.

Screens: Yes ☒ No ☐
Manufacturer's Name Johnson
Type PVC Model No.
Diam. 2" Slot size 10 from 230 ft. to 235 ft.
Diam. Slot size from ft. to ft.

Gravel packed: Yes ☐ No ☒ Size of gravel
Gravel placed from ft. to ft.

Surface seal: Yes ☒ No ☐ To what depth? 60' ft.
Material used in seal Bentonite
Did any strata contain unusable water? Yes ☐ No ☐
Type of water? Depth of strata
Method of sealing strata off

(7) PUMP: Manufacturer's Name
Type: H.P.

(8) WATER LEVELS: Land-surface elevation above mean sea level 1921.66 ft.
Static level Flowing ft. below top of well Date
Artesian pressure Approx 10 PSI lbs. per square inch Date
Artesian water is controlled by (Cap, valve, etc.)

(9) WELL TESTS: Drawdown is amount water level is lowered below static level
Was a pump test made? Yes ☐ No ☒ If yes, by whom?
Yield: gal./min. with ft. drawdown after hrs.
" " " "
" " " "

Recovery data (time taken as zero when pump turned off) (water level measured from well top to water level)

Time	Water Level	Time	Water Level	Time	Water Level

Date of test
Bailer test B-06 gal./min. with ft. drawdown after hrs.
Airtest gal./min. with stem set at ft. for hrs.
Artesian flow g.p.m. Date
Temperature of water Was a chemical analysis made? Yes ☐ No ☒

(10) WELL LOG or ABANDONMENT PROCEDURE DESCRIPTION

Formation: Describe by color, character, size of material and structure, and show thickness of aquifers and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of information.

MATERIAL	FROM	TO
Brown silt	0	3
silty sand + gravel	3	15
Gray clay	15	150
Silty gravel	150	157
Sand with some silt	157	227
Sand + gravel	227	236
Silt Stone	236	260
Northing 677450.70		
Easting 1885465.64		

RECEIVED JAN 24 1997 DEPARTMENT OF ECOLOGY CENTRAL REGION OFFICE

Work Started 9-15-96 19 Completed 10-15-96 19

WELL CONSTRUCTOR CERTIFICATION:

I constructed and/or accept responsibility for construction of this well, and its compliance with all Washington well construction standards. Materials used and the information reported above are true to my best knowledge and belief.

NAME Holt Drilling Inc (PERSON, FIRM, OR CORPORATION) (TYPE OR PRINT)
Address 10621 Todd Rd E
(Signed) (WELL DRILLER) License No. 1094
Contractor's Registration No. HOLDI 13606 Date 12-12- 19 96

(USE ADDITIONAL SHEETS IF NECESSARY)

Ecology is an Equal Opportunity and Affirmative Action employer. For special accommodation needs, contact the Water Resources Program at (206) 407-6600. The TDD number is (206) 407-6006.

ECY 050-1-20 (9/93) * * f

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The Department of Ecology does NOT Warranty the Data and/or the Information on this Well Report.

File Original and First Copy with Department of Ecology
Second Copy — Owner's Copy
Third Copy — Driller's Copy

52139

WATER WELL REPORT

STATE OF WASHINGTON

Start Card No. WB 72142

UNIQUE WELL I.D. #

Water Right Permit No.

OWNER: Name BPA Address N/A

(2) LOCATION OF WELL: County Kittitas SW 1/4 SW 1/4 Sec 27 T. 19 N., R. 15 E. W.M.

(2a) STREET ADDRESS OF WELL (or nearest address) Cle Elum Fish Hatchery TH-7 20 N

(3) PROPOSED USE: ☐ Domestic ☐ Industrial ☐ Municipal ☐ ☐ Irrigation ☐ Test Well ☒ Other ☐ ☐ DeWater

(4) TYPE OF WORK: Owner's number of well (If more than one) TH-7

Abandoned ☐ New well ☐ Method: Dug ☐ Bored ☐
Deepened ☐ Cable ☐ Driven ☐
Reconditioned ☐ Rotary ☒ Jetted ☐

(5) DIMENSIONS: Diameter of well 8" inches.
Drilled 240 feet. Depth of completed well 240 ft.

(6) CONSTRUCTION DETAILS:

Casing installed: 8" Diam. from +2 ft. to 240 ft.
Welded ☒
Liner installed ☐
Threaded ☐ " Diam. from ft. to ft.
" Diam. from ft. to ft.

Perforations: Yes ☐ No ☒
Type of perforator used
SIZE of perforations in. by in.
perforations from ft. to ft.
perforations from ft. to ft.
perforations from ft. to ft.

Screens: Yes ☐ No ☒
Manufacturer's Name
Type Model No.
Diam. Slot size from ft. to ft.
Diam. Slot size from ft. to ft.

Gravel packed: Yes ☐ No ☒ Size of gravel
Gravel placed from ft. to ft.

Surface seal: Yes ☐ No ☒ To what depth? ft.
Material used in seal
Did any strata contain unusable water? Yes ☐ No ☐
Type of water? Depth of strata
Method of sealing strata off

(7) PUMP: Manufacturer's Name
Type: H.P.

(8) WATER LEVELS: Land-surface elevation above mean sea level 1921.64 ft.
Static level N/A ft. below top of well Date
Artesian pressure lbs. per square inch Date
Artesian water is controlled by (Cap, valve, etc.)

(9) WELL TESTS: Drawdown is amount water level is lowered below static level
Was a pump test made? Yes ☐ No ☒ If yes, by whom?
Yield: gal./min. with ft. drawdown after hrs.
" " " "
" " " "

Recovery data (time taken as zero when pump turned off) (water level measured from well top to water level)

Time	Water Level	Time	Water Level	Time	Water Level
	N/A				

Date of test
Bailer test B-06 gal./min. with ft. drawdown after hrs.
Airtest gal./min. with stem set at ft. for hrs.
Artesian flow g.p.m. Date
Temperature of water Was a chemical analysis made? Yes ☐ No ☒

(10) WELL LOG or ABANDONMENT PROCEDURE DESCRIPTION

Formation: Describe by color, character, size of material and structure, and show thickness of aquifers and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of information.

MATERIAL	FROM	TO
Silty gravel	0	14
Clay & silt	14	92
Silty gravel	92	119
Sandy silt	119	189
Silty gravel	189	204
clay	204	240

Northing 677450.70

Easting 1885465.64

RECEIVED
JAN 24 1997
DEPARTMENT OF ECOLOGY
CENTRAL REGION OFFICE

Work Started 9-20-96 19. Completed 10-20-96 19

WELL CONSTRUCTOR CERTIFICATION:

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NAME Holt Drilling Inc (PERSON, FIRM, OR CORPORATION) (TYPE OR PRINT)

Address 10421 Todd Rd E

(Signed) Ken Holt (WELL DRILLER) License No. 1099

Contractor's Registration No. HOLTDI1360G Date 1-20 1997

(USE ADDITIONAL SHEETS IF NECESSARY)

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ECY 050-1-20 (9/93) ** f

UNIFIED SOIL CLASSIFICATION SYSTEM

MAJOR DIVISIONS				TYPICAL NAMES
COARSE GRAINED SOILS (More than half is larger than No. 200 Sieve)	GRAVELS (More than half coarse fraction is larger than No. 4 sieve size)	Clean gravels with little or no fines	GW	Well graded gravels, gravel-sand mixtures
			GP	Poorly graded gravels, gravel-sand mixtures
		Gravels with over 12% fines	GM	Silty gravels, poorly graded gravel-sand-silt mixtures
			GC	Clayey gravels, poorly graded gravel-sand-clay mixtures
	SANDS (More than half coarse fraction is smaller than No. 4 sieve size)	Clean sands with little or no fines	SW	Well graded sands, gravelly sands
			SP	Poorly graded sands, gravelly sands
		Sands with over 12% fines	SM	Silty sand, poorly graded sand-silt mixtures
			SC	Clayey sands, poorly graded sand-clay mixtures
FINE GRAINED SOILS (More than half is smaller than No. 200 Sieve)	SILTS AND CLAYS (Liquid limit less than 50)		ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands, or clayey silts with slight plasticity
			CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays
			OL	Organic clays and organic silty clays of low plasticity
	SILTS AND CLAYS (Liquid limit greater than 50)		MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts
			CH	Inorganic clays of high plasticity, fat clays
			OH	Organic clays of medium to high plasticity, organic silts
HIGHLY ORGANIC SOILS			PT	Peat and other highly organic soils

SAMPLE
- "Undisturbed"
- Bulk/Grab
- Not Recovered
- Recovered, Not Retained

CONTACT BETWEEN UNITS
- Well Defined Change
- Gradational Change
- Obscure Change
- End of Exploration

BLOWS PER FOOT

Hammer is 140 pounds with 30-inch drop, unless otherwise noted
- S - SPT Sampler (2.0-Inch O.D.)
- T - Thin Wall Sampler (2.8-Inch Sample)
- H - Split Barrel Sampler (2.4-Inch Sample)

MOISTURE DESCRIPTION
- Dry - Considerably less than optimum for compaction
- Moist - Near optimum moisture content
- Wet - Over optimum moisture content
- Saturated - Below water table, in capillary zone, or in perched groundwater

PHYSICAL PROPERTY TESTS

Consol	-	Consolidation
LL	-	Liquid Limit
PL	-	Plastic Limit
Gs	-	Specific Gravity
SA	-	Size Analysis
TxS	-	Triaxial Shear
TxP	-	Triaxial Permeability
Perm	-	Permeability
Po	-	Porosity
MC	-	Moisture Content
MD	-	Moisture/Density
DS	-	Direct Shear
VS	-	Vane Shear
Comp	-	Compaction

UU - Unconsolidated, Undrained
CU - Consolidated, Undrained
CD - Consolidated, Drained

AGI TECHNOLOGIES

Soil Classification/Legend

Trendwest Properties: Cle Elum UGA Draft EIS
Cle Elum, Washington

PLATE 1

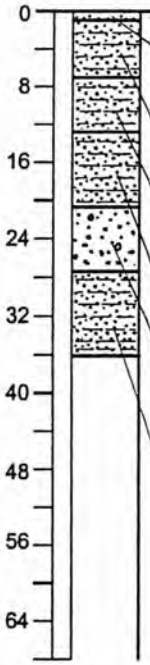
PROJECT NO.	DRAWN	DATE	APPROVED	REVISED	DATE
14,887.011	PJS	7/20/99			

soilcleg.cdr

Laboratory Tests | Moisture Content (%) | Depth (inches) | Sample

Test Pit Number 1

Land Surface Elevation ~2,130 feet Date 5/11/99



0" - 1" Dark Brown (7.5 YR 3/2) Sandy Loam (SM), loose, forest duff and leaf litter, fine grained.

1" - 7" Dark Brown (7.5 YR 3/4) Sandy Loam (SM), fine grained, with 5% fine to medium gravel, common fine-medium roots.

7" - 13" Dark Brown (7.5 YR 3/4) Sandy Loam (SM), fine grained, with 5% fine to medium gravel, common fine roots.

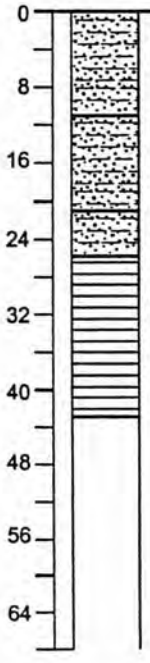
13" - 21" Dark Yellowish Brown (10 YR 3/4) Sandy Loam (SM), fine grained, common fine roots, with 5% fine to medium gravel.

21" - 27" Dark Yellowish Brown (10 YR 3/4) Gravelly Sandy Loam (SW), fine to coarse grained, gravel - fine to coarse with cobbles, with many fine roots.

27" - 36" Dark Yellowish Brown (10 YR 3/6) Gravelly Sandy Loam (SM), with pockets of clean gray sand, with cobbles and fine roots, 12% clay.

Test Pit Number 2

Land Surface Elevation ~2,130 feet Date 5/11/99



0" - 11" Dark Brown (10 YR 3/3) Sandy Loam (SM), loose, with black mottling, many fine roots, fine grained with some coarser sand.

11" - 21" Dark Brown (7.5 YR 3/4) Sandy Loam (SM), loose, fine to medium grained, with 1% to 2% of gravel, and fine roots.

21" - 26" Brown (10 YR 4/3) Sandy Loam (SM), soft, with 1% to 2% gravel, fine grained.

26" - 43" Dark Yellowish Brown (10 YR 4/4) Sandy Clay Loam (CL), slightly hard, with fine tubular pores, slight mottling.

AGI TECHNOLOGIES

B-06

Exploration Logs

Trendwest Properties: Cle Elum UGA Draft EIS
Cle Elum, Washington

PLATE 2

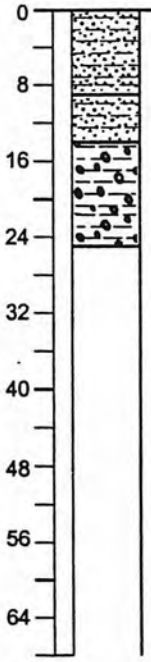
PROJECT NO.	DRAWN	DATE	APPROVED	REVISED	DATE
14,887.011	PJS	7/19/99			

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Laboratory Tests | Moisture Content (%) | Depth (inches) | Sample

Test Pit Number 3

Land Surface Elevation ~2,120 feet Date 5/11/99



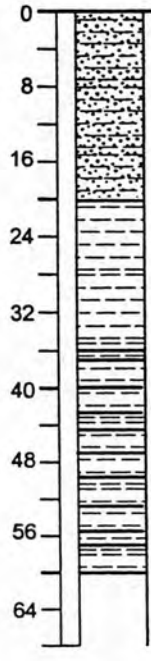
0" - 9" Brown (10 YR 4/3) Sandy Loam (SM), soft, with many fine roots, fine grained.

9" - 14" (7.5 YR 3/4) Sandy Loam (SM), soft, fine grained, 1% gravel.

14" - 25" Dark Yellowish Brown (10 YR 4/4) Very Gravelly Sandy Loam (GM), fine to coarse grained, fine to coarse gravel.

Hand Auger Number 4

Land Surface Elevation ~2,170 feet Date 5/11/99



0" - 20" Dark Yellowish Brown (10 YR 3/4) Sandy Loam (SM), soft, fine grained.

20" - 36" Dark Yellowish Brown (10 YR 4/4) Silt Loam (ML), slightly hard, trace gravel, 20% clay, slightly mottled.

36" - 60" Dark Yellowish Brown (10 YR 4/4) Silt Loam (ML-CL), slightly hard, trace gravel, 20% to 25% clay, slightly mottled.

AGI TECHNOLOGIES

Exploration Logs

Trendwest Properties: Cle Elum UGA Draft EIS
Cle Elum, Washington

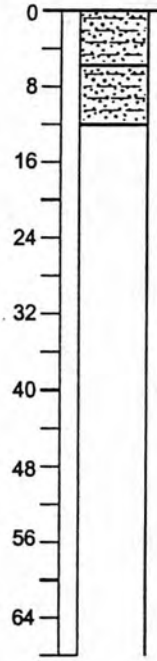
PLATE 3

PROJECT NO.	DRAWN	DATE	APPROVED	REVISED	DATE
4887011tp.cdr 14,887.011	PJS	7/19/99			

Laboratory Tests | Moisture Content (%) | Depth (inches) | Sample

Hand Auger Number 5

Land Surface Elevation ~2,150 feet Date 5/11/99



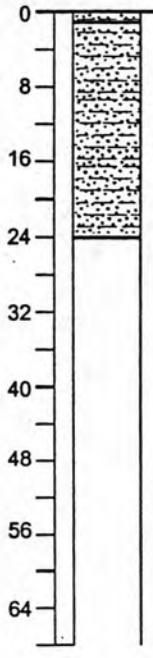
0" - 6" Very Dark Grayish Brown (7.5 YR 3/2) Sandy Loam (SM), loose, fine grained, with trace coarse sand and many fine roots.

6" - 12" (10 YR 4/3) Sandy Loam (SM).

Refusal on gravel at 12".

Hand Auger Number 6

Land Surface Elevation ~2,030 feet Date 5/12/99



0" - 1" Duff.

1" - 24" Dark Brown (7.5 YR 3/4) Loam (SM), fine grained, with 5% gravel, many fine roots.

Refusal at 24".

AGI TECHNOLOGIES

Exploration Logs

Trendwest Properties: Cle Elum UGA Draft EIS
Cle Elum, Washington

PLATE 4

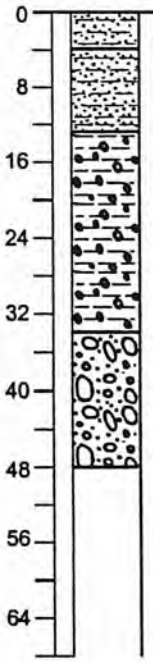
PROJECT NO.	DRAWN	DATE	APPROVED	REVISED	DATE
14,887.011	PJS	7/19/99			

4887011tp.cdr

Laboratory Tests | Moisture Content (%) | Depth (inches) | Sample

Test Pit Number 7

Land Surface Elevation ~2,030 feet Date 5/12/99

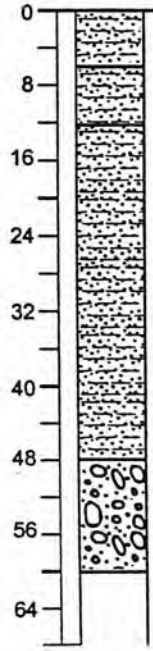


0" - 4" Very Dark Brown (10 YR 2/2) Loam and Forest Duff, fine roots.
4" - 13" Dark Brown (7.5 YR 3/4) Sandy Loam (SM), 5% of gravel, fine-grained sand.
13" - 34" (7.5 YR 4/6) Very Gravelly Loam (GM), 15% clay.

34" - 48" Dark Yellowish Brown (10 YR 3/4) Extremely Gravelly Sandy Loam (GW), with cobbles, medium- to coarse-grained sand.

Test Pit Number 8

Land Surface Elevation ~2,045 feet Date 5/12/99



0" - 6" Very Dark Grayish Brown (7.5 YR 3/2) Sandy Loam (SM), loose, with fine roots, 5% to 10% clay.
6" - 12" Dark Brown (7.5 YR 3/4) Sandy Loam (SM), soft, fine roots.
12" - 48" (7.5 YR 4/6) Sandy Loam (SM), 10% to 15% clay, 5% gravel (fine to medium).

48" - 60" Dark Yellowish Brown (10 YR 3/4) Very Gravelly/Cobbly Loamy Sand (GW).

AGI TECHNOLOGIES

Exploration Logs

Trendwest Properties: Cle Elum UGA Draft EIS
Cle Elum, Washington

PLATE 5

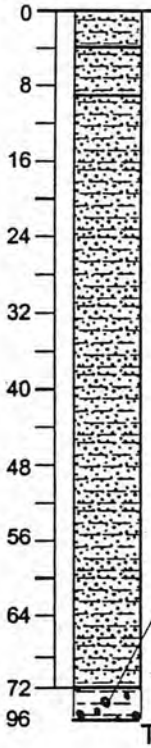
PROJECT NO.	DRAWN	DATE	APPROVED	REVISED	DATE
14,887.011	PJS	7/19/99			

4887011tp.cdr

Laboratory Tests | Moisture Content (%) | Depth (inches) | Sample

Test Pit Number 9

Land Surface Elevation ~2,075 feet Date 5/12/99



0" - 4" Very Dark Grayish Brown (10 YR 3/2) Sandy Loam (SM) and Forest Duff, many fine roots.

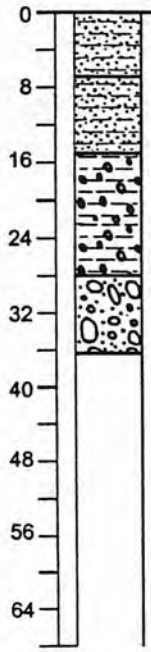
4" - 9" Dark Brown (7.5 YR 3/4) Sandy Loam (SM), 5% to 10% gravel.

9" - 72" Dark Yellowish Brown (10 YR 3/4) Sandy Loam (SM), 5% gravel.

72" - 96" Dark Yellowish Brown (10 YR 4/4) Gravelly Loam (GM), few cobbles, gradual transition.

Test Pit Number 10

Land Surface Elevation ~2,030 feet Date 5/12/99



0" - 7" Very Dark Brown (10 YR 2/2) Sandy Loam (SM), loose, many fine roots, fine grained.

7" - 15" Dark Reddish Brown (5 YR 3/2) Sandy Loam (SM), soft, 10% gravel, fine grained.

15" - 28" Dark yellowish brown (10 YR 4/4) Very Gravelly Sandy Loam (GM), fine grained.

28" - 36" Dark Yellowish Brown (10 YR 4/4) Extremely Cobbly Loamy Sand (GW), fine- to coarse-grained sand.

AGI TECHNOLOGIES

Exploration Logs

Trendwest Properties: Cle Elum UGA Draft EIS
Cle Elum, Washington

PLATE 6

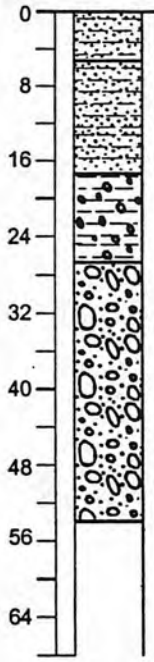
PROJECT NO.	DRAWN	DATE	APPROVED	REVISED	DATE
14,887.011	PJS	7/19/99			

4887011tp.cdr

Laboratory Tests | Moisture Content (%) | Depth (inches) | Sample

Test Pit Number 11

Land Surface Elevation ~2,105 feet Date 5/12/99



0" - 5" Very Dark Brown (10 YR 2/2) Sandy Loam (SM), loose, with many fine roots.

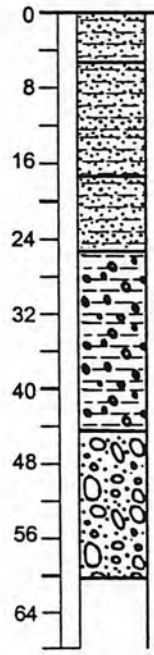
5" - 17" Dark Yellowish Brown (10 YR 3/4) Sandy Loam (SM), soft, with many fine roots.

17" - 27" Dark Yellowish Brown with black organic mottling (10 YR 3/4) Gravelly Loam (GM), with many fine roots.

27" - 54" Dark Yellowish Brown (10 YR 3/6) Extremely Cobbly Loamy Sand (GW), fine to coarse grained.

Test Pit Number 12

Land Surface Elevation ~2,115 feet Date 5/12/99



0" - 5" Very Dark Grayish Brown (10 YR 3/2) Sandy Loam (SM), with 20% gravel, many fine roots.

5" - 18" Dark Yellowish Brown (10 YR 3/4) Sandy Loam (SM), 2% gravel, many fine roots.

18" - 25" Dark Yellowish Brown (10 YR 3/4) Sandy Loam (SM),12% to 15% clay.

25" - 45" Dark Yellowish Brown (10 YR 3/4) Very Gravelly/Cobbly Sandy Loam (GM).

45" - 60" Dark Yellowish Brown (10 YR 3/6) Extremely Gravelly/Cobbly Sand (GW).

AGI TECHNOLOGIES

Exploration Logs

Trendwest Properties: Cle Elum UGA Draft EIS
Cle Elum, Washington

PLATE 7

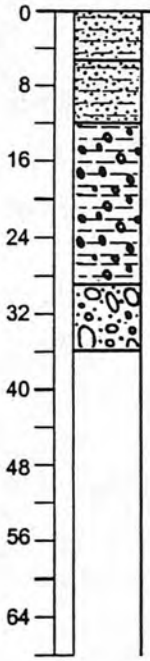
PROJECT NO.	DRAWN	DATE	APPROVED	REVISED	DATE
4887011tp.cdr	14,887.011	PJS	7/19/99		

B-06

Laboratory Tests | Moisture Content (%) | Depth (inches) | Sample

Test Pit Number 13

Land Surface Elevation ~2,135 feet Date 5/12/99



0" - 5" Very Dark Brown (10 YR 2/2) Sandy Loam (SM), loose, with many fine roots.

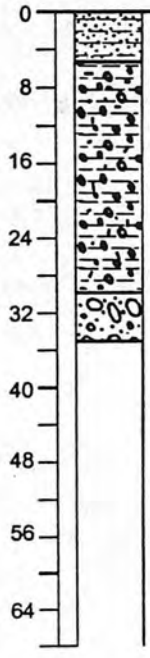
5" - 12" Dark Yellowish Brown (10 YR 3/4) Sandy Loam (SM), loose, 5% gravel, many fine roots.

12" - 29" Dark Yellowish Brown (10 YR 4/6) Very Gravelly/Cobbly Sandy Loam (GM).

29" - 36" Dark Yellowish Brown (10 YR 3/6) Extremely Gravelly/Cobbly Loamy Sand (GW).

Test Pit Number 14

Land Surface Elevation ~2,150 feet Date 5/12/99



0" - 5" Very Dark Brown (10 YR 2/2) Sandy Loam (SM), loose, fine roots.

5" - 30" Dark Yellowish Brown (10 YR 3/6) Gravelly Sandy Loam (GM-SM).

30" - 35" Dark Yellowish Brown (10 YR 3/6) Extremely Gravelly Loamy Sand (GW), with rocks.

AGI TECHNOLOGIES

B-06

Exploration Logs

Trendwest Properties: Cle Elum UGA Draft EIS
Cle Elum, Washington

PLATE 8

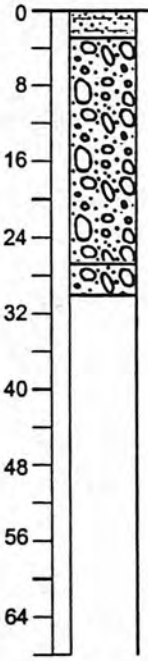
PROJECT NO.	DRAWN	DATE	APPROVED	REVISED	DATE
14,887.011	PJS	7/19/99			

4887011tp.cdr

Laboratory Tests | Moisture Content (%) | Depth (inches) | Sample

Test Pit Number 15

Land Surface Elevation ~2,130 feet Date 5/12/99



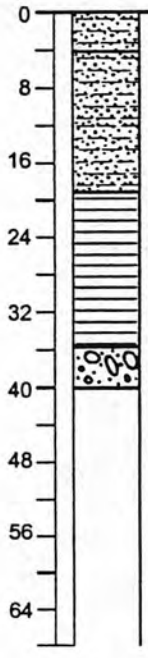
0" - 3" Dark Brown (7.5 YR 3/2) Sandy Loam (SM), fine grained, with fine roots.

3" - 27" Dark Brown (7.5 YR 3/4) Very Cobbly Sandy Loam (GW), with large rocks, fine grained.

27" - 30" Dark Yellowish Brown (10 YR 4/4) Very Gravelly Loamy Sand (GW), with large rocks, medium to coarse grained.

Test Pit Number 16

Land Surface Elevation ~2,135 feet Date 5/12/99



0" - 4" Very Dark Brown (10 YR 2/2) Sandy Loam (SM), loose, with fine roots.

4" - 19" Brown (10 YR 4/3) Sandy Loam (SM), soft, 5% gravel.

19" - 36" Dark Yellowish Brown (10 YR 4/4) Clay Loam (CL), soft, 5% gravel.

36" - 40" Dark Yellowish Brown (10 YR 3/4) Extremely Cobbly Sandy Loam (GW).

AGI TECHNOLOGIES

Exploration Logs

Trendwest Properties: Cle Elum UGA Draft EIS
Cle Elum, Washington

PLATE 9

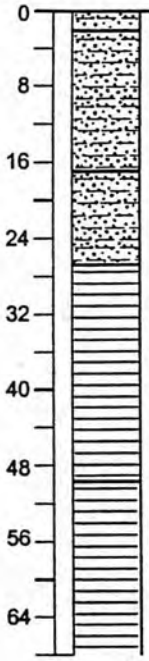
PROJECT NO.	DRAWN	DATE	APPROVED	REVISED	DATE
14,887.011	PJS	7/19/99			

4887011tp.cdr

Laboratory Tests | Moisture Content (%) | Depth (inches) | Sample

Test Pit Number 17

Land Surface Elevation ~2,150 feet Date 5/12/99



0" - 2" Very Dark Grayish Brown (10 YR 3/2) Sandy Loam (SM), loose, many fine roots, fine grained.

2" - 17" Dark Brown (10 YR 3/3) Cobbly Sandy Loam (SM), loose, fine-grained sand, rounded subangular cobbles, 9% to 10% clay.

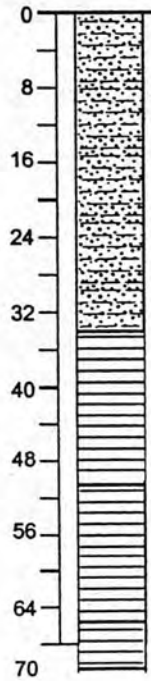
17" - 27" Dark Yellowish Brown (10 YR 4/4) Gravelly Sandy Loam (SM), loose, 12% to 15% clay, with rounded and angular rocks, cobbles, gravel.

27" - 50" Dark Yellowish Brown (10 YR 4/4) Sandy Clay Loam (CL), soft, 20% to 25% clay, slightly mottled, with gravel.

50+" Brown (10 YR 5/3) Sandy Clay Loam (CL), 20% to 25% clay, with iron-oxide mottling and light brownish gray (10 YR 1/2) mottled, few fine roots, gravel.

Hand Auger Number 18

Land Surface Elevation ~2,120 feet Date 5/12/99



0" - 34" Brown Sandy Loam (SM).

34" - 51" Brown Sandy Clay Loam (CL).

51" - 66" Becomes wet, slightly mottled.

66" - 70" Strong mottling, very wet.

AGI TECHNOLOGIES

Exploration Logs

Trendwest Properties: Cle Elum UGA Draft EIS
Cle Elum, Washington

PLATE 10

B-06

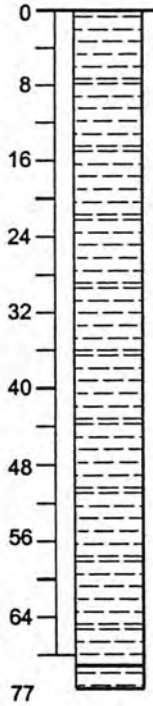
PROJECT NO.	DRAWN	DATE	APPROVED	REVISED	DATE
14,887.011	PJS	7/19/99			

4887011tp.cdr

Laboratory Tests | Moisture Content (%) | Depth (inches) | Sample

Hand Auger Number 19

Land Surface Elevation ~2,090 feet Date 5/12/99

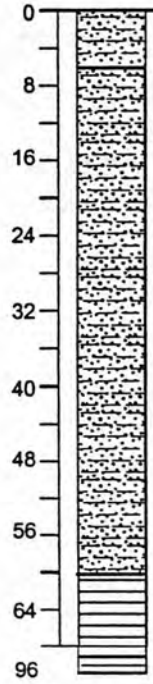


0" - 72" Very Dark Brown Loam (ML), fine grained.

72" - 77" Becomes dark brown with fine gravel.

Hand Auger Number 20

Land Surface Elevation ~2,100 feet Date 5/12/99



0" - 6" Dark Brown Sandy Loam (SM), with many fine roots.

6" - 60" Dark Brown (7.5 YR 3/4) Sandy Loam (SM).

60" - 94" Dark Yellowish Brown (10 YR 4/4) Sandy Clay Loam (CL), wet, with slight mottling.

94" - 96" Dark Yellowish Brown (10 YR 4/4) Sandy Clay Loam (CL), with slightly less clay.

AGI TECHNOLOGIES

Exploration Logs

Trendwest Properties: Cle Elum UGA Draft EIS
Cle Elum, Washington

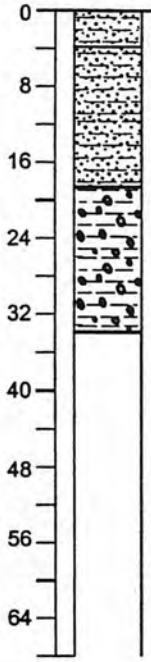
PLATE 11

PROJECT NO.	DRAWN	DATE	APPROVED	REVISED	DATE
4887011tp.cdr	14,887.011	PJS	7/19/99		

Laboratory Tests | Moisture Content (%) | Depth (inches) | Sample

Test Pit Number 21

Land Surface Elevation ~2,075 feet Date 5/12/99



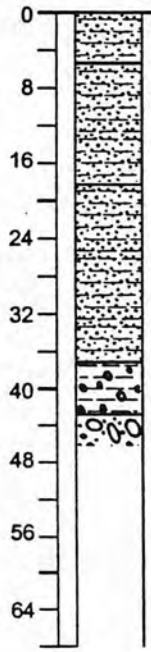
0" - 4" Very Dark Grayish Brown (10 YR 3/2) Sandy Loam (SM), with many fine roots.

4" - 18" Dark Brown (7.5 YR 3/2) Sandy Loam (SM), 5% gravel.

18" - 34" Dark Brown (7.5 YR 3/4) Gravelly Sandy Clay Loam (GM).

Test Pit Number 22

Land Surface Elevation ~2,070 feet Date 5/12/99



0" - 5" Very Dark Brown (10 YR 2/2) Loam (SM), fine grained, with many fine roots.

5" - 18" Dark Yellowish Brown (10 YR 3/4) Sandy Loam (SM), 10% clay, many fine roots, fine-grained sand.

18" - 37" Dark Yellowish Brown (10 YR 4/4) Loam (SM), 10% to 15% clay.

37" - 43" Dark Yellowish Brown (10 YR 4/4) Cobbly Loam (GM).

43+" Brown (10 YR 5/4) Extremely Cobbly Loamy Sand (GW).

AGI TECHNOLOGIES

Exploration Logs

Trendwest Properties: Cle Elum UGA Draft EIS
Cle Elum, Washington

PLATE 12

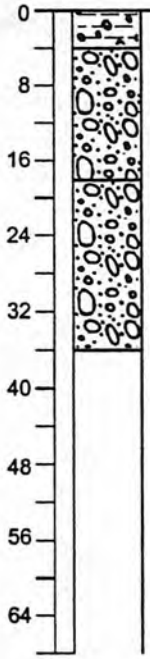
PROJECT NO.	DRAWN	DATE	APPROVED	REVISED	DATE
14,887.011	PJS	7/19/99			

4887011tp.cdr

Laboratory Tests | Moisture Content (%) | Depth (inches) | Sample

Test Pit Number 23

Land Surface Elevation ~1,980 feet Date 5/13/99



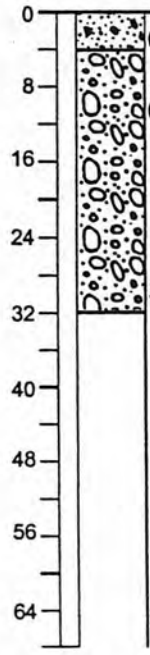
0" - 4" Dark Brown (10 YR 3/3) Gravelly Sandy Loam (GM), soft, platy structure, fine to coarse sand, with fine to coarse roots.

4" - 17" Dark Yellowish Brown (10 YR 3/4) Extremely Cobbly Sandy Loam (GW), soft, fine to coarse grained.

17" - 36" Dark Grayish Brown (2.5 YR 4/2) Extremely Cobbly Loamy Sand (GW), becomes rocky at 25".

Test Pit Number 24

Land Surface Elevation ~1,980 feet Date 5/13/99



0" - 6" Black (10 YR 2/1) Very Gravelly/Cobbly Loamy Sand (GW), 5% silt with many fine roots.

6" - 32" Dark Brown (10 YR 3/3) Very Gravelly Sand (GW), 3% fines, with coarse roots.

32" Becomes rocky/bouldery.

AGI TECHNOLOGIES

B-06

Exploration Logs

Trendwest Properties: Cle Elum UGA Draft EIS
Cle Elum, Washington

PLATE 13

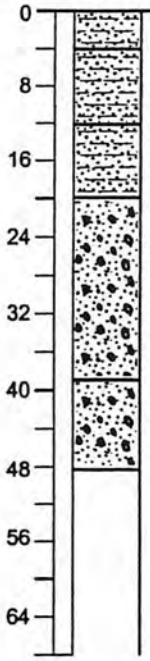
PROJECT NO.	DRAWN	DATE	APPROVED	REVISED	DATE
14,887.011	PJS	7/19/99			

4887011tp.cdr

Laboratory Tests | Moisture Content (%) | Depth (inches) | Sample

Test Pit Number 25

Land Surface Elevation ~2,005 feet Date 5/13/99



0" - 4" Very Dark Brown (10 YR 2/2) Sandy Loam (SM), with many fine roots, 10% gravel, 9% clay.

4" - 12" Dark Brown (10 YR 3/3) Gravelly Sandy Loam (SM), 15% to 20% fine to coarse gravel.

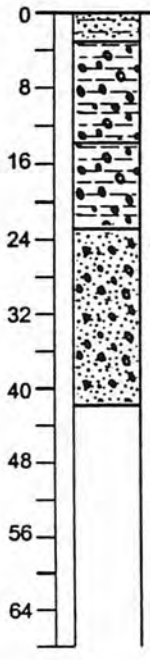
12" - 20" Dark Brown (7.5 YR 3/4) Gravelly Sandy Loam (SM), 15% to 20% fine to coarse gravel.

20" - 39" Dark Yellowish Brown (10 YR 3/4) Extremely Cobbly/Rocky Sandy Loam (GP).

39" - 48" Extremely Cobbly/Rocky Loamy Sand (GP), medium to coarse grained.

Test Pit Number 26

Land Surface Elevation ~1,990 feet Date 5/13/99



0" - 3" Black (10 YR 2/1) Gravelly Sandy Loam (SM), 15% to 20% gravel.

3 - 14" Dark Brown (10 YR 3/3) Very Cobbly Sandy Loam (GM), fine- to medium-grained sand.

14" - 23" Dark Brown (10 YR 3/3) Very Cobbly Sandy Loam (GM), fine- to medium-grained sand.

23" - 42" Dark Grayish Brown (2.5 YR) Extremely Cobbly Sand (GP), <3% fines, medium to coarse sand.

AGI TECHNOLOGIES

B-06

Exploration Logs

Trendwest Properties: Cle Elum UGA Draft EIS
Cle Elum, Washington

PLATE 14

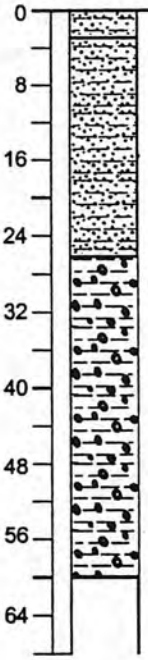
PROJECT NO.	DRAWN	DATE	APPROVED	REVISED	DATE
14,887.011	PJS	7/19/99			

4887011tp.cdr

Laboratory Tests | Moisture Content (%) | Depth (inches) | Sample

Test Pit Number 27

Land Surface Elevation ~2020 feet Date 5/13/99



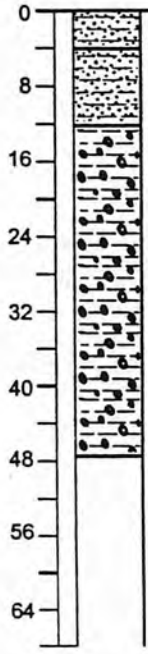
0" - 3" Black (10 YR 2/1) Sandy Loam (SM), 5% to 10% clay.

3" - 26" Dark Brown (7.5 YR 3/4) Gravelly Sandy Loam (SM), fine- to coarse-grained sand, fine to medium gravel.

26" - 60" Dark Yellowish Brown (10 YR 3/4) Very Gravelly/Cobbly Sandy Loam (GM), 10% to 15% clay, with boulders up to 24".

Test Pit Number 28

Land Surface Elevation ~2,015 feet Date 5/13/99



0" - 3" Very Dark Brown (10 YR 2/2) Gravelly Sandy Loam (SM), 25% to 35% fine to coarse gravel, fine to coarse sand.

3" - 12" Dark Yellowish Brown (10 YR 3/4) Gravelly Sandy Loam (SM), with fine to coarse roots, 10% fines, fine to medium sand.

12" - 48" Dark Yellowish Brown (10 YR 4/4) Very Gravelly Sandy Loam (GM), with 10% to 15% cobbles, 10% clay, fine to coarse sand.

AGI TECHNOLOGIES

Exploration Logs

Trendwest Properties: Cle Elum UGA Draft EIS
Cle Elum, Washington

PLATE 15

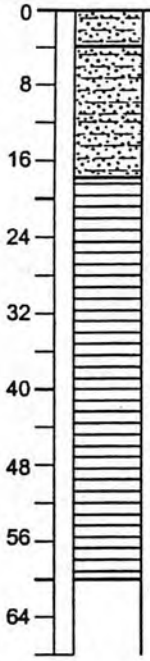
PROJECT NO.	DRAWN	DATE	APPROVED	REVISED	DATE
14,887.011	PJS	7/19/99			

4887011tp.cdr

Laboratory Tests | Moisture Content (%) | Depth (inches) | Sample

Test Pit Number 29

Land Surface Elevation ~2,120 feet Date 5/13/99



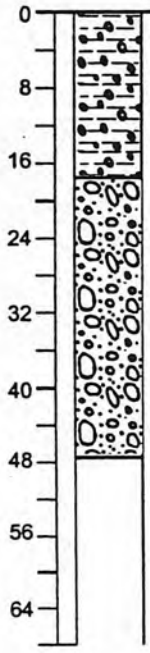
0" - 4" Dark Brown (10 YR 2/2) Loam (SM), with many fine roots.

4" - 18" Dark Brown (7.5 YR 4/4) Sandy Loam (SM), 10% to 15% clay.

18" - 60" Strong Brown (7.5 YR 4/6) Sandy Clay Loam (CL), with slight mottling, 25% clay.

Test Pit Number 30

Land Surface Elevation ~2,140 feet Date 5/13/99



0" - 17" Dark Brown (7.5 YR 3/4) Very Cobbly Sandy Loam (GM), fine- to medium- grained sand, with many fine to medium roots, 7% clay, with rocks.

17" - 48" Yellowish Brown (10 YR 5/4) Extremely Gravelly Sandy Loam (GW), 9% clay, with rocks and boulders, stratified, clay sticking to faces of rocks and sand slightly mottled.

AGI TECHNOLOGIES

Exploration Logs

Trendwest Properties: Cle Elum UGA Draft EIS
Cle Elum, Washington

PLATE 16

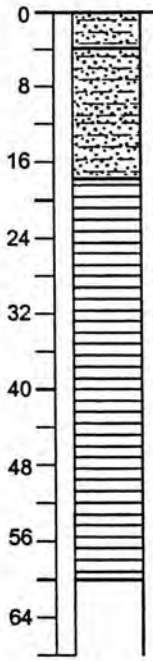
PROJECT NO.	DRAWN	DATE	APPROVED	REVISED	DATE
14,887.011	PJS	7/19/99			

4887011tp.cdr

Laboratory Tests | Moisture Content (%) | Depth (inches) | Sample

Test Pit Number 31

Land Surface Elevation ~2,160 feet Date 5/13/99



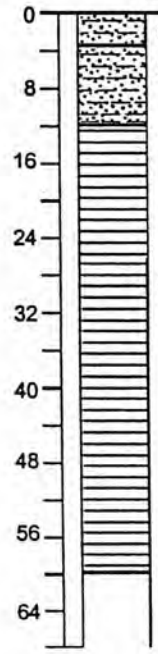
0" - 4" Dark Brown (10 YR 2/2) Loam (SM), with many fine roots.

4" - 18" Dark Brown (7.5 YR 4/4) Sandy Loam (SM), 10% to 15% clay.

18" - 60" Strong Brown (7.5 YR 4/6) Sandy Clay Loam (CL), with slight mottling, 25% clay.

Test Pit Number 32

Land Surface Elevation ~2,130 feet Date 5/13/99



0" - 3" Black (10 YR 2/1) Loam (SM).

3" - 12" Dark Brown (7.5 YR 3/4) Sandy Loam (SM), with fine roots.

12" - 26" Strong Brown (7.5 YR 4/6) Sandy Clay Loam (CL), 10% to 15% gravel.

26" -60" Dark Yellowish Brown (10 YR 3/4) Sandy Clay Loam (CL), slightly mottled, 5% to 10% gravel.

AGI TECHNOLOGIES

Exploration Logs

Trendwest Properties: Cle Elum UGA Draft EIS
Cle Elum, Washington

PLATE 17

PROJECT NO.	DRAWN	DATE	APPROVED	REVISED	DATE
14,887.011	PJS	7/19/99			

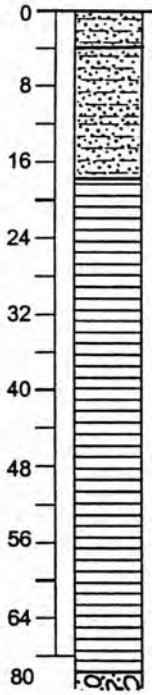
4887011tp.cdr

B-26

Laboratory Tests | Moisture Content (%) | Depth (inches) | Sample

Test Pit Number 33

Land Surface Elevation ~2,110 feet Date 5/13/99



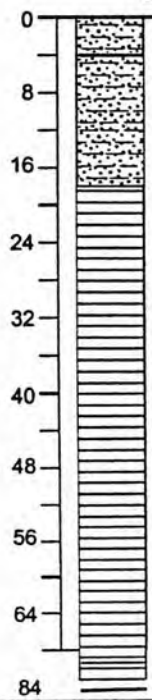
0" - 4" Dark Brown (10 YR 2/2) Loam (SM), with many fine roots.
4" - 18" Dark Brown (7.5 YR 4/4) Sandy Loam (SM), 10% to 15% clay.

18" - 80" Strong Brown (7.5 YR 4/6) Sandy Clay Loam (CL), with slight mottling, 25% clay, few 18" - 24" rocks.

80" Very Gravelly (10 YR 4/4) Loamy Sand (GW), medium to coarse grained.

Test Pit Number 34

Land Surface Elevation ~2,140 feet Date 5/13/99



0" - 4" Dark Brown (10 YR 2/2) Loam (SM), with many fine roots.
4" - 18" Dark Brown (7.5 YR 4/4) Sandy Loam (SM), 10% to 15% clay.

18" - 72" Strong Brown (7.5 YR 4/6) Sandy Clay Loam (CL), with slight mottling, 25% clay, few 18- to 24-inch rocks.

72" - 84" Becomes Clay Loam (CL).

AGI TECHNOLOGIES

Exploration Logs

Trendwest Properties: Cle Elum UGA Draft EIS
Cle Elum, Washington

PLATE 18

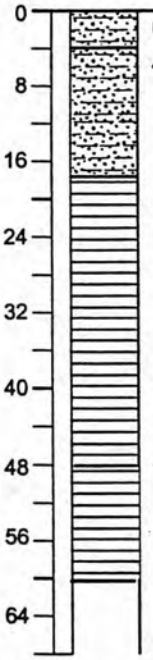
PROJECT NO.	DRAWN	DATE	APPROVED	REVISED	DATE
14,887.011	PJS	7/19/99			

4887011tp.cdr

Laboratory Tests | Moisture Content (%) | Depth (inches) | Sample

Test Pit Number 35

Land Surface Elevation ~2,145 feet Date 5/13/99



0" - 4" Dark Brown (10 YR 2/2) Loam (SM), with many fine roots.

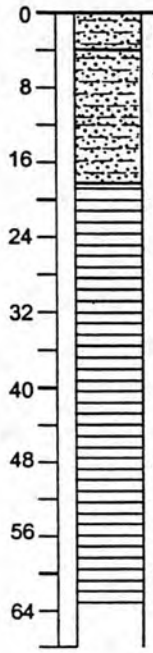
4" - 18" Dark Brown (7.5 YR 4/4) Sandy Loam (SM), 10% to 15% clay.

18" - 48" Strong Brown (7.5 YR 4/6) Sandy Clay Loam (CL), with slight mottling, 25% clay.

48" - 60" With 5% to 10% cobbles and 18" rocks.

Test Pit Number 36

Land Surface Elevation ~2,155 feet Date 5/13/99



0" - 4" Dark Brown (10 YR 2/2) Loam (SM), with many fine roots.

4" - 18" Dark Brown (7.5 YR 4/4) Sandy Loam (SM), 10% to 15% clay.

18" - 72" Strong Brown (7.5 YR 4/6) Sandy Clay Loam (CL), with slight mottling, 25% clay.

48" - 60" With 5% to 10% cobbles and 18-inch rocks.

60+" Strong mottling.

AGI TECHNOLOGIES

Exploration Logs

Trendwest Properties: Cle Elum UGA Draft EIS
Cle Elum, Washington

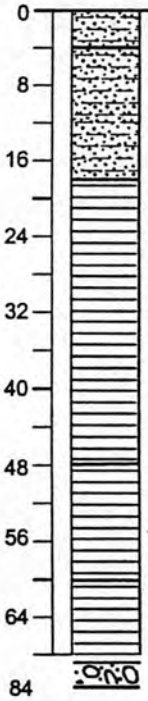
PLATE 19

PROJECT NO.	DRAWN	DATE	APPROVED	REVISED	DATE
4887011tp.cdr	14,887.011	PJS	7/19/99		

Laboratory Tests | Moisture Content (%) | Depth (inches) | Sample

Test Pit Number 37

Land Surface Elevation ~2,125 feet Date 5/13/99



0" - 4" Dark Brown (10 YR 2/2) Loam (SM), with many fine roots.

4" - 18" Dark Brown (7.5 YR 4/4) Sandy Loam (SM), 10% to 15% clay.

18" - 48" Strong Brown (7.5 YR 4/6) Sandy Clay Loam (CL), with slight mottling, 25% clay.

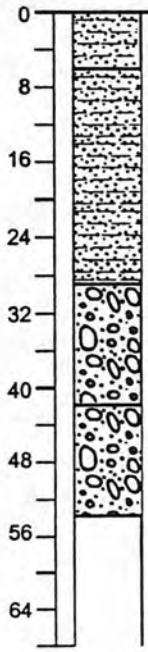
48" - 60" With 5% to 10% cobbles.

60" - 72" Strong mottling.

72" - 84" Very Gravelly Sand (GW).

Test Pit Number 38

Land Surface Elevation ~2,120 feet Date 5/13/99



0" - 6" Dark Yellowish Brown (10 YR 3/4) Sandy Loam (SM), 15% clay, 5% to 10% fine gravel.

6" - 29" Dark Yellowish Brown (10 YR 3/4) Sandy Loam (SM), 15% to 20% clay, 5% fine gravel.

29" - 42" Dark Yellowish Brown (10 YR 4/4) Very Gravelly/Cobbly Sandy Loam (GW), fine grained.

42" - 54" Very Gravelly Sand (GW), trace silt, medium to coarse grained, with cobbles.

AGI TECHNOLOGIES

B-06

Exploration Logs

Trendwest Properties: Cle Elum UGA Draft EIS
Cle Elum, Washington

PLATE 20

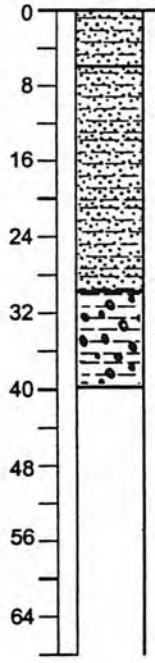
PROJECT NO.	DRAWN	DATE	APPROVED	REVISED	DATE
14,887.011	PJS	7/19/99			

4887011tp.cdr

Laboratory Tests | Moisture Content (%) | Depth (inches) | Sample

Test Pit Number 39

Land Surface Elevation ~2,075 feet Date 5/13/99



0" - 6" Dark Brown Loam (SM), with many fine roots, 5% gravel.

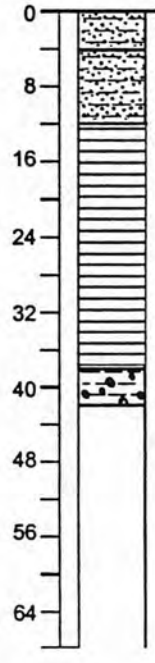
6" - 30" Dark Brown (7.5 YR 3/4) Sandy Loam (SM), 2% to 5% gravel, fine grained.

30" - 40" Dark Yellowish Brown (10 YR 4/4) Very Gravelly Sandy Loam (GM), fine grained.

40" Very Gravelly Sand, medium to coarse grained.

Test Pit Number 40

Land Surface Elevation ~2,070 feet Date 5/13/99



0" - 4" Forest Duff.

4" - 12" Very Dark Grayish Brown (10 YR 3/2) Sandy Loam (SM), 10% to 15% fines.

12" - 38" Dark Yellowish Brown (10 YR 3/4) Sandy Clay Loam (CL), 5% gravel.

38" - 42" Dark Yellowish Brown (10 YR 3/4) Very Gravelly Sandy Loam (GM), 15% clay, with cobbles.

AGI TECHNOLOGIES

Exploration Logs

Trendwest Properties: Cle Elum UGA Draft EIS
Cle Elum, Washington

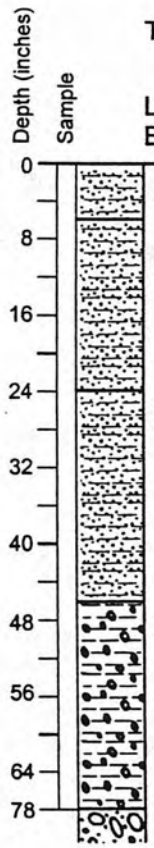
PLATE 21

PROJECT NO.	DRAWN	DATE	APPROVED	REVISED	DATE
14,887.011	PJS	7/19/99			

4887011tp.cdr

Test Pit Number 41

Land Surface Elevation ~2,040 feet Date 5/13/99



0" - 6" Very Dark Brown (10 YR 2/2) Loam (SM), many fine roots.

6" - 24" Dark Yellowish Brown (10 YR 3/4) Sandy Loam (SM), 10% to 15% clay, 10% gravel, fine grained.

24" - 46" Dark Yellowish Brown (10 YR 3/6) Sandy Loam (SM), with 5% gravel, 15% to 20% clay, fine-grained sand.

46" - 78" Dark Yellowish Brown (10 YR 3/4) Gravelly Sandy Loam (GM), with cobbles to 8", fine-grained sand.

78" - 90" Gravelly Sand (GW).

AGI TECHNOLOGIES

Exploration Logs

Trendwest Properties: Cle Elum UGA Draft EIS
Cle Elum, Washington

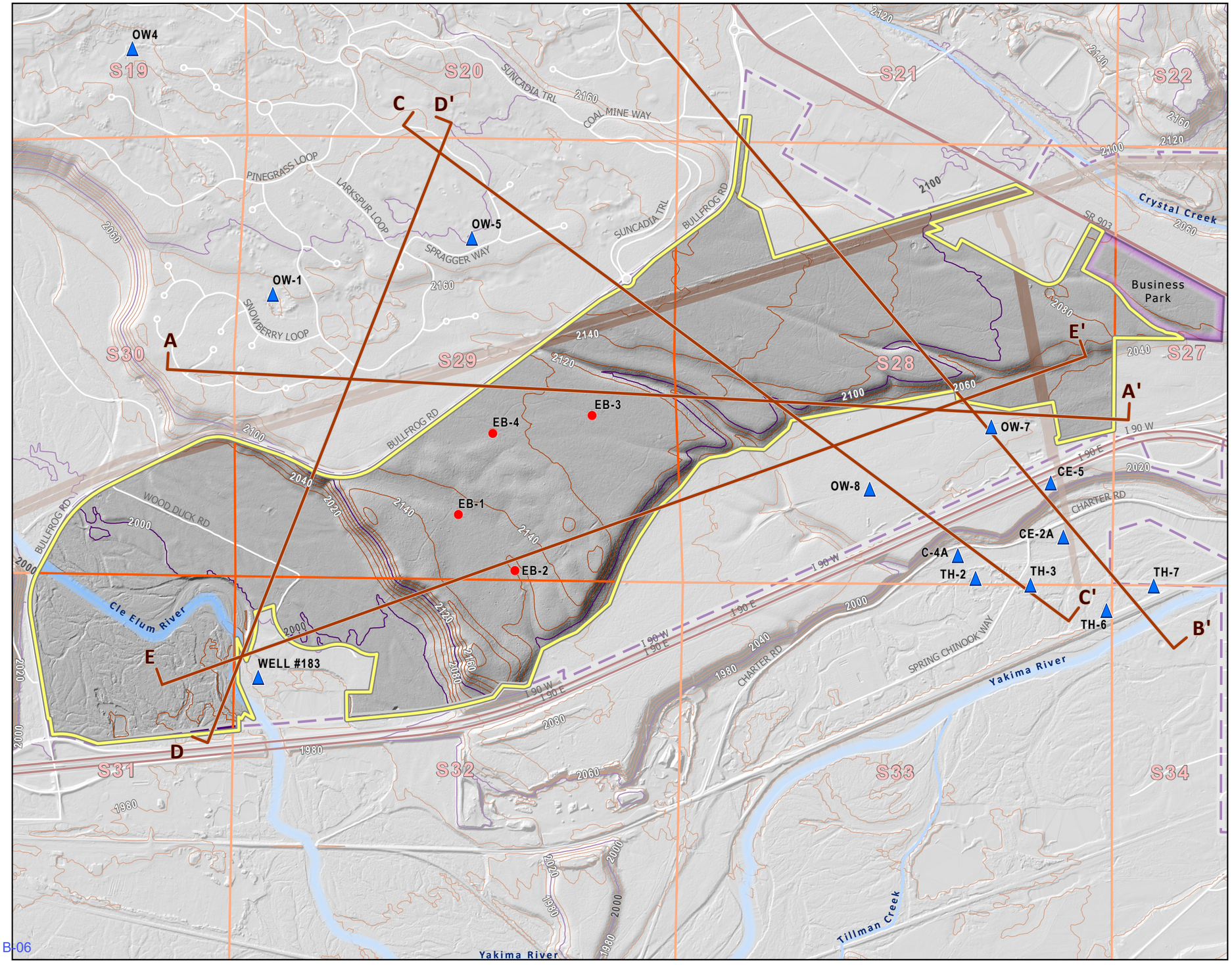
PLATE 22

PROJECT NO.	DRAWN	DATE	APPROVED	REVISED	DATE
14,887.011	PJS	7/19/99			

4887011tp-41.cdr

APPENDIX C

Geologic Cross Section (2019 SEIS)



B-06

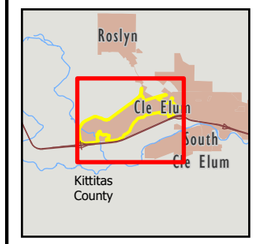
G:\GIS_Projects\aaY2019\190414 47 Degrees N\aprx_mxd\EIS0320\190414H001 F7 WELLS_1pg_47Deg.aprx

PROJECT BOUNDARY
OBSERVATION WELL (AESI, 1997, 1998)
EXPLORATION BORING (AESI 2020)
CROSS SECTION
TRANSMISSION LINES
OFF PROPERTY BUSINESS PARK
CITY BOUNDARY
SECTION
CONTOUR 100 FT
CONTOUR 20 FT

NOTE: ENTIRE PROJECT AREA IS WITHIN A GROUP A SURFACE WATER PROTECTION AREA

DATA SOURCES / REFERENCES:
WASHINGTON STATE LIDAR PORTAL: YAKIMA 2014, NO REPORT AVAILABLE. CONTOURS FROM LIDAR
KITTITAS CO: ROADS, PARCELS, CITY 10/19
ESM: SURVEYED PROJECT BOUNDARY 11/19
WELLS, VARIOUS SOURCES

LOCATIONS AND DISTANCES SHOWN ARE APPROXIMATE



0 1200
FEET

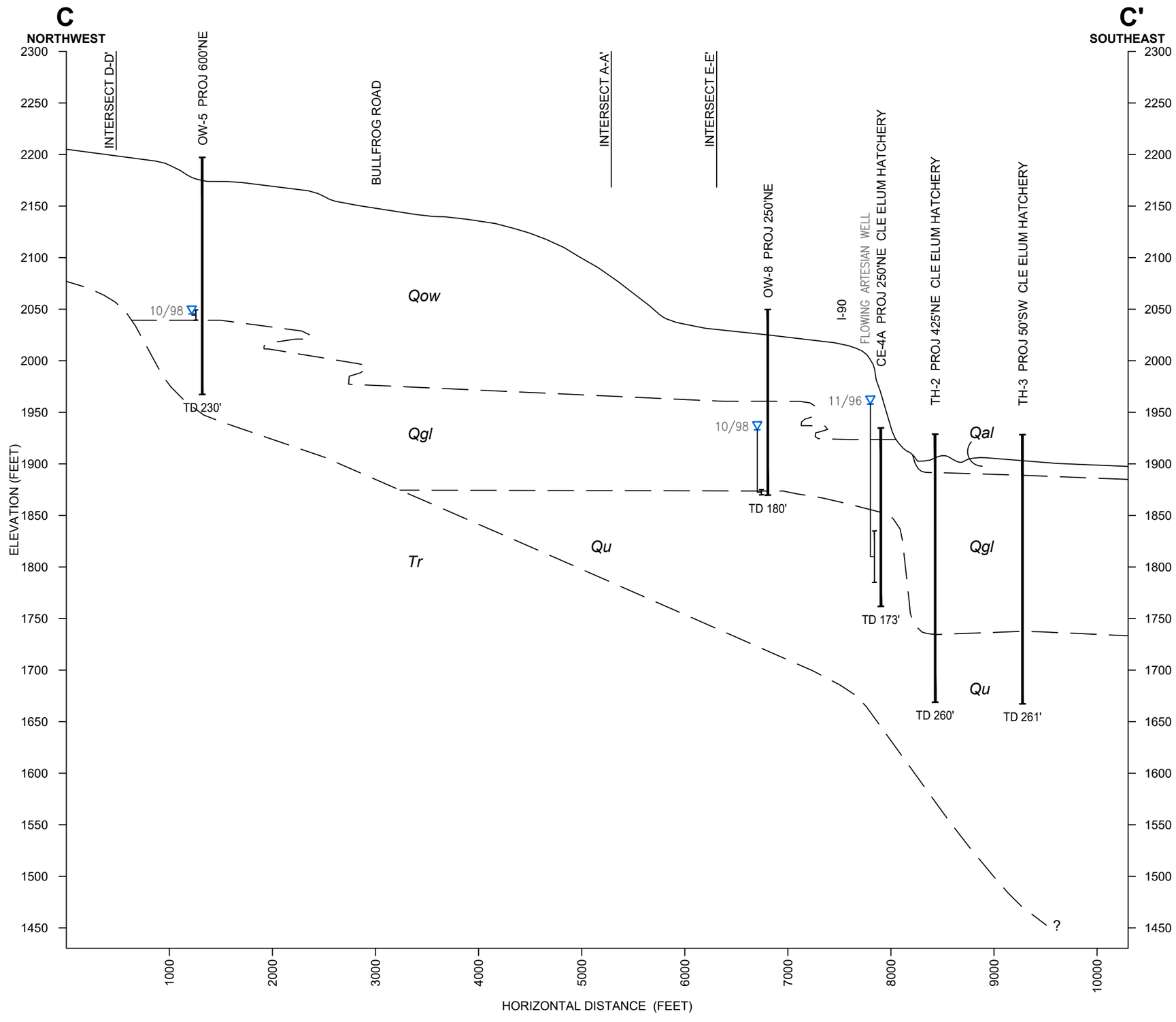
BLACK AND WHITE REPRODUCTION OF THIS COLOR ORIGINAL MAY REDUCE ITS EFFECTIVENESS AND LEAD TO INCORRECT INTERPRETATION

associated earth sciences incorporated

WELLS AND CROSS-SECTIONS

47° NORTH SEIS
CLE ELUM, WASHINGTON

PROJ NO.	DATE:	FIGURE:
20190414H001	4/20	7



B-06

LEGEND:

Qal	ALLUVIUM
Qow	GLACIAL OUTWASH DEPOSITS
Qgm	GLACIAL MORAINE DEPOSITS
Qgl	GLACIOLACUSTRINE DEPOSITS
Qu	UNDIFFERENTIATED GLACIAL DEPOSITS - PRIMARILY GLACIAL OUTWASH
Tr	ROSLYN FORMATION - BEDROCK
Tt	TEANAWAY FORMATION - BEDROCK
	EXPLORATION / WELL
	STATIC WATER LEVEL
	SCREENED INTERVAL
TD	TOTAL DEPTH OF BORING
	GEOLOGIC CONTACT

VERTICAL EXAGGERATION = 10X

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

associated earth sciences incorporated

GEOLOGIC CROSS-SECTION C - C'

47° NORTH
CLE ELUM, WASHINGTON

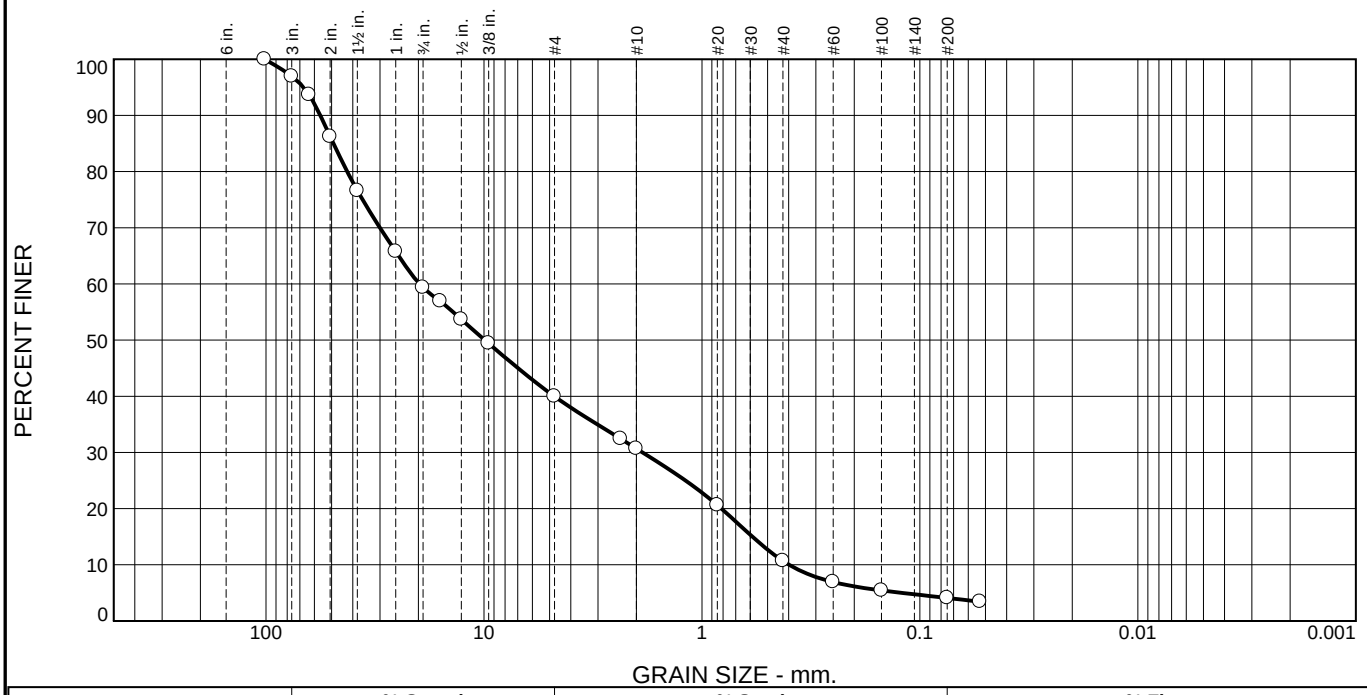
PROJ NO.	DATE:	FIGURE:
20190414H001	4/20	10

190414 47 Degree \ 190414 GeoSects.dwg LAYOUT: F10 Sect C-C 4-20

APPENDIX D

Grain-size Laboratory Testing Data

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
3.0	37.7	19.3	9.3	20.0	6.6	4.1	

TEST RESULTS

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
4"	100.0		
3"	97.0		
2.5"	93.7		
2"	86.2		
1.50"	76.6		
1"	65.8		
3/4"	59.3		
5/8"	56.9		
1/2"	53.7		
3/8"	49.4		
#4	40.0		
#8	32.4		
#10	30.7		
#20	20.6		
#40	10.7		
#60	6.9		
#100	5.4		
#200	4.1		
#270	3.4		

* (no specification provided)

Material Description

very sandy GRAVEL trace silt

Atterberg Limits (ASTM D 4318)

PL= NP **LL=** NV **PI=**

Classification

USCS (D 2487)= GP **AASHTO (M 145)=** A-1-a

Coefficients

D_{90}= 56.3510 D_{85}= 49.0694 D_{60}= 19.7778
D_{50}= 9.9070 D_{30}= 1.8744 D_{15}= 0.5868
D_{10}= 0.3983 C_u= 49.65 C_c= 0.45

Remarks

Date Received: 8-20-2024 **Date Tested:** 8-27-2024

Tested By: FEW

Checked By: PEL/TP

Title:

Location: Onsite - Facility 10
Sample Number: EP-48 **Depth:** 5'

Date Sampled: 8-12-2024

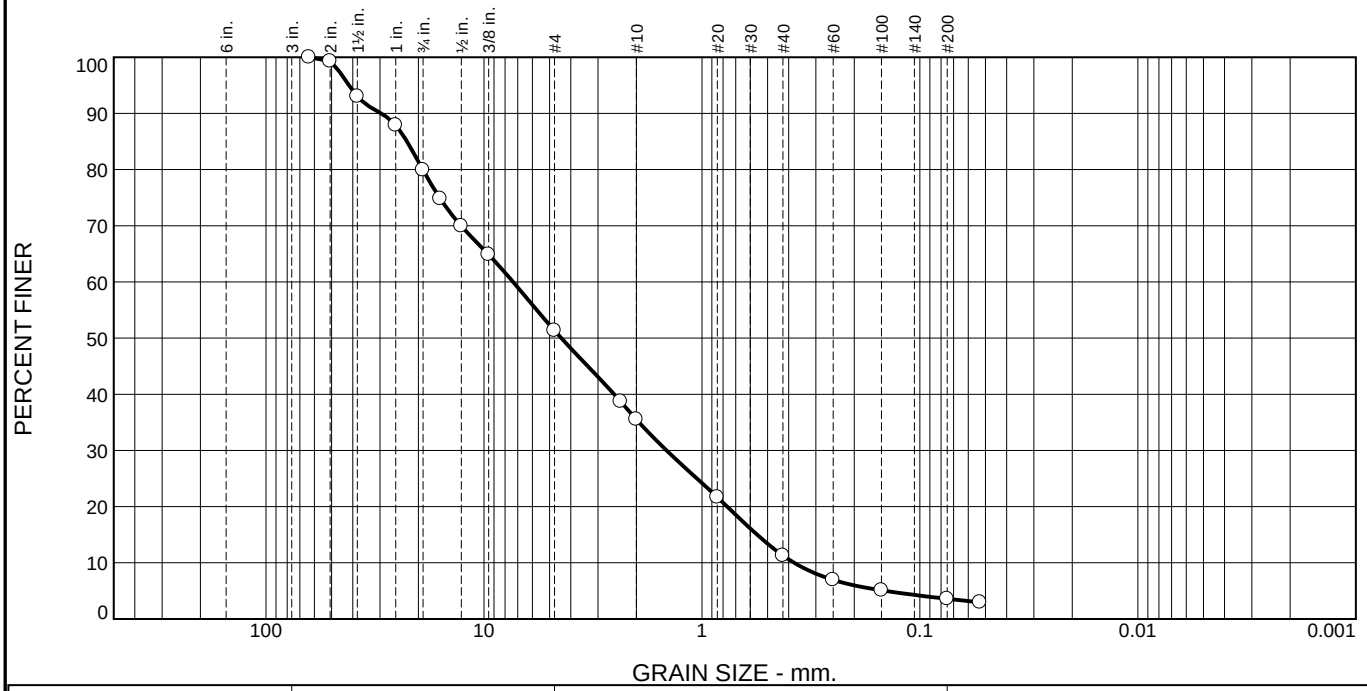
associated earth sciences incorporated

Client: Blue Fern Development
Project: Bullfrog Flats

Project No: 20240155 E001 **Figure**

B-06

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	20.1	28.5	15.9	24.2	7.7	3.6	

TEST RESULTS

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
2.5"	100.0		
2"	99.3		
1.50"	93.0		
1"	87.9		
3/4"	79.9		
5/8"	74.8		
1/2"	69.9		
3/8"	64.9		
#4	51.4		
#8	38.7		
#10	35.5		
#20	21.7		
#40	11.3		
#60	6.9		
#100	5.1		
#200	3.6		
#270	3.0		

* (no specification provided)

Material Description

very sandy GRAVEL trace silt

Atterberg Limits (ASTM D 4318)

PL= NP **LL=** NV **PI=**

Classification

USCS (D 2487)= GP **AASHTO (M 145)=** A-1-a

Coefficients

D_{90}= 29.6350 D_{85}= 22.5380 D_{60}= 7.3576
D_{50}= 4.4180 D_{30}= 1.4536 D_{15}= 0.5584
D_{10}= 0.3775 C_u= 19.49 C_c= 0.76

Remarks

Date Received: 8-20-2024 **Date Tested:** 8-26-2024

Tested By: FEW

Checked By: PEL/TP

Title:

Location: Onsite - Facility 10
Sample Number: EP-49 **Depth:** 5'

Date Sampled: 8-12-2024

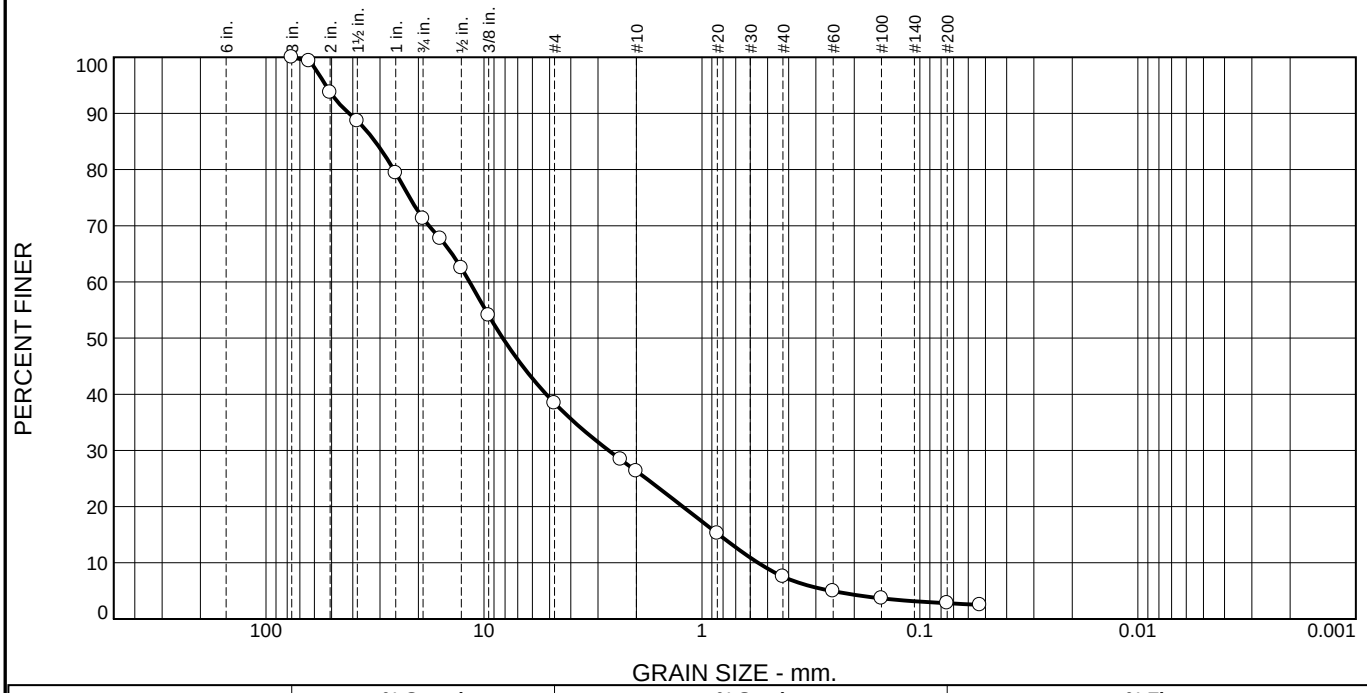
associated earth sciences incorporated

Client: Blue Fern Development
Project: Bullfrog Flats

Project No: 20240155 E001 **Figure**

B-06

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	28.7	32.9	12.1	18.8	4.7	2.8	

TEST RESULTS

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
3"	100.0		
2.5"	99.3		
2"	93.7		
1.50"	88.7		
1"	79.4		
3/4"	71.3		
5/8"	67.7		
1/2"	62.5		
3/8"	54.1		
#4	38.4		
#8	28.4		
#10	26.3		
#20	15.2		
#40	7.5		
#60	4.9		
#100	3.7		
#200	2.8		
#270	2.5		

* (no specification provided)

Material Description

very sandy GRAVEL trace silt

Atterberg Limits (ASTM D 4318)

PL= NP **LL=** NV **PI=**

Classification

USCS (D 2487)= GW **AASHTO (M 145)=** A-1-a

Coefficients

D_{90}= 41.5449 D_{85}= 31.5768 D_{60}= 11.6389
D_{50}= 8.2024 D_{30}= 2.6800 D_{15}= 0.8350
D_{10}= 0.5532 C_u= 21.04 C_c= 1.12

Remarks

Date Received: 8-20-2024 **Date Tested:** 8-26-2024

Tested By: FEW

Checked By: PEL/TP

Title:

Location: Onsite - Facility 10
Sample Number: EP-50 **Depth:** 5'

Date Sampled: 8-12-2024

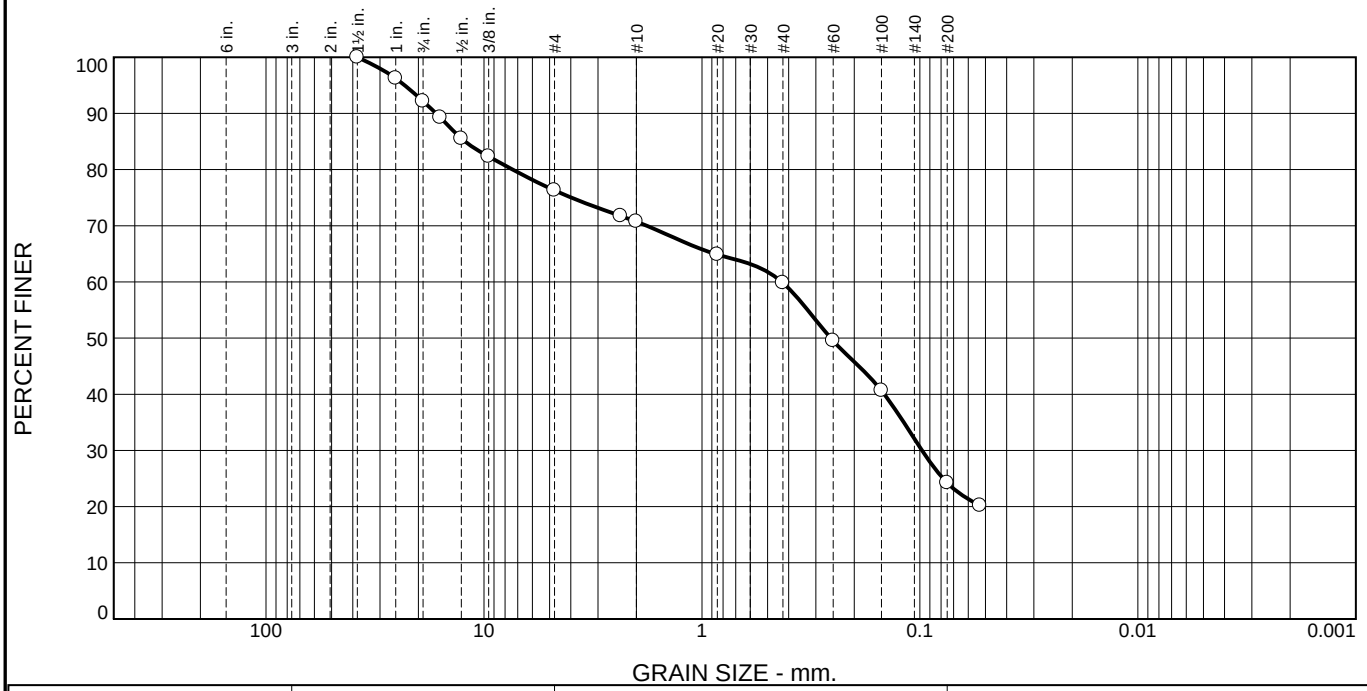
associated earth sciences incorporated

Client: Blue Fern Development
Project: Bullfrog Flats

Project No: 20240155 E001 **Figure**

B-06

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	7.8	15.9	5.6	10.9	35.6	24.2	

TEST RESULTS

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
1.5"	100.0		
1"	96.2		
3/4"	92.2		
5/8"	89.3		
1/2"	85.5		
3/8"	82.3		
#4	76.3		
#8	71.7		
#10	70.7		
#20	64.9		
#40	59.8		
#60	49.5		
#100	40.6		
#200	24.2		
#270	20.2		

* (no specification provided)

Material Description

gravelly silty SAND

Atterberg Limits (ASTM D 4318)

PL= NP **LL=** NV **PI=**

Classification

USCS (D 2487)= SM **AASHTO (M 145)=** A-2-4(0)

Coefficients

D_{90}= 16.5850 D_{85}= 12.2221 D_{60}= 0.4300
D_{50}= 0.2565 D_{30}= 0.0978 D_{15}=
D_{10}= C_u= C_c=

Remarks

Date Received: 8-20-2024 **Date Tested:** 8-26-2024

Tested By: FEW

Checked By: PEL/TP

Title:

Location: Onsite
Sample Number: EP-51 **Depth:** 2'

Date Sampled: 8-12-2024

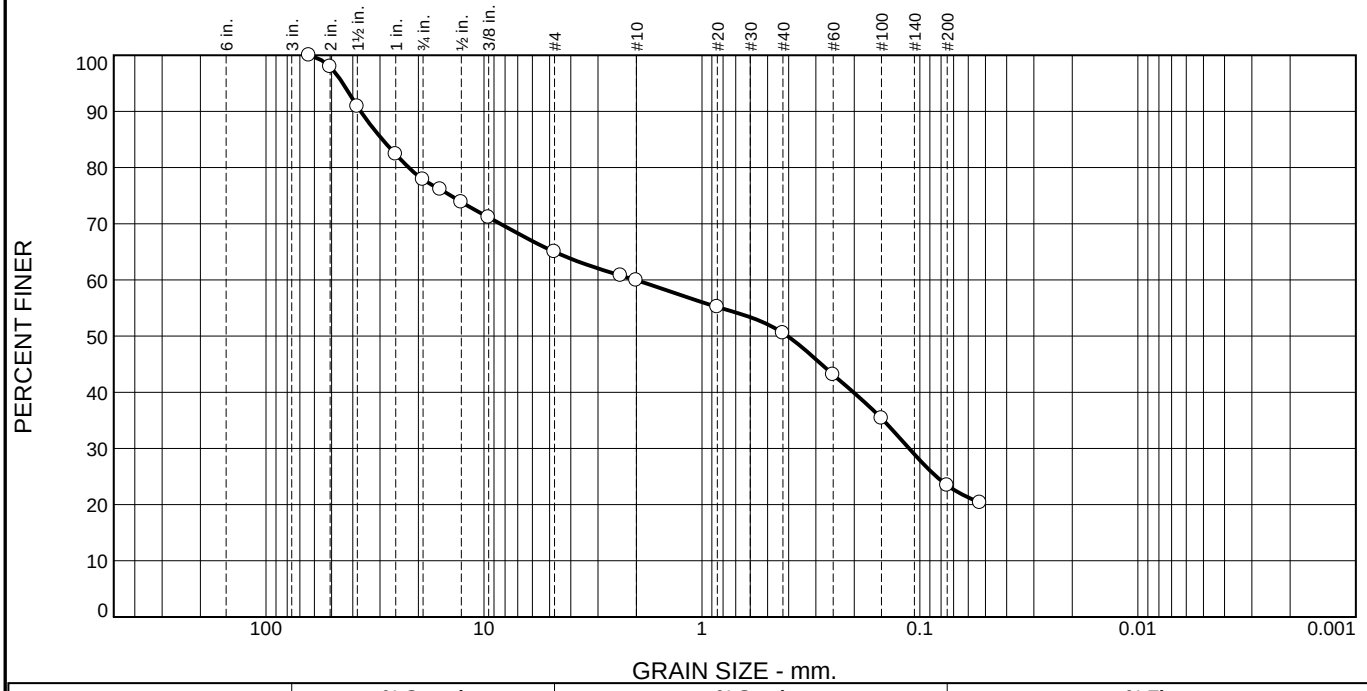
associated earth sciences incorporated

Client: Blue Fern Development
Project: Bullfrog Flats

Project No: 20240155 E001 **Figure**

B-06

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	22.1	12.9	5.1	9.4	27.1	23.4	

TEST RESULTS

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
2.5"	100.0		
2"	97.9		
1.50"	90.9		
1"	82.4		
3/4"	77.9		
5/8"	76.1		
1/2"	73.9		
3/8"	71.1		
#4	65.0		
#8	60.8		
#10	59.9		
#20	55.2		
#40	50.5		
#60	43.1		
#100	35.4		
#200	23.4		
#270	20.3		

* (no specification provided)

Material Description

very gravelly silty SAND

Atterberg Limits (ASTM D 4318)

PL= NP **LL=** NV **PI=**

Classification

USCS (D 2487)= SM **AASHTO (M 145)=** A-1-b

Coefficients

D_{90}= 36.7916 D_{85}= 29.2519 D_{60}= 2.0230
D_{50}= 0.4050 D_{30}= 0.1121 D_{15}=
D_{10}= C_u= C_c=

Remarks

Date Received: 8-20-2024 **Date Tested:** 8-26-2024

Tested By: FEW

Checked By: PEL/TP

Title:

Location: Onsite
Sample Number: EP-52 **Depth:** 2'

Date Sampled: 8-12-2024

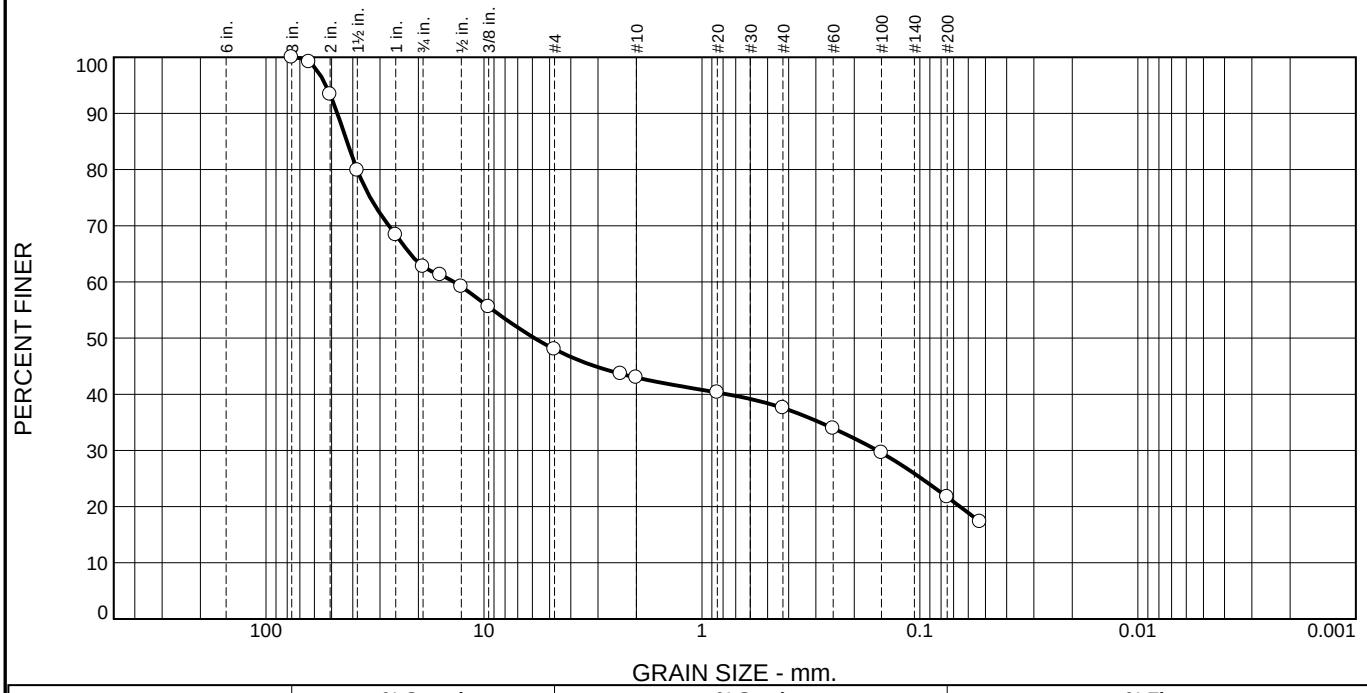
associated earth sciences incorporated

Client: Blue Fern Development
Project: Bullfrog Flats

Project No: 20240155 E001 **Figure**

B-06

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	37.3	14.7	5.0	5.4	15.9	21.7	

TEST RESULTS

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
3"	100.0		
2.5"	99.2		
2"	93.4		
1.50"	79.9		
1"	68.4		
3/4"	62.7		
5/8"	61.3		
1/2"	59.2		
3/8"	55.6		
#4	48.0		
#8	43.6		
#10	43.0		
#20	40.3		
#40	37.6		
#60	33.9		
#100	29.6		
#200	21.7		
#270	17.3		

* (no specification provided)

Material Description

sandy silty GRAVEL

Atterberg Limits (ASTM D 4318)

PL= NP **LL=** NV **PI=**

Classification

USCS (D 2487)= GM **AASHTO (M 145)=** A-1-b

Coefficients

D_{90}= 47.0594 D_{85}= 42.5198 D_{60}= 13.7162
D_{50}= 5.8639 D_{30}= 0.1568 D_{15}=
D_{10}= C_u= C_c=

Remarks

Date Received: 8-20-2024 **Date Tested:** 8-27-2024

Tested By: FEW

Checked By: PEL/TP

Title:

Location: Onsite
Sample Number: EP-53 **Depth:** 2'

Date Sampled: 8-12-2024

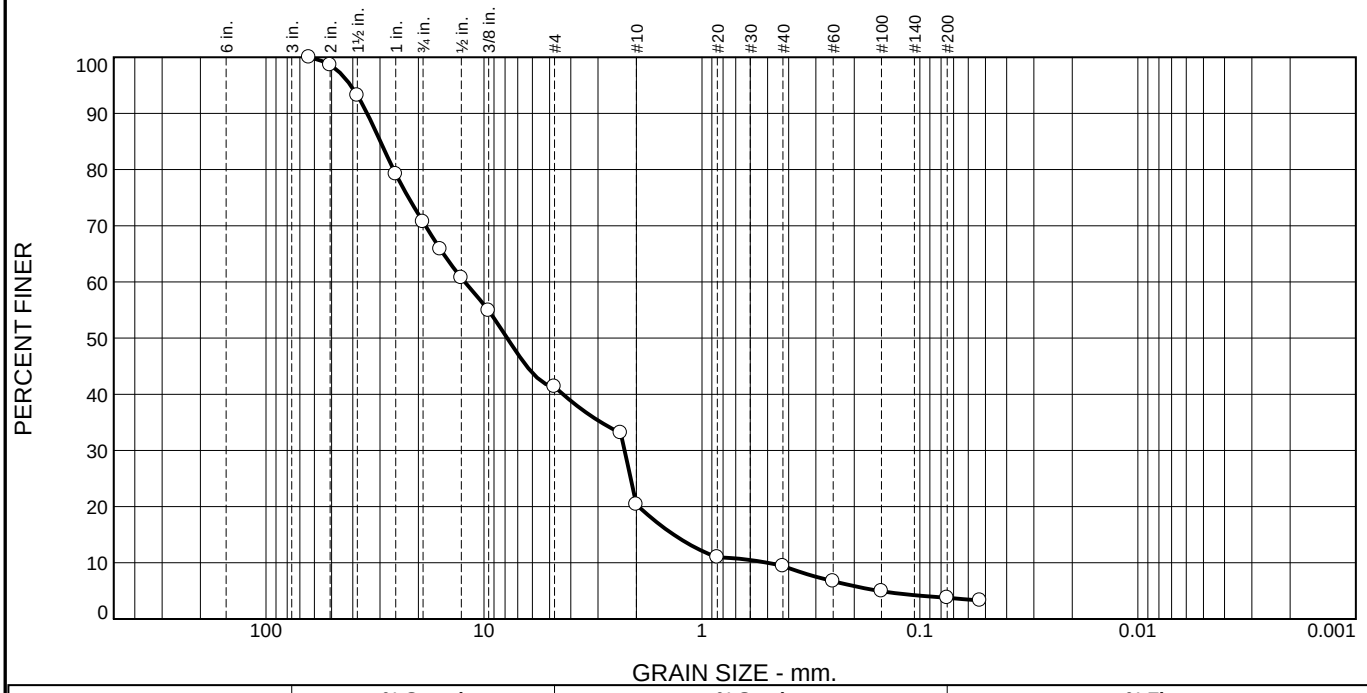
associated earth sciences incorporated

Client: Blue Fern Development
Project: Bullfrog Flats

Project No: 20240155 E001 **Figure**

B-06

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	29.3	29.3	21.0	11.0	5.6	3.8	

TEST RESULTS

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
2.5"	100.0		
2"	98.6		
1.50"	93.2		
1"	79.2		
3/4"	70.7		
5/8"	65.8		
1/2"	60.7		
3/8"	54.9		
#4	41.4		
#8	33.1		
#10	20.4		
#20	11.0		
#40	9.4		
#60	6.7		
#100	4.9		
#200	3.8		
#270	3.3		

* (no specification provided)

Material Description

very sandy GRAVEL trace silt

Atterberg Limits (ASTM D 4318)

PL= NP **LL=** NV **PI=**

Classification

USCS (D 2487)= GP **AASHTO (M 145)=** A-1-a

Coefficients

D_{90}= 34.3779 D_{85}= 29.8732 D_{60}= 12.2563
D_{50}= 7.8283 D_{30}= 2.2610 D_{15}= 1.3473
D_{10}= 0.4997 C_u= 24.53 C_c= 0.83

Remarks

Date Received: 8-26-2024 **Date Tested:** 8-30-2024

Tested By: FEW

Checked By: PEL/TP

Title:

Location: Onsite BA-5
Sample Number: EP-57 **Depth:** 5'

Date Sampled: 8-12-2024

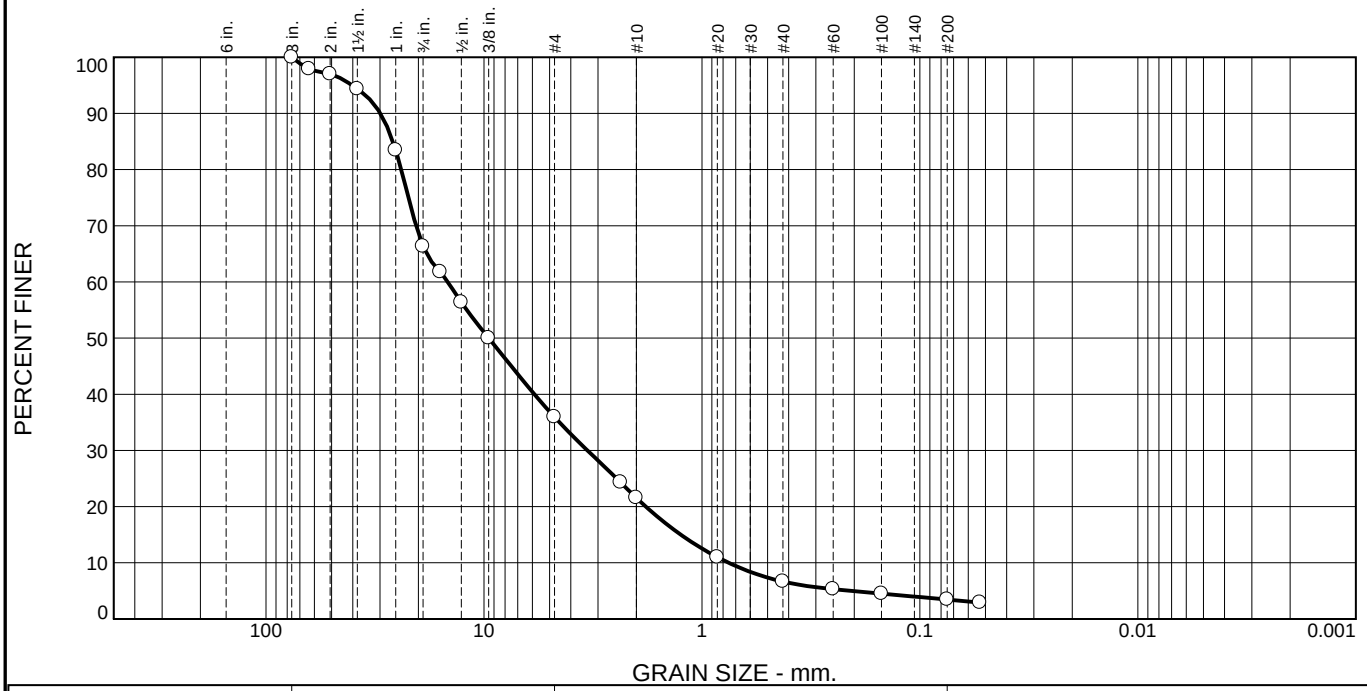
associated earth sciences incorporated

Client: Blue Fern Development
Project: Bullfrog Flats

Project No: 20240155 E001 **Figure**

B-06

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	33.7	30.4	14.3	15.0	3.1	3.5	

TEST RESULTS

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
3"	100.0		
2.5"	97.9		
2"	97.0		
1.50"	94.4		
1"	83.5		
3/4"	66.3		
5/8"	61.8		
1/2"	56.4		
3/8"	50.0		
#4	35.9		
#8	24.3		
#10	21.6		
#20	11.0		
#40	6.6		
#60	5.3		
#100	4.5		
#200	3.5		
#270	2.9		

* (no specification provided)

Material Description

very sandy GRAVEL trace silt

Atterberg Limits (ASTM D 4318)

PL= NP **LL=** NV **PI=**

Classification

USCS (D 2487)= GW **AASHTO (M 145)=** A-1-a

Coefficients

D_{90}= 29.8748 D_{85}= 26.1733 D_{60}= 14.6742
D_{50}= 9.5160 D_{30}= 3.3529 D_{15}= 1.2511
D_{10}= 0.7540 C_u= 19.46 C_c= 1.02

Remarks

Date Received: 8-26-2024 **Date Tested:** 8-28-2024

Tested By: FEW

Checked By: PEL/TP

Title:

Location: Onsite - BA-5
Sample Number: EP-58 **Depth:** 5'

Date Sampled: 8-12-2024

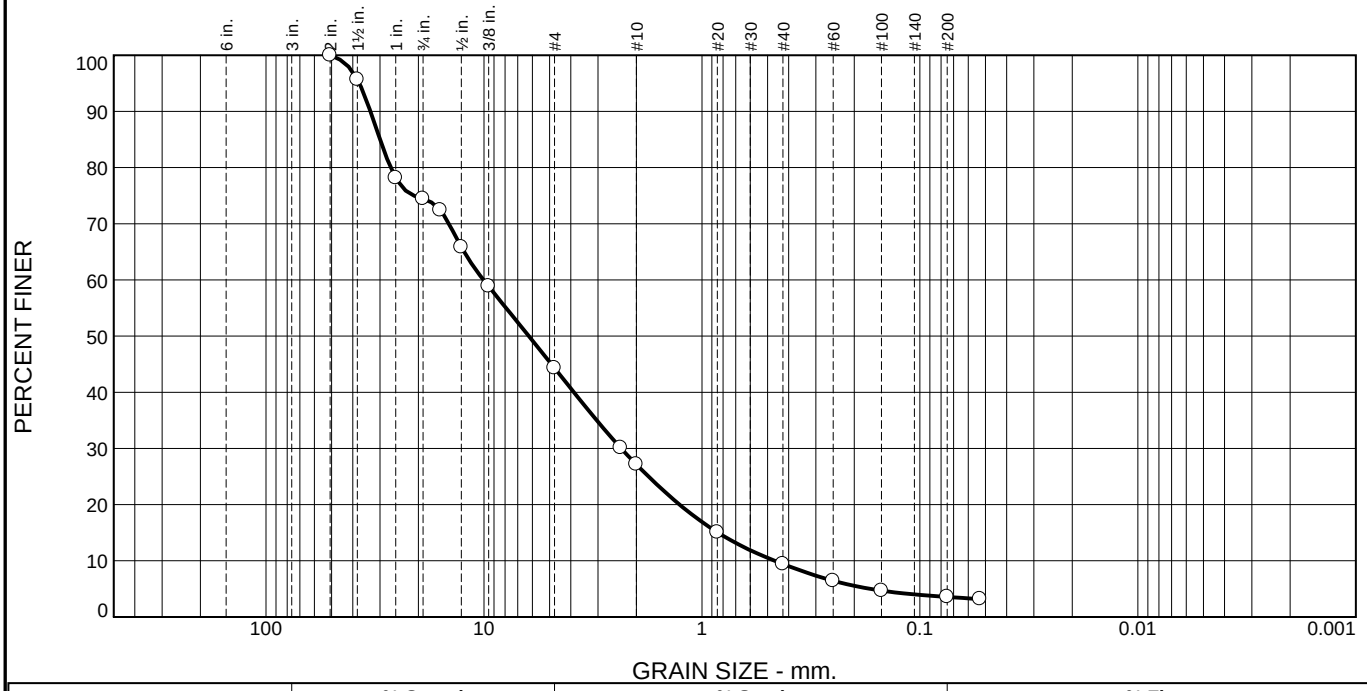
associated earth sciences incorporated

Client: Blue Fern Development
Project: Bullfrog Flats

Project No: 20240155 E001 **Figure**

B-06

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	25.5	30.2	17.1	17.8	5.8	3.6	

TEST RESULTS

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
2"	100.0		
1.50"	95.7		
1"	78.1		
3/4"	74.5		
5/8"	72.4		
1/2"	65.8		
3/8"	58.9		
#4	44.3		
#8	30.1		
#10	27.2		
#20	15.1		
#40	9.4		
#60	6.4		
#100	4.7		
#200	3.6		
#270	3.2		

* (no specification provided)

Material Description

very sandy GRAVEL trace silt

Atterberg Limits (ASTM D 4318)

PL= NP **LL=** NV **PI=**

Classification

USCS (D 2487)= GW **AASHTO (M 145)=** A-1-a

Coefficients

D_{90}= 33.2069 D_{85}= 29.9870 D_{60}= 10.0455
D_{50}= 6.2287 D_{30}= 2.3477 D_{15}= 0.8444
D_{10}= 0.4631 C_u= 21.69 C_c= 1.18

Remarks

Date Received: 8-26-2024 **Date Tested:** 8-28-2024

Tested By: FEW

Checked By: PEL/TP

Title:

Location: Onsite - BA-5
Sample Number: EP-59 **Depth:** 6'

Date Sampled: 8-12-2024

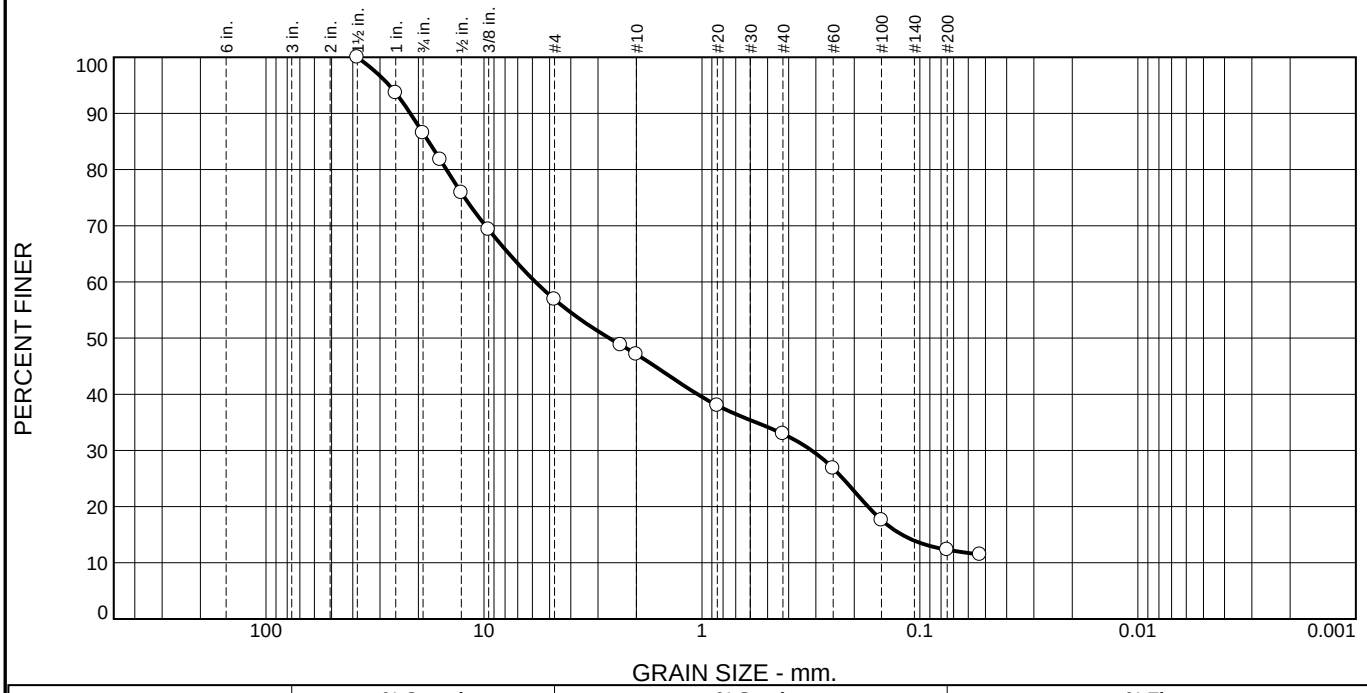
associated earth sciences incorporated

Client: Blue Fern Development
Project: Bullfrog Flats

Project No: 20240155 E001 **Figure**

B-06

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	13.5	29.6	9.8	14.2	20.6	12.3	

TEST RESULTS

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
1.5"	100.0		
1"	93.7		
3/4"	86.5		
5/8"	81.8		
1/2"	75.9		
3/8"	69.3		
#4	56.9		
#8	48.8		
#10	47.1		
#20	38.0		
#40	32.9		
#60	26.8		
#100	17.6		
#200	12.3		
#270	11.5		

* (no specification provided)

Material Description

very gravelly silty SAND

Atterberg Limits (ASTM D 4318)

PL= NP **LL=** NV **PI=**

Classification

USCS (D 2487)= SM **AASHTO (M 145)=** A-1-b

Coefficients

D_{90}= 21.7733 D_{85}= 17.9769 D_{60}= 5.8071
D_{50}= 2.6619 D_{30}= 0.3136 D_{15}= 0.1210
D_{10}= C_u= C_c=

Remarks

Date Received: 8-26-2024 **Date Tested:** 8-30-2024

Tested By: FEW

Checked By: PEL/TP

Title:

Location: Onsite IA-3
Sample Number: EP-62 **Depth:** 3'

Date Sampled: 8-13-2024

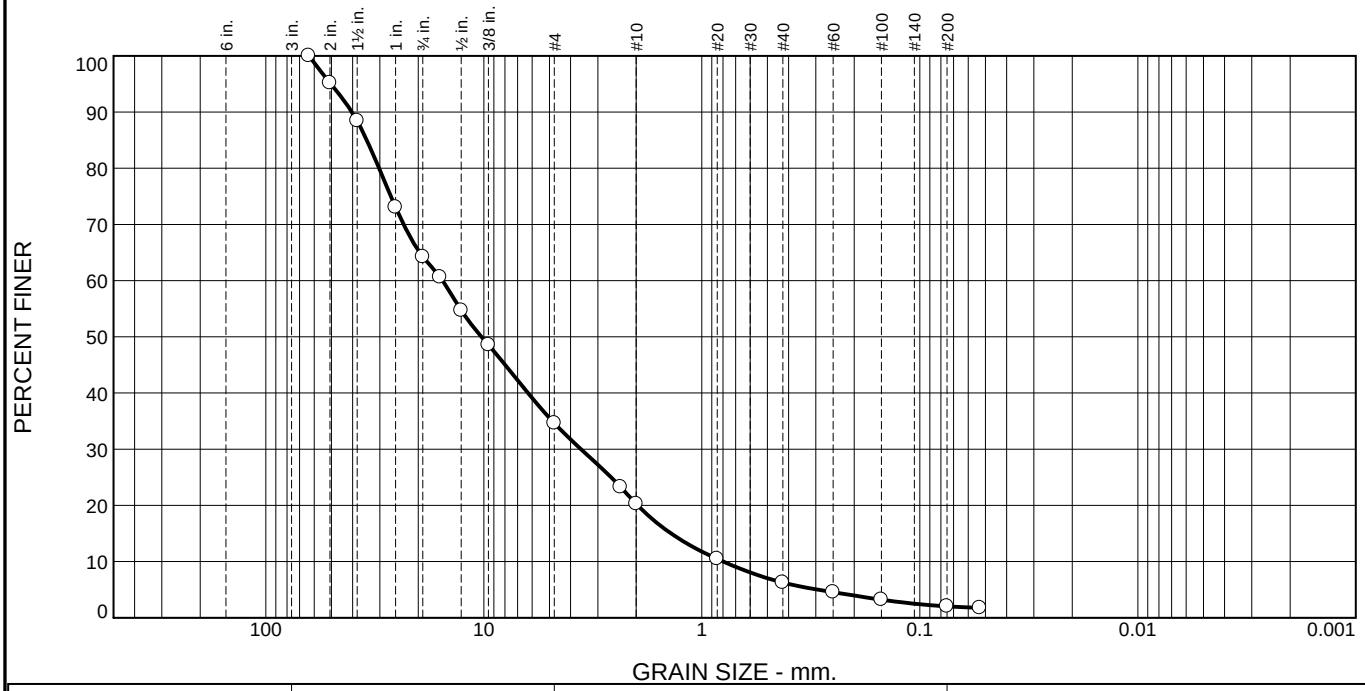
associated earth sciences incorporated

Client: Blue Fern Development
Project: Bullfrog Flats

Project No: 20240155 E001 **Figure**

B-06

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	35.8	29.6	14.3	14.0	4.3	2.0	

TEST RESULTS

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
2.5"	100.0		
2"	95.2		
1.50"	88.4		
1"	73.0		
3/4"	64.2		
5/8"	60.6		
1/2"	54.7		
3/8"	48.6		
#4	34.6		
#8	23.3		
#10	20.3		
#20	10.5		
#40	6.3		
#60	4.6		
#100	3.2		
#200	2.0		
#270	1.8		

* (no specification provided)

Material Description

very sandy GRAVEL trace silt

Atterberg Limits (ASTM D 4318)

PL= NP **LL=** NV **PI=** NP

Classification

USCS (D 2487)= GW **AASHTO (M 145)=** A-1-a

Coefficients

D_{90}= 40.2656 D_{85}= 34.4054 D_{60}= 15.4602
D_{50}= 10.2462 D_{30}= 3.5836 D_{15}= 1.3842
D_{10}= 0.7985 C_u= 19.36 C_c= 1.04

Remarks

Date Received: 8-26-2024 **Date Tested:** 8-30-2024

Tested By: FEW

Checked By: PEL/TP

Title:

Location: Onsite IA-3
Sample Number: EP-62 **Depth:** 13'

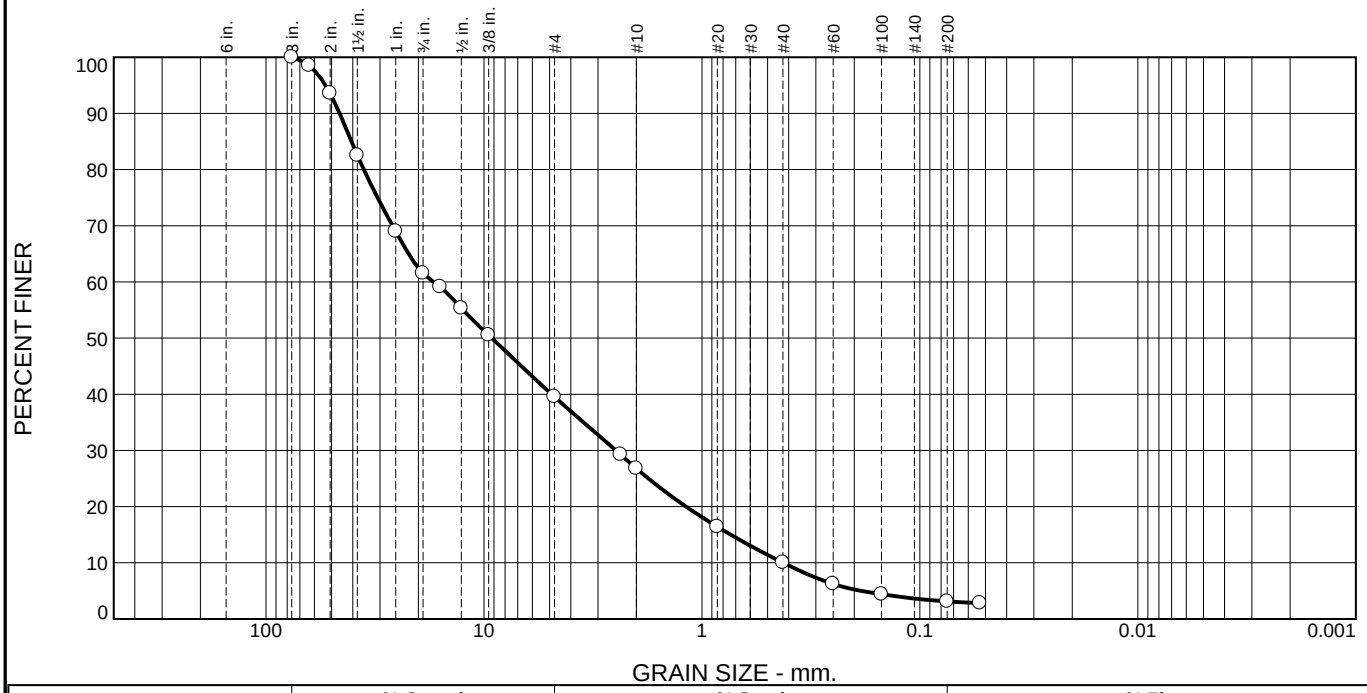
Date Sampled: 8-13-2024

associated earth sciences incorporated

Client: Blue Fern Development
Project: Bullfrog Flats

Project No: 20240155 E001 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	38.5	22.0	12.7	16.8	6.9	3.1	

TEST RESULTS

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
3"	100.0		
2.5"	98.5		
2"	93.6		
1.50"	82.5		
1"	69.0		
3/4"	61.5		
5/8"	59.1		
1/2"	55.3		
3/8"	50.5		
#4	39.5		
#8	29.2		
#10	26.8		
#20	16.4		
#40	10.0		
#60	6.2		
#100	4.4		
#200	3.1		
#270	2.8		

* (no specification provided)

Material Description

very sandy GRAVEL trace silt

Atterberg Limits (ASTM D 4318)

PL= NP **LL=** NV **PI=**

Classification

USCS (D 2487)= GP **AASHTO (M 145)=** A-1-a

Coefficients

D_{90}= 45.9314 D_{85}= 40.5330 D_{60}= 17.0441
D_{50}= 9.2104 D_{30}= 2.4831 D_{15}= 0.7379
D_{10}= 0.4238 C_u= 40.22 C_c= 0.85

Remarks

Date Received: 8-26-2024 **Date Tested:** 8-30-2024

Tested By: FEW

Checked By: PEL/TP

Title:

Location: Onsite IA-3
Sample Number: EP-63 **Depth:** 7'

Date Sampled: 8-13-2024

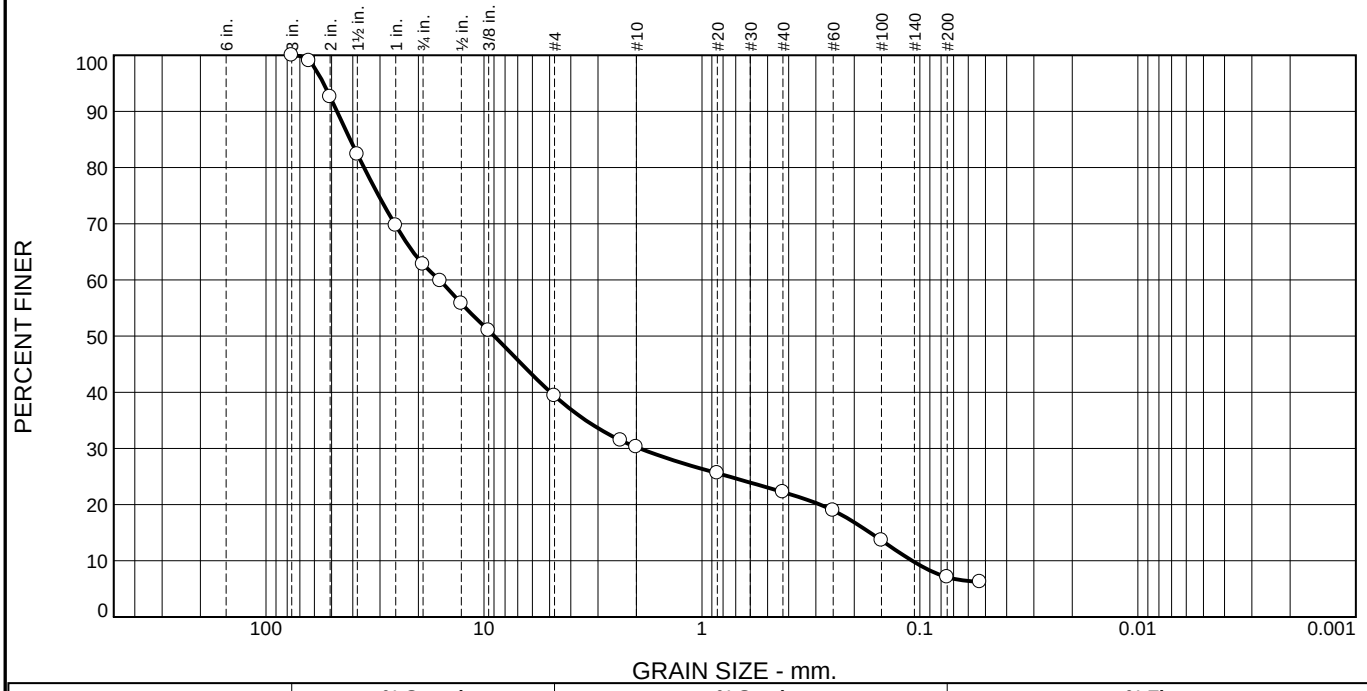
associated earth sciences incorporated

Client: Blue Fern Development
Project: Bullfrog Flats

Project No: 20240155 E001 **Figure**

B-06

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	37.2	23.4	9.2	8.0	15.1	7.1	

TEST RESULTS

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
3"	100.0		
2.5"	99.0		
2"	92.6		
1.50"	82.4		
1"	69.7		
3/4"	62.8		
5/8"	59.8		
1/2"	55.8		
3/8"	51.0		
#4	39.4		
#8	31.4		
#10	30.2		
#20	25.6		
#40	22.2		
#60	18.9		
#100	13.6		
#200	7.1		
#270	6.2		

* (no specification provided)

Material Description

very sandy GRAVEL some silt

Atterberg Limits (ASTM D 4318)

PL= NP **LL=** NV **PI=**

Classification

USCS (D 2487)= GW-GM **AASHTO (M 145)=** A-1-a

Coefficients

D_{90}= 47.2641 D_{85}= 41.0908 D_{60}= 16.0379
D_{50}= 8.9726 D_{30}= 1.9289 D_{15}= 0.1691
D_{10}= 0.1085 C_u= 147.76 C_c= 2.14

Remarks

Date Received: 8-27-2024 **Date Tested:** 8-30-2024

Tested By: FEW

Checked By: PEL/TP

Title:

Location: Onsite BA-4
Sample Number: EP-69 **Depth:** 3'

Date Sampled: 8-13-2024

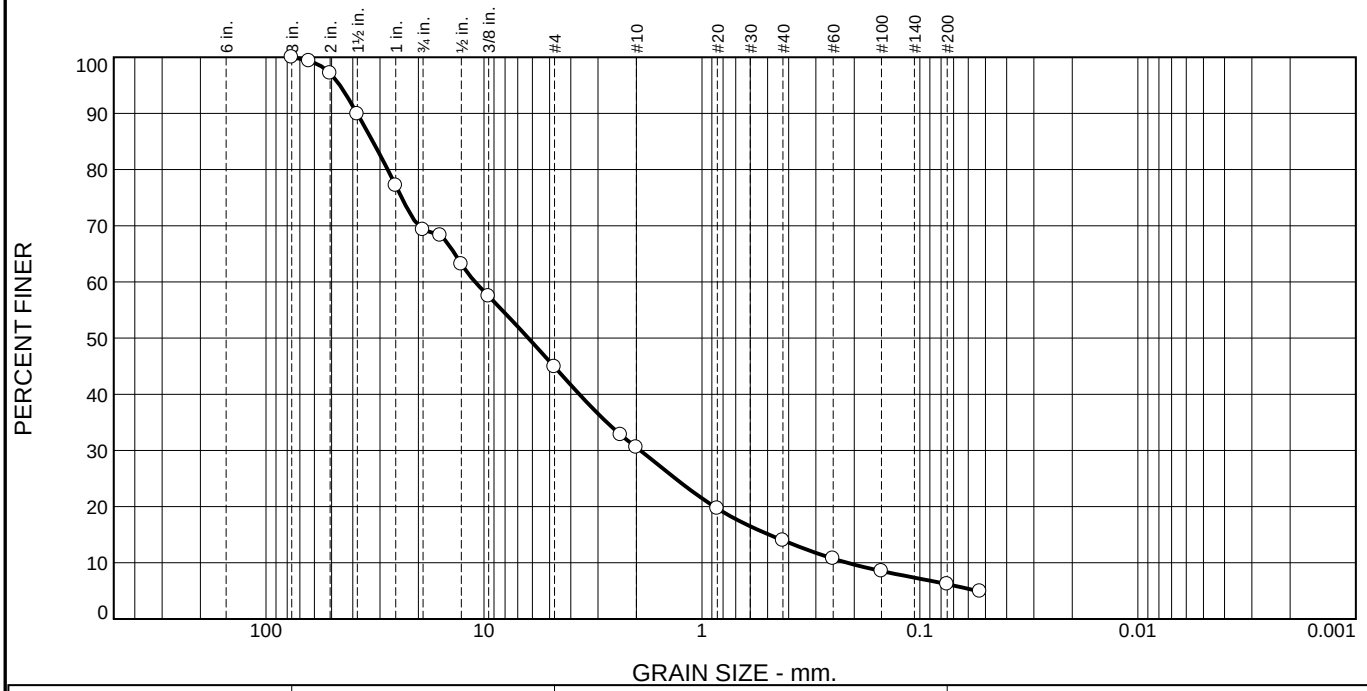
associated earth sciences incorporated

Client: Blue Fern Development
Project: Bullfrog Flats

Project No: 20240155 E001 **Figure**

B-06

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	30.7	24.4	14.3	16.6	7.8	6.2	

TEST RESULTS

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
3"	100.0		
2.5"	99.3		
2"	97.2		
1.50"	89.9		
1"	77.2		
3/4"	69.3		
5/8"	68.3		
1/2"	63.2		
3/8"	57.5		
#4	44.9		
#8	32.8		
#10	30.6		
#20	19.7		
#40	14.0		
#60	10.7		
#100	8.5		
#200	6.2		
#270	4.9		

* (no specification provided)

Material Description

very sandy GRAVEL some silt

Atterberg Limits (ASTM D 4318)

PL= NP **LL=** NV **PI=**

Classification

USCS (D 2487)= GW-GM **AASHTO (M 145)=** A-1-a

Coefficients

D_{90}= 38.2370 D_{85}= 32.3780 D_{60}= 10.9783
D_{50}= 6.2608 D_{30}= 1.9180 D_{15}= 0.4916
D_{10}= 0.2153 C_u= 50.98 C_c= 1.56

Remarks

Date Received: 8-27-2024 **Date Tested:** 8-29-2024

Tested By: FEW

Checked By: PEL/TP

Title:

Location: Onsite BA-4
Sample Number: EP-70 **Depth:** 7'

Date Sampled: 8-13-2024

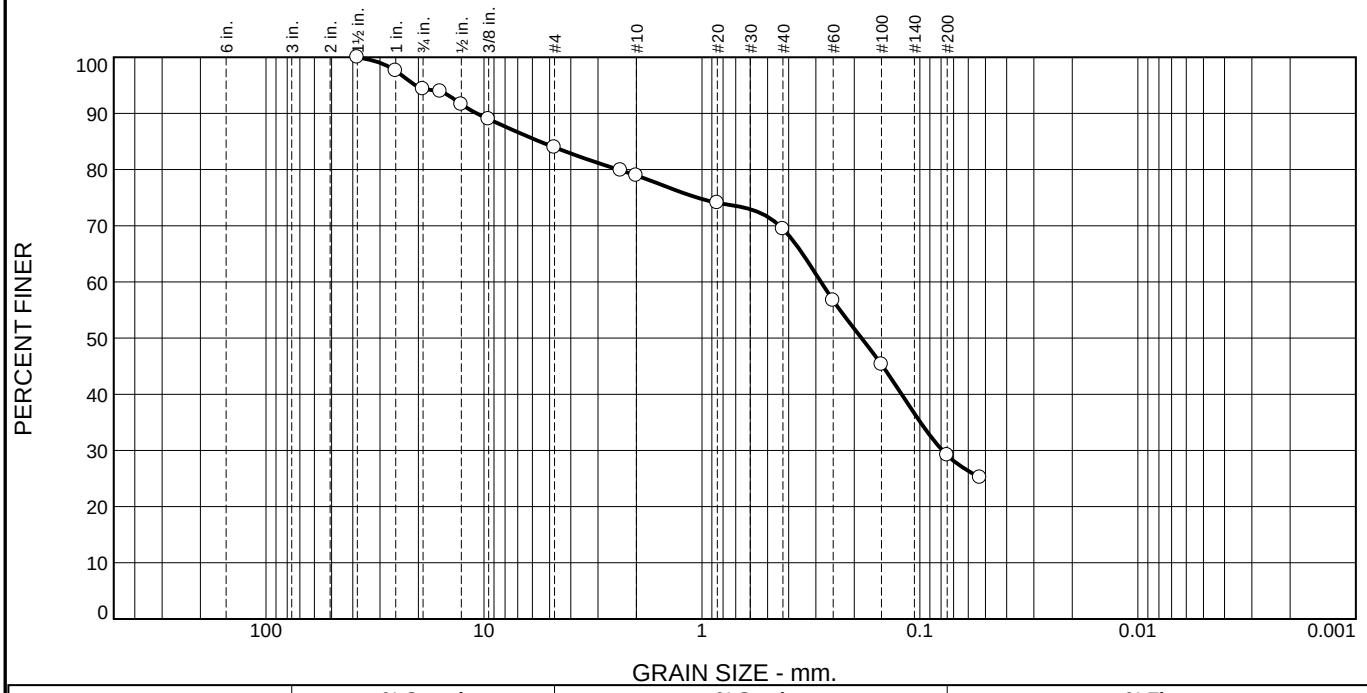
associated earth sciences incorporated

Client: Blue Fern Development
Project: Bullfrog Flats

Project No: 20240155 E001 **Figure**

B-06

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	5.6	10.4	5.1	9.5	40.2	29.2	

TEST RESULTS

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
1.5"	100.0		
1"	97.6		
3/4"	94.4		
5/8"	93.9		
1/2"	91.6		
3/8"	89.0		
#4	84.0		
#8	79.9		
#10	78.9		
#20	74.1		
#40	69.4		
#60	56.7		
#100	45.3		
#200	29.2		
#270	25.2		

* (no specification provided)

Material Description

gravelly silty SAND

Atterberg Limits (ASTM D 4318)

PL= NP **LL=** NV **PI=**

Classification

USCS (D 2487)= SM **AASHTO (M 145)=** A-2-4(0)

Coefficients

D_{90}= 10.7943 D_{85}= 5.5475 D_{60}= 0.2845
D_{50}= 0.1853 D_{30}= 0.0788 D_{15}=
D_{10}= C_u= C_c=

Remarks

Date Received: 8-27-2024 **Date Tested:** 8-29-2024

Tested By: FEW

Checked By: PEL/TP

Title:

Location: Onsite BA-4
Sample Number: EP-71 **Depth:** 3'

Date Sampled: 8-13-2024

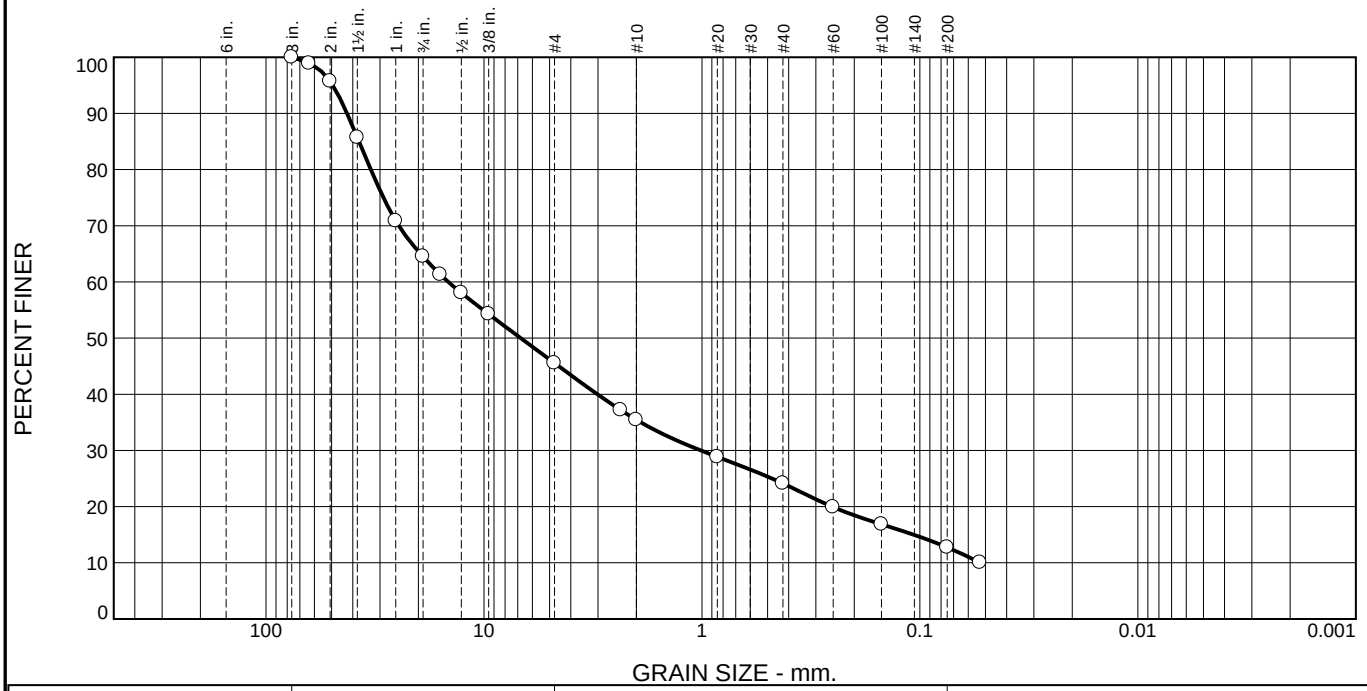
associated earth sciences incorporated

Client: Blue Fern Development
Project: Bullfrog Flats

Project No: 20240155 E001 **Figure**

B-06

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	35.5	18.9	10.1	11.4	11.3	12.8	

TEST RESULTS

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
3"	100.0		
2.5"	98.9		
2"	95.7		
1.50"	85.7		
1"	70.9		
3/4"	64.5		
5/8"	61.3		
1/2"	58.1		
3/8"	54.3		
#4	45.6		
#8	37.2		
#10	35.5		
#20	28.9		
#40	24.1		
#60	19.9		
#100	16.8		
#200	12.8		
#270	10.0		

* (no specification provided)

Material Description

very sandy silty GRAVEL

Atterberg Limits (ASTM D 4318)

PL= NP **LL=** NV **PI=**

Classification

USCS (D 2487)= GM **AASHTO (M 145)=** A-1-a

Coefficients

D_{90}= 42.4874 D_{85}= 37.4582 D_{60}= 14.5903
D_{50}= 6.7882 D_{30}= 1.0128 D_{15}= 0.1069
D_{10}= C_u= C_c=

Remarks

Date Received: 8-27-2024 **Date Tested:** 8-29-2024

Tested By: FEW

Checked By: PEL/TP

Title:

Location: Onsite BA-2
Sample Number: EP-73 **Depth:** 4'

Date Sampled: 8-14-2024

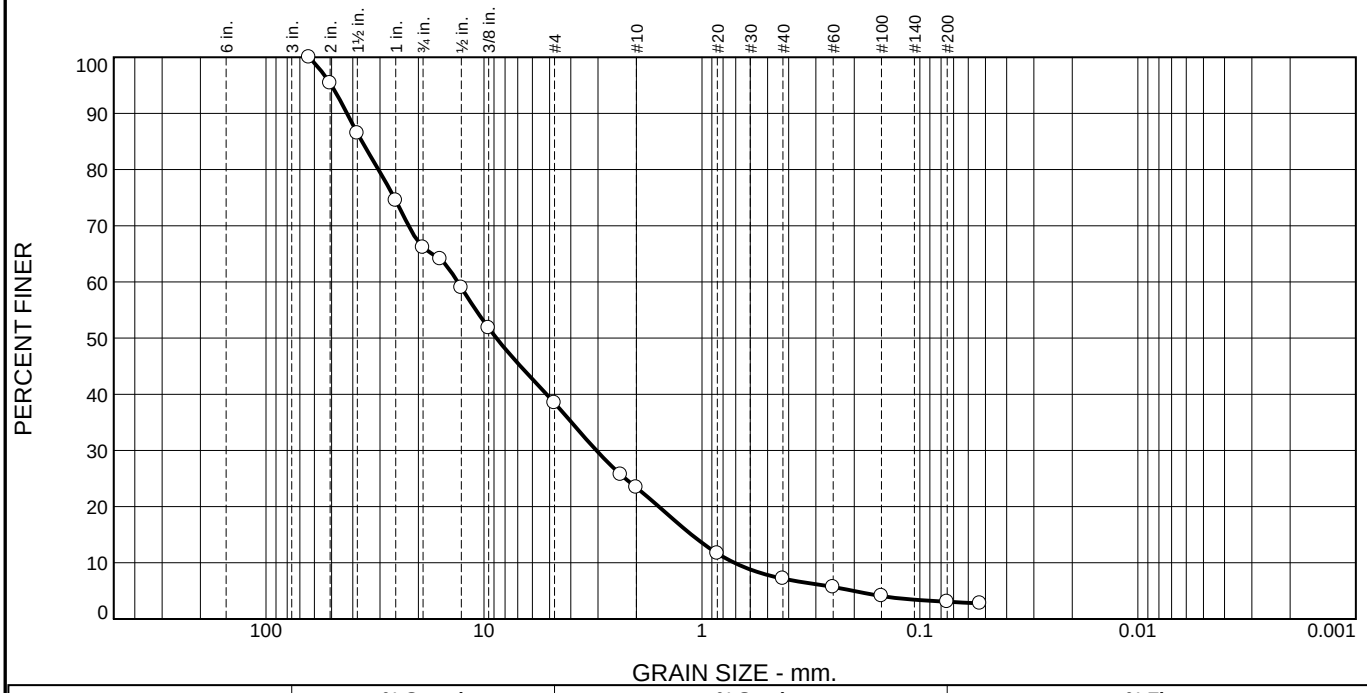
associated earth sciences incorporated

Client: Blue Fern Development
Project: Bullfrog Flats

Project No: 20240155 E001 **Figure**

B-06

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	33.9	27.6	15.1	16.2	4.1	3.1	

TEST RESULTS

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
2.5"	100.0		
2"	95.4		
1.50"	86.5		
1"	74.5		
3/4"	66.1		
5/8"	64.1		
1/2"	59.0		
3/8"	51.8		
#4	38.5		
#8	25.7		
#10	23.4		
#20	11.7		
#40	7.2		
#60	5.7		
#100	4.1		
#200	3.1		
#270	2.8		

* (no specification provided)

Material Description

very sandy GRAVEL trace silt

Atterberg Limits (ASTM D 4318)

PL= NP **LL=** NV **PI=**

Classification

USCS (D 2487)= GP **AASHTO (M 145)=** A-1-a

Coefficients

D_{90}= 42.4989 D_{85}= 36.3020 D_{60}= 13.1934
D_{50}= 8.7684 D_{30}= 3.0509 D_{15}= 1.1160
D_{10}= 0.7100 C_u= 18.58 C_c= 0.99

Remarks

Date Received: 8-27-2024 **Date Tested:** 8-30-2024

Tested By: FEW

Checked By: PEL/TP

Title:

Location: Onsite BA-2
Sample Number: EP-74 **Depth:** 9'

Date Sampled: 8-14-2024

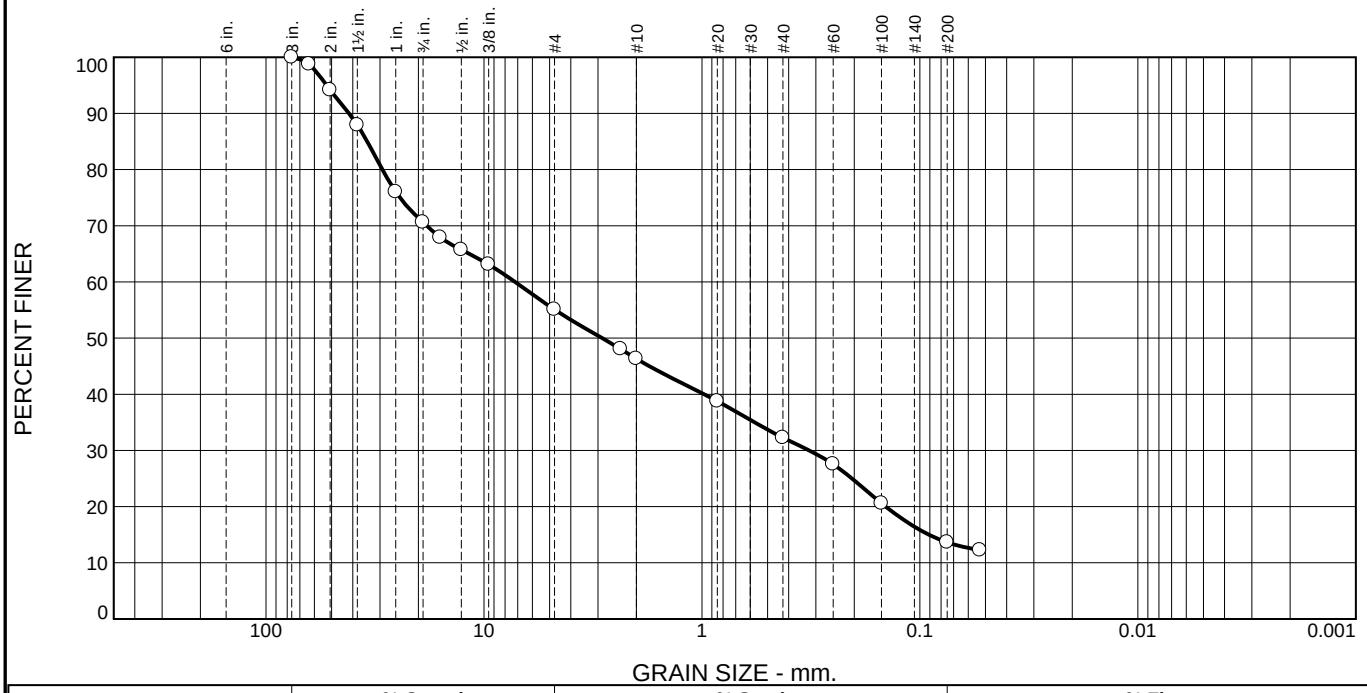
associated earth sciences incorporated

Client: Blue Fern Development
Project: Bullfrog Flats

Project No: 20240155 E001 **Figure**

B-06

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	29.4	15.5	8.8	14.0	18.7	13.6	

TEST RESULTS

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
3"	100.0		
2.5"	98.7		
2"	94.2		
1.50"	87.9		
1"	76.0		
3/4"	70.6		
5/8"	67.9		
1/2"	65.7		
3/8"	63.1		
#4	55.1		
#8	48.0		
#10	46.3		
#20	38.8		
#40	32.3		
#60	27.5		
#100	20.6		
#200	13.6		
#270	12.2		

* (no specification provided)

Material Description

very sandy silty GRAVEL

Atterberg Limits (ASTM D 4318)

PL= NP **LL=** NV **PI=**

Classification

USCS (D 2487)= GM **AASHTO (M 145)=** A-1-b

Coefficients

D_{90}= 41.6357 D_{85}= 34.3524 D_{60}= 7.2020
D_{50}= 2.8715 D_{30}= 0.3222 D_{15}= 0.0910
D_{10}= C_u= C_c=

Remarks

Date Received: 8-14-2024 **Date Tested:** 8-14-2024

Tested By: FEW

Checked By: PEL/TP

Title:

Location: Onsite BA-2
Sample Number: EP-75 **Depth:** 4'

Date Sampled: 8-14-2024

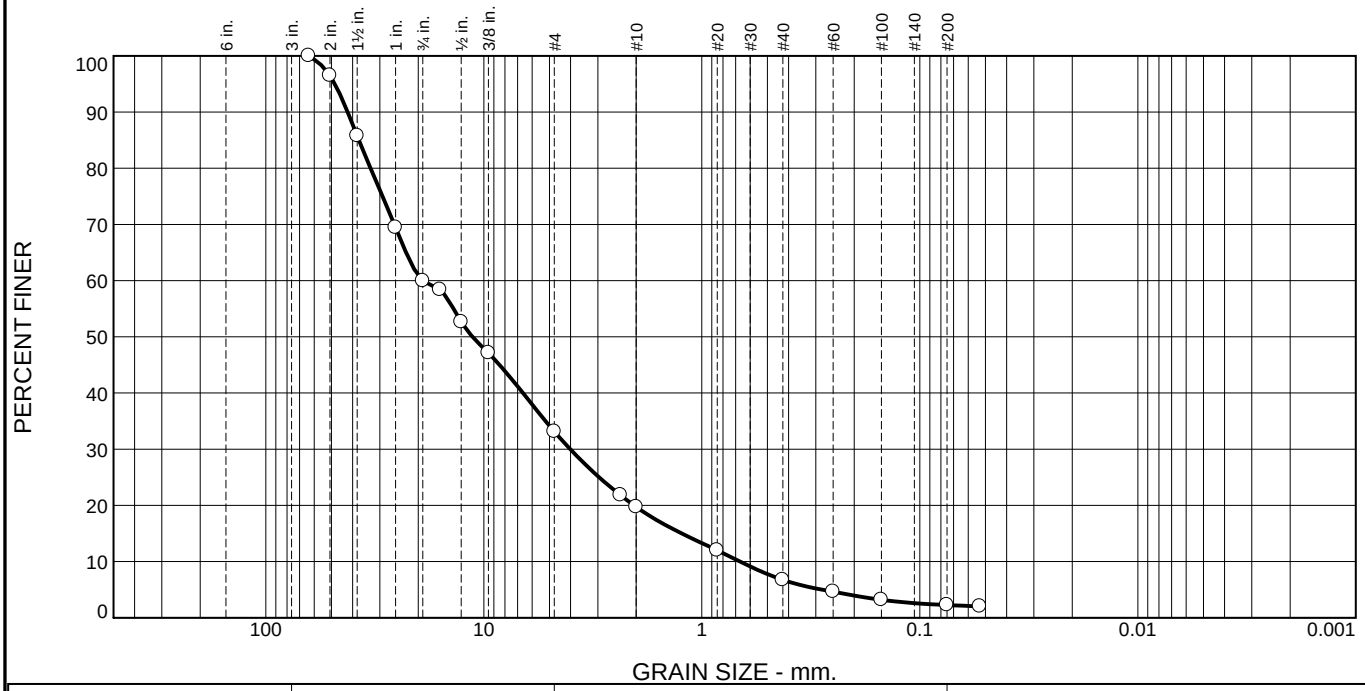
associated earth sciences incorporated

Client: Blue Fern Development
Project: Bullfrog Flats

Project No: 20240155 E001 **Figure**

B-06

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	40.0	26.9	13.4	13.0	4.4	2.3	

TEST RESULTS

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
2.5"	100.0		
2"	96.5		
1.50"	85.8		
1"	69.4		
3/4"	60.0		
5/8"	58.4		
1/2"	52.7		
3/8"	47.1		
#4	33.1		
#8	21.8		
#10	19.7		
#20	12.0		
#40	6.7		
#60	4.6		
#100	3.2		
#200	2.3		
#270	2.0		

* (no specification provided)

Material Description

very sandy GRAVEL trace silt

Atterberg Limits (ASTM D 4318)

PL= NP **LL=** NV **PI=**

Classification

USCS (D 2487)= GW **AASHTO (M 145)=** A-1-a

Coefficients

D_{90}= 42.1475 D_{85}= 37.4005 D_{60}= 19.0910
D_{50}= 11.2755 D_{30}= 4.0172 D_{15}= 1.2359
D_{10}= 0.6679 C_u= 28.59 C_c= 1.27

Remarks

Date Received: 8-28-2024 **Date Tested:** 9-3-2024

Tested By: FEW

Checked By: PEL/TP

Title:

Location: Onsite IA-1
Sample Number: EP-78 **Depth:** 14'

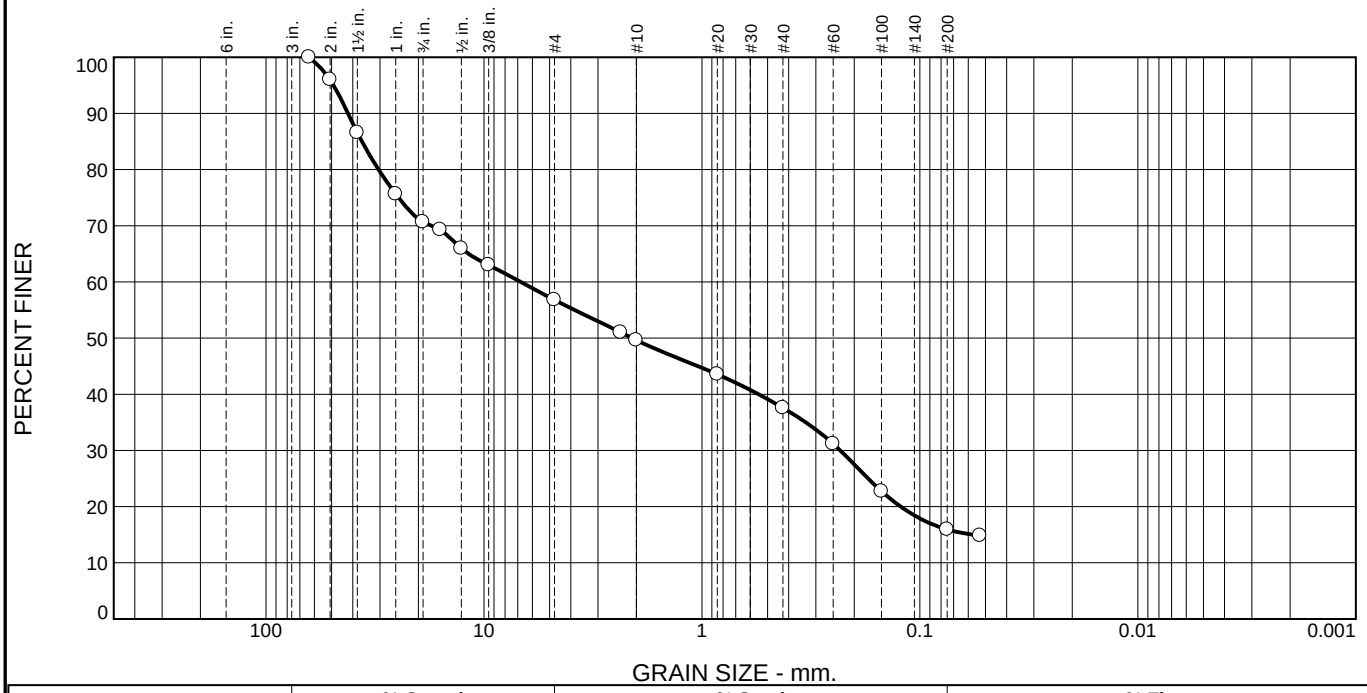
Date Sampled: 8-14-2024

associated earth sciences incorporated

Client: Blue Fern Development
Project: Bullfrog Flats

Project No: 20240155 E001 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	29.3	13.9	7.2	12.0	21.7	15.9	

TEST RESULTS

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
2.5"	100.0		
2"	96.0		
1.50"	86.5		
1"	75.7		
3/4"	70.7		
5/8"	69.3		
1/2"	66.0		
3/8"	63.0		
#4	56.8		
#8	51.0		
#10	49.6		
#20	43.5		
#40	37.6		
#60	31.2		
#100	22.7		
#200	15.9		
#270	14.8		

* (no specification provided)

Material Description

very sandy silty GRAVEL

Atterberg Limits (ASTM D 4318)

PL= NP **LL=** NV **PI=**

Classification

USCS (D 2487)= GM **AASHTO (M 145)=** A-1-b

Coefficients

D_{90}= 42.0679 D_{85}= 36.3292 D_{60}= 6.7895
D_{50}= 2.0900 D_{30}= 0.2320 D_{15}= 0.0572
D_{10}= C_u= C_c=

Remarks

Date Received: 8-28-2024 **Date Tested:** 8-30-2024

Tested By: FEW

Checked By: PEL/TP

Title:

Location: Onsite BA-1
Sample Number: EP-81 **Depth:** 2'

Date Sampled: 8-14-2024

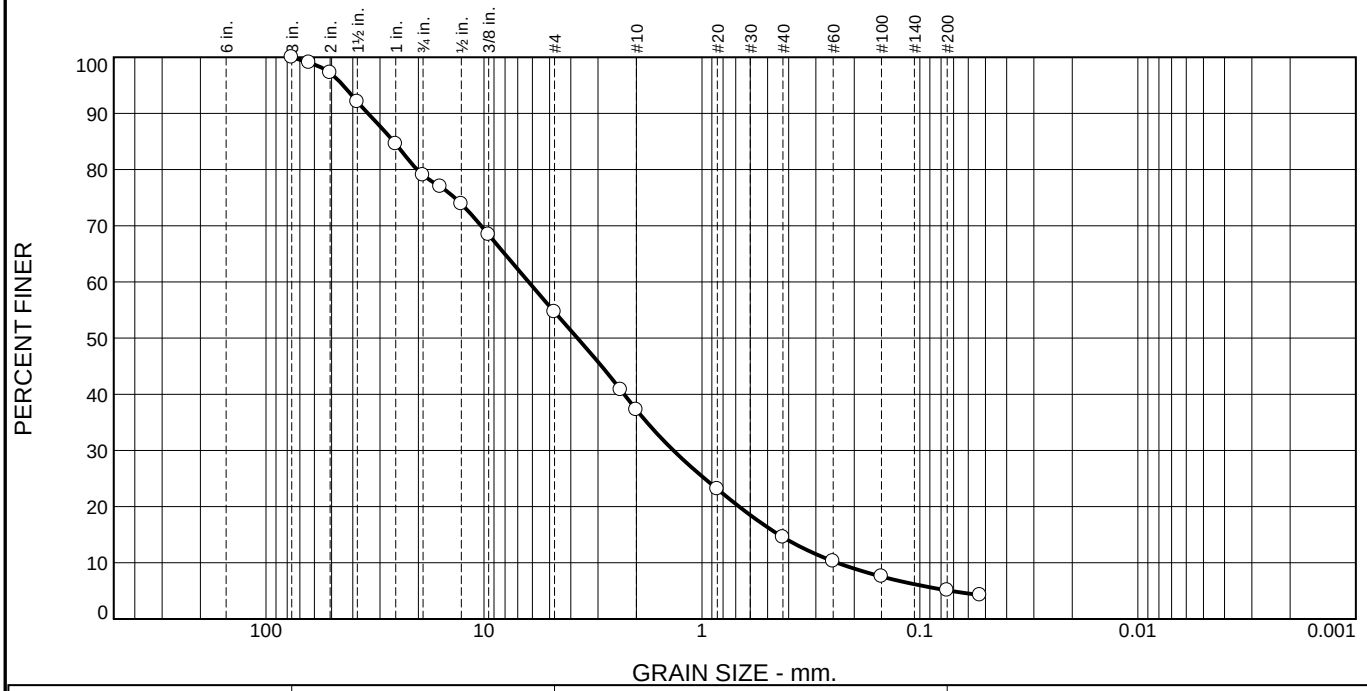
associated earth sciences incorporated

Client: Blue Fern Development
Project: Bullfrog Flats

Project No: 20240155 E001 **Figure**

B-06

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	21.0	24.3	17.5	22.6	9.5	5.1	

TEST RESULTS

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
3"	100.0		
2.5"	99.0		
2"	97.2		
1.50"	92.1		
1"	84.6		
3/4"	79.0		
5/8"	77.0		
1/2"	73.9		
3/8"	68.4		
#4	54.7		
#8	40.8		
#10	37.2		
#20	23.1		
#40	14.6		
#60	10.3		
#100	7.6		
#200	5.1		
#270	4.2		

* (no specification provided)

Material Description

very gravelly SAND some silt

Atterberg Limits (ASTM D 4318)

PL= NP **LL=** NV **PI=**

Classification

USCS (D 2487)= SW-SM **AASHTO (M 145)=** A-1-a

Coefficients

D_{90}= 34.0857 D_{85}= 25.9448 D_{60}= 6.2434
D_{50}= 3.7257 D_{30}= 1.3515 D_{15}= 0.4435
D_{10}= 0.2394 C_u= 26.08 C_c= 1.22

Remarks

Date Received: 8-28-2024 **Date Tested:** 8-30-2024

Tested By: FEW

Checked By: PEL/TP

Title:

Location: Onsite BA-1
Sample Number: EP-82 **Depth:** 5'

Date Sampled: 8-14-2024

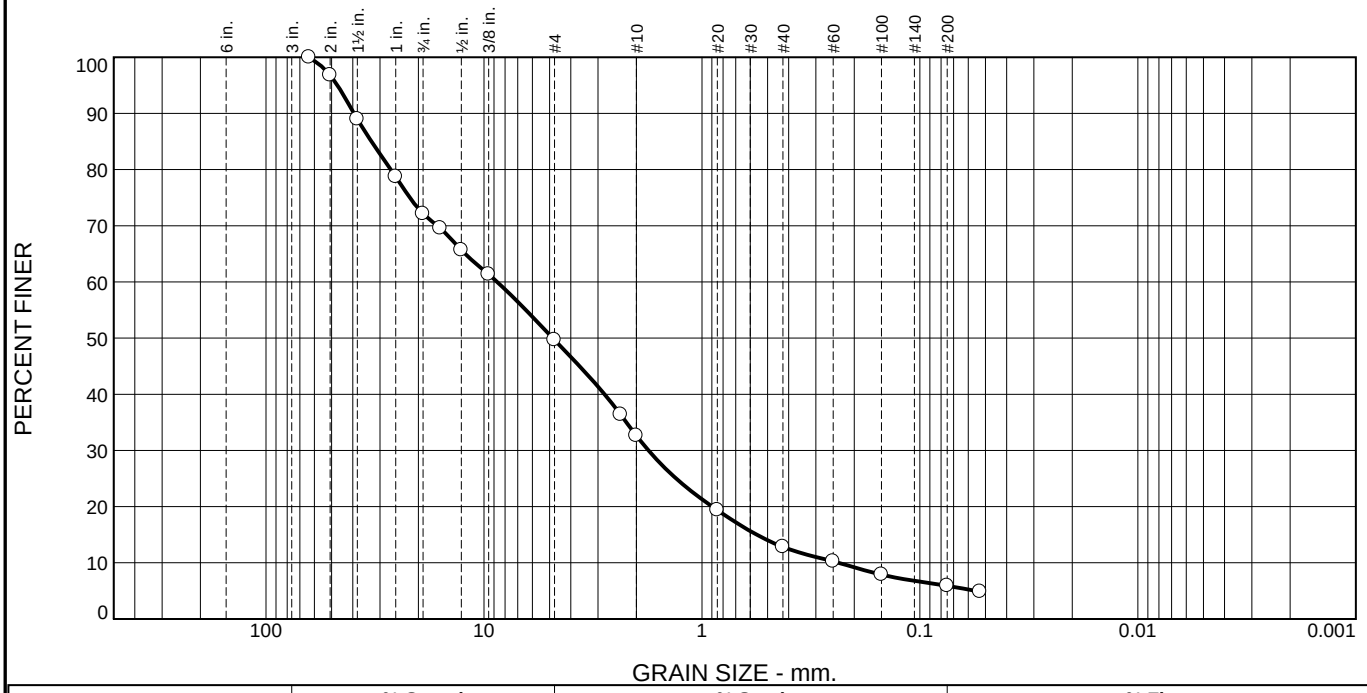
associated earth sciences incorporated

Client: Blue Fern Development
Project: Bullfrog Flats

Project No: 20240155 E001 **Figure**

B-06

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	27.9	22.4	17.1	19.8	6.9	5.9	

TEST RESULTS

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
2.5"	100.0		
2"	96.8		
1.50"	89.0		
1"	78.7		
3/4"	72.1		
5/8"	69.6		
1/2"	65.7		
3/8"	61.4		
#4	49.7		
#8	36.4		
#10	32.6		
#20	19.4		
#40	12.8		
#60	10.2		
#100	7.9		
#200	5.9		
#270	4.8		

* (no specification provided)

Material Description

very sandy GRAVEL some silt

Atterberg Limits (ASTM D 4318)

PL= NP **LL=** NV **PI=**

Classification

USCS (D 2487)= GW-GM **AASHTO (M 145)=** A-1-a

Coefficients

D_{90}= 39.4847 D_{85}= 32.8314 D_{60}= 8.7002
D_{50}= 4.8360 D_{30}= 1.7605 D_{15}= 0.5606
D_{10}= 0.2370 C_u= 36.71 C_c= 1.50

Remarks

Date Received: 8-28-2024 **Date Tested:** 8-30-2024

Tested By: FEW

Checked By: PEL/TP

Title:

Location: Onsite BA-1
Sample Number: EP-83 **Depth:** 2'

Date Sampled: 8-14-2024

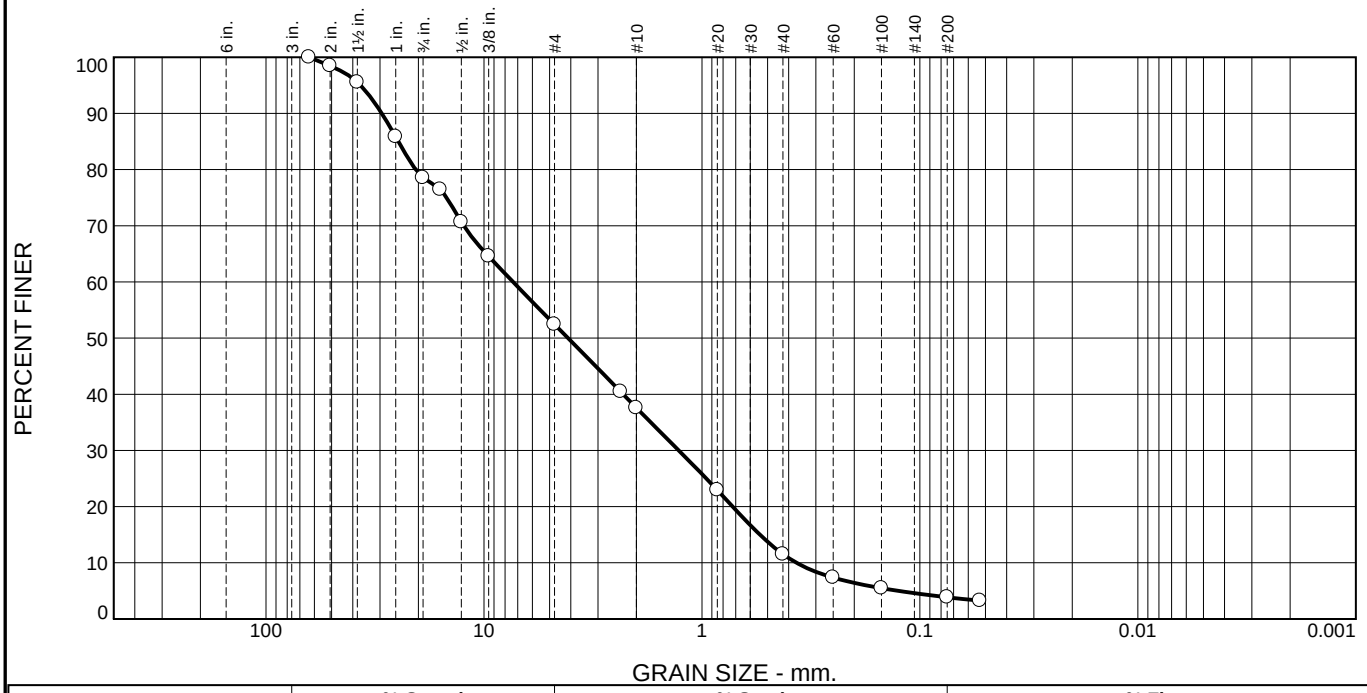
associated earth sciences incorporated

Client: Blue Fern Development
Project: Bullfrog Flats

Project No: 20240155 E001 **Figure**

B-06

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	21.4	26.2	14.8	26.1	7.6	3.9	

TEST RESULTS

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
2.5"	100.0		
2"	98.5		
1.50"	95.5		
1"	85.8		
3/4"	78.6		
5/8"	76.4		
1/2"	70.7		
3/8"	64.6		
#4	52.4		
#8	40.4		
#10	37.6		
#20	22.9		
#40	11.5		
#60	7.4		
#100	5.5		
#200	3.9		
#270	3.2		

* (no specification provided)

Material Description

very gravelly SAND trace silt

Atterberg Limits (ASTM D 4318)

PL= NP **LL=** NV **PI=**

Classification

USCS (D 2487)= SP **AASHTO (M 145)=** A-1-a

Coefficients

D_{90}= 29.4506 D_{85}= 24.7006 D_{60}= 7.3614
D_{50}= 4.1161 D_{30}= 1.2781 D_{15}= 0.5421
D_{10}= 0.3685 C_u= 19.98 C_c= 0.60

Remarks

Date Received: 8-28-2024 **Date Tested:** 8-30-2024

Tested By: FEW

Checked By: PEL/TP

Title:

Location: Onsite BA-3
Sample Number: EP-87 **Depth:** 7'

Date Sampled: 8-15-2024

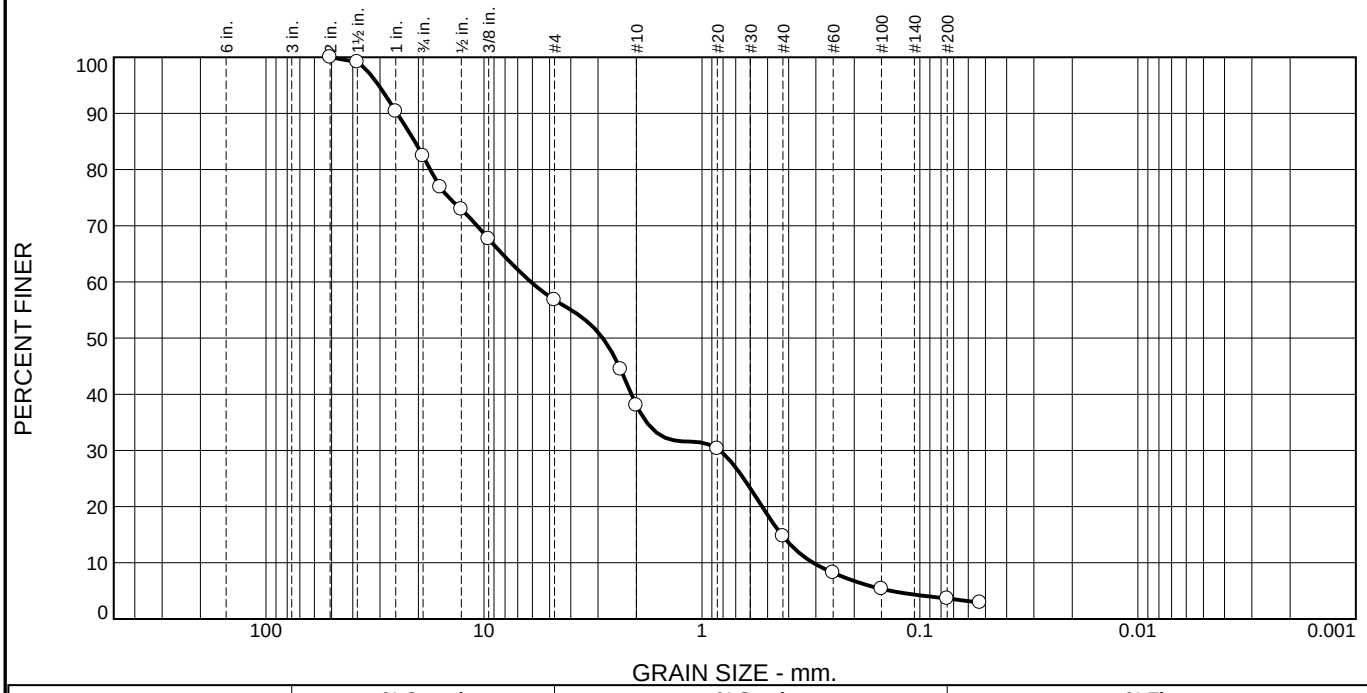
associated earth sciences incorporated

Client: Blue Fern Development
Project: Bullfrog Flats

Project No: 20240155 E001 **Figure**

B-06

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	17.6	25.6	18.8	23.3	11.1	3.6	

TEST RESULTS

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
2"	100.0		
1.50"	99.1		
1"	90.4		
3/4"	82.4		
5/8"	76.9		
1/2"	72.9		
3/8"	67.7		
#4	56.8		
#8	44.4		
#10	38.0		
#20	30.3		
#40	14.7		
#60	8.2		
#100	5.4		
#200	3.6		
#270	2.9		

* (no specification provided)

Material Description

very gravelly SAND trace silt

Atterberg Limits (ASTM D 4318)

PL= NP **LL=** NV **PI=**

Classification

USCS (D 2487)= SP **AASHTO (M 145)=** A-1-a

Coefficients

D_{90}= 25.0378 D_{85}= 20.7679 D_{60}= 6.0852
D_{50}= 2.8540 D_{30}= 0.8298 D_{15}= 0.4309
D_{10}= 0.3088 C_u= 19.71 C_c= 0.37

Remarks

Date Received: 8-28-2024 **Date Tested:** 8-30-2024

Tested By: FEW

Checked By: PEL/TP

Title:

Location: Onsite BA-3
Sample Number: EP-88 **Depth:** 7'

Date Sampled: 8-15-2024

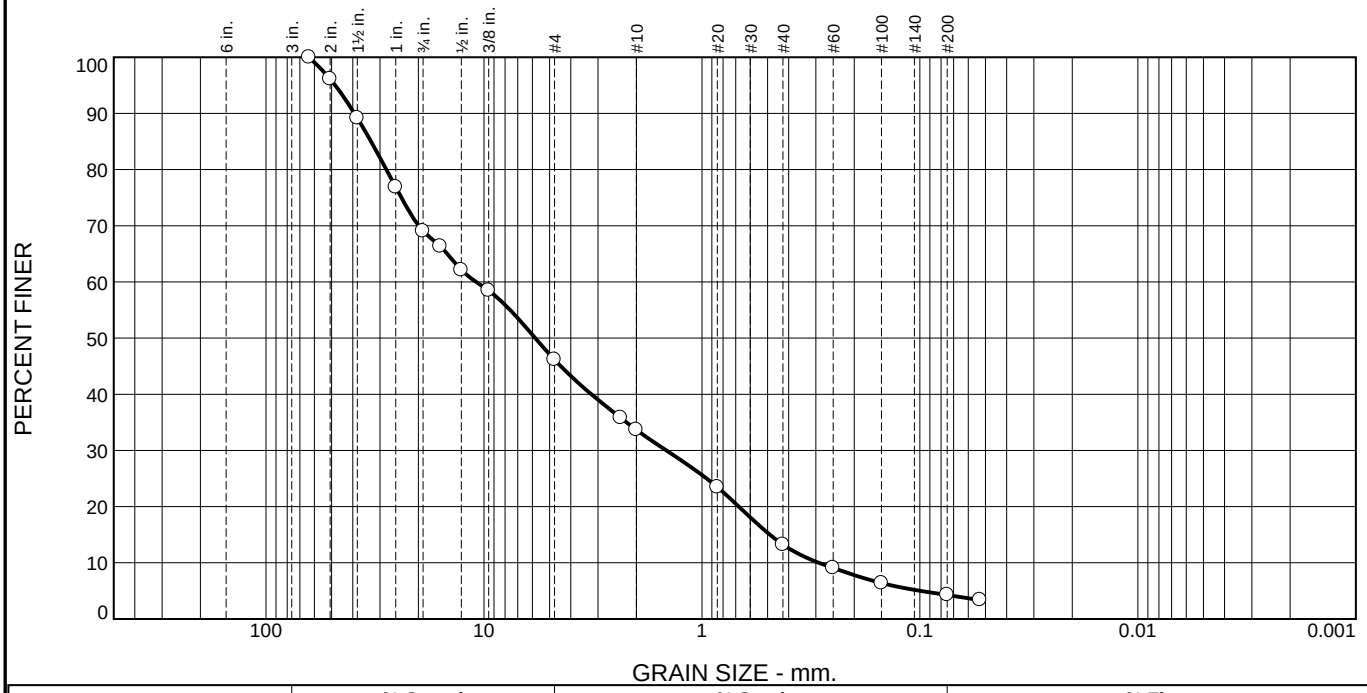
associated earth sciences incorporated

Client: Blue Fern Development
Project: Bullfrog Flats

Project No: 20240155 E001 **Figure**

B-06

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	30.9	22.9	12.5	20.5	8.9	4.3	

TEST RESULTS

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
2.5"	100.0		
2"	96.1		
1.50"	89.2		
1"	76.9		
3/4"	69.1		
5/8"	66.4		
1/2"	62.1		
3/8"	58.5		
#4	46.2		
#8	35.8		
#10	33.7		
#20	23.5		
#40	13.2		
#60	9.1		
#100	6.4		
#200	4.3		
#270	3.4		

* (no specification provided)

Material Description

very sandy GRAVEL trace silt

Atterberg Limits (ASTM D 4318)

PL= NP **LL=** NV **PI=**

Classification

USCS (D 2487)= GP **AASHTO (M 145)=** A-1-a

Coefficients

D_{90}= 39.2869 D_{85}= 32.9984 D_{60}= 10.8717
D_{50}= 5.8166 D_{30}= 1.4573 D_{15}= 0.4882
D_{10}= 0.2912 C_u= 37.33 C_c= 0.67

Remarks

Date Received: 8-28-2024 **Date Tested:** 8-30-2024

Tested By: FEW

Checked By: PEL/TP

Title:

Location: Onsite BA-3
Sample Number: EP-89 **Depth:** 7'

Date Sampled: 8-15-2024

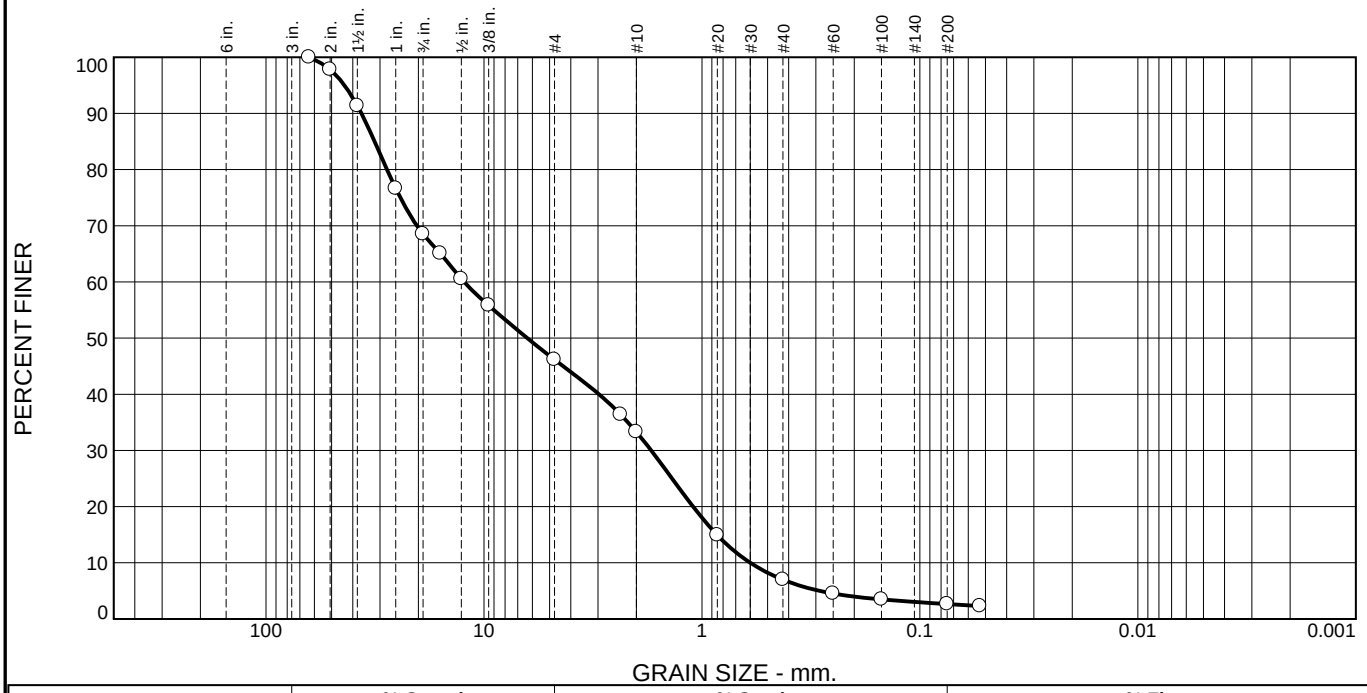
associated earth sciences incorporated

Client: Blue Fern Development
Project: Bullfrog Flats

Project No: 20240155 E001 **Figure**

B-06

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	31.5	22.3	12.9	26.3	4.3	2.7	

TEST RESULTS

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
2.5"	100.0		
2"	97.8		
1.50"	91.4		
1"	76.6		
3/4"	68.5		
5/8"	65.1		
1/2"	60.5		
3/8"	55.8		
#4	46.2		
#8	36.4		
#10	33.3		
#20	14.9		
#40	7.0		
#60	4.5		
#100	3.5		
#200	2.7		
#270	2.3		

* (no specification provided)

Material Description

very sandy GRAVEL trace silt

Atterberg Limits (ASTM D 4318)

PL= NP **LL=** NV **PI=**

Classification

USCS (D 2487)= GP **AASHTO (M 145)=** A-1-a

Coefficients

D_{90}= 36.5193 D_{85}= 31.7772 D_{60}= 12.3436
D_{50}= 6.3329 D_{30}= 1.7105 D_{15}= 0.8544
D_{10}= 0.6003 C_u= 20.56 C_c= 0.39

Remarks

Date Received: 8-28-2024 **Date Tested:** 8-30-2024

Tested By: FEW

Checked By: PEL/TP

Title:

Location: Onsite IA-2
Sample Number: EP-90 **Depth:** 11'

Date Sampled: 8-15-2024

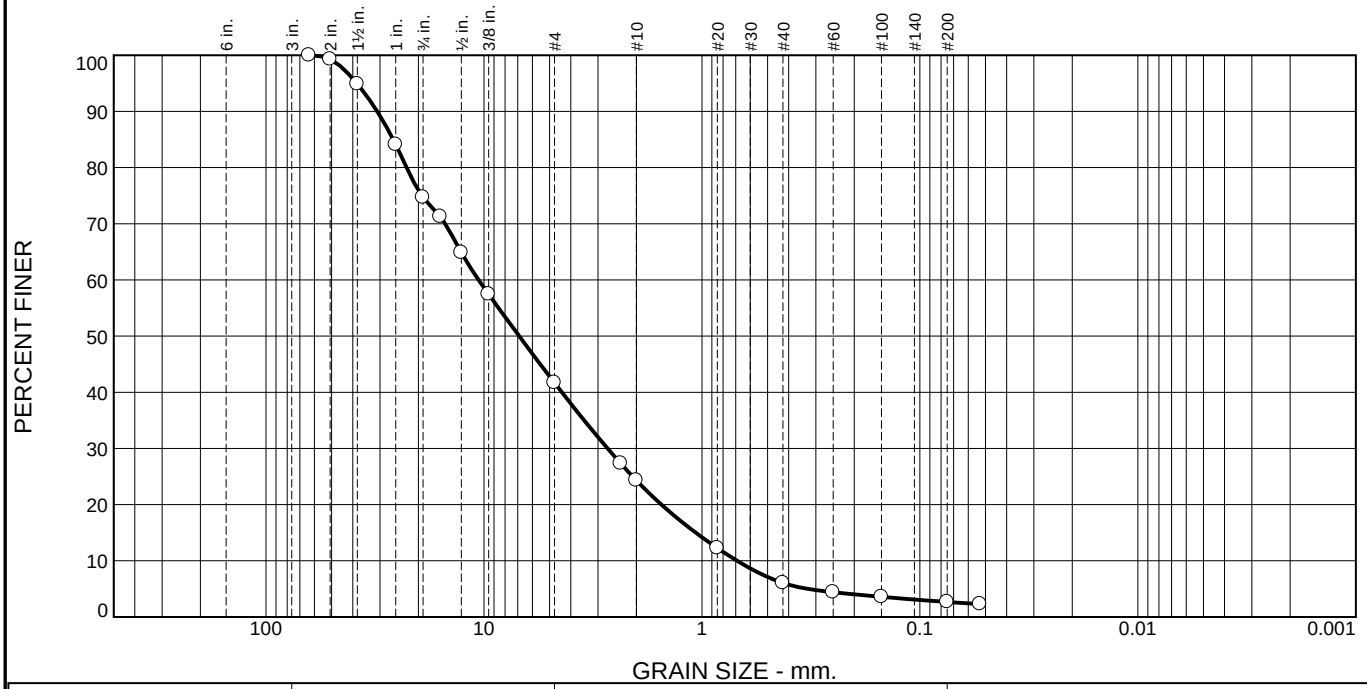
associated earth sciences incorporated

Client: Blue Fern Development
Project: Bullfrog Flats

Project No: 20240155 E001 **Figure**

B-06

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	25.3	33.0	17.4	18.2	3.4	2.7	

TEST RESULTS

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
2.5"	100.0		
2"	99.3		
1.50"	94.9		
1"	84.1		
3/4"	74.7		
5/8"	71.3		
1/2"	64.9		
3/8"	57.5		
#4	41.7		
#8	27.3		
#10	24.3		
#20	12.3		
#40	6.1		
#60	4.4		
#100	3.6		
#200	2.7		
#270	2.3		

* (no specification provided)

Material Description

very sandy GRAVEL trace silt

Atterberg Limits (ASTM D 4318)

PL= NP **LL=** NV **PI=** NP

Classification

USCS (D 2487)= GW **AASHTO (M 145)=** A-1-a

Coefficients

D_{90}= 30.8997 D_{85}= 26.0967 D_{60}= 10.5862
D_{50}= 6.8950 D_{30}= 2.7101 D_{15}= 1.0677
D_{10}= 0.6903 C_u= 15.34 C_c= 1.01

Remarks

Date Received: 8-28-2024 **Date Tested:** 8-30-2024

Tested By: FEW

Checked By: PEL/TP

Title:

Location: Onsite IA-2
Sample Number: EP-91 **Depth:** 18'

Date Sampled: 8-15-2024

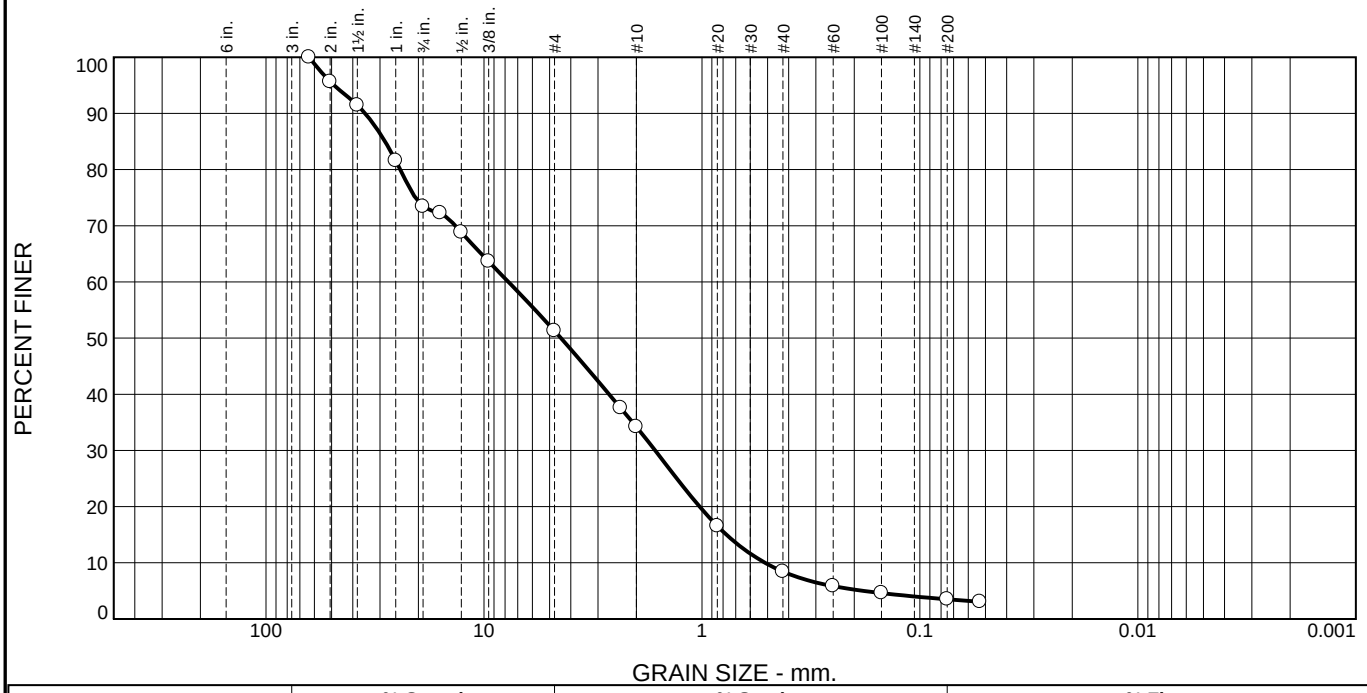
associated earth sciences incorporated

Client: Blue Fern Development
Project: Bullfrog Flats

Project No: 20240155 E001 **Figure**

B-06

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	26.6	22.1	17.1	25.8	4.9	3.5	

TEST RESULTS

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
2.5"	100.0		
2"	95.7		
1.50"	91.5		
1"	81.6		
3/4"	73.4		
5/8"	72.3		
1/2"	68.8		
3/8"	63.7		
#4	51.3		
#8	37.5		
#10	34.2		
#20	16.5		
#40	8.4		
#60	5.8		
#100	4.6		
#200	3.5		
#270	3.1		

* (no specification provided)

Material Description

very sandy GRAVEL trace silt

Atterberg Limits (ASTM D 4318)

PL= NP **LL=** NV **PI=**

Classification

USCS (D 2487)= GP **AASHTO (M 145)=** A-1-a

Coefficients

D_{90}= 35.1062 D_{85}= 28.4306 D_{60}= 7.7251
D_{50}= 4.4365 D_{30}= 1.6404 D_{15}= 0.7725
D_{10}= 0.5139 C_u= 15.03 C_c= 0.68

Remarks

Date Received: 8-28-2024 **Date Tested:** 8-30-2024

Tested By: FEW

Checked By: PEL/TP

Title:

Location: Onsite IA-2
Sample Number: EP-92 **Depth:** 11'

Date Sampled: 8-15-2024

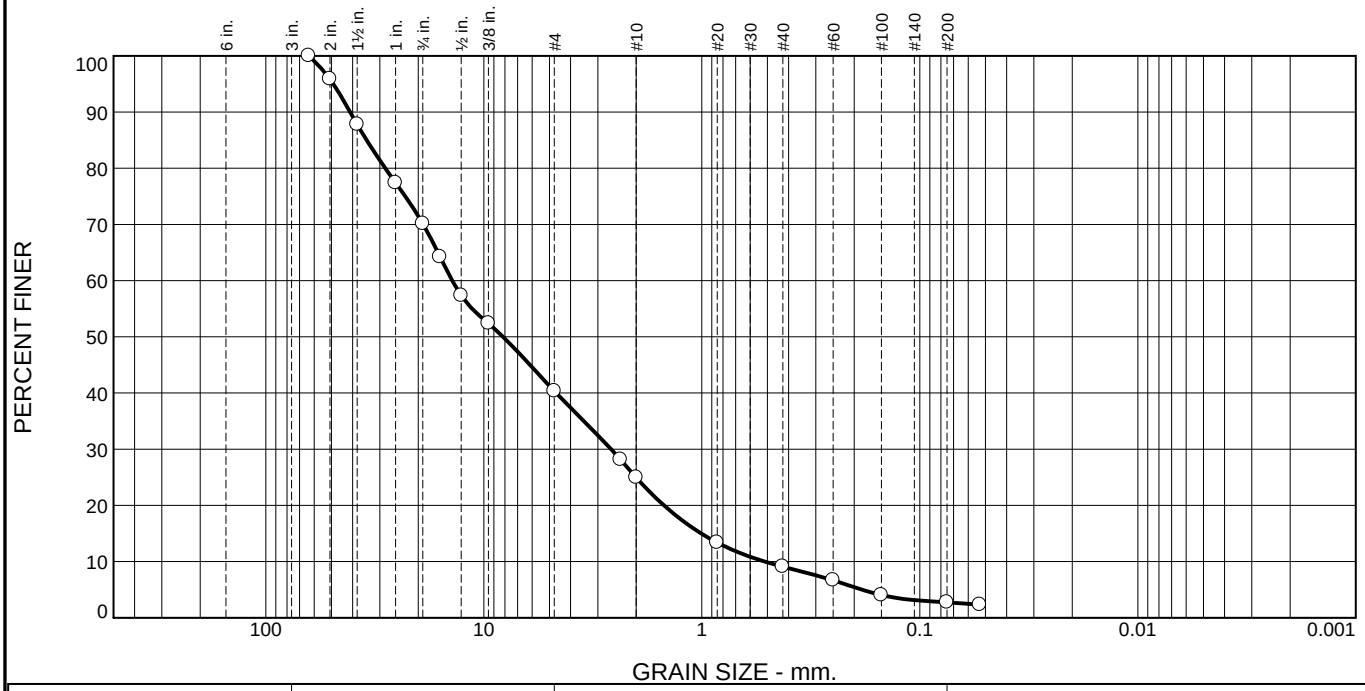
associated earth sciences incorporated

Client: Blue Fern Development
Project: Bullfrog Flats

Project No: 20240155 E001 **Figure**

B-06

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	29.9	29.8	15.4	15.8	6.4	2.7	

TEST RESULTS

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
2.5"	100.0		
2"	95.9		
1.50"	87.8		
1"	77.4		
3/4"	70.1		
5/8"	64.2		
1/2"	57.3		
3/8"	52.4		
#4	40.3		
#8	28.1		
#10	24.9		
#20	13.4		
#40	9.1		
#60	6.7		
#100	4.0		
#200	2.7		
#270	2.3		

* (no specification provided)

Material Description

very sandy GRAVEL trace silt

Atterberg Limits (ASTM D 4318)

PL= NP **LL=** NV **PI=**

Classification

USCS (D 2487)= GP **AASHTO (M 145)=** A-1-a

Coefficients

D_{90}= 41.0566 D_{85}= 34.4715 D_{60}= 13.9626
D_{50}= 8.1706 D_{30}= 2.6094 D_{15}= 1.0067
D_{10}= 0.5142 C_u= 27.15 C_c= 0.95

Remarks

Date Received: 9-19-2024 **Date Tested:** 9-25-2024

Tested By: FEW

Checked By: PEL/TP

Title:

Location: Onsite BA-4
Sample Number: EP-105 **Depth:** 8'

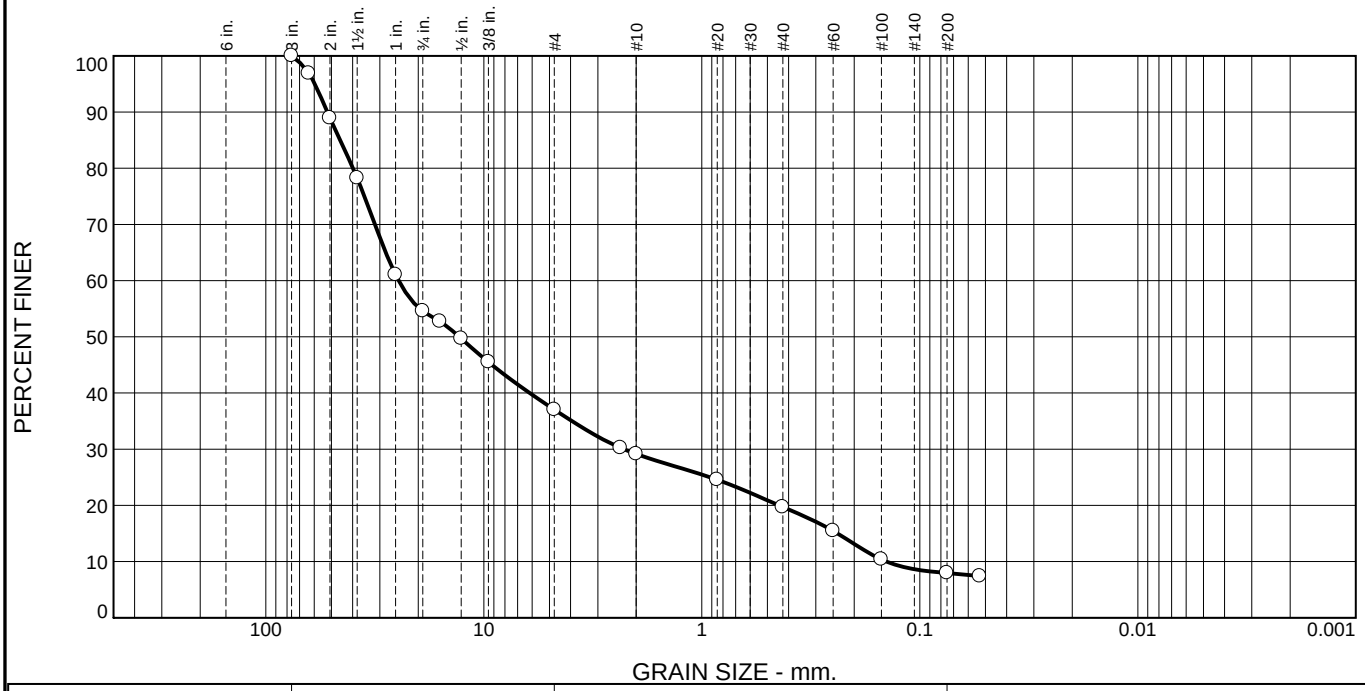
Date Sampled: 9-12-2024

associated earth sciences incorporated

Client: Blue Fern Development
Project: Bullfrog Flats

Project No: 20240155 E001 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	45.4	17.6	7.9	9.4	11.7	8.0	

TEST RESULTS

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
3"	100.0		
2.5"	96.9		
2"	88.9		
1.50"	78.3		
1"	61.0		
3/4"	54.6		
5/8"	52.7		
1/2"	49.7		
3/8"	45.5		
#4	37.0		
#8	30.2		
#10	29.1		
#20	24.6		
#40	19.7		
#60	15.5		
#100	10.4		
#200	8.0		
#270	7.4		

* (no specification provided)

Material Description

sandy GRAVEL some silt

Atterberg Limits (ASTM D 4318)

PL= NP **LL=** NV **PI=**

Classification

USCS (D 2487)= GW-GM **AASHTO (M 145)=** A-1-a

Coefficients

D_{90}= 52.2204 D_{85}= 45.6396 D_{60}= 24.6126
D_{50}= 12.9701 D_{30}= 2.2803 D_{15}= 0.2386
D_{10}= 0.1424 C_u= 172.90 C_c= 1.48

Remarks

Date Received: 9-19-2024 **Date Tested:** 9-27-2024

Tested By: FEW

Checked By: PEL/TP

Title:

Location: Onsite BA-6
Sample Number: IT-1 **Depth:** 3'

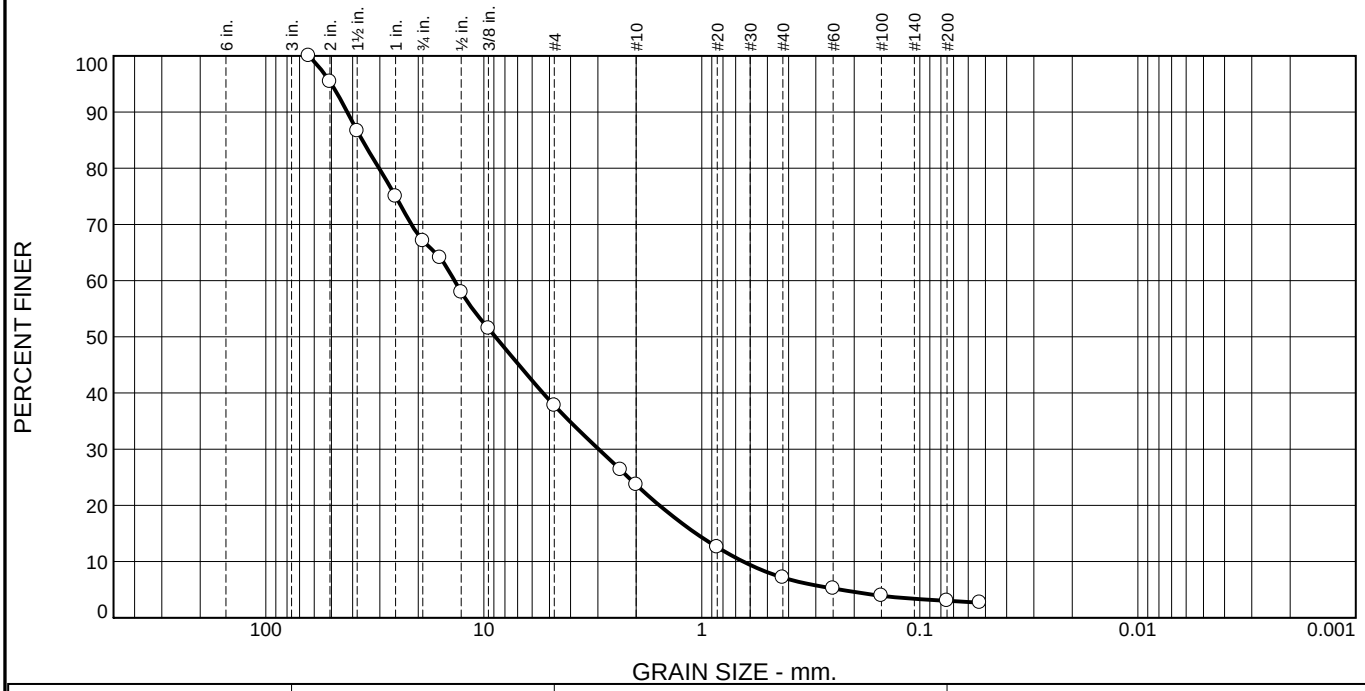
Date Sampled: 9-10-2024

associated earth sciences incorporated

Client: Blue Fern Development
Project: Bullfrog Flats

Project No: 20240155 E001 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	32.9	29.3	14.1	16.6	4.1	3.0	

TEST RESULTS

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
2.5"	100.0		
2"	95.4		
1.50"	86.7		
1"	75.0		
3/4"	67.1		
5/8"	64.1		
1/2"	57.9		
3/8"	51.5		
#4	37.8		
#8	26.3		
#10	23.7		
#20	12.6		
#40	7.1		
#60	5.2		
#100	3.9		
#200	3.0		
#270	2.7		

* (no specification provided)

Material Description

very sandy GRAVEL trace silt

Atterberg Limits (ASTM D 4318)

PL= NP **LL=** NV **PI=**

Classification

USCS (D 2487)= GW **AASHTO (M 145)=** A-1-a

Coefficients

D_{90}= 42.3237 D_{85}= 36.0751 D_{60}= 13.6377
D_{50}= 8.8484 D_{30}= 2.9735 D_{15}= 1.0629
D_{10}= 0.6466 C_u= 21.09 C_c= 1.00

Remarks

Date Received: 9-19-2024 **Date Tested:** 9-26-2024

Tested By: FEW

Checked By: PEL/TP

Title:

Location: Onsite BA-6
Sample Number: IT-1 **Depth:** 12'

Date Sampled: 9-10-2024

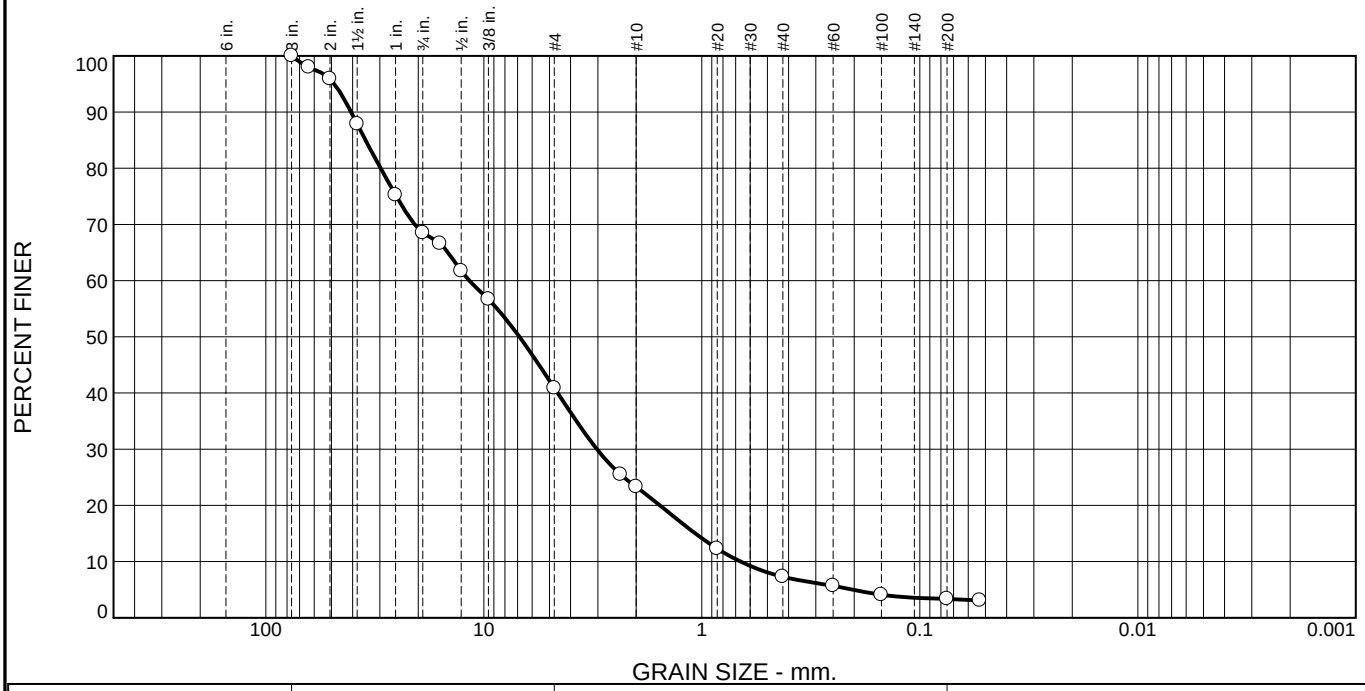
associated earth sciences incorporated

Client: Blue Fern Development
Project: Bullfrog Flats

Project No: 20240155 E001 **Figure**

B-06

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	31.5	27.6	17.6	16.0	4.0	3.3	

TEST RESULTS

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
3"	100.0		
2.5"	98.0		
2"	95.9		
1.50"	87.9		
1"	75.3		
3/4"	68.5		
5/8"	66.6		
1/2"	61.7		
3/8"	56.7		
#4	40.9		
#8	25.5		
#10	23.3		
#20	12.3		
#40	7.3		
#60	5.7		
#100	4.1		
#200	3.3		
#270	3.1		

* (no specification provided)

Material Description

very sandy GRAVEL trace silt

Atterberg Limits (ASTM D 4318)

PL= NP **LL=** NV **PI=**

Classification

USCS (D 2487)= GW **AASHTO (M 145)=** A-1-a

Coefficients

D_{90}= 40.6324 D_{85}= 34.8742 D_{60}= 11.6611
D_{50}= 6.8673 D_{30}= 3.0262 D_{15}= 1.0707
D_{10}= 0.6653 C_u= 17.53 C_c= 1.18

Remarks

Date Received: 9-19-2024 **Date Tested:** 9-27-2024

Tested By: FEW

Checked By: PEL/TP

Title:

Location: Onsite IA-3
Sample Number: IT-2 **Depth:** 5'

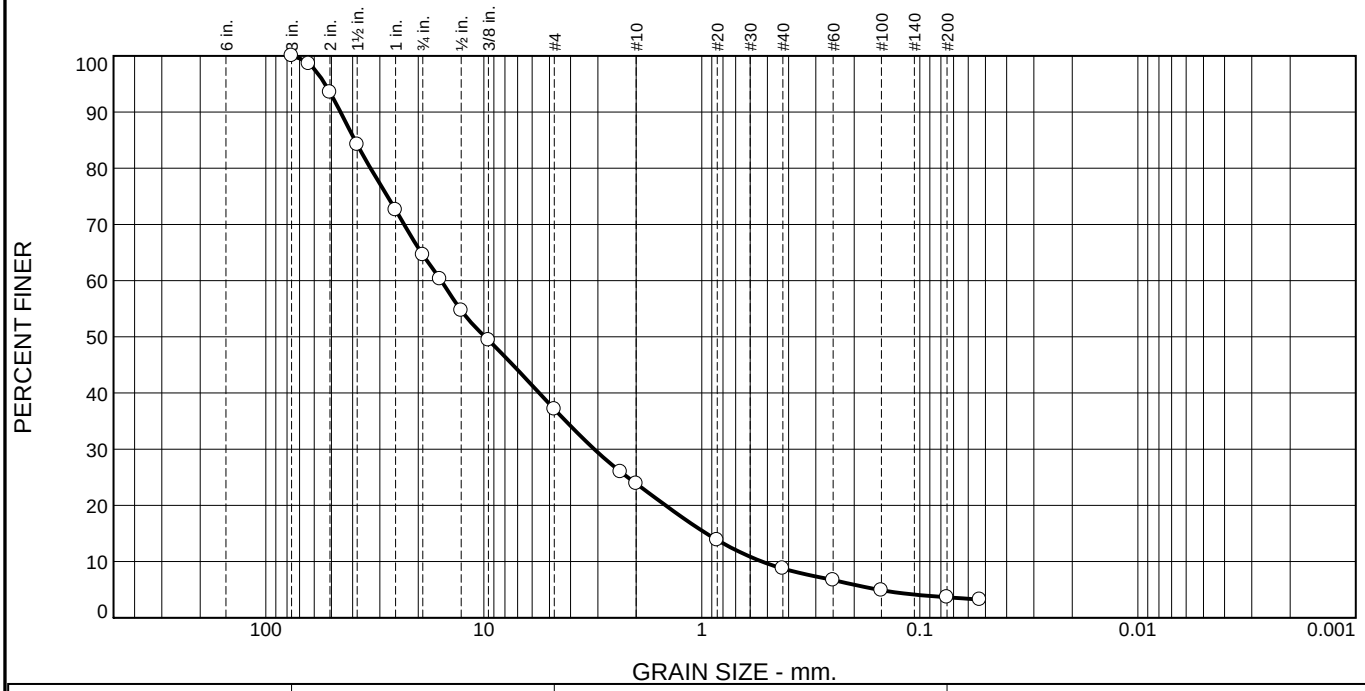
Date Sampled: 9-11-2024

associated earth sciences incorporated

Client: Blue Fern Development
Project: Bullfrog Flats

Project No: 20240155 E001 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	35.4	27.5	13.2	15.1	5.2	3.6	

TEST RESULTS

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
3"	100.0		
2.5"	98.6		
2"	93.5		
1.50"	84.2		
1"	72.6		
3/4"	64.6		
5/8"	60.3		
1/2"	54.7		
3/8"	49.4		
#4	37.1		
#8	26.0		
#10	23.9		
#20	13.8		
#40	8.8		
#60	6.7		
#100	4.9		
#200	3.6		
#270	3.2		

* (no specification provided)

Material Description

very sandy GRAVEL trace silt

Atterberg Limits (ASTM D 4318)

PL= NP **LL=** NV **PI=**

Classification

USCS (D 2487)= GW **AASHTO (M 145)=** A-1-a

Coefficients

D_{90}= 45.4417 D_{85}= 39.0344 D_{60}= 15.6991
D_{50}= 9.8662 D_{30}= 3.1135 D_{15}= 0.9535
D_{10}= 0.5296 C_u= 29.65 C_c= 1.17

Remarks

Date Received: 9-19-2024 **Date Tested:** 9-27-2024

Tested By: FEW

Checked By: PEL/TP

Title:

Location: Onsite IA-3
Sample Number: IT-2 **Depth:** 9'

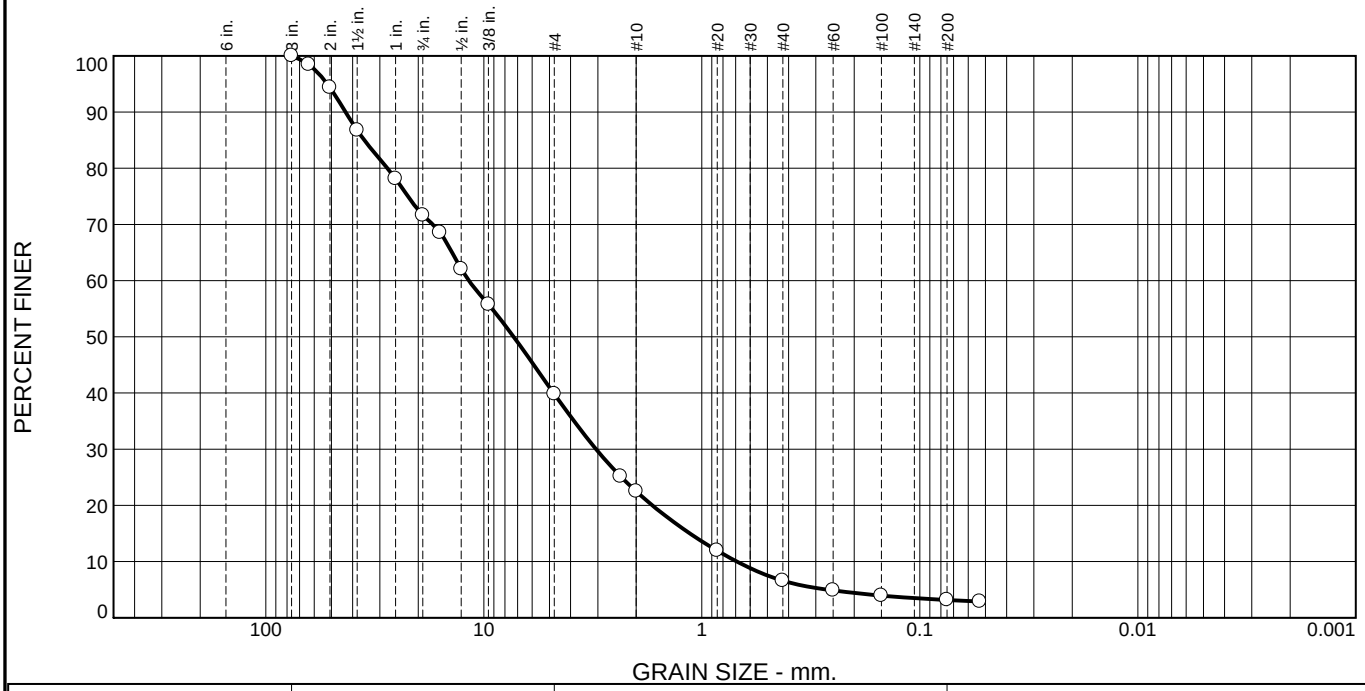
Date Sampled: 9-11-2024

associated earth sciences incorporated

Client: Blue Fern Development
Project: Bullfrog Flats

Project No: 20240155 E001 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	28.4	31.8	17.3	15.9	3.4	3.2	

TEST RESULTS

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
3"	100.0		
2.5"	98.4		
2"	94.4		
1.50"	86.8		
1"	78.1		
3/4"	71.6		
5/8"	68.6		
1/2"	62.1		
3/8"	55.8		
#4	39.8		
#8	25.2		
#10	22.5		
#20	11.9		
#40	6.6		
#60	4.9		
#100	3.9		
#200	3.2		
#270	2.9		

* (no specification provided)

Material Description

very sandy GRAVEL trace silt

Atterberg Limits (ASTM D 4318)

PL= NP **LL=** NV **PI=**

Classification

USCS (D 2487)= GW **AASHTO (M 145)=** A-1-a

Coefficients

D_{90}= 43.0772 D_{85}= 35.3407 D_{60}= 11.7181
D_{50}= 7.2985 D_{30}= 3.0539 D_{15}= 1.1347
D_{10}= 0.6913 C_u= 16.95 C_c= 1.15

Remarks

Date Received: 9-19-2024 **Date Tested:** 9-30-2024

Tested By: FEW

Checked By: PEL

Title:

Location: Onsite BA-3
Sample Number: IT-3 **Depth:** 7'

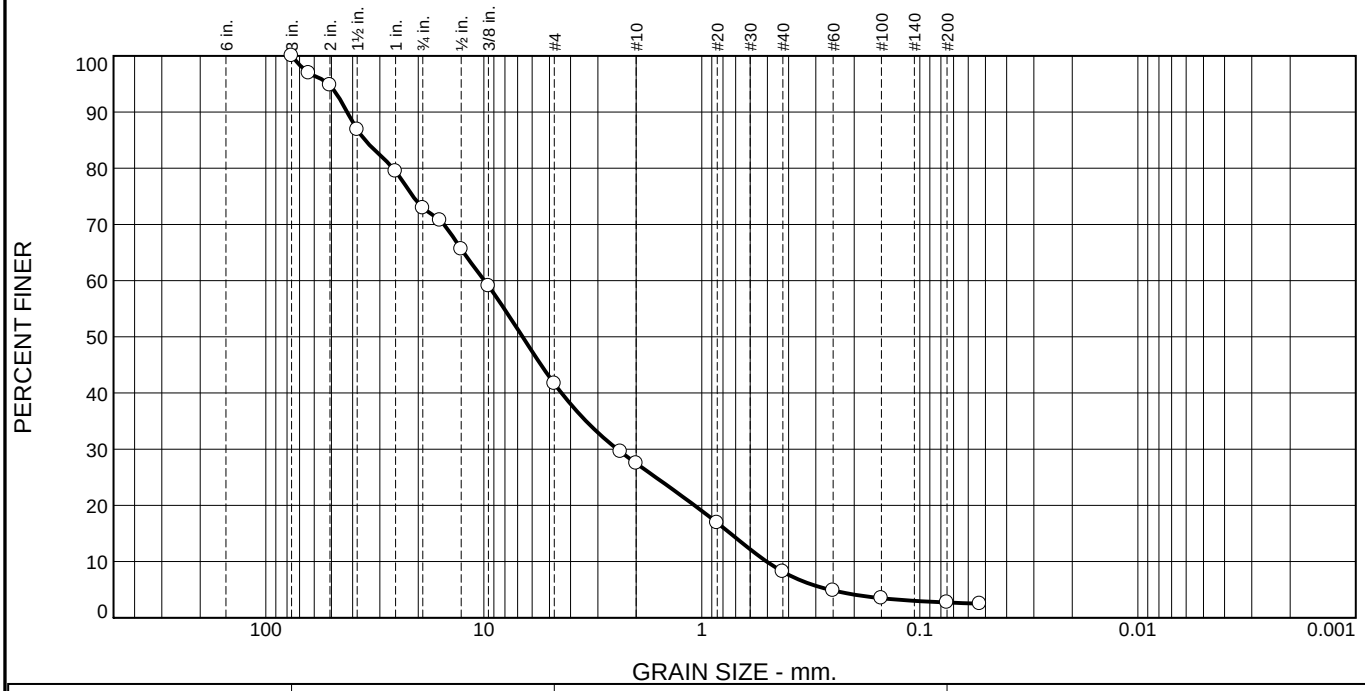
Date Sampled: 9-12-2024

associated earth sciences incorporated

Client: Blue Fern Development
Project: Bullfrog Flats

Project No: 20240155 E001 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	27.1	31.2	14.2	19.3	5.5	2.7	

TEST RESULTS

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
3"	100.0		
2.5"	96.9		
2"	94.8		
1.50"	86.9		
1"	79.4		
3/4"	72.9		
5/8"	70.7		
1/2"	65.6		
3/8"	59.1		
#4	41.7		
#8	29.5		
#10	27.5		
#20	16.9		
#40	8.2		
#60	4.9		
#100	3.5		
#200	2.7		
#270	2.5		

* (no specification provided)

Material Description

very sandy GRAVEL trace silt

Atterberg Limits (ASTM D 4318)

PL= NP **LL=** NV **PI=**

Classification

USCS (D 2487)= GW **AASHTO (M 145)=** A-1-a

Coefficients

D_{90}= 42.3714 D_{85}= 35.0563 D_{60}= 9.9294
D_{50}= 6.6414 D_{30}= 2.4423 D_{15}= 0.7396
D_{10}= 0.5038 C_u= 19.71 C_c= 1.19

Remarks

Date Received: 9-19-2024 **Date Tested:** 9-30-2024

Tested By: FEW

Checked By: PEL/TP

Title:

Location: Onsite BA-3
Sample Number: IT-3 **Depth:** 11'

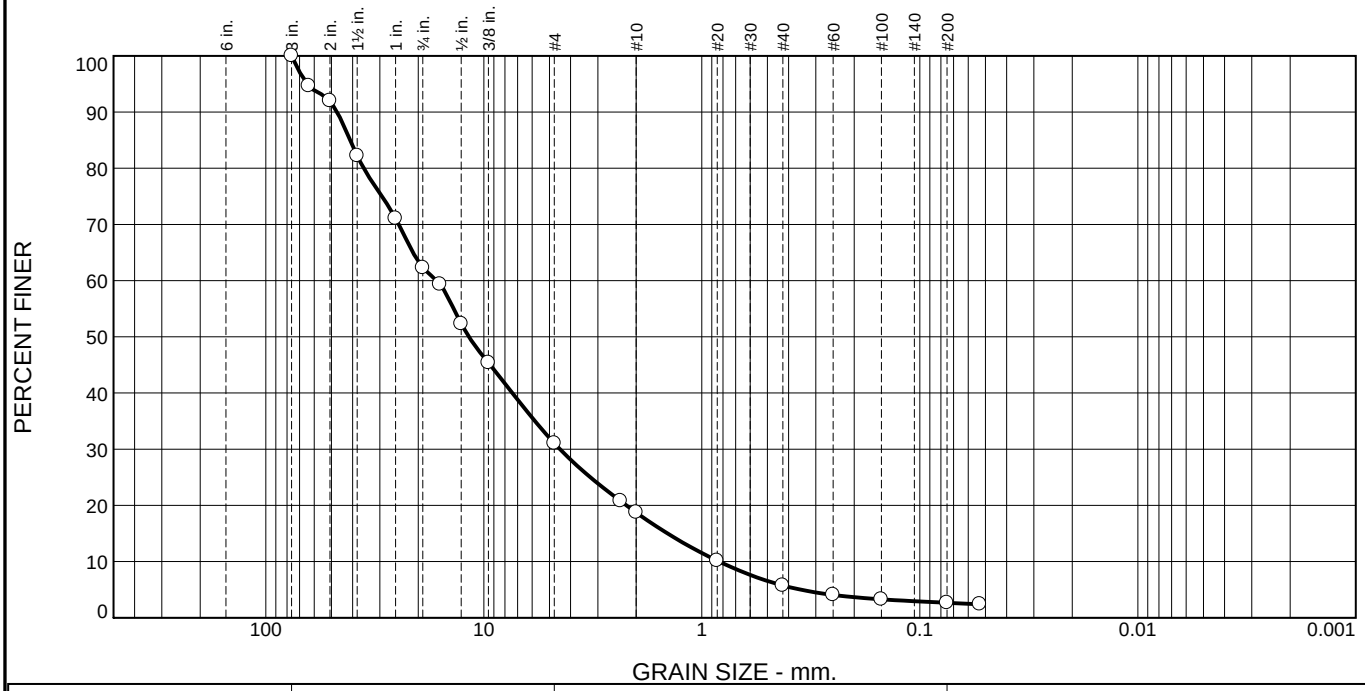
Date Sampled: 9-12-2024

associated earth sciences incorporated

Client: Blue Fern Development
Project: Bullfrog Flats

Project No: 20240155 E001 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	37.7	31.3	12.3	13.0	3.0	2.7	

TEST RESULTS

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
3"	100.0		
2.5"	94.6		
2"	92.0		
1.50"	82.2		
1"	71.1		
3/4"	62.3		
5/8"	59.3		
1/2"	52.3		
3/8"	45.4		
#4	31.0		
#8	20.8		
#10	18.7		
#20	10.2		
#40	5.7		
#60	4.1		
#100	3.3		
#200	2.7		
#270	2.4		

* (no specification provided)

Material Description

sandy GRAVEL trace silt

Atterberg Limits (ASTM D 4318)

PL= NP **LL=** NV **PI=**

Classification

USCS (D 2487)= GW **AASHTO (M 145)=** A-1-a

Coefficients

D_{90}= 47.0679 D_{85}= 41.0587 D_{60}= 16.4279
D_{50}= 11.7172 D_{30}= 4.4774 D_{15}= 1.4368
D_{10}= 0.8340 C_u= 19.70 C_c= 1.46

Remarks

Date Received: 9-19-2024 **Date Tested:** 9-30-2024

Tested By: FEW

Checked By: PEL/TP

Title:

Location: Onsite IA-1
Sample Number: IT-4 **Depth:** 9'

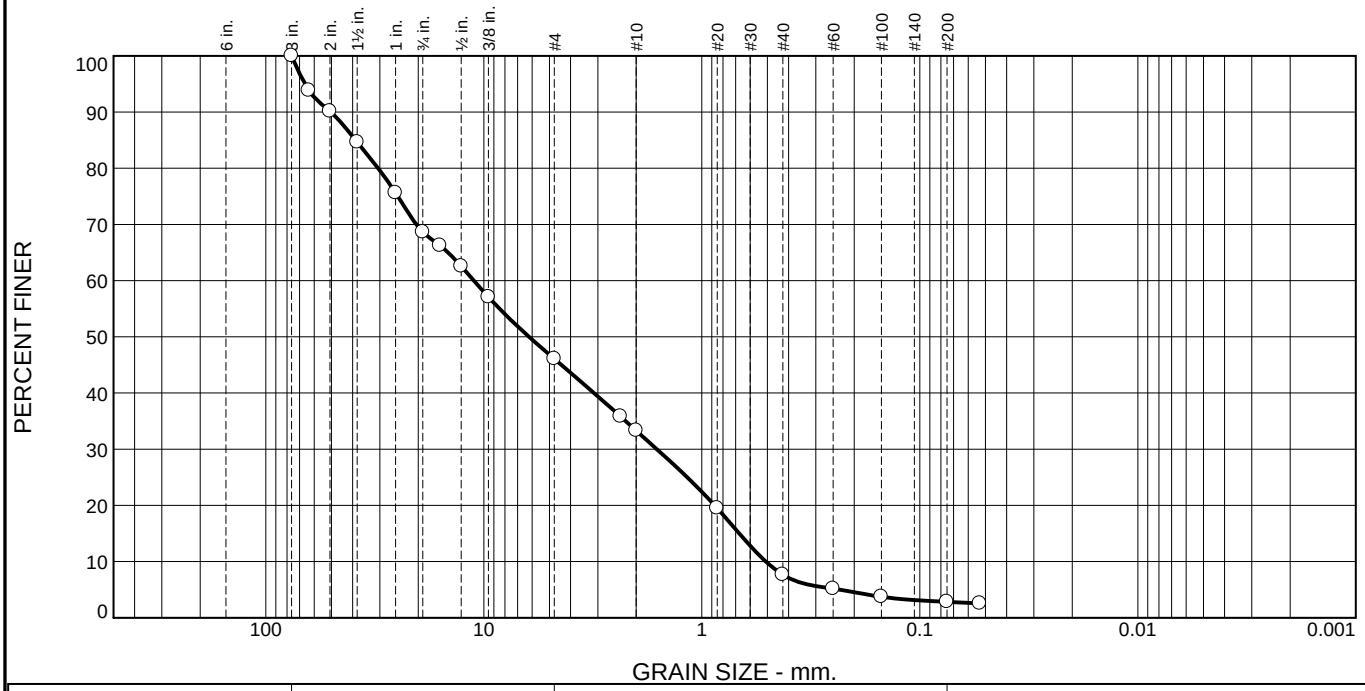
Date Sampled: 9-13-2024

associated earth sciences incorporated

Client: Blue Fern Development
Project: Bullfrog Flats

Project No: 20240155 E001 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	31.4	22.5	12.8	25.6	4.9	2.8	

TEST RESULTS

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
3"	100.0		
2.5"	93.8		
2"	90.2		
1.50"	84.6		
1"	75.6		
3/4"	68.6		
5/8"	66.2		
1/2"	62.5		
3/8"	57.1		
#4	46.1		
#8	35.8		
#10	33.3		
#20	19.5		
#40	7.7		
#60	5.2		
#100	3.7		
#200	2.8		
#270	2.5		

* (no specification provided)

Material Description

very sandy GRAVEL trace silt

Atterberg Limits (ASTM D 4318)

PL= NP **LL=** NV **PI=**

Classification

USCS (D 2487)= GP **AASHTO (M 145)=** A-1-a

Coefficients

D_{90}= 50.2521 D_{85}= 38.7543 D_{60}= 11.1141
D_{50}= 6.2033 D_{30}= 1.6087 D_{15}= 0.6737
D_{10}= 0.5087 C_u= 21.85 C_c= 0.46

Remarks

Date Received: 9-19-2024 **Date Tested:** 9-25-2024

Tested By: FEW

Checked By: PEL/TP

Title:

Location: Onsite IA-1
Sample Number: IT-4 **Depth:** 12'

Date Sampled: 9-13-2024

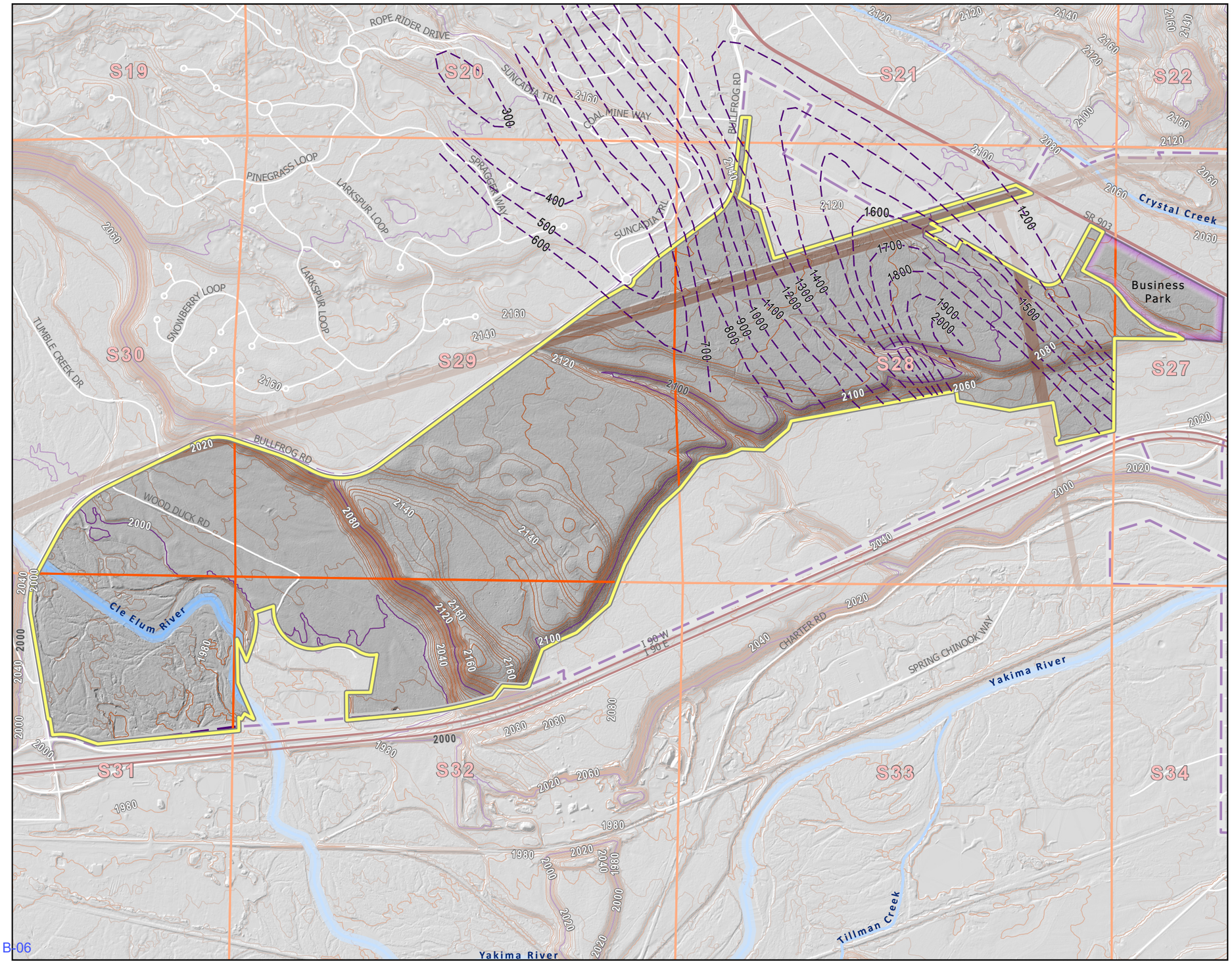
associated earth sciences incorporated

Client: Blue Fern Development
Project: Bullfrog Flats

Project No: 20240155 E001 **Figure**

APPENDIX E

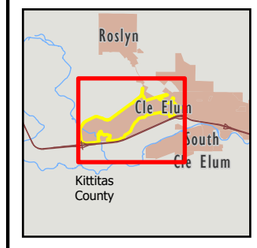
Coal Mine Hazard Depths (2019 SEIS)



PROJECT BOUNDARY
DEPTH TO UNDERGROUND MINE (ICE, 1999)
TRANSMISSION LINES
OFF PROPERTY BUSINESS PARK
CITY BOUNDARY
SECTION
CONTOUR 100 FT
CONTOUR 20 FT
CONTOUR 5 FT

DATA SOURCES / REFERENCES:
WASHINGTON STATE LIDAR PORTAL: YAKIMA 2014, NO REPORT AVAILABLE. CONTOURS FROM LIDAR
KITTITAS CO: ROADS, PARCELS, CITY 10/19
ESM: SURVEYED PROJECT BOUNDARY 11/19
DEPTH TO UNDERGROUND WORKINGS:
MOUNTAIN STAR MASTER PLANNED RESORT EIS,
COAL MINE HAZARD ASSESSMENT, KITTITAS CO. WA.
PREPARED BY ICICLE CREEK ENGINEERS, INC. JUNE 1, 1999

LOCATIONS AND DISTANCES SHOWN ARE APPROXIMATE



0 1200
FEET

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

associated earth sciences incorporated

COAL MINE HAZARD ASSESSMENT

47° NORTH SEIS
CLE ELUM, WASHINGTON

PROJ NO.	DATE:	FIGURE:
20190414H001	4/20	E

G:\GIS_Projects\aaY2019\190414 47 Degrees N\aprx_mxd\EIS0320\190414H001 AE MineHaz_1pg_47Deg.aprx

APPENDIX F

Infiltration Testing Data

Project Name:	Bullfrog Flats	**Water Source:**	Water Truck (2 inch connections)
Project Number:	20240155	**Meter:**	FM-1 (0.3-3gpm)
Date:	9/10/2024	**Pit Area (sq. feet):**	15
Weather:	OC 70's	**Ring Area (sq. feet):**	NA
Test No.:	IT-1 (Facility BA-6)	**Test Depth (feet):**	3
Performed By:	PEL	**Receptor Soils:**	Loess/Outwash Gravel

Time (24-hr)	Flow Rate (gpm)	Stage (feet)	Totalizer (gallons)	Comments
7:37	0	0	0	Flow on
7:45	3.01	0.26	22	
8:00	3.02	0.59	67	
8:15	3.03	0.79	113	
8:30	3.02	0.98	157	
8:31	3.02	0.99	161	decreased flow
8:45	1.36	0.95	180	increased flow
9:00	1.85	0.97	208	decreased flow
9:15	1.8	0.98	235	decreased flow
9:30	1.73	0.99	261	decreased flow
9:45	1.61	1.00	285	decreased flow
10:00	1.5	1.00	308	
10:15	1.51	0.99	331	increased flow
10:30	1.55	0.99	354	
10:45	1.54	0.99	377	
11:00	1.54	0.99	400	
11:15	1.49	0.99	423	
11:30	1.53	0.99	446	
11:48	1.53	1.00	473	
12:00	1.53	1.00	492	
12:15	1.53	1.00	515	
12:30	1.5	1.00	538	
12:45	1.54	1.01	561	
13:00	1.49	1.01	583	
13:15	1.44	1.01	606	
13:30	1.48	1.01	628	
13:46	1.49	1.01	652	
13:55	1.48	1.01	665	
14:05	1.44	1.01	680	
14:15	1.46	1.00	694	
14:25	1.47	1.00	709	
14:35	1.48	1.00	724	
14:45	1.46	1.00	738	Flow off, begin falling head
14:50	0	0.95		
14:54	0	0.90		
14:59	0	0.85		
15:03	0	0.80		
15:07	0	0.75		
15:12	0	0.70		
15:17	0	0.65		
15:23	0	0.60		
15:29	0	0.55		
15:36	0	0.50		
15:43	0	0.45		
15:45	0	0.44		

	Average Infiltration Rate (in/hr) during last hour of inflow:	9.6
	Average Infiltration Rate (in/hr) during falling head:	6.7

Note:

Meter zeroed at start of test. Ran low flow meter (0.3-3gpm) for duration of test
Shut down flow at 14:45
Calculated infiltration rate accounts for change in storage during course of test.

Project Name:	Bullfrog Flats	**Water Source:**	Water truck
Project Number:	20240155	**Meter:**	FM-6 (3-50gpm)
Date:	9/11/2024	**Pit Area (sq. feet):**	3.5x5 = 17.5
Weather:	OC 60's	**Ring Area (sq. feet):**	NA
Test No.:	IT-2 (Facility IA-3)	**Test Depth (feet):**	5 (Facility SG 2101)
Performed By:	PEL	**Receptor Soils:**	Outwash

Time (24-hr)	Flow Rate (gpm)	Stage (feet)	Totalizer (gallons)	Comments
9:00	0	0	0	Flow On
9:03	35	0.90	101	Decreased Flow
9:07	14.9	1.00	161.8	Decreased Flow
9:15	7.3	0.93	224.0	Increased Flow
9:20	9.5	0.98	270.0	Decreased Flow
9:30	7.9	0.99	349.6	
9:45	7.8	1.00	468.3	Decreased Flow
10:00	7.0	0.97	573.1	
10:15	7.0	0.97	678.6	
10:30	7.0	0.97	783.9	Caving
10:45	7.0	1.00	889.2	
11:00	7.0	1.00	994.3	Decreased Flow
11:15	7.0	1.10	1,099	
11:30	6.45	0.98	1,198	Increased Flow
11:45	6.45	0.97	1,293	
12:00	6.8	0.98	1,396	
12:15	6.8	1.00	1,498	Decreased Flow
12:30	6.6	1.00	1,597	
12:45	6.55	1.00	1,696	
13:04	6.56	1.00	1,821	
13:15	6.55	1.00	1,893	
13:30	6.56	1.00	1,992	
13:45	6.55	1.00	2,090	
14:00	6.52	1.00	2,188	
14:15	6.52	1.00	2,286	
14:30	6.54	1.00	2,384	
14:45	6.52	1.00	2,482	
15:00	6.52	1.00	2,580	
15:10	6.52	1.00	2,645	
15:20	6.52	1.00	2,710	
15:30	6.52	1.00	2,775	
15:40	6.52	1.00	2,840	
15:50	6.53	1.00	2,900	Fluctuating flow, low on water
16:00	5.21	0.95	2,958	Flow Off Begin Falling Head
16:02	0	0.90		
16:03	0	0.85		
16:04	0	0.80		
16:05	0	0.75		
16:07	0	0.70		
16:08	0	0.65		
16:10	0	0.60		
16:12	0	0.55		
16:14	0	0.50		
16:16	0	0.45		
16:18	0	0.40		
16:21	0	0.35		
16:24	0	0.30		
16:27	0	0.25		
16:30	0	0.20		
16:33	0	0.15		
16:36	0	0.10		Last value used in falling head calc
16:38	0	0.05		
16:40	0	0		

	Average Infiltration Rate (in/hr) during last hour of inflow:	35.3
	Average Infiltration Rate (in/hr) during falling head:	17.0

Note:

Meter zeroed at start of test. Ran medium flow meter (3-50gpm) for duration of test
Shut down flow at 16:00
Test area prepared with toothed excavator bucket

Project Name:	Bullfrog Flats	**Water Source:**	Water truck
Project Number:	20240155	**Meter:**	FM-9 (3-50gpm)
Date:	9/12/2024	**Pit Area (sq. feet):**	3x5 = 15
Weather:	OC 60's	**Ring Area (sq. feet):**	NA
Test No.:	IT-3 (Facility BA-3)	**Test Depth (feet):**	7 (Facility SG 2130)
Performed By:	PEL	**Receptor Soils:**	Outwash

Time (24-hr)	Flow Rate (gpm)	Stage (feet)	Totalizer (gallons)	Comments
8:00	0	0	0	Flow On
8:02	20.2	0.56	40.7	Decreased Flow
8:15	13.5	0.64	217.4	Decreased Flow
8:22	8.3	0.40	278.4	Increased Flow
8:30	9	0.38	350.4	
8:32	9	0.44	368.5	Increased Flow
8:36	11.1	0.48	415.2	Decreased Flow
8:45	9.8	0.49	501.8	
9:00	9.7	0.50	648.8	
9:15	9.6	0.52	794.2	
9:30	9.4	0.48	935.8	
9:45	9.5	0.36	1,079	
9:48	9.5	0.36	1,107	Increased Flow
10:00	10	0.40	1,227	
10:15	10	0.40	1,378	Increased Flow
10:18	14	0.52	1,418	Decreased Flow
10:30	12	0.56	1,557	Decreased Flow
10:45	11.5	0.53	1,728	
11:00	11.5	0.54	1,899	
11:15	11.4	0.54	2,071	
11:30	11.4	0.55	2,242	
11:47	11.3	0.55	2,435	
12:00	11.6	0.55	2,585	
12:15	11.4	0.56	2,756	
12:30	11.8	0.58	2,932	
12:45	12.1	0.55	3,103	
13:00	11.5	0.53	3,278	
13:15	11.5	0.52	3,449	Changing water sources
13:30	11.3	0.68	3,619	Fuctuating pressure, decreased flow
13:45	9.2	0.66	3,760	
14:00	9.1	0.67	3,897	Changing water sources, decreased flow
14:10	8.3	0.65	3,978	
14:20	8.3	0.65	4,061	
14:30	8.3	0.67	4,145	
14:40	8.3	0.67	4,227	
14:50	8.3	0.67	4,311	
15:00	8.3	0.67	4,394	Flow off begin falling head
15:00:45	0	0.65		
15:01:00	0	0.60		
15:01:40	0	0.55		
15:02:00	0	0.50		
15:02:30	0	0.45		
15:03:00	0	0.40		
15:03:30	0	0.35		
15:04:00	0	0.30		
15:04:30	0	0.25		
15:05:00	0	0.20		last value used in falling head calc
15:05:20	0	0.15		falling head rate increases for last 0.15ft
15:05:30	0	0.10		
15:05:45	0	0.05		
15:06:00	0	0		

	Average Infiltration Rate (in/hr) during last hour of inflow:	53.2
	Average Infiltration Rate (in/hr) during falling head:	67.7

Note:

Meter zeroed at start of test. Ran medium flow meter (3-50gpm) for duration of test
Shut down flow at 15:00
Test area prepared with toothed excavator bucket

Project Name:	Bullfrog Flats	**Water Source:**	Water truck
Project Number:	20240155	**Meter:**	FM-9 (3-50gpm)
Date:	9/13/2024	**Pit Area (sq. feet):**	3x6 = 18
Weather:	PC 70's	**Ring Area (sq. feet):**	NA
Test No.:	IT-4 (Facility IA-1)	**Test Depth (feet):**	9 (Facility SG 2096)
Performed By:	PEL	**Receptor Soils:**	Outwash

Time (24-hr)	Flow Rate (gpm)	Stage (feet)	Totalizer (gallons)	Comments
7:45	0	0	0	Flow On
7:50	14.8	0.31	68.8	Flow Increased
7:55	22.0	0.62	177.6	Flow Increased
8:00	31.0	0.90	330.9	Flow Decreased
8:08	13.1	0.79	437.8	Flow Increased
8:15	31.3	0.99	651.8	Flow Decreased
8:25	27.6	1.00	916.7	Flow Decreased
8:30	26.1	0.99	1,046	
8:45	26.0	0.97	1,437	
9:00	26.2	0.98	1,831	
9:15	26.6	0.98	2,225	
9:30	26.4	0.98	2,623	
9:45	26.3	0.98	3,019	
10:00	27.2	0.98	3,420	
10:03	26.2	0.98	3,504	Changed Water Source
10:07	15.7	0.68	3,545	Conserving Water, Decreased Flow
10:15	15.9	0.57	3,673	
10:30	15.6	0.50	3,908	
10:33	15.6	0.49	3,955	Changed Water Source Increased Flow
10:39	37.0	1.00	4,150	
10:45	27.7	0.98	4,315	
11:00	27.5	0.99	4,792	
11:15	27.4	0.99	5,140	
11:30	27.3	0.99	5,552	
11:45	27.2	0.98	5,960	
12:00	27.2	0.97	6,369	
12:15	27.7	0.98	6,784	Changed Water Surce Decreased Flow
12:30	16.8	0.55	7,028	
12:40	16.5	0.53	7,194	Changed Water Source Increased Flow
12:45	35.7	0.89	7,349	
12:48	35.7	1.02	7,456	
13:00	27.7	0.98	7,789	
13:15	28.1	0.98	8,211	
13:30	28.2	0.98	8,634	
13:45	28.1	0.98	9,057	
13:55	28.1	0.98	9,337	
14:05	27.9	0.98	9,617	
14:15	27.8	0.98	9,895	
14:25	28.1	0.98	10,175	
14:35	28.1	0.98	10,454	
14:45:00	28.1	0.98	10,735	Flow Off, Falling Head
14:45:30	0	0.90		
14:46:00	0	0.80		
14:46:40	0	0.70		
14:47:23	0	0.60		
14:48:08	0	0.50		
14:48:50	0	0.40		
14:49:35	0	0.30		
14:50:20	0	0.20		
14:50:48	0	0.10		last value used in falling head calc
14:51:20	0	0.00		

	Average Infiltration Rate (in/hr) during last hour of inflow:	149.6
	Average Infiltration Rate (in/hr) during falling head:	109.2

Note:

Meter zeroed at start of test. Ran medium flow meter (3-50gpm) for duration of test
Shut down flow at 14:45
Test area prepared with toothed excavator bucket

Table F-1: Sieve-Based Infiltration Rate Summary

Facility No.	Test Number	Test Depth (ft)	Soil Description	% Passing #200 Sieve	CFv	CFt	CFm	CFb	Massmann Uncorrected Rate (in/hr)	Massmann Design Rate (in/hr)
BA-1	EP-81	2	silty, very sandy GRAVEL (GM)	15.9	0.7	0.4	0.9	1	7	1.7
BA-1	EP-82	5	very gravelly SAND, some silt (SW-SM)	5.1	0.7	0.5	0.9	1	38	11.9
BA-1	EP-83	2	very sandy GRAVEL, some silt (GW-GM)	5.9	0.7	0.5	0.9	1	34	10.9
BA-2	EP-73	4	silty, very sandy GRAVEL (GM)	12.8	1	0.4	0.9	1	12	4.4
BA-2	EP-74	9	very sandy GRAVEL, trace silt (GP)	3.1	1	0.75	0.9	1	256	172.6
BA-2	EP-75	4	silty, very sandy GRAVEL (GM)	13.6	1	0.4	0.9	1	8	3.1
BA-3	EP-87	7	very gravelly SAND, trace silt (SP)	3.9	1	0.75	0.9	1	76	51.3
BA-3	EP-88	7	very gravelly SAND, trace silt (SP)	3.6	1	0.75	0.9	1	66	44.4
BA-3	EP-89	7	very sandy GRAVEL, trace silt (GP)	4.3	1	0.75	0.9	1	48	32.4
BA-3	IT-3	7	very sandy GRAVEL, trace silt (GW)	3.2	1	0.75	0.9	1	247	166.4
BA-3	IT-3	11	very sandy GRAVEL, trace silt (GW)	2.7	1	0.75	0.9	1	113	75.9
BA-4	EP-69	3	very sandy GRAVEL, some silt (GW-GM)	7.1	0.7	0.5	0.9	1	18	5.8
BA-4	EP-70	7	very sandy GRAVEL, some silt (GW-GM)	6.2	0.7	0.5	0.9	1	34	10.6
BA-4	EP-71	3	silty, gravelly SAND (SM)	29.2	0.7	0.4	0.9	1	7	1.9
BA-4	EP-105	8	very sandy GRAVEL, trace silt (GW)	2.7	0.7	0.75	0.9	1	135	64.0
BA-5	EP-57	5	very sandy GRAVEL, trace silt (GP)	3.8	1	0.75	0.9	1	191	129.1
BA-5	EP-58	5	very sandy GRAVEL, trace silt (GP)	3.5	1	0.75	0.9	1	493	332.8
BA-5	EP-59	6	very sandy GRAVEL, trace silt (GW)	3.6	1	0.75	0.9	1	122	82.6
BA-6	EP-51	2	silty, gravelly SAND (SM)	24.2	1	0.4	0.9	1	8	2.9
BA-6	EP-52	2	silty, very gravelly SAND (SM)	23.4	1	0.4	0.9	1	5	1.8
BA-6	EP-53	2	silty, sandy GRAVEL (GM)	21.7	1	0.4	0.9	1	6	2.2
BA-6	IT-1	3	sandy GRAVEL, some silt (GW-GM)	8	1	0.5	0.9	1	22	10.1
BA-6	IT-1	12	very sandy GRAVEL, trace silt (GW)	3	1	0.75	0.9	1	146	98.4
IA-1	EP-78	14	very sandy GRAVEL, trace silt (GW)	2.3	1	0.75	0.9	1	324	218.7
IA-1	IT-4	9	sandy GRAVEL, trace silt (GW)	2.7	1	0.75	0.9	1	534	360.3
IA-1	IT-4	12	very sandy GRAVEL, trace silt (GP)	2.8	1	0.75	0.9	1	92	61.8
IA-2	EP-90	11	very sandy GRAVEL, trace silt (GP)	2.7	1	0.75	0.9	1	192	129.8
IA-2	EP-91	18	very sandy GRAVEL, trace silt (GW)	2.7	1	0.75	0.9	1	331	223.6
IA-2	EP-92	11	very sandy GRAVEL, trace silt (GP)	3.5	1	0.75	0.9	1	121	81.4
IA-3	EP-62	3	silty, very gravelly SAND (SM)	12.3	1	0.4	0.9	1	15	5.4
IA-3	EP-62	13	very sandy GRAVEL, trace silt (GP)	2	1	0.75	0.9	1	547	368.9
IA-3	EP-63	7	very sandy GRAVEL, trace silt (GP)	3.1	1	0.75	0.9	1	95	64.3
IA-3	IT-2	5	very sandy GRAVEL, trace silt (GW)	3.3	1	0.75	0.9	1	213	143.4
IA-3	IT-2	9	very sandy GRAVEL, trace silt (GW)	3.6	1	0.75	0.9	1	127	86.1
IA-4	EP-49	5	very sandy GRAVEL, trace silt (GP)	3.6	1	0.75	0.9	1	82	55.6
IA-4	EP-50	5	very sandy GRAVEL, trace silt (GW)	2.8	1	0.75	0.9	1	150	101.2
IA-4	EP-48	5	very sandy GRAVEL, trace silt (GP)	4.1	1	0.75	0.9	1	58	39.3

APPENDIX G

CBR Laboratory Testing Data

HWA GeoSciences Inc.
DBE/MWBE

September 18, 2024
HWA Project No. 2012-038-23 Task 3400

Associated Earth Sciences, Inc.
911 5th Avenue
Kirkland, Washington 98033

Attention: Mr. Tim Peter, L.E.G, LHg.

Subject: **Materials Laboratory Report**
Bullfrog Flats
Client Project No. 20240155H001

Dear Mr. Peter;

In accordance with your request, HWA GeoSciences Inc. (HWA) performed laboratory testing for the above referenced project. Herein we present the results of our laboratory analyses, which are summarized on the attached reports. The laboratory testing program was performed in general accordance with your instructions and appropriate ASTM Standards as outlined below.

SAMPLE DESCRIPTIONS: The subject samples were delivered to our laboratory on August 22, 2024 by AESI personnel. The samples were contained in 5-gallon plastic buckets designated with sample ID and sample depth. The soils were classified for engineering purposes using visual-manual methods in accordance with ASTM D2488 (Standard Practice for Description and Identification of Soils [Visual-Manual Procedures]). Descriptions of soils observed in these samples may be found on the attached Figures. The as-received moisture contents of the samples can be found in Table 1.

CBR (CALIFORNIA BEARING RATIO) OF LABORATORY COMPACTED SOILS: The submitted samples were tested in general accordance with method ASTM D 1883. Proctor data was provided by the client to be used for remolding parameters. Prior to testing, the samples were passed over a 3/4-inch screen to remove oversize material. The samples were conditioned to approximately the optimum moisture content as determined by ASTM D 1557. Three specimens were then compacted into molds for testing. Different compaction efforts were used to remold each specimen. The results are reported on the attached California Bearing Ratio of Lab Compacted Soils Report, Figures 1 through 6

Note: Testing of sample EP-95, S-2, compacted to 99.6% of maximum dry density, had to be terminated early since the strength of the material exceeded the capacity of the load cell.

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Table 1: As-Received Moisture Content

Moisture Content of Soil (ASTM D2216)		
Sample	**Depth (ft)**	**Moisture Content (%)**
EP-54, S-1	1.0	6.9
EP-65, S-1	1.0	6.6
EP-76, S-1	1.0	8.1
EP-84, S-1	1.0	5.7
EP-95, S-1	3.5	5.7
EP-95, S-2	5.0	7.2

CLOSURE: Experience has shown that test values on soil and other natural materials vary with each representative sample. As such, HWA has no knowledge as to the extent and quantity of material the tested samples may represent. HWA also makes no warranty as to how representative either the samples tested or the test results obtained are to actual field conditions. It is a well-established fact that sampling methods present varying degrees of disturbance that affect sample representativeness.

No copy should be made of this report except in its entirety.

We appreciate the opportunity to provide laboratory testing services on this project. Should you have any questions or comments, or if we may be of further service, please call.

HWA GEOSCIENCES INC.

Alexander Hodges

Alex Hodges
Materials Laboratory Supervisor

Chad T. McMullen, P.E.
Laboratory Quality Assurance Manager

Attachments:

Figures 1-6 CBR of Lab Compacted Soils

B-06

CBR (California Bearing Ratio) OF LAB COMPACTED SOILS
(ASTM D 1883)

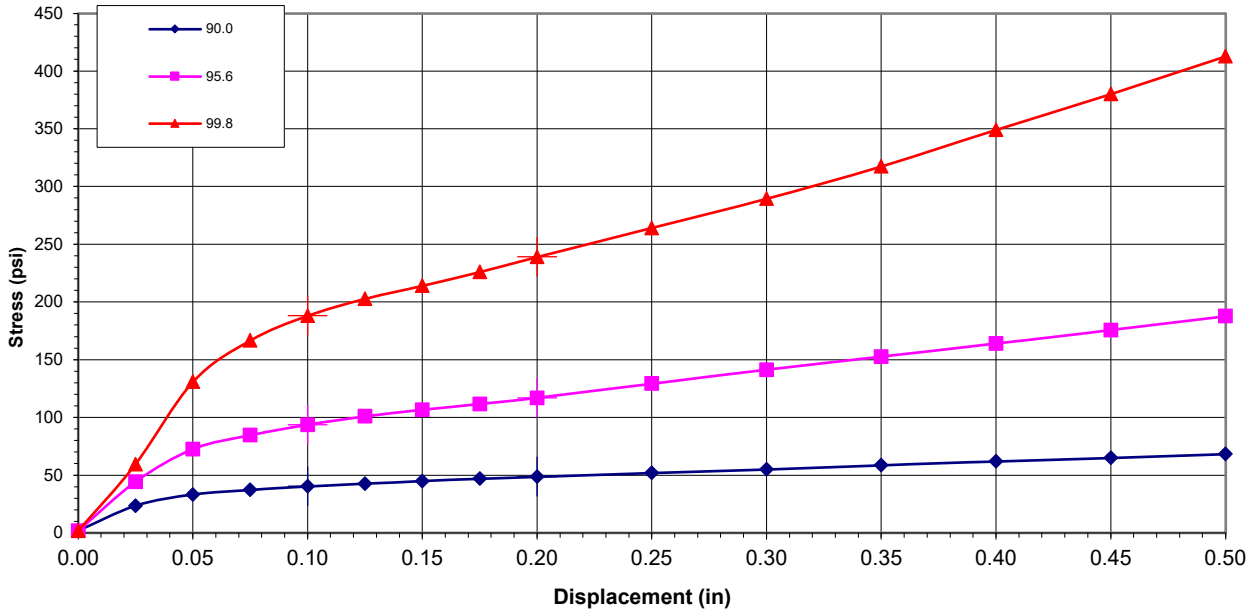
HWA GEOSCIENCES INC.

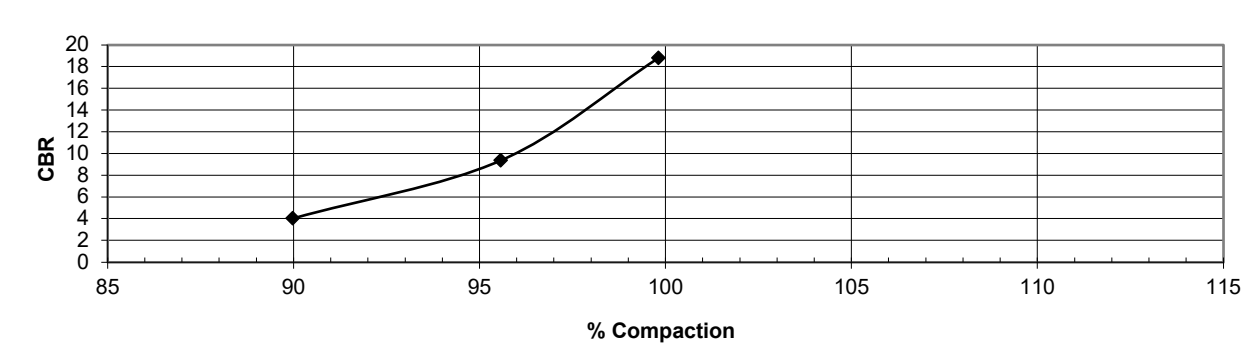
CLIENT: ***Associated Earth Sciences***
PROJECT: ***Bullfrog Flats*** **SAMPLE ID:** ***EP-54***
PROJECT NO: ***2012-038*** Sampled By: *Client* Tested By: *TS*
Date Sampled: *N/A* Date Received: *8/22/2024* Date Tested: *9/3/2024*

Material Description: *Dark yellowish-brown, silty SAND*
Sample Location: *Onsite*

Compaction Standard: [ ] D698 [X] D1557 Condition: [X] Soaked for 96 hrs [ ] Unsoaked
Max. Dry Density: *108.3* pcf @ *14.3* % M.C. with *0* % scalped-off on the 3/4" sieve

	Trial 1	Trial 2	Trial 3
Dry Density (pcf)	**97.4**	**103.5**	**108.1**
Percent Compaction	**90.0**	**95.6**	**99.8**
Moisture before Compaction (%)	**14.4**	**13.6**	**14.5**
Moisture after Compaction (%)	**14.4**	**13.6**	**14.5**
Percent Swell (initial ht = 7")	**0.2**	**0.3**	**0.2**
Moisture, after Soaking (%)	**23.0**	**20.2**	**18.8**
Moisture, Top 1", after Soak (%)	**21.5**	**20.3**	**20.0**
Surcharge Weight (lbs)	**10**	**10**	**10**
CBR at 0.1" Penetration	**4.0**	**9.4**	**18.8**
CBR at 0.2" Penetration	**3.2**	**7.8**	**15.9**
CBR Value	**4.0**	**9.4**	**18.8**





B-06

REVIEWED BY: CM FIGURE: 1

CBR (California Bearing Ratio) OF LAB COMPACTED SOILS
(ASTM D 1883)

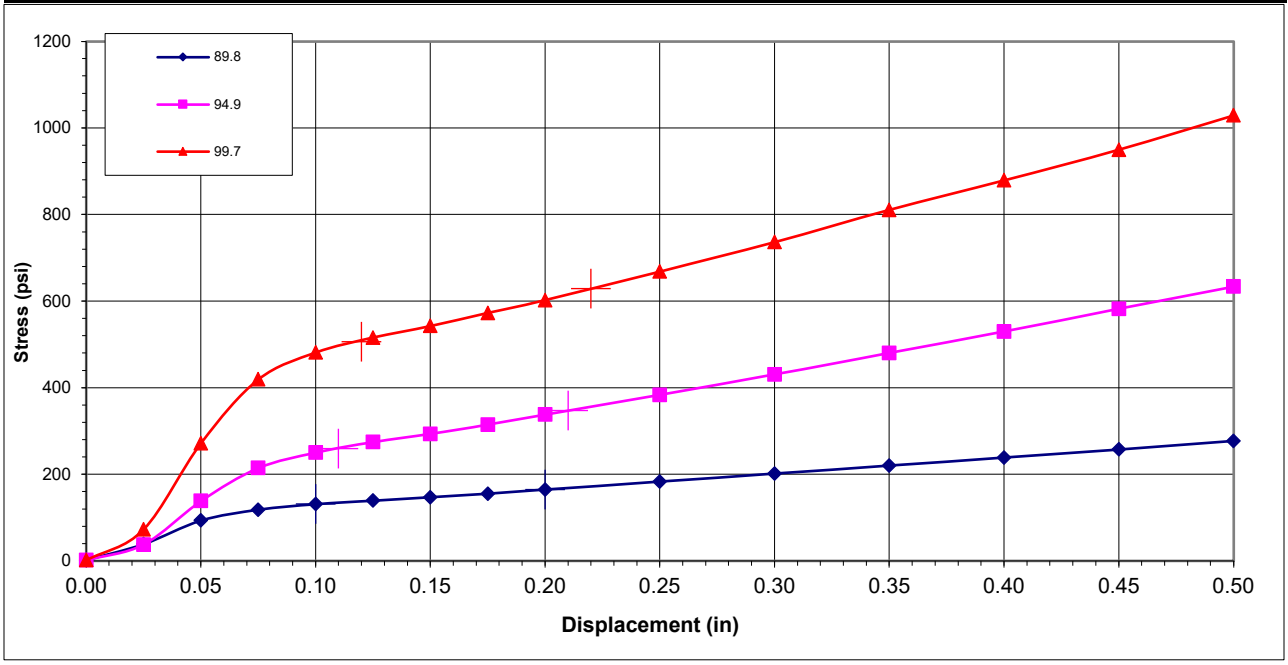
HWA GEOSCIENCES INC.

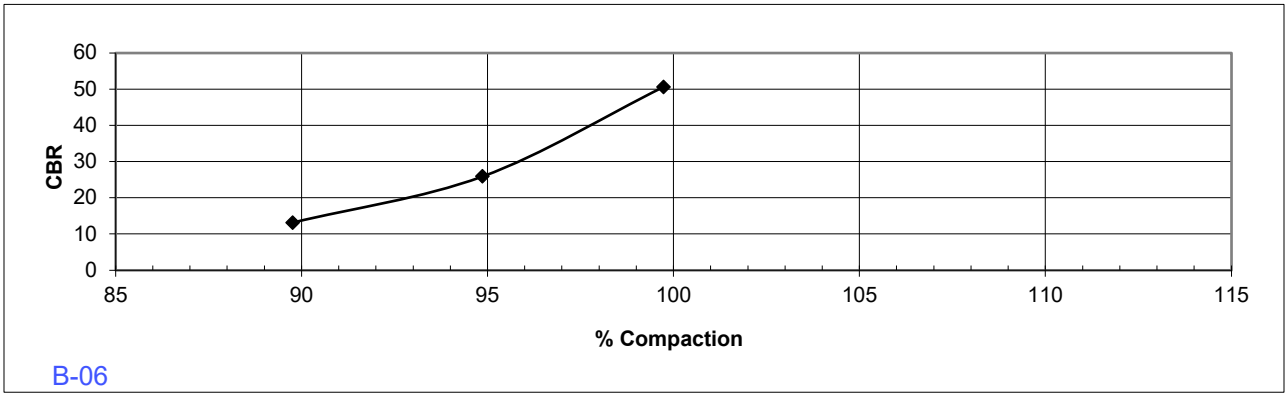
CLIENT: ***Associated Earth Sciences***
PROJECT: ***Bullfrog Flats*** **SAMPLE ID:** ***EP-65***
PROJECT NO: ***2012-038 T3400*** Sampled By: *Client* Tested By: *TS*
Date Sampled: *N/A* Date Received: *8/22/2024* Date Tested: *9/3/2024*

Material Description: *Dark yellowish-brown, silty SAND*
Sample Location: *Onsite*

Compaction Standard: [ ] D698 [X] D1557 Condition: [X] Soaked for 96 hrs [ ] Unsoaked
Max. Dry Density: *115.3* pcf @ *12.9* % M.C. with *0* % scalped-off on the 3/4" sieve

	Trial 1	Trial 2	Trial 3
Dry Density (pcf)	**103.5**	**109.4**	**115.0**
Percent Compaction	**89.8**	**94.9**	**99.7**
Moisture before Compaction (%)	**13.1**	**12.9**	**12.9**
Moisture after Compaction (%)	**13.1**	**12.9**	**12.9**
Percent Swell (initial ht = 7")	**0.4**	**0.4**	**0.5**
Moisture, after Soaking (%)	**20.7**	**17.9**	**16.0**
Moisture, Top 1", after Soak (%)	**23.0**	**20.6**	**18.5**
Surcharge Weight (lbs)	**10**	**10**	**10**
CBR at 0.1" Penetration	**13.1**	**25.9**	**50.6**
CBR at 0.2" Penetration	**11.0**	**23.2**	**41.9**
CBR Value	**13.1**	**25.9**	**50.6**





B-06

REVIEWED BY: CM FIGURE: 2

CBR (California Bearing Ratio) OF LAB COMPACTED SOILS
(ASTM D 1883)

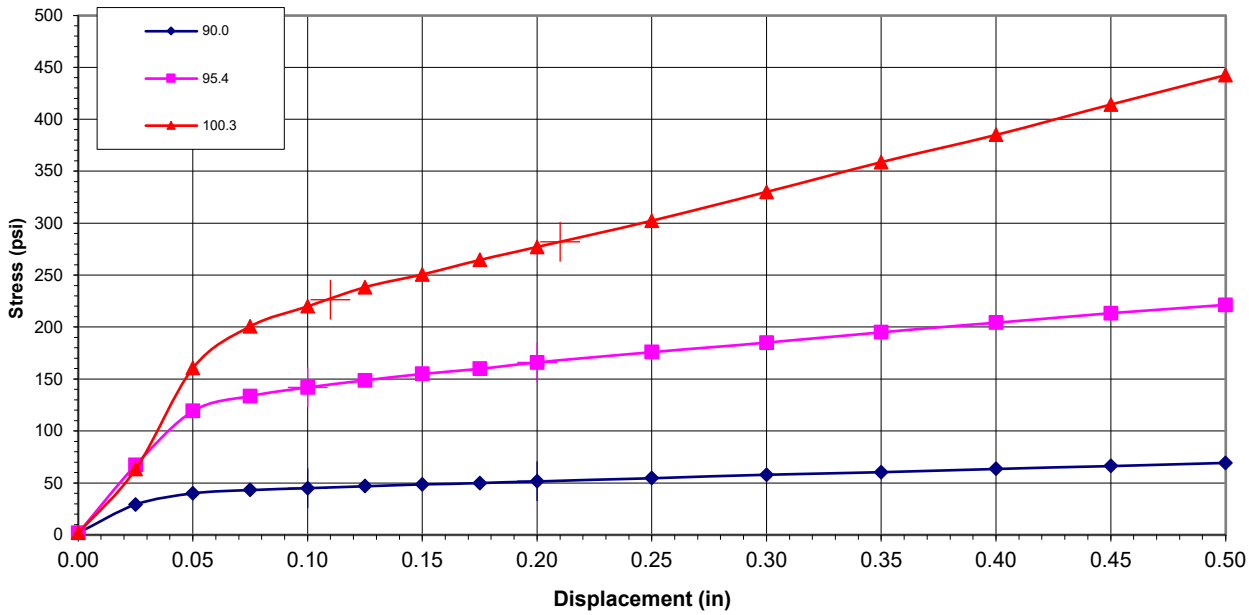
HWA GEOSCIENCES INC.

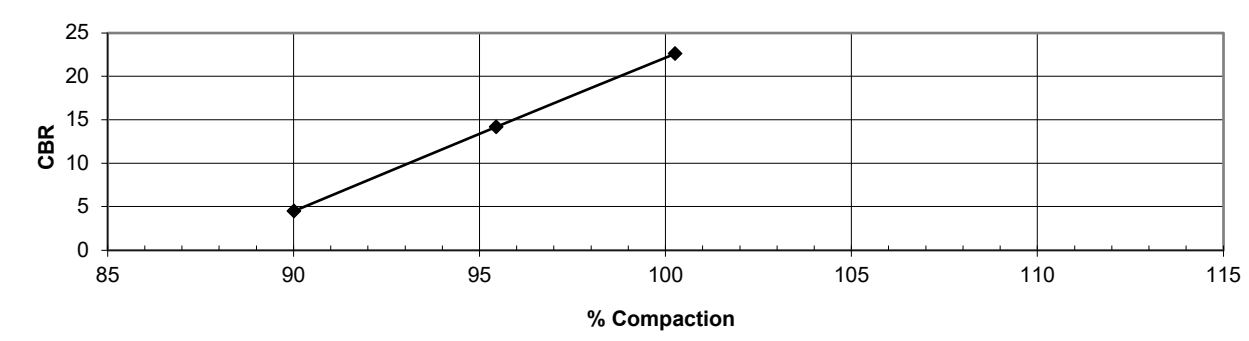
CLIENT: ***Associated Earth Sciences***
PROJECT: ***Bullfrog Flats*** **SAMPLE ID:** ***AP-76***
PROJECT NO: ***2012-038 T3400*** Sampled By: *Client* Tested By: *TS*
Date Sampled: *N/A* Date Received: *8/22/2024* Date Tested: *9/3/2024*

Material Description: *Dark yellowish-brown, silty SAND*
Sample Location: *Onsite*

Compaction Standard: [ ] D698 [X] D1557 Condition: [X] Soaked for 96 hrs [ ] Unsoaked
Max. Dry Density: *117.4* pcf @ *11.9* % M.C. with *0* % scalped-off on the 3/4" sieve

	Trial 1	Trial 2	Trial 3
Dry Density (pcf)	**105.7**	**112.1**	**117.7**
Percent Compaction	**90.0**	**95.4**	**100.3**
Moisture before Compaction (%)	**11.9**	**11.3**	**11.6**
Moisture after Compaction (%)	**11.9**	**11.3**	**11.6**
Percent Swell (initial ht = 7")	**0.5**	**0.5**	**0.3**
Moisture, after Soaking (%)	**19.3**	**16.3**	**14.8**
Moisture, Top 1", after Soak (%)	**18.7**	**17.5**	**16.7**
Surcharge Weight (lbs)	**10**	**10**	**10**
CBR at 0.1" Penetration	**4.5**	**14.2**	**22.6**
CBR at 0.2" Penetration	**3.4**	**11.1**	**18.8**
CBR Value	**4.5**	**14.2**	**22.6**





B-06

REVIEWED BY: CM FIGURE: 3

CBR (California Bearing Ratio) OF LAB COMPACTED SOILS
(ASTM D 1883)

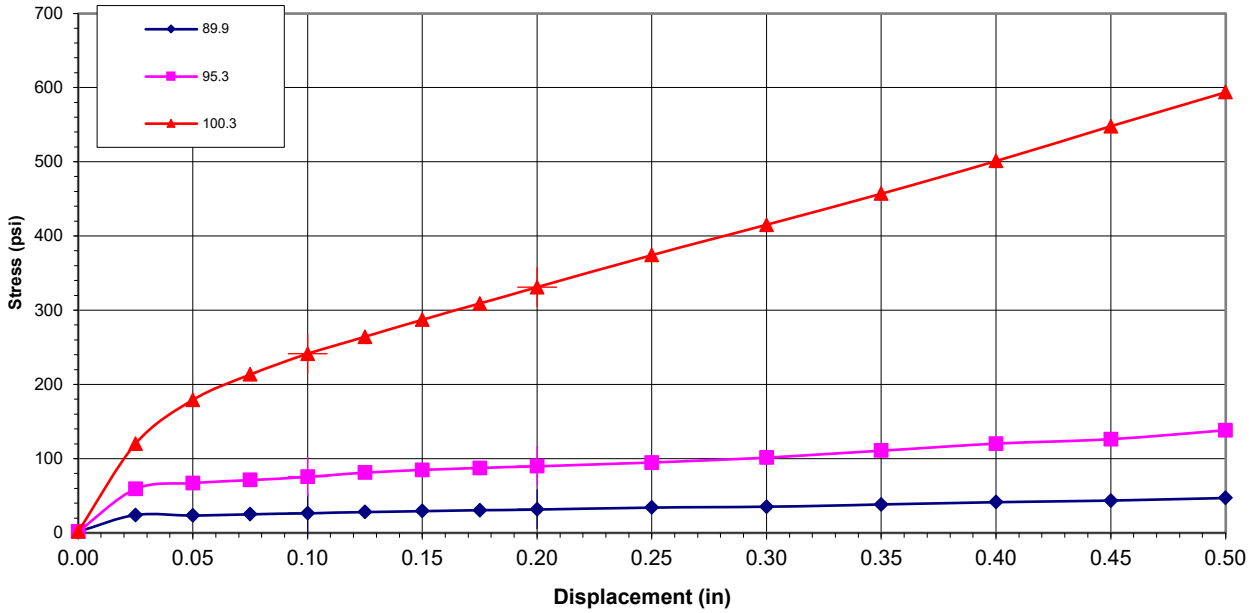
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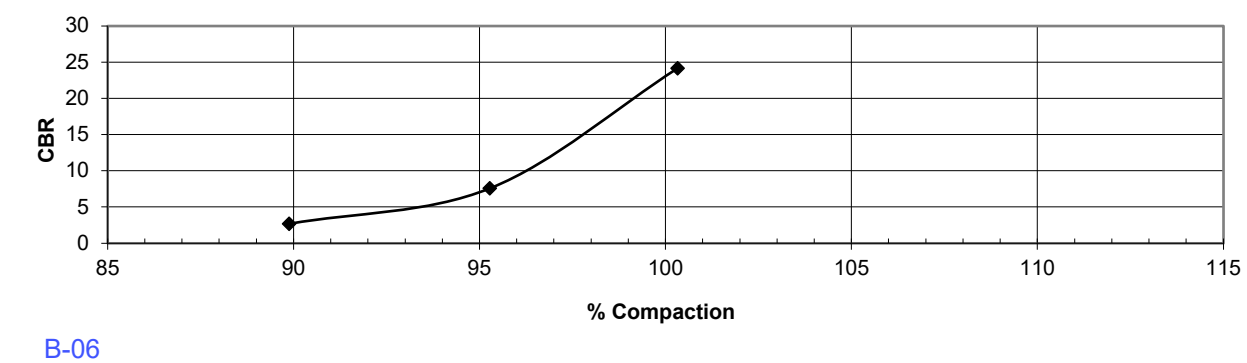
CLIENT: ***Associated Earth Sciences***
PROJECT: ***Bullfrog Flats*** **SAMPLE ID:** ***EP-84***
PROJECT NO: ***2012-038 T3400*** Sampled By: *Client* Tested By: *TS*
Date Sampled: *N/A* Date Received: *8/22/2024* Date Tested: *9/9/2024*

Material Description: *Dark yellowish-brown, silty SAND with gravel*
Sample Location: *Onsite*

Compaction Standard: [ ] D698 [X] D1557 Condition: [X] Soaked for 96 hrs [ ] Unsoaked
Max. Dry Density: *120.9* pcf @ *10.6* % M.C. with *35* % scalped-off on the 3/4" sieve

	Trial 1	Trial 2	Trial 3
Dry Density (pcf)	**108.7**	**115.2**	**121.3**
Percent Compaction	**89.9**	**95.3**	**100.3**
Moisture before Compaction (%)	**10.8**	**10.3**	**10.2**
Moisture after Compaction (%)	**10.8**	**10.3**	**10.2**
Percent Swell (initial ht = 7")	**0.0**	**0.1**	**0.1**
Moisture, after Soaking (%)	**17.8**	**15.0**	**13.1**
Moisture, Top 1", after Soak (%)	**14.2**	**13.6**	**13.2**
Surcharge Weight (lbs)	**10**	**10**	**10**
CBR at 0.1" Penetration	**2.7**	**7.6**	**24.1**
CBR at 0.2" Penetration	**2.1**	**6.0**	**22.1**
CBR Value	**2.7**	**7.6**	**24.1**





B-06

REVIEWED BY: CM FIGURE: 4

CBR (California Bearing Ratio) OF LAB COMPACTED SOILS
(ASTM D 1883)

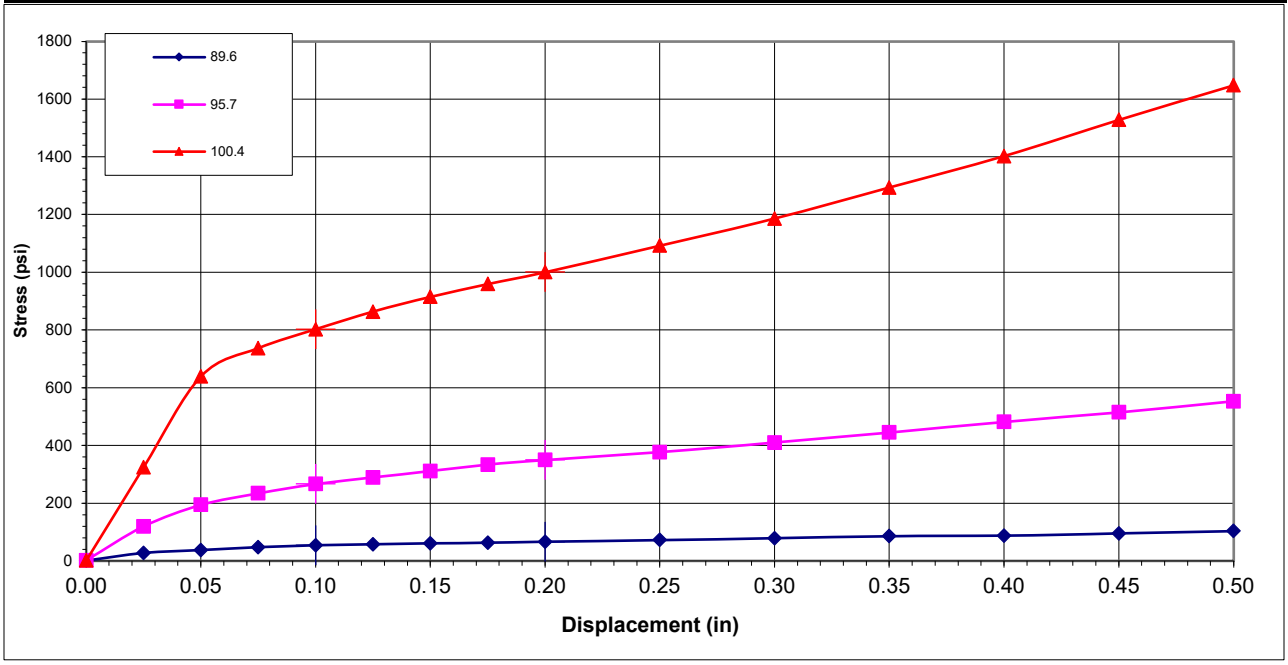
HWA GEOSCIENCES INC.

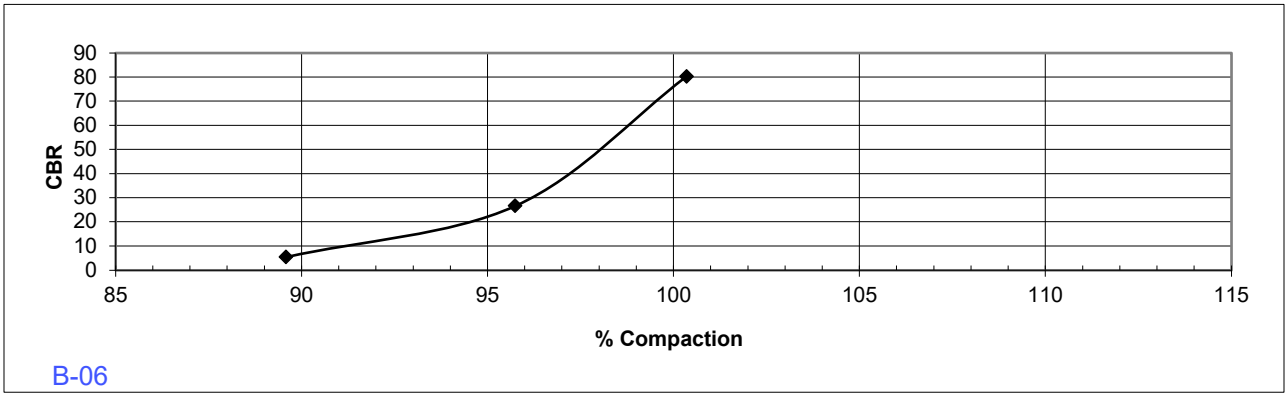
CLIENT: ***Associated Earth Sciences***
PROJECT: ***Bullfrog Flats*** **SAMPLE ID:** ***EP-95, S-1***
PROJECT NO: ***2012-038 T3400*** Sampled By: *Client* Tested By: *TS*
Date Sampled: *N/A* Date Received: *8/22/2024* Date Tested: *9/9/2024*

Material Description: *Dark yellowish-brown, silty SAND with gravel*
Sample Location: *Onsite*

Compaction Standard: [ ] D698 [X] D1557 Condition: [X] Soaked for 96 hrs [ ] Unsoaked
Max. Dry Density: *122.8* pcf @ *11.1* % M.C. with *14* % scalped-off on the 3/4" sieve

	Trial 1	Trial 2	Trial 3
Dry Density (pcf)	**110.0**	**117.6**	**123.2**
Percent Compaction	**89.6**	**95.7**	**100.4**
Moisture before Compaction (%)	**11.6**	**10.1**	**10.6**
Moisture after Compaction (%)	**11.6**	**10.1**	**10.6**
Percent Swell (initial ht = 7")	**0.1**	**0.0**	**0.0**
Moisture, after Soaking (%)	**17.9**	**13.8**	**12.7**
Moisture, Top 1", after Soak (%)	**16.1**	**15.5**	**14.8**
Surcharge Weight (lbs)	**10**	**10**	**10**
CBR at 0.1" Penetration	**5.4**	**26.7**	**80.3**
CBR at 0.2" Penetration	**4.4**	**23.3**	**66.7**
CBR Value	**5.4**	**26.7**	**80.3**





B-06

REVIEWED BY: CM FIGURE: 5

CBR (California Bearing Ratio) OF LAB COMPACTED SOILS
(ASTM D 1883)

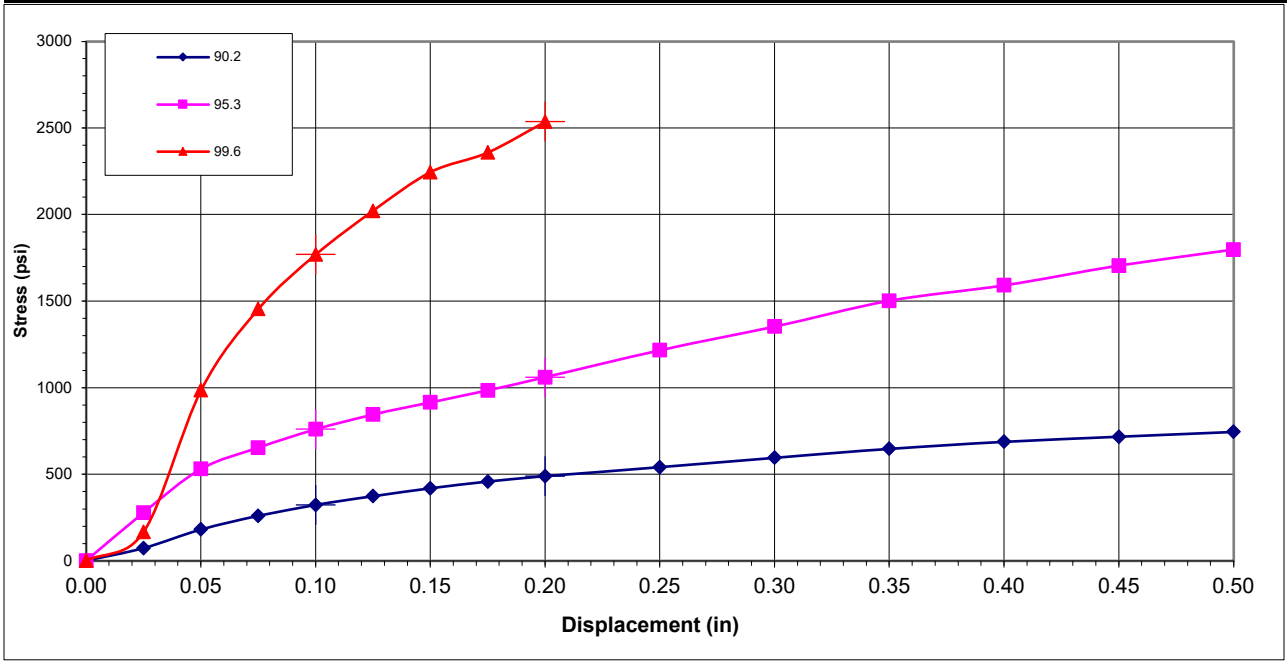
HWA GEOSCIENCES INC.

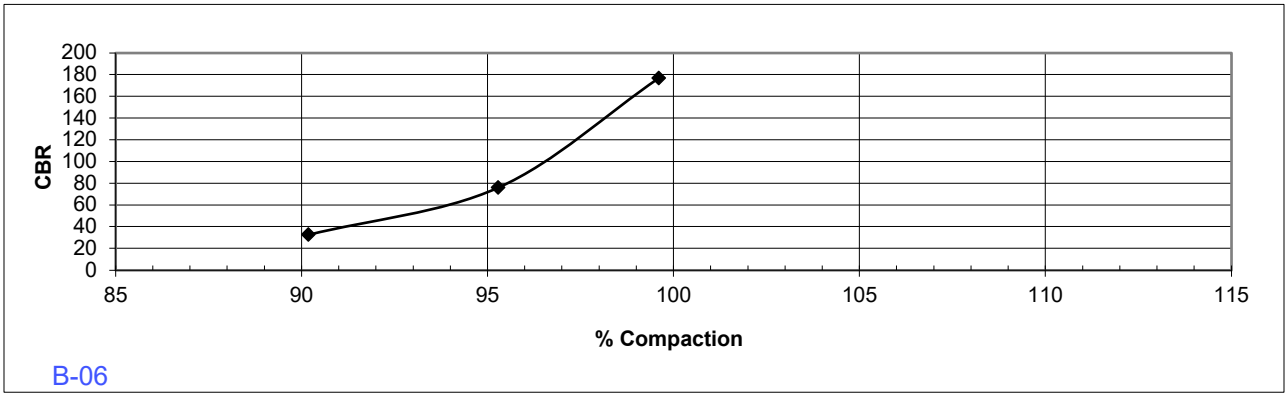
CLIENT: ***Associated Earth Sciences***
PROJECT: ***Bullfrog Flats*** **SAMPLE ID:** ***EP-95, S-2***
PROJECT NO: ***2012-038 T3400*** Sampled By: *Client* Tested By: *TS*
Date Sampled: *N/A* Date Received: *8/22/2024* Date Tested: *9/9/2024*

Material Description: *Dark yellowish-brown, poorly graded SAND with silt and gravel*
Sample Location: *Onsite*

Compaction Standard: ☐ D698 ☒ D1557 Condition: ☒ Soaked for 96 hrs ☐ Unsoaked
Max. Dry Density: *129* pcf @ *9.3* % M.C. with *18* % scalped-off on the 3/4" sieve

	Trial 1	Trial 2	Trial 3
Dry Density (pcf)	**116.3**	**122.9**	**128.5**
Percent Compaction	**90.2**	**95.3**	**99.6**
Moisture before Compaction (%)	**9.0**	**8.9**	**9.6**
Moisture after Compaction (%)	**9.0**	**8.9**	**9.6**
Percent Swell (initial ht = 7")	**0.0**	**0.0**	**0.0**
Moisture, after Soaking (%)	**14.3**	**12.3**	**11.3**
Moisture, Top 1", after Soak (%)	**10.3**	**10.6**	**10.2**
Surcharge Weight (lbs)	**10**	**10**	**10**
CBR at 0.1" Penetration	**32.3**	**76.1**	**176.9**
CBR at 0.2" Penetration	**32.6**	**70.7**	**169.1**
CBR Value	**32.6**	**76.1**	**176.9**





B-06

REVIEWED BY: CM FIGURE: 6

Appendix I – Operations & Maintenance Manual

6.A.1 How To Use The BMP Maintenance Tables

The Best Management Practice (BMP) specific maintenance criteria contained in this appendix are intended to be conditions for determining if maintenance actions are required as identified through inspection. They are not intended to be measures of the required condition of the BMP at all times between inspections. In other words, exceeding these conditions at any time between inspections and/or maintenance does not automatically constitute a violation of these criteria. However, based on inspection observations, the inspection and maintenance schedules shall be adjusted to minimize the length of time that a BMP is in a condition that requires a maintenance action.

6.A.2 Maintenance Standards - Detention Ponds

Table 6.43: Maintenance Standards - Detention Ponds

Maintenance Component	Defect	Conditions When Maintenance Is Needed	Results Expected When Maintenance Is Performed
General	Trash and Debris	Any trash and debris which exceed 5 cubic feet (cf) per 1,000 square feet (sf), which is about equal to the amount of trash it would take to fill up one standard size garbage can. In general, there should be no visual evidence of dumping. If less than the threshold above, all trash and debris will be removed as part of next scheduled maintenance.	Trash and debris cleared from site
	Poisonous Vegetation and Noxious Weeds	Any poisonous or nuisance vegetation which may constitute a hazard to maintenance personnel or the public. Any evidence of noxious weeds as defined by State or local regulations. (Apply requirements of adopted integrated pest management (IPM) policies for the use of herbicides).	No danger of poisonous vegetation where maintenance personnel or the public might normally be. (Coordinate with local health department). Complete eradication of noxious weeds may not be possible. Compliance with State or local eradication policies required
	Contaminants and Pollution	Any evidence of oil, gasoline, contaminants or other pollutants. (Coordinate removal/cleanup with local water quality response agency).	No contaminants or pollutants present.
	Rodent Holes	Any evidence of rodent holes if the pond is acting as a dam or berm, or any evidence of water piping through dam or berm via rodent holes.	Rodents destroyed and dam or berm repaired. (Coordinate with local health department and Ecology Dam Safety Office if pond exceeds 10 acre-feet).
	Beaver Dams	Dam results in change or function of the BMP.	BMP is returned to design function. (Coordinate trapping of beavers and removal of dams with appropriate permitting agencies).
	Insects	When insects such as wasps and hornets interfere with maintenance activities.	Insects destroyed or removed from site. Apply insecticides in compliance with adopted IPM policies
	Tree Growth and Hazard Trees	Tree growth does not allow maintenance and inspection access, or interferes with maintenance activity (i.e. slope mowing, silt removal, vactoring, or equipment movements). If trees are not interfering with access or maintenance, do not remove. If dead, diseased, or dying trees are identified. (Use a certified arborist to determine health of tree or removal requirements)	Trees do not hinder maintenance activities. Harvested trees should be recycled into mulch or other beneficial uses (e.g. alders for firewood). Remove hazard trees.
Side Slopes of Pond	Erosion	Eroded damage over 2 inches deep where cause of damage is still present or where there is potential for continued erosion.	Slopes should be stabilized using appropriate erosion control measure(s); e.g. rock reinforcement, planting of grass, compaction.

Table 6.43: Maintenance Standards - Detention Ponds (continued)

Maintenance Component	Defect	Conditions When Maintenance Is Needed	Results Expected When Maintenance Is Performed
		Any erosion observed on a compacted berm embankment.	If erosion is occurring on compacted berms a licensed engineer in the state of Washington should be consulted to resolve source of erosion.
Storage Area	Sediment	Accumulated sediment that exceeds 10% of the designed pond depth unless otherwise specified or affects inletting or outletting condition of the BMP.	Sediment cleaned out to designed pond shape and depth; pond reseeded if necessary to control erosion.
	Liner (if applicable)	Liner is visible and has more than three 0.25-inch holes in it.	Liner repaired or replaced. Liner is fully covered.
Pond Berms (Dikes)	Settlements	Any part of berm which has settled 4 inches lower than the design elevation. If settlement is apparent, measure berm to determine amount of settlement. Settling can be an indication of more severe problems with the berm or outlet works. A licensed engineer in the state of Washington should be consulted to determine the source of the settlement.	Dike is built back to the design elevation.
	Piping	Discernible water flow through pond berm. Ongoing erosion with potential for erosion to continue. (Recommend a geotechnical engineer be called in to inspect and evaluate condition and recommend repair of condition.	Piping eliminated. Erosion potential resolved.
Emergency Overflow/Spillway	Tree Growth	Tree growth on emergency spillways creates blockage problems and may cause failure of the berm due to uncontrolled overtopping. Tree growth on berms over 4 feet in height may lead to piping through the berm which could lead to failure of the berm.	Trees should be removed. If root system is small (base less than 4 inches) the root system may be left in place. Otherwise the roots should be removed and the berm restored. A licensed engineer in the state of Washington should be consulted for proper berm/spillway restoration.
	Piping	Discernible water flow through pond berm. Ongoing erosion with potential for erosion to continue. (Recommend a geotechnical engineer be called in to inspect and evaluate condition and recommend repair of condition.	Piping eliminated. Erosion potential resolved.
	Emergency Overflow/Spillway	Only one layer of rock exists above native soil in area five square feet or larger, or any exposure of native soil at the top of outflow path of spillway. (Riprap on inside slopes need not be replaced.)	Rocks and pad depth are restored to design standards.
	Erosion	See Side Slopes of Pond	

6.A.3 Maintenance Standards - Infiltration

Table 6.44: Maintenance Standards - Infiltration

Maintenance Component	Defect	Conditions When Maintenance Is Needed	Results Expected When Maintenance Is Performed
General	Trash & Debris	See 6.A.2 Maintenance Standards - Detention Ponds	
	Poisonous/Noxious Vegetation	See 6.A.2 Maintenance Standards - Detention Ponds	
	Contaminants and Pollution	See 6.A.2 Maintenance Standards - Detention Ponds	
	Rodent Holes	See 6.A.2 Maintenance Standards - Detention Ponds	
Storage Area	Sediment	Water ponding in infiltration pond after rainfall ceases and appropriate time allowed for infiltration. (A percolation test pit or test of the pond indicates that the pond is only working at 90% of its designed capabilities. Test every 2 to 5 years. If two inches or more sediment is present, remove).	Sediment is removed and/or pond is cleaned so that infiltration system works according to design.
Filter Bags (if applicable)	Filled With Sediment and Debris	Sediment and debris fill bag more than 1/2 full.	Filter bag is replaced or system is redesigned.
Rock Filters	Sediment and Debris	By visual inspection, little or no water flows through filter during heavy rain storms.	Gravel in rock filter is replaced.
Side Slopes of Pond	Erosion	See 6.A.2 Maintenance Standards - Detention Ponds	
Emergency Overflow Spillway and Berms over 4 feet in height	Tree Growth	See 6.A.2 Maintenance Standards - Detention Ponds	
	Piping	See 6.A.2 Maintenance Standards - Detention Ponds	
Emergency Overflow Spillway	Rock Missing	See 6.A.2 Maintenance Standards - Detention Ponds	
	Erosion	See 6.A.2 Maintenance Standards - Detention Ponds	
Pre-settling Ponds and Vaults	Facility of Sump Filled with Sediment and/or Debris	6" or designed sediment trap depth of sediment.	Sediment is removed.

6.A.7 Maintenance Standards - Catch Basins

Table 6.48: Maintenance Standards - Catch Basins

Maintenance Component	Defect	Conditions When Maintenance is Needed	Results Expected When Maintenance is performed
General	Trash & Debris	Trash or debris which is located immediately in front of the catch basin opening or is blocking inletting capacity of the basin by more than 10%. Trash or debris (in the basin) that exceeds 60% of the sump depth as measured from the bottom of basin to invert of the lowest pipe into or out of the basin, but in no case less than a minimum of 6 inches clearance from the debris surface to the invert of the lowest pipe. Trash or debris in any inlet or outlet pipe blocking more than 1/3 of its height. Dead animals or vegetation that could generate odors that could cause complaints or dangerous gases (e.g. methane).	No Trash or debris located immediately in front of catch basin or on grate opening. No trash or debris in the catch basin. Inlet and outlet pipes free of trash or debris. No dead animals or vegetation present within the catch basin.
	Sediment	Sediment (in the basin) that exceeds 60% of the sump depth as measured from the bottom of basin to invert of the lowest pipe into or out of the basin, but in no case less than a minimum of 6 inches clearance from the sediment surface to the invert of the lowest pipe.	No sediment in the catch basin
	Structure Damage to Frame and/or Top Slab	Top slab has holes larger than 2 square inches or cracks wider than 1/4 inch. (Intent is to make sure no material is running into basin). Frame not sitting flush on top slab, i.e. separation of more than 3/4 inch of the frame from the top slab. Frame not securely attached.	Top slab is free of holes and cracks. Frame is sitting flush on the riser rings or top slab and firmly attached.
	Fractures or Cracks in Basin Walls/ Bottom	Maintenance person judges that structure is unsound. Grout fillet has separated or cracked wider than 1/2 inch and longer than 1 foot at the joint of any inlet/outlet pipe or any evidence of soil particles entering catch basin through cracks.	Basin replaced or repaired to design standards. Pipe is regrouted and secure at basin wall.
	Settlement/ Misalignment	If failure of basin has created a safety, function, or design problem.	Basin replaced or repaired to design standards.
	Vegetation	Vegetation growing across and blocking more than 10% of the basin opening. Vegetation growing in inlet/outlet pipe joints that is more than 6 inches tall and less than 6 inches apart.	No vegetation blocking opening to basin. No vegetation or root growth present.
	Contamination and Pollution	See 6.A.2 Maintenance Standards - Detention Ponds	No pollution present.
Catch Basin Cover	Cover Not in Place	Cover is missing or only partially in place. Any open catch basin requires maintenance.	Cover/grate is in place, meets design standards, and is secured.
	Locking Mechanism Not Working	Mechanism cannot be opened by one maintenance person with proper tools. Bolts into frame have less than 1/2 inch of thread.	Mechanism opens with proper tools.
	Cover Difficult to Remove	One maintenance person cannot remove lid after applying normal lifting pressure. (Intent is keep cover from sealing off access to maintenance.)	Cover can be removed by one maintenance person.
Ladder	Ladder Rungs Unsafe	Ladder is unsafe due to missing rungs, not securely attached to basin wall, misalignment, rust, cracks, or sharp edges.	Ladder meets design standards and allows maintenance person safe access.
Metal Grates (if applicable)	Grate opening Unsafe	Grate with opening wider than 7/8 inch.	Grate opening meets design standards.
	Trash and Debris	Trash and debris that is blocking more than 20% of grate surface inletting capacity.	Grate free of trash and debris.
	Damaged or Missing.	Grate missing or broken member(s) of the grate.	Grate is in place, meets the design standards, and is installed and aligned with the flow path.

6.A.9 Maintenance Standards - Energy Dissipators

Table 6.50: Maintenance Standards - Energy Dissipators

Maintenance Components	Defect	Conditions When Maintenance is Needed	Results Expected When Maintenance is Performed
External			
Rock Pad	Missing or Moved Rock	Only one layer of rock exists above native soil in area five square feet or larger, or any exposure of native soil.	Rock pad replaced to design standards.
	Erosion	Soil erosion in or adjacent to rock pad.	Rock pad replaced to design standards.
	Pipe Plugged with Sediment	Accumulated sediment that exceeds 20% of the design depth.	Pipe cleaned/flushed so that it matches design.
Dispersion Trench	Not Discharging Water Properly	Visual evidence of water discharging at concentrated points along trench (normal condition is a "sheet flow" of water along trench). Intent is to prevent erosion damage.	Trench redesigned or rebuilt to standards.
	Perforations Plugged	Over 1/2 of perforations in pipe are plugged with debris and sediment.	Perforated pipe cleaned or replaced.
	Water Flowing out Top of "Distributor" Catch Basin	Maintenance person observes or receives credible report of water flowing out during any storm less than the design storm or is causing or appears likely to cause damage.	Energy dissipator rebuilt or redesigned to standards.
	Receiving Area Oversaturated	Water in receiving area is causing or has potential of causing landslide problems.	No danger of landslides.
Internal			
Manhole/Chamber	Worn or Damaged Post, Baffles, or Side of Chamber	Structure dissipating flow deteriorates to 1/2 of original size or any concentrated worn spot exceeding one square foot, which would make structure unsound.	Structure replaced to design standards.
	Other Defects	See 6.A.7 Maintenance Standards - Catch Basins	

6.A.23 Maintenance Standards - Bioretention

Table 6.64: Maintenance Standards - Bioretention

Maintenance Component	Activity	Objective	Schedule	Notes
Routine Maintenance				
Vegetation	Maintain drip irrigation system without breaks or blockages. Hand water as needed for specific plants.	Establish vegetation with a minimum 80% survival rate	Twice annually (May and July) or as indicated by plant health	Plants should be selected to be drought tolerant and not require watering after establishment (2 to 3 years). Watering may be required during prolonged dry periods after plants are established.
	Remove and/or prune vegetation	Maintain adequate plant coverage and plant health. Reduce shading of understory if species require sun. Maintain soil health and infiltration capability. Maintain clearances from utilities and sight distances.	Once or twice annually	Depending on aesthetic requirements, occasional pruning and removing dead plant material may be necessary.
	Remove undesired vegetation by hand weeding.	Reduce competition for desired vegetation. Improve aesthetics.	Prior to major weed species disbursing seeds (usually twice annually)	Periodic weeding is necessary until plants are established. The weeding schedule should become less frequent if the appropriate plant species and planting density have been used and, as a result, undesirable plants excluded.
Curb cuts	Remove any accumulation of debris from gutter and entrance to bioretention area.	Maintain proper flow of stormwater from paved/ impervious areas to bioretention BMP.	Twice annually (October and January)	
Mulch	Replace or add mulch with hand tools to a depth of 2 to 3 inches.	Replenish organic material in soil, reduce erosion, prolong good soil moisture level, and filter pollutants.	Once annually or every 2 years	Consider replacing mulch annually in bioretention BMPs where high pollutant loading is likely (e.g., contributing areas that include quick marts). Use compost in the bottom of the BMP and wood chips on side slopes and rim (above typical water levels).
General	Trash removal	Maintain aesthetics and prevent clogging of infrastructure.	Twice annually	
Nonroutine Maintenance				
Inlets/ Outlets	Clear vegetation within 1 foot of inlets and outlets to maintain access pathways.	Prevent clogging of infrastructure and maintain sight lines and access for inspections.	Once annually	If sediment is deposited in the bioretention area, immediately determine the source within the contributing area and stabilize.
Bioretention Area	Shovel or rake out sediment within vegetated areas. Vacuum catch basins or other sediment structures.	Reduce sediment transport and clogging of infrastructure. Maintain desired plant survival and appearance of the BMP. Maintain proper elevations and ponding depths.	Determined by inspection	

Table 6.64: Maintenance Standards - Bioretention (continued)

Maintenance Component	Activity	Objective	Schedule	Notes
Underdrains	Jet clean or rotary cut debris/roots from underdrains.	Maintain proper subsurface drainage, ponding depths, and dewatering rates.	Determined by inspection of clean-outs	Bioretention BMPs should be designed with a proper elevation drop from pavement to vegetated area to prevent blockage of storm flows by vegetation into infiltration area.
Vegetation	Reseed or replant bare spots or poorly performing plants.	Maintain dense vegetation cover to prevent erosion, encourage infiltration and exclude unwanted weed species.	Determined by inspection	Soil mixes for bioretention BMPs are designed to maintain long-term fertility and pollutant processing capability. Estimates from metal attenuation research suggest that metal accumulation should not present an environmental concern for at least 20 years in bioretention systems. Replacing mulch in bioretention BMPs where heavy metal and hydrocarbon deposition is likely provides additional of protection for prolonged performance.
Soil Medium	Remove vegetation (save as much plant material as possible for replanting) and excavated soil with backhoe, excavator or, if small BMP, by hand.	Replace soil medium to maintain infiltration, soil fertility, and pollutant removal capability	Determined by inspection (visual, infiltration, pollutant, and soil fertility tests)	
General	Remove excess vegetation at the intersection of pavement and vegetation with a line trimmer, vacuum sweeper, rake or shovel.	Prevent accumulation of vegetation at pavement edge and maintain proper sheet flow of stormwater from paved/impervious areas to bioretention BMP.	Determined by inspection	If specific plants have a high mortality rate, assess the cause and replace with appropriate species.
	Various activities to maintain walls, intake and outfall pads, weirs, and other hardscape elements.	Rebuild or reinforce structures to maintain proper drainage and aesthetics and prevent erosion.	Determined by inspection	
	Maintain proper slope with hand tools, back hoe, or excavator; replant exposed areas.	Regrade or recontour side slopes to prevent erosion where side slopes have been disturbed by foot or vehicle intrusion.	Determined by inspection	