# DRAFT Drainage Control Plan Report

for

# The Lodge

456 Carpenter Rd. SE
Lacey, WA 98503
TPN 11815310200

City of Lacey Project No. __-____
Olympic Engineering Project No. 22020

March 17, 2023

PO Box 12690
Olympia WA 98508
360.705.2474
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**COVER SHEET**

# THE LODGE

Lacey, Washington
March 17, 2023

## Owner/Applicant

| | |
|---|---|
| Prepared for: | Olympia Hangars, LLC |
| Contact: | Jeff Powell<br>7842 Old Hwy. 99 SE, Hangar #M-5<br>Tumwater, WA 98501<br>(360) 888-5333<br>jeff@primedevelopmentgroup.com |

## Reviewing Agency

| | |
|---|---|
| Jurisdiction: | City of Lacey, Washington |
| Project Number: | __-____ |
| Project Contact: | Sarah Schelling, AICP, Senior Planner<br>(360) 491-5642<br>sschelli@ci.lacey.wa.us |

## Contractor

Contact:

## References

City of Lacey Stormwater Design Manual (SDM)*, 2022 ed.*

## Project Engineer

| | |
|---|---|
| Prepared by: | Olympic Engineering, Inc.<br>PO Box 12690<br>Olympia, WA 98508<br>(360) 705-2474<br>www.olyeng.com |
| Contact: | Chris Merritt, PE |
| Olympic Project: | 22020 |
| File Name: | Draft Drainage Report |

3/17/2023

"I hereby certify that this DRAFT Drainage Control Plan Report for **The Lodge** project has been prepared by me or under my supervision and meets the standard of care and expertise which is usual and customary in this community for professional engineers. I understand that the City of Lacey does not and will not assume liability for the sufficiency, suitability, or performance of drainage BMPs prepared by me."

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## SECTION 1 – PROPOSED OVERVIEW

### 1.1 Site Information

Site Address
456 Carpenter Rd. SE
Lacey, WA 98503

Parcel Number
11815310200

Zoning
MD, Moderate Density

Owner
Olympia Hangars, LLC
Attn: Jeff Powell
7842 Old Hwy. 99 SE, Hangar #M-5
Tumwater, WA 98501
(360) 888-5333
jeff@primedevelopmentgroup.com

### 1.2 Project Description

The proposal is to construct four multi-family buildings (94 units) with associated access, driveway, parking lot, utility, and storm drainage improvements.

All proposed site work improvements are anticipated to be constructed in one phase with substantial site work construction completion by Spring/Summer 2024. The completion timeframe of the buildings is currently unknown.

### 1.3 Proposed Stormwater Drainage Design

- Stormwater runoff from the parking lot and drive aisle areas will be routed to a Bioretention Facility (BMP T7.30).
- Stormwater runoff from the roof areas of multifamily buildings and their associated carports, along with the Office building and grilling station roof areas, will be tightlined to Downspout Infiltration Trenches (BMP T5.10A).
- Stormwater runoff from the combined shop and refuse roof area, along with Carport A, will be routed to the Bioretention Facility noted above.
- Stormwater runoff from the tops of the retaining walls will be sheet flow dispersed (BMP T5.12) over adjacent lawn/landscape/forested areas.
- Stormwater runoff from sidewalks immediately adjacent to pavement (e.g. drive aisles, parking lot) will sheet flow onto the pavement and be routed to the Bioretention Facility noted above.
- Stormwater runoff from sidewalks with lawn/landscaping along both sides will be sheet flow dispersed (BMP T5.12) over the adjacent lawn/landscape areas.

This project will meet the LID Performance Standard.

See Core Requirements in Section 2.5, along with Section 5, for additional information regarding these proposed stormwater BMPs.

## 1.4 Subarea Data Tabulations

| | |
|---|---|
| Parcel Area: | 217,500 sf (4.993 ac) |
| Off-Site Area: | 862 sf (0.020) ac) |
| Total Project Area: | 218,362 sf (5.013 ac) |

| Existing Surfaces | Surface Type | Area (sf) | Area (ac) |
|---|---|---|---|
| Roof | Impervious | 1,935 | 0.044 |
| Concrete | Impervious | 195 | 0.005 |
| Forest | Pervious | 215,370 | 4.944 |
| Lawn/Landscape (Off-Site) | Pervious | 862 | 0.020 |
| **Total** | | **218,362** | **5.013** |

| Proposed New/Replaced Surfaces | Surface Type | PGIS? | Area (sf) | Area (ac) |
|---|---|---|---|---|
| Roof [(1)] | Impervious | No | 71,889 | 1.650 |
| Roof [(2)] | Impervious | No | 4,488 | 0.103 |
| Driveway (On-Site) [(1)] | Impervious | Yes | 46,963 | 1.078 |
| Driveway (Off-Site) [(4)] | Impervious | Yes | 803 | 0.018 |
| Retaining Walls [(3)] | Impervious | No | 1,280 | 0.029 |
| Sidewalk (On-Site) [(2)] | Impervious | Yes | 3,125 | 0.072 |
| Sidewalk (On-Site) [(3)] | Impervious | No | 2,428 | 0.056 |
| Sidewalk (Off-Site) [(3)] | Impervious | No | 59 | 0.001 |
| Bioretention Facility (ponded area) | - | No | 4,850 | 0.111 |
| Lawn/Landscaping | Pervious | No | 40,727 | 0.935 |
| Forest | Pervious | No | 41,750 | 0.958 |
| **Total** | | | **218,362** | **5.013** |

[(1)] Contributing to Downspout Infiltration Trenches (BMP T5.10A)
[(2)] Contributing to Bioretention Facility (BMP T5.30)
[(3)] Sheet Flow Dispersion (BMP T5.12)
[(4)] Contributes to existing Serenity Acres stormwater system

| | |
|---|---|
| Total Hard Surface: | 135,885 sf |
| Total Lawn/Landscape: | 40,727 sf |
| Total Forest: | 41,750 sf |
| Total: | 218,362 sf |

62.1% development (impervious) coverage (excludes off-site areas) <75% allowed per zoning

The square-footages and acreages in the table above may not match due to rounding.

## SECTION 2 – DEVELOPMENT CONDITIONS AND REQUIREMENTS

### 2.1 Project Vesting

The 2022 SDM is applicable to this project.

### 2.2 Permits Required

At this time, it is anticipated that the following permits may be required for this project:

- City of Lacey – Right-of-Way Access Permit
- City of Lacey – Grading and Building Permits
- Washington State Department of Ecology – Construction Stormwater General Permit

### 2.3 Project Type and Size

This project is a new development project that will create more than 5,000 sf of new hard surface area; therefore, Core Requirements #1-9 are applicable.

### 2.4 Critical Areas

There are no known critical areas (e.g. wetlands, steep slopes, etc.) on-site or within the immediate vicinity of the site.

### 2.5 Core Requirements

The total proposed "new and/or replaced" hard surface area is greater than 5,000 sf; therefore, this project is required to address Core Requirements (CR) #1-9 per Chapter 2, Section 2.2, of the City of Lacey Stormwater Design Manual (SDM).

This project will meet the LID Performance Standard as the majority of stormwater runoff will be infiltrated.

These Core Requirements have been addressed as follows:

**Core Requirement #1 – Preparation of Stormwater Site Plans**

A Drainage Plan has been prepared (see Appendix). After Site Plan approval, a final Drainage Control Plan Report and Plans meeting the requirements of Chapter 3, Section 3.3.3 of the SDM will be prepared and submitted to the city for review and approval. A Construction Stormwater Pollution Prevention Plan (SWPPP) will be provided with the Final Drainage Report (see CR#2 below).

**Core Requirement #2 – Construction Stormwater Pollution Prevention (SWPP)**

A Draft SWPP plan has been prepared (see Appendix).

**Core Requirement #3 – Source Control of Pollution**

A Stormwater Maintenance and Pollution Source Control Manual will be provided with the final Drainage Control Plan Report and will be recorded prior to final project approval.

**Core Requirement #4 – Preservation of Natural Drainage Systems and Outfalls**

There are no known natural drainage patterns or outfalls located on or adjacent to the parcel. If any are found, they will be maintained and will remain undisturbed to the maximum extent practical.

**Core Requirement #5 – On-Site Stormwater Management**

The project will meet the LID Performance Standard as the majority of stormwater runoff from the improvements will be full infiltrated. The proposed stormwater Best Management Practices (BMPs) are as follows:

Lawn and Landscape Areas:

- All disturbed and/or new lawn and landscape areas will contain soils meeting the Post-Construction Soil Quality and Depth (BMP T5.13) requirements.

Roof Areas:

- Stormwater runoff from the roof areas of the multifamily buildings, carports, office building, and grilling stations will be tightlined to Downspout Infiltration Trenches (BMP T5.10A) (100% infiltration). The trenches have been sized using WWHM (see Appendix). The trench descriptions and sizes are as follows:

| Associated Roof Areas | Label | Length (ft) | Width (ft) | Height (ft) |
|---|---|---|---|---|
| Building A and grill station | Trench A | 185 | 6 | 4 |
| North half of Building B and Carport B1 | Trench B North | 40 | 12 | 4 |
| South half of Building B and Carports B2 & B3 | Trench B South | 110 | 6 | 4 |
| Building C and Carport C | Trench C | 42 | 6 | 4 |
| Building D and Carports D1 & D2 | Trench D | 65 | 12 | 4 |
| Office and grill station | Trench Office | 22 | 6 | 4 |

- Stormwater runoff from the combined shop and refuse roof area, along with Carport A, will be routed to the Bioretention Facility (BMP T7.30) noted below.

Other Hard Surface Areas:

- Stormwater runoff from the parking lot and drive aisle areas will be routed to a Bioretention Facility (BMP T7.30) (100% infiltration).
- Stormwater runoff from sidewalks adjacent to pavement (e.g. drive aisles, parking lot) will sheet flow onto the pavement and be routed to the Bioretention Facility noted above.
- Stormwater runoff from sidewalks with lawn/landscaping along both

sides will be sheet flow dispersed (BMP T5.12) over the adjacent lawn/landscape areas.
- Stormwater runoff from the tops of the walls will be sheet flow dispersed (BMP T5.12) over adjacent lawn/landscape/forested areas.

**Stormwater Facility Drawdown Times**

| Facility | Max. Stage Height (ft) | Infiltration Rate (in/hr) | Drawdown Time (hours) |
|---|---|---|---|
| Bioretention Pond | 1 | 3 | 4 |
| Trench A | 2.8 | 9 | 3.7 |
| Trench B North | 2.8 | 9 | 3.7 |
| Trench B South | 2.8 | 9 | 3.7 |
| Trench C | 3 | 9 | 4 |
| Trench D | 3 | 9 | 4 |
| Trench Office | 2.7 | 9 | 3.6 |

Drawdown time = (stage height x 12”/1’) / (infiltration rate)

All downspout infiltration trenches provide for a minimum of 1’ of freeboard and the bioretention facility provides a minimum of 2’ of freeboard.

**Modeling Narrative**

- Stormwater runoff from the sidewalk and wall areas being dispersed have been modeled as a “lawn” area in WWHM.

- All lawn/landscape areas will meet the Post-Construction Soil Quality and Depth (BMP T5.13) requirements and have been modeled as “pasture” in WWHM.

- The bioretention facility was modeled with a 3”/hr design infiltration rate as that’s the lowest rate between the default bioretention soil mix rate and the design rate recommended by Pacific Testing & Inspection (PTI). The downspout infiltration trenches were modeled using a 9”/hr rate (PTI recommended a design rate of 9.59”/hr). Additional evaluation of all exposed infiltration surface sub-grades will be conducted prior to facility construction to confirm the design rates are acceptable.

**Core Requirement #6 – Runoff Treatment**

This project will create and/or replace more than 5,000 square-feet of new pollution generating hard surface (PGHS) area; therefore, Runoff Treatment facilities are required per Section 2.2.6 of the SDM. See Core Requirement #5 above for a description of the proposed stormwater BMPs.

A minimum 18” depth of bioretention soil mix will be provided beneath the bioretention facility which meets the requirements for both basic and enhanced treatment. The proposed soil mix provided by the contractor will be reviewed by Olympic Engineering and PTI to ensure it meets the

requirements of Section 7.4.4 of the SDM prior to placement.

**Core Requirement #7 – Flow Control**

This project will have less than 10,000 square-feet of new "effective" hard surface area; will convert more than ¾-acre of vegetation to lawn/landscape; and will cause less than a 0.15-cfs increase in the 100-year recurrence interval flow frequency. Flow control is applicable as more than ¾-acre of vegetation is being converted to lawn/landscape. Per WWHM, the Flow Control standard has been met and the project will meet the LID Performance Standard.

See Core Requirement #5 above for a description of the proposed stormwater BMPs.

**Core Requirement #8 – Wetlands Protection**

There are no known wetlands on-site or within the immediate vicinity; therefore, this Core Requirement is not applicable.

**Core Requirement #9 – Operation and Maintenance**

A Stormwater Maintenance and Pollution Source Control Manual will be recorded prior to final project approval. The owner will be responsible for all maintenance of the stormwater infrastructure.

**Additional Requirements –Financial Guarantees**

Maintenance and/or operational bonding or other financial guarantees will be provided prior to final project approval, if required.

## SECTION 3 – SITE AND VICINITY DESCRIPTION

### 3.1 Existing Physiography

The parcel is undeveloped and mostly forested with mature fir trees. Site topography slopes down from west/south to east/north with an overall relief of approximately 20'.

There are no creeks, lakes, ponds, springs, etc. on or near the subject parcel.

Per FEMA FIRM Panel #53067C0191E the project is located in Zone X (an area determined to be outside the 0.2% annual chance floodplain).

### 3.2 Existing Improvements

The site contains an old single-family residence, shed, and driveway. The existing residence will be converted to an office building.

No known underground or leaking storage tanks are located on-site per a field visit and review of the Washington State Department of Ecology (DOE) UST/LUST map.

An-site well serving the single-family residence has been decommissioned. No other known wells are located on-site or within 200-feet of the site per a DOE well log search.

The septic system serving the single-family residence has been removed per the owner.

### 3.3 Drainage Patterns

There is no known off-site drainage affecting the subject parcel and there is no known runoff from the subject parcel affecting adjacent parcels. There are no known historical drainage problems such as flooding, erosion, etc. on or near the subject parcel.

See Section 4.1 below for the soil conditions.

This project is not located within any known adopted basin plan areas.

The project site is located within the Henderson Inlet Watershed.

### 3.4 Qualitative Analysis

Over 99% of the stormwater runoff generated by the new improvements will be collected, stored, and fully infiltrated on-site and there will be no direct discharge to a downstream conveyance system (there is no downstream conveyance system or receiving water). Some stormwater runoff from the new driveway entrances (803 sf, 0.36%) will flow into the Serenity Acres stormwater facilities.

The proposed bioretention facility has 2-feet of freeboard and all downspout infiltration trenches have at least 1-foot of freeboard (see Section 2.5). Any emergency overflow from the downspout infiltration trenches would flow into the on-site stormwater conveyance systems and be conveyed to the bioretention pond. 2' of freeboard in the bioretention pond provides an additional 2.7 times the storage volume available in the 1' working depth of the pond and the side slopes in the freeboard area will have a higher infiltration rate than the BSM; therefore, the pond has capacity to accommodate premature failing/clogging. As stated above, there is no downstream conveyance system to convey emergency overflow to.

### 3.5 Quantitative Analysis

Based on the information in Section 3.4 above, a Quantitative Analysis is not warranted.

## SECTION 4 – SOIL AND INFILTRATION ANALYSIS

### 4.1 Summary of Soils and Geotechnical Data

The Natural Resource Conservation Service (NRCS) classifies the on-site soils as Yelm Fine Sandy Loam (HSG A) with a small area (4%) of Nisqually Loamy Fine Sand (HSG A) mapped along a portion of the east property line. A Soils Report has been prepared by Pacific Testing & Inspection (PTI) (see Appendix). Twelve test pits were evaluated to depths of up to 13' below-grade and the soils generally consisted of fine to course sandy gravel (GW/GP).

Fill material was encountered in four test pits down to 3' below-grade in the north/northwestern area of the parcel. This material will be removed and replaced with suitable structural fill as needed.

### 4.2 Subsurface Factors

Groundwater, nor any indications of groundwater, were encountered in any test pits. Based on available records obtained by PTI, perched groundwater was found to be at 19' below-grade where glacial till was present and well log records indicate groundwater at 45' to 85' below-grade.

### 4.3 Infiltration Rates

Per the Geotechnical Report, the initial Ksat for the proposed bioretention pond was 4.3"/hr and 38.08"/hr at 3'-5' and 5'-8' below-grade, respectively, with a harmonic mean design rate of 11"/hr. Per Section 7.4.4 of the SDM, factors of safety applied to the initial Ksat for a bioretention facility are at the discretion of the soils professional. The design 3"/hr design rate of the default bioretention soil mix is less than any corrected rate of the soils. Therefore, a long-term rate of 3"/hr was used for the proposed bioretention facility.

The initial Ksat for the proposed infiltration trenches was 23.98"/hr and the recommended long-term design infiltration rate was 9.59"/hr. A long-term rate of 9"/hr was used for the proposed downspout infiltration trenches.

Per the Geotechnical Report, the soils at a 3'-7' depth have a Cation Exchange Capacity of 5.25 meq/100g and an organic content of 0.85%-2.55%.

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## SECTION 5 – ON-SITE STORMWATER MANAGEMENT AND LOW IMPACT DEVELOPMENT (CORE REQUIREMENT #5)

### 5.1 LID Site Design

The effective impervious surface area has been minimized to the maximum extend practical by fully infiltrating the majority of the runoff through a Bioretention Facility (BMP T7.30) and Downspout Infiltration Trenches (BMP T5.10A). See Section 2.5 for additional information.

### 5.2 Methodology

The project will meet the LID Performance Standard along with the Runoff Treatment and Flow Control Requirements (see Sections 2.5, 5.1, and 5.5 for additional information). Approximately 19% of the existing forested area will be retained. The proposed buildings were scattered around the site to provide for lawn/landscape areas between the buildings and other hard surface areas to the maximum extent practical. Over 99% of the stormwater runoff from the proposed impervious surface will be fully infiltrated on-site.

### 5.3 LID Practices

Stormwater runoff from the driveway and parking lot areas, along with some roof areas, will be conveyed to a Bioretention Facility (BMP T5.30). Stormwater runoff from the majority of the roof areas will be routed to several Downspout Infiltration Trenches (BMP T5.10A). See Sections 2.5, 5.4, and 5.5 for additional information.

### 5.4 Post-Construction Soil Quality and Depth

See Section 2.5. All disturbed and proposed lawn/landscape areas will meet the Post-Construction Soil Quality and Depth requirements. It is anticipated that the bulk of this requirement will be met by stripping, stockpiling, and reusing existing topsoil

and this soils will be amended as needed. Any additional soil/compost needed to meet this requirement will be imported from approved sources.

### 5.5 Retained Trees and Aesthetics

Approximately 19% of the exiting forested area will be retained and all other areas not covered with a hard surface will be landscaped. The proposed bioretention facility will be landscaped per SDM and zoning code requirements and it has been designed to minimize tree removal around the facility. A landscape and irrigation plan will be prepared meeting City of Lacey requirements.

## SECTION 6 – RUNOFF TREATMENT AND FLOW CONTROL (CORE REQUIRMENTS #6 AND #7

### 6.1 Runoff Treatment Selections

Step 1: There are no receiving waters.
Step 2: Oil control is not applicable as this is not a high-use site.
Step 3: The native soil is not conducive for pollutant control due to the in-situ infiltration rate of the native soils exceeding 9”/hr and the soils in at least one area not meeting the minimum 1% organic content requirement.
Step 4: Phosphorus control is not applicable as there will be no discharges to fresh water bodies or wetlands.
Step 5: Enhanced treatment “may” be required since this is a multifamily residential project. The project is outside a 1-year time of travel zone for a wellhead, is not located within a Category I critical aquifer recharge area, is not infiltrating to deep UIC wells, is not discharging directly to fresh waters or conveyance systems tributary to fresh waters designated for aquatic use, and is not proposing infiltration within one-quarter mile of a fresh water designated for aquatic life.

Per Section 8.3.4 of the SDM, the proposed Bioretention Facility (BMP T5.30) will meet the Enhanced Treatment requirements.

### 6.2 BMP Types & Descriptions

See Section 2.5 for the proposed stormwater BMPs.

### 6.3 Facility Selection and Design Data

See Section 2.5 for the proposed stormwater BMPs, Section 6.1 for the treatment selection, and Section 6.4 for the Design Data. All treatment and flow control BMPs were sized using WWHM.

### 6.4 Design Calculations

Over 99% of the stormwater runoff generated by this project will be infiltrated. See Section 4.3 for the design infiltration rates uses. See WWHM report in the Appendix.

## SECTION 7 – RUNOFF COLLECTION & CONVEYANCE SYSTEM

### 7.1 System Design & Layout

Stormwater runoff from the proposed roof areas will be tightlined by 4”-6” diam. pipes to individual building Downspout Infiltration Trenches (BMP T5.10A). Stormwater runoff from the proposed driveway and parking lot areas will be collected in catch basins and conveyed through 8”-12” diam. pipes to the Bioretention Facility (BMP

T5.30).

### 7.2 Conveyance System Calculations Summary

Conveyance systems are designed to convey the 25-year 24-hour storm event, at a minimum. The conveyance systems comprise of 4”-6” diameter pipes for conveyance of roof runoff to the downspout infiltration trenches and 8”-12 diameter storm pipes for conveyance of driveway and parking lot runoff to the bioretention facility. Detailed calculations will be provided with the final Drainage Control Plan Report.

## SECTION 8 – SOURCE CONTROL

### 8.1 Potential Sources of Pollution

Residential projects generally do not have the potential to produce pollution and most of the Source Control BMPs are applicable to manufacturing, commercial, etc. land uses. Potential sources of pollution common to residential homes are from overuse of fertilizers and pesticides associated with lawn/landscape maintenance.

### 8.2 Source Control BMPs

Source Control BMPs are generally appliable to manufacturing, commercial, etc. land uses, not to a residential land use. However, S417, Maintenance of Stormwater Drainage and Treatment Systems and S411, Landscaping and Lawn/Vegetation Management, are applicable.

Catch basins can contain oil and grease, hydrocarbons, debris, heavy metals, etc. and the owner will be required to maintain all storm drainage facilities.

Lawn/landscape areas can contain excessive fertilizers, pesticides, and noxious weeds. BMPs will be required to minimize these pollutants and to properly dispose of noxious weeds and yard waste during lawn/landscape maintenance.

### 8.3 Source Control Checklist and Worksheet

A Source Control Checklist and Source Control Worksheets will be provided with the final Drainage Control Plan Report.

## SECTION 9 – COVENANTS, DEDICATIONS, EASEMENTS, AGREEMENTS, AND GUARANTEES

### 9.1 Covenants, Dedications, and Easements

No covenants, dedications, or easements are proposed or required for the stormwater facilities as the parcel is not being subdivided and it will remain under a single ownership.

### 9.2 Agreements and Guarantees

The owner will be responsible for maintenance of the on-site storm drainage systems. A Maintenance and Source Control Manual and declaration of covenant will be recorded prior to final project approval.

Maintenance and/or operational bonding or other financial guarantees will be provided prior to final project approval, if required.

**Appendix 1**
**Drainage Plans**

# SEC 15, TWP 18N, RGE 1W, W.M.

## LEGEND

| EXISTING | PROPOSED | |
|---|---|---|
| SS | SS | SANITARY SEWER |
| W | W | WATER |
| SD | SD | STORM |
| | RD | ROOF DRAIN |
| | | CATCH BASIN |
| CO | | SEWER MANHOLE |
| | | SEWER CLEANOUT |
| | | FIRE HYDRANT |
| | | WATER METER |

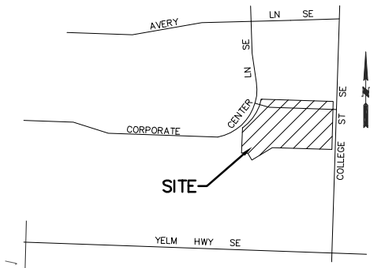
SCALE: 1"=30 FEET
0 15 30 60

## SURVEY NOTE

THE BOUNDARY AND TOPOGRAPHIC SURVEY INFORMATION DEPICTED HEREON WAS PROVIDED BY BUTLER SURVEYING AND OBTAINED FROM CITY RECORDS. THIS SURVEY INFORMATION WAS NOT FIELD VERIFIED BY OLYMPIC ENGINEERING AND OLYMPIC ENGINEERING ASSUMES NO LIABILITY IN THE ACCURACY OF THIS INFORMATION OR FOR OMISSIONS WHICH MAY HAVE BEEN INCORPORATED INTO THESE DRAWINGS AS A RESULT.

## VICINITY MAP

N.T.S.




## PROJECT INFORMATION

| | |
|---|---|
| OWNER/APPLICANT: | OLYMPIA HANGARS, LLC<br>7842 OLD HWY 99 SE, HANGAR #M-5<br>TUMWATER, WA 98501 |
| PARCEL NO: | 11815310200 |
| SITE ADDRESS: | 456 CARPENTER RD. SE<br>LACEY, WA 98503 |
| ZONING: | MD, MODERATE DENSITY |
| PARCEL AREA: | 4.993 ACRES (217,500) |
| WATER/SEWER: | CITY OF LACEY |
| TELECOMMUNICATIONS: | COMCAST & LUMEN |
| POWER/GAS: | PUGET SOUND ENERGY |
| FIRE DISTRICT: | LACEY |
| REFUSE/RECYCLING: | PACIFIC DISPOSAL |
| SOIL TYPE: | NISQUALLY LOAMY FINE SAND (HSG A) PER NRCS |
| FEMA FIRM DESIGNATION: | ZONE X (PANEL #53067C0191E), OUTSIDE THE 0.2% ANNUAL CHANCE FLOODPLAIN |
| GRADING: | ±7,525 CY CUT & ±2,600 CY FILL (FOR APPLICATION PURPOSES ONLY) |

PROPOSED BUILDING C WILL BE CONSTRUCTED IN THE FUTURE AND THE BUILDING PAD AREA WILL BE UTILIZED AS A TEMPORARY CONSTRUCTION PARKING/STAGING AREA (BMP C107), A CONCRETE WASHOUT AREA (BMP C154), AND WHEELWASH (BMP C106)

PROPOSED TEMPORARY CONSTRUCTION ENTRANCE (BMP C105)

PROPOSED DOWNSPOUT INFILTRATION TRENCH "C" (BMP T5.10A) (BUILDING C & CARPORT C). SEE DETAIL ON SHEET 2.

BIORETENTION POND AREA TO BE UTILIZED AS A TEMPORARY SEDIMENT POND

PROPOSED BIORETENTION FACILITY (BMP T7.30). SEE DETAIL ON SHEET 2. BOTTOM ELEV. = 157.0

PROPOSED DOWNSPOUT INFILTRATION TRENCH "A" (BMP T5.10A) (BUILDING A & GRILL AREA). SEE DETAIL ON SHEET 2.

PROPOSED DOWNSPOUT INFILTRATION TRENCH (BMP T5.10A) (PANABODE & GRILL AREA). SEE DETAIL ON SHEET 2.

PROPOSED ROOF DRAIN PIPE (TYP.)

PROPOSED SILT FENCING (BMP C233) AROUND PROJECT PERIMETER.

PROPOSED DOWNSPOUT INFILTRATION TRENCH "D" (BMP T5.10A) (BUILDING D, CARPORT D1, CARPORT D2). SEE DETAIL ON SHEET 2.

PROPOSED DOWNSPOUT INFILTRATION TRENCH "B SOUTH" (BMP T5.10A) (SOUTH HALF BUILDING B, CARPORT B2, CARPORT B3). SEE DETAIL ON SHEET 2.

PROPOSED STORM PIPE (TYP.)

PROPOSED CATCH BASIN WITH INLET PROTECTION (BMP ___) (TYP.)

PROPOSED DOWNSPOUT INFILTRATION TRENCH "B NORTH" (BMP T5.10A) (NORTH HALF BUILDING B, CARPORT B1). SEE DETAIL ON SHEET 2.

PROPOSED RETAINING WALL

PROPOSED BUILDING C
FF=174.0 WEST
FF=172.0 EAST

PROPOSED CARPORT C

PROPOSED BUILDING A
FF=163.0 GARAGE
FF=174.0 MAIN

PROPOSED CARPORT A

PROPOSED BUILDING B
FF=174.0

PROPOSED CARPORT B1

PROPOSED CARPORT B2

PROPOSED CARPORT B3

PROPOSED BUILDING D
FF=175.0

PROPOSED CARPORT D1

PROPOSED CARPORT D2

EX. HOUSE TO BE CONVERTED TO OFFICE FF=177.54

GRILL AREA

GRILL AREA

SHOP FF=163

REFUSE

BUILDING "E" FINISHED FLOOR ELEVATION 165.70

PROPOSED SLOTTED TRENCH DRAIN ACROSS ENTRY

CARPENTER ROAD SW

LEMANTER RAMP

LEMANTER STREET SIDEWALK

EDGE ASPHALT

PLANTER

SIDEWALK

PARKING STALLS

RETAINING WALL

ALDEA GLEN GREEN BELT TRACT

S 87°40'33" E 430.05

S 87°40'33" E 660.63

N 87°49'54" W 661.84

N 01°59'32" E 329.83

N 01°26'02" E 39.27

S 01°29'51" W 60.01

S 01°46'43" W 328.04

200.58

220.90

108.93

"CALL UNDERGROUND LOCATE AT 1-800-424-5555 OR 811 BEFORE YOU DIG"

## SHEET INDEX


1 PRELIMINARY EROSION CONTROL AND DRAINAGE PLAN
2 PRELIMINARY WATER AND SANITARY SEWER PLAN
3 DETAILS AND NOTES


| NO. | DATE | REVISION |
|---|---|---|

**THE LODAGE**

CITY OF LACEY, WASHINGTON

**PRELIMINARY EROSION CONTROL AND DRAINAGE PLAN**

DESIGNED BY: CMM
DRAWN BY: CMM
CHECKED BY:
SCALE: 1" = 30'
DATE: 3/17/2023

3/17/2023
CHRISTOPHER M. MANN
STATE OF WASHINGTON
97401
REGISTERED PROFESSIONAL ENGINEER


PO Box 12690
Olympia, WA 98508
360.705.2474
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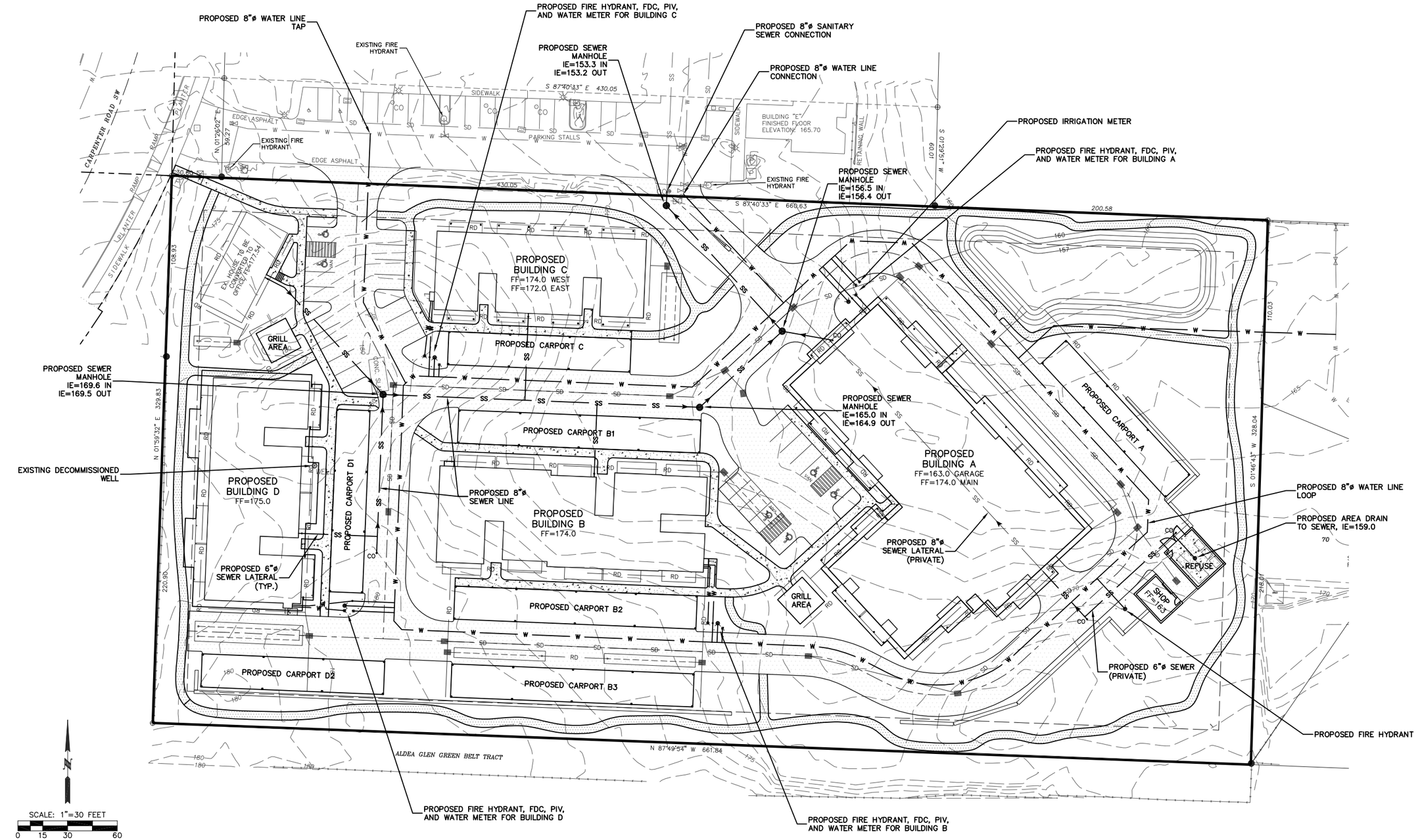
OLYMPIC ENGINEERING
Civil Engineering • Land Planning • Project Management


JOB NUMBER: 22020
DRAWING NAME: 22020_SITE

SEC 15, TWP 18N, RGE 1W, W.M.




SCALE: 1"=30 FEET
0 15 30 60

"CALL UNDERGROUND LOCATE AT 1-800-424-5555 OR 811 BEFORE YOU DIG"

| NO. | DATE | REVISION |
|---|---|---|
| | | |

**THE LODAGE**

CITY OF LACEY, WASHINGTON

**PRELIMINARY WATER AND SANITARY SEWER PLAN**

DESIGNED BY: CMM
DRAWN BY: CMM
CHECKED BY:
SCALE: 1" = 30'
DATE: 3/17/2023

3/17/2023
CHRISTOPHER M. MERRITT
STATE OF WASHINGTON
37401
REGISTERED PROFESSIONAL ENGINEER


PO Box 12690
Olympia, WA 98508
360.705.2474
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OLYMPIC ENGINEERING
Civil Engineering • Land Planning • Project Management


JOB NUMBER: 22020
DRAWING NAME: 22020_UTIL

## BIORETENTION SOIL MIX (BSM) REQUIREMENTS

Contractor shall submit proposed BSM specifications to Olympic Engineering and Pacific Testing & Inspection for review and approval prior to installation.

Bioretention soil shall be a well-blended mixture of mineral aggregate and composted material measured on a volume basis. Bioretention soil shall consist of two parts fine compost (approximately 35 to 40 percent) by volume and three parts mineral aggregate (approximately 60 to 65 percent), by volume. The mixture shall be well blended to produce a homogeneous mix.

Mineral Aggregate:
- Percent Fines: A range of 2 to 4 percent passing the US #200 sieve is ideal and fines should not be above 5 percent for a proper functioning specification according to ASTM D422.

Mineral Aggregate Gradation:
- Mineral Aggregate shall be free of wood, waste, coating, or any other deleterious material. The aggregate portion of the Bioretention Soil Mix (BSM) should be well-graded. According to ASTM D 2487-98 (Classification of Soils for Engineering Purposes (Unified Soil Classification System)), well-graded sand should have the following gradation coefficients:
  a. Coefficient of Uniformity (Cu = D60/D10) equal to or greater than 4, and
  b. Coefficient of Curve (Cc = (D30)2/D60 x D10) greater than or equal to 1 and less than or equal to 3.

Aggregate shall be analyzed by an accredited lab using the US sieve numbers and gradation noted below.

| US Sieve Number | Percent Passing |
|---|---|
| 0.375 inch | 100 |
| 4 | 95–100 |
| 10 | 75–90 |
| 40 | 24–40 |
| 100 | 4–10 |
| 200 | 2–5 |

Where existing soils meet the above aggregate gradation, those soils may be amended rather than importing mineral aggregate.

Compost to Aggregate Ratio, Organic Matter Content, Cation Exchange Capacity:

- Compost to aggregate ratio: 60–65 percent mineral aggregate, 35–40 percent compost.
- Organic matter content: 5–8 percent by weight.
- Cation Exchange Capacity (CEC) must be > 5 milliequivalents/100 g dry soil. Note: Soil mixes meeting the above specifications do not have to be tested for CEC. They will readily meet the minimum CEC.

Composted Material
To ensure that the BSM will support healthy plant growth and root development, contribute to biofiltration of pollutants, and not restrict infiltration when used in the proportions cited herein, the following compost standards are required:

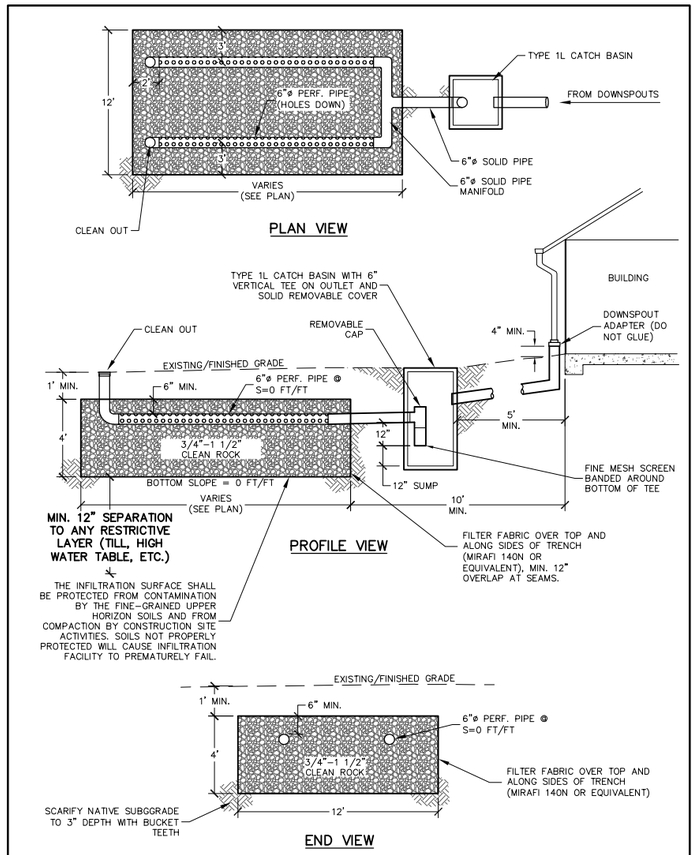
- Material must meet the definition of "composted material" in WAC 173-350-100 and complies with the testing parameters and standards in wac 173-350-220.
- Material must be produced at a composting facility that is permitted by a jurisdictional health authority. Permitted compost facilities in Washington State are included on a list available at <https: //ecology.wa.gov/Waste-Toxics/Reducing-recycling-waste/Organic-materials/Managing-organics-compost>.

- The completed compost product must originate a minimum of 65 percent by volume from recycled plant waste comprising "yard debris", "crop residues", and "bulking agents" as those terms are defined in WAC 173-350-100. A maximum of 35 percent by volume of "postconsumer food waste" as defined in WAC 173-350-100, but no including biosolids, may be substituted for recycled plant waste.
- Moisture content must be such that there is no visible free water or dust produced when handling the material.
- The material shall be tested in accordance with the U.S. Composting Council "Test Method for the Examination of Compost and Composting" (TMECC), as established in the Composting Council's "Seal of Testing Assurance" (STA) program. Most Washington compost BMPs now use these tests.
- Composted material shall meet the size gradations established in the U.S. Composting Council's Seal of Testing Assurance (STA) program, as follows: Fine Compost shall meet the following gradation by dry weight:

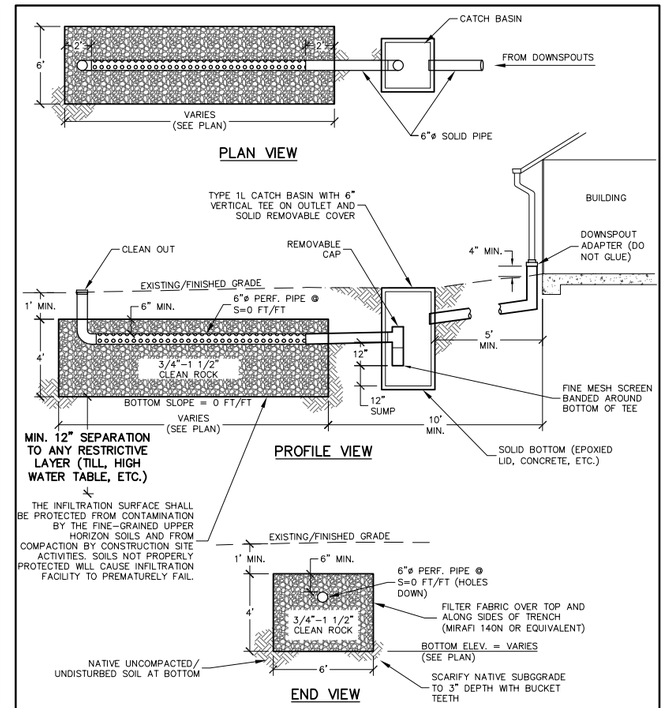
| | Min. | Max. |
|---|---|---|
| Percent passing 2" | 100 | |
| Percent passing 1" | 99 | 100 |
| Percent passing 0.625" | 90 | 100 |
| Percent passing 0.25" | 75 | 100 |

- The pH shall be between 6.0 and 8.5 (TMECC 04.11-A).
- "Physical contaminants" (as defined in WAC 173-350-100) content shall be less than 1 percent by weight (TMECC 03.08-A) total, not to exceed 0.25 percent film plastic by dry weight.
- Minimum organic matter content shall be 40 percent by dry weight basis as determined by TMECC 05.07-A, "Loss-On-Ignition Organic Matter Method."
- Soluble salt contents shall be less than 4.0 dS/mm (mmhos/cm) tested in accordance with TMECC 04.10-A, "1:5 Slurry Method, Mass Basis."
- Maturity indicators from a cucumber bioassay shall be greater than 80 percent for both emergence and vigor, in accordance with TMECC 05.05-A, "Germination and Vigor".
- The material must be stable (low oxygen use and CO2 generation) and mature (capable of supporting plant growth). This is critical to plant success in a bioretention soil mixes. Stability shall be 7 mg CO2-C/g OM/day or below in accordance with TMECC 05.08-B, "Carbon Dioxide Evolution Rate."
- Fine Compost shall have a carbon to nitrogen ratio of less than 25:1 as determined using TMECC 05.02A "Carbon to Nitrogen Ratio" which uses the TMECC 04.01 "Organic Carbon" and TMECC 04.02-D "Total Nitrogen by Oxidation." The Engineer may specify a Carbon:Nitrogen ratio up to 35:1 for projects where the plants selected are entirely Puget Sound lowland native species, and up to 40:1 for coarse compost to be used as a surface mulch (not in a soil mix).

Compost not conforming to the above requirements or taken from a source other than those tested and accepted shall be immediately removed from the project and replaced.

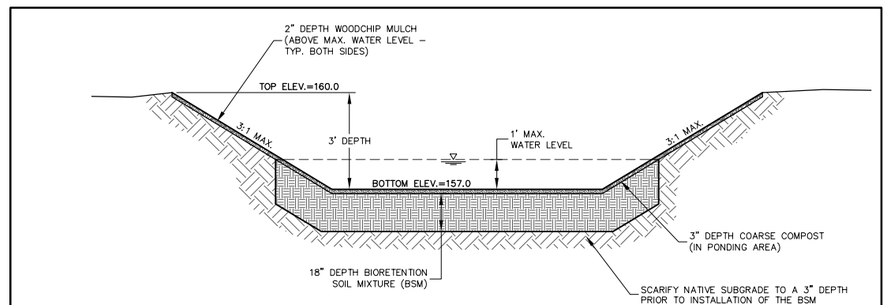



## DOWNSPOUT INFILTRATION TRENCH (BMP T5.10A) DETAIL
N.T.S.




NOTES:
1. PIPE MATERIAL SHALL BE AS APPROVED IN THE UNIFORM PLUMBING CODE (UPC) AND BE INSTALLED PER THE MANUFACTURER'S RECOMMENDATIONS.
2. TOP OF DRAIN ROCK SHALL BE AT OR LOWER THAN THE INLET INVERT ELEVATION IN THE CATCH BASIN UNLESS PROHIBITED BY EXISTING TOPOGRAPHY.
3. CATCH BASIN SHALL BE INSTALLED IN-LINE WITH TRENCH FOR MAINTENANCE ACCESS.
4. MAINTAIN MIN. 10' SETBACK FROM TRENCH TO ANY BUILDING FOUNDATIONS OR PROPERTY LINES.
5. WASHED ROCK SHALL MEET WSDOT "GRAVEL BACKFILL FOR DRYWELLS".

## DOWNSPOUT INFILTRATION TRENCH (BMP T5.10A) DETAIL
N.T.S.




NOTES:
1. SEE LANDSCAPING PLANS FOR REQUIRED PLANTINGS.
2. COMPACT BSM TO 85% PER ASTM 1577.
3. SEE "BIORETENTION SOIL MIX (BSM) REQUIREMENTS" THIS SHEET.
4. THE SUBGRADE SHALL BE EVALUATED BY PACIFIC TESTING & INSPECTION (PTI) (360-736-3922) AND OLYMPIC ENGINEERING. CONTRACTOR SHALL CONTACT PTI AND OLYMPIC ENGINEERING A MINIMUM OF 7-DAYS PRIOR TO REACHING SUBGRADE TO SCHEDULE THE EVALUATIONS.
5. CONTRACTOR SHALL CONTACT PTI AND OLYMPIC ENGINEERING AFTER POND COMPLETION FOR INFILTRATION RATE VERIFICATION TESTING OF THE NATIVE SUBGRADE. THE MIN. LONG-TERM/CORRECTED INFILTRATION RATE SHALL BE 3 INCHES PER HOUR OR GREATER.

## BIORETENTION FACILITY (BMP T7.30) DETAIL
N.T.S.



| NO. | DATE | REVISION |
|---|---|---|
| | | |

THE LODGE

CITY OF LACEY, WASHINGTON

DETAILS AND NOTES

DESIGNED BY: CMM
DRAWN BY: CMM
CHECKED BY:
SCALE: N.T.S.
DATE: 3/17/2023

3/17/2023
CHRISTOPHER M. REITZ
STATE OF WASHINGTON
37401
REGISTERED PROFESSIONAL ENGINEER

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OLYMPIC ENGINEERING
Civil Engineering • Land Planning • Project Management

JOB NUMBER: 22020
DRAWING NAME: 22020_DETL

# Appendix 2
# Drainage Calculations

# WWHM2012

# PROJECT REPORT

# General Model Information

| | |
|---|---|
| Project Name: | 22020_031323 |
| Site Name: | The Lodge |
| Site Address: | 456 Carpenter Rd. SE |
| City: | Lacey |
| Report Date: | 3/17/2023 |
| Gage: | Woodland Creek |
| Data Start: | 1955/10/01 |
| Data End: | 2011/09/30 |
| Timestep: | 15 Minute |
| Precip Scale: | 0.889 |
| Version Date: | 2019/09/13 |
| Version: | 4.2.17 |

## POC Thresholds

| | |
|---|---|
| Low Flow Threshold for POC1: | 50 Percent of the 2 Year |
| High Flow Threshold for POC1: | 50 Year |

# *Landuse Basin Data*

## *Predeveloped Land Use*

### Basin 1

| | |
|---|---|
| Bypass: | No |
| GroundWater: | No |

| Pervious Land Use | acre |
|---|---|
| A B, Forest, Mod | 0.645 |
| A B, Forest, Flat | 4.299 |
| A B, Lawn, Mod | 0.02 |
| Pervious Total | 4.964 |

| Impervious Land Use | acre |
|---|---|
| ROOF TOPS FLAT | 0.049 |
| Impervious Total | 0.049 |
| Basin Total | 5.013 |

Element Flows To:

| Surface | Interflow | Groundwater |
|---|---|---|

## *Mitigated Land Use*

### Drives / Parking

| | |
|---|---|
| Bypass: | No |
| GroundWater: | No |
| Pervious Land Use | acre |
| Pervious Total | 0 |
| Impervious Land Use | acre |
| ROOF TOPS FLAT | 0.103 |
| DRIVEWAYS FLAT | 0.985 |
| DRIVEWAYS MOD | 0.093 |
| SIDEWALKS FLAT | 0.072 |
| Impervious Total | 1.253 |
| Basin Total | 1.253 |

Element Flows To:

| Surface | Interflow | Groundwater |
|---|---|---|
| Bioretention Pond | Bioretention Pond | |

## Trench D

| | |
|---|---|
| Bypass: | No |
| GroundWater: | No |
| Pervious Land Use | acre |
| Pervious Total | 0 |
| Impervious Land Use | acre |
| ROOF TOPS FLAT | 0.357 |
| Impervious Total | 0.357 |
| Basin Total | 0.357 |

Element Flows To:

| Surface | Interflow | Groundwater |
|---|---|---|
| Trench D | Trench D | |

## Trench A

| | |
|---|---|
| Bypass: | No |
| GroundWater: | No |
| Pervious Land Use | acre |
| Pervious Total | 0 |
| Impervious Land Use | acre |
| ROOF TOPS FLAT | 0.494 |
| Impervious Total | 0.494 |
| Basin Total | 0.494 |

Element Flows To:

| Surface | Interflow | Groundwater |
|---|---|---|
| Trench A | Trench A | |

## Trench C

| | |
|---|---|
| Bypass: | No |
| GroundWater: | No |
| Pervious Land Use | acre |
| Pervious Total | 0 |
| Impervious Land Use | acre |
| ROOF TOPS FLAT | 0.233 |
| Impervious Total | 0.233 |
| Basin Total | 0.233 |

Element Flows To:

| Surface | Interflow | Groundwater |
|---|---|---|
| Trench C | Trench C | |

## Trench B South

| | |
|---|---|
| Bypass: | No |
| GroundWater: | No |
| Pervious Land Use | acre |
| Pervious Total | 0 |
| Impervious Land Use | acre |
| ROOF TOPS FLAT | 0.294 |
| Impervious Total | 0.294 |
| Basin Total | 0.294 |

Element Flows To:

| Surface | Interflow | Groundwater |
|---|---|---|
| Trench B South | Trench B South | |

## Tench B North

| | |
|---|---|
| Bypass: | No |
| GroundWater: | No |
| Pervious Land Use | acre |
| Pervious Total | 0 |
| Impervious Land Use | acre |
| ROOF TOPS FLAT | 0.215 |
| Impervious Total | 0.215 |
| Basin Total | 0.215 |

Element Flows To:

| Surface | Interflow | Groundwater |
|---|---|---|
| Trench B North | Trench B North | |

## Trench Office

| | |
|---|---|
| Bypass: | No |
| GroundWater: | No |
| Pervious Land Use | acre |
| Pervious Total | 0 |
| Impervious Land Use | acre |
| ROOF TOPS FLAT | 0.058 |
| Impervious Total | 0.058 |
| Basin Total | 0.058 |

Element Flows To:

| Surface | Interflow | Groundwater |
|---|---|---|
| Trench Office | Trench Office | |

## Pervious & sheet flow

| | |
|---|---|
| Bypass: | Yes |
| GroundWater: | No |

| Pervious Land Use | acre |
|---|---|
| A B, Forest, Flat | 0.958 |
| A B, Pasture, Flat | 0.935 |
| A B, Lawn, Flat | 0.085 |
| Pervious Total | 1.978 |

| Impervious Land Use | acre |
|---|---|
| DRIVEWAYS FLAT | 0.018 |
| SIDEWALKS FLAT | 0.001 |
| Impervious Total | 0.019 |
| Basin Total | 1.997 |

Element Flows To:

| Surface | Interflow | Groundwater |
|---|---|---|

# Routing Elements
## Predeveloped Routing

## *Mitigated Routing*

### Trench D

| | |
|---|---|
| Bottom Length: | 65.00 ft. |
| Bottom Width: | 12.00 ft. |
| Trench bottom slope 1: | 0 To 1 |
| Trench Left side slope 0: | 0 To 1 |
| Trench right side slope 2: | 0 To 1 |
| Material thickness of first layer: | 4 |
| Pour Space of material for first layer: | 0.4 |
| Material thickness of second layer: | 0 |
| Pour Space of material for second layer: | 0 |
| Material thickness of third layer: | 0 |
| Pour Space of material for third layer: | 0 |
| Infiltration On | |
| Infiltration rate: | 9 |
| Infiltration safety factor: | 1 |
| Total Volume Infiltrated (ac-ft.): | 68.318 |
| Total Volume Through Riser (ac-ft.): | 0 |
| Total Volume Through Facility (ac-ft.): | 68.318 |
| Percent Infiltrated: | 100 |
| Total Precip Applied to Facility: | 0 |
| Total Evap From Facility: | 0 |
| Discharge Structure | |
| Riser Height: | 3 ft. |
| Riser Diameter: | 6 in. |
| Element Flows To: | |
| Outlet 1 | Outlet 2 |

Gravel Trench Bed Hydraulic Table

| Stage(feet) | Area(ac.) | Volume(ac-ft.) | Discharge(cfs) | Infilt(cfs) |
|---|---|---|---|---|
| 0.0000 | 0.017 | 0.000 | 0.000 | 0.000 |
| 0.0444 | 0.017 | 0.000 | 0.000 | 0.162 |
| 0.0889 | 0.017 | 0.000 | 0.000 | 0.162 |
| 0.1333 | 0.017 | 0.001 | 0.000 | 0.162 |
| 0.1778 | 0.017 | 0.001 | 0.000 | 0.162 |
| 0.2222 | 0.017 | 0.001 | 0.000 | 0.162 |
| 0.2667 | 0.017 | 0.001 | 0.000 | 0.162 |
| 0.3111 | 0.017 | 0.002 | 0.000 | 0.162 |
| 0.3556 | 0.017 | 0.002 | 0.000 | 0.162 |
| 0.4000 | 0.017 | 0.002 | 0.000 | 0.162 |
| 0.4444 | 0.017 | 0.003 | 0.000 | 0.162 |
| 0.4889 | 0.017 | 0.003 | 0.000 | 0.162 |
| 0.5333 | 0.017 | 0.003 | 0.000 | 0.162 |
| 0.5778 | 0.017 | 0.004 | 0.000 | 0.162 |
| 0.6222 | 0.017 | 0.004 | 0.000 | 0.162 |
| 0.6667 | 0.017 | 0.004 | 0.000 | 0.162 |
| 0.7111 | 0.017 | 0.005 | 0.000 | 0.162 |
| 0.7556 | 0.017 | 0.005 | 0.000 | 0.162 |
| 0.8000 | 0.017 | 0.005 | 0.000 | 0.162 |
| 0.8444 | 0.017 | 0.006 | 0.000 | 0.162 |
| 0.8889 | 0.017 | 0.006 | 0.000 | 0.162 |
| 0.9333 | 0.017 | 0.006 | 0.000 | 0.162 |
| 0.9778 | 0.017 | 0.007 | 0.000 | 0.162 |
| 1.0222 | 0.017 | 0.007 | 0.000 | 0.162 |

| | | | | |
|---|---|---|---|---|
| 1.0667 | 0.017 | 0.007 | 0.000 | 0.162 |
| 1.1111 | 0.017 | 0.008 | 0.000 | 0.162 |
| 1.1556 | 0.017 | 0.008 | 0.000 | 0.162 |
| 1.2000 | 0.017 | 0.008 | 0.000 | 0.162 |
| 1.2444 | 0.017 | 0.008 | 0.000 | 0.162 |
| 1.2889 | 0.017 | 0.009 | 0.000 | 0.162 |
| 1.3333 | 0.017 | 0.009 | 0.000 | 0.162 |
| 1.3778 | 0.017 | 0.009 | 0.000 | 0.162 |
| 1.4222 | 0.017 | 0.010 | 0.000 | 0.162 |
| 1.4667 | 0.017 | 0.010 | 0.000 | 0.162 |
| 1.5111 | 0.017 | 0.010 | 0.000 | 0.162 |
| 1.5556 | 0.017 | 0.011 | 0.000 | 0.162 |
| 1.6000 | 0.017 | 0.011 | 0.000 | 0.162 |
| 1.6444 | 0.017 | 0.011 | 0.000 | 0.162 |
| 1.6889 | 0.017 | 0.012 | 0.000 | 0.162 |
| 1.7333 | 0.017 | 0.012 | 0.000 | 0.162 |
| 1.7778 | 0.017 | 0.012 | 0.000 | 0.162 |
| 1.8222 | 0.017 | 0.013 | 0.000 | 0.162 |
| 1.8667 | 0.017 | 0.013 | 0.000 | 0.162 |
| 1.9111 | 0.017 | 0.013 | 0.000 | 0.162 |
| 1.9556 | 0.017 | 0.014 | 0.000 | 0.162 |
| 2.0000 | 0.017 | 0.014 | 0.000 | 0.162 |
| 2.0444 | 0.017 | 0.014 | 0.000 | 0.162 |
| 2.0889 | 0.017 | 0.015 | 0.000 | 0.162 |
| 2.1333 | 0.017 | 0.015 | 0.000 | 0.162 |
| 2.1778 | 0.017 | 0.015 | 0.000 | 0.162 |
| 2.2222 | 0.017 | 0.015 | 0.000 | 0.162 |
| 2.2667 | 0.017 | 0.016 | 0.000 | 0.162 |
| 2.3111 | 0.017 | 0.016 | 0.000 | 0.162 |
| 2.3556 | 0.017 | 0.016 | 0.000 | 0.162 |
| 2.4000 | 0.017 | 0.017 | 0.000 | 0.162 |
| 2.4444 | 0.017 | 0.017 | 0.000 | 0.162 |
| 2.4889 | 0.017 | 0.017 | 0.000 | 0.162 |
| 2.5333 | 0.017 | 0.018 | 0.000 | 0.162 |
| 2.5778 | 0.017 | 0.018 | 0.000 | 0.162 |
| 2.6222 | 0.017 | 0.018 | 0.000 | 0.162 |
| 2.6667 | 0.017 | 0.019 | 0.000 | 0.162 |
| 2.7111 | 0.017 | 0.019 | 0.000 | 0.162 |
| 2.7556 | 0.017 | 0.019 | 0.000 | 0.162 |
| 2.8000 | 0.017 | 0.020 | 0.000 | 0.162 |
| 2.8444 | 0.017 | 0.020 | 0.000 | 0.162 |
| 2.8889 | 0.017 | 0.020 | 0.000 | 0.162 |
| 2.9333 | 0.017 | 0.021 | 0.000 | 0.162 |
| 2.9778 | 0.017 | 0.021 | 0.000 | 0.162 |
| 3.0222 | 0.017 | 0.021 | 0.017 | 0.162 |
| 3.0667 | 0.017 | 0.022 | 0.090 | 0.162 |
| 3.1111 | 0.017 | 0.022 | 0.184 | 0.162 |
| 3.1556 | 0.017 | 0.022 | 0.277 | 0.162 |
| 3.2000 | 0.017 | 0.022 | 0.346 | 0.162 |
| 3.2444 | 0.017 | 0.023 | 0.385 | 0.162 |
| 3.2889 | 0.017 | 0.023 | 0.423 | 0.162 |
| 3.3333 | 0.017 | 0.023 | 0.454 | 0.162 |
| 3.3778 | 0.017 | 0.024 | 0.484 | 0.162 |
| 3.4222 | 0.017 | 0.024 | 0.511 | 0.162 |
| 3.4667 | 0.017 | 0.024 | 0.537 | 0.162 |
| 3.5111 | 0.017 | 0.025 | 0.562 | 0.162 |
| 3.5556 | 0.017 | 0.025 | 0.586 | 0.162 |
| 3.6000 | 0.017 | 0.025 | 0.609 | 0.162 |

| | | | | |
|---|---|---|---|---|
| 3.6444 | 0.017 | 0.026 | 0.632 | 0.162 |
| 3.6889 | 0.017 | 0.026 | 0.653 | 0.162 |
| 3.7333 | 0.017 | 0.026 | 0.674 | 0.162 |
| 3.7778 | 0.017 | 0.027 | 0.694 | 0.162 |
| 3.8222 | 0.017 | 0.027 | 0.714 | 0.162 |
| 3.8667 | 0.017 | 0.027 | 0.733 | 0.162 |
| 3.9111 | 0.017 | 0.028 | 0.751 | 0.162 |
| 3.9556 | 0.017 | 0.028 | 0.769 | 0.162 |
| 4.0000 | 0.017 | 0.028 | 0.787 | 0.162 |

## Trench A

| | |
|---|---|
| Bottom Length: | 185.00 ft. |
| Bottom Width: | 6.00 ft. |
| Trench bottom slope 1: | 0 To 1 |
| Trench Left side slope 0: | 0 To 1 |
| Trench right side slope 2: | 0 To 1 |
| Material thickness of first layer: | 4 |
| Pour Space of material for first layer: | 0.4 |
| Material thickness of second layer: | 0 |
| Pour Space of material for second layer: | 0 |
| Material thickness of third layer: | 0 |
| Pour Space of material for third layer: | 0 |
| Infiltration On | |
| Infiltration rate: | 9 |
| Infiltration safety factor: | 1 |
| Total Volume Infiltrated (ac-ft.): | 94.633 |
| Total Volume Through Riser (ac-ft.): | 0 |
| Total Volume Through Facility (ac-ft.): | 94.633 |
| Percent Infiltrated: | 100 |
| Total Precip Applied to Facility: | 0 |
| Total Evap From Facility: | 0 |
| Discharge Structure | |
| Riser Height: | 3 ft. |
| Riser Diameter: | 6 in. |
| Element Flows To: | |
| Outlet 1 | Outlet 2 |

Gravel Trench Bed Hydraulic Table

| Stage(feet) | Area(ac.) | Volume(ac-ft.) | Discharge(cfs) | Infilt(cfs) |
|---|---|---|---|---|
| 0.0000 | 0.025 | 0.000 | 0.000 | 0.000 |
| 0.0444 | 0.025 | 0.000 | 0.000 | 0.231 |
| 0.0889 | 0.025 | 0.000 | 0.000 | 0.231 |
| 0.1333 | 0.025 | 0.001 | 0.000 | 0.231 |
| 0.1778 | 0.025 | 0.001 | 0.000 | 0.231 |
| 0.2222 | 0.025 | 0.002 | 0.000 | 0.231 |
| 0.2667 | 0.025 | 0.002 | 0.000 | 0.231 |
| 0.3111 | 0.025 | 0.003 | 0.000 | 0.231 |
| 0.3556 | 0.025 | 0.003 | 0.000 | 0.231 |
| 0.4000 | 0.025 | 0.004 | 0.000 | 0.231 |
| 0.4444 | 0.025 | 0.004 | 0.000 | 0.231 |
| 0.4889 | 0.025 | 0.005 | 0.000 | 0.231 |
| 0.5333 | 0.025 | 0.005 | 0.000 | 0.231 |
| 0.5778 | 0.025 | 0.005 | 0.000 | 0.231 |
| 0.6222 | 0.025 | 0.006 | 0.000 | 0.231 |
| 0.6667 | 0.025 | 0.006 | 0.000 | 0.231 |
| 0.7111 | 0.025 | 0.007 | 0.000 | 0.231 |
| 0.7556 | 0.025 | 0.007 | 0.000 | 0.231 |
| 0.8000 | 0.025 | 0.008 | 0.000 | 0.231 |
| 0.8444 | 0.025 | 0.008 | 0.000 | 0.231 |
| 0.8889 | 0.025 | 0.009 | 0.000 | 0.231 |
| 0.9333 | 0.025 | 0.009 | 0.000 | 0.231 |
| 0.9778 | 0.025 | 0.010 | 0.000 | 0.231 |
| 1.0222 | 0.025 | 0.010 | 0.000 | 0.231 |
| 1.0667 | 0.025 | 0.010 | 0.000 | 0.231 |
| 1.1111 | 0.025 | 0.011 | 0.000 | 0.231 |

| | | | | |
|---|---|---|---|---|
| 1.1556 | 0.025 | 0.011 | 0.000 | 0.231 |
| 1.2000 | 0.025 | 0.012 | 0.000 | 0.231 |
| 1.2444 | 0.025 | 0.012 | 0.000 | 0.231 |
| 1.2889 | 0.025 | 0.013 | 0.000 | 0.231 |
| 1.3333 | 0.025 | 0.013 | 0.000 | 0.231 |
| 1.3778 | 0.025 | 0.014 | 0.000 | 0.231 |
| 1.4222 | 0.025 | 0.014 | 0.000 | 0.231 |
| 1.4667 | 0.025 | 0.014 | 0.000 | 0.231 |
| 1.5111 | 0.025 | 0.015 | 0.000 | 0.231 |
| 1.5556 | 0.025 | 0.015 | 0.000 | 0.231 |
| 1.6000 | 0.025 | 0.016 | 0.000 | 0.231 |
| 1.6444 | 0.025 | 0.016 | 0.000 | 0.231 |
| 1.6889 | 0.025 | 0.017 | 0.000 | 0.231 |
| 1.7333 | 0.025 | 0.017 | 0.000 | 0.231 |
| 1.7778 | 0.025 | 0.018 | 0.000 | 0.231 |
| 1.8222 | 0.025 | 0.018 | 0.000 | 0.231 |
| 1.8667 | 0.025 | 0.019 | 0.000 | 0.231 |
| 1.9111 | 0.025 | 0.019 | 0.000 | 0.231 |
| 1.9556 | 0.025 | 0.019 | 0.000 | 0.231 |
| 2.0000 | 0.025 | 0.020 | 0.000 | 0.231 |
| 2.0444 | 0.025 | 0.020 | 0.000 | 0.231 |
| 2.0889 | 0.025 | 0.021 | 0.000 | 0.231 |
| 2.1333 | 0.025 | 0.021 | 0.000 | 0.231 |
| 2.1778 | 0.025 | 0.022 | 0.000 | 0.231 |
| 2.2222 | 0.025 | 0.022 | 0.000 | 0.231 |
| 2.2667 | 0.025 | 0.023 | 0.000 | 0.231 |
| 2.3111 | 0.025 | 0.023 | 0.000 | 0.231 |
| 2.3556 | 0.025 | 0.024 | 0.000 | 0.231 |
| 2.4000 | 0.025 | 0.024 | 0.000 | 0.231 |
| 2.4444 | 0.025 | 0.024 | 0.000 | 0.231 |
| 2.4889 | 0.025 | 0.025 | 0.000 | 0.231 |
| 2.5333 | 0.025 | 0.025 | 0.000 | 0.231 |
| 2.5778 | 0.025 | 0.026 | 0.000 | 0.231 |
| 2.6222 | 0.025 | 0.026 | 0.000 | 0.231 |
| 2.6667 | 0.025 | 0.027 | 0.000 | 0.231 |
| 2.7111 | 0.025 | 0.027 | 0.000 | 0.231 |
| 2.7556 | 0.025 | 0.028 | 0.000 | 0.231 |
| 2.8000 | 0.025 | 0.028 | 0.000 | 0.231 |
| 2.8444 | 0.025 | 0.029 | 0.000 | 0.231 |
| 2.8889 | 0.025 | 0.029 | 0.000 | 0.231 |
| 2.9333 | 0.025 | 0.029 | 0.000 | 0.231 |
| 2.9778 | 0.025 | 0.030 | 0.000 | 0.231 |
| 3.0222 | 0.025 | 0.030 | 0.017 | 0.231 |
| 3.0667 | 0.025 | 0.031 | 0.090 | 0.231 |
| 3.1111 | 0.025 | 0.031 | 0.184 | 0.231 |
| 3.1556 | 0.025 | 0.032 | 0.277 | 0.231 |
| 3.2000 | 0.025 | 0.032 | 0.346 | 0.231 |
| 3.2444 | 0.025 | 0.033 | 0.385 | 0.231 |
| 3.2889 | 0.025 | 0.033 | 0.423 | 0.231 |
| 3.3333 | 0.025 | 0.034 | 0.454 | 0.231 |
| 3.3778 | 0.025 | 0.034 | 0.484 | 0.231 |
| 3.4222 | 0.025 | 0.034 | 0.511 | 0.231 |
| 3.4667 | 0.025 | 0.035 | 0.537 | 0.231 |
| 3.5111 | 0.025 | 0.035 | 0.562 | 0.231 |
| 3.5556 | 0.025 | 0.036 | 0.586 | 0.231 |
| 3.6000 | 0.025 | 0.036 | 0.609 | 0.231 |
| 3.6444 | 0.025 | 0.037 | 0.632 | 0.231 |
| 3.6889 | 0.025 | 0.037 | 0.653 | 0.231 |

| | | | | |
|---|---|---|---|---|
| 3.7333 | 0.025 | 0.038 | 0.674 | 0.231 |
| 3.7778 | 0.025 | 0.038 | 0.694 | 0.231 |
| 3.8222 | 0.025 | 0.039 | 0.714 | 0.231 |
| 3.8667 | 0.025 | 0.039 | 0.733 | 0.231 |
| 3.9111 | 0.025 | 0.039 | 0.751 | 0.231 |
| 3.9556 | 0.025 | 0.040 | 0.769 | 0.231 |
| 4.0000 | 0.025 | 0.040 | 0.787 | 0.231 |

## Trench C

| | |
|---|---|
| Bottom Length: | 42.00 ft. |
| Bottom Width: | 12.00 ft. |
| Trench bottom slope 1: | 0 To 1 |
| Trench Left side slope 0: | 0 To 1 |
| Trench right side slope 2: | 0 To 1 |
| Material thickness of first layer: | 4 |
| Pour Space of material for first layer: | 0.4 |
| Material thickness of second layer: | 0 |
| Pour Space of material for second layer: | 0 |
| Material thickness of third layer: | 0 |
| Pour Space of material for third layer: | 0 |
| Infiltration On | |
| Infiltration rate: | 9 |
| Infiltration safety factor: | 1 |
| Total Volume Infiltrated (ac-ft.): | 44.515 |
| Total Volume Through Riser (ac-ft.): | 0 |
| Total Volume Through Facility (ac-ft.): | 44.516 |
| Percent Infiltrated: | 100 |
| Total Precip Applied to Facility: | 0 |
| Total Evap From Facility: | 0 |
| Discharge Structure | |
| Riser Height: | 3 ft. |
| Riser Diameter: | 6 in. |
| Element Flows To: | |
| Outlet 1 | Outlet 2 |

Gravel Trench Bed Hydraulic Table

| Stage(feet) | Area(ac.) | Volume(ac-ft.) | Discharge(cfs) | Infilt(cfs) |
|---|---|---|---|---|
| 0.0000 | 0.011 | 0.000 | 0.000 | 0.000 |
| 0.0444 | 0.011 | 0.000 | 0.000 | 0.105 |
| 0.0889 | 0.011 | 0.000 | 0.000 | 0.105 |
| 0.1333 | 0.011 | 0.000 | 0.000 | 0.105 |
| 0.1778 | 0.011 | 0.000 | 0.000 | 0.105 |
| 0.2222 | 0.011 | 0.001 | 0.000 | 0.105 |
| 0.2667 | 0.011 | 0.001 | 0.000 | 0.105 |
| 0.3111 | 0.011 | 0.001 | 0.000 | 0.105 |
| 0.3556 | 0.011 | 0.001 | 0.000 | 0.105 |
| 0.4000 | 0.011 | 0.001 | 0.000 | 0.105 |
| 0.4444 | 0.011 | 0.002 | 0.000 | 0.105 |
| 0.4889 | 0.011 | 0.002 | 0.000 | 0.105 |
| 0.5333 | 0.011 | 0.002 | 0.000 | 0.105 |
| 0.5778 | 0.011 | 0.002 | 0.000 | 0.105 |
| 0.6222 | 0.011 | 0.002 | 0.000 | 0.105 |
| 0.6667 | 0.011 | 0.003 | 0.000 | 0.105 |
| 0.7111 | 0.011 | 0.003 | 0.000 | 0.105 |
| 0.7556 | 0.011 | 0.003 | 0.000 | 0.105 |
| 0.8000 | 0.011 | 0.003 | 0.000 | 0.105 |
| 0.8444 | 0.011 | 0.003 | 0.000 | 0.105 |
| 0.8889 | 0.011 | 0.004 | 0.000 | 0.105 |
| 0.9333 | 0.011 | 0.004 | 0.000 | 0.105 |
| 0.9778 | 0.011 | 0.004 | 0.000 | 0.105 |
| 1.0222 | 0.011 | 0.004 | 0.000 | 0.105 |
| 1.0667 | 0.011 | 0.004 | 0.000 | 0.105 |
| 1.1111 | 0.011 | 0.005 | 0.000 | 0.105 |

| | | | | |
|---|---|---|---|---|
| 1.1556 | 0.011 | 0.005 | 0.000 | 0.105 |
| 1.2000 | 0.011 | 0.005 | 0.000 | 0.105 |
| 1.2444 | 0.011 | 0.005 | 0.000 | 0.105 |
| 1.2889 | 0.011 | 0.006 | 0.000 | 0.105 |
| 1.3333 | 0.011 | 0.006 | 0.000 | 0.105 |
| 1.3778 | 0.011 | 0.006 | 0.000 | 0.105 |
| 1.4222 | 0.011 | 0.006 | 0.000 | 0.105 |
| 1.4667 | 0.011 | 0.006 | 0.000 | 0.105 |
| 1.5111 | 0.011 | 0.007 | 0.000 | 0.105 |
| 1.5556 | 0.011 | 0.007 | 0.000 | 0.105 |
| 1.6000 | 0.011 | 0.007 | 0.000 | 0.105 |
| 1.6444 | 0.011 | 0.007 | 0.000 | 0.105 |
| 1.6889 | 0.011 | 0.007 | 0.000 | 0.105 |
| 1.7333 | 0.011 | 0.008 | 0.000 | 0.105 |
| 1.7778 | 0.011 | 0.008 | 0.000 | 0.105 |
| 1.8222 | 0.011 | 0.008 | 0.000 | 0.105 |
| 1.8667 | 0.011 | 0.008 | 0.000 | 0.105 |
| 1.9111 | 0.011 | 0.008 | 0.000 | 0.105 |
| 1.9556 | 0.011 | 0.009 | 0.000 | 0.105 |
| 2.0000 | 0.011 | 0.009 | 0.000 | 0.105 |
| 2.0444 | 0.011 | 0.009 | 0.000 | 0.105 |
| 2.0889 | 0.011 | 0.009 | 0.000 | 0.105 |
| 2.1333 | 0.011 | 0.009 | 0.000 | 0.105 |
| 2.1778 | 0.011 | 0.010 | 0.000 | 0.105 |
| 2.2222 | 0.011 | 0.010 | 0.000 | 0.105 |
| 2.2667 | 0.011 | 0.010 | 0.000 | 0.105 |
| 2.3111 | 0.011 | 0.010 | 0.000 | 0.105 |
| 2.3556 | 0.011 | 0.010 | 0.000 | 0.105 |
| 2.4000 | 0.011 | 0.011 | 0.000 | 0.105 |
| 2.4444 | 0.011 | 0.011 | 0.000 | 0.105 |
| 2.4889 | 0.011 | 0.011 | 0.000 | 0.105 |
| 2.5333 | 0.011 | 0.011 | 0.000 | 0.105 |
| 2.5778 | 0.011 | 0.011 | 0.000 | 0.105 |
| 2.6222 | 0.011 | 0.012 | 0.000 | 0.105 |
| 2.6667 | 0.011 | 0.012 | 0.000 | 0.105 |
| 2.7111 | 0.011 | 0.012 | 0.000 | 0.105 |
| 2.7556 | 0.011 | 0.012 | 0.000 | 0.105 |
| 2.8000 | 0.011 | 0.013 | 0.000 | 0.105 |
| 2.8444 | 0.011 | 0.013 | 0.000 | 0.105 |
| 2.8889 | 0.011 | 0.013 | 0.000 | 0.105 |
| 2.9333 | 0.011 | 0.013 | 0.000 | 0.105 |
| 2.9778 | 0.011 | 0.013 | 0.000 | 0.105 |
| 3.0222 | 0.011 | 0.014 | 0.017 | 0.105 |
| 3.0667 | 0.011 | 0.014 | 0.090 | 0.105 |
| 3.1111 | 0.011 | 0.014 | 0.184 | 0.105 |
| 3.1556 | 0.011 | 0.014 | 0.277 | 0.105 |
| 3.2000 | 0.011 | 0.014 | 0.346 | 0.105 |
| 3.2444 | 0.011 | 0.015 | 0.385 | 0.105 |
| 3.2889 | 0.011 | 0.015 | 0.423 | 0.105 |
| 3.3333 | 0.011 | 0.015 | 0.454 | 0.105 |
| 3.3778 | 0.011 | 0.015 | 0.484 | 0.105 |
| 3.4222 | 0.011 | 0.015 | 0.511 | 0.105 |
| 3.4667 | 0.011 | 0.016 | 0.537 | 0.105 |
| 3.5111 | 0.011 | 0.016 | 0.562 | 0.105 |
| 3.5556 | 0.011 | 0.016 | 0.586 | 0.105 |
| 3.6000 | 0.011 | 0.016 | 0.609 | 0.105 |
| 3.6444 | 0.011 | 0.016 | 0.632 | 0.105 |
| 3.6889 | 0.011 | 0.017 | 0.653 | 0.105 |

| | | | | |
|---|---|---|---|---|
| 3.7333 | 0.011 | 0.017 | 0.674 | 0.105 |
| 3.7778 | 0.011 | 0.017 | 0.694 | 0.105 |
| 3.8222 | 0.011 | 0.017 | 0.714 | 0.105 |
| 3.8667 | 0.011 | 0.017 | 0.733 | 0.105 |
| 3.9111 | 0.011 | 0.018 | 0.751 | 0.105 |
| 3.9556 | 0.011 | 0.018 | 0.769 | 0.105 |
| 4.0000 | 0.011 | 0.018 | 0.787 | 0.105 |

## Trench B South

| | |
|---|---|
| Bottom Length: | 110.00 ft. |
| Bottom Width: | 6.00 ft. |
| Trench bottom slope 1: | 0 To 1 |
| Trench Left side slope 0: | 0 To 1 |
| Trench right side slope 2: | 0 To 1 |
| Material thickness of first layer: | 4 |
| Pour Space of material for first layer: | 0.4 |
| Material thickness of second layer: | 0 |
| Pour Space of material for second layer: | 0 |
| Material thickness of third layer: | 0 |
| Pour Space of material for third layer: | 0 |
| Infiltration On | |
| Infiltration rate: | 9 |
| Infiltration safety factor: | 1 |
| Total Volume Infiltrated (ac-ft.): | 56.231 |
| Total Volume Through Riser (ac-ft.): | 0 |
| Total Volume Through Facility (ac-ft.): | 56.231 |
| Percent Infiltrated: | 100 |
| Total Precip Applied to Facility: | 0 |
| Total Evap From Facility: | 0 |
| Discharge Structure | |
| Riser Height: | 3 ft. |
| Riser Diameter: | 6 in. |
| Element Flows To: | |
| Outlet 1 | Outlet 2 |

Gravel Trench Bed Hydraulic Table

| Stage(feet) | Area(ac.) | Volume(ac-ft.) | Discharge(cfs) | Infilt(cfs) |
|---|---|---|---|---|
| 0.0000 | 0.015 | 0.000 | 0.000 | 0.000 |
| 0.0444 | 0.015 | 0.000 | 0.000 | 0.137 |
| 0.0889 | 0.015 | 0.000 | 0.000 | 0.137 |
| 0.1333 | 0.015 | 0.000 | 0.000 | 0.137 |
| 0.1778 | 0.015 | 0.001 | 0.000 | 0.137 |
| 0.2222 | 0.015 | 0.001 | 0.000 | 0.137 |
| 0.2667 | 0.015 | 0.001 | 0.000 | 0.137 |
| 0.3111 | 0.015 | 0.001 | 0.000 | 0.137 |
| 0.3556 | 0.015 | 0.002 | 0.000 | 0.137 |
| 0.4000 | 0.015 | 0.002 | 0.000 | 0.137 |
| 0.4444 | 0.015 | 0.002 | 0.000 | 0.137 |
| 0.4889 | 0.015 | 0.003 | 0.000 | 0.137 |
| 0.5333 | 0.015 | 0.003 | 0.000 | 0.137 |
| 0.5778 | 0.015 | 0.003 | 0.000 | 0.137 |
| 0.6222 | 0.015 | 0.003 | 0.000 | 0.137 |
| 0.6667 | 0.015 | 0.004 | 0.000 | 0.137 |
| 0.7111 | 0.015 | 0.004 | 0.000 | 0.137 |
| 0.7556 | 0.015 | 0.004 | 0.000 | 0.137 |
| 0.8000 | 0.015 | 0.004 | 0.000 | 0.137 |
| 0.8444 | 0.015 | 0.005 | 0.000 | 0.137 |
| 0.8889 | 0.015 | 0.005 | 0.000 | 0.137 |
| 0.9333 | 0.015 | 0.005 | 0.000 | 0.137 |
| 0.9778 | 0.015 | 0.005 | 0.000 | 0.137 |
| 1.0222 | 0.015 | 0.006 | 0.000 | 0.137 |
| 1.0667 | 0.015 | 0.006 | 0.000 | 0.137 |
| 1.1111 | 0.015 | 0.006 | 0.000 | 0.137 |

| | | | | |
|---|---|---|---|---|
| 1.1556 | 0.015 | 0.007 | 0.000 | 0.137 |
| 1.2000 | 0.015 | 0.007 | 0.000 | 0.137 |
| 1.2444 | 0.015 | 0.007 | 0.000 | 0.137 |
| 1.2889 | 0.015 | 0.007 | 0.000 | 0.137 |
| 1.3333 | 0.015 | 0.008 | 0.000 | 0.137 |
| 1.3778 | 0.015 | 0.008 | 0.000 | 0.137 |
| 1.4222 | 0.015 | 0.008 | 0.000 | 0.137 |
| 1.4667 | 0.015 | 0.008 | 0.000 | 0.137 |
| 1.5111 | 0.015 | 0.009 | 0.000 | 0.137 |
| 1.5556 | 0.015 | 0.009 | 0.000 | 0.137 |
| 1.6000 | 0.015 | 0.009 | 0.000 | 0.137 |
| 1.6444 | 0.015 | 0.010 | 0.000 | 0.137 |
| 1.6889 | 0.015 | 0.010 | 0.000 | 0.137 |
| 1.7333 | 0.015 | 0.010 | 0.000 | 0.137 |
| 1.7778 | 0.015 | 0.010 | 0.000 | 0.137 |
| 1.8222 | 0.015 | 0.011 | 0.000 | 0.137 |
| 1.8667 | 0.015 | 0.011 | 0.000 | 0.137 |
| 1.9111 | 0.015 | 0.011 | 0.000 | 0.137 |
| 1.9556 | 0.015 | 0.011 | 0.000 | 0.137 |
| 2.0000 | 0.015 | 0.012 | 0.000 | 0.137 |
| 2.0444 | 0.015 | 0.012 | 0.000 | 0.137 |
| 2.0889 | 0.015 | 0.012 | 0.000 | 0.137 |
| 2.1333 | 0.015 | 0.012 | 0.000 | 0.137 |
| 2.1778 | 0.015 | 0.013 | 0.000 | 0.137 |
| 2.2222 | 0.015 | 0.013 | 0.000 | 0.137 |
| 2.2667 | 0.015 | 0.013 | 0.000 | 0.137 |
| 2.3111 | 0.015 | 0.014 | 0.000 | 0.137 |
| 2.3556 | 0.015 | 0.014 | 0.000 | 0.137 |
| 2.4000 | 0.015 | 0.014 | 0.000 | 0.137 |
| 2.4444 | 0.015 | 0.014 | 0.000 | 0.137 |
| 2.4889 | 0.015 | 0.015 | 0.000 | 0.137 |
| 2.5333 | 0.015 | 0.015 | 0.000 | 0.137 |
| 2.5778 | 0.015 | 0.015 | 0.000 | 0.137 |
| 2.6222 | 0.015 | 0.015 | 0.000 | 0.137 |
| 2.6667 | 0.015 | 0.016 | 0.000 | 0.137 |
| 2.7111 | 0.015 | 0.016 | 0.000 | 0.137 |
| 2.7556 | 0.015 | 0.016 | 0.000 | 0.137 |
| 2.8000 | 0.015 | 0.017 | 0.000 | 0.137 |
| 2.8444 | 0.015 | 0.017 | 0.000 | 0.137 |
| 2.8889 | 0.015 | 0.017 | 0.000 | 0.137 |
| 2.9333 | 0.015 | 0.017 | 0.000 | 0.137 |
| 2.9778 | 0.015 | 0.018 | 0.000 | 0.137 |
| 3.0222 | 0.015 | 0.018 | 0.017 | 0.137 |
| 3.0667 | 0.015 | 0.018 | 0.090 | 0.137 |
| 3.1111 | 0.015 | 0.018 | 0.184 | 0.137 |
| 3.1556 | 0.015 | 0.019 | 0.277 | 0.137 |
| 3.2000 | 0.015 | 0.019 | 0.346 | 0.137 |
| 3.2444 | 0.015 | 0.019 | 0.385 | 0.137 |
| 3.2889 | 0.015 | 0.019 | 0.423 | 0.137 |
| 3.3333 | 0.015 | 0.020 | 0.454 | 0.137 |
| 3.3778 | 0.015 | 0.020 | 0.484 | 0.137 |
| 3.4222 | 0.015 | 0.020 | 0.511 | 0.137 |
| 3.4667 | 0.015 | 0.021 | 0.537 | 0.137 |
| 3.5111 | 0.015 | 0.021 | 0.562 | 0.137 |
| 3.5556 | 0.015 | 0.021 | 0.586 | 0.137 |
| 3.6000 | 0.015 | 0.021 | 0.609 | 0.137 |
| 3.6444 | 0.015 | 0.022 | 0.632 | 0.137 |
| 3.6889 | 0.015 | 0.022 | 0.653 | 0.137 |

| | | | | |
|---|---|---|---|---|
| 3.7333 | 0.015 | 0.022 | 0.674 | 0.137 |
| 3.7778 | 0.015 | 0.022 | 0.694 | 0.137 |
| 3.8222 | 0.015 | 0.023 | 0.714 | 0.137 |
| 3.8667 | 0.015 | 0.023 | 0.733 | 0.137 |
| 3.9111 | 0.015 | 0.023 | 0.751 | 0.137 |
| 3.9556 | 0.015 | 0.024 | 0.769 | 0.137 |
| 4.0000 | 0.015 | 0.024 | 0.787 | 0.137 |

## Trench B North

| | |
|---|---|
| Bottom Length: | 40.00 ft. |
| Bottom Width: | 12.00 ft. |
| Trench bottom slope 1: | 0 To 1 |
| Trench Left side slope 0: | 0 To 1 |
| Trench right side slope 2: | 0 To 1 |
| Material thickness of first layer: | 4 |
| Pour Space of material for first layer: | 0.4 |
| Material thickness of second layer: | 0 |
| Pour Space of material for second layer: | 0 |
| Material thickness of third layer: | 0 |
| Pour Space of material for third layer: | 0 |
| Infiltration On | |
| Infiltration rate: | 9 |
| Infiltration safety factor: | 1 |
| Total Volume Infiltrated (ac-ft.): | 41.054 |
| Total Volume Through Riser (ac-ft.): | 0 |
| Total Volume Through Facility (ac-ft.): | 41.054 |
| Percent Infiltrated: | 100 |
| Total Precip Applied to Facility: | 0 |
| Total Evap From Facility: | 0 |
| Discharge Structure | |
| Riser Height: | 3 ft. |
| Riser Diameter: | 6 in. |
| Element Flows To: | |
| Outlet 1 | Outlet 2 |

Gravel Trench Bed Hydraulic Table

| Stage(feet) | Area(ac.) | Volume(ac-ft.) | Discharge(cfs) | Infilt(cfs) |
|---|---|---|---|---|
| 0.0000 | 0.011 | 0.000 | 0.000 | 0.000 |
| 0.0444 | 0.011 | 0.000 | 0.000 | 0.100 |
| 0.0889 | 0.011 | 0.000 | 0.000 | 0.100 |
| 0.1333 | 0.011 | 0.000 | 0.000 | 0.100 |
| 0.1778 | 0.011 | 0.000 | 0.000 | 0.100 |
| 0.2222 | 0.011 | 0.001 | 0.000 | 0.100 |
| 0.2667 | 0.011 | 0.001 | 0.000 | 0.100 |
| 0.3111 | 0.011 | 0.001 | 0.000 | 0.100 |
| 0.3556 | 0.011 | 0.001 | 0.000 | 0.100 |
| 0.4000 | 0.011 | 0.001 | 0.000 | 0.100 |
| 0.4444 | 0.011 | 0.002 | 0.000 | 0.100 |
| 0.4889 | 0.011 | 0.002 | 0.000 | 0.100 |
| 0.5333 | 0.011 | 0.002 | 0.000 | 0.100 |
| 0.5778 | 0.011 | 0.002 | 0.000 | 0.100 |
| 0.6222 | 0.011 | 0.002 | 0.000 | 0.100 |
| 0.6667 | 0.011 | 0.002 | 0.000 | 0.100 |
| 0.7111 | 0.011 | 0.003 | 0.000 | 0.100 |
| 0.7556 | 0.011 | 0.003 | 0.000 | 0.100 |
| 0.8000 | 0.011 | 0.003 | 0.000 | 0.100 |
| 0.8444 | 0.011 | 0.003 | 0.000 | 0.100 |
| 0.8889 | 0.011 | 0.003 | 0.000 | 0.100 |
| 0.9333 | 0.011 | 0.004 | 0.000 | 0.100 |
| 0.9778 | 0.011 | 0.004 | 0.000 | 0.100 |
| 1.0222 | 0.011 | 0.004 | 0.000 | 0.100 |
| 1.0667 | 0.011 | 0.004 | 0.000 | 0.100 |
| 1.1111 | 0.011 | 0.004 | 0.000 | 0.100 |

| | | | | |
|---|---|---|---|---|
| 1.1556 | 0.011 | 0.005 | 0.000 | 0.100 |
| 1.2000 | 0.011 | 0.005 | 0.000 | 0.100 |
| 1.2444 | 0.011 | 0.005 | 0.000 | 0.100 |
| 1.2889 | 0.011 | 0.005 | 0.000 | 0.100 |
| 1.3333 | 0.011 | 0.005 | 0.000 | 0.100 |
| 1.3778 | 0.011 | 0.006 | 0.000 | 0.100 |
| 1.4222 | 0.011 | 0.006 | 0.000 | 0.100 |
| 1.4667 | 0.011 | 0.006 | 0.000 | 0.100 |
| 1.5111 | 0.011 | 0.006 | 0.000 | 0.100 |
| 1.5556 | 0.011 | 0.006 | 0.000 | 0.100 |
| 1.6000 | 0.011 | 0.007 | 0.000 | 0.100 |
| 1.6444 | 0.011 | 0.007 | 0.000 | 0.100 |
| 1.6889 | 0.011 | 0.007 | 0.000 | 0.100 |
| 1.7333 | 0.011 | 0.007 | 0.000 | 0.100 |
| 1.7778 | 0.011 | 0.007 | 0.000 | 0.100 |
| 1.8222 | 0.011 | 0.008 | 0.000 | 0.100 |
| 1.8667 | 0.011 | 0.008 | 0.000 | 0.100 |
| 1.9111 | 0.011 | 0.008 | 0.000 | 0.100 |
| 1.9556 | 0.011 | 0.008 | 0.000 | 0.100 |
| 2.0000 | 0.011 | 0.008 | 0.000 | 0.100 |
| 2.0444 | 0.011 | 0.009 | 0.000 | 0.100 |
| 2.0889 | 0.011 | 0.009 | 0.000 | 0.100 |
| 2.1333 | 0.011 | 0.009 | 0.000 | 0.100 |
| 2.1778 | 0.011 | 0.009 | 0.000 | 0.100 |
| 2.2222 | 0.011 | 0.009 | 0.000 | 0.100 |
| 2.2667 | 0.011 | 0.010 | 0.000 | 0.100 |
| 2.3111 | 0.011 | 0.010 | 0.000 | 0.100 |
| 2.3556 | 0.011 | 0.010 | 0.000 | 0.100 |
| 2.4000 | 0.011 | 0.010 | 0.000 | 0.100 |
| 2.4444 | 0.011 | 0.010 | 0.000 | 0.100 |
| 2.4889 | 0.011 | 0.011 | 0.000 | 0.100 |
| 2.5333 | 0.011 | 0.011 | 0.000 | 0.100 |
| 2.5778 | 0.011 | 0.011 | 0.000 | 0.100 |
| 2.6222 | 0.011 | 0.011 | 0.000 | 0.100 |
| 2.6667 | 0.011 | 0.011 | 0.000 | 0.100 |
| 2.7111 | 0.011 | 0.011 | 0.000 | 0.100 |
| 2.7556 | 0.011 | 0.012 | 0.000 | 0.100 |
| 2.8000 | 0.011 | 0.012 | 0.000 | 0.100 |
| 2.8444 | 0.011 | 0.012 | 0.000 | 0.100 |
| 2.8889 | 0.011 | 0.012 | 0.000 | 0.100 |
| 2.9333 | 0.011 | 0.012 | 0.000 | 0.100 |
| 2.9778 | 0.011 | 0.013 | 0.000 | 0.100 |
| 3.0222 | 0.011 | 0.013 | 0.017 | 0.100 |
| 3.0667 | 0.011 | 0.013 | 0.090 | 0.100 |
| 3.1111 | 0.011 | 0.013 | 0.184 | 0.100 |
| 3.1556 | 0.011 | 0.013 | 0.277 | 0.100 |
| 3.2000 | 0.011 | 0.014 | 0.346 | 0.100 |
| 3.2444 | 0.011 | 0.014 | 0.385 | 0.100 |
| 3.2889 | 0.011 | 0.014 | 0.423 | 0.100 |
| 3.3333 | 0.011 | 0.014 | 0.454 | 0.100 |
| 3.3778 | 0.011 | 0.014 | 0.484 | 0.100 |
| 3.4222 | 0.011 | 0.015 | 0.511 | 0.100 |
| 3.4667 | 0.011 | 0.015 | 0.537 | 0.100 |
| 3.5111 | 0.011 | 0.015 | 0.562 | 0.100 |
| 3.5556 | 0.011 | 0.015 | 0.586 | 0.100 |
| 3.6000 | 0.011 | 0.015 | 0.609 | 0.100 |
| 3.6444 | 0.011 | 0.016 | 0.632 | 0.100 |
| 3.6889 | 0.011 | 0.016 | 0.653 | 0.100 |

| | | | | |
|---|---|---|---|---|
| 3.7333 | 0.011 | 0.016 | 0.674 | 0.100 |
| 3.7778 | 0.011 | 0.016 | 0.694 | 0.100 |
| 3.8222 | 0.011 | 0.016 | 0.714 | 0.100 |
| 3.8667 | 0.011 | 0.017 | 0.733 | 0.100 |
| 3.9111 | 0.011 | 0.017 | 0.751 | 0.100 |
| 3.9556 | 0.011 | 0.017 | 0.769 | 0.100 |
| 4.0000 | 0.011 | 0.017 | 0.787 | 0.100 |

## Trench Office

| | |
|---|---|
| Bottom Length: | 22.00 ft. |
| Bottom Width: | 6.00 ft. |
| Trench bottom slope 1: | 0 To 1 |
| Trench Left side slope 0: | 0 To 1 |
| Trench right side slope 2: | 0 To 1 |
| Material thickness of first layer: | 4 |
| Pour Space of material for first layer: | 0.4 |
| Material thickness of second layer: | 0 |
| Pour Space of material for second layer: | 0 |
| Material thickness of third layer: | 0 |
| Pour Space of material for third layer: | 0 |
| Infiltration On | |
| Infiltration rate: | 9 |
| Infiltration safety factor: | 1 |
| Total Volume Infiltrated (ac-ft.): | 10.918 |
| Total Volume Through Riser (ac-ft.): | 0 |
| Total Volume Through Facility (ac-ft.): | 10.918 |
| Percent Infiltrated: | 100 |
| Total Precip Applied to Facility: | 0 |
| Total Evap From Facility: | 0 |
| Discharge Structure | |
| Riser Height: | 3 ft. |
| Riser Diameter: | 6 in. |
| Element Flows To: | |
| Outlet 1 | Outlet 2 |

Gravel Trench Bed Hydraulic Table

| Stage(feet) | Area(ac.) | Volume(ac-ft.) | Discharge(cfs) | Infilt(cfs) |
|---|---|---|---|---|
| 0.0000 | 0.003 | 0.000 | 0.000 | 0.000 |
| 0.0444 | 0.003 | 0.000 | 0.000 | 0.027 |
| 0.0889 | 0.003 | 0.000 | 0.000 | 0.027 |
| 0.1333 | 0.003 | 0.000 | 0.000 | 0.027 |
| 0.1778 | 0.003 | 0.000 | 0.000 | 0.027 |
| 0.2222 | 0.003 | 0.000 | 0.000 | 0.027 |
| 0.2667 | 0.003 | 0.000 | 0.000 | 0.027 |
| 0.3111 | 0.003 | 0.000 | 0.000 | 0.027 |
| 0.3556 | 0.003 | 0.000 | 0.000 | 0.027 |
| 0.4000 | 0.003 | 0.000 | 0.000 | 0.027 |
| 0.4444 | 0.003 | 0.000 | 0.000 | 0.027 |
| 0.4889 | 0.003 | 0.000 | 0.000 | 0.027 |
| 0.5333 | 0.003 | 0.000 | 0.000 | 0.027 |
| 0.5778 | 0.003 | 0.000 | 0.000 | 0.027 |
| 0.6222 | 0.003 | 0.000 | 0.000 | 0.027 |
| 0.6667 | 0.003 | 0.000 | 0.000 | 0.027 |
| 0.7111 | 0.003 | 0.000 | 0.000 | 0.027 |
| 0.7556 | 0.003 | 0.000 | 0.000 | 0.027 |
| 0.8000 | 0.003 | 0.001 | 0.000 | 0.027 |
| 0.8444 | 0.003 | 0.001 | 0.000 | 0.027 |
| 0.8889 | 0.003 | 0.001 | 0.000 | 0.027 |
| 0.9333 | 0.003 | 0.001 | 0.000 | 0.027 |
| 0.9778 | 0.003 | 0.001 | 0.000 | 0.027 |
| 1.0222 | 0.003 | 0.001 | 0.000 | 0.027 |
| 1.0667 | 0.003 | 0.001 | 0.000 | 0.027 |
| 1.1111 | 0.003 | 0.001 | 0.000 | 0.027 |

| | | | | |
|---|---|---|---|---|
| 1.1556 | 0.003 | 0.001 | 0.000 | 0.027 |
| 1.2000 | 0.003 | 0.001 | 0.000 | 0.027 |
| 1.2444 | 0.003 | 0.001 | 0.000 | 0.027 |
| 1.2889 | 0.003 | 0.001 | 0.000 | 0.027 |
| 1.3333 | 0.003 | 0.001 | 0.000 | 0.027 |
| 1.3778 | 0.003 | 0.001 | 0.000 | 0.027 |
| 1.4222 | 0.003 | 0.001 | 0.000 | 0.027 |
| 1.4667 | 0.003 | 0.001 | 0.000 | 0.027 |
| 1.5111 | 0.003 | 0.001 | 0.000 | 0.027 |
| 1.5556 | 0.003 | 0.001 | 0.000 | 0.027 |
| 1.6000 | 0.003 | 0.001 | 0.000 | 0.027 |
| 1.6444 | 0.003 | 0.002 | 0.000 | 0.027 |
| 1.6889 | 0.003 | 0.002 | 0.000 | 0.027 |
| 1.7333 | 0.003 | 0.002 | 0.000 | 0.027 |
| 1.7778 | 0.003 | 0.002 | 0.000 | 0.027 |
| 1.8222 | 0.003 | 0.002 | 0.000 | 0.027 |
| 1.8667 | 0.003 | 0.002 | 0.000 | 0.027 |
| 1.9111 | 0.003 | 0.002 | 0.000 | 0.027 |
| 1.9556 | 0.003 | 0.002 | 0.000 | 0.027 |
| 2.0000 | 0.003 | 0.002 | 0.000 | 0.027 |
| 2.0444 | 0.003 | 0.002 | 0.000 | 0.027 |
| 2.0889 | 0.003 | 0.002 | 0.000 | 0.027 |
| 2.1333 | 0.003 | 0.002 | 0.000 | 0.027 |
| 2.1778 | 0.003 | 0.002 | 0.000 | 0.027 |
| 2.2222 | 0.003 | 0.002 | 0.000 | 0.027 |
| 2.2667 | 0.003 | 0.002 | 0.000 | 0.027 |
| 2.3111 | 0.003 | 0.002 | 0.000 | 0.027 |
| 2.3556 | 0.003 | 0.002 | 0.000 | 0.027 |
| 2.4000 | 0.003 | 0.002 | 0.000 | 0.027 |
| 2.4444 | 0.003 | 0.003 | 0.000 | 0.027 |
| 2.4889 | 0.003 | 0.003 | 0.000 | 0.027 |
| 2.5333 | 0.003 | 0.003 | 0.000 | 0.027 |
| 2.5778 | 0.003 | 0.003 | 0.000 | 0.027 |
| 2.6222 | 0.003 | 0.003 | 0.000 | 0.027 |
| 2.6667 | 0.003 | 0.003 | 0.000 | 0.027 |
| 2.7111 | 0.003 | 0.003 | 0.000 | 0.027 |
| 2.7556 | 0.003 | 0.003 | 0.000 | 0.027 |
| 2.8000 | 0.003 | 0.003 | 0.000 | 0.027 |
| 2.8444 | 0.003 | 0.003 | 0.000 | 0.027 |
| 2.8889 | 0.003 | 0.003 | 0.000 | 0.027 |
| 2.9333 | 0.003 | 0.003 | 0.000 | 0.027 |
| 2.9778 | 0.003 | 0.003 | 0.000 | 0.027 |
| 3.0222 | 0.003 | 0.003 | 0.017 | 0.027 |
| 3.0667 | 0.003 | 0.003 | 0.090 | 0.027 |
| 3.1111 | 0.003 | 0.003 | 0.184 | 0.027 |
| 3.1556 | 0.003 | 0.003 | 0.277 | 0.027 |
| 3.2000 | 0.003 | 0.003 | 0.346 | 0.027 |
| 3.2444 | 0.003 | 0.003 | 0.385 | 0.027 |
| 3.2889 | 0.003 | 0.004 | 0.423 | 0.027 |
| 3.3333 | 0.003 | 0.004 | 0.454 | 0.027 |
| 3.3778 | 0.003 | 0.004 | 0.484 | 0.027 |
| 3.4222 | 0.003 | 0.004 | 0.511 | 0.027 |
| 3.4667 | 0.003 | 0.004 | 0.537 | 0.027 |
| 3.5111 | 0.003 | 0.004 | 0.562 | 0.027 |
| 3.5556 | 0.003 | 0.004 | 0.586 | 0.027 |
| 3.6000 | 0.003 | 0.004 | 0.609 | 0.027 |
| 3.6444 | 0.003 | 0.004 | 0.632 | 0.027 |
| 3.6889 | 0.003 | 0.004 | 0.653 | 0.027 |

| | | | | |
|---|---|---|---|---|
| 3.7333 | 0.003 | 0.004 | 0.674 | 0.027 |
| 3.7778 | 0.003 | 0.004 | 0.694 | 0.027 |
| 3.8222 | 0.003 | 0.004 | 0.714 | 0.027 |
| 3.8667 | 0.003 | 0.004 | 0.733 | 0.027 |
| 3.9111 | 0.003 | 0.004 | 0.751 | 0.027 |
| 3.9556 | 0.003 | 0.004 | 0.769 | 0.027 |
| 4.0000 | 0.003 | 0.004 | 0.787 | 0.027 |

## Bioretention Pond

| | |
|---|---|
| Bottom Length: | 90.00 ft. |
| Bottom Width: | 41.00 ft. |
| Trench bottom slope 1: | 3 To 1 |
| Trench Left side slope 0: | 3 To 1 |
| Trench right side slope 2: | 3 To 1 |
| Material thickness of first layer: | 1.5 |
| Pour Space of material for first layer: | 0.3 |
| Material thickness of second layer: | 0 |
| Pour Space of material for second layer: | 0 |
| Material thickness of third layer: | 0 |
| Pour Space of material for third layer: | 0 |
| Infiltration On | |
| Infiltration rate: | 3 |
| Infiltration safety factor: | 1 |
| Wetted surface area On | |
| Total Volume Infiltrated (ac-ft.): | 257.007 |
| Total Volume Through Riser (ac-ft.): | 0 |
| Total Volume Through Facility (ac-ft.): | 257.007 |
| Percent Infiltrated: | 100 |
| Total Precip Applied to Facility: | 17.877 |
| Total Evap From Facility: | 1.685 |
| Discharge Structure | |
| Riser Height: | 2.5 ft. |
| Riser Diameter: | 6 in. |
| Element Flows To: | |
| Outlet 1 | Outlet 2 |

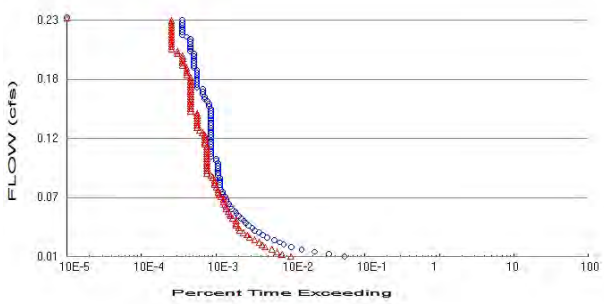
Gravel Trench Bed Hydraulic Table

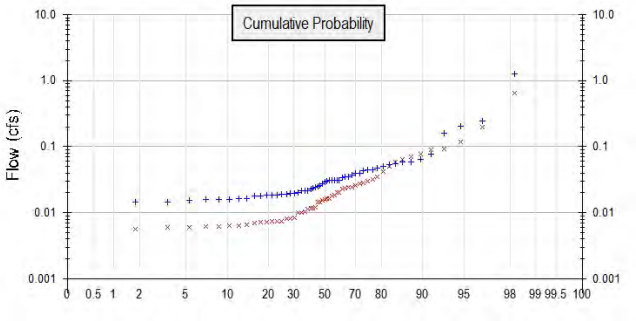
| Stage(feet) | Area(ac.) | Volume(ac-ft.) | Discharge(cfs) | Infilt(cfs) |
|---|---|---|---|---|
| 0.0000 | 0.084 | 0.000 | 0.000 | 0.000 |
| 0.0500 | 0.085 | 0.001 | 0.000 | 0.259 |
| 0.1000 | 0.086 | 0.002 | 0.000 | 0.261 |
| 0.1500 | 0.087 | 0.003 | 0.000 | 0.264 |
| 0.2000 | 0.088 | 0.005 | 0.000 | 0.267 |
| 0.2500 | 0.089 | 0.006 | 0.000 | 0.270 |
| 0.3000 | 0.090 | 0.007 | 0.000 | 0.272 |
| 0.3500 | 0.091 | 0.009 | 0.000 | 0.275 |
| 0.4000 | 0.092 | 0.010 | 0.000 | 0.278 |
| 0.4500 | 0.093 | 0.012 | 0.000 | 0.281 |
| 0.5000 | 0.093 | 0.013 | 0.000 | 0.284 |
| 0.5500 | 0.094 | 0.014 | 0.000 | 0.287 |
| 0.6000 | 0.095 | 0.016 | 0.000 | 0.289 |
| 0.6500 | 0.096 | 0.017 | 0.000 | 0.292 |
| 0.7000 | 0.097 | 0.019 | 0.000 | 0.295 |
| 0.7500 | 0.098 | 0.020 | 0.000 | 0.298 |
| 0.8000 | 0.099 | 0.022 | 0.000 | 0.301 |
| 0.8500 | 0.100 | 0.023 | 0.000 | 0.304 |
| 0.9000 | 0.101 | 0.025 | 0.000 | 0.307 |
| 0.9500 | 0.102 | 0.026 | 0.000 | 0.310 |
| 1.0000 | 0.103 | 0.028 | 0.000 | 0.313 |
| 1.0500 | 0.104 | 0.029 | 0.000 | 0.316 |
| 1.1000 | 0.105 | 0.031 | 0.000 | 0.319 |
| 1.1500 | 0.106 | 0.032 | 0.000 | 0.322 |
| 1.2000 | 0.107 | 0.034 | 0.000 | 0.325 |

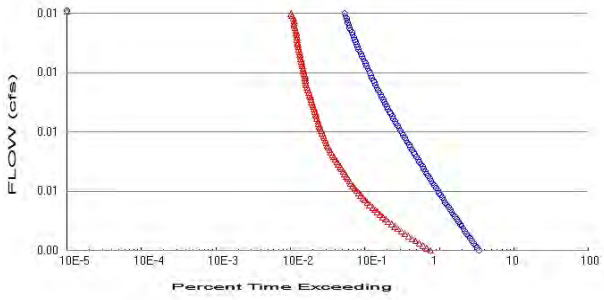
| | | | | |
|---|---|---|---|---|
| 1.2500 | 0.108 | 0.036 | 0.000 | 0.328 |
| 1.3000 | 0.109 | 0.037 | 0.000 | 0.331 |
| 1.3500 | 0.110 | 0.039 | 0.000 | 0.334 |
| 1.4000 | 0.111 | 0.041 | 0.000 | 0.337 |
| 1.4500 | 0.112 | 0.042 | 0.000 | 0.340 |
| 1.5000 | 0.113 | 0.048 | 0.000 | 0.343 |
| 1.5500 | 0.114 | 0.054 | 0.000 | 0.346 |
| 1.6000 | 0.115 | 0.059 | 0.000 | 0.350 |
| 1.6500 | 0.116 | 0.065 | 0.000 | 0.353 |
| 1.7000 | 0.117 | 0.071 | 0.000 | 0.356 |
| 1.7500 | 0.118 | 0.077 | 0.000 | 0.359 |
| 1.8000 | 0.119 | 0.083 | 0.000 | 0.362 |
| 1.8500 | 0.120 | 0.089 | 0.000 | 0.365 |
| 1.9000 | 0.122 | 0.095 | 0.000 | 0.369 |
| 1.9500 | 0.123 | 0.101 | 0.000 | 0.372 |
| 2.0000 | 0.124 | 0.107 | 0.000 | 0.375 |
| 2.0500 | 0.125 | 0.114 | 0.000 | 0.378 |
| 2.1000 | 0.126 | 0.120 | 0.000 | 0.381 |
| 2.1500 | 0.127 | 0.126 | 0.000 | 0.385 |
| 2.2000 | 0.128 | 0.133 | 0.000 | 0.388 |
| 2.2500 | 0.129 | 0.139 | 0.000 | 0.391 |
| 2.3000 | 0.130 | 0.146 | 0.000 | 0.395 |
| 2.3500 | 0.131 | 0.152 | 0.000 | 0.398 |
| 2.4000 | 0.132 | 0.159 | 0.000 | 0.401 |
| 2.4500 | 0.133 | 0.165 | 0.000 | 0.405 |
| 2.5000 | 0.135 | 0.172 | 0.000 | 0.408 |
| 2.5500 | 0.136 | 0.179 | 0.059 | 0.411 |
| 2.6000 | 0.137 | 0.186 | 0.160 | 0.415 |
| 2.6500 | 0.138 | 0.193 | 0.266 | 0.418 |
| 2.7000 | 0.139 | 0.200 | 0.346 | 0.421 |
| 2.7500 | 0.140 | 0.207 | 0.389 | 0.425 |
| 2.8000 | 0.141 | 0.214 | 0.431 | 0.428 |
| 2.8500 | 0.142 | 0.221 | 0.465 | 0.432 |
| 2.9000 | 0.144 | 0.228 | 0.498 | 0.435 |
| 2.9500 | 0.145 | 0.235 | 0.528 | 0.439 |
| 3.0000 | 0.146 | 0.242 | 0.556 | 0.442 |
| 3.0500 | 0.147 | 0.250 | 0.584 | 0.446 |
| 3.1000 | 0.148 | 0.257 | 0.609 | 0.449 |
| 3.1500 | 0.149 | 0.265 | 0.634 | 0.453 |
| 3.2000 | 0.150 | 0.272 | 0.658 | 0.456 |
| 3.2500 | 0.152 | 0.280 | 0.681 | 0.460 |
| 3.3000 | 0.153 | 0.287 | 0.704 | 0.463 |
| 3.3500 | 0.154 | 0.295 | 0.726 | 0.467 |
| 3.4000 | 0.155 | 0.303 | 0.747 | 0.470 |
| 3.4500 | 0.156 | 0.311 | 0.767 | 0.474 |
| 3.5000 | 0.158 | 0.319 | 0.787 | 0.477 |
| 3.5500 | 0.159 | 0.326 | 0.806 | 0.481 |
| 3.6000 | 0.160 | 0.334 | 0.825 | 0.485 |
| 3.6500 | 0.161 | 0.342 | 0.844 | 0.488 |
| 3.7000 | 0.162 | 0.351 | 0.862 | 0.492 |
| 3.7500 | 0.164 | 0.359 | 0.880 | 0.496 |
| 3.8000 | 0.165 | 0.367 | 0.897 | 0.499 |
| 3.8500 | 0.166 | 0.375 | 0.914 | 0.503 |
| 3.9000 | 0.167 | 0.384 | 0.931 | 0.507 |
| 3.9500 | 0.168 | 0.392 | 0.948 | 0.510 |
| 4.0000 | 0.170 | 0.401 | 0.964 | 0.514 |
| 4.0500 | 0.171 | 0.409 | 0.980 | 0.518 |
| 4.1000 | 0.172 | 0.418 | 0.996 | 0.522 |

| | | | | |
|---|---|---|---|---|
| 4.1500 | 0.173 | 0.426 | 1.011 | 0.525 |
| 4.2000 | 0.175 | 0.435 | 1.026 | 0.529 |
| 4.2500 | 0.176 | 0.444 | 1.041 | 0.533 |
| 4.3000 | 0.177 | 0.453 | 1.056 | 0.537 |
| 4.3500 | 0.178 | 0.462 | 1.071 | 0.541 |
| 4.4000 | 0.180 | 0.471 | 1.085 | 0.544 |
| 4.4500 | 0.181 | 0.480 | 1.099 | 0.548 |
| 4.5000 | 0.182 | 0.489 | 1.113 | 0.552 |

# *Analysis Results*
## *POC 1*




\+ Predeveloped  x Mitigated

Predeveloped Landuse Totals for POC #1
Total Pervious Area: 4.964
Total Impervious Area: 0.049

Mitigated Landuse Totals for POC #1
Total Pervious Area: 1.978
Total Impervious Area: 2.923

Flow Frequency Method: Log Pearson Type III 17B

Flow Frequency Return Periods for Predeveloped. POC #1

| **Return Period** | **Flow(cfs)** |
|---|---|
| 2 year | 0.029094 |
| 5 year | 0.060715 |
| 10 year | 0.095125 |
| 25 year | 0.161581 |
| 50 year | 0.234162 |
| 100 year | 0.333419 |

Flow Frequency Return Periods for Mitigated. POC #1

| **Return Period** | **Flow(cfs)** |
|---|---|
| 2 year | 0.016207 |
| 5 year | 0.040919 |
| 10 year | 0.071286 |
| 25 year | 0.136263 |
| 50 year | 0.213699 |
| 100 year | 0.327281 |

## Annual Peaks

Annual Peaks for Predeveloped and Mitigated. POC #1

| Year | Predeveloped | Mitigated |
|---|---|---|
| 1956 | 0.039 | 0.029 |
| 1957 | 0.034 | 0.032 |
| 1958 | 0.018 | 0.010 |
| 1959 | 0.025 | 0.021 |
| 1960 | 0.030 | 0.026 |
| 1961 | 0.026 | 0.015 |
| 1962 | 0.021 | 0.007 |
| 1963 | 0.064 | 0.092 |
| 1964 | 0.050 | 0.070 |
| 1965 | 0.027 | 0.024 |
| 1966 | 0.015 | 0.006 |
| 1967 | 0.043 | 0.024 |
| 1968 | 0.018 | 0.012 |
| 1969 | 0.015 | 0.006 |
| 1970 | 0.016 | 0.006 |
| 1971 | 0.204 | 0.118 |
| 1972 | 0.077 | 0.050 |
| 1973 | 0.016 | 0.006 |
| 1974 | 0.035 | 0.020 |
| 1975 | 0.029 | 0.016 |
| 1976 | 0.044 | 0.024 |
| 1977 | 0.037 | 0.014 |
| 1978 | 0.059 | 0.078 |
| 1979 | 0.031 | 0.023 |
| 1980 | 0.021 | 0.010 |
| 1981 | 0.031 | 0.030 |
| 1982 | 0.044 | 0.042 |
| 1983 | 0.047 | 0.019 |
| 1984 | 0.023 | 0.016 |
| 1985 | 0.031 | 0.012 |
| 1986 | 0.054 | 0.064 |
| 1987 | 0.056 | 0.035 |
| 1988 | 0.016 | 0.006 |
| 1989 | 0.016 | 0.006 |
| 1990 | 0.024 | 0.015 |
| 1991 | 0.245 | 0.201 |
| 1992 | 1.272 | 0.654 |
| 1993 | 0.160 | 0.090 |
| 1994 | 0.019 | 0.007 |
| 1995 | 0.031 | 0.011 |
| 1996 | 0.040 | 0.027 |
| 1997 | 0.058 | 0.058 |
| 1998 | 0.035 | 0.018 |
| 1999 | 0.021 | 0.009 |
| 2000 | 0.018 | 0.007 |
| 2001 | 0.016 | 0.007 |
| 2002 | 0.019 | 0.008 |
| 2003 | 0.015 | 0.006 |
| 2004 | 0.020 | 0.007 |
| 2005 | 0.013 | 0.005 |
| 2006 | 0.020 | 0.008 |
| 2007 | 0.020 | 0.008 |
| 2008 | 0.018 | 0.007 |
| 2009 | 0.024 | 0.012 |
| 2010 | 0.031 | 0.017 |
| 2011 | 0.018 | 0.010 |

## Ranked Annual Peaks

Ranked Annual Peaks for Predeveloped and Mitigated.  POC #1

| Rank | Predeveloped | Mitigated |
|---|---|---|
| 1 | 1.2717 | 0.6542 |
| 2 | 0.2449 | 0.2008 |
| 3 | 0.2037 | 0.1181 |
| 4 | 0.1602 | 0.0916 |
| 5 | 0.0773 | 0.0897 |
| 6 | 0.0643 | 0.0778 |
| 7 | 0.0586 | 0.0705 |
| 8 | 0.0579 | 0.0641 |
| 9 | 0.0559 | 0.0584 |
| 10 | 0.0536 | 0.0503 |
| 11 | 0.0502 | 0.0419 |
| 12 | 0.0475 | 0.0353 |
| 13 | 0.0444 | 0.0320 |
| 14 | 0.0444 | 0.0299 |
| 15 | 0.0434 | 0.0285 |
| 16 | 0.0397 | 0.0272 |
| 17 | 0.0393 | 0.0257 |
| 18 | 0.0369 | 0.0244 |
| 19 | 0.0351 | 0.0242 |
| 20 | 0.0350 | 0.0239 |
| 21 | 0.0342 | 0.0231 |
| 22 | 0.0314 | 0.0205 |
| 23 | 0.0313 | 0.0205 |
| 24 | 0.0312 | 0.0186 |
| 25 | 0.0307 | 0.0178 |
| 26 | 0.0306 | 0.0166 |
| 27 | 0.0303 | 0.0162 |
| 28 | 0.0290 | 0.0161 |
| 29 | 0.0272 | 0.0153 |
| 30 | 0.0257 | 0.0145 |
| 31 | 0.0254 | 0.0143 |
| 32 | 0.0241 | 0.0120 |
| 33 | 0.0236 | 0.0117 |
| 34 | 0.0230 | 0.0116 |
| 35 | 0.0214 | 0.0115 |
| 36 | 0.0213 | 0.0103 |
| 37 | 0.0212 | 0.0101 |
| 38 | 0.0200 | 0.0100 |
| 39 | 0.0198 | 0.0085 |
| 40 | 0.0196 | 0.0081 |
| 41 | 0.0193 | 0.0081 |
| 42 | 0.0190 | 0.0075 |
| 43 | 0.0184 | 0.0075 |
| 44 | 0.0183 | 0.0074 |
| 45 | 0.0183 | 0.0073 |
| 46 | 0.0181 | 0.0072 |
| 47 | 0.0179 | 0.0071 |
| 48 | 0.0165 | 0.0065 |
| 49 | 0.0163 | 0.0064 |
| 50 | 0.0158 | 0.0064 |
| 51 | 0.0158 | 0.0062 |
| 52 | 0.0158 | 0.0061 |
| 53 | 0.0152 | 0.0060 |
| 54 | 0.0147 | 0.0060 |

| | | |
|---|---|---|
| 55 | 0.0145 | 0.0057 |
| 56 | 0.0129 | 0.0052 |

## LID Duration Flows

The Facility PASSED

| Flow(cfs) | Predev | Mit | Percentage | Pass/Fail |
|---|---|---|---|---|
| 0.0023 | 67233 | 15029 | 22 | Pass |
| 0.0025 | 63483 | 13317 | 20 | Pass |
| 0.0026 | 60027 | 11862 | 19 | Pass |
| 0.0027 | 56787 | 10576 | 18 | Pass |
| 0.0028 | 53822 | 9419 | 17 | Pass |
| 0.0029 | 51034 | 8465 | 16 | Pass |
| 0.0031 | 48363 | 7589 | 15 | Pass |
| 0.0032 | 45830 | 6798 | 14 | Pass |
| 0.0033 | 43493 | 6103 | 14 | Pass |
| 0.0034 | 41294 | 5502 | 13 | Pass |
| 0.0036 | 39193 | 4958 | 12 | Pass |
| 0.0037 | 37210 | 4514 | 12 | Pass |
| 0.0038 | 35325 | 4094 | 11 | Pass |
| 0.0039 | 33577 | 3741 | 11 | Pass |
| 0.0041 | 31928 | 3421 | 10 | Pass |
| 0.0042 | 30357 | 3155 | 10 | Pass |
| 0.0043 | 28904 | 2910 | 10 | Pass |
| 0.0044 | 27490 | 2690 | 9 | Pass |
| 0.0045 | 26135 | 2500 | 9 | Pass |
| 0.0047 | 24859 | 2293 | 9 | Pass |
| 0.0048 | 23642 | 2129 | 9 | Pass |
| 0.0049 | 22503 | 1977 | 8 | Pass |
| 0.0050 | 21442 | 1853 | 8 | Pass |
| 0.0052 | 20421 | 1731 | 8 | Pass |
| 0.0053 | 19522 | 1622 | 8 | Pass |
| 0.0054 | 18625 | 1532 | 8 | Pass |
| 0.0055 | 17725 | 1442 | 8 | Pass |
| 0.0057 | 16887 | 1355 | 8 | Pass |
| 0.0058 | 16095 | 1270 | 7 | Pass |
| 0.0059 | 15316 | 1219 | 7 | Pass |
| 0.0060 | 14629 | 1170 | 7 | Pass |
| 0.0062 | 13912 | 1110 | 7 | Pass |
| 0.0063 | 13288 | 1056 | 7 | Pass |
| 0.0064 | 12687 | 1009 | 7 | Pass |
| 0.0065 | 12153 | 959 | 7 | Pass |
| 0.0066 | 11634 | 918 | 7 | Pass |
| 0.0068 | 11094 | 870 | 7 | Pass |
| 0.0069 | 10601 | 826 | 7 | Pass |
| 0.0070 | 10146 | 787 | 7 | Pass |
| 0.0071 | 9688 | 753 | 7 | Pass |
| 0.0073 | 9239 | 723 | 7 | Pass |
| 0.0074 | 8828 | 691 | 7 | Pass |
| 0.0075 | 8443 | 662 | 7 | Pass |
| 0.0076 | 8080 | 636 | 7 | Pass |
| 0.0078 | 7737 | 614 | 7 | Pass |
| 0.0079 | 7397 | 595 | 8 | Pass |
| 0.0080 | 7051 | 577 | 8 | Pass |
| 0.0081 | 6745 | 561 | 8 | Pass |
| 0.0083 | 6458 | 547 | 8 | Pass |
| 0.0084 | 6166 | 527 | 8 | Pass |
| 0.0085 | 5901 | 515 | 8 | Pass |
| 0.0086 | 5655 | 494 | 8 | Pass |
| 0.0087 | 5396 | 483 | 8 | Pass |

| | | | | |
|---|---|---|---|---|
| 0.0089 | 5150 | 470 | 9 | Pass |
| 0.0090 | 4962 | 462 | 9 | Pass |
| 0.0091 | 4764 | 449 | 9 | Pass |
| 0.0092 | 4573 | 438 | 9 | Pass |
| 0.0094 | 4389 | 430 | 9 | Pass |
| 0.0095 | 4216 | 420 | 9 | Pass |
| 0.0096 | 4035 | 411 | 10 | Pass |
| 0.0097 | 3878 | 402 | 10 | Pass |
| 0.0099 | 3723 | 392 | 10 | Pass |
| 0.0100 | 3582 | 380 | 10 | Pass |
| 0.0101 | 3448 | 371 | 10 | Pass |
| 0.0102 | 3326 | 367 | 11 | Pass |
| 0.0104 | 3187 | 360 | 11 | Pass |
| 0.0105 | 3075 | 349 | 11 | Pass |
| 0.0106 | 2955 | 338 | 11 | Pass |
| 0.0107 | 2835 | 330 | 11 | Pass |
| 0.0108 | 2735 | 321 | 11 | Pass |
| 0.0110 | 2639 | 315 | 11 | Pass |
| 0.0111 | 2551 | 311 | 12 | Pass |
| 0.0112 | 2447 | 309 | 12 | Pass |
| 0.0113 | 2366 | 308 | 13 | Pass |
| 0.0115 | 2282 | 302 | 13 | Pass |
| 0.0116 | 2223 | 296 | 13 | Pass |
| 0.0117 | 2152 | 290 | 13 | Pass |
| 0.0118 | 2074 | 287 | 13 | Pass |
| 0.0120 | 2021 | 281 | 13 | Pass |
| 0.0121 | 1951 | 276 | 14 | Pass |
| 0.0122 | 1870 | 271 | 14 | Pass |
| 0.0123 | 1806 | 268 | 14 | Pass |
| 0.0124 | 1742 | 264 | 15 | Pass |
| 0.0126 | 1679 | 259 | 15 | Pass |
| 0.0127 | 1627 | 256 | 15 | Pass |
| 0.0128 | 1581 | 253 | 16 | Pass |
| 0.0129 | 1529 | 247 | 16 | Pass |
| 0.0131 | 1477 | 246 | 16 | Pass |
| 0.0132 | 1437 | 242 | 16 | Pass |
| 0.0133 | 1389 | 242 | 17 | Pass |
| 0.0134 | 1342 | 239 | 17 | Pass |
| 0.0136 | 1311 | 236 | 18 | Pass |
| 0.0137 | 1265 | 232 | 18 | Pass |
| 0.0138 | 1231 | 226 | 18 | Pass |
| 0.0139 | 1202 | 221 | 18 | Pass |
| 0.0141 | 1168 | 220 | 18 | Pass |
| 0.0142 | 1140 | 220 | 19 | Pass |
| 0.0143 | 1116 | 216 | 19 | Pass |
| 0.0144 | 1079 | 207 | 19 | Pass |
| 0.0145 | 1050 | 200 | 19 | Pass |

## Duration Flows

The Facility PASSED

| Flow(cfs) | Predev | Mit | Percentage | Pass/Fail |
|---|---|---|---|---|
| 0.0145 | 1050 | 200 | 19 | Pass |
| 0.0168 | 647 | 152 | 23 | Pass |
| 0.0190 | 415 | 130 | 31 | Pass |
| 0.0212 | 278 | 111 | 39 | Pass |
| 0.0234 | 202 | 90 | 44 | Pass |
| 0.0256 | 160 | 82 | 51 | Pass |
| 0.0279 | 140 | 75 | 53 | Pass |
| 0.0301 | 121 | 65 | 53 | Pass |
| 0.0323 | 95 | 56 | 58 | Pass |
| 0.0345 | 84 | 52 | 61 | Pass |
| 0.0367 | 75 | 46 | 61 | Pass |
| 0.0389 | 65 | 41 | 63 | Pass |
| 0.0412 | 61 | 40 | 65 | Pass |
| 0.0434 | 54 | 37 | 68 | Pass |
| 0.0456 | 49 | 37 | 75 | Pass |
| 0.0478 | 47 | 37 | 78 | Pass |
| 0.0500 | 43 | 33 | 76 | Pass |
| 0.0523 | 40 | 31 | 77 | Pass |
| 0.0545 | 37 | 30 | 81 | Pass |
| 0.0567 | 36 | 29 | 80 | Pass |
| 0.0589 | 32 | 27 | 84 | Pass |
| 0.0611 | 31 | 27 | 87 | Pass |
| 0.0634 | 29 | 26 | 89 | Pass |
| 0.0656 | 27 | 25 | 92 | Pass |
| 0.0678 | 27 | 25 | 92 | Pass |
| 0.0700 | 26 | 23 | 88 | Pass |
| 0.0722 | 24 | 22 | 91 | Pass |
| 0.0744 | 24 | 21 | 87 | Pass |
| 0.0767 | 23 | 21 | 91 | Pass |
| 0.0789 | 22 | 20 | 90 | Pass |
| 0.0811 | 22 | 19 | 86 | Pass |
| 0.0833 | 22 | 19 | 86 | Pass |
| 0.0855 | 22 | 19 | 86 | Pass |
| 0.0878 | 22 | 18 | 81 | Pass |
| 0.0900 | 21 | 17 | 80 | Pass |
| 0.0922 | 21 | 15 | 71 | Pass |
| 0.0944 | 21 | 15 | 71 | Pass |
| 0.0966 | 21 | 15 | 71 | Pass |
| 0.0988 | 21 | 15 | 71 | Pass |
| 0.1011 | 21 | 15 | 71 | Pass |
| 0.1033 | 20 | 15 | 75 | Pass |
| 0.1055 | 20 | 15 | 75 | Pass |
| 0.1077 | 17 | 15 | 88 | Pass |
| 0.1099 | 17 | 15 | 88 | Pass |
| 0.1122 | 17 | 15 | 88 | Pass |
| 0.1144 | 17 | 15 | 88 | Pass |
| 0.1166 | 17 | 15 | 88 | Pass |
| 0.1188 | 17 | 14 | 82 | Pass |
| 0.1210 | 17 | 14 | 82 | Pass |
| 0.1232 | 17 | 14 | 82 | Pass |
| 0.1255 | 17 | 14 | 82 | Pass |
| 0.1277 | 17 | 14 | 82 | Pass |
| 0.1299 | 17 | 13 | 76 | Pass |

| | | | | |
|---|---|---|---|---|
| 0.1321 | 17 | 12 | 70 | Pass |
| 0.1343 | 17 | 11 | 64 | Pass |
| 0.1366 | 17 | 11 | 64 | Pass |
| 0.1388 | 17 | 11 | 64 | Pass |
| 0.1410 | 17 | 11 | 64 | Pass |
| 0.1432 | 17 | 11 | 64 | Pass |
| 0.1454 | 17 | 11 | 64 | Pass |
| 0.1476 | 17 | 11 | 64 | Pass |
| 0.1499 | 17 | 9 | 52 | Pass |
| 0.1521 | 17 | 9 | 52 | Pass |
| 0.1543 | 16 | 9 | 56 | Pass |
| 0.1565 | 16 | 9 | 56 | Pass |
| 0.1587 | 15 | 9 | 60 | Pass |
| 0.1610 | 14 | 9 | 64 | Pass |
| 0.1632 | 14 | 9 | 64 | Pass |
| 0.1654 | 13 | 9 | 69 | Pass |
| 0.1676 | 13 | 9 | 69 | Pass |
| 0.1698 | 13 | 9 | 69 | Pass |
| 0.1720 | 11 | 9 | 81 | Pass |
| 0.1743 | 11 | 9 | 81 | Pass |
| 0.1765 | 11 | 9 | 81 | Pass |
| 0.1787 | 11 | 9 | 81 | Pass |
| 0.1809 | 11 | 9 | 81 | Pass |
| 0.1831 | 11 | 8 | 72 | Pass |
| 0.1854 | 11 | 8 | 72 | Pass |
| 0.1876 | 11 | 8 | 72 | Pass |
| 0.1898 | 10 | 8 | 80 | Pass |
| 0.1920 | 10 | 7 | 70 | Pass |
| 0.1942 | 10 | 7 | 70 | Pass |
| 0.1965 | 10 | 7 | 70 | Pass |
| 0.1987 | 10 | 7 | 70 | Pass |
| 0.2009 | 10 | 7 | 70 | Pass |
| 0.2031 | 10 | 6 | 60 | Pass |
| 0.2053 | 9 | 6 | 66 | Pass |
| 0.2075 | 9 | 5 | 55 | Pass |
| 0.2098 | 9 | 5 | 55 | Pass |
| 0.2120 | 9 | 5 | 55 | Pass |
| 0.2142 | 9 | 5 | 55 | Pass |
| 0.2164 | 9 | 5 | 55 | Pass |
| 0.2186 | 8 | 5 | 62 | Pass |
| 0.2209 | 7 | 5 | 71 | Pass |
| 0.2231 | 7 | 5 | 71 | Pass |
| 0.2253 | 7 | 5 | 71 | Pass |
| 0.2275 | 7 | 5 | 71 | Pass |
| 0.2297 | 7 | 5 | 71 | Pass |
| 0.2319 | 7 | 5 | 71 | Pass |
| 0.2342 | 7 | 5 | 71 | Pass |

## Water Quality

Water Quality BMP Flow and Volume for POC #1

| | |
|---|---|
| On-line facility volume: | 0 acre-feet |
| On-line facility target flow: | 0 cfs. |
| Adjusted for 15 min: | 0 cfs. |
| Off-line facility target flow: | 0 cfs. |
| Adjusted for 15 min: | 0 cfs. |

Not applicable

# LID Report

| LID Technique | Used for Treatment ? | Total Volume Needs Treatment (ac-ft) | Volume Through Facility (ac-ft) | Infiltration Volume (ac-ft) | Cumulative Volume Infiltration Credit | Percent Volume Infiltrated | Water Quality | Percent Water Quality Treated | Comment |
|---|---|---|---|---|---|---|---|---|---|
| Trench D POC | ☐ | 62.17 | | | ☐ | 100.00 | | | |
| Trench A POC | ☐ | 86.12 | | | ☐ | 100.00 | | | |
| Trench C POC | ☐ | 40.51 | | | ☐ | 100.00 | | | |
| Trench B South POC | ☐ | 51.17 | | | ☐ | 100.00 | | | |
| Trench B North POC | ☐ | 37.36 | | | ☐ | 100.00 | | | |
| Trench Office POC | ☐ | 9.94 | | | ☐ | 100.00 | | | |
| Bioretention Pond POC | ☑ | 233.88 | 257.01 | 257.01 | ☑ | 100.00 | 257.01 | 100.00 | Treat. Credit |
| Total Volume Infiltrated | | 521.14 | 257.01 | 257.01 | | 100.00 | 257.01 | 257 / 257 = 100% | Treat. Credit = 100% |
| Compliance with LID Standard 8% of 2-yr to 50% of 2-yr | | | | | | | | | Duration Analysis Result = Passed |
| | | | | | | | | | |

# Model Default Modifications

Total of 0 changes have been made.

## PERLND Changes

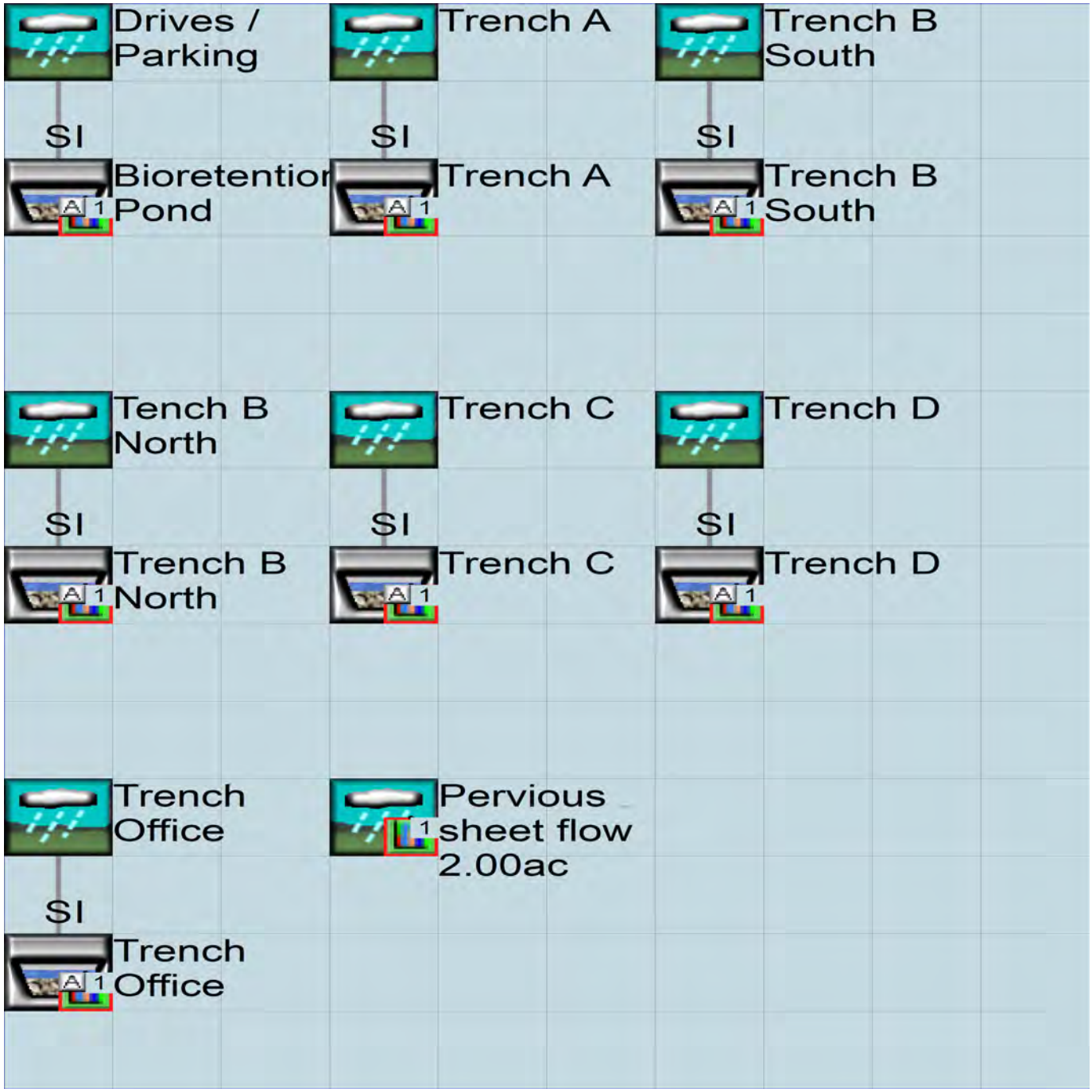
No PERLND changes have been made.

## IMPLND Changes

No IMPLND changes have been made.

# *Appendix*
## *Predeveloped Schematic*

## *Mitigated Schematic*



**Appendix 3**
**Soils Reports**

United States Department of Agriculture

NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

# Custom Soil Resource Report for Thurston County Area, Washington

## The Lodge, 456 Carpenter Rd. SE


March 8, 2023

# Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (https://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

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126—Yelm fine sandy loam, 0 to 3 percent slopes.....11

# Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

# Custom Soil Resource Report
## Soil Map


Map Scale: 1:1,130 if printed on A landscape (11" x 8.5") sheet.

N

Meters
0 15 30 60 90

Feet
0 50 100 200 300

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 10N WGS84

## MAP LEGEND

**Area of Interest (AOI)**
- Area of Interest (AOI)

**Soils**
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

**Special Point Features**
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

**Water Features**
- Streams and Canals

**Transportation**
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

**Background**
- Aerial Photography

## MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Thurston County Area, Washington
Survey Area Data: Version 16, Sep 8, 2022

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Jul 31, 2022—Aug 8, 2022

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

# Map Unit Legend

| Map Unit Symbol | Map Unit Name | Acres in AOI | Percent of AOI |
|---|---|---|---|
| 74 | Nisqually loamy fine sand, 3 to 15 percent slopes | 0.2 | 4.0% |
| 126 | Yelm fine sandy loam, 0 to 3 percent slopes | 4.9 | 96.0% |
| **Totals for Area of Interest** | | **5.1** | **100.0%** |

# Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however,

onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

# Thurston County Area, Washington

## 74—Nisqually loamy fine sand, 3 to 15 percent slopes

### Map Unit Setting

*National map unit symbol:* 2ndc9
*Elevation:* 160 to 1,310 feet
*Mean annual precipitation:* 40 to 60 inches
*Mean annual air temperature:* 50 degrees F
*Frost-free period:* 150 to 200 days
*Farmland classification:* Farmland of statewide importance

### Map Unit Composition

*Nisqually and similar soils:* 85 percent
*Minor components:* 5 percent
*Estimates are based on observations, descriptions, and transects of the mapunit.*

### Description of Nisqually

#### Setting

*Landform:* Terraces
*Parent material:* Sandy glacial outwash

#### Typical profile

*H1 - 0 to 5 inches:* loamy fine sand
*H2 - 5 to 31 inches:* loamy fine sand
*H3 - 31 to 60 inches:* loamy sand

#### Properties and qualities

*Slope:* 3 to 15 percent
*Depth to restrictive feature:* More than 80 inches
*Drainage class:* Somewhat excessively drained
*Capacity of the most limiting layer to transmit water (Ksat):* High (1.98 to 5.95 in/hr)
*Depth to water table:* More than 80 inches
*Frequency of flooding:* None
*Frequency of ponding:* None
*Available water supply, 0 to 60 inches:* Low (about 4.9 inches)

#### Interpretive groups

*Land capability classification (irrigated):* None specified
*Land capability classification (nonirrigated):* 3e
*Hydrologic Soil Group:* A
*Ecological site:* R002XA006WA - Puget Lowlands Prairie
*Forage suitability group:* Droughty Soils (G002XS401WA)
*Other vegetative classification:* Droughty Soils (G002XS401WA)
*Hydric soil rating:* No

### Minor Components

#### Yelm

*Percent of map unit:* 3 percent
*Hydric soil rating:* No

#### Norma

*Percent of map unit:* 2 percent

*Landform:* Depressions
*Other vegetative classification:* Wet Soils (G002XS101WA)
*Hydric soil rating:* Yes

## 126—Yelm fine sandy loam, 0 to 3 percent slopes

### Map Unit Setting

*National map unit symbol:* 2nd88
*Elevation:* 80 to 980 feet
*Mean annual precipitation:* 30 to 60 inches
*Mean annual air temperature:* 50 degrees F
*Frost-free period:* 170 to 200 days
*Farmland classification:* All areas are prime farmland

### Map Unit Composition

*Yelm and similar soils:* 85 percent
*Minor components:* 13 percent
*Estimates are based on observations, descriptions, and transects of the mapunit.*

### Description of Yelm

#### Setting

*Landform:* Outwash terraces
*Parent material:* Glacial outwash

#### Typical profile

*H1 - 0 to 8 inches:* fine sandy loam
*H2 - 8 to 46 inches:* fine sandy loam
*H3 - 46 to 60 inches:* loamy sand

#### Properties and qualities

*Slope:* 0 to 3 percent
*Depth to restrictive feature:* More than 80 inches
*Drainage class:* Moderately well drained
*Capacity of the most limiting layer to transmit water (Ksat):* High (1.98 to 5.95 in/hr)
*Depth to water table:* About 18 to 36 inches
*Frequency of flooding:* None
*Frequency of ponding:* None
*Available water supply, 0 to 60 inches:* High (about 11.0 inches)

#### Interpretive groups

*Land capability classification (irrigated):* 3w
*Land capability classification (nonirrigated):* 3w
*Hydrologic Soil Group:* B
*Ecological site:* F002XA005WA - Puget Lowlands Moist Forest
*Forage suitability group:* Seasonally Wet Soils (G002XS201WA)
*Other vegetative classification:* Seasonally Wet Soils (G002XS201WA)
*Hydric soil rating:* No

**Minor Components**

**Everson, undrained**

*Percent of map unit:* 5 percent
*Landform:* Depressions
*Other vegetative classification:* Wet Soils (G002XS101WA)
*Hydric soil rating:* Yes

**Norma**

*Percent of map unit:* 5 percent
*Landform:* Depressions
*Other vegetative classification:* Wet Soils (G002XS101WA)
*Hydric soil rating:* Yes

**Skipopa**

*Percent of map unit:* 3 percent
*Other vegetative classification:* Seasonally Wet Soils (G002XN202WA)
*Hydric soil rating:* No

# Geotechnical Report

## Serenity Apartments – The Lodge

## 456 Carpenter Road SE
## Lacey, Washington 98503

Prepared For:

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7843 Old Highway 99 SE, Suite M-5
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2/8/23

**February 8, 2023**

**PTI Project # 220073**

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# 1.0 INTRODUCTION

Pacific Testing & Inspection, Inc. (PTI) has completed a geotechnical investigation for the planned second phase of Serenity Apartments – The Lodge.

A recent geotechnical evaluation of the project was conducted by PTI on December 20th and 21st, 2022. During this site visit, surface and subsurface conditions were assessed. After completion of the field work, laboratory work, and applicable project research, PTI prepared this geotechnical report. At a minimum, this report conforms to the requirements outlined in the International Building Code (IBC) Sections 1603.1.6 and 1803.6.

As presented herein, this report includes information pertaining to the project in this Introduction Section; field methods and soil descriptions in the Subsurface Investigation Section; and, supporting documentation with relation to the aforesaid IBC sections and project requirements in the Engineering Conclusions and Recommendations Section.

## 1.1 Project Information

Information pertaining to the planned development of the project was provided by the proponent of the property. The planned development consists of multi-story, high density housing development extension of the Serenity Apartments which includes paved ingress/ egress/ parking, drainage facilities, and other ancillary features.

## 1.2 Purpose of Investigation and Scope of Work

The purpose of this geotechnical investigation is to minimally address the reporting requirements outlined in the IBC, and further evaluate the project as necessary with respect to geotechnical constraints in order to provide recommendations that should be implemented during development.

In order to fulfill the purpose of investigation, the geotechnical program completed for the proposed improvements of the project include:

- Review project information provided by the proponent of the project;
- Conduct a site visit to document the site conditions that may influence the construction and performance of the proposed improvements of the project;
- Define general subsurface conditions of the site by observing subsoils within twelve (12) test pits, review geological and other soil mapping for the general area, research published references concerning earthquake/ slope/ erosion hazards, and review any other pertinent documents near the project;
- Collect bulk samples as necessary, at various depths and locations;
- Perform laboratory testing to determine selected index and/or engineering properties of the site soils;
- Complete an engineering analysis supported by the planned site alterations, and the surface and subsurface conditions that were identified by the field investigation, soil testing, and applicable project research; and,
- Establish conclusions based on findings, and make recommendations for foundations, drainage, pavements, earthwork construction requirements, and other considerations as outlined in this report.

## 2.0 SUBSURFACE INVESTIGATION

Information on subsurface conditions pertaining to the project was primarily gathered on December 20th, and 21st, 2022 by a representative with PTI. Applicable information on field methods, sampling, field testing, general geologic conditions, specific subsurface conditions, and results from soil testing are presented in this section of the report. Appendix A of this report includes pertinent information on subsurface conditions for the project, such as boring logs.

### 2.1 Field Methods, Sampling and Field Testing

Information on subsurface conditions for the project was accomplished by examining soils within 12 test pits extending to depths of up to 13 feet below the existing ground surface. Deeper test pits were not feasible due to caving of the sidewalls. See the Test Pit Location Map in Appendix A.

Soil samples were obtained from this project and utilized for laboratory testing as necessary. PTI evaluated the relative density of the near-surface in-situ soils by gauging the resistance of the excavation equipment.

### 2.2 Soil Profile

The following subsurface conditions are estimated descriptions of the project subgrade utilizing information from the depth of penetration at all testing, sampling, observed and investigated locations. Soils for this project were primarily described utilizing the Unified Soil Classification System (USCS) and the Soil Conservation Service (SCS) descriptions.

Within test pit locations, fill was encountered within the three of our test pits to a depth of up to 2.5 feet below the current ground surface. The three test pits with fill were primarily within the northern and middle third of the property. Native soils within the upper 13 feet were predominantly a varying conglomerate of silt, sand and gravel (GP, GM, SM), and ranged from loose near the surface to dense/ very dense below. Expanded and specific subsurface descriptions, other than what is provided in this section, are provided in the soil logs located in Appendix B of this report.

Visual classifications were performed in the field in accordance with the American Standards for Testing and Materials (ASTM) D2488. Laboratory testing was performed in order to further classify soils at selected locations and depths.

The soil samples obtained at the project site during the field investigation were preserved and transported for laboratory testing. The following soil tests were performed in accordance with the American Standards for Testing and Materials (ASTM):

23 Particle Size Analyses (ASTM D422); and,
23 Moisture Contents (ASTM D2216).

The results from the sieve analysis and moisture content tests, performed by PTI, are provided in Appendix C of this report.

#### 2.3.1 Groundwater

Groundwater was not encountered within any of our test pits that were excavated up to 13 feet below the existing ground surface. PTI reviewed nearby subsurface investigations and

water well reports. Shallow perched groundwater has been recorded as little as 19 feet below the ground surface where glacial till is present. Permanent groundwater was recorded to range from 45 to 85 feet below the ground surface.

### 2.3.2 Infiltration Rates and Cation Exchange Rate

Infiltration rates are based on the Soil Grain Size Analysis Method as outlined in the 2022 City of Lacey Stormwater Design Manual. PTI accounted for the most conservative value found within the upper 5 feet of soils for pervious pavement areas. Infiltration pond areas, are also conservative, assuming the pond bottom is approximately 2 feet below the existing ground surface. Washington. Based on soil characteristics and the aforesaid drainage manual, infiltration was determined to be the following:

$Log_{10}(K_{sat}) = -1.57+1.90D_{10} + 0.015D_{60} – 0.013D_{90} – 2.08f_{fines}$

$K_{sat}$ = saturated hydraulic conductivity, cm/sec
$D_{10}$ = soil sample 10% finer by weight, mm
$D_{60}$ = soil sample 60% finer by weight, mm
$D_{90}$ = soil sample 90% finer by weight, mm
$f_{fines}$ = soil fraction passing #200 seive, by weight, mm

**Pervious Pavement**

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Log10(Ksat) = -1.57+1.90( | 0.04 | ) + 0.015( | 26.62 | ) – 0.013( | 41 | ) – 2.08( | 0.176 | ) = | -1.99378 | |
| Ksat = 10^( | -1.99378 | ) cm/sec | | Ksat = | 14.38 | in/hr | | | | |
| Ksat design = Ksat x CFT | | | | | | | | | | |
| CFT = CFV * CFt * CFm | | | | | | | | | | |
| | Ksat = | 14.38 | in/hr | | | | | | | |
| | CFV = | 1.0 | (0.33 to 1.0) site variability and number of test locations | | | | | | | |
| | CFt = | 0.4 | (0.4) grain size test method | | | | | | | |
| | CFm = | 0.9 | (0.9) degree of influent control | | | | | | | |
| | **$K_{sat\ design}$ =** | | **5.18** | **in/hr** | | | | | | |

**Bioretention facility - 3'-5'**

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Log10(Ksat) = -1.57+1.90( | 0.02 | ) + 0.015( | 0.33 | ) – 0.013( | 6 | ) – 2.08( | 0.44 | ) = | -2.52025 | | |
| Ksat = 10^( | -2.52025 | ) cm/sec | | Ksat = | 4.278 | in/hr | | | | | |
| Ksat design = Ksat x CFT | | | | | | | | | | | |
| CFT = CFV * CFt * CFm | | | | | | | | | | | |
| | | $K_{sat}$ = **4.28** | **in/hr** | | | | | | | | |

**Bioretention Facility - 5'-8'**

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Log10(Ksat) = -1.57+1.90( | 0.11 | ) + 0.015( | 12.66 | ) – 0.013( | 16.5 | ) – 2.08( | 0.089 | ) = | -1.57072 | | |
| Ksat = 10^( | -1.57072 | ) cm/sec | | Ksat = | 38.08 | in/hr | | | | | |
| Ksat design = Ksat x CFT | | | | | | | | | | | |
| CFT = CFV * CFt * CFm | | | | | | | | | | | |
| | | $K_{sat}$ = **38.08** | **in/hr** | | | | | | | | |

**Design Infiltration Rate for Bioretention Facility:**

**Detention Pond: Ksat design = 6ft/((2ft/4.28 in/hr)+(3ft/38.08 in/hr)) = 11.0 in/hr**

Note: Factors of safety for the bioretention facility were eliminated based on page 7-59 of the stormwater manual – "Assignment of Appropriate Safety Factor."

**Infiltration Trench**

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Log10(Ksat) = -1.57+1.90( | 0.23 | ) + 0.015( | 12.58 | ) – 0.013( | 51 | ) – 2.08( | 0.079 | ) = | -1.77162 | |
| Ksat = 10^( | -1.77162 | ) cm/sec | | Ksat = | 23.98 | in/hr | | | | |
| Ksat design = Ksat x CFT | | | | | | | | | | |
| CFT = CFV * CFt * CFm | | | | | | | | | | |
| | Ksat = | 23.98 | in/hr | | | | | | | |
| | CFV = | 1.0 | (0.33 to 1.0) site variability and number of test locations | | | | | | | |
| | CFt = | 0.4 | (0.4) grain size test method | | | | | | | |
| | CFm = | 1.0 | degree of influent control | | | | | | | |
| | $K_{sat\ design}$ = | | **9.59** | **in/hr** | | | | | | |

**Cation Exchange Rate**

Water quality for this project may be achieved by the soil subgrade beneath proposed water storage areas. The Cation-Exchange Capacity (CEC) of the soils were tested by Libby Environmental and determined to range from 5.25 meq/100g to 213 meq/100g. See Appendix C for laboratory results.

**Organic Content**

Organic content of as tested on 6 soil samples in our laboratory per ASTM D2974 ranged from 0.85% to 2.55%. See Appendix C for complete laboratory results.

## 3.0 ENGINEERING CONCLUSIONS & RECOMMENDATIONS

The following section includes seismic considerations, erosion, building foundations, earthwork, retaining walls, and drainage recommendations.

### 3.1 Slope Stability

According to the "Interactive Geologic Map, 1:100,000 Quadrangle," as depicted by the Department of Natural Resources, this project does not have a mapped landslide or liquefaction hazard. Based on the mapped conditions, soil characteristics, minor sloping grades, observed surface conditions, and other pertinent information, it is our opinion that the proposed development is not subject to a landslide hazard, and the development may commence in accordance with the recommendations in this geotechnical report.

### 3.2 Seismic Considerations and Liquefaction

The nearest Class 'A' or Class 'B' fault to this property is the Olympia Structure and is over 2 miles from the parcel to the southwest. This information is based on the USGS Quaternary Fault and Fold Database for the United States with the following description:

**Fault Name:** Olympia structure (class B)
**Fault System:** Olympia structure (class B)
**Geologic Age (Years):** unknown
**Geologic Age Description:** insufficient data to determine age (class B)
**Fault Detection Method:** geophysical lineament
**Fault Visibility:** inferred fault trace
**Slip Rate (mm per year):**--
**Fault Description:** fault
**USGS Fault ID:**--
**Fault Source URL:**--
**Fault Source Citation:** Brocher, Thomas M.; Parsons, Tom E.; Blakely, Richard J.; Christensen, Nikolas I.; Fisher, Michael A.; Wells, Ray E.; SHIPS Working Group, 2001, Upper crustal structure in Puget Lowland, Washington--Results from the 1998 Seismic Hazards Investigations in Puget Sound: Journal of Geophysical Research, v. 106, no. B7, p. 13,541-13,564.

Soils immediately below the expected foundation depth for this project may use the following seismic parameters:

**Seismic Design Category Code:**D1
**Seismic Design Category (SDC):**Seismic design category D1
**SDC Description:** 0.67 < S(DS) <= 0.83, where S(DS) is the 5 percent damped design spectral response acceleration at short periods

Based on observed and known subsurface conditions in the area, the potential for liquefaction is believed to be low for this project. According to the Interactive Geological Map of Washington, liquefaction hazards are very low within the vicinity of the property.

### 3.3 Erosion

Based on the USCS description of the project soils, the surface soils are considered to have a low to moderate erodibility hazard. According to the Resource Map from the Washington State DNR, the project is not within terrain labeled 'highly erodible.'

It is our opinion that standard erosion control per the drainage engineer or agency requirements is sufficient for the development of this project. Extents of temporary erosion control will mostly depend on the timeliness of construction, moisture content of the soil, and amount of rainfall during construction. Soil erosion typical to the existing site conditions and planned disturbance of the project include wind-borne silts during dry weather, and sediment transport during prolonged wet weather. Sediment transport could be from stormwater runoff or tracking off-site with construction equipment.

Erosion control measures during construction may include stockpiling cleared vegetation, silt fencing, intercepting swales, berms, straw bales, plastic cover or other standard controls. Any erosion control should be located down-slope and beyond the limits of construction and clearing of vegetation where surface water is expected to flow. If the loss of sediments appears to be greater than expected, or erosion control measures are not functioning as needed, additional measures must be implemented immediately.

Permanent erosion control will also be necessary if substantial vegetation has not been established within disturbed areas upon completion of the project. Temporary erosion control should remain in place until permanent erosion control has been established. Permanent erosion control may include promoting the growth of vegetation within the exposed areas by mulching, seeding or an equivalent measure. Additional erosion control measures that should be performed include routine maintenance and replacement, when necessary, of permanent erosion control, vegetation, drainage structures and/or features.

### 3.4 Building Foundation Recommendations

Recommendations provided in this section account for the site development of a typical commercial facility. The recommended allowable bearing capacities and settlements as presented below, consider the probable type of construction as well as the field investigation results by implementing practical engineering judgment within published engineering standards. Evaluations include classifying site soils based on observed field conditions and soil testing for this project. After deriving conservative relative densities, unit weights and angles of internal friction of the in-situ soils, the Terzhagi ultimate bearing capacity equation was utilized for determining foundation width and depth. Foundation parameters provided herein account for typical structural pressures due to the planned type of development. A structural analysis is beyond the scope of a geotechnical report, and a structural engineer may be required to design specific foundations and other structural elements based on the soil investigation.

Stepped foundations are acceptable, if warranted for this project. Continuous, isolated, or stepped foundations shall be horizontally level between the bottom of the foundation and the top of the bearing strata. The frost penetration depth is not expected to extend beyond 12 inches below the ground surface for this project under normal circumstances and anticipated design features.

A modulus of subgrade reaction of no more than 240 pci should be used for the foundation system. Friction between the bottom of the foundation and soil may be utilized to resist lateral loads. A

coefficient of friction of 0.4 may be used for this application and should account for the vertical dead loads only.

Existing in-situ soils for this project indicates that the structure can be established on shallow, continuous or isolated footings. Foundations shall be established on relatively undisturbed native soil that is competent and unyielding. Alternatively, foundations may be constructed on selective re-compacted native soil or compacted engineered fill as described in the Earthwork Construction Recommendations Section of this report.

For a bearing capacity requirement of no more than 2000 psf, a minimum continuous footing width of 18 inches shall be placed at a minimum of 36 inches below the existing ground surface atop prepared subgrade and unyielding soils. Foundation depth may be reduced upon a site inspection by the geotechnical engineer or his assigns. Foundation depth may also be reduced if placed atop engineered fill after removal of the upper unsuitable soils to a depth of 3 feet. In addition, fill soils must be avoided or foundations shall penetrate at least 3 feet below the bottom of the fill or these soils excavated for ensuing structural fill. For a columnar load of no more than 6 tons, a circular or square isolated foundation diameter or width shall be at least 30 inches. Additional loads may be applied to foundations by effectively increasing foundation size by correlating our values per the structural engineer. In addition, ground improvement may commence in order to increase bearing capacity, and subsequently would require additional recommendations from PTI.

Foundation recommendations are made available based on adherence to the remaining recommendations that are provided in this report. Alterations to the aforementioned foundation recommendations may be completed upon a site inspection by a geotechnical engineer after the foundation excavation is completed.

### 3.4.1 Settlement

Total and differential settlement that a structure will undergo depends primarily on the subsurface conditions, type of structure, amount and duration of pressure exerted by the structure, reduction of pore water pressure, and in some instances, the infiltration of free moisture. Based on the expected native soil conditions, anticipated development, and construction abides by the recommendations in this report, the assumed foundation system may undergo a maximum of 1.0 inch total settlement, and a maximum differential settlement of 0.75 inch.

### 3.4.2 Concrete Slabs-on-Grade

Concrete slabs, if utilized, should be supported on a minimum of 6 inches of compacted coarse, granular material (Retained on U.S. Sieve #10 or greater) that is placed over undisturbed, competent native subgrade or engineered fill per the Earthwork Recommendations Section below.

The recommendations for interior concrete slabs-on-grade as presented herein are only relevant for the geotechnical application of this project. Although beyond the scope of this report, concrete slabs should also be designed for structural integrity and environmental reliability. This includes vapor barriers or moisture control for mitigating excessive moisture in the building.

## 3.5 Earthwork Construction Recommendations

Founding material for building foundations shall consist of undisturbed native soils to the specified foundation depths. Compacted engineered fill, or selective re-compacted native soils may be used to the extents provided in this Earthwork Construction Recommendations Section. The following recommendations include excavations, subgrade preparation, type of fill, and placement of fill for building foundations.

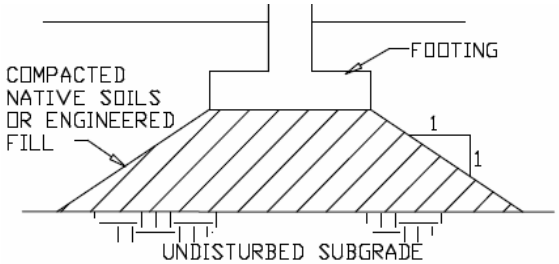
### 3.5.1 Excavation

Excavation is recommended to remove any excessive organic content or other deleterious material, if present, beneath foundations and to achieve appropriate foundation depth. Additional sub-excavation will be required for this project if the soils below the required foundation depth are loose, saturated, not as described in this report, or otherwise incompetent due to inappropriate land disturbing, or excessive water trapped within foundation excavations prior to foundation construction. All soils below the bottom of the excavation shall be competent, and relatively undisturbed or properly compacted fill. If these soils are disturbed or deemed incompetent, re-compaction of these soils below the anticipated footing depth is necessary. Excavations shall be completely dewatered, compacted, and suitable before placement of additional native soil, engineered fill or structural concrete. Subgrades shall be prepared for ensuing structural fill, foundations and slabs by proof rolling with a vibratory steel drum roller or a hand-held jumping jack until firm and unyielding.

### 3.5.2 Placement and Compaction of Native Soils and Engineered Fill

For engineered fill or disturbed native soils that will be utilized as fill material directly beneath foundations, observation and/ or geotechnical testing is required prior to foundation construction. The following placement and compaction requirements are necessary.

For disturbed native soils or engineered fill beneath foundations, limits of compacted or re-compacted fill shall extend laterally from the bottom edge of the foundation at a rate of one horizontal foot for each foot of compacted or re-compacted fill depth beneath the foundation. See the illustration below.




Both engineered fill and native soils used as compacted fill should be free of roots and other organics, rocks over 6 inches in size, or any other deleterious matter. If import material is utilized as structural fill material for placement in building pad areas, we recommend that it meets the current Washington State Department of Transportation

Standard Specification for Road, Bridge and Municipal Construction (WSDOT), Section 9-03(14), for Gravel Borrow. The material should be placed per the recommendation in section 2-06 of WSDOT for sub-grade. Material should be placed in 12 inch vertical lifts and compacted with a vibratory smooth drum roller to achieve 95% of the (ASTM D1557) modified proctor. Each lift surface should be adequately maintained during construction in order to achieve acceptable compaction and inter-lift bonding. Alternative materials may be imported for this project and used for foundation support per the geotechnical engineer.

Temporary earth cuts and temporary fill slopes exceeding 4 feet in height should be limited to a slope of 2:1 (horizontal: vertical). Utility trenches or other confined excavations exceeding 4 feet should conform to OSHA safety regulations. Permanent cut and fill slopes shall be limited to a slope of 2:1, unless otherwise approved by an engineer.

### 3.6 Retaining Walls and Lateral Earth Pressures

Both native soils or engineered fill soils per the requirements previously provided in this geotechnical report may be used for retaining wall foundations. Bearing capacity, foundation depths and all other foundation parameters shall adhere to the Building Foundation recommendations as provided in Section 3.4 of this report.

Lateral Earth Pressures

The lateral earth pressures exerted through the backfill of a retaining wall are dependent upon several factors including height of retained soil behind the wall, type of soil that is retained, degree of backfill compaction, slope of backfill, surcharges, hydrostatic pressures, earthquake pressures, and the direction and distance that the top of the wall moves.

An equivalent fluid unit weight used for structural design may be estimated as the product of the backfill soil unit weight and the earth pressure coefficient for at-rest pressures. Retaining walls should be designed to resist a lateral earth pressure based on an equivalent fluid unit weight of the following:

| | At-Rest | Active |
|---|---|---|
| Native Soils | 55 pcf | 34 pcf |
| Engineered Fill Soils | 45 pcf | 28 pcf |

The values provided above shall be increased by 1 pcf for every 1 degree of backfill/ natural slope angle. These equivalent fluid unit weight values do not include lateral earth pressures induced by earthquakes, groundwater, or surcharges from live loads.

Retaining Wall Backfill

Backfill may consist of engineered fill, as presented in the report, or borrow material approved by a geotechnical engineer. Compaction of these materials shall be achieved in compacted lifts of about 12 inches. Each lift should be uniformly compacted to at least 85%, and no more than 90% of the modified Proctor maximum dry density (ASTM D 1557). If pavement or building loads are planned to be located within retaining wall backfill, then 90% compaction is required. In addition,

heavy construction equipment should be at a distance of at least ½ the wall height. Over-compaction and limiting heavy construction equipment should be prevented to minimize the risk of excess lateral earth pressure on the retaining structure. PTI recommends that retaining wall backfill is compacted with light equipment such as a hand-held power tamper. If clean, coarse gravel soils are utilized as engineered fill, and surcharges will not influence the retaining wall, compaction may be achieved by reasonably densifying granular soils with construction equipment.

### 3.7 Surface and Subsurface Drainage

Positive drainage should be provided in the final design for all planned residential buildings. Drainage shall include sloping the ground surface, driveways and sidewalks away from the project structures. All constructed surface and subsurface drains should be adequately maintained during the life of the structure. If drainage problems occur during or after construction, additional engineered water mitigation will be required immediately. This may include a combination of swales, berms, drainpipes, infiltration facilities, or outlet protection in order to divert water away from the structures to an appropriate protected discharge area. Leakage of water pipes, both drainage and supply lines, shall be prevented at all times.

Subsurface water intercepted in the footing perimeter drains, and stormwater collected from roof drains shall be separately tight lined to drainage facilities to a location at least 10 feet downslope of the structure. Roof and foundation drains may share a tightline if an above ground drainage outlet is allowable and a backflow preventer is installed within the pipe system in order to prevent roof water from entering the foundation area.

Infiltration facilities are feasible for this project. For existing in-situ soils, an infiltration rate should be used as provided in Section 2.3.2 of this report.

### 3.8 Parking and Pavement Analysis

It is our understanding that pavements or partial pavements may be utilized as pervious pavement. Calculations and design guidelines below are for standard hot mix asphalt pavements. Pervious pavement sections are also recommended below. Pervious pavement is a relatively new concept in order to meet stormwater management requirements. Pervious pavement requires skilled, experienced labor for constructing this type of system. Performance has proved to vary greatly for pervious pavement, and overall long-term performance cannot be ascertained. Therefore, we cannot guarantee the performance of pervious pavement.

The standard pavement section design analysis was completed using AASHTO's Guide for Design of Pavement Structures. The AASHTO procedure utilizes a Structural Number (SN) which is used to determine thicknesses of pavement structural sections based on their corresponding structural coefficients. The structural number is determined from a nomograph (Appendix D) utilizing Equivalent Single-Axle Loads (ESALs), Reliability (R%), Serviceability Loss (ΔPSI), Standard Deviation ($S_o$), and Soil Resilient Modulus ($M_R$) of the subgrade soil. ESALs were determined by assuming an ADT. This should be confirmed by the owner, and if PTI's assumptions are significantly different, we should be contacted to revise our recommendations.

**Standard Pavement**

ESALs = (ADT)(365 days/yr)(N)(DDF)(DLDF)(GR)(PT)(TF)

ADT = 2-way Average Daily Traffic Count
= 400 (assumed)
N = Pavement Design Life
= 20 years
DDF = Direction Distribution Factor
= 50% (50-50 split each direction)
DLDF = Design Lane Distribution Factor
= 100% (one lane in one direction)
GR = Growth Rate
= 0%
PT = Percent Trucks
= 5%
TF = Truck Factor
= 1.7 (common default value)

ESALs = (400)(365)(20)(0.5)(1.0)(.05)(1.7) = 124,100

R% = 80% (Reliability value for local access)
ΔPSI = 2.0 (Serviceability Loss for local access)
$S_o$ = 0.45 (Standard Deviation)
$M_R$ = 1155+555(R Value) = 1155+555(30) = 17,805 psf
where R-Value is interpolated from soil results

The flexible pavement nomograph presented in the AASHTO Guide, was used to calculate the structural number of 2.0. In conjunction with known or assumed pavement layer depths ($d_1$, etc…), typical published structural coefficients ($a_1$, etc…), and drainage coefficients ($m_1$, etc…), as needed, the following formula was used to determine the pavement structural section.

$SN \leq a_1d_1 + a_2d_2m_2 + \ldots. + a_id_im_i + \ldots$

$2.0 \leq (0.42 \times 3 \text{ in}) + (0.14 \times 2 \text{ in}) + (0.14 \times 4 \text{ in})$

where a = 0.42 for asphalt concrete (class B)
a = 0.14 for CSTS
a = 0.14 for CSBC

Based on the result of the analysis provided above, PTI recommends that the following pavement elements be utilized at a minimum:

| | |
|---|---|
| Asphalt concrete | : 3.0 inches |
| CSTC | : 2.0 inches |
| CSBC | : 4.0 inches |

PTI recommends construction to occur during the dry season (May 1st to October 31st) if at all possible. The upper organic laden soils should be removed beneath proposed roadway sections to a depth so that the necessary fill and/ or pavement structural section is to the desired grade. Upon

excavation, the native subgrade should be moisture conditioned and proof rolled with a 60K steel drum roller to a firm, unyielding condition. If necessary, engineered fill soils should be placed and compacted in order to achieve proper grade. Engineered fill soils should be approved by the geotechnical engineer and compacted to at least 95% of the modified Proctor.

Upon satisfactory completion of the subgrade preparation and necessary fill, the overlying 4.0 inches Crushed Surfacing Base Course (CSBC), 2.0 inches of Crushed Surfacing Top Course (CSTC) and 3.0 inches asphalt concrete layers may be constructed. New CSB/TC should meet the requirements of Class B foundation material from the Washington State Department of Transportation Standard Specifications for Road, Bridge and Municipal Construction. Furthermore, the base materials shall be compacted per the (ASTM D1557) modified Proctor. Each lift surface throughout the project should be adequately maintained during construction in order to achieve acceptable compaction and inter-lift bonding.

**Porous Asphalt Pavement**

The porous pavement section should consist of a layer of permeable asphalt over a 2-inch choker course, over a 6-inch minimum stone storage gallery over a non-woven geotextile fabric over undisturbed subgrade.

The layer of permeable asphalt shall be 2 inches minimum for light duty traffic, and 4 inches for heavy duty traffic. Asphalt shall be produced and placed by an experienced manufacturer and contractor. The asphalt product shall consist of a gradation and bituminous mixture based on local pervious asphalt experience considering materials, practice, and project use.

The 2-inch choker course shall consist of ½" crushed rock that is clean and uniformly graded. Alternately, the chocker course may consist of AASHTO grade No. 57 with a maximum stone size of 1 ½".

The stone gallery shall be a minimum of 6 inches deep, but the depth shall be sufficient for water storage per the civil engineer. AASHTO grade No. 3 stone, or other approved aggregate shall be used. In addition, the stone gallery shall have a minimum void space of 20%. The stone gallery shall be placed in loose lifts not to exceed 12 inches, and compacted by three passes with a walk-behind lightweight vibratory roller or a vibratory tamping hammer.

The non-woven geotextile fabric shall be Marafi 160N or better. The geotextile shall be handled and placed per manufacturer's requirements.

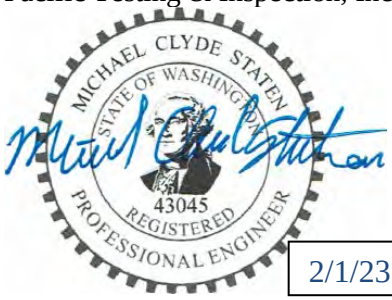
## 4.0 LIMITATIONS

Due to the inherent natural variations of the soil stratification and the nature of geotechnical subsurface explorations, there is always a possibility that soil conditions encountered during construction are different than those described in this report. Therefore, it is recommended that a qualified engineer observes and documents the construction, or PTI is promptly notified if project and subsurface conditions found on-site are not as presented in this report so that we can re-evaluate our recommendations.

This report presents engineering design guidelines, and is intended only for the owner, or owners' representative, and location of project described herein. This report should not be used to dictate construction procedures or relieve the contractor of his responsibility. Any assumptions by PTI that are listed in this report should be reviewed by the owner and contractor. If our assumptions are significantly different than actual project information, PTI should be contacted to review our recommendations.

Please contact PTI if you have any questions, comments, or require additional information.

Sincerely,
Pacific Testing & Inspection, Inc.

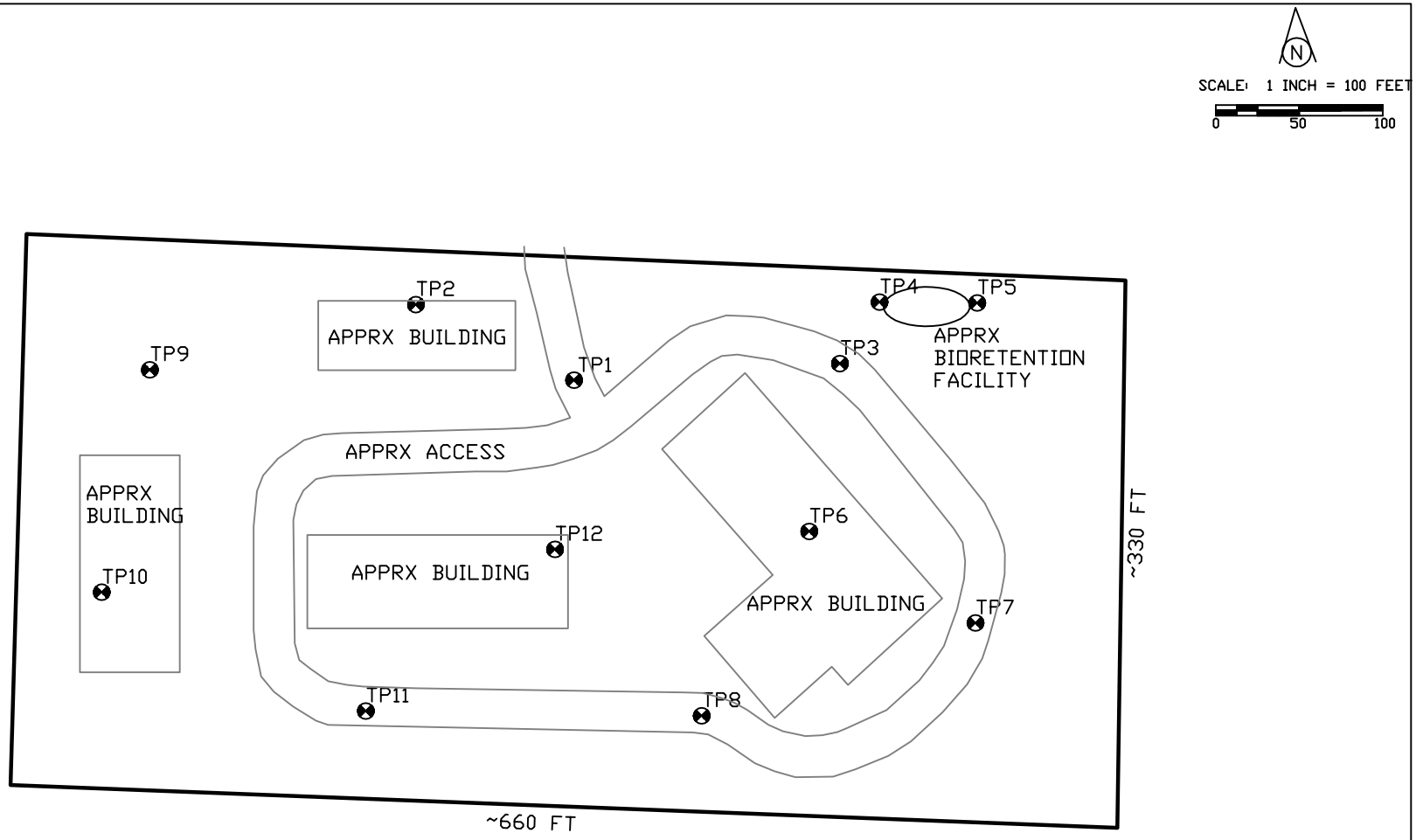



2/1/23

Michael Staten, P.E.
Engineer

# APPENDIX A

# TEST PIT LOCATION MAP




PROJECT & LOCATION

SERENITY APARTEMENTS
THE LODGE

456 CARPENTER ROAD SE
LACEY, WASHINGTON

ENGINEER:
PACIFIC TESTING & INSPECTION, INC
3215 HARRISON AVENUE
CENTRALIA, WASHINGTON 98531
360-736-3922

# TEST PIT LOCATION PLAN

# APPENDIX B

# TEST PIT LOGS

# Pacific Testing & Inspection Inc.

3215 Harrison Avenue, Centralia, WA 98531

Phone (360) 736-3922 Fax (360) 807-6002


## LOG OF TEST PIT

| Project No.: | Project Name: | Client: | Date: |
|---|---|---|---|
| 220073 | Serenity II The Lodge | Olympia Hangars, LLC | 12-20-2022 |

| Test Pit No.: | Location: | Diameter: | |
|---|---|---|---|
| 1 | NE Pervious Paving | | |

| Logged By: | Depth of Water: | Date Checked: | Depth of Caving: |
|---|---|---|---|
| TB | 0’ | 12-20-2022 | |

| Elev. Or Depth | Lab # | USCS | Description | Remarks | Moisture (%) |
|---|---|---|---|---|---|
| 0’-1.5’ | | (Gp) | Brown fine to coarse sandy gravel w/ silt & cobbles | Fill, moist, Org., dense, 4” Spalls | |
| 1.5’-2.5’ | | (Gp) | Medium Brown fine to coarse sandy gravel w/ silt | Fill, moist, Org., dense | |
| 2.5’-3.0’ | | (Gm) | Medium Brown fine to coarse sandy gravel w/ silt | Moist, V. dense, <2”, >25% | |
| 3’-4’ | | (Gp - Gm) | Yellowish brown fine to coarse sandy gravel w/ silt | Moist, V. dense, <2”, >40% | |
| 4’-8’ | 22-379 | (Gp - Gm) | Dk. Yellowish brown fine to coarse sandy gravel w/ trace silt, gets coarser | Moist, V. dense, <4”, >50% | 5.5% |
| 8’-10’ | 22-380 | (Gp - Gm) | Dk. Yellowish brown fine to coarse sandy gravel w/ silt, gets siltyer | Moist, V. dense, <6”, >60% | 5.2% |
| 11’ | | (Gp-Gm) | Test Pit Terminated | Same as above | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |

| Reported by: | Reviewed by: |
|---|---|
| Tim Barney ICC Geotechnical Inspector | Michael Staten, PE |

# Pacific Testing & Inspection Inc.

3215 Harrison Avenue, Centralia, WA 98531

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## LOG OF TEST PIT

| Project No.: | Project Name: | Client: | Date: |
|---|---|---|---|
| 220073 | Serenity II The Lodge | Olympia Hangars, LLC | 12-20-2022 |

| Test Pit No.: | Location: | Diameter: | 304A Survey |
|---|---|---|---|
| 2 | Building C | | 172.44 |

| Logged By: | Depth of Water: | Date Checked: | Depth of Caving: 3’ |
|---|---|---|---|
| TB | 0’ | 12-20-2022 | |

| Elev. Or Depth | Lab # | USCS | Description | Remarks | Moisture (%) |
|---|---|---|---|---|---|
| 0’-1.0’ | | (Gp) | Brown fine to coarse sandy gravel w/ silt | Fill, moist, Org., dense, 4” Spalls | |
| 1.0’-3.0’’ | 22-381 | (Gp-Gm) | Yellowish brown fine to coarse sandy gravel w/ silt | Moist, dense <10”, >60% | 2.8% |
| 3.0’-5’ | 22-382 | (Gp) | Dk. Yellowish Brown gravel fine to coarse sand w/ silt, gets coarser | Moist, V. dense, <4”, >60% | 4.6% |
| | | | | | |
| | | | | | |
| | | | | | |
| 6’ | | | Test Pit Terminated | Same as above | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |

| Reported by: | Reviewed by: |
|---|---|
| Tim Barney ICC Geotechnical Inspector | Michael Staten, PE |

# Pacific Testing & Inspection Inc.

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## LOG OF TEST PIT

| Project No.: | Project Name: | Client: | Date: |
|---|---|---|---|
| 220073 | Serenity II The Lodge | Olympia Hangars, LLC | 12-20-2022 |

| Test Pit No.: | Location: | Diameter: | |
|---|---|---|---|
| 3 | Perv. Paving S Bld. E | | |

| Logged By: | Depth of Water: | Date Checked: | Depth of Caving: 3’ |
|---|---|---|---|
| TB | 0’ | 12-20-2022 | |

| Elev. Or Depth | Lab # | USCS | Description | Remarks | Moisture (%) |
|---|---|---|---|---|---|
| 0’-1.0’ | | (Gp-Gm) | Brown fine to coarse sandy gravel w/ silt | Fill, moist, Org., dense, 8”, <40% | |
| 1.0’-3.0’’ | 22-389 | (Gp-Gm) | Dk. Yellowish brown fine to coarse sandy gravel w/ silt | Moist, dense, <6”, >50% | 3.5% |
| 3.0’-5’ | 22-390 | (Gp) | Dk. Yellowish Brown gravel w/ fine to coarse sand trace silt, gets coarser | Moist, V. dense, <8”, >70% | 3.5% |
| | | | | | |
| | | | | | |
| | | | | | |
| 6’ | | | Test Pit Terminated | Same as above | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |

| Reported by: | Reviewed by: |
|---|---|
| Tim Barney ICC Geotechnical Inspector | Michael Staten, PE |

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3215 Harrison Avenue, Centralia, WA 98531

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## LOG OF TEST PIT

| Project No.: | Project Name: | Client: | Date: |
|---|---|---|---|
| 220073 | Serenity II The Lodge | Olympia Hangars, LLC | 12-20-2022 |

| Test Pit No.: | Location: | Diameter: | 311A Survey |
|---|---|---|---|
| 4 | NE Pond West Pit | | 159.91 |

| Logged By: | Depth of Water: | Date Checked: | Depth of Caving: 8’ |
|---|---|---|---|
| TB | 0’ | 12-20-2022 | |

| Elev. Or Depth | Lab # | USCS | Description | Remarks | Moisture (%) |
|---|---|---|---|---|---|
| 0’-6” | | Ol | Brown fine to coarse sandy silt w/ organics | Duff, moist, Org., loose | |
| 6”-1.0’’ | | (Gm-Sp) | Medium brown fine to coarse sandy gravel w/ silt | Moist, dense, <3”, <20% | |
| 1.0’-2’ | | (Gp) | Yellowish Brown gravel w/ fine to coarse sand trace silt, gets coarser | Moist, V. dense, <3”, <30% | |
| 2’-4’ | | (Gp-Sp) | Gray fine to coarse sandy gravel w/ silt | Moist, V. dense, <2”, <25% | |
| 4’-7’ | 22-391 | (Sm) | Dk. Yellowish Brown fine to coarse sandy well cemented silt w/ some gravels | Dry, V. dense, <1.5”, <15% | 9.1% |
| 7’-9’ | 22-384 | (Gp-Gm) | Gray- Brown fine to coarse sandy gravel w/ silt | Moist, V. dense, <6”, >50% | 2.6% |
| 9’-12’ | 22-383 | (Gp) | Dk. Yellowish Brown fine to coarse sandy gravel w/ silt | Moist, V. dense, <4”, >60% | 3.4% |
| | | | | | |
| | | | | | |
| 13’ | | | Test Pit Terminated | Same as above | |
| | | | | | |

| Reported by: | Reviewed by: |
|---|---|
| Tim Barney ICC Geotechnical Inspector | Michael Staten, PE |

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3215 Harrison Avenue, Centralia, WA 98531

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## LOG OF TEST PIT

| Project No.: | Project Name: | Client: | Date: |
|---|---|---|---|
| 220073 | Serenity II The Lodge | Olympia Hangars, LLC | 12-20-2022 |

| Test Pit No.: | Location: | Diameter: | 312A Survey 160.10 |
|---|---|---|---|
| 5 | NE Pond East Pit | | |

| Logged By: | Depth of Water: | Date Checked: | Depth of Caving: 8’ |
|---|---|---|---|
| TB | 0’ | 12-20-2022 | |

| Elev. Or Depth | Lab # | USCS | Description | Remarks | Moisture (%) |
|---|---|---|---|---|---|
| 0’-6” | | Ol | Brown fine to coarse sandy silt w/ organics | Duff, moist, Org., loose | |
| 6”-1.0’’ | | (Gm-Sp) | Medium brown fine to coarse sandy gravel w/ silt | Moist, dense, <1”, <10% | |
| 1.0’-2’ | | (Gp) | Yellowish Brown gravel w/ fine to coarse sand w/ silt, (gets coarser) | Moist, V. dense, <3”, >30% | |
| 2’-8’ | 22-393 | (Gp-Gm) | Dk. Yellowish Brown fine to coarse sandy gravel w/ silt | Moist, V. dense, <4”, >50% | 5.6% |
| 8’-10’ | | (Gp-Gm) | Yellowish Brown fine to coarse sandy gravel w/ silt | Dry, V. dense, <3”, >60% | |
| 10-11’’ | | (Gp-Gm) | Dk. Yellowish Brown fine to coarse sandy gravel w/ silt | Moist, V. dense, <2”, >50% | |
| 11’-12’ | 22-392 | (Gp-Gm) | Dk. Yellowish Brown fine to coarse sandy gravel w/ silt,(gets finer) | Moist, V. dense, <3”, >60% | 4.0% |
| | | | | | |
| | | | | | |
| 13’ | | | Test Pit Terminated | Same as above | |
| | | | | | |

| Reported by: | Reviewed by: |
|---|---|
| Tim Barney ICC Geotechnical Inspector | Michael Staten, PE |

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Phone (360) 736-3922 Fax (360) 807-6002


## LOG OF TEST PIT

| Project No.: | Project Name: | Client: | Date: |
|---|---|---|---|
| 220073 | Serenity II The Lodge | Olympia Hangars, LLC | 12-20-2022 |

| Test Pit No.: | Location: | Diameter: | 309A Survey |
|---|---|---|---|
| 6 | Building A | | 165.55 |

| Logged By: | Depth of Water: | Date Checked: | Depth of Caving: 3’ |
|---|---|---|---|
| TB | 0’ | 12-20-2022 | |

| Elev. Or Depth | Lab # | USCS | Description | Remarks | Moisture (%) |
|---|---|---|---|---|---|
| 0’-6” | | Ol | Brown fine to coarse sandy silt w/ organics | Duff, moist, Org., loose | |
| 6”-2.0’’ | | (Gm-Gw) | Medium brown fine to coarse sandy gravel w/ silt | Moist, dense, <1”, <20% | |
| 2’-5’ | 22-385 | (Gm-Gw) | Gray to Brown fine to coarse sandy gravel w/ silt | Moist, V. dense, <5”, >60% | 2.8% |
| 5’-7’ | 22-386 | (Gm-Gw) | Dk. Yellowish Brown fine to coarse sandy gravel w/ silt | Moist, V. dense, <10”, >70% | 3.0% |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| 8’ | | | Test Pit Terminated | Same as above | |
| | | | | | |

| Reported by: | Reviewed by: |
|---|---|
| Tim Barney ICC Geotechnical Inspector | Michael Staten, PE |

# Pacific Testing & Inspection Inc.

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Phone (360) 736-3922 Fax (360) 807-6002


## LOG OF TEST PIT

| Project No.: | Project Name: | Client: | Date: |
|---|---|---|---|
| 220073 | Serenity II The Lodge | Olympia Hangars, LLC | 12-21-2022 |

| Test Pit No.: | Location: | Diameter: | 308A Survey |
|---|---|---|---|
| 7 | Pervious Pavement | | 166.32 |

| Logged By: | Depth of Water: | Date Checked: | Depth of Caving: 3’ |
|---|---|---|---|
| TB | 0’ | 12-20-2022 | |

| Elev. Or Depth | Lab # | USCS | Description | Remarks | Moisture (%) |
|---|---|---|---|---|---|
| 0’-6” | | Ol | Brown fine to coarse sandy silt w/ organics | Duff, moist, Org., loose | |
| 6”-4.0’’ | | (Gp-Gw) | Gray - Yellowish Brown fine to coarse sandy gravel w/ trace silt | Moist, V. dense, <4”, >40% | |
| 4’-5’ | | (Gp) | Gray - Yellowish Brown fine to coarse sandy gravel w/ trace silt | Moist, V. dense, <2”, >60% | |
| 5’-6’ | 22-387 | (Gp-Gw) | Gray -Yellowish Brown fine to coarse sandy gravel w/ trace silt | Moist, V. dense, <4”, >60% | 3.3% |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| 6’ | | | Test Pit Terminated | Same as above | |
| | | | | | |

| Reported by: | Reviewed by: |
|---|---|
| Tim Barney ICC Geotechnical Inspector | Michael Staten, PE |

# Pacific Testing & Inspection Inc.

3215 Harrison Avenue, Centralia, WA 98531

Phone (360) 736-3922 Fax (360) 807-6002


## LOG OF TEST PIT

| Project No.: | Project Name: | Client: | Date: |
|---|---|---|---|
| 220073 | Serenity II The Lodge | Olympia Hangars, LLC | 12-21-2022 |

| Test Pit No.: | Location: | Diameter: | 307A Survey 170.06 |
|---|---|---|---|
| 8 | Pervious Pavement | | |

| Logged By: | Depth of Water: | Date Checked: | Depth of Caving: 4’ |
|---|---|---|---|
| TB | 0’ | 12-21-2022 | |

| Elev. Or Depth | Lab # | USCS | Description | Remarks | Moisture (%) |
|---|---|---|---|---|---|
| 0’-6” | | Ol | Brown fine to coarse sandy silt w/ organics | Duff, moist, Org., loose | |
| 6”-1.0’’ | | (Gp-Gw) | Dk. Brown fine to coarse sandy gravel w/ silt | Moist, dense, <6”, >40% | |
| 1’-4’ | | (Gp-Gm) | Gray – Dk. Yellowish Brown fine to coarse sandy gravel w/ silt | Moist, V. dense, <5”, >50% | |
| 4’-6’ | 22-388 | (Gp-Gm) | Dk. Yellowish Brown fine to coarse sandy gravel w/ silt | Moist, V. dense, <6”, >70% | 3.5% |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| 6’ | | | Test Pit Terminated | Same as above | |
| | | | | | |

| Reported by: | Reviewed by: |
|---|---|
| Tim Barney ICC Geotechnical Inspector | Michael Staten, PE |

# Pacific Testing & Inspection Inc.

3215 Harrison Avenue, Centralia, WA 98531

Phone (360) 736-3922 Fax (360) 807-6002


## LOG OF TEST PIT

| Project No.: | Project Name: | Client: | Date: |
|---|---|---|---|
| 220073 | Serenity II The Lodge | Olympia Hangars, LLC | 12-21-2022 |

| Test Pit No.: | Location: | Diameter: | 300A Survey |
|---|---|---|---|
| 9 | Office Relocated (S & E) | | 176.19 |

| Logged By: | Depth of Water: | Date Checked: | Depth of Caving: 3’ |
|---|---|---|---|
| TB | 0’ | 12-21-2022 | |

| Elev. Or Depth | Lab # | USCS | Description | Remarks | Moisture (%) |
|---|---|---|---|---|---|
| 0’-3’ | | Gp | Brown fine to coarse sandy silt w/ some organics | Fill, moist, <6”, >50% Med. dense | |
| 3’-6’ | 22-395 | (Gp-Gw) | Dk. Yellowish Brown- Gray fine to coarse sandy gravel w/ silt | Moist, dense, <7”, >70% | 2.7% |
| 6’-12’ | | (Gp-Gm) | Gray-Dk. Yellowish Brown fine to coarse sandy gravel w/ silt | Moist, V. dense, <5”, >70%, gets coarser | |
| 12’ – 13’ | 22-396 | (Gp-Gm) | Gray- Dk. Yellowish Brown fine to coarse sandy gravel w/ silt | Moist, V. dense, <6”, >70% | 3.5% |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| 13’ | | | Test Pit Terminated | Same as above | |
| | | | | | |

| Reported by: | Reviewed by: |
|---|---|
| Tim Barney ICC Geotechnical Inspector | Michael Staten, PE |

# Pacific Testing & Inspection Inc.

3215 Harrison Avenue, Centralia, WA 98531

Phone (360) 736-3922 Fax (360) 807-6002


## LOG OF TEST PIT

| Project No.: | Project Name: | Client: | Date: |
|---|---|---|---|
| 220073 | Serenity II The Lodge | Olympia Hangars, LLC | 12-21-2022 |

| Test Pit No.: | Location: | Diameter: | 301A Survey |
|---|---|---|---|
| 10 | Building B1 (Relocated) | | 177.37 |

| Logged By: | Depth of Water: | Date Checked: | Depth of Caving: 4’ |
|---|---|---|---|
| TB | 0’ | 12-21-2022 | |

| Elev. Or Depth | Lab # | USCS | Description | Remarks | Moisture (%) |
|---|---|---|---|---|---|
| 0’-6” | | Ol | Brown fine to coarse sandy silt w/ organics | Duff, moist, Org., <4”, loose | |
| 6”-3’ | | (Gp-Gw) | Brown- Gray fine to coarse sandy gravel w/ silt | Moist, dense, <3”, >40% | |
| 3’-7’ | 22-397 | (Gp-Gm) | Gray - Yellowish Brown fine to coarse sandy gravel w/ silt | Moist, V. dense, <6”, >60% | 4.3% |
| 7’ – 10’ | 22-398 | (Gp-Gm) | Gray fine to coarse sandy gravel w/ silt | Moist, V. dense, <6”, >70%, silt adhering to coarse agg | 5.3% |
| | | | | | |
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| | | | | | |
| | | | | | |
| | | | | | |
| 11’ | | | Test Pit Terminated | Same as above | |
| | | | | | |

| Reported by: | Reviewed by: |
|---|---|
| Tim Barney ICC Geotechnical Inspector | Michael Staten, PE |

# Pacific Testing & Inspection Inc.

3215 Harrison Avenue, Centralia, WA 98531

Phone (360) 736-3922 Fax (360) 807-6002


## LOG OF TEST PIT

| Project No.: | Project Name: | Client: | Date: |
|---|---|---|---|
| 220073 | Serenity II The Lodge | Olympia Hangars, LLC | 12-21-2022 |

| Test Pit No.: | Location: | Diameter: | 303A Survey |
|---|---|---|---|
| 11 | Pervious Paving | | 176.85 |

| Logged By: | Depth of Water: | Date Checked: | Depth of Caving: 3’ |
|---|---|---|---|
| TB | 0’ | 12-21-2022 | |

| Elev. Or Depth | Lab # | USCS | Description | Remarks | Moisture (%) |
|---|---|---|---|---|---|
| 0’-6” | | Ol | Dk. Brown fine to coarse sandy silt w/ organics | Duff, moist, Org., <4”, loose | |
| 6”-3’ | | (Gp-Gw) | Gray- Yellowish Brown fine to coarse sandy gravel w/ silt | Moist, dense, <3”, >60% | |
| 3’-6’ | 22-399 | (Gp-Gm) | Yellowish Brown fine to coarse sandy gravel w/ silt | Moist, V. dense, <6”, >70% | 3.4% |
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| | | | | | |
| 6’ | | | Test Pit Terminated | Same as above | |
| | | | | | |

| Reported by: | Reviewed by: |
|---|---|
| Tim Barney ICC Geotechnical Inspector | Michael Staten, PE |

# Pacific Testing & Inspection Inc.

3215 Harrison Avenue, Centralia, WA 98531

Phone (360) 736-3922 Fax (360) 807-6002


## LOG OF TEST PIT

| Project No.: | Project Name: | Client: | Date: |
|---|---|---|---|
| 220073 | Serenity II The Lodge | Olympia Hangars, LLC | 12-21-2022 |

| Test Pit No.: | Location: | Diameter: | 303A Survey |
|---|---|---|---|
| 12 | Building B2 Relocated (N & W) | | 176.85 |

| Logged By: | Depth of Water: | Date Checked: | Depth of Caving: 3’ |
|---|---|---|---|
| TB | 0’ | 12-21-2022 | |

| Elev. Or Depth | Lab # | USCS | Description | Remarks | Moisture (%) |
|---|---|---|---|---|---|
| 0’-6” | | (Ol) | Brown fine to coarse sandy silt w/ organics | Hog Fuel, moist, Org., <2”, loose | |
| 6”-3’ | | (Gp-Gw) | Yellowish Brown- Gray fine to coarse sandy silt w/ gravel | Moist, dense, <4”, >20% | |
| 3’-6’ | | (Ml) | Gray- Yellowish Brown fine to coarse sandy silt w/ some gravel (well cemented) | Moist, V. dense, <1”, <10% | |
| 6’-7’ | 22-401 | (Ml) | Dk. Yellowish Brown fine to coarse sandy silt w/some gravel, (well cemented) | Wet, V. dense, <1”, <10% | 31.9% |
| 7’-12’ | 22-400 | (Gm-Gp) | Dk. Yellowish Brown- fine to coarse sandy gravel w/ silt | Moist, V. dense, <3”, >50% | 7.1% |
| | | | | | |
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| | | | | | |
| 13’ | | | Test Pit Terminated | Same as above | |
| | | | | | |

| Reported by: | Reviewed by: |
|---|---|
| Tim Barney ICC Geotechnical Inspector | Michael Staten, PE |

# APPENDIX C

# LABORATORY TESTING RESULTS

# Pacific Testing & Inspection Inc.

3215 Harrison Avenue Centralia, WA 98531
Phone (360) 736-3922 Fax (360) 807-6002

**Project:** Serenity II The Lodge
**Date Sampled:** December 20, 2022
**Date Tested:** December 29, 2022
**Lab #:** 22-402 - 22-407

**File No.:** 220073
**Customer:** Olympia Hangars, LLC
**Sampled by:** TB
**Tested by:** TB

## Organic Content - AASHTO T-267/ ASTM D-2974

| Sample ID | Location | Tare | Soil + Tare, Pre-Ignition | Soil + Tare, Post Ignition | % Organics |
|---|---|---|---|---|---|
| 22-402 | Test Pit 11 @ 5' | 163.100 | 284.200 | 282.000 | 1.82% |
| 22-403 | Test Pit 1 @ 7' | 165.800 | 283.300 | 280.300 | 2.55% |
| 22-404 | Test Pit 8 @ 5' | 163.100 | 291.000 | 288.800 | 1.72% |
| 22-405 | Test Pit 7 @ 5' | 165.800 | 330.300 | 328.900 | 0.85% |
| 22-406 | Test Pit 3 @ 3' | 163.100 | 334.800 | 332.000 | 1.63% |
| 22-407 | Test Pit 3 @ 5' | 165.800 | 280.200 | 278.400 | 1.57% |
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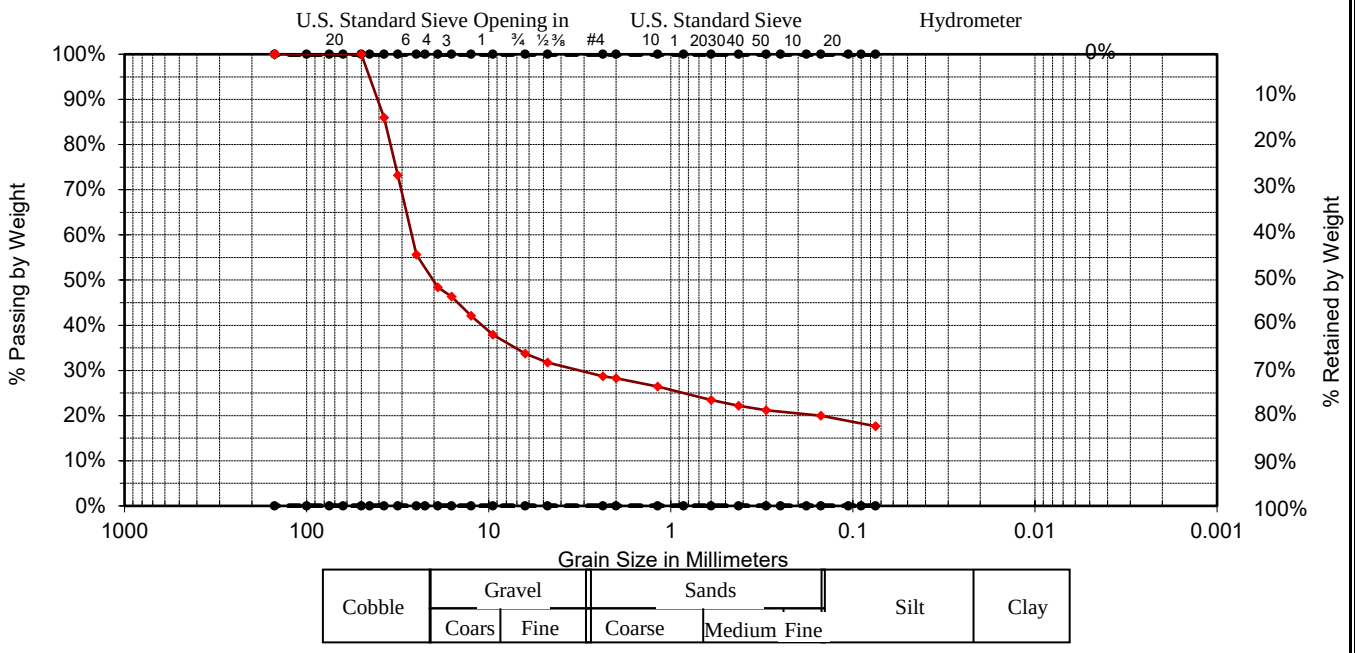
**Reviewed by:** Tim Barney

# Pacific Testing & Inspection Inc.

3215 Harrison Avenue Centralia, WA 98531
Phone (360) 736-3922 Fax (360) 807-6022

**ASTM C-136** **Sieve Report** **ASTM D-4318**




| | | | | | |
|---|---|---|---|---|---|
| Date : | 12/21/2022 | $D_{10}$ = | 0.04 | **USCS Classification** | % Gravel % Sand |
| Sample #: | 22-379 | $D_{30}$ = | 3.40 | GM, Silty Gravel | 68.3% 14.1% |
| Source: | TP1@4'-8' (paving) | $D_{60}$ = | 26.62 | **Specifications** | Color: |
| Project #: | 220073 | $C_C$ = | 10.19 | No Specs | 10YR 4/4 dk yell brn |
| Project: | Serenity - The Lodge | $C_{U=}$ | 625.89 | Sample Meets Specs | % Silt & Clay |
| Client: | Olympia Hangars, LLC | Liquid Limit= | 0.0% | n/a | 17.6% |
| Tested By: | HH | Plastic Limit= | 0.0% | Fineness Modulus | |
| Date Tested: | 12/27/2022 | Plasticity Index= | 0.0% | 5.76 | |

| **Coarse Section** Sieve Size US | Metric | Actual Cumulative Percent Passing | Interpolated Cumulative Percent Passing | Specs Max | Specs Min |
|---|---|---|---|---|---|
| 6.00" | 150.00 | | 100% | | |
| 4.00" | 100.00 | | 100% | | |
| 3.00" | 75.00 | | 100% | | |
| 2.50" | 63.00 | | 100% | | |
| 2.00" | 50.00 | 100% | 100% | | |
| 1.75" | 45.00 | | 94% | | |
| 1.50" | 37.50 | 86% | 86% | | |
| 1.25" | 31.50 | 73% | 73% | | |
| 1.00" | 25.00 | 56% | 56% | | |
| 7/8" | 22.40 | | 52% | | |
| 3/4" | 19.00 | 48% | 48% | | |
| 5/8" | 16.00 | 46% | 46% | | |
| 1/2" | 12.50 | 42% | 42% | | |
| 3/8" | 9.50 | 38% | 38% | | |
| 1/4" | 6.30 | 34% | 34% | | |
| #4 | 4.75 | 32% | 32% | | |

| **Fines Section** Sieve Size US | Metric | Actual Cumulative Percent Passing | Interpolated Cumulative Percent Passing | Specs Max | Specs Min |
|---|---|---|---|---|---|
| #4 | 4.750 | 32% | 32% | | |
| #8 | 2.360 | 29% | 29% | | |
| #10 | 2.000 | 28% | 28% | | |
| #16 | 1.180 | 26% | 26% | | |
| #20 | 0.850 | | 25% | | |
| #30 | 0.600 | 23% | 23% | | |
| #40 | 0.425 | 22% | 22% | | |
| #50 | 0.300 | 21% | 21% | | |
| #60 | 0.250 | | 21% | | |
| #80 | 0.180 | | 20% | | |
| #100 | 0.150 | 20% | 20% | | |
| #140 | 0.106 | | 19% | | |
| #170 | 0.090 | | 18% | | |
| #200 | 0.075 | 17.6% | 17.6% | | |
| #270 | 0.053 | | | | |



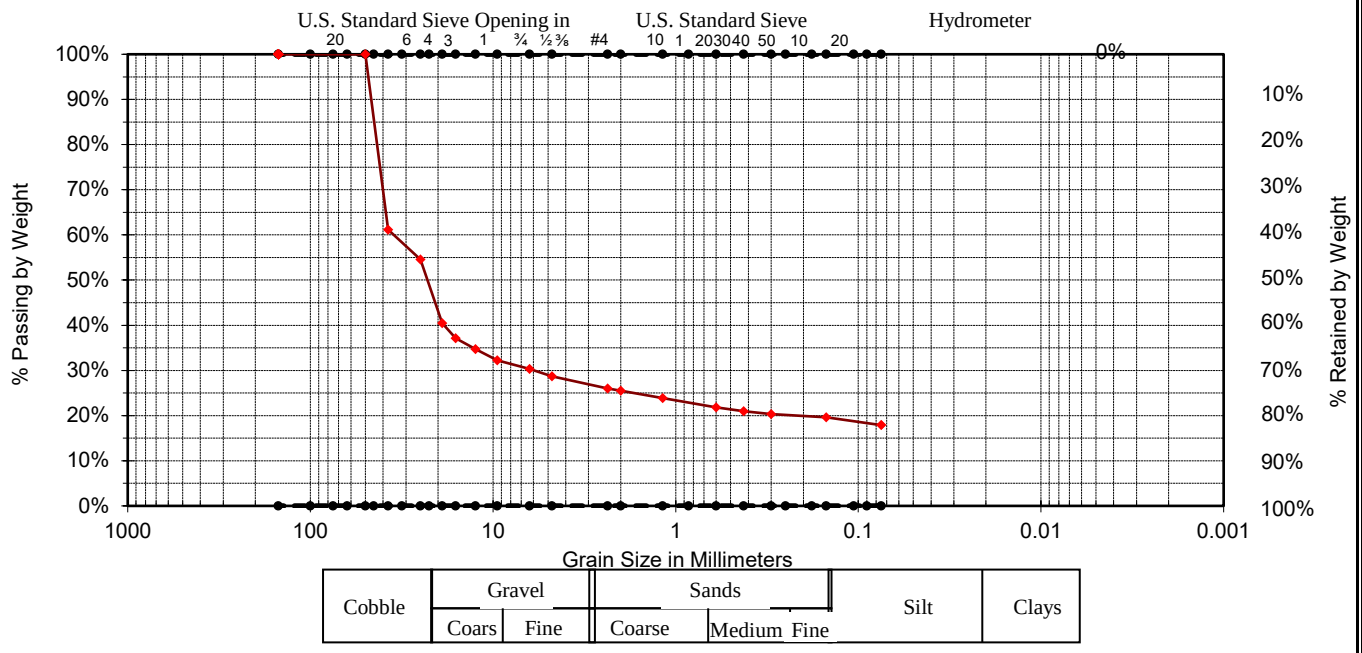
Comments: _____

Reviewed by: Tim Barney

# Pacific Testing & Inspection Inc.

3215 Harrison Avenue Centralia, WA 98531
Phone (360) 736-3922 Fax (360) 807-6022

**ASTM C-136** **Sieve Report** **ASTM D-4318**




| | | | | | |
|---|---|---|---|---|---|
| Date : | 12/21/2022 | $D_{10}$ = | 0.04 | **USCS Classification** | % Gravel % Sand |
| Sample #: | 22-380 | $D_{30}$ = | 5.98 | GM, Silty Gravel | 71.3% 10.8% |
| Source: | TP1@8'-10' (paving) | $D_{60}$ = | 35.32 | **Specifications** | Color: |
| Project #: | 220073 | $C_C$ = | 24.17 | No Specs | 10YR 3/4 dk yell brn |
| Project: | Serenity - The Lodge | $C_{U=}$ | 842.41 | Sample Meets Specs | % Silt & Clay |
| Client: | Olympia Hangars, LLC | Liquid Limit= | 0.0% | n/a | 17.9% |
| Tested By: | HH | Plastic Limit= | 0.0% | Fineness Modulus | |
| Date Tested: | 12/27/2022 | Plasticity Index= | 0.0% | 6.26 | |

| **Coarse Section** Sieve Size US | Metric | Actual Cumulative Percent Passing | Interpolated Cumulative Percent Passing | Specs Max | Specs Min |
|---|---|---|---|---|---|
| 6.00" | 150.00 | | 100% | | |
| 4.00" | 100.00 | | 100% | | |
| 3.00" | 75.00 | | 100% | | |
| 2.50" | 63.00 | | 100% | | |
| 2.00" | 50.00 | 100% | 100% | | |
| 1.75" | 45.00 | | 84% | | |
| 1.50" | 37.50 | 61% | 61% | | |
| 1.25" | 31.50 | | 58% | | |
| 1.00" | 25.00 | 55% | 55% | | |
| 7/8" | 22.40 | | 48% | | |
| 3/4" | 19.00 | 40% | 40% | | |
| 5/8" | 16.00 | 37% | 37% | | |
| 1/2" | 12.50 | 35% | 35% | | |
| 3/8" | 9.50 | 32% | 32% | | |
| 1/4" | 6.30 | 30% | 30% | | |
| #4 | 4.75 | 29% | 29% | | |

| **Fines Section** Sieve Size US | Metric | Actual Cumulative Percent Passing | Interpolated Cumulative Percent Passing | Specs Max | Specs Min |
|---|---|---|---|---|---|
| #4 | 4.750 | 29% | 29% | | |
| #8 | 2.360 | 26% | 26% | | |
| #10 | 2.000 | 25% | 25% | | |
| #16 | 1.180 | 24% | 24% | | |
| #20 | 0.850 | | 23% | | |
| #30 | 0.600 | 22% | 22% | | |
| #40 | 0.425 | 21% | 21% | | |
| #50 | 0.300 | 20% | 20% | | |
| #60 | 0.250 | | 20% | | |
| #80 | 0.180 | | 20% | | |
| #100 | 0.150 | 20% | 20% | | |
| #140 | 0.106 | | 19% | | |
| #170 | 0.090 | | 18% | | |
| #200 | 0.075 | 17.9% | 17.9% | | |
| #270 | 0.053 | | | | |



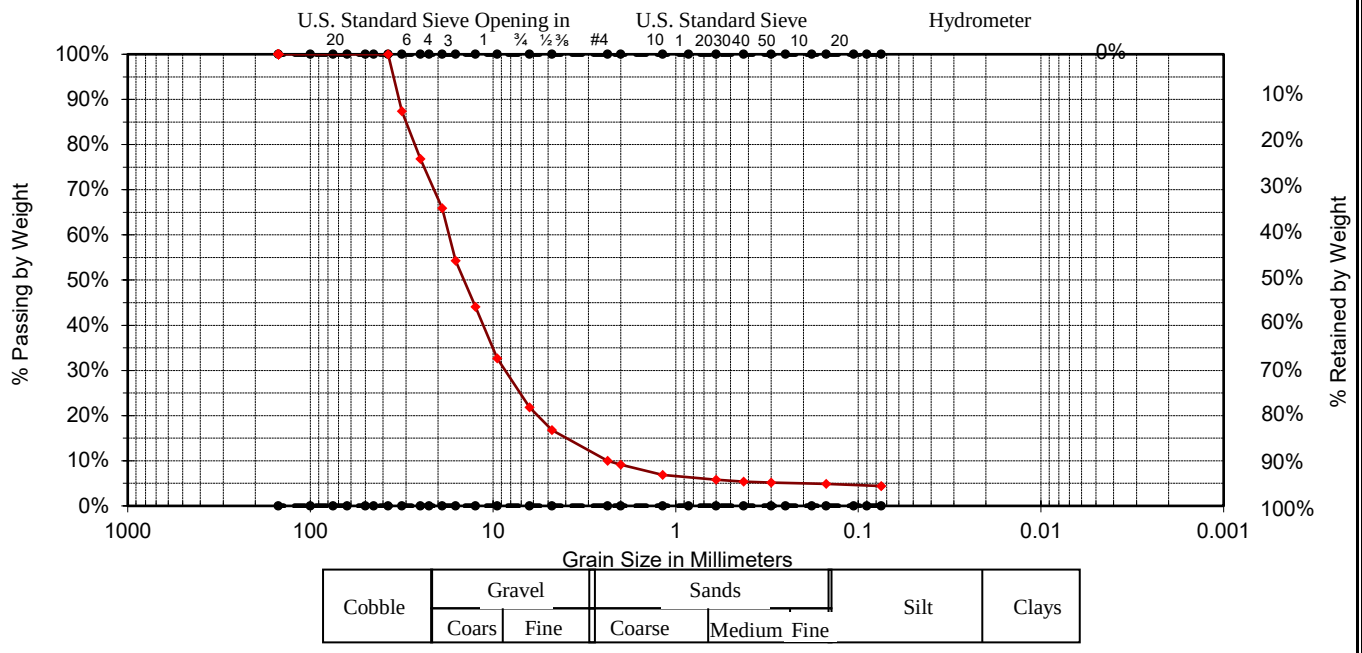
Comments:

Reviewed by: Tim Barney

# Pacific Testing & Inspection Inc.

3215 Harrison Avenue Centralia, WA 98531
Phone (360) 736-3922 Fax (360) 807-6022

**ASTM C-136** **Sieve Report** **ASTM D-4318**




| | | | | | |
|---|---|---|---|---|---|
| Date : | 12/21/2022 | $D_{10}$ = | 2.37 | **USCS Classification** | % Gravel % Sand |
| Sample #: | 22-381 | $D_{30}$ = | 8.71 | GW, Well-graded Gravel | 83.2% 12.4% |
| Source: | TP2@3' Bldg C | $D_{60}$ = | 17.48 | **Specifications** | Color: |
| Project #: | 220073 | $C_C$ = | 1.83 | No Specs | 10YR 3/4 dk yell brn |
| Project: | Serenity - The Lodge | $C_{U=}$ | 7.36 | Sample Meets Specs | % Silt & Clay |
| Client: | Olympia Hangars, LLC | Liquid Limit= | 0.0% | n/a | 4.4% |
| Tested By: | HH | Plastic Limit= | 0.0% | Fineness Modulus | |
| Date Tested: | 12/27/2022 | Plasticity Index= | 0.0% | 6.52 | |

| Coarse Section | | Actual Cumulative | Interpolated Cumulative | | |
|---|---|---|---|---|---|
| Sieve Size | | Percent | Percent | Specs | Specs |
| US | Metric | Passing | Passing | Max | Min |
| 6.00" | 150.00 | | 100% | | |
| 4.00" | 100.00 | | 100% | | |
| 3.00" | 75.00 | | 100% | | |
| 2.50" | 63.00 | | 100% | | |
| 2.00" | 50.00 | | 100% | | |
| 1.75" | 45.00 | | 100% | | |
| 1.50" | 37.50 | 100% | 100% | | |
| 1.25" | 31.50 | 87% | 87% | | |
| 1.00" | 25.00 | 77% | 77% | | |
| 7/8" | 22.40 | | 72% | | |
| 3/4" | 19.00 | 66% | 66% | | |
| 5/8" | 16.00 | 54% | 54% | | |
| 1/2" | 12.50 | 44% | 44% | | |
| 3/8" | 9.50 | 33% | 33% | | |
| 1/4" | 6.30 | 22% | 22% | | |
| #4 | 4.75 | 17% | 17% | | |

| Fines Section | | Actual Cumulative | Interpolated Cumulative | | |
|---|---|---|---|---|---|
| Sieve Size | | Percent | Percent | Specs | Specs |
| US | Metric | Passing | Passing | Max | Min |
| #4 | 4.750 | 17% | 17% | | |
| #8 | 2.360 | 10% | 10% | | |
| #10 | 2.000 | 9% | 9% | | |
| #16 | 1.180 | 7% | 7% | | |
| #20 | 0.850 | | 6% | | |
| #30 | 0.600 | 6% | 6% | | |
| #40 | 0.425 | 5% | 5% | | |
| #50 | 0.300 | 5% | 5% | | |
| #60 | 0.250 | | 5% | | |
| #80 | 0.180 | | 5% | | |
| #100 | 0.150 | 5% | 5% | | |
| #140 | 0.106 | | 5% | | |
| #170 | 0.090 | | 4% | | |
| #200 | 0.075 | 4.4% | 4.4% | | |
| #270 | 0.053 | | | | |



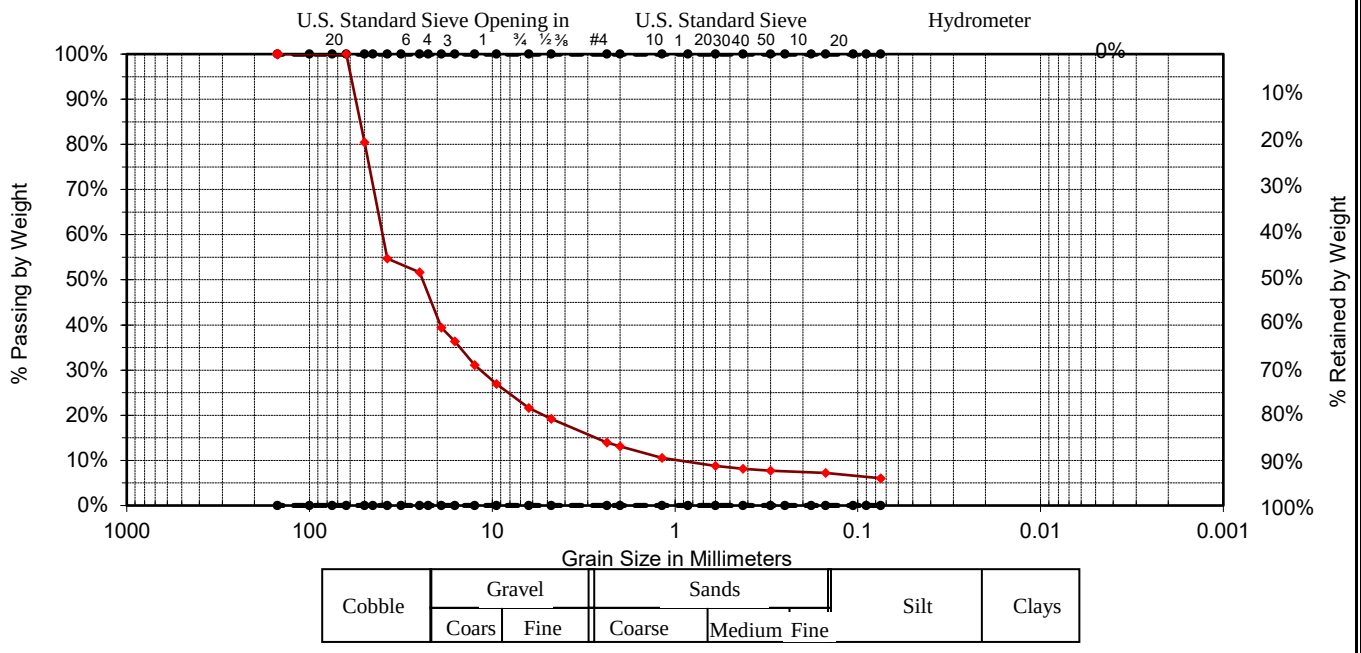
Comments: _____

Reviewed by: Tim Barney

# Pacific Testing & Inspection Inc.

3215 Harrison Avenue Centralia, WA 98531
Phone (360) 736-3922 Fax (360) 807-6022

**ASTM C-136** **Sieve Report** **ASTM D-4318**




| | | | | | |
|---|---|---|---|---|---|
| Date : | 12/21/2022 | $D_{10}$ = | 1.01 | **USCS Classification** | % Gravel % Sand |
| Sample #: | 22-382 | $D_{30}$ = | 11.71 | GP-GM, Poorly graded Gravel with Sil | 80.8% 13.1% |
| Source: | TP2@Bldg C(-5') | $D_{60}$ = | 40.08 | **Specifications** | Color: |
| Project #: | 220073 | $C_C$ = | 3.40 | No Specs | 10YR 3/4 dk yell brn |
| Project: | Serenity - The Lodge | $C_{U=}$ | 39.79 | Sample Meets Specs | % Silt & Clay |
| Client: | Olympia Hangars, LLC | Liquid Limit= | 0.0% | n/a | 6.0% |
| Tested By: | HH | Plastic Limit= | 0.0% | Fineness Modulus | |
| Date Tested: | 12/27/2022 | Plasticity Index= | 0.0% | 7.12 | |

| **Coarse Section** Sieve Size US | Metric | Actual Cumulative Percent Passing | Interpolated Cumulative Percent Passing | Specs Max | Specs Min |
|---|---|---|---|---|---|
| 6.00" | 150.00 | | 100% | | |
| 4.00" | 100.00 | | 100% | | |
| 3.00" | 75.00 | | 100% | | |
| 2.50" | 63.00 | 100% | 100% | | |
| 2.00" | 50.00 | 80% | 80% | | |
| 1.75" | 45.00 | | 70% | | |
| 1.50" | 37.50 | 55% | 55% | | |
| 1.25" | 31.50 | | 53% | | |
| 1.00" | 25.00 | 52% | 52% | | |
| 7/8" | 22.40 | | 46% | | |
| 3/4" | 19.00 | 39% | 39% | | |
| 5/8" | 16.00 | 36% | 36% | | |
| 1/2" | 12.50 | 31% | 31% | | |
| 3/8" | 9.50 | 27% | 27% | | |
| 1/4" | 6.30 | 22% | 22% | | |
| #4 | 4.75 | 19% | 19% | | |

| **Fines Section** Sieve Size US | Metric | Actual Cumulative Percent Passing | Interpolated Cumulative Percent Passing | Specs Max | Specs Min |
|---|---|---|---|---|---|
| #4 | 4.750 | 19% | 19% | | |
| #8 | 2.360 | 14% | 14% | | |
| #10 | 2.000 | 13% | 13% | | |
| #16 | 1.180 | 11% | 11% | | |
| #20 | 0.850 | | 10% | | |
| #30 | 0.600 | 9% | 9% | | |
| #40 | 0.425 | 8% | 8% | | |
| #50 | 0.300 | 8% | 8% | | |
| #60 | 0.250 | | 8% | | |
| #80 | 0.180 | | 7% | | |
| #100 | 0.150 | 7% | 7% | | |
| #140 | 0.106 | | 7% | | |
| #170 | 0.090 | | 6% | | |
| #200 | 0.075 | 6.0% | 6.0% | | |
| #270 | 0.053 | | | | |



Comments: _____

Reviewed by: Tim Barney

# Pacific Testing & Inspection Inc.

3215 Harrison Avenue Centralia, WA 98531
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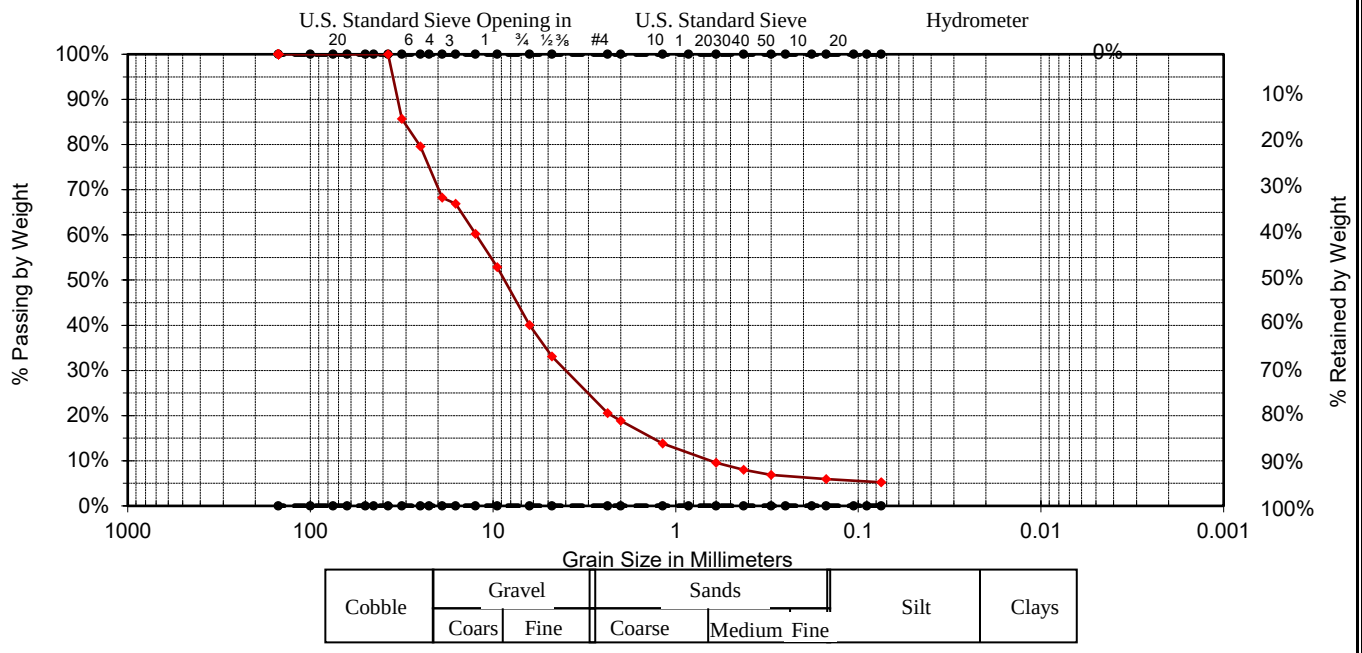
**ASTM C-136** **Sieve Report** **ASTM D-4318**




| | | | | | |
|---|---|---|---|---|---|
| Date : | 12/21/2022 | $D_{10}$ = | 0.66 | **USCS Classification** | % Gravel % Sand |
| Sample #: | 22-389 | $D_{30}$ = | 4.16 | GW-GM, Well-graded Gravel with Silt | 66.9% 27.9% |
| Source: | TP3@3' (paving) | $D_{60}$ = | 12.40 | **Specifications** | Color: |
| Project #: | 220073 | $C_C$ = | 2.12 | No Specs | 10YR 3/4 dk yell brn |
| Project: | Serenity - The Lodge | $C_{U=}$ | 18.82 | Sample Meets Specs | % Silt & Clay |
| Client: | Olympia Hangars, LLC | Liquid Limit= | 0.0% | n/a | 5.2% |
| Tested By: | HH | Plastic Limit= | 0.0% | Fineness Modulus | |
| Date Tested: | 12/27/2022 | Plasticity Index= | 0.0% | 5.89 | |

| **Coarse Section** Sieve Size US | Metric | Actual Cumulative Percent Passing | Interpolated Cumulative Percent Passing | Specs Max | Specs Min |
|---|---|---|---|---|---|
| 6.00" | 150.00 | | 100% | | |
| 4.00" | 100.00 | | 100% | | |
| 3.00" | 75.00 | | 100% | | |
| 2.50" | 63.00 | | 100% | | |
| 2.00" | 50.00 | | 100% | | |
| 1.75" | 45.00 | | 100% | | |
| 1.50" | 37.50 | 100% | 100% | | |
| 1.25" | 31.50 | 86% | 86% | | |
| 1.00" | 25.00 | 80% | 80% | | |
| 7/8" | 22.40 | | 75% | | |
| 3/4" | 19.00 | 68% | 68% | | |
| 5/8" | 16.00 | 67% | 67% | | |
| 1/2" | 12.50 | 60% | 60% | | |
| 3/8" | 9.50 | 53% | 53% | | |
| 1/4" | 6.30 | 40% | 40% | | |
| #4 | 4.75 | 33% | 33% | | |

| **Fines Section** Sieve Size US | Metric | Actual Cumulative Percent Passing | Interpolated Cumulative Percent Passing | Specs Max | Specs Min |
|---|---|---|---|---|---|
| #4 | 4.750 | 33% | 33% | | |
| #8 | 2.360 | 21% | 21% | | |
| #10 | 2.000 | 19% | 19% | | |
| #16 | 1.180 | 14% | 14% | | |
| #20 | 0.850 | | 11% | | |
| #30 | 0.600 | 10% | 10% | | |
| #40 | 0.425 | 8% | 8% | | |
| #50 | 0.300 | 7% | 7% | | |
| #60 | 0.250 | | 7% | | |
| #80 | 0.180 | | 6% | | |
| #100 | 0.150 | 6% | 6% | | |
| #140 | 0.106 | | 6% | | |
| #170 | 0.090 | | 5% | | |
| #200 | 0.075 | 5.2% | 5.2% | | |
| #270 | 0.053 | | | | |



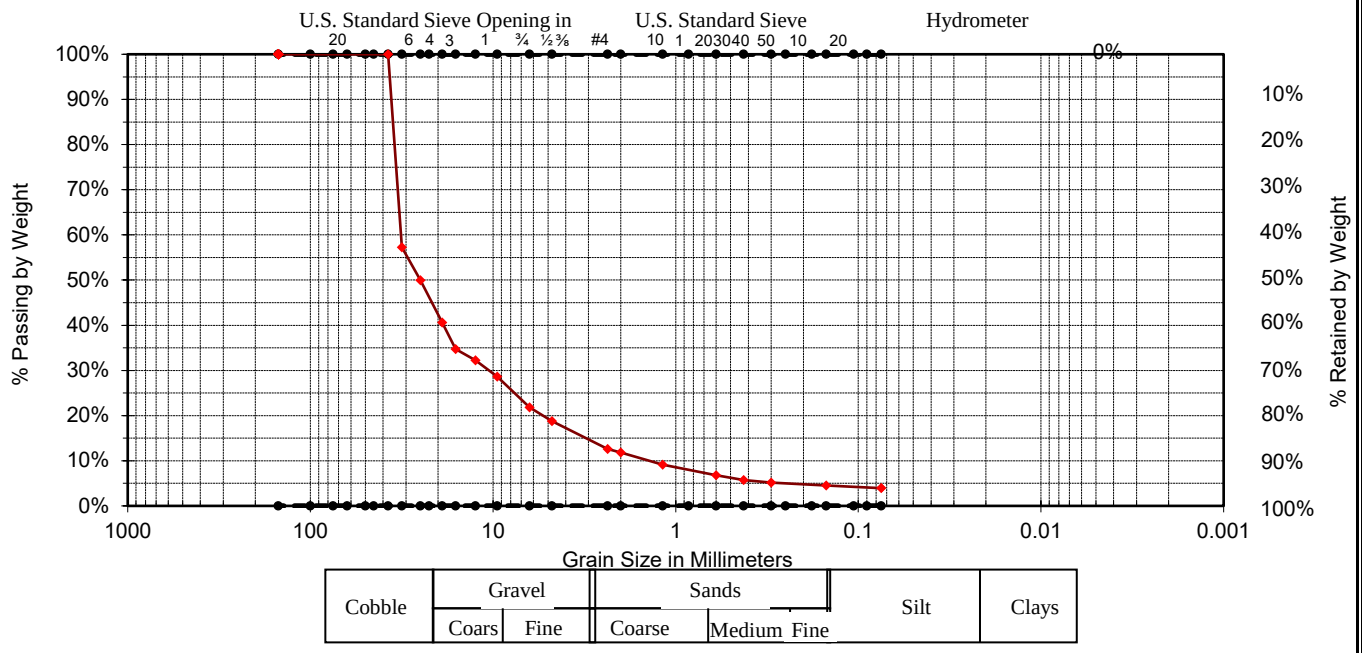
Comments: _____

Reviewed by: Tim Barney

# Pacific Testing & Inspection Inc.

3215 Harrison Avenue Centralia, WA 98531
Phone (360) 736-3922 Fax (360) 807-6022

**ASTM C-136** **Sieve Report** **ASTM D-4318**




| | | | | | |
|---|---|---|---|---|---|
| Date : | 12/21/2022 | $D_{10}$ = | 1.44 | **USCS Classification** | % Gravel % Sand |
| Sample #: | 22-390 | $D_{30}$ = | 10.67 | GW, Well-graded Gravel | 81.3% 14.8% |
| Source: | TP3@5' (paving) | $D_{60}$ = | 31.88 | **Specifications** | Color: |
| Project #: | 220073 | $C_C$ = | 2.48 | No Specs | 10YR 3/4 dk yell brn |
| Project: | Serenity - The Lodge | $C_{U=}$ | 22.19 | Sample Meets Specs | % Silt & Clay |
| Client: | Olympia Hangars, LLC | Liquid Limit= | 0.0% | n/a | 3.9% |
| Tested By: | HH | Plastic Limit= | 0.0% | Fineness Modulus | |
| Date Tested: | 12/27/2022 | Plasticity Index= | 0.0% | 6.74 | |

| Coarse Section | | Actual Cumulative | Interpolated Cumulative | | |
|---|---|---|---|---|---|
| Sieve Size US | Sieve Size Metric | Percent Passing | Percent Passing | Specs Max | Specs Min |
| 6.00" | 150.00 | | 100% | | |
| 4.00" | 100.00 | | 100% | | |
| 3.00" | 75.00 | | 100% | | |
| 2.50" | 63.00 | | 100% | | |
| 2.00" | 50.00 | | 100% | | |
| 1.75" | 45.00 | | 100% | | |
| 1.50" | 37.50 | 100% | 100% | | |
| 1.25" | 31.50 | 57% | 57% | | |
| 1.00" | 25.00 | 50% | 50% | | |
| 7/8" | 22.40 | | 46% | | |
| 3/4" | 19.00 | 41% | 41% | | |
| 5/8" | 16.00 | 35% | 35% | | |
| 1/2" | 12.50 | 32% | 32% | | |
| 3/8" | 9.50 | 29% | 29% | | |
| 1/4" | 6.30 | 22% | 22% | | |
| #4 | 4.75 | 19% | 19% | | |

| Fines Section | | Actual Cumulative | Interpolated Cumulative | | |
|---|---|---|---|---|---|
| Sieve Size US | Sieve Size Metric | Percent Passing | Percent Passing | Specs Max | Specs Min |
| #4 | 4.750 | 19% | 19% | | |
| #8 | 2.360 | 13% | 13% | | |
| #10 | 2.000 | 12% | 12% | | |
| #16 | 1.180 | 9% | 9% | | |
| #20 | 0.850 | | 8% | | |
| #30 | 0.600 | 7% | 7% | | |
| #40 | 0.425 | 6% | 6% | | |
| #50 | 0.300 | 5% | 5% | | |
| #60 | 0.250 | | 5% | | |
| #80 | 0.180 | | 5% | | |
| #100 | 0.150 | 5% | 5% | | |
| #140 | 0.106 | | 4% | | |
| #170 | 0.090 | | 4% | | |
| #200 | 0.075 | 3.9% | 3.9% | | |
| #270 | 0.053 | | | | |



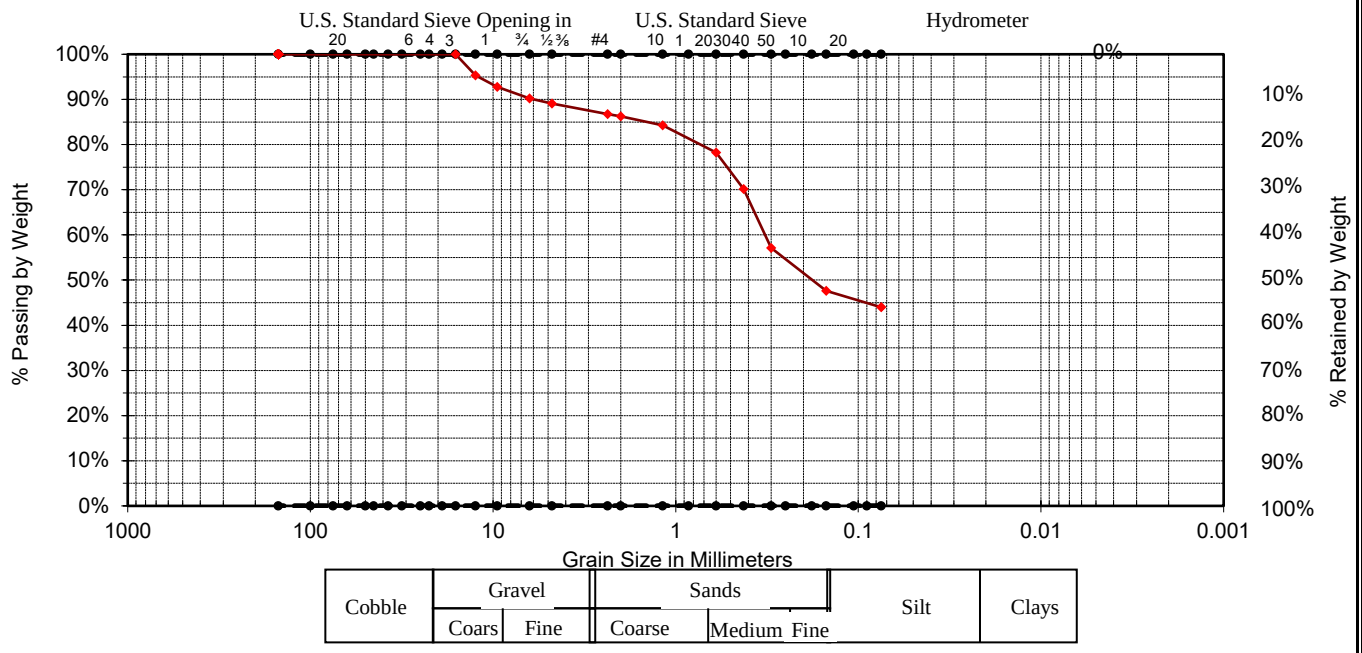
Comments:

Reviewed by: Tim Barney

# Pacific Testing & Inspection Inc.

3215 Harrison Avenue Centralia, WA 98531
Phone (360) 736-3922 Fax (360) 807-6022

**ASTM C-136** **Sieve Report** **ASTM D-4318**




| | | | | | |
|---|---|---|---|---|---|
| Date : | 12/21/2022 | $D_{10}$ = | 0.02 | **USCS Classification** | % Gravel % Sand |
| Sample #: | 22-391 | $D_{30}$ = | 0.05 | SM, Silty Sand | 10.9% 45.1% |
| Source: | TP4@NE pond -4'(W pit) | $D_{60}$ = | 0.33 | **Specifications** | Color: |
| Project #: | 220073 | $C_C$ = | 0.47 | No Specs | 10YR 3/4 dk yell brn |
| Project: | Serenity - The Lodge | $C_{U=}$ | 19.22 | Sample Meets Specs | % Silt & Clay |
| Client: | Olympia Hangars, LLC | Liquid Limit= | 0.0% | n/a | 44.0% |
| Tested By: | HH | Plastic Limit= | 0.0% | Fineness Modulus | |
| Date Tested: | 12/27/2022 | Plasticity Index= | 0.0% | 1.64 | |

| **Coarse Section** Sieve Size US | Metric | Actual Cumulative Percent Passing | Interpolated Cumulative Percent Passing | Specs Max | Specs Min |
|---|---|---|---|---|---|
| 6.00" | 150.00 | | 100% | | |
| 4.00" | 100.00 | | 100% | | |
| 3.00" | 75.00 | | 100% | | |
| 2.50" | 63.00 | | 100% | | |
| 2.00" | 50.00 | | 100% | | |
| 1.75" | 45.00 | | 100% | | |
| 1.50" | 37.50 | | 100% | | |
| 1.25" | 31.50 | | 100% | | |
| 1.00" | 25.00 | | 100% | | |
| 7/8" | 22.40 | | 100% | | |
| 3/4" | 19.00 | | 100% | | |
| 5/8" | 16.00 | 100% | 100% | | |
| 1/2" | 12.50 | 95% | 95% | | |
| 3/8" | 9.50 | 93% | 93% | | |
| 1/4" | 6.30 | 90% | 90% | | |
| #4 | 4.75 | 89% | 89% | | |

| **Fines Section** Sieve Size US | Metric | Actual Cumulative Percent Passing | Interpolated Cumulative Percent Passing | Specs Max | Specs Min |
|---|---|---|---|---|---|
| #4 | 4.750 | 89% | 89% | | |
| #8 | 2.360 | 87% | 87% | | |
| #10 | 2.000 | 86% | 86% | | |
| #16 | 1.180 | 84% | 84% | | |
| #20 | 0.850 | | 81% | | |
| #30 | 0.600 | 78% | 78% | | |
| #40 | 0.425 | 70% | 70% | | |
| #50 | 0.300 | 57% | 57% | | |
| #60 | 0.250 | | 54% | | |
| #80 | 0.180 | | 50% | | |
| #100 | 0.150 | 48% | 48% | | |
| #140 | 0.106 | | 45% | | |
| #170 | 0.090 | | 45% | | |
| #200 | 0.075 | 44.0% | 44.0% | | |
| #270 | 0.053 | | | | |



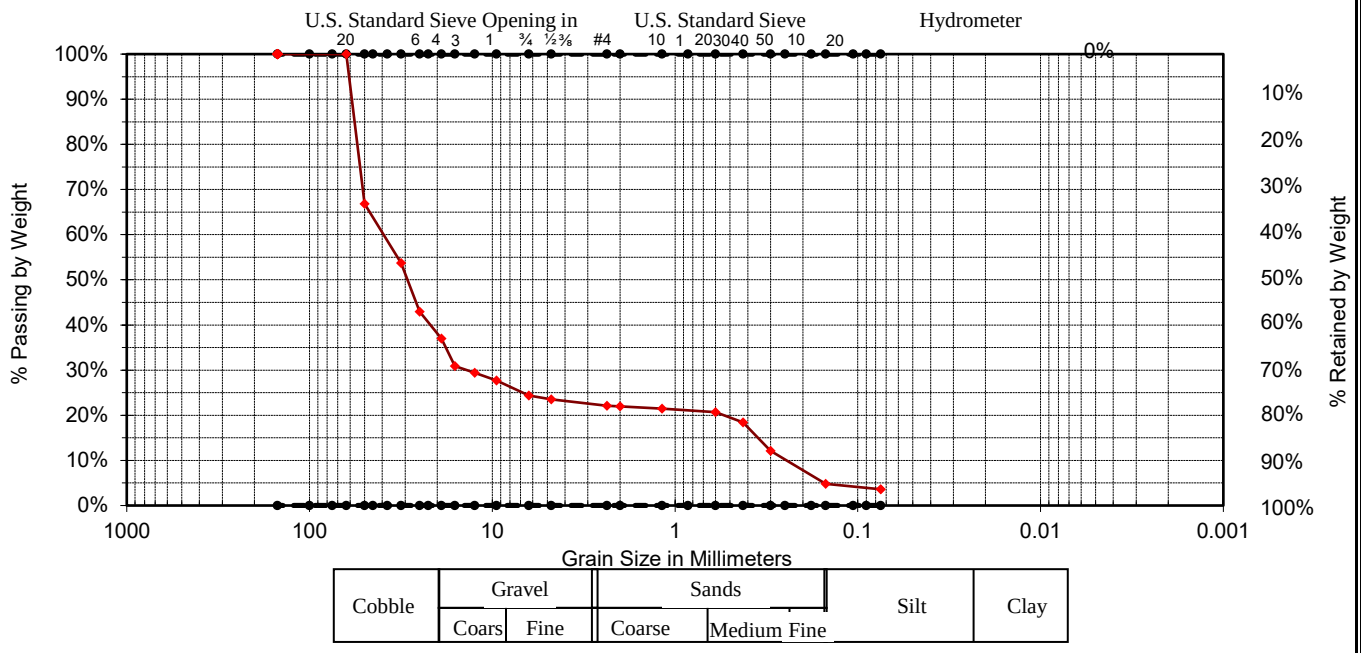
Comments:

Reviewed by: Tim Barney

# Pacific Testing & Inspection Inc.

3215 Harrison Avenue Centralia, WA 98531
Phone (360) 736-3922 Fax (360) 807-6022

**ASTM C-136** **Sieve Report** **ASTM D-4318**




| | | | | | |
|---|---|---|---|---|---|
| Date : | 12/21/2022 | $D_{10}$ = | 0.26 | **USCS Classification** | % Gravel % Sand |
| Sample #: | 22-383 | $D_{30}$ = | 13.91 | GP, Poorly graded Gravel with Sand | 76.5% 19.9% |
| Source: | TP4@NE pond(W pit -12') | $D_{60}$ = | 40.36 | **Specifications** | Color: |
| Project #: | 220073 | $C_C$ = | 18.66 | No Specs | 10YR 3/4 dk yell brn |
| Project: | Serenity - The Lodge | $C_{U=}$ | 157.12 | Sample Meets Specs | % Silt & Clay |
| Client: | Olympia Hangars, LLC | Liquid Limit= | 0.0% | n/a | 3.6% |
| Tested By: | HH | Plastic Limit= | 0.0% | Fineness Modulus | |
| Date Tested: | 12/27/2022 | Plasticity Index= | 0.0% | 6.73 | |

| Coarse Section | | Actual Cumulative | Interpolated Cumulative | | |
|---|---|---|---|---|---|
| Sieve Size US | Sieve Size Metric | Percent Passing | Percent Passing | Specs Max | Specs Min |
| 6.00" | 150.00 | | 100% | | |
| 4.00" | 100.00 | | 100% | | |
| 3.00" | 75.00 | | 100% | | |
| 2.50" | 63.00 | 100% | 100% | | |
| 2.00" | 50.00 | 67% | 67% | | |
| 1.75" | 45.00 | | 63% | | |
| 1.50" | 37.50 | | 58% | | |
| 1.25" | 31.50 | 54% | 54% | | |
| 1.00" | 25.00 | 43% | 43% | | |
| 7/8" | 22.40 | | 40% | | |
| 3/4" | 19.00 | 37% | 37% | | |
| 5/8" | 16.00 | 31% | 31% | | |
| 1/2" | 12.50 | 29% | 29% | | |
| 3/8" | 9.50 | 28% | 28% | | |
| 1/4" | 6.30 | 24% | 24% | | |
| #4 | 4.75 | 23% | 23% | | |

| Fines Section | | Actual Cumulative | Interpolated Cumulative | | |
|---|---|---|---|---|---|
| Sieve Size US | Sieve Size Metric | Percent Passing | Percent Passing | Specs Max | Specs Min |
| #4 | 4.750 | 23% | 23% | | |
| #8 | 2.360 | 22% | 22% | | |
| #10 | 2.000 | 22% | 22% | | |
| #16 | 1.180 | 21% | 21% | | |
| #20 | 0.850 | | 21% | | |
| #30 | 0.600 | 21% | 21% | | |
| #40 | 0.425 | 18% | 18% | | |
| #50 | 0.300 | 12% | 12% | | |
| #60 | 0.250 | | 10% | | |
| #80 | 0.180 | | 6% | | |
| #100 | 0.150 | 5% | 5% | | |
| #140 | 0.106 | | 4% | | |
| #170 | 0.090 | | 4% | | |
| #200 | 0.075 | 3.6% | 3.6% | | |
| #270 | 0.053 | | | | |



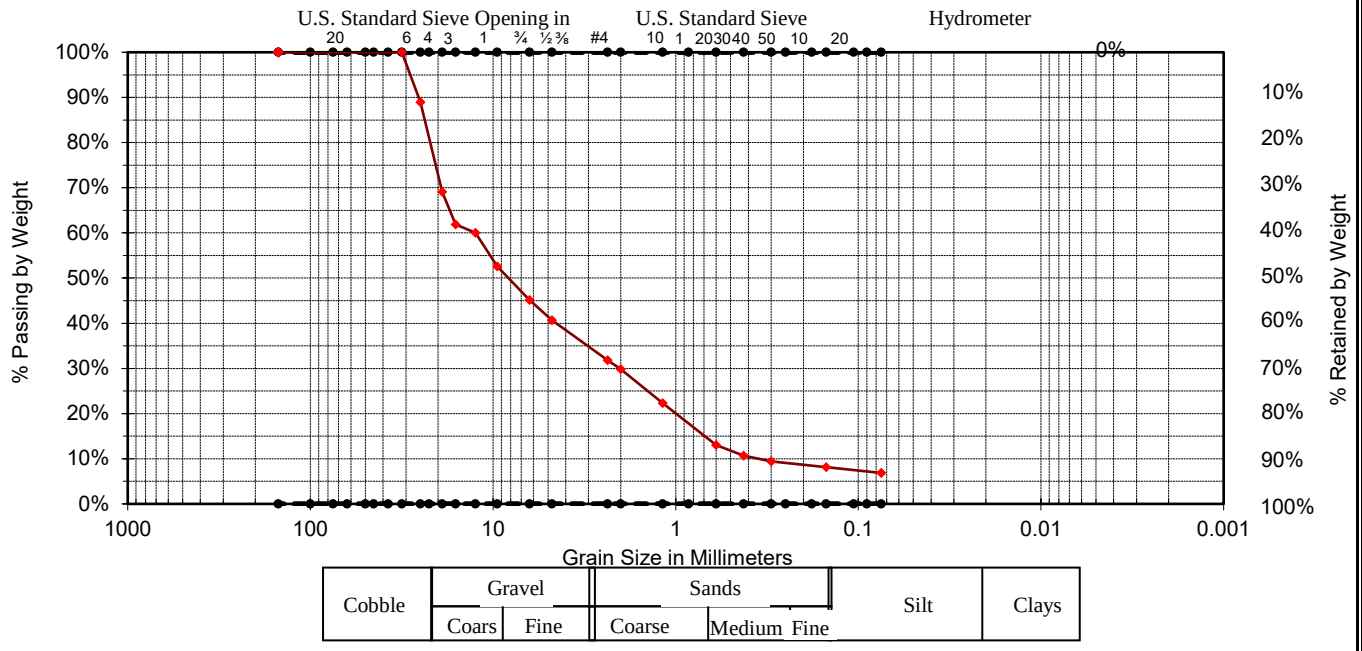
Comments: _____

Reviewed by: Tim Barney

# Pacific Testing & Inspection Inc.

3215 Harrison Avenue Centralia, WA 98531
Phone (360) 736-3922 Fax (360) 807-6022

**ASTM C-136** **Sieve Report** **ASTM D-4318**




| | | | | | |
|---|---|---|---|---|---|
| Date : | 12/21/2022 | $D_{10}$ = | 0.36 | **USCS Classification** | % Gravel % Sand |
| Sample #: | 22-384 | $D_{30}$ = | 2.03 | GP-GM, Poorly graded Gravel with Sil | 59.3% 33.8% |
| Source: | TP4@NE pond W pit (-7') | $D_{60}$ = | 12.51 | **Specifications** | Color: |
| Project #: | 220073 | $C_C$ = | 0.92 | No Specs | 10YR 4/3 brn |
| Project: | Serenity - The Lodge | $C_{U=}$ | 35.09 | Sample Meets Specs | % Silt & Clay |
| Client: | Olympia Hangars, LLC | Liquid Limit= | 0.0% | n/a | 6.9% |
| Tested By: | HH | Plastic Limit= | 0.0% | Fineness Modulus | |
| Date Tested: | 12/27/2022 | Plasticity Index= | 0.0% | 5.53 | |

| **Coarse Section** Sieve Size US | Metric | Actual Cumulative Percent Passing | Interpolated Cumulative Percent Passing | Specs Max | Specs Min |
|---|---|---|---|---|---|
| 6.00" | 150.00 | | 100% | | |
| 4.00" | 100.00 | | 100% | | |
| 3.00" | 75.00 | | 100% | | |
| 2.50" | 63.00 | | 100% | | |
| 2.00" | 50.00 | | 100% | | |
| 1.75" | 45.00 | | 100% | | |
| 1.50" | 37.50 | | 100% | | |
| 1.25" | 31.50 | 100% | 100% | | |
| 1.00" | 25.00 | 89% | 89% | | |
| 7/8" | 22.40 | | 80% | | |
| 3/4" | 19.00 | 69% | 69% | | |
| 5/8" | 16.00 | 62% | 62% | | |
| 1/2" | 12.50 | 60% | 60% | | |
| 3/8" | 9.50 | 53% | 53% | | |
| 1/4" | 6.30 | 45% | 45% | | |
| #4 | 4.75 | 41% | 41% | | |

| **Fines Section** Sieve Size US | Metric | Actual Cumulative Percent Passing | Interpolated Cumulative Percent Passing | Specs Max | Specs Min |
|---|---|---|---|---|---|
| #4 | 4.750 | 41% | 41% | | |
| #8 | 2.360 | 32% | 32% | | |
| #10 | 2.000 | 30% | 30% | | |
| #16 | 1.180 | 22% | 22% | | |
| #20 | 0.850 | | 17% | | |
| #30 | 0.600 | 13% | 13% | | |
| #40 | 0.425 | 11% | 11% | | |
| #50 | 0.300 | 9% | 9% | | |
| #60 | 0.250 | | 9% | | |
| #80 | 0.180 | | 8% | | |
| #100 | 0.150 | 8% | 8% | | |
| #140 | 0.106 | | 7% | | |
| #170 | 0.090 | | 7% | | |
| #200 | 0.075 | 6.9% | 6.9% | | |
| #270 | 0.053 | | | | |



Comments:

Reviewed by: Tim Barney

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3215 Harrison Avenue Centralia, WA 98531
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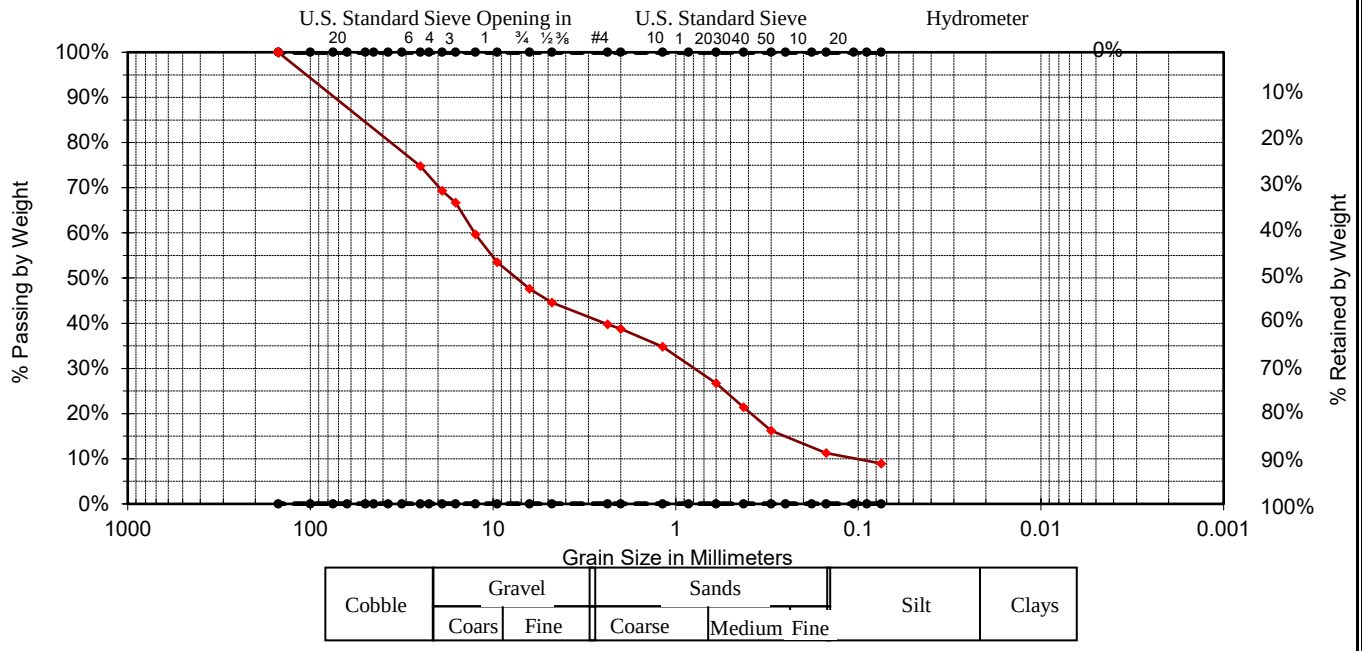
**ASTM C-136** **Sieve Report** **ASTM D-4318**




| | | | | | |
|---|---|---|---|---|---|
| Date : | 12/21/2022 | $D_{10}$ = | 0.11 | **USCS Classification** | % Gravel % Sand |
| Sample #: | 22-393 | $D_{30}$ = | 0.84 | GP-GM, Poorly graded Gravel with Sil | 55.4% 35.6% |
| Source: | TP5@NE pond E pit -8' | $D_{60}$ = | 12.66 | **Specifications** | Color: |
| Project #: | 220073 | $C_C$ = | 0.51 | No Specs | 10YR 3/4 dk yell brn |
| Project: | Serenity - The Lodge | $C_{U=}$ | 115.76 | Sample Meets Specs | % Silt & Clay |
| Client: | Olympia Hangars, LLC | Liquid Limit= | 0.0% | n/a | 8.9% |
| Tested By: | HH | Plastic Limit= | 0.0% | Fineness Modulus | |
| Date Tested: | 12/27/2022 | Plasticity Index= | 0.0% | 5.04 | |

| **Coarse Section** Sieve Size US | Metric | Actual Cumulative Percent Passing | Interpolated Cumulative Percent Passing | Specs Max | Specs Min |
|---|---|---|---|---|---|
| 6.00" | 150.00 | | 100% | | |
| 4.00" | 100.00 | | 100% | | |
| 3.00" | 75.00 | | 100% | | |
| 2.50" | 63.00 | | 100% | | |
| 2.00" | 50.00 | | 100% | | |
| 1.75" | 45.00 | | 100% | | |
| 1.50" | 37.50 | | 100% | | |
| 1.25" | 31.50 | | 100% | | |
| 1.00" | 25.00 | 75% | 75% | | |
| 7/8" | 22.40 | | 72% | | |
| 3/4" | 19.00 | 69% | 69% | | |
| 5/8" | 16.00 | 67% | 67% | | |
| 1/2" | 12.50 | 60% | 60% | | |
| 3/8" | 9.50 | 54% | 54% | | |
| 1/4" | 6.30 | 48% | 48% | | |
| #4 | 4.75 | 45% | 45% | | |

| **Fines Section** Sieve Size US | Metric | Actual Cumulative Percent Passing | Interpolated Cumulative Percent Passing | Specs Max | Specs Min |
|---|---|---|---|---|---|
| #4 | 4.750 | 45% | 45% | | |
| #8 | 2.360 | 40% | 40% | | |
| #10 | 2.000 | 39% | 39% | | |
| #16 | 1.180 | 35% | 35% | | |
| #20 | 0.850 | | 30% | | |
| #30 | 0.600 | 27% | 27% | | |
| #40 | 0.425 | 21% | 21% | | |
| #50 | 0.300 | 16% | 16% | | |
| #60 | 0.250 | | 15% | | |
| #80 | 0.180 | | 12% | | |
| #100 | 0.150 | 11% | 11% | | |
| #140 | 0.106 | | 10% | | |
| #170 | 0.090 | | 9% | | |
| #200 | 0.075 | 8.9% | 8.9% | | |
| #270 | 0.053 | | | | |



Comments: _____

Reviewed by: Tim Barney

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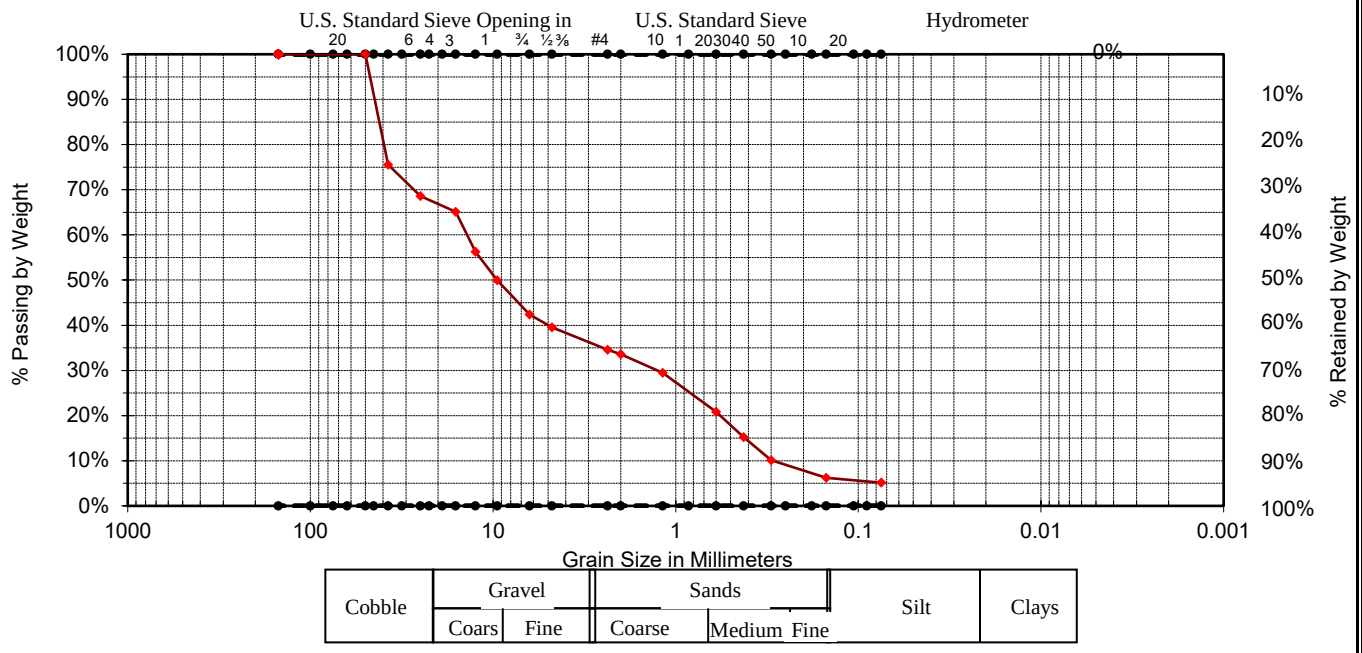
**ASTM C-136** **Sieve Report** **ASTM D-4318**




| | | | | | |
|---|---|---|---|---|---|
| Date : | 12/21/2022 | $D_{10}$ = | 0.29 | **USCS Classification** | % Gravel % Sand |
| Sample #: | 22-392 | $D_{30}$ = | 1.28 | GP-GM, Poorly graded Gravel with Sil | 60.5% 34.4% |
| Source: | TP5@NE pond E pit -12' | $D_{60}$ = | 13.98 | **Specifications** | Color: |
| Project #: | 220073 | $C_C$ = | 0.40 | No Specs | 10YR 3/4 dk yell brn |
| Project: | Serenity - The Lodge | $C_{U=}$ | 47.49 | Sample Meets Specs | % Silt & Clay |
| Client: | Olympia Hangars, LLC | Liquid Limit= | 0.0% | n/a | 5.1% |
| Tested By: | HH | Plastic Limit= | 0.0% | Fineness Modulus | |
| Date Tested: | 12/27/2022 | Plasticity Index= | 0.0% | 5.67 | |

| **Coarse Section** Sieve Size US | Metric | Actual Cumulative Percent Passing | Interpolated Cumulative Percent Passing | Specs Max | Specs Min |
|---|---|---|---|---|---|
| 6.00" | 150.00 | | 100% | | |
| 4.00" | 100.00 | | 100% | | |
| 3.00" | 75.00 | | 100% | | |
| 2.50" | 63.00 | | 100% | | |
| 2.00" | 50.00 | 100% | 100% | | |
| 1.75" | 45.00 | | 90% | | |
| 1.50" | 37.50 | 76% | 76% | | |
| 1.25" | 31.50 | | 72% | | |
| 1.00" | 25.00 | 69% | 69% | | |
| 7/8" | 22.40 | | 68% | | |
| 3/4" | 19.00 | | 66% | | |
| 5/8" | 16.00 | 65% | 65% | | |
| 1/2" | 12.50 | 56% | 56% | | |
| 3/8" | 9.50 | 50% | 50% | | |
| 1/4" | 6.30 | 42% | 42% | | |
| #4 | 4.75 | 40% | 40% | | |

| **Fines Section** Sieve Size US | Metric | Actual Cumulative Percent Passing | Interpolated Cumulative Percent Passing | Specs Max | Specs Min |
|---|---|---|---|---|---|
| #4 | 4.750 | 40% | 40% | | |
| #8 | 2.360 | 35% | 35% | | |
| #10 | 2.000 | 34% | 34% | | |
| #16 | 1.180 | 29% | 29% | | |
| #20 | 0.850 | | 25% | | |
| #30 | 0.600 | 21% | 21% | | |
| #40 | 0.425 | 15% | 15% | | |
| #50 | 0.300 | 10% | 10% | | |
| #60 | 0.250 | | 9% | | |
| #80 | 0.180 | | 7% | | |
| #100 | 0.150 | 6% | 6% | | |
| #140 | 0.106 | | 6% | | |
| #170 | 0.090 | | 5% | | |
| #200 | 0.075 | 5.1% | 5.1% | | |
| #270 | 0.053 | | | | |



Comments: _____

Reviewed by: Tim Barney

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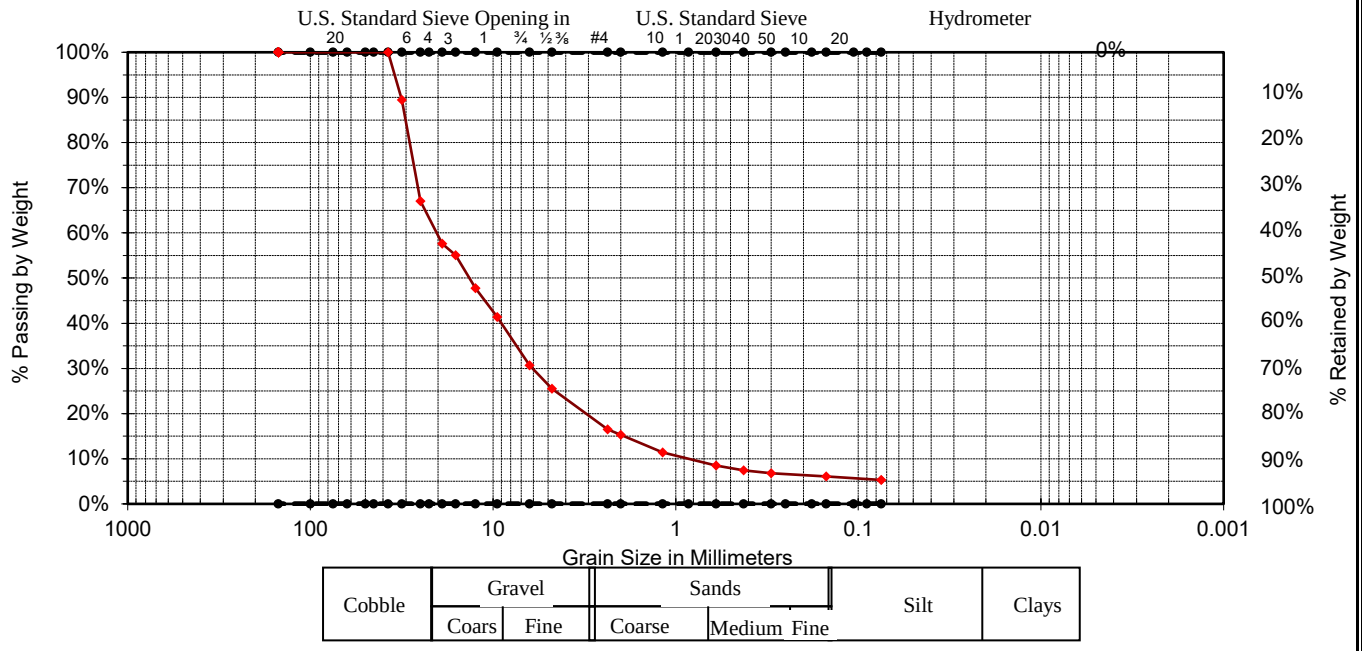
**ASTM C-136** **Sieve Report** **ASTM D-4318**




| | | | | | |
|---|---|---|---|---|---|
| Date : | 12/21/2022 | $D_{10}$ = | 0.90 | **USCS Classification** | % Gravel % Sand |
| Sample #: | 22-385 | $D_{30}$ = | 6.10 | GW-GM, Well-graded Gravel with Silt | 74.5% 20.2% |
| Source: | TP6 Bldg A -5' | $D_{60}$ = | 20.52 | **Specifications** | Color: |
| Project #: | 220073 | $C_C$ = | 2.01 | No Specs | 10YR 4/3 brn |
| Project: | Serenity - The Lodge | $C_{U=}$ | 22.71 | Sample Meets Specs | % Silt & Clay |
| Client: | Olympia Hangars, LLC | Liquid Limit= | 0.0% | n/a | 5.3% |
| Tested By: | HH | Plastic Limit= | 0.0% | Fineness Modulus | |
| Date Tested: | 12/27/2022 | Plasticity Index= | 0.0% | 6.26 | |

| **Coarse Section** Sieve Size US | Metric | Actual Cumulative Percent Passing | Interpolated Cumulative Percent Passing | Specs Max | Specs Min |
|---|---|---|---|---|---|
| 6.00" | 150.00 | | 100% | | |
| 4.00" | 100.00 | | 100% | | |
| 3.00" | 75.00 | | 100% | | |
| 2.50" | 63.00 | | 100% | | |
| 2.00" | 50.00 | | 100% | | |
| 1.75" | 45.00 | | 100% | | |
| 1.50" | 37.50 | 100% | 100% | | |
| 1.25" | 31.50 | 89% | 89% | | |
| 1.00" | 25.00 | 67% | 67% | | |
| 7/8" | 22.40 | | 63% | | |
| 3/4" | 19.00 | 58% | 58% | | |
| 5/8" | 16.00 | 55% | 55% | | |
| 1/2" | 12.50 | 48% | 48% | | |
| 3/8" | 9.50 | 41% | 41% | | |
| 1/4" | 6.30 | 31% | 31% | | |
| #4 | 4.75 | 26% | 26% | | |

| **Fines Section** Sieve Size US | Metric | Actual Cumulative Percent Passing | Interpolated Cumulative Percent Passing | Specs Max | Specs Min |
|---|---|---|---|---|---|
| #4 | 4.750 | 26% | 26% | | |
| #8 | 2.360 | 17% | 17% | | |
| #10 | 2.000 | 15% | 15% | | |
| #16 | 1.180 | 11% | 11% | | |
| #20 | 0.850 | | 10% | | |
| #30 | 0.600 | 8% | 8% | | |
| #40 | 0.425 | 7% | 7% | | |
| #50 | 0.300 | 7% | 7% | | |
| #60 | 0.250 | | 7% | | |
| #80 | 0.180 | | 6% | | |
| #100 | 0.150 | 6% | 6% | | |
| #140 | 0.106 | | 6% | | |
| #170 | 0.090 | | 5% | | |
| #200 | 0.075 | 5.3% | 5.3% | | |
| #270 | 0.053 | | | | |



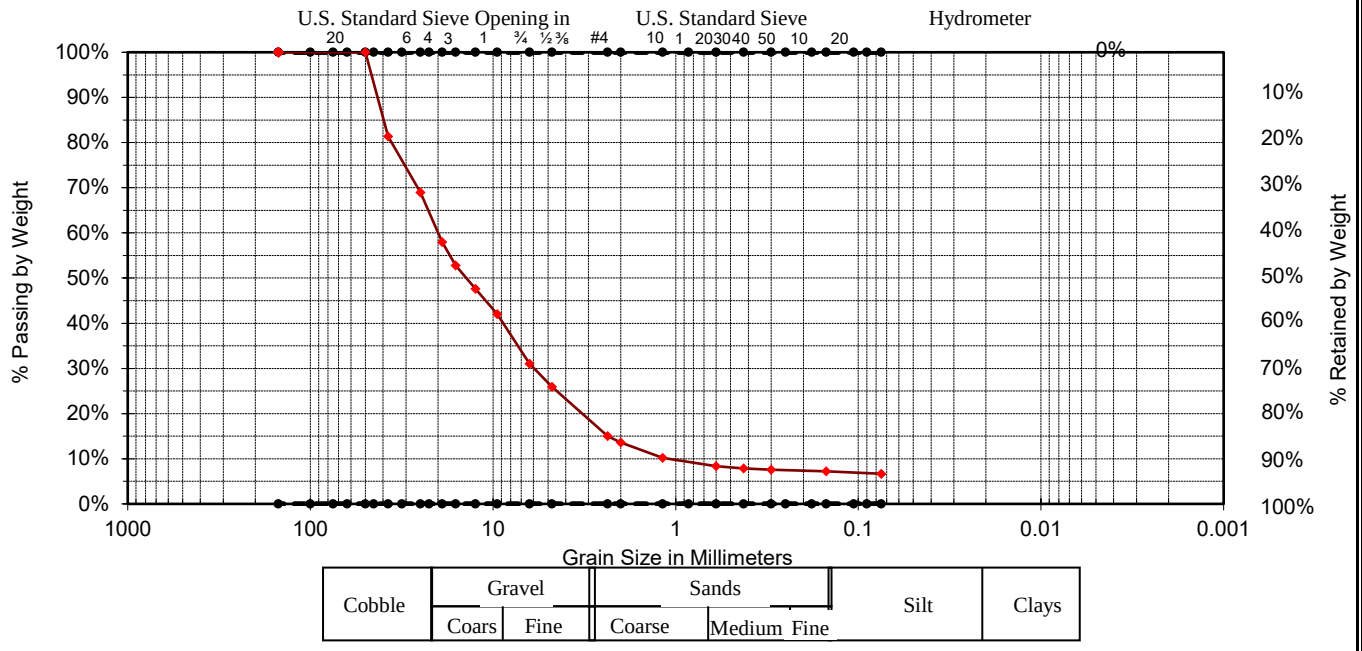
Comments: _____

Reviewed by: Tim Barney

# Pacific Testing & Inspection Inc.

3215 Harrison Avenue Centralia, WA 98531
Phone (360) 736-3922 Fax (360) 807-6022

**ASTM C-136** **Sieve Report** **ASTM D-4318**




| | | | | | |
|---|---|---|---|---|---|
| Date : | 12/21/2022 | $D_{10}$ = | 1.11 | **USCS Classification** | % Gravel % Sand |
| Sample #: | 22-386 | $D_{30}$ = | 5.99 | GW-GM, Well-graded Gravel with Silt | 74.1% 19.2% |
| Source: | TP6 Bldg A -7' | $D_{60}$ = | 20.12 | **Specifications** | Color: |
| Project #: | 220073 | $C_C$ = | 1.61 | No Specs | 10YR 3/4 dk yell brn |
| Project: | Serenity - The Lodge | $C_{U=}$ | 18.11 | Sample Meets Specs | % Silt & Clay |
| Client: | Olympia Hangars, LLC | Liquid Limit= | 0.0% | n/a | 6.7% |
| Tested By: | HH | Plastic Limit= | 0.0% | Fineness Modulus | |
| Date Tested: | 12/27/2022 | Plasticity Index= | 0.0% | 6.44 | |

| **Coarse Section** Sieve Size US | Metric | Actual Cumulative Percent Passing | Interpolated Cumulative Percent Passing | Specs Max | Specs Min |
|---|---|---|---|---|---|
| 6.00" | 150.00 | | 100% | | |
| 4.00" | 100.00 | | 100% | | |
| 3.00" | 75.00 | | 100% | | |
| 2.50" | 63.00 | | 100% | | |
| 2.00" | 50.00 | 100% | 100% | | |
| 1.75" | 45.00 | | 93% | | |
| 1.50" | 37.50 | 81% | 81% | | |
| 1.25" | 31.50 | | 75% | | |
| 1.00" | 25.00 | 69% | 69% | | |
| 7/8" | 22.40 | | 64% | | |
| 3/4" | 19.00 | 58% | 58% | | |
| 5/8" | 16.00 | 53% | 53% | | |
| 1/2" | 12.50 | 48% | 48% | | |
| 3/8" | 9.50 | 42% | 42% | | |
| 1/4" | 6.30 | 31% | 31% | | |
| #4 | 4.75 | 26% | 26% | | |

| **Fines Section** Sieve Size US | Metric | Actual Cumulative Percent Passing | Interpolated Cumulative Percent Passing | Specs Max | Specs Min |
|---|---|---|---|---|---|
| #4 | 4.750 | 26% | 26% | | |
| #8 | 2.360 | 15% | 15% | | |
| #10 | 2.000 | 14% | 14% | | |
| #16 | 1.180 | 10% | 10% | | |
| #20 | 0.850 | | 9% | | |
| #30 | 0.600 | 8% | 8% | | |
| #40 | 0.425 | 8% | 8% | | |
| #50 | 0.300 | 8% | 8% | | |
| #60 | 0.250 | | 7% | | |
| #80 | 0.180 | | 7% | | |
| #100 | 0.150 | 7% | 7% | | |
| #140 | 0.106 | | 7% | | |
| #170 | 0.090 | | 7% | | |
| #200 | 0.075 | 6.7% | 6.7% | | |
| #270 | 0.053 | | | | |



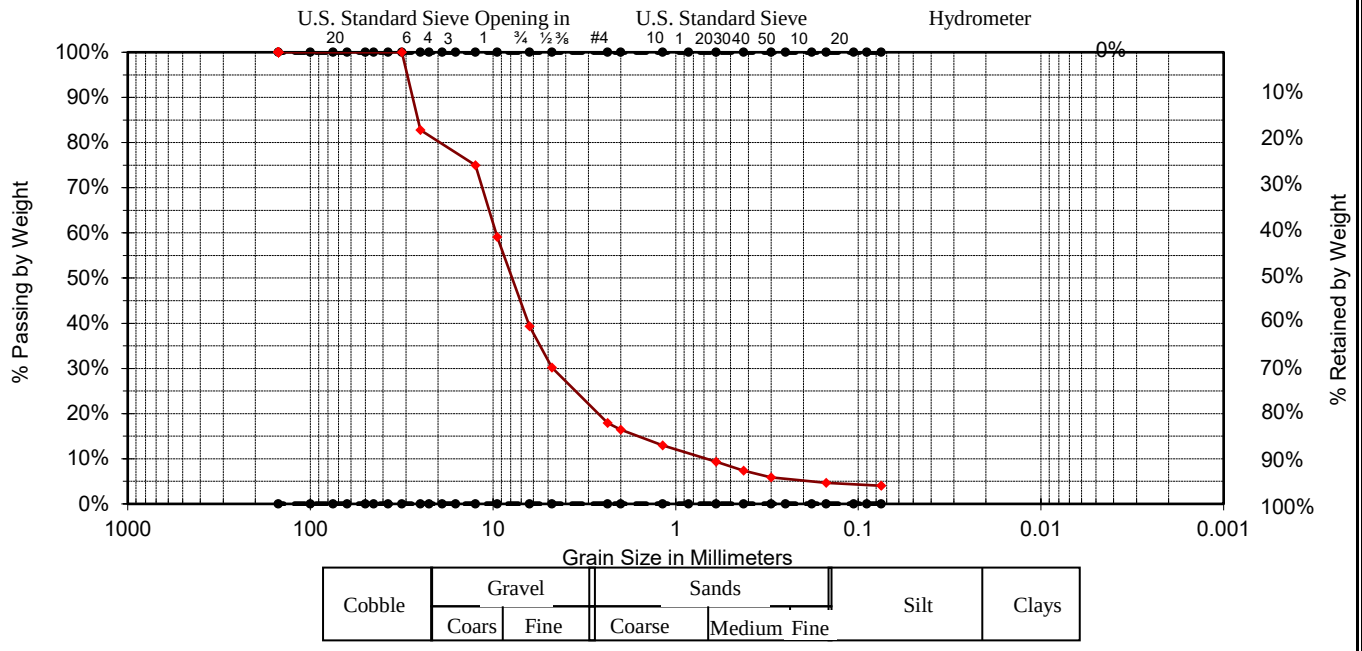
Comments:

Reviewed by: Tim Barney

# Pacific Testing & Inspection Inc.

3215 Harrison Avenue Centralia, WA 98531
Phone (360) 736-3922 Fax (360) 807-6022

**ASTM C-136** **Sieve Report** **ASTM D-4318**




| | | | | | |
|---|---|---|---|---|---|
| Date : | 12/21/2022 | $D_{10}$ = | 0.71 | **USCS Classification** | % Gravel % Sand |
| Sample #: | 22-387 | $D_{30}$ = | 4.72 | GP, Poorly graded Gravel with Sand | 69.9% 26.1% |
| Source: | TP7 pavement -5' | $D_{60}$ = | 9.67 | **Specifications** | Color: |
| Project #: | 220073 | $C_C$ = | 3.24 | No Specs | 10YR 4/3 brn |
| Project: | Serenity - The Lodge | $C_{U=}$ | 13.61 | Sample Meets Specs | % Silt & Clay |
| Client: | Olympia Hangars, LLC | Liquid Limit= | 0.0% | n/a | 4.0% |
| Tested By: | HH | Plastic Limit= | 0.0% | Fineness Modulus | |
| Date Tested: | 12/27/2022 | Plasticity Index= | 0.0% | 5.81 | |

| **Coarse Section** Sieve Size US | Metric | Actual Cumulative Percent Passing | Interpolated Cumulative Percent Passing | Specs Max | Specs Min |
|---|---|---|---|---|---|
| 6.00" | 150.00 | | 100% | | |
| 4.00" | 100.00 | | 100% | | |
| 3.00" | 75.00 | | 100% | | |
| 2.50" | 63.00 | | 100% | | |
| 2.00" | 50.00 | | 100% | | |
| 1.75" | 45.00 | | 100% | | |
| 1.50" | 37.50 | | 100% | | |
| 1.25" | 31.50 | 100% | 100% | | |
| 1.00" | 25.00 | 83% | 83% | | |
| 7/8" | 22.40 | | 81% | | |
| 3/4" | 19.00 | | 79% | | |
| 5/8" | 16.00 | | 77% | | |
| 1/2" | 12.50 | 75% | 75% | | |
| 3/8" | 9.50 | 59% | 59% | | |
| 1/4" | 6.30 | 39% | 39% | | |
| #4 | 4.75 | 30% | 30% | | |

| **Fines Section** Sieve Size US | Metric | Actual Cumulative Percent Passing | Interpolated Cumulative Percent Passing | Specs Max | Specs Min |
|---|---|---|---|---|---|
| #4 | 4.750 | 30% | 30% | | |
| #8 | 2.360 | 18% | 18% | | |
| #10 | 2.000 | 16% | 16% | | |
| #16 | 1.180 | 13% | 13% | | |
| #20 | 0.850 | | 11% | | |
| #30 | 0.600 | 9% | 9% | | |
| #40 | 0.425 | 7% | 7% | | |
| #50 | 0.300 | 6% | 6% | | |
| #60 | 0.250 | | 5% | | |
| #80 | 0.180 | | 5% | | |
| #100 | 0.150 | 5% | 5% | | |
| #140 | 0.106 | | 4% | | |
| #170 | 0.090 | | 4% | | |
| #200 | 0.075 | 4.0% | 4.0% | | |
| #270 | 0.053 | | | | |



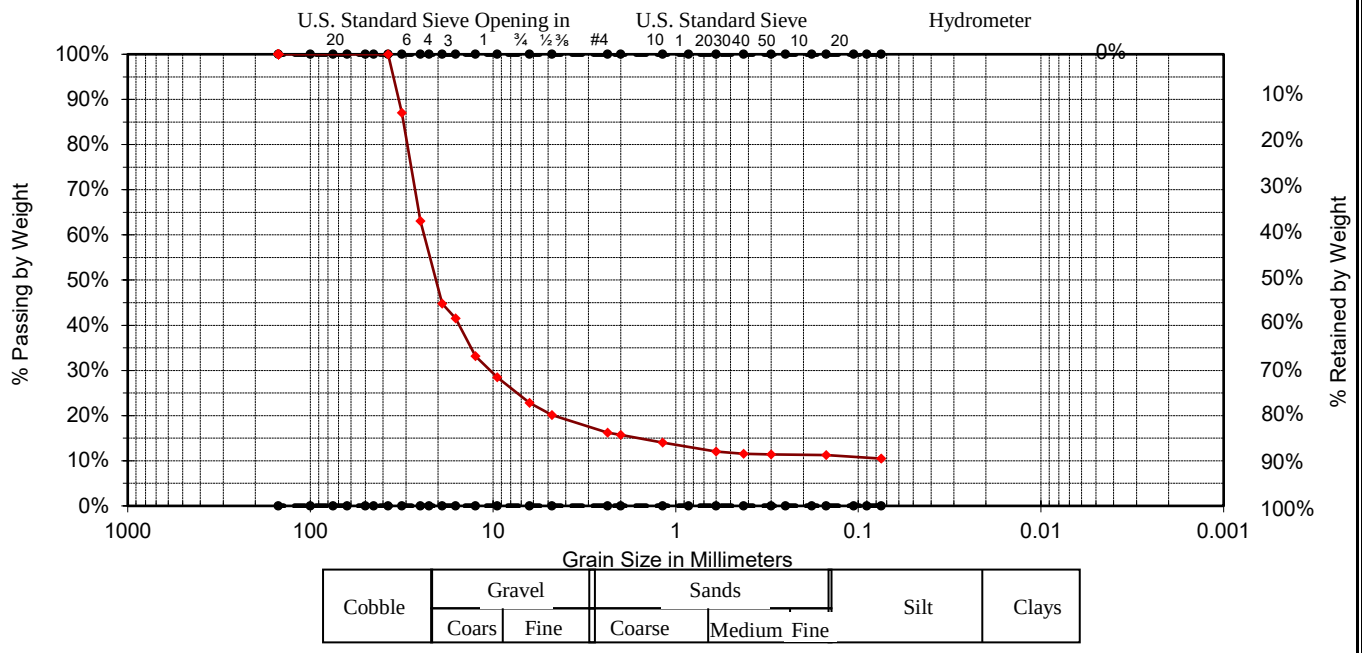
Comments:

Reviewed by: Tim Barney

# Pacific Testing & Inspection Inc.

3215 Harrison Avenue Centralia, WA 98531
Phone (360) 736-3922 Fax (360) 807-6022

**ASTM C-136** **Sieve Report** **ASTM D-4318**




| | | | | | |
|---|---|---|---|---|---|
| Date : | 12/21/2022 | $D_{10}$ = | 0.07 | **USCS Classification** | % Gravel % Sand |
| Sample #: | 22-388 | $D_{30}$ = | 10.48 | GP-GM, Poorly graded Gravel with Sil | 79.9% 9.6% |
| Source: | TP8 pavement -5' | $D_{60}$ = | 23.99 | **Specifications** | Color: |
| Project #: | 220073 | $C_C$ = | 63.99 | No Specs | 10YR 4/4 dk yell brn |
| Project: | Serenity - The Lodge | $C_{U=}$ | 335.10 | Sample Meets Specs | % Silt & Clay |
| Client: | Olympia Hangars, LLC | Liquid Limit= | 0.0% | n/a | 10.5% |
| Tested By: | HH | Plastic Limit= | 0.0% | Fineness Modulus | |
| Date Tested: | 12/27/2022 | Plasticity Index= | 0.0% | 6.42 | |

| Coarse Section | | Actual Cumulative | Interpolated Cumulative | | |
|---|---|---|---|---|---|
| Sieve Size | | Percent | Percent | Specs | Specs |
| US | Metric | Passing | Passing | Max | Min |
| 6.00" | 150.00 | | 100% | | |
| 4.00" | 100.00 | | 100% | | |
| 3.00" | 75.00 | | 100% | | |
| 2.50" | 63.00 | | 100% | | |
| 2.00" | 50.00 | | 100% | | |
| 1.75" | 45.00 | | 100% | | |
| 1.50" | 37.50 | 100% | 100% | | |
| 1.25" | 31.50 | 87% | 87% | | |
| 1.00" | 25.00 | 63% | 63% | | |
| 7/8" | 22.40 | | 55% | | |
| 3/4" | 19.00 | 45% | 45% | | |
| 5/8" | 16.00 | 42% | 42% | | |
| 1/2" | 12.50 | 33% | 33% | | |
| 3/8" | 9.50 | 28% | 28% | | |
| 1/4" | 6.30 | 23% | 23% | | |
| #4 | 4.75 | 20% | 20% | | |

| Fines Section | | Actual Cumulative | Interpolated Cumulative | | |
|---|---|---|---|---|---|
| Sieve Size | | Percent | Percent | Specs | Specs |
| US | Metric | Passing | Passing | Max | Min |
| #4 | 4.750 | 20% | 20% | | |
| #8 | 2.360 | 16% | 16% | | |
| #10 | 2.000 | 16% | 16% | | |
| #16 | 1.180 | 14% | 14% | | |
| #20 | 0.850 | | 13% | | |
| #30 | 0.600 | 12% | 12% | | |
| #40 | 0.425 | 12% | 12% | | |
| #50 | 0.300 | 11% | 11% | | |
| #60 | 0.250 | | 11% | | |
| #80 | 0.180 | | 11% | | |
| #100 | 0.150 | 11% | 11% | | |
| #140 | 0.106 | | 11% | | |
| #170 | 0.090 | | 11% | | |
| #200 | 0.075 | 10.5% | 10.5% | | |
| #270 | 0.053 | | | | |



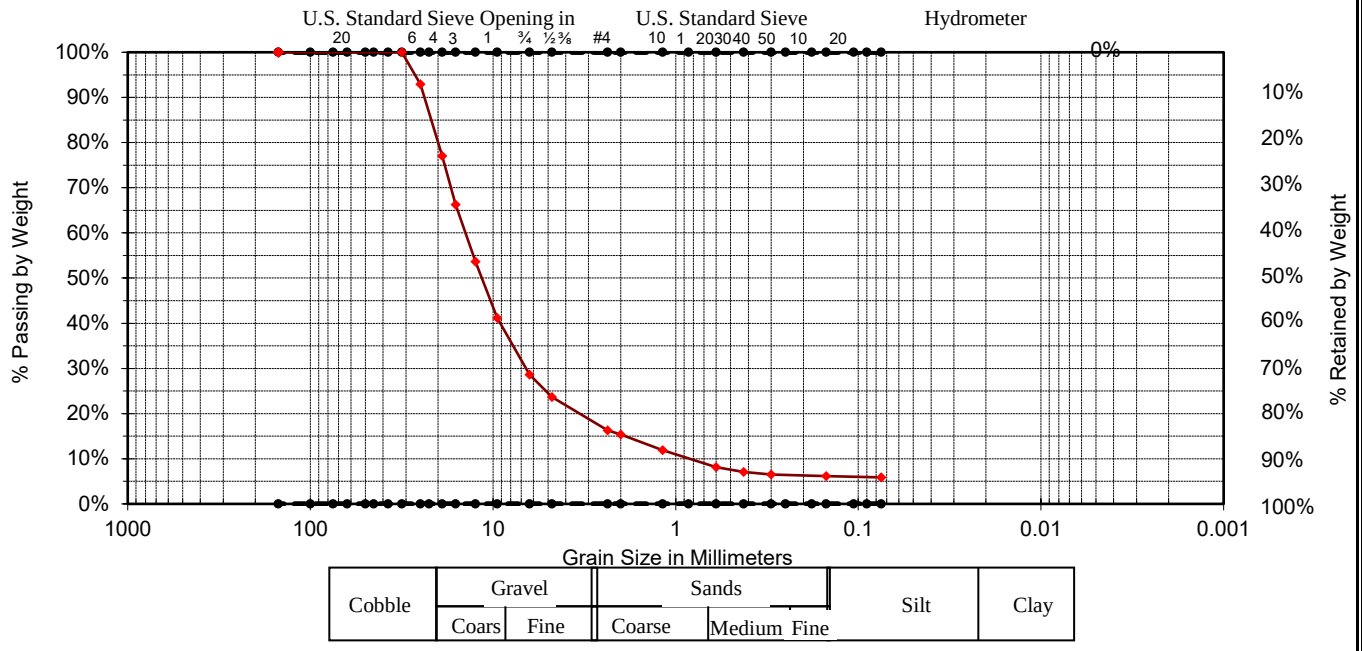
Comments:

Reviewed by: Tim Barney

# Pacific Testing & Inspection Inc.

3215 Harrison Avenue Centralia, WA 98531
Phone (360) 736-3922 Fax (360) 807-6022

**ASTM C-136** **Sieve Report** **ASTM D-4318**




| | | | | | |
|---|---|---|---|---|---|
| Date : | 12/21/2022 | $D_{10}$ = | 0.88 | **USCS Classification** | % Gravel % Sand |
| Sample #: | 22-396 | $D_{30}$ = | 6.64 | GP-GM, Poorly graded Gravel with Sil | 76.3% 17.8% |
| Source: | TP9 Office@6' | $D_{60}$ = | 14.27 | **Specifications** | Color: |
| Project #: | 220073 | $C_C$ = | 3.50 | No Specs | 10YR 3/4 dk yell brn |
| Project: | Serenity - The Lodge | $C_{U=}$ | 16.16 | Sample Meets Specs | % Silt & Clay |
| Client: | Olympia Hangars, LLC | Liquid Limit= | 0.0% | n/a | 5.9% |
| Tested By: | HH | Plastic Limit= | 0.0% | Fineness Modulus | |
| Date Tested: | 12/27/2022 | Plasticity Index= | 0.0% | 6.09 | |

| Coarse Section | | Actual Cumulative | Interpolated Cumulative | | |
|---|---|---|---|---|---|
| Sieve Size US | Sieve Size Metric | Percent Passing | Percent Passing | Specs Max | Specs Min |
| 6.00" | 150.00 | | 100% | | |
| 4.00" | 100.00 | | 100% | | |
| 3.00" | 75.00 | | 100% | | |
| 2.50" | 63.00 | | 100% | | |
| 2.00" | 50.00 | | 100% | | |
| 1.75" | 45.00 | | 100% | | |
| 1.50" | 37.50 | | 100% | | |
| 1.25" | 31.50 | 100% | 100% | | |
| 1.00" | 25.00 | 93% | 93% | | |
| 7/8" | 22.40 | | 86% | | |
| 3/4" | 19.00 | 77% | 77% | | |
| 5/8" | 16.00 | 66% | 66% | | |
| 1/2" | 12.50 | 54% | 54% | | |
| 3/8" | 9.50 | 41% | 41% | | |
| 1/4" | 6.30 | 29% | 29% | | |
| #4 | 4.75 | 24% | 24% | | |

| Fines Section | | Actual Cumulative | Interpolated Cumulative | | |
|---|---|---|---|---|---|
| Sieve Size US | Sieve Size Metric | Percent Passing | Percent Passing | Specs Max | Specs Min |
| #4 | 4.750 | 24% | 24% | | |
| #8 | 2.360 | 16% | 16% | | |
| #10 | 2.000 | 15% | 15% | | |
| #16 | 1.180 | 12% | 12% | | |
| #20 | 0.850 | | 10% | | |
| #30 | 0.600 | 8% | 8% | | |
| #40 | 0.425 | 7% | 7% | | |
| #50 | 0.300 | 7% | 7% | | |
| #60 | 0.250 | | 6% | | |
| #80 | 0.180 | | 6% | | |
| #100 | 0.150 | 6% | 6% | | |
| #140 | 0.106 | | 6% | | |
| #170 | 0.090 | | 6% | | |
| #200 | 0.075 | 5.9% | 5.9% | | |
| #270 | 0.053 | | | | |



Comments: _____

Reviewed by: Tim Barney

# Pacific Testing & Inspection Inc.

3215 Harrison Avenue Centralia, WA 98531
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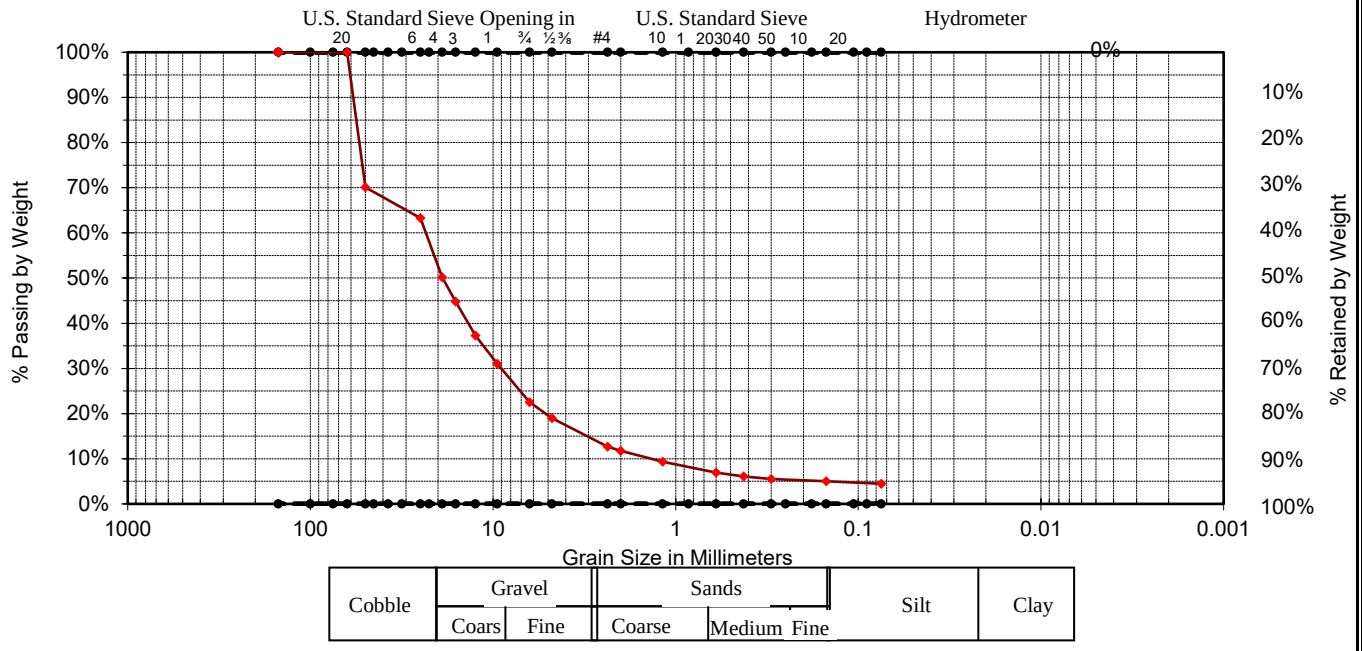
**ASTM C-136** **Sieve Report** **ASTM D-4318**




| | | | | | |
|---|---|---|---|---|---|
| Date : | 12/21/2022 | $D_{10}$ = | 1.40 | **USCS Classification** | % Gravel % Sand |
| Sample #: | 22-395 | $D_{30}$ = | 9.12 | GW, Well-graded Gravel | 81.0% 14.5% |
| Source: | TP9 Office -4' | $D_{60}$ = | 23.50 | **Specifications** | Color: |
| Project #: | 220073 | $C_C$ = | 2.53 | No Specs | 10YR 3/4 dk yell brn |
| Project: | Serenity - The Lodge | $C_{U=}$ | 16.81 | Sample Meets Specs | % Silt & Clay |
| Client: | Olympia Hangars, LLC | Liquid Limit= | 0.0% | n/a | 4.5% |
| Tested By: | HH | Plastic Limit= | 0.0% | Fineness Modulus | |
| Date Tested: | 12/27/2022 | Plasticity Index= | 0.0% | 6.94 | |

| **Coarse Section** Sieve Size US | Metric | Actual Cumulative Percent Passing | Interpolated Cumulative Percent Passing | Specs Max | Specs Min |
|---|---|---|---|---|---|
| 6.00" | 150.00 | | 100% | | |
| 4.00" | 100.00 | | 100% | | |
| 3.00" | 75.00 | | 100% | | |
| 2.50" | 63.00 | 100% | 100% | | |
| 2.00" | 50.00 | 70% | 70% | | |
| 1.75" | 45.00 | | 69% | | |
| 1.50" | 37.50 | | 67% | | |
| 1.25" | 31.50 | | 65% | | |
| 1.00" | 25.00 | 63% | 63% | | |
| 7/8" | 22.40 | | 58% | | |
| 3/4" | 19.00 | 50% | 50% | | |
| 5/8" | 16.00 | 45% | 45% | | |
| 1/2" | 12.50 | 37% | 37% | | |
| 3/8" | 9.50 | 31% | 31% | | |
| 1/4" | 6.30 | 23% | 23% | | |
| #4 | 4.75 | 19% | 19% | | |

| **Fines Section** Sieve Size US | Metric | Actual Cumulative Percent Passing | Interpolated Cumulative Percent Passing | Specs Max | Specs Min |
|---|---|---|---|---|---|
| #4 | 4.750 | 19% | 19% | | |
| #8 | 2.360 | 13% | 13% | | |
| #10 | 2.000 | 12% | 12% | | |
| #16 | 1.180 | 9% | 9% | | |
| #20 | 0.850 | | 8% | | |
| #30 | 0.600 | 7% | 7% | | |
| #40 | 0.425 | 6% | 6% | | |
| #50 | 0.300 | 6% | 6% | | |
| #60 | 0.250 | | 5% | | |
| #80 | 0.180 | | 5% | | |
| #100 | 0.150 | 5% | 5% | | |
| #140 | 0.106 | | 5% | | |
| #170 | 0.090 | | 5% | | |
| #200 | 0.075 | 4.5% | 4.5% | | |
| #270 | 0.053 | | | | |



Comments:

Reviewed by: Tim Barney

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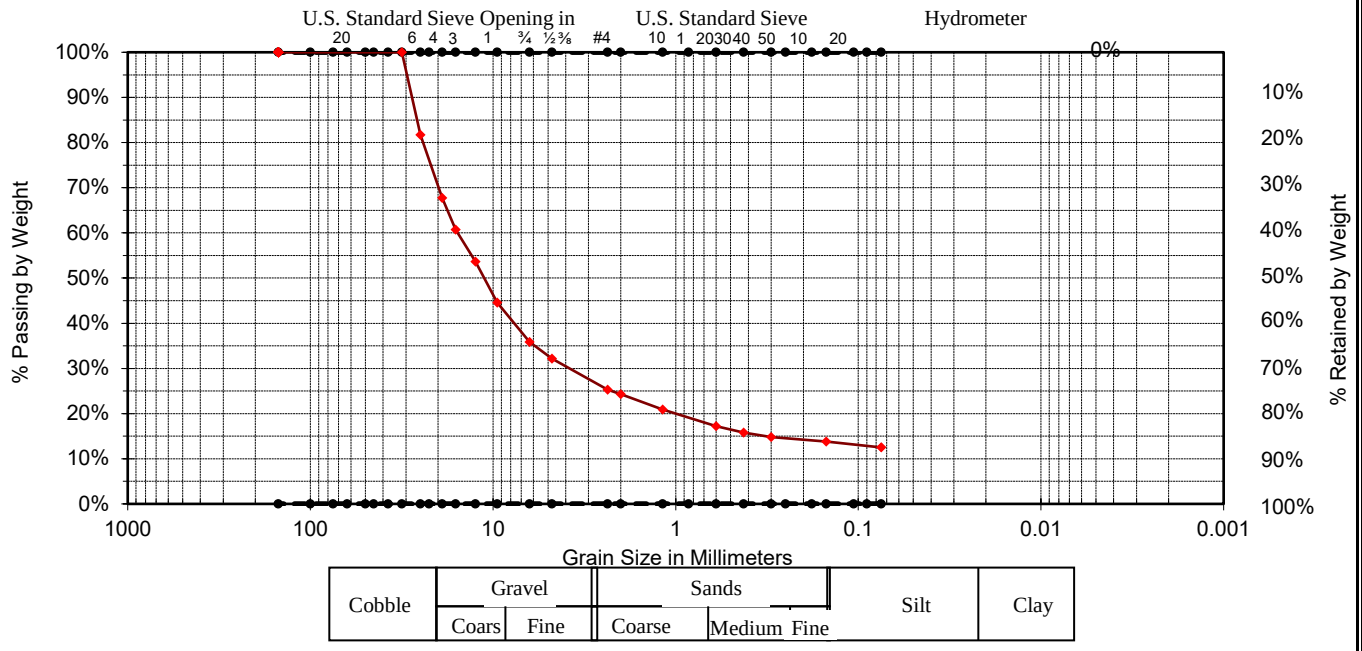
**ASTM C-136** **Sieve Report** **ASTM D-4318**




| | | | | | |
|---|---|---|---|---|---|
| Date : | 12/21/2022 | $D_{10}$ = | 0.06 | **USCS Classification** | % Gravel % Sand |
| Sample #: | 22-397 | $D_{30}$ = | 3.99 | GM, Silty Gravel with Sand | 67.8% 19.7% |
| Source: | TP10 Bldg B1@6' | $D_{60}$ = | 15.63 | **Specifications** | Color: |
| Project #: | 220073 | $C_C$ = | 17.03 | No Specs | 10YR 3/4 dk yell brn |
| Project: | Serenity - The Lodge | $C_{U=}$ | 260.56 | Sample Meets Specs | % Silt & Clay |
| Client: | Olympia Hangars, LLC | Liquid Limit= | 0.0% | n/a | 12.5% |
| Tested By: | HH | Plastic Limit= | 0.0% | Fineness Modulus | |
| Date Tested: | 12/27/2022 | Plasticity Index= | 0.0% | 5.64 | |

| **Coarse Section** Sieve Size US | Metric | Actual Cumulative Percent Passing | Interpolated Cumulative Percent Passing | Specs Max | Specs Min |
|---|---|---|---|---|---|
| 6.00" | 150.00 | | 100% | | |
| 4.00" | 100.00 | | 100% | | |
| 3.00" | 75.00 | | 100% | | |
| 2.50" | 63.00 | | 100% | | |
| 2.00" | 50.00 | | 100% | | |
| 1.75" | 45.00 | | 100% | | |
| 1.50" | 37.50 | | 100% | | |
| 1.25" | 31.50 | 100% | 100% | | |
| 1.00" | 25.00 | 82% | 82% | | |
| 7/8" | 22.40 | | 76% | | |
| 3/4" | 19.00 | 68% | 68% | | |
| 5/8" | 16.00 | 61% | 61% | | |
| 1/2" | 12.50 | 54% | 54% | | |
| 3/8" | 9.50 | 45% | 45% | | |
| 1/4" | 6.30 | 36% | 36% | | |
| #4 | 4.75 | 32% | 32% | | |

| **Fines Section** Sieve Size US | Metric | Actual Cumulative Percent Passing | Interpolated Cumulative Percent Passing | Specs Max | Specs Min |
|---|---|---|---|---|---|
| #4 | 4.750 | 32% | 32% | | |
| #8 | 2.360 | 25% | 25% | | |
| #10 | 2.000 | 24% | 24% | | |
| #16 | 1.180 | 21% | 21% | | |
| #20 | 0.850 | | 19% | | |
| #30 | 0.600 | 17% | 17% | | |
| #40 | 0.425 | 16% | 16% | | |
| #50 | 0.300 | 15% | 15% | | |
| #60 | 0.250 | | 14% | | |
| #80 | 0.180 | | 14% | | |
| #100 | 0.150 | 14% | 14% | | |
| #140 | 0.106 | | 13% | | |
| #170 | 0.090 | | 13% | | |
| #200 | 0.075 | 12.5% | 12.5% | | |
| #270 | 0.053 | | | | |



Comments:

Reviewed by: Tim Barney

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3215 Harrison Avenue Centralia, WA 98531
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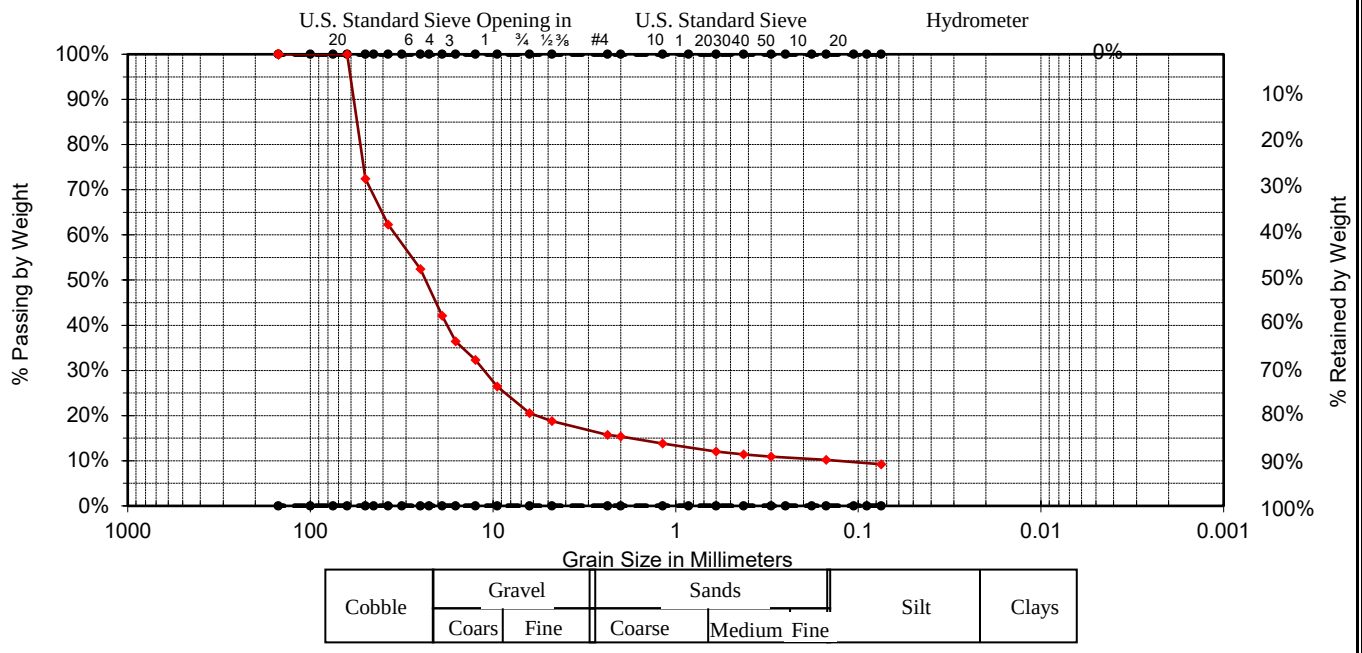
**ASTM C-136** **Sieve Report** **ASTM D-4318**




| | | | | | |
|---|---|---|---|---|---|
| Date : | 12/21/2022 | $D_{10}$ = | 0.13 | **USCS Classification** | % Gravel % Sand |
| Sample #: | 22-398 | $D_{30}$ = | 11.32 | GP-GM, Poorly graded Gravel with Sil | 81.2% 9.5% |
| Source: | TP10 Bldg B1@9' | $D_{60}$ = | 34.59 | **Specifications** | Color: |
| Project #: | 220073 | $C_C$ = | 27.63 | No Specs | 10YR 3/4 dk yell brn |
| Project: | Serenity - The Lodge | $C_{U=}$ | 257.91 | Sample Meets Specs | % Silt & Clay |
| Client: | Olympia Hangars, LLC | Liquid Limit= | 0.0% | n/a | 9.2% |
| Tested By: | HH | Plastic Limit= | 0.0% | Fineness Modulus | |
| Date Tested: | 12/27/2022 | Plasticity Index= | 0.0% | 6.88 | |

| Coarse Section | | Actual Cumulative | Interpolated Cumulative | | |
|---|---|---|---|---|---|
| Sieve Size US | Sieve Size Metric | Percent Passing | Percent Passing | Specs Max | Specs Min |
| 6.00" | 150.00 | | 100% | | |
| 4.00" | 100.00 | | 100% | | |
| 3.00" | 75.00 | | 100% | | |
| 2.50" | 63.00 | 100% | 100% | | |
| 2.00" | 50.00 | 72% | 72% | | |
| 1.75" | 45.00 | | 68% | | |
| 1.50" | 37.50 | 62% | 62% | | |
| 1.25" | 31.50 | | 58% | | |
| 1.00" | 25.00 | 52% | 52% | | |
| 7/8" | 22.40 | | 48% | | |
| 3/4" | 19.00 | 42% | 42% | | |
| 5/8" | 16.00 | 36% | 36% | | |
| 1/2" | 12.50 | 32% | 32% | | |
| 3/8" | 9.50 | 26% | 26% | | |
| 1/4" | 6.30 | 21% | 21% | | |
| #4 | 4.75 | 19% | 19% | | |

| Fines Section | | Actual Cumulative | Interpolated Cumulative | | |
|---|---|---|---|---|---|
| Sieve Size US | Sieve Size Metric | Percent Passing | Percent Passing | Specs Max | Specs Min |
| #4 | 4.750 | 19% | 19% | | |
| #8 | 2.360 | 16% | 16% | | |
| #10 | 2.000 | 15% | 15% | | |
| #16 | 1.180 | 14% | 14% | | |
| #20 | 0.850 | | 13% | | |
| #30 | 0.600 | 12% | 12% | | |
| #40 | 0.425 | 11% | 11% | | |
| #50 | 0.300 | 11% | 11% | | |
| #60 | 0.250 | | 11% | | |
| #80 | 0.180 | | 10% | | |
| #100 | 0.150 | 10% | 10% | | |
| #140 | 0.106 | | 10% | | |
| #170 | 0.090 | | 9% | | |
| #200 | 0.075 | 9.2% | 9.2% | | |
| #270 | 0.053 | | | | |



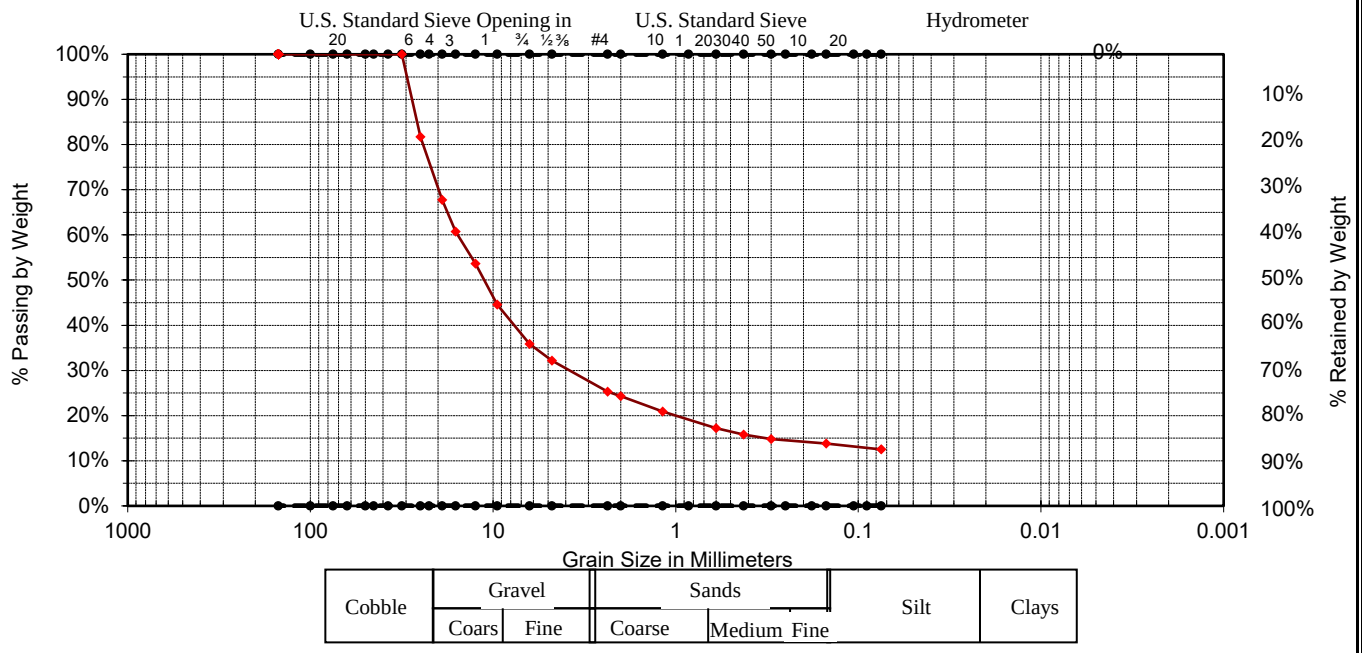
Comments: _____

Reviewed by: Tim Barney

# Pacific Testing & Inspection Inc.

3215 Harrison Avenue Centralia, WA 98531
Phone (360) 736-3922 Fax (360) 807-6022

**ASTM C-136** **Sieve Report** **ASTM D-4318**




| | | | | | |
|---|---|---|---|---|---|
| Date : | 12/21/2022 | $D_{10}$ = | 0.06 | **USCS Classification** | % Gravel % Sand |
| Sample #: | 22-397 | $D_{30}$ = | 3.99 | GM, Silty Gravel with Sand | 67.8% 19.7% |
| Source: | TP10 Bldg B1@6' | $D_{60}$ = | 15.63 | **Specifications** | Color: |
| Project #: | 220073 | $C_C$ = | 17.03 | No Specs | 10YR 3/4 dk yell brn |
| Project: | Serenity - The Lodge | $C_{U=}$ | 260.56 | Sample Meets Specs | % Silt & Clay |
| Client: | Olympia Hangars, LLC | Liquid Limit= | 0.0% | n/a | 12.5% |
| Tested By: | HH | Plastic Limit= | 0.0% | Fineness Modulus | |
| Date Tested: | 12/27/2022 | Plasticity Index= | 0.0% | 5.64 | |

| **Coarse Section** Sieve Size US | Metric | Actual Cumulative Percent Passing | Interpolated Cumulative Percent Passing | Specs Max | Specs Min |
|---|---|---|---|---|---|
| 6.00" | 150.00 | | 100% | | |
| 4.00" | 100.00 | | 100% | | |
| 3.00" | 75.00 | | 100% | | |
| 2.50" | 63.00 | | 100% | | |
| 2.00" | 50.00 | | 100% | | |
| 1.75" | 45.00 | | 100% | | |
| 1.50" | 37.50 | | 100% | | |
| 1.25" | 31.50 | 100% | 100% | | |
| 1.00" | 25.00 | 82% | 82% | | |
| 7/8" | 22.40 | | 76% | | |
| 3/4" | 19.00 | 68% | 68% | | |
| 5/8" | 16.00 | 61% | 61% | | |
| 1/2" | 12.50 | 54% | 54% | | |
| 3/8" | 9.50 | 45% | 45% | | |
| 1/4" | 6.30 | 36% | 36% | | |
| #4 | 4.75 | 32% | 32% | | |

| **Fines Section** Sieve Size US | Metric | Actual Cumulative Percent Passing | Interpolated Cumulative Percent Passing | Specs Max | Specs Min |
|---|---|---|---|---|---|
| #4 | 4.750 | 32% | 32% | | |
| #8 | 2.360 | 25% | 25% | | |
| #10 | 2.000 | 24% | 24% | | |
| #16 | 1.180 | 21% | 21% | | |
| #20 | 0.850 | | 19% | | |
| #30 | 0.600 | 17% | 17% | | |
| #40 | 0.425 | 16% | 16% | | |
| #50 | 0.300 | 15% | 15% | | |
| #60 | 0.250 | | 14% | | |
| #80 | 0.180 | | 14% | | |
| #100 | 0.150 | 14% | 14% | | |
| #140 | 0.106 | | 13% | | |
| #170 | 0.090 | | 13% | | |
| #200 | 0.075 | 12.5% | 12.5% | | |
| #270 | 0.053 | | | | |



Comments: _____

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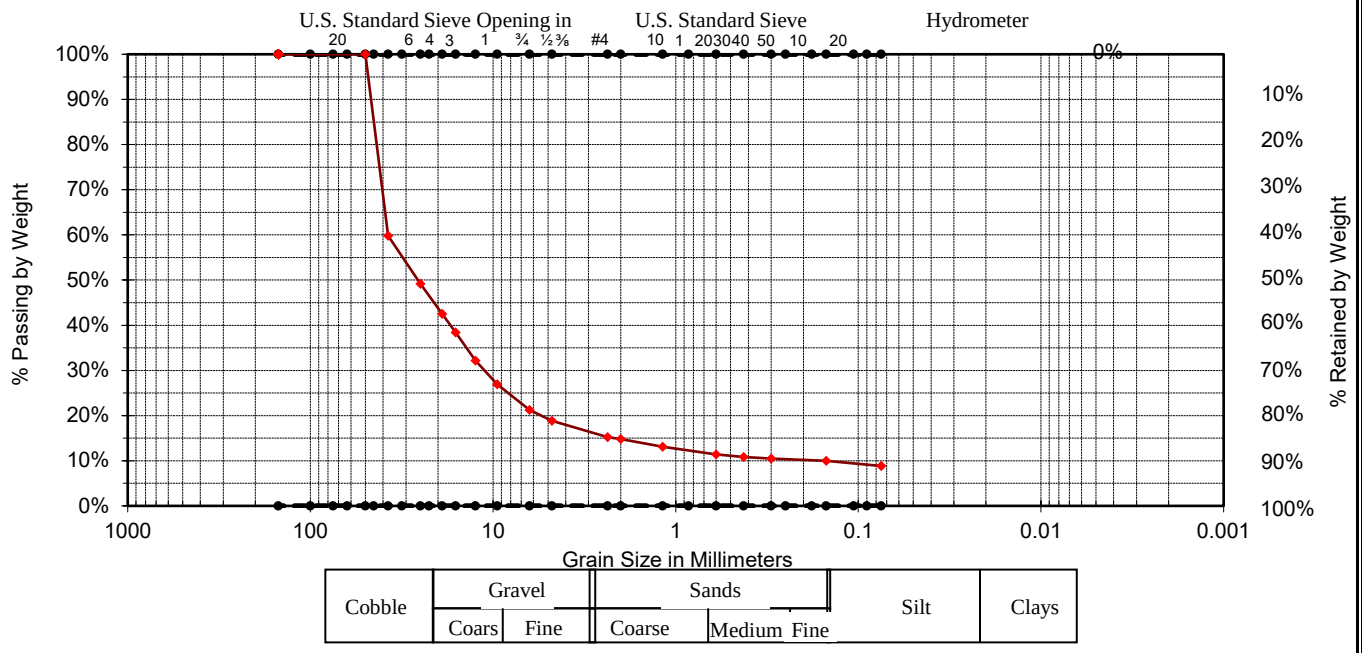
**ASTM C-136** **Sieve Report** **ASTM D-4318**




| | | | | | |
|---|---|---|---|---|---|
| Date : | 12/21/2022 | $D_{10}$ = | 0.15 | **USCS Classification** | % Gravel % Sand |
| Sample #: | 22-399 | $D_{30}$ = | 11.26 | GP-GM, Poorly graded Gravel with Sil | 81.2% 10.0% |
| Source: | TP11 pavement@5' | $D_{60}$ = | 37.55 | **Specifications** | Color: |
| Project #: | 220073 | $C_C$ = | 21.85 | No Specs | 10YR 3/4 dk yell brn |
| Project: | Serenity - The Lodge | $C_{U=}$ | 243.07 | Sample Meets Specs | % Silt & Clay |
| Client: | Olympia Hangars, LLC | Liquid Limit= | 0.0% | n/a | 8.8% |
| Tested By: | HH | Plastic Limit= | 0.0% | Fineness Modulus | |
| Date Tested: | 12/27/2022 | Plasticity Index= | 0.0% | 6.92 | |

| Coarse Section | | Actual Cumulative | Interpolated Cumulative | | |
|---|---|---|---|---|---|
| Sieve Size | | Percent | Percent | Specs | Specs |
| US | Metric | Passing | Passing | Max | Min |
| 6.00" | 150.00 | | 100% | | |
| 4.00" | 100.00 | | 100% | | |
| 3.00" | 75.00 | | 100% | | |
| 2.50" | 63.00 | | 100% | | |
| 2.00" | 50.00 | 100% | 100% | | |
| 1.75" | 45.00 | | 84% | | |
| 1.50" | 37.50 | 60% | 60% | | |
| 1.25" | 31.50 | | 55% | | |
| 1.00" | 25.00 | 49% | 49% | | |
| 7/8" | 22.40 | | 46% | | |
| 3/4" | 19.00 | 42% | 42% | | |
| 5/8" | 16.00 | 38% | 38% | | |
| 1/2" | 12.50 | 32% | 32% | | |
| 3/8" | 9.50 | 27% | 27% | | |
| 1/4" | 6.30 | 21% | 21% | | |
| #4 | 4.75 | 19% | 19% | | |

| Fines Section | | Actual Cumulative | Interpolated Cumulative | | |
|---|---|---|---|---|---|
| Sieve Size | | Percent | Percent | Specs | Specs |
| US | Metric | Passing | Passing | Max | Min |
| #4 | 4.750 | 19% | 19% | | |
| #8 | 2.360 | 15% | 15% | | |
| #10 | 2.000 | 15% | 15% | | |
| #16 | 1.180 | 13% | 13% | | |
| #20 | 0.850 | | 12% | | |
| #30 | 0.600 | 11% | 11% | | |
| #40 | 0.425 | 11% | 11% | | |
| #50 | 0.300 | 10% | 10% | | |
| #60 | 0.250 | | 10% | | |
| #80 | 0.180 | | 10% | | |
| #100 | 0.150 | 10% | 10% | | |
| #140 | 0.106 | | 9% | | |
| #170 | 0.090 | | 9% | | |
| #200 | 0.075 | 8.8% | 8.8% | | |
| #270 | 0.053 | | | | |



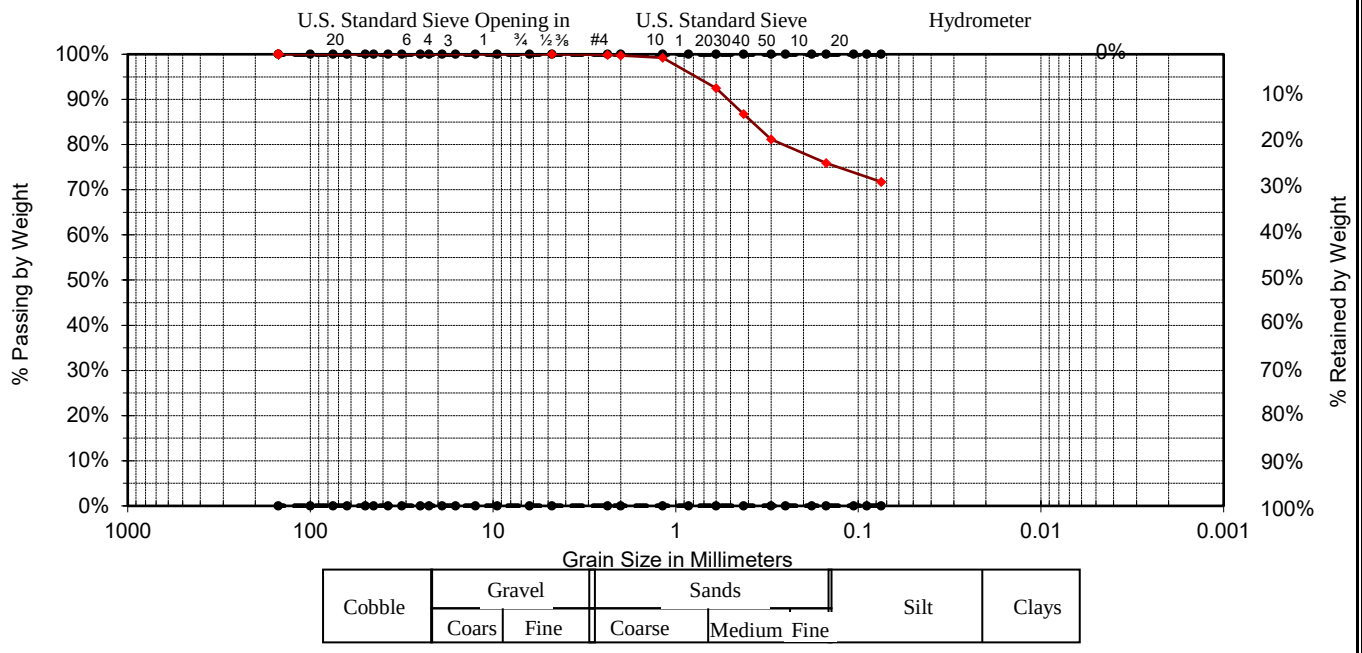
Comments: _____

Reviewed by: Tim Barney

# Pacific Testing & Inspection Inc.

3215 Harrison Avenue Centralia, WA 98531
Phone (360) 736-3922 Fax (360) 807-6022

**ASTM C-136** **Sieve Report** **ASTM D-4318**




| | | | | | |
|---|---|---|---|---|---|
| Date : | 12/21/2022 | $D_{10}$ = | 0.01 | **USCS Classification** | % Gravel % Sand |
| Sample #: | 22-401 | $D_{30}$ = | 0.03 | ML, Silt with Sand | 0.0% 28.3% |
| Source: | TP12@6' Bldg B2 | $D_{60}$ = | 0.06 | **Specifications** | Color: |
| Project #: | 220073 | $C_C$ = | 1.50 | No Specs | 10YR 4/4 dk yell brn |
| Project: | Serenity - The Lodge | $C_{U=}$ | 6.00 | Sample Meets Specs | % Silt & Clay |
| Client: | Olympia Hangars, LLC | Liquid Limit= | 0.0% | n/a | 71.7% |
| Tested By: | HH | Plastic Limit= | 0.0% | Fineness Modulus | |
| Date Tested: | 12/27/2022 | Plasticity Index= | 0.0% | 0.51 | |

| **Coarse Section** Sieve Size US | Metric | Actual Cumulative Percent Passing | Interpolated Cumulative Percent Passing | Specs Max | Specs Min |
|---|---|---|---|---|---|
| 6.00" | 150.00 | | 100% | | |
| 4.00" | 100.00 | | 100% | | |
| 3.00" | 75.00 | | 100% | | |
| 2.50" | 63.00 | | 100% | | |
| 2.00" | 50.00 | | 100% | | |
| 1.75" | 45.00 | | 100% | | |
| 1.50" | 37.50 | | 100% | | |
| 1.25" | 31.50 | | 100% | | |
| 1.00" | 25.00 | | 100% | | |
| 7/8" | 22.40 | | 100% | | |
| 3/4" | 19.00 | | 100% | | |
| 5/8" | 16.00 | | 100% | | |
| 1/2" | 12.50 | | 100% | | |
| 3/8" | 9.50 | | 100% | | |
| 1/4" | 6.30 | | 100% | | |
| #4 | 4.75 | 100% | 100% | | |

| **Fines Section** Sieve Size US | Metric | Actual Cumulative Percent Passing | Interpolated Cumulative Percent Passing | Specs Max | Specs Min |
|---|---|---|---|---|---|
| #4 | 4.750 | 100% | 100% | | |
| #8 | 2.360 | 100% | 100% | | |
| #10 | 2.000 | 100% | 100% | | |
| #16 | 1.180 | 99% | 99% | | |
| #20 | 0.850 | | 95% | | |
| #30 | 0.600 | 93% | 93% | | |
| #40 | 0.425 | 87% | 87% | | |
| #50 | 0.300 | 81% | 81% | | |
| #60 | 0.250 | | 79% | | |
| #80 | 0.180 | | 77% | | |
| #100 | 0.150 | 76% | 76% | | |
| #140 | 0.106 | | 73% | | |
| #170 | 0.090 | | 73% | | |
| #200 | 0.075 | 71.7% | 71.7% | | |
| #270 | 0.053 | | | | |



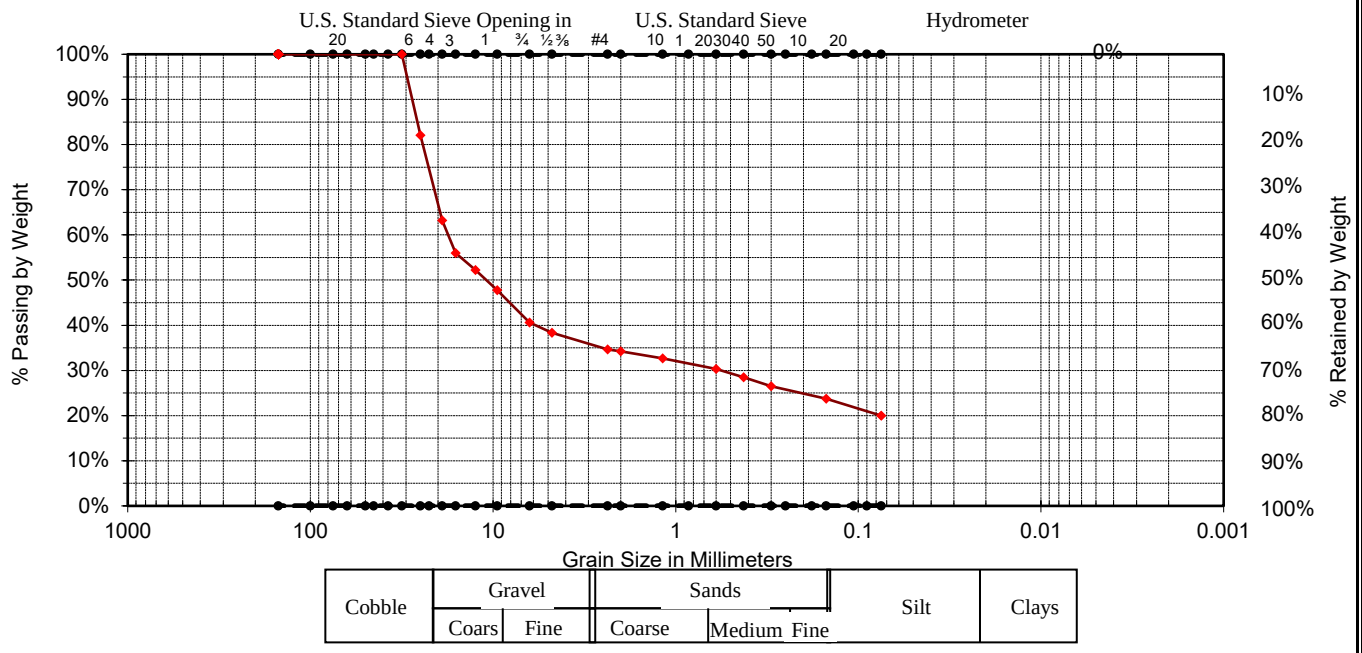
Comments: _____

Reviewed by: Tim Barney

# Pacific Testing & Inspection Inc.

3215 Harrison Avenue Centralia, WA 98531
Phone (360) 736-3922 Fax (360) 807-6022

**ASTM C-136** **Sieve Report** **ASTM D-4318**




| | | | | | |
|---|---|---|---|---|---|
| Date : | 12/21/2022 | $D_{10}$ = | 0.04 | **USCS Classification** | % Gravel % Sand |
| Sample #: | 22-400 | $D_{30}$ = | 0.57 | GM, Silty Gravel with Sand | 61.6% 18.4% |
| Source: | TP12 Bldg B2@12' | $D_{60}$ = | 17.67 | **Specifications** | Color: |
| Project #: | 220073 | $C_C$ = | 0.49 | No Specs | 10YR 4/4 dk yell brn |
| Project: | Serenity - The Lodge | $C_{U=}$ | 470.66 | Sample Meets Specs | % Silt & Clay |
| Client: | Olympia Hangars, LLC | Liquid Limit= | 0.0% | n/a | 20.0% |
| Tested By: | HH | Plastic Limit= | 0.0% | Fineness Modulus | |
| Date Tested: | 12/27/2022 | Plasticity Index= | 0.0% | 5.03 | |

| **Coarse Section** Sieve Size US | Metric | Actual Cumulative Percent Passing | Interpolated Cumulative Percent Passing | Specs Max | Specs Min |
|---|---|---|---|---|---|
| 6.00" | 150.00 | | 100% | | |
| 4.00" | 100.00 | | 100% | | |
| 3.00" | 75.00 | | 100% | | |
| 2.50" | 63.00 | | 100% | | |
| 2.00" | 50.00 | | 100% | | |
| 1.75" | 45.00 | | 100% | | |
| 1.50" | 37.50 | | 100% | | |
| 1.25" | 31.50 | 100% | 100% | | |
| 1.00" | 25.00 | 82% | 82% | | |
| 7/8" | 22.40 | | 74% | | |
| 3/4" | 19.00 | 63% | 63% | | |
| 5/8" | 16.00 | 56% | 56% | | |
| 1/2" | 12.50 | 52% | 52% | | |
| 3/8" | 9.50 | 48% | 48% | | |
| 1/4" | 6.30 | 41% | 41% | | |
| #4 | 4.75 | 38% | 38% | | |

| **Fines Section** Sieve Size US | Metric | Actual Cumulative Percent Passing | Interpolated Cumulative Percent Passing | Specs Max | Specs Min |
|---|---|---|---|---|---|
| #4 | 4.750 | 38% | 38% | | |
| #8 | 2.360 | 35% | 35% | | |
| #10 | 2.000 | 34% | 34% | | |
| #16 | 1.180 | 33% | 33% | | |
| #20 | 0.850 | | 31% | | |
| #30 | 0.600 | 30% | 30% | | |
| #40 | 0.425 | 28% | 28% | | |
| #50 | 0.300 | 27% | 27% | | |
| #60 | 0.250 | | 26% | | |
| #80 | 0.180 | | 24% | | |
| #100 | 0.150 | 24% | 24% | | |
| #140 | 0.106 | | 22% | | |
| #170 | 0.090 | | 21% | | |
| #200 | 0.075 | 20.0% | 20.0% | | |
| #270 | 0.053 | | | | |

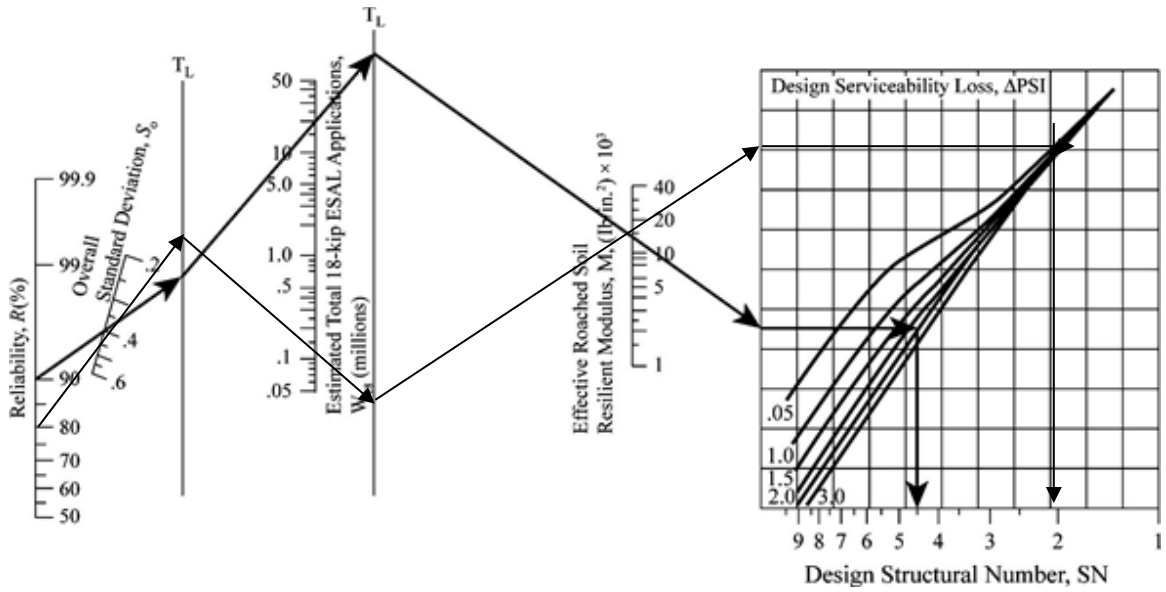


Comments: _____

Reviewed by: Tim Barney

# APPENDIX D

# NOMOGRAPH


Reliability, R(%)
99.9
99
90
80
70
60
50
Overall Standard Deviation, $S_o$
.2
.4
.6
$T_L$
$T_L$
$T_L$
Estimated Total 18-kip ESAL Applications, $W_{18}$ (millions)
50
10
5.0
1.0
.5
.1
.05
Effective Roached Soil Resilient Modulus, $M_r$ (lb/in.$^2$) × $10^3$
40
20
10
5
1
Design Serviceability Loss, ΔPSI
.05
1.0
1.5
2.0
3.0
9 8 7 6 5 4 3 2 1
Design Structural Number, SN

**Appendix 4**
**SWPPP**

# DRAFT
# Construction Stormwater Pollution Prevention Plan (SWPPP)

for

# The Lodge

456 Carpenter Rd. SE
Lacey, WA 98503
TPN 11815310200

City of Lacey Project No. __-____
Olympic Engineering Project No. 22020

March 17, 2023

Prepared by:

OLYMPIC ENGINEERING

PO Box 12690
Olympia WA 98508
360.705.2474
www.olyeng.com

Certified Erosion and Sediment Control Lead (CESCL)

_____
_____
_____
_____

Civil Engineer

Chris Merritt, PE
Olympic Engineering, Inc.
PO Box 12690
Olympia, WA 98508
(360) 705-2474
chris@olyeng.com

Applicant

Olympia Hangars, LLC
Jeff Powell
7842 Old Hwy. 99 SE, Hangar #M-5
Tumwater, WA 98501
(360) 888-5333
jeff@primedevelopmentgroup.com

Contractor

_____
_____
_____
_____

This SWPPP has been prepared by Olympic Engineering based on our estimate of anticipated site conditions throughout construction along with anticipated construction methods and sequencing used by the contractor. The BMP's suggested in this SWPPP are simply suggestions and the contractor and/or owner is responsible for implementing all BMPs necessary to minimize and prevent erosion and sedimentation throughout construction and through final site stabilization.

<u>The owner retains the ultimate responsibility for environmental protection at the site and for ensuring the project is in compliance at all times.</u>

3/17/2023

*"I hereby state that this DRAFT Construction SWPPP for the **The Lodge** project has been prepared by me or under my supervision and meets the standard of care and expertise which is usual and customary in this community for professional engineers. I understand that the City of Lacey does not and will not assume liability for the sufficiency, suitability, or performance of drainage facilities designed by me."*

## Project Overview

The proposal is to construct four multi-family buildings (94 units) with associated access, driveway, parking lot, utility, and storm drainage improvements.

All proposed site work improvements are anticipated to be constructed in one phase with substantial site work construction completion by Spring/Summer 2024. The completion timeframe of the buildings is currently unknown.

Proposed Stormwater BMP's:

- Stormwater runoff from the parking lot and drive aisle areas will be routed to a Bioretention Facility (BMP T7.30).
- Stormwater runoff from the roof areas of multifamily buildings and their associated carports, along with the Office building and grilling station roof areas, will be tightlined to Downspout Infiltration Trenches (BMP T5.10A).
- Stormwater runoff from the combined shop and refuse roof area, along with Carport A, will be routed to the Bioretention Facility noted above.
- Stormwater runoff from the tops of the retaining walls will be sheet flow dispersed (BMP T5.12) over adjacent lawn/landscape/forested areas.
- Stormwater runoff from sidewalks immediately adjacent to pavement (e.g. drive aisles, parking lot) will sheet flow onto the pavement and be routed to the Bioretention Facility noted above.
- Stormwater runoff from sidewalks with lawn/landscaping along both sides will be sheet flow dispersed (BMP T5.12) over the adjacent lawn/landscape areas.

The parcel is undeveloped and mostly forested with mature fir trees. Site topography slopes down from west/south to east/north with an overall relief of approximately 20'.

There are no creeks, lakes, ponds, springs, etc. on or near the subject parcel.

Per FEMA FIRM Panel #53067C0191E the project is located in Zone X (an area determined to be outside the 0.2% annual chance floodplain).

The Natural Resource Conservation Service (NRCS) classifies the on-site soils as Yelm Fine Sandy Loam (HSG A) with a small area (4%) of Nisqually Loamy Fine Sand (HSG A) mapped along a portion of the east property line. A Soils Report has been prepared by Pacific Testing & Inspection (PTI). Twelve test pits were evaluated to depths of up to 13' below-grade and the soils generally consisted of fine to course sandy gravel (GW/GP). Groundwater, nor any indications of groundwater, were encountered in any test pits. Based on available records obtained by PTI, perched groundwater was found to be at 19' below-grade where glacial till was present and well log records indicate groundwater at 45' to 85' below-grade.

## Objective

To control erosion and prevent sediment and other pollutants from leaving the site during the construction phase of a project. To have fully functional stormwater facilities and BMPs for the developed site upon completion of construction.

## Supplemental Guidelines

If a Construction SWPPP is found to be inadequate (with respect to erosion and sediment control requirements), then the Plan Approval Authority within the City shall require that other BMPs be implemented, as appropriate.

The Plan Approval Authority may allow development of generic Construction SWPPP's that apply to commonly conducted public road activities, such as road surface replacement, that trigger this core requirement. They may also develop an abbreviated SWPPP format for project sites that will disturb less than 1 acre.

Based on the information provided and/or local weather conditions, the local permitting authority may expand or restrict the seasonal limitation on site disturbance. The local permitting authority shall take enforcement action - such as a notice of violation, administrative order, penalty, or stop-work order under the following circumstances:

- If, during the course of any construction activity or soil disturbance during the seasonal limitation period, sediment leaves the construction site causing a violation of the surface water quality standard; or
- If clearing and grading limits or erosion and sediment control measures shown in the approved plan are not maintained.

**General Requirements**

Clearing and grading activities for developments shall be permitted only if conducted pursuant to an approved site development plan (e.g., subdivision approval) that establishes permitted areas of clearing, grading, cutting, and filling. These permitted clearing and grading areas and any other areas required to preserve critical or sensitive areas, buffers, native growth protection easements, or tree retention areas shall be delineated on the site plans and the development site.

The SWPPP shall be implemented beginning with initial land disturbance through final stabilization. Sediment and Erosion control BMPs shall be consistent with the BMPs contained in Chapter 5 of the City of Lacey Stormwater Design Manual (SDM)*, 2022 ed.*

Seasonal Work Limitations - From October 1 through April 30, clearing, grading, and other soil disturbing activities shall only be permitted if shown to the satisfaction of the local permitting authority that silt-laden runoff will be prevented from leaving the site. See Element #12 below for additional information.

**Project Requirements - Construction SWPPP Elements**

In most cases, all of the following elements shall apply and be implemented throughout construction. Self-contained sites (discharges only to groundwater) must comply with all elements with the exception of Element 3: Control Flow Rates.

The suggested BMPs underlined and in **bold** are proposed for use in all phases of construction. Additional BMP's shall be implemented as necessary to minimize and prevent erosion and sedimentation throughout construction. See Chapter 5 of the SDM for reference. All BMP's shall be maintained until final site stabilization.

**Element #1: Preserve Vegetation/Mark Clearing Limits**

- Prior to beginning land disturbing activities, including clearing and grading, clearly mark all clearing limits, sensitive areas and their buffers, and trees that are to be preserved within the construction area. These shall be clearly marked, both in the field and on the plans, to prevent damage and offsite impacts.
- Clearly visible plastic, metal, or stake wire fence may be used to mark the clearing limits.

- The duff layer, native topsoil, and natural vegetation shall be retained in an undisturbed state to the maximum degree practicable. If it is not practicable to retain the duff layer in place, stockpile it on-site, cover it to prevent erosion, and replace it immediately upon completion of the ground disturbing activities.

**Suggested BMPs:**

- **BMP C100: Preservation of Native Topsoil (On-site)**
- **BMP C101: Preserving Natural Vegetation (On-site)**
- BMP C102: Buffer Zones
- BMP C103: High Visibility Plastic Fence.
- **BMP C233: Silt Fence**

**Element #2: Establish Construction Access**

- Limit construction vehicle access and exit to one route, if possible, or two for linear projects such as roadways where more than one access is necessary for large equipment maneuvering.
- Stabilize access points with a pad of quarry spalls or crushed rock, or equivalent BMP prior to traffic leaving the construction site to minimize the tracking of sediment onto public roads.
- Wheel wash or tire baths should be located on site, if the stabilized construction entrance is not effective in preventing sediment from being tracked on public roads.
- If sediment is tracked off site, clean the affected roadway thoroughly at the end of each day, or more frequently as necessary (for example during wet weather) to prevent sediment from entering waters of the state. Remove sediment from roads by shoveling or pickup sweeping and transport to a controlled sediment disposal area. Street washing is allowed only after sediment is removed in this manner.
- Control street wash wastewater by pumping back on site to an approved infiltration facility, or otherwise preventing it from discharging into systems tributary to the city municipal separated storm sewer system, wetlands, or waters of the State. Other options include discharge to the sanitary sewer, or discharge to an approved offsite treatment system. For discharges to the sanitary sewer, permits must be obtained from the local jurisdiction providing the sewer.

**Element #3: Control Flow Rates**

- Protect properties and waterways downstream from development sites from erosion and the associated discharge of turbid waters due to increases in the volume, velocity, and peak flow rate of stormwater runoff from the project site.
- Downstream analysis is necessary if changes in offsite flows could impair or alter conveyance systems, stream banks, bed sediment, or aquatic habitat. See Volume I, Chapter 2, for potential offsite analysis requirements and guidelines (Core Requirement #11).
- Where necessary to comply with Core Requirement #7, construct stormwater retention/detention facilities as one of the first steps in grading. Ensure that detention facilities are functional prior to construction of site improvements (e.g., impervious surfaces).
- Outlet structures designed for permanent detention ponds are not appropriate for use during construction without modification. If used during construction, install an outlet structure that will allow for long-term storage of runoff and enable sediment to settle. Verify that the pond is sized appropriately for this purpose. Restore ponds to their original design dimensions, remove sediment, and install a final outlet structure at completion of the project.
- Sites that must implement flow control (Core Requirement #7) for the developed site condition must also control stormwater release rates during construction. Construction site stormwater discharges shall not exceed the discharge durations of the pre-developed condition for the range of pre-developed discharge rates from ½ of the 2-year flow through the 10-year flow as

predicted by an approved continuous runoff model. Match the pre-developed condition to the land cover condition immediately prior to the development project.

- The City may require pond designs that provide additional or different stormwater flow control if necessary to address local conditions or to protect properties and waterways downstream from erosion due to increases in the volume, velocity, and peak flow rate of stormwater runoff from the project site.
- If permanent infiltration ponds are used for flow control during construction, protect them from siltation during the construction phase.

**Suggested BMPs:**

- BMP C203: Water Bars
- BMP C207: Check Dams
- **BMP C209: Outlet Protection**
- BMP C235: Wattles
- BMP C240: Sediment Trap
- **BMP C241: Temporary Sediment Pond**
- Refer to Volumes III and V for site suitability and sizing for infiltration facilities and for design of Detention and Infiltration Facilities for flow control.

**Element #4: Install Sediment Controls**

- Prior to leaving a construction site or prior to discharge to an infiltration facility, pass stormwater runoff from disturbed areas through a sediment pond or other appropriate sediment removal BMP.
- Runoff from fully stabilized areas may be discharged without a sediment removal BMP, but must meet the flow control performance standard of Element #3, the first bullet. Full stabilization means concrete or asphalt paving; quarry spalls used as ditch lining; or the use of rolled erosion products, a bonded fiber matrix product, or vegetative cover in a manner that will fully prevent soil erosion. The City shall inspect and approve areas fully stabilized by means other than pavement or quarry spalls.
- Construct sediment ponds, vegetated buffer strips, sediment barriers or filters, dikes, and other BMPs intended to trap sediment on site as one of the first steps in grading. Ensure that these BMPs are functional before other land disturbing activities take place.
- Where feasible, design outlet structures that withdraw impounded water from the surface to avoid discharging sediment that is still suspended lower in the water column.
- Seed and mulch earthen structures such as dams, dikes, and diversions according to the timing indicated in Element #5.
- Locate BMPs intended to trap sediment on site in a manner to avoid interference with the movement of juvenile salmonids attempting to enter off-channel areas or drainages, often during non-storm events, in response to rain event changes in stream elevation or wetted area.
- If installing a floating pump structure, include a stopper to prevent the pump basket from hitting the bottom of the pond.

**Suggested BMPs:**

- BMP C231: Brush Barrier
- BMP C232: Gravel Filter Berm
- **BMP C233: Silt Fence**
- **BMP C234: Vegetated Strip**
- BMP C235: Wattles
- BMP C240: Sediment Trap

- o **BMP C241: Temporary Sediment Pond**
- o BMP C250: Construction Stormwater Chemical Treatment
- o BMP C251: Construction Stormwater Filtration.

**Element #5: Stabilize Soils**

- Stabilize all exposed and un-worked soils by application of effective BMPs that prevent erosion; protect the soil from the erosive forces of raindrop impact, flowing water, and wind.
- Control stormwater volume and velocity within the site to minimize erosion; and control stormwater discharges, including both peak flow rates and total stormwater volume, to minimize erosion at outlets and to minimize downstream channel and stream bank erosion.
- From October 1 through April 30, no soils shall remain exposed and un-worked for more than 2 days. From May 1 to September 30, no soils shall remain exposed and un-worked for more than 7 days. This condition applies to all soils on site, whether at final grade or not. These time limits may be adjusted by the City if it can be shown that the average time between storm events justifies a different standard.
- Stabilize soils at the end of the shift before a holiday or weekend if the weather forecast calls for precipitation. Applicable practices include, but are not limited to, temporary and permanent seeding, sodding, mulching, plastic covering, erosion control fabrics and matting, soil application of polyacrylamide (PAM), the early application of gravel base on areas to be paved, and dust control.
- Soil stabilization measures should be appropriate for the time of year, site conditions, estimated duration of use, and potential water quality impacts that stabilization agents may have on downstream waters or ground water.
- Soil stockpiles must be stabilized from erosion, protected with sediment trapping measures, and when possible, be located away from storm drain inlets, waterways and drainage channels.
- Minimize the amount of soil exposed during construction activity.
- Minimize the disturbance of steep slopes.
- Minimize soil compaction and, unless infeasible, preserve topsoil.
- Ensure that gravel base used for stabilization is clean and does not contain fines or sediment.
- Linear construction activities, including right-of-way and easement clearing, roadway development, pipelines, and trenching for utilities, shall be conducted to meet the soil stabilization requirements and time periods set forth above.

**Suggested BMPs:**

- o **BMP C120: Temporary and Permanent Seeding**
- o **BMP C121: Mulching**
- o BMP C122: Nets and Blankets
- o **BMP C123: Plastic Covering**
- o BMP C124: Sodding
- o **BMP C125: Topsoiling/Composting**
- o BMP C126: Polyacrylamide for Soil Erosion Protection
- o BMP C130: Surface Roughening
- o BMP C131: Gradient Terraces
- o **BMP C140: Dust Control**

**Element #6: Protect Slopes**

- Design and construct cut and fill slopes in a manner that will minimize erosion.
- Consider soil type and its potential for erosion.

- Reduce slope runoff velocities by reducing the length of continuous slope with terracing and diversions, reducing slope steepness, and roughening slope surface.
- Divert offsite stormwater (run-on) or ground water away from slopes and disturbed areas with interceptor dikes, pipes, and/or swales. Manage offsite stormwater separately from stormwater generated on the site.
- At the top of slopes, collect drainage in pipe slope drains or protected channels to prevent erosion.
- Design temporary pipe slope drains to handle the peak 10-minute velocity of flow from a 10-year, 24-hour event assuming a Type 1A rainfall distribution. Alternatively, the 10-year, 1 hour flow rate indicated by an approved continuous runoff model, increased by a factor of 1.6, may be used. If a 15-minute (or less) time step is used, no correction factor is required. The hydrologic analysis shall use the existing land cover condition for predicting flow rates from tributary areas outside the project limits. For tributary areas on the project site, the analysis shall use the temporary or permanent project land cover condition, whichever will produce the highest flow rates. If using the Western Washington Hydrology Model (WWHM) to predict flows, bare soil areas shall be modeled as "landscaped" area.
- Permanent pipe slope drains shall be sized for the 100-year, 24-hour event.
- Provide drainage to remove ground water intersecting the slope surface of exposed soil areas.
- Place excavated material on the uphill side of trenches, consistent with safety and space considerations.
- Place check dams at regular intervals within channels that are cut down a slope.
- Stabilize soils on slopes, as specified in Element #5.
- BMP combinations are the most effective method of protecting slopes with disturbed soils. For example, using both mulching and straw erosion control blankets in combination.

**Suggested BMPs:**

- BMP C120: Temporary and Permanent Seeding
- **BMP C121: Mulching**
- BMP C122: Nets and Blankets
- BMP C123: Plastic Covering
- BMP C124: Sodding
- BMP C130: Surface Roughening
- BMP C131: Gradient Terraces
- BMP C200: Interceptor Dike and Swale
- BMP C201: Grass-Lined Channels
- BMP C203: Water Bars
- BMP C204: Pipe Slope Drains
- BMP C205: Subsurface Drains
- BMP C206: Level Spreader
- BMP C207: Check Dams
- BMP C208: Triangular Silt Dike (Geotextile-Encased Check Dam).

**Element #7: Protect Drain Inlets**

- Protect all storm drain inlets made operable during construction so that stormwater runoff does not enter the conveyance system without first being filtered or treated to remove sediment.
- Keep all approach roads clean. Do not allow sediment and street wash water to enter storm drains without prior and adequate treatment unless treatment is provided before the storm drain discharges to waters of the state.

- Inspect inlets weekly at a minimum and daily during storm events. Clean inlet protection devices, or remove and replace when sediment has filled one-third of the available storage (unless a different standard is specified by the product manufacturer).

**Suggested BMPs:**

- **BMP C220: Storm Drain Inlet Protection**

**Element #8: Stabilize Channels and Outlets**

- Design, construct, and stabilize all temporary on-site conveyance channels to prevent erosion from the expected peak 10 minute velocity of flow from a Type 1A, 10-year, 24-hour frequency storm. Alternatively, the 10-year, 1-hour time step flow rate indicated by an approved continuous runoff model, increased by a factor of 1.6, may be used. If a 15-minute (or less) time step is used, no correction factor is required. The hydrologic analysis shall use the existing land cover condition for predicting flow rates from tributary areas outside the project limits. For tributary areas on the project site, the analysis shall use the temporary or permanent project land cover condition, whichever will produce the highest flow rates. If using the Western Washington Hydrology Model (WWHM) to predict flows, bare soil areas shall be modeled as "landscaped" area.
- Provide stabilization, including armoring material, adequate to prevent erosion of outlets, adjacent streambanks, slopes, and downstream reaches at the outlets of all conveyance systems.
- The best method for stabilizing channels is to completely line the channel with a blanket product first, then add check dams as necessary to function as an anchor and to slow the flow of water.

**Suggested BMPs:**

- BMP C122: Nets and Blankets
- BMP C202: Channel Lining
- BMP C207: Check Dams
- **BMP C209: Outlet Protection**

**Element #9: Control Pollutants**

- Design, install, implement and maintain effective pollution prevention measures to minimize the discharge of pollutants.
- Handle and dispose all pollutants, including waste materials and demolition debris that occur on-site, in a manner that does not cause contamination of stormwater. Woody debris may be chipped, ground, or chopped and spread on site.
- Provide cover, containment, and protection from vandalism for all chemicals, liquid products, petroleum products, and other materials that have the potential to pose a threat to human health or the environment. On-site fueling tanks shall include secondary containment. Secondary containment means placing tanks or containers within an impervious structure capable of containing 110% of the volume contained in the largest tank within the containment structure. Double- walled tanks do not require additional secondary containment.
- Use spill prevention and control measures when conducting fueling, maintenance and repair of heavy equipment and vehicles including oil changes, hydraulic system drain down, solvent and de-greasing cleaning operations, fuel tank drain down and removal, and other activities which may result in discharge or spillage of pollutants to the ground or into

stormwater runoff. Clean contaminated surfaces immediately following any discharge or spill incident. Emergency repairs may be performed on-site using temporary plastic placed beneath and, if raining, over the vehicle.

- Discharge wheel wash or tire bath wastewater to a separate on-site treatment system that prevents discharge to surface water, such as a closed-loop recirculation or upland land application, or to the sanitary sewer, with local sewer district approval.
- Apply agricultural chemicals, including fertilizers and pesticides, in a manner and at application rates that will not result in loss of chemical to stormwater runoff. Follow manufacturers' recommendations for application rates and procedures shall be followed.
- Use BMPs to prevent or treat contamination of stormwater runoff by pH modifying sources. These acidic or basic sources include, but are not limited to, bulk cement, cement kiln dust, fly ash, new concrete washing and curing waters, waste streams generated from concrete grinding and sawing, exposed aggregate processes, dewatering concrete vaults, concrete pumping and mixer washout waters.
- Adjust the pH of stormwater if necessary to prevent violations of the water quality standards. Projects must obtain written approval from the Department of Ecology prior to using chemical treatment other than CO2 or dry ice to adjust pH.
- Washout of concrete trucks shall be performed off-site or in designated concrete washout areas only. Do not wash out concrete trucks onto the ground, or into storm drains, open ditches, streets, or streams. Do not dump excess concrete on site, except in designated concrete washout areas. Concrete spillage or concrete discharge to surface waters of the State if prohibited. Do not use upland land applications for discharging wastewater from concrete washout areas.
- Wheel wash or tire bath wastewater shall not be mixed with wastewater from concrete washout areas.

**Suggested BMPs:**

- **BMP C151: Concrete Handling**
- **BMP C152: Sawcutting and Surfacing Pollution Prevention**
- **BMP C153: Material Delivery, Storage and Containment**
- **BMP C154: Concrete Washout Area**
- BMP C250: Construction Stormwater Chemical Treatment
- BMP C251: Construction Stormwater Filtration
- BMP C252: High pH Neutralization Using CO2
- BMP C253: pH Control for High pH Water.
- See Volume IV – Source Control BMPs.

**Element #10: Control De-Watering**

- Discharge foundation, vault, and trench de-watering water, which have similar characteristics to stormwater runoff at the site, into a controlled conveyance system prior to discharge to a sediment trap or sediment pond. Channels must be stabilized, as specified in Element #8.
- Discharge clean, non-turbid de-watering water, such as well-point ground water, to systems tributary to, or directly into surface waters of the State, as specified in Element #8, provided the de-watering flow does not cause erosion or flooding of receiving waters or interfere with operation of the system. Do not route these clean waters through stormwater sediment ponds. Note that "surface waters of the State" may exist on a construction site as well as off site; for example, a creek running through a site.
- Handle highly turbid or contaminated dewatering water from construction equipment operation, clamshell digging, concrete tremie pour, or work inside a cofferdam, separately from stormwater.

- Discharging sediment-laden (muddy) water into waters of the State likely constitutes violation of water quality standards for turbidity. The easiest way to avoid discharging muddy water is through infiltration and preserving vegetation.
- Other treatment or disposal options, depending on site constraints, may include:

    - Infiltration
    - Transport offsite in a vehicle, such as a vacuum flush truck, for legal disposal in a manner that does not pollute state waters
    - Ecology-approved on-site chemical treatment or other suitable treatment technologies
    - Sanitary sewer discharge with local sewer district approval, if there is no other option
    - Use of a sedimentation bag with outfall to a ditch or swale for small volumes of localized dewatering.

**Suggested BMPs:**

- BMP C203: Water Bars
- **BMP C236: Vegetative Filtration**

**Element #11: Maintain BMPs**

- Maintain and repair all temporary and permanent erosion and sediment control BMPs as needed to assure continued performance of their intended function. Conduct maintenance and repair in accordance with BMP specifications.
- Remove all temporary erosion and sediment control BMPs not designed to remain in place following construction (e.g. compost socks), within 30 days after final site stabilization is achieved or after the temporary BMPs are no longer needed. Remove or stabilize trapped sediment on site. Permanently stabilize disturbed soil resulting from removal of BMPs or vegetation.
- Protect all BMPs installed for the permanent control of stormwater from sediment and compaction. All BMPs that are to remain in place following completion of construction shall be examined and placed in full operating condition. If sediment enters the BMPs during construction, it shall be removed and the facility shall be returned to the conditions specified in the construction documents.

**Suggested BMPs**

- **BMP C150: Materials On Hand**
- **BMP C160: Certified Erosion and Sediment Control Lead**

**Element #12: Manage the Project**

**Phasing of Construction:**

- Phase development projects to the maximum extent practicable and take into account seasonal work limits in order to prevent soil erosion and, to reduce to the maximum extent practicable, the transport of sediment from the site during construction. Revegetation of exposed areas and maintenance of that vegetation shall be an integral part of the clearing activities for any phase.
- Clearing and grading activities for developments are permitted only if conducted pursuant to an approved site development plan (e.g., subdivision approval) that establishes permitted areas of clearing, grading, cutting, and filling. When establishing these permitted clearing and grading areas, minimize the removal of existing trees and the disturbance/compaction

of native soils except as needed for building purposes. Delineate the permitted clearing and grading areas and any other areas required to preserve critical or sensitive areas, buffers, native growth protection easements, or tree retention areas as may be required by the City, on the site plans and the development site.

**Seasonal Work Limitations:**

- From October 1 through April 30, clearing, grading, and other soil disturbing activities will not be permitted unless it is shown to the satisfaction of the City that silt-laden runoff will be prevented from leaving the site through a combination of the following:

    - Site conditions including existing vegetative coverage, slope, soil type, and proximity to receiving waters; and
    - Limitations on activities and the extent of disturbed areas; and
    - Proposed erosion and sediment control measures.

- Based on the information provided and/or local weather conditions, the City may expand or restrict the seasonal limitation on site disturbance. The City shall take enforcement action – such as a notice of violation, administrative order, penalty, or stop-work order under the following circumstances:

    - If, during the course of any construction activity or soil disturbance during the seasonal limitation period, sediment leaves the construction site causing a violation of the surface water quality standard; or
    - If clearing and grading limits or erosion and sediment control measures shown in the approved plan are not maintained.

- The following activities are exempt from the seasonal clearing and grading limitations:

    - Routine maintenance and necessary repair of erosion and sediment control BMPs;
    - Routine maintenance of public facilities or existing utility structures that do not expose the soil or result in the removal of the vegetative cover to soil; and
    - Activities where there is 100 percent infiltration of surface water runoff within the site in approved and installed erosion and sediment control facilities.

**Coordination with Utilities and Other Contractors:**

The primary project proponent shall evaluate, with input from utilities and other contractors, the stormwater management requirements for the entire project, including the utilities, when preparing the Construction SWPPP.

**Inspection and Monitoring:**

- For construction sites that will disturb 1 acre or more a Certified Erosion and Sediment Control Lead (CESCL) shall be identified in the Construction SWPPP and shall be on-site or on-call at all times. Certification must be obtained through an approved training program that meets the erosion and sediment control training standards established by Ecology.
- Project sites less than one acre (not part of a larger common plan of development or sale) may have a person without CESCL certification conduct inspections. The person shall be identified in the Construction SWPPP and shall be on-site or on-call at all times.
- All BMPs shall be inspected, maintained, and repaired as needed to assure continued performance of their intended function. Site inspections shall be conducted at least weekly and

immediately following any substantial rainfall event by a person who is knowledgeable in the principles and practices of erosion and sediment control. The CESCL or inspector (project sites less than one acre) must have the skills to:

1) Assess the site conditions and construction activities that could impact the quality of stormwater, and
2) Assess the effectiveness of erosion and sediment control measures used to control the quality of stormwater discharges.

- The CESCL or inspector must examine stormwater visually for the presence of suspended sediment, turbidity, discoloration, and oil sheen. They must evaluate the effectiveness of BMPs and determine if it is necessary to install, maintain, or repair BMPs to improve the quality of stormwater discharges.
- Implement appropriate BMPs or design changes as soon as possible whenever inspection and/or monitoring reveals that the BMPs identified in the Construction SWPPP are inadequate, due to the actual discharge of or potential to discharge a significant amount of any pollutant.
- Based on the results of the inspection, construction site operators must correct the problems identified by:

    - Reviewing the SWPPP for compliance with the 13 construction SWPPP elements and making appropriate revisions within 7 days of the inspection.
    - Immediately beginning the process of fully implementing and maintaining appropriate source control and/or treatment BMPs as soon as possible, addressing the problems no later than within 10 days of the inspection. If installation of necessary treatment BMPs is not feasible within 10 days, the construction site operator may request and extension from the City within the initial 10-day response period.
    - Documenting BMP implementation and maintenance in the site log book (sites larger than 1-acre).
    - The CESCL or inspector must inspect all areas disturbed by construction activities, all BMPs, and all stormwater discharge points at least once every calendar week and within 24 hours of any discharge from the site. (For purposes of this condition, individual discharge events that last more than one day do not require daily inspections. For example, if a stormwater pond discharges continuously over the course of a week, only one inspection is required that week). The CESCL or inspector may reduce the inspection frequency for temporarily stabilized, inactive sites to once every calendar month.

**Maintaining an Updated Construction SWPPP:**

- The Construction SWPPP shall be retained on-site or within reasonable access to the site.
- The SWPPP shall be modified whenever there is a change in the design, construction, operation, or maintenance at the construction site that has, or could have, a significant effect on the discharge of pollutants to waters of the state.
- The SWPPP shall be modified if, during inspections or investigations conducted by the owner/operator, City or a state regulatory authority, it is determined that the SWPPP is ineffective in eliminating or significantly minimizing pollutants in stormwater discharges from the site. The SWPPP shall be modified as necessary to include additional or modified BMPs designed to correct problems identified. Revisions to the SWPPP shall be completed within seven (7) days following the inspection.

**Suggested BMPs**

- **BMP C150: Materials On Hand**
- **BMP C160: Certified Erosion and Sediment Control Lead**
- **BMP C162: Scheduling**

**Element #13: Protect Low Impact Development BMPs**

- Protect all Bioretention and Rain Garden BMPs from sedimentation through installation and maintenance of erosion and sediment control BMPs on portions of the site that drain into the Bioretention and/or Rain Garden BMPs.
- Restore Bioretention and Rain Garden BMPs to their fully functioning condition if they accumulate sediment during construction. Restoring the BMP includes removal of sediment and any sediment-laden Bioretention/Rain Garden soils, and replacing the removed soils with soils meeting the design specification.
- Prevent compaction of Bioretention, Rain Garden, and other infiltration BMPs by excluding construction equipment and foot traffic. Protect completed lawn and landscaped areas from compaction due to construction equipment.
- Protect surrounding land uses from erosion and manage to avoid introducing sediment onto permeable pavements. Do not allow muddy construction equipment on the base material or pavement. Do not allow sediment-lade runoff onto permeable pavements.
- Clean pavements fouled with sediments or no longer passing an initial infiltration test using procedures acceptable to the City or in accordance with manufacturer's procedures.
- Keep heavy equipment off of existing soils under LID facilities (Bioretention, Rain Gardens, Infiltration Ponds, Permeable Pavements, etc.) that have been excavated to final grade to retain the infiltration rate of the soils.

**Suggested BMPs**

- BMP C102: Buffer Zone
- BMP C103: High Visibility Fence
- BMP C200: Interceptor Dike and Swale
- BMP C201: Grass-Lined Channels
- BMP C207: Check Dams
- BMP C208: Triangular Silt Dike (TSD) (Geotextile-Encased Check Dam).
- BMP C231: Brush Barrier
- **BMP C233: Silt Fence**
- BMP C234: Vegetated Strip
- Additional Guidance: See Chapter 5: Precision Site Preparation and Construction in the LID Technical Guidance Manual for Puget Sound for more detail on protecting LID integrated management practices.