Attachment 18

VILLAGE AT CAIN ROAD

Preliminary Drainage Design Report

Prepared for: Summit Land Development, LLC
1868 State Avenue NE
Olympia, WA 98506

(360) 754-7010

March 15, 2019

Prepared by: Lance Talmadge, EIT

Reviewed by: Roland Blake Wilkerson, PE
HATTON GODAT PANTIER
3910 Martin Way E., Suite B
Olympia, WA 98506
(360) 943-1599

I hereby certify that this Preliminary Drainage Control Plan for **VILLAGE AT CAIN ROAD, 2017 22nd Avenue SE, Olympia**, Washington, has been prepared by me or under my supervision and meets minimum standards of CITY OF OLYMPIA and normal standards of engineering practice. I hereby acknowledge and agree that CITY OF OLYMPIA does not and will not assume liability for the sufficiency, suitability or performance of drainage facilities designed by me.

Signature

3/22/19
Date

Seal

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I. THURSTON REGIONAL FACILITY SUMMARY FORM

Complete one for each facility (e.g., detention/retention, coalescing plate filter) on the project site. Attach 8 ½" by 11" sketch showing location of facility.

Proponent's facility name or identifier (e.g., Pond A): **Combination Infiltration and Wet Pond**

Name of road or street to access facility: **22nd and Cain Road**

Hearings Examiner case number: _____

Development Review Project No./Bldg. Permit No.: _____

Parcel Number(s): **09940068005**

To Be Completed By Utility Staff:

Utility facility number ..... _____

Parcel number status, (num, 1ch) ..... _____
0-Known; 1-Public; 2-Unknown; 3-Unassigned

Basin and sub-basin, (num, 6ch) ..... _____
2ch-Basin; 2ch-Sub-basin; 2ch-Future

Responsible jurisdiction, (alpha, 1ch) ..... _____
O-Olympia; C-County; T-Tumwater; L-Lacey

Part 1 – Project Name and Proponent

Project name: **VILLAGE AT CAIN ROAD**

Project owner: **Summit Land Development, LLC**

Project contact: **Rob Rice**

Address: **1868 State Ave, Olympia, WA 98506**

Phone: **(360) 754-7010**

Project proponent (if different): _____

Address: _____

Phone: _____

Project engineer: **Roland Blake Wilkerson, PE**
Firm: **HATTON GODAT PANTIER**
Phone number: **(360) 943-1599**

Part 2 – Project Location

Section	**24**
Township	**18**
Range	**2W**

Names and addresses of adjacent property owners:

City of Olympia	PO Box 1967 Olympia, WA 98507
Wozniak, Linda Sue	2205 Nut Tree Loop SE, Olympia WA 98501
Buehler, Daniel A	2505 Danbury Court SE, Olympia WA 98501
Backman, Julie	2203 Nut Tree Loop SE, Olympia WA 98501
Whitbeck Co-Trusteees,	2201 Nut Tree Loop SE, Olympia WA 98501
Whitbeck, John	2201 Nut Tree Loop SE, Olympia WA 98501
Collins, Kenneth & Priscilla	2121 22nd Ave SE, Olympia WA 98501
Springer, Laura	2105 22nd Ave SE, Olympia WA 98501
McGrath, Dale	2031 22nd Ave SE, Olympia WA 98501

Part 3 – Type of Permit Application

Type of permit (e.g., commercial building): **Residential Plat**

Other permits (☒):

- ☐ DOF /W HPA
- ☐ COE 404
- ☐ COE Wetlands
- ☐ DOE Dam Safety
- ☐ FEMA
- ☐ Floodplain
- ☐ Shoreline Management
- ☒ Rockery/Retaining Wall
- ☐ Encroachment
- ☒ Grading
- ☐ Other

Other agencies (e.g., federal, state, local) that have reviewed or will review this Drainage and Erosion Control Plan: **NONE**

Part 4 – Proposed Project Description

What stream basin is the project in (e.g., Percival, Woodland)? **Indian-Moxlie**

Zoning: ..... **Residential (R-6-12)**

Onsite

Residential Subdivision:

Number of lots	**24**
Average lot size (acres)	**0.11**

Building Permit/Commercial Plat:

Building(s) (footprint, acres)	**0.98**
Patio/Porch paving (acres)	**0.11**
Driveway Surface (acres)	**0.22**
Public roads-including right of way (acres)	**0.80**
Public roads asphalt area (acres)	**0.29**
Public roads sidewalk area (acres)	**0.25**
Private roads-including gravel shoulder (acres)	**0.11**
Onsite impervious surface total (acres)	**1.96**

Part 5 – Pre-Developed Project Site Characteristics

Stream through site (Y/N) **N**

Name ____

DNR Type ____

Type of feature this facility discharges to (e.g., lake, stream, intermittent stream, pothole, roadside ditch, sheet flow to adjacent property): **Infiltration via existing kettle/depression.**

Swales (Y/N)	**N**
Steep slopes—steeper than 10% (Y/N)	**N**
Erosion hazard (Y/N)	**N**
100-year floodplain (Y/N)	**N**
Wetlands (Y/N)	**N**
Seeps/springs (Y/N)	**N**
High groundwater table (Y/N)	**N**
Other	**N**

Part 6– Facility Description – Combination Infiltration/Wet Pond

Total area tributary to facility including offsite (acres)	**10.72**
Total onsite area tributary to facility (acres)	**5.01**
Design roof/patio/porch area tributary to facility (acres)	**1.09**
Design pavement area tributary to facility (acres)	**1.26**
Design lawn/landscape area tributary to facility (acres)	**2.86**
Design native area tributary to facility (acres)	**5.00**
Design pond area tributary to facility (acres)	**0.51**
Design total tributary area to facility (acres)	**10.72**

Enter "1" for type of facility

Wet pond detention	**1**
Wet pond water surface area (acres)	**0.12**
Dry pond detention	
Underground detention	
Infiltration pond	**1**
Drywell infiltration	
Other	

Outlet type (enter "1" for each type present)

Filter	
Oil/water separator	
Single orifice	
Multiple orifices	
Weir	
Spillway	
Pump(s)	
Other	

Part 7 – Release to Groundwater

Design percolation rate to groundwater (if applicable) **3.5 inches per hour**

Part 8 – Release to Surface Water (if applicable)

Jurisdiction MSL Elevation (Ft)	Percent Design Full	Volume (Cf)	Discharge To Surface Water (Cfs)
163.00	0	0.00	0.00
164.50	25	12,680	0.00
165.50	50	24,394	0.00
168.00	100	85,181	0.00

II. DRAINAGE REPORT

Section 1 Project Description

The Village at Cain Road plat proposes to develop 24 single-family lots on 5.01 acres. The project is situated on Tax Parcel Number 09940068005 in the City of Olympia. The site is in Section 24, Township 18, Range 2 West, Willamette Meridian. Zoning for the project is R-6-12 Residential. The project area is bounded by 22nd Avenue to the north, developed single family lots to the west, McGrath Woods Park to the south and Cain Road to the east. (See Vicinity Map in Appendix A)

Construction will include one new local roadway, widening of Cain Road to install a turn lane and widening of the asphalt shoulder along 22nd Avenue. Frontage improvements include pavement widening, landscaping, sidewalks, and storm drainage along Cain Road and 22nd Avenue. Homes in the proposed subdivision are to be served by the City of Olympia Water and Sewer. See Part 4 of the Thurston County Summary Form for a summary of the proposed surfaces.

Stormwater runoff from the development will be caught and conveyed to a combination infiltration basin and wet pond for treatment and flow control. The ponds were designed to meet criteria from the 2016 City of Olympia Drainage Design and Erosion Control Manual (DDECM). Offsite areas contributing to the pond include McGrath Woods Park, the half street portions of Cain Road and lawn areas to the north and east of the project. Bypass will be provided for the existing stormwater pond located at the eastern side of the project area. The proposed Tract C will provide a 15-foot stormwater easement for this bypass.

Section 2 Existing Conditions

The site in its existing condition is primarily undeveloped forest however, a single-family home exists at the north property line along 22nd Avenue. The site generally slopes to the northwest from a high of 180 near the east property line to a low point of 165 near the northwest corner of the site. Slopes on the site are generally 3% to 5%. Vegetation on the site consists of Cedar, Fir and Maples trees, shrubbery is primarily nettles, Salal and ferns. No critical areas, wetlands or streams exist onsite.

The site is bounded by 22nd Avenue and existing homes to the north. Cain road runs the length of the western property line. McGrath Woods Park runs the length of the southern property line. Homes in the Old Orchard Subdivision run the length of the eastern property line. Onsite stormwater runoff onsite sheet flows and shallow concentrates through forested conditions to a kettle in the northwestern portion of the site. This kettle infiltrates onsite and does not discharge and therefore makes the site a closed depression.

All onsite flows enter this kettle. Offsite flows include the forested area from McGrath Woods Park to the south extending to the top of a gulley in the townhome parcel south of the park. Portions of the lawn areas from the adjacent homes to the north and east also sheet flow onsite and enter the kettle. Roof areas for the adjacent lots are assumed to be placed on drywells. An existing stormwater pond is adjacent to the eastern property line in the Old Orchard Subdivision.

Cain Road runoff flows via curb to a catch basin located at the southeast corner at the intersection of Cain and 22nd. Runoff from the half street portion of 22nd Avenue sheet flow into a

ditch/depression between the edge of asphalt and sidewalk to enter the catch basin at the same intersection. Flows from this catch basin convey to the west to the catch basin located at the center, then the southwest corner of the intersection and down 22nd Avenue to the west.

Section 3 Soils Report

Insight Geologic Inc. completed a Geotechnical and Stormwater Investigation dated April 16, 2018 with supplements dated July 19, 2018 and March 14, 2019. The initial report found soils at the site are recessional glacial outwash in a loose to moderately dense condition. Soils were found to be consistent with Yelm fine sandy loam which is mapped by the NRCS for the area. See Appendix B for report and supplementals.

Groundwater in the April 16, 2018 was approximated at 8 to 9 feet below the ground surface. Winter groundwater monitoring, detailed in a July 19,2018 report, monitored groundwater over the course of two months. Three monitoring wells were monitored in the vicinity of the proposed pond. Two of the monitoring wells (MW1 and MW3) did not record any groundwater during the report timeline. One well, MW2, did record groundwater with a peak of 18.11 feet below the ground surface, placing the high groundwater mark at an approximate elevation of 145.89.

Insight Geologic conducted a geotechnical and stormwater investigation in March of 2018 and produced a reported dated April 16, 2018 with their results. Based on their findings, using the "Detailed Method", they recommended a long-term design infiltration rate of 0.1 in/hr for the storm pond. Using this rate, Hatton Godat Pantier (HGP) designed a storm pond with a release to the existing storm system in 22nd Avenue SE. This generated a comment from the City of Olympia expressing their belief that the site is part of a closed basin which drains to a kettle southwest of the intersection of Cain Road and 22nd Avenue SE, with no release to 22nd Avenue SE.

In November of 2018, Insight Geologic conducted a supplemental subsurface exploration drilling an additional four borings within the existing depression. Based on gradation analyses of the soils encountered above a silt layer located approximately between 9 and 11.5 feet below ground surface, an infiltration rate (0.27 in/hr) was calculated for the existing condition using Massman's saturated potential hydraulic conductivity and hydraulic gradient equations from the 2016 City of Olympia DDECM.

A WWHM model was developed for the existing condition using the calculated infiltration rate, a storm pond with bottom area and volume equivalent to those calculated from the existing contours in the onsite depression with infiltration through side walls turned on, and 10.8 acres of flat forest contributing to the depression. WWHM modeled an existing condition release of 0.495 cfs from a 2-year storm and 1.17 cfs from a 100-year storm. Note, correction factors for site variability and biofouling were not included in calculating the infiltration rate for the existing condition.

Because the calculations and modeling for the existing condition was not consistent with Olympia's assertation that the onsite depression was a closed basin with no release, HGP asked for a meeting with Olympia staff where we could present our findings.

During the meeting all parties agreed that the existing vegetation, among other indicators at the site, didn't seem consistent with the soils information or WWHM modeling. Based on this understanding, HGP suggested that an actual existing condition infiltration rate could be determined through a large scale Pilot Infiltration Test (PIT). However, the City of Olympia's 2016 DDECM requires the use of the "Detailed Method" for sites required to fulfill Core Requirement #7,

so the City of Olympia staff would have to agree to allow the use of the PIT results. City of Olympia staff agreed to allow the use of the existing infiltration rate determined by the PIT in designing the project's pond.

The results of Insight Geologic's PIT are detailed in their attached supplemental report (see Appendix B) Based on these results, Insight Geologic recommends a design infiltration rate of 3.5 in/hr.

Section 4 Wells and Septic Systems

Records at Thurston County and the Department of Ecology were searched in order to locate wells and septic systems that may be located within the setback distances from the stormwater pond or ponds. In addition, the Project Engineer, or someone under his direct supervision, has visited the site to verify the presence or absence of wells and septic systems as best can be done visually without trespassing onto other properties. All wells and septic systems found to be located within the setback distances from the stormwater pond or ponds have been shown on the plans.

Section 5 Fuel Tanks

Records at Thurston County and the Department of Ecology were searched in order to locate the presence of above and below ground fuel storage tanks that may be located within the setback distances from the stormwater pond or ponds. In addition, the Project Engineer, or someone under his direct supervision, has visited the site to verify the presence or absence of fuel tanks as best can be done visually without trespassing onto other properties. No fuel tanks were found to be located within the setback distances from the stormwater pond or within the project area.

Section 6 Subbasin Description

For preliminary design the threshold discharge area was divided to six basins. The McGrath Park Basin includes the forested park south of the site. This basin includes portions of a gulley south of the park property line. The Cain Road Half Street Basin includes the half street pavement from Cain Road extending south to the entrance to the townhomes south of McGrath Park. The 22nd/Nut Tree Lawn Basin includes the lawn areas from the lots adjacent to the northeast corner of the project area. The Village at Cain Plat is all the onsite surfaces within the property line. The bypass basin is the half street portion and frontage areas around the intersection of Cain and 22nd Avenue. This basin will bypass the pond and be collected and conveyed at catch basin located at the southeast corner of the intersection. See Table 6.1 and Appendix C.

Table 6.1 Threshold Discharge Area Subbasin Summary

#	Basin	Native	Lawn	Roads	Roofs	Driveways	Sidewalks	Pond	Total
1	McGrath Park	4.15	0	0	0	0	0	0	4.15
2	Cain Road Half Street	0	0	0.39	0	0	0	0	0.39
3	22nd/Nut Tree Lawn Areas	0	1.16	0	0	0	0	0	1.16
4	Village at Cain Plat	0.85	1.70	0.40	1.09	0.22	0.25	0.51	5.02
Total to Pond		**5.00**	**2.86**	**0.79**	**1.09**	**0.22**	**0.25**	**0.51**	**10.72**
5	Bypass	0	0.04	0.16	0	0	0.04	0	0.24
Total TDA		**5.00**	**2.90**	**0.95**	**1.09**	**0.22**	**0.29**	**0.51**	**10.96**

Section 7 Floodplain Analysis

The Federal Emergency Management Agency prepares maps for all areas within Thurston County, including the incorporated cities therein. Panel # 53067C0188F depicts the areas, if any, subjected to flooding in the vicinity of this proposal. By inspection of this map, this proposed development area appears to be in Zone X, an area of minimal flooding. This area, therefore, is not located within the 100-year flood plain. See Appendix E

Section 8 Aesthetic Considerations for Facilities

All above ground stormwater facilities will be hydroseeded upon completion. In addition, the water quality wet pond will be planted with a variety of wetland species both in the permanent pool and along the fringes of the permanent water surface. Additional landscaping shall also be provided throughout the project in conformance with the approved landscaping and tree restoration plan, as applicable, and as otherwise required by the approving authority.

Section 9 Facility Selection and Sizing

This project triggers all nine core requirements. See Table 9.2 and 9.3. A review of the Indian-Moxlie Basin plan did not dictate any specific requirement for the treatment of stormwater runoff. The project therefore will provide basic treatment as specified in Section 2.5.6 of Volume 1 of the DDECM. Basic treatment will be provided through the use of BMPT0.10 Basic Wetpond.

To provide flow control the project proposes the use of a combined wet pond and infiltration basin. The infiltration pond is sized using WWHM2012 v.4.2.14. Sizing of the infiltration pond included all onsite and offsite basins and all surfaces. Onsite roof areas are included in the infiltration basin calculation, no offsite roof areas are included. The Bypass basin and the overflow from the adjacent pond areas are not included in the sizing criteria. The bypass basin will enter the catch basin at the corner of Cain and 22nd and contribute to the downstream flows.

20-foot setbacks were applied to the available storm tract to obtain an available area to place both ponds.

To size the wetpond:

1) The 24-hour volume from the mitigated runoff was obtained from WWHM.
    a. Required 24-hour volume = 0.4295 ac-ft.
2) A bottom area was determined to be 2,137 sf with a length to width ratio great than 3:1.
    a. Length of bottom = 85 feet
    b. Width of bottom = 25 feet.
    c. Design Length to Width Ratio = 3.4:1
    d. Design bottom of wet pond = 157.50 ft.
3) From this bottom area the top area was determined to be 5,365 sf.
    a. Depth of wetpond from design bottom to design water surface = 6 feet.
    b. Design wetpond water surface = 163.50 feet.

c. Top length = 110 feet.

d. Top Width = 49 feet.

4) Provided Wetpond Volume = ((√5,365*2,137) + 5,365+2,137) (6/3) = 21,776 cf.

5) Required Wetpond Volume = 0.4295 ac-ft = 19,140 cf.

6) 1st cell is sized to store approximately 30% of the total volume.

7) A wood baffle wall was placed between the two cells with a top elevation of 162.50.

8) Sediment storage was provided in both cells, the first cell has 1 foot of storage and the 2nd cell ½ a foot.

9) The wetpond bottom elevation of 157.50 is approximately 7 feet above the recorded high groundwater measured in the Geotechnical Report date July 19, 2018.

To size the infiltration basin.

1) The combined facility has a design top elevation of 169, with a design water surface on the infiltration basin is set to 168 and a bottom of 163 at 5 feet of depth. 1 foot of storage is designed from elevation 163.50 to 164.50 above the wetpond.

2) The irregular bottom surface area of the pond is 8117 sf. To model the pond bottom in WWHM a 90 x 90 pond bottom was used. (90x90 = 8100 sf).

3) This area was modeled in WWHM at a 3.5 in/hr infiltration rate, 100% infiltration was reached.

Sizing Emergency Overflow Riser

100-year Pond Inflow = 2.3552 cfs

110% of the 100-year Inflow = (1.1)(2.3552 cfs) = 2.58742 cfs

Riser Diameter (D) = 48 inches = 4 feet

Head from crest of riser (H) = 6 inches =0.5 feet

Qweir = 9.739DH^(3/2)

Qweir = 9.739 (4) (0.5^(3/2)) = 13.77 cfs

Qinflow = 2.58742 cfs

Table 9.1 – Pond Facilities Area Summary			
(All areas measured in acres)	Onsite	Offsite	Pond
Total Non-Pollution Generating Impervious Surface (NPGIS)	1.09	0	1.09
Total Pollution Generating Impervious Surface (PGIS)	0.87	0.39	1.26
Total Pollution Generating Pervious Surface (PGPS)	1.70	1.16	2.86
Native Vegetation Converted to Lawn/Landscape (Offsite areas are existing lawn/landscaping)	1.70	1.16	n/a
Native Vegetation Not Converted (Offsite areas are existing/remaining forest)	0.85	4.15	5.0
Total Effective Impervious Surface	**1.96**	**0.39**	**2.35**
Increase (Decrease) in 100-year Storm Peak (cfs)	**-**	**-**	**(0.1776)**
Discharge Point (none onsite infiltration)	0	0	0

Table 9.2 – Treatment Requirements by Threshold Discharge Area				
	< ¾ Acres of PGPS	≥ ¾ Acres of PGPS	< 5,000 ft² of PGIS	≥ 5,000 ft² of PGIS
Treatment Facilities		X		X
Onsite Stormwater BMPs	X	X	X	X

Table 9.3 – Flow Control Requirements by Threshold Discharge Area		
	Flow Control Facilities	Onsite Stormwater Management BMPs
< ¾ acres conversion to lawn/landscape or < 2.5 acres to pasture.		X
≥ ¾ acres conversion to lawn/landscape or ≥ 2.5 acres to pasture.	X	X
< 10,000 ft² of effective impervious area.		X
≥ 10,000 ft² of effective impervious area.	X	X
≥ 0.1 cfs increase in the 100-year return frequency flow.	X	X

Core Requirement #1: Preparation of Drainage Control Plans

This project triggers all core requirements including the submission are Drainage Control Plans. All required documents including the SWPPP and Management Plan will be included with the construction documents.

Core Requirement #2: Construction Stormwater Pollution Prevention Plan

A Construction Stormwater Pollution Prevention Plan (C-SWPPP) will be developed to address erosion and sediment control anticipated during construction. A construction NPDES permit will be obtained prior to construction. The C-SWPPP will address all thirteen elements as required by the Department of Ecology and will be included with the construction documents.

Core Requirement #3: Source Control of Pollution

Permanent source control BMPs are used to prevent stormwater from coming in contact with pollutants and are used as a cost-effective means of reducing pollutants in stormwater. The selection of permanent source control BMPs is based on the activities likely to occur on the site and the pollutants associated with those activities.

Chapter 3, Volume IV of the 2016 City of Olympia DDECM have been reviewed. Applicable Source Control BMP's can be found in the Source Control Plan located in Section IV of this document.

There are two types of source control BMPs: operational and structural. Operational source control BMPs are non-structural practices that prevent or reduce pollutants from entering stormwater. Structural source control BMP's are physical, structural or mechanical devices or facilities intended to prevent pollutants from entering stormwater. Section 3.2, Volume IV – Source Control of the Thurston County DDECM lists examples of these two types of source control BMP's.

EXAMPLES OF OPERATION SOURCE CONTROL BMPS

A. Form a Pollution Prevention Team that will be responsible for inspecting the stormwater systems and potential pollution sources, operation and maintenance of stormwater systems and enforcement of preventing pollution discharges into the stormwater systems. The team will also be the emergency response team.

B. Good housekeeping includes containing and cleaning up spills on any exposed soils, vegetation or paved areas; sweeping paved surfaces; cleaning pollutants and debris from all BMPs regularly; and making repairs to containment systems, leaks and other sources that could pollute the drainage system.

C. Preventative Maintenance

    1. Provide recycling or post signs to recycle materials such as oils, solvents and wood waste to the maximum extent practicable.
    2. Prevent the discharge of unpermitted liquids and solids into the storm drainage system.
    3. Use drip pans to collect leaks and spills from vehicles and equipment.
    4. Store liquids in steel or plastic containers that are rigid, durable, corrosion resistant, non-absorbent, water tight, rodent-proof and equipped with a close-fitting cover.

D. Spill Prevention and Cleanup

    1. Stencil warning signs at stormwater catch basins and drains – "Dump no waste".
    2. Immediately stop, contain and clean up all spills.

3. Contact appropriate local agency (Fire Department, City of Olympia Public Works, Health Department or Department of Ecology) for assistance and guidance.
4. Keep spill containment and clean up kits readily accessible.

E. Employee training shall include identification of pollutant sources, understanding pollutant control measures, spill response procedures and acceptable material handling practices.

F. Inspections

1. Inspections should occur a minimum of twice a year, once during October 1 through April 30 and once during May 1 through September 30. Verify that BMPs are being implemented adequately and make note of any observations of floating materials, suspended solids, oil and grease, discoloration, turbidity or odor in stormwater discharges. Check pH as needed.
2. Determine whether there are unpermitted non-stormwater discharges to the drainage system and eliminate discharges.
5. Retain the following reports for at least three years:
    i. Visual inspection reports.
    ii. Reports on spills of oil or hazardous substances greater than Reportable Quantities that cause a violation of the State of Washington's Water Quality Standards. Contact Department of Ecology and ask for an oil spill operations or a hazardous waste specialist to determine if a spill is a substance of a Reportable Quantity. Southwest Region Dept. of Ecology: (360) 407-6300 or call 911.

EXAMPLES OF STRUCTURAL SOURCE CONTROL BMPS

A. Enclosing and/or covering pollutant sources, i.e., within a building or other enclosure, a roof over storage and working areas, a temporary tarpaulin, etc.

B. Physically segregating the pollutant source to prevent contact with uncontaminated stormwater that runs on the site from surrounding areas.

The owner will receive a copy of the Pollution Source Control Program as found in the Stormwater Maintenance Plan in Section IV below. The Source Control Program describes Best Management Practices (BMPs) for residential properties.

Core Requirement #4: Preservation of Natural Drainage Systems and Outfalls

Natural drainage patters shall be maintained and discharges from the project shall occur at the natural location. The project proposes the location of stormwater facilities in the existing kettle/depression located on the site. Current runoff in the existing condition would discharge to the low point in the northwest corner of the project area and infiltrate through this existing depression. No discharges from the existing depression are known to occur. The project proposed the location of the infiltration pond at the existing depression. The infiltration pond will infiltrate 100% of the runoff, maintaining the natural drainage pattern of the site.

Core Requirement #5: Onsite Stormwater Management

Projects shall employ On-site Stormwater Management BMPs in accordance with the following project thresholds, standards and lists to infiltrate, disperse, and retain stormwater runoff onsite to the extent feasible without causing flooding or erosion impacts.

This project triggers Core Requirements #1 through #9 and therefore must meet the requirements in Table 2.5.1. To satisfy the requirements in Table 2.5.1 of Volume I Section 2.5.5 this project will meet the LID Performance Standard and implement BMP T5.13.

The LID Performance Standard states that stormwater discharge rates shall match developed discharge durations to pre-developed durations for the range of pre-developed discharges from 8% of the 2-year peak flow to 50% of the 2-year peak flow. This project will infiltration 100% of the runoff onsite, therefore meeting the requirements of the LID Performance Standard. The project will also implement BMP T5.13, Post-Construction Soil Quality and Depth, in all new lawn and landscaped areas. Roof areas will sheet flow via splash blocks and combine with all other flows to the combined wetpond and infiltration pond.

Core Requirement #6: Runoff Treatment

Project in which the total pollution generating hard surface is 5,000 square feet or more in a threshold discharge are required to provide treatment. A review of the Indian-Moxlie basin plan did not specify any enhanced or phosphorous treatment requirements. The project proposes basic treatment through the use of BMP T0.10, Basic Wetpond. The wetpond was sized to treat the online water quality facility volume modeled by WWHM.

Core Requirement #7: Flow Control

The project is not in a flow control exempt region of Olympia and therefore is required to provide flow control. The project proposes to infiltrate 100% of the runoff onsite through the infiltration pond. This pond will be placed in the same location as the existing kettle/depression.

Closed Depression Analysis

To determine the height of the emergency overflow spillway, a closed depression analysis per Volume III, Section 2.4 of the 2016 DDECM was followed. As no overflow the existing kettle/depression has been observed, Case 1 was followed. The existing infiltration rate used for the analysis was the same as the design rate of 3.5 in/hr. The contributing area was the same as the design as 10.73 acres, modeled as A/B forest.

The existing kettle was determined to have a bottom at elevation 162 and a top at 168. The bottom area was determined to be approximately 314 sf. Side slopes for the existing depression were determined to be approximately 10:1. Sidewalls were turned for infiltration. Using the Analysis menu in WWHM, the 100-year Stage for the existing kettle is at 162.45.

This project does not propose to discharge runoff from the pond. The pond will however have an emergency overflow from the pond. Per Case 1 of Section 2.4, the post-development high water level, shall be no more than 0.1 feet higher than then predevelopment level, unless the development has acquired ownership or discharge rights to the depression. The project does have ownership to the depression and will replace the closed depression with a storage pond. Therefore, the pond may be flooded and the emergency overflow spillway will be placed higher than the 0.1

foot predeveloped highwater mark of 162.45. The emergency overflow for the project will be placed at 168.50 feet, 0.5 feet above the 168 design water level.

Core Requirement #8: Wetlands Protection

The project does not propose the release of any stormwater discharge to any wetlands. No wetlands are located onsite or within the immediate vicinity of the site.

Core Requirement #9: Operation and Maintenance

A Stormwater Facility Maintenance Program consistent with the provision in Volume IV shall be provided for the proposed stormwater facilities and BMPs. This plan can be found in Section IV.

Additional Requirement #1: Financial Liability

Performance bonding or other appropriate financial guarantee equal to 125% of the stormwater system construction costs shall be required for all projects to ensure construction of drainage facilities are in compliance with the standards set forth in the DDECM. The financial liability will be addressed in the construction documents.

Additional Requirement #2: Offsite Analysis and Mitigation

An offsite analysis is required for project which discharge stormwater offsite. This project triggers this requirement. See Section 11.

Section 10 Conveyance System Analysis and Design

Conveyance systems will be sized through use of the rational method or modeling using HYDRA software. Conveyance analysis and sizing criteria will be included with the construction documents.

Section 11 Offsite Analysis and Mitigation

Emergency overflow discharges from the proposed stormwater facilities will enter the existing stormwater system located at the corner of 22nd Avenue and Cain Road. An existing 8" pipe will be replaced with a 12" pipe that connects into an existing 12" pipe that runs west along 22nd Avenue. The connection will be at the catch basin at the southeast corner of the intersection of 22nd and Cain. The ultimate discharge for the system located along 22nd Avenue is a drainage ditch located west of Lybarger Street. This drainage ditch drains into Moxlie-Indian Creek with a final discharge in Budd Bay.

Section 12 Utilities

Utilities will be installed according to the standards set forth by the City of Olympia and are shown on the plans. Stormwater structures, pipes and facilities will be installed to ensure no conflict with the proposed utilities.

Section 13 Covenants, Dedications, Easements, Agreements

All stormwater facilities located on private property shall be owned, operated and maintained by the property owners, their heirs, successors and assigns. The property owners shall enter into an

agreement with the governing body, a copy of which agreement is included in Section IV of this report. The agreement requires maintenance of the stormwater facilities in accordance with the maintenance plan provided and shall grant easement for access to the governing body to inspect the stormwater facilities. The agreement also makes provisions for the governing body to make repairs, after due notice is given to the owners, if repairs are necessary to ensure proper performance of the stormwater system and if the owners fail to make the necessary repairs. The cost of said repairs shall be borne by the property owners, their heirs, successors and assigns.

Section 14 Other permits or Conditions Placed on the Project

No other permits are known to be required for this project.

IV. STORMWATER SITE MANAGEMENT PLAN

VILLAGE AT CAIN ROAD

March 15, 2019

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I. MAINTENANCE AGREEMENT

TO BE INCLUDED WITH CONSTRUCTION DOCUMENTS

Attachment "A"
Stormwater Facilities Maintenance Program

II. STORMWATER FACILITY MAINTENANCE GUIDE

Introduction

What Is Stormwater Runoff?

When urban and suburban development covers the land with buildings, streets and parking lots, much of the native topsoil, duff, trees, shrubs and grass are replaced by asphalt and concrete. Rainfall that would have soaked directly into the ground instead stays on the surface as *stormwater runoff* making its way into storm drains (including man-made pipes, ditches or swale networks), stormwater ponds, surface and groundwater and, eventually, to Puget Sound.

What Is a Storm Drain System and How Does It Work?

The storm drain system for most developments includes measures to *carry, store, cleanse and release* the stormwater. Components work together to reduce the impacts of development on the environment. Impacts can include *flooding* that results in property damage and blocked emergency routes, *erosion* that can cause damage to salmon spawning habitat and *pollution* that harms fish and/or drinking water supplies.

The storm drain system provides a safe method to carry stormwater to the treatment and storage area. Swales and ponds filter pollutants from the stormwater by *physically* settling out particles, *chemically* binding pollutants to pond sediments and *biologically* converting pollutants to less harmful compounds. Ponds also store treated water, releasing it gradually to a nearby stream or to groundwater.

What Does Stormwater Runoff Have to Do With Water Quality?

Stormwater runoff must be treated because it carries litter, oil, gasoline, fertilizers, pesticides, pet wastes, sediments and anything else that can float, dissolve or be swept along by moving water. Left untreated, polluted stormwater can reach nearby waterways where it can harm and even kill aquatic life. It can also pollute groundwater to the extent that it requires treatment before it is suitable for drinking. Nationally, stormwater is recognized as a major threat to water quality. Remember to keep everything out of stormwater systems except the rainwater they are designed to collect.

Stormwater Facilities

Different types of ponds are designed for different purposes. For example, wet ponds primarily provide treatment of stormwater. Dry ponds or retention ponds are designed to provide storage for stormwater and allow for its gradual release downstream or into the ground.

Who Is Responsible for Maintaining Stormwater Facilities?

All stormwater facilities require maintenance. Regular maintenance ensures proper functioning and preserves visual appeal. This Stormwater Facility Maintenance Guide was designed to explain how stormwater facilities work and provide user-friendly, straightforward guidance on facility maintenance. You are responsible for regularly maintaining privately owned ponds, catch basins,

pipes and other drainage facilities on your property. Stormwater facilities located in public rights-of-way are maintained by local governments.

How to Use the Stormwater Facility Maintenance Guide

This Maintenance Guide includes a Site Plan specific to your development and a Facility Key that identifies the private stormwater facilities you are responsible for maintaining. A "Quick List" of maintenance activities has also been included to help you identify the more routine needs of your facility.

Included in This Guide

- Comprehensive Maintenance Checklists that provide specific details on required maintenance
- Pollution Prevention Tips that list ways to protect water quality and keep storm drain systems functioning smoothly
- Resources to provide more information and technical assistance

A Regional Approach to Stormwater Management

The Cities of Lacey, Olympia and Tumwater together with Thurston County are taking steps to educate and involve area residents in water quality issues and stormwater management. Stormwater runoff is a widespread cause of water quality impairment and stream degradation. The jurisdictions are working together with residents, businesses, community groups and schools to address this problem. This guide focuses on providing information on ways that you can reduce stormwater impacts through pollution prevention and proper facility maintenance.

Your Stormwater Facilities

This section consists of two parts that are to be used together: the ***Facility Key*** and the ***Site Plan***. Review the site plan and identify the numbers denoting a feature of the system. Then check the facility key for the feature type and checklist name.

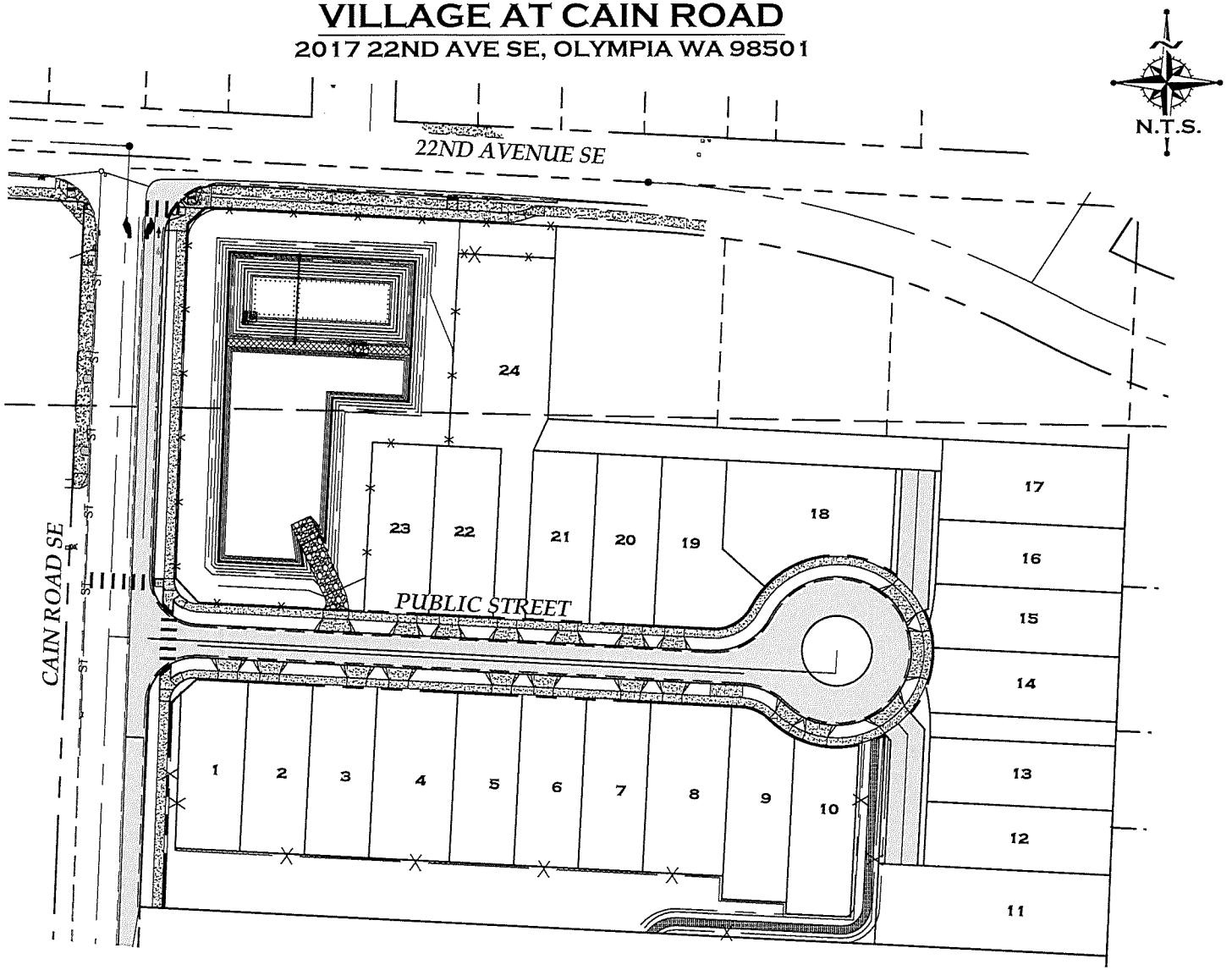
Facility Key

The stormwater facility in your neighborhood is comprised of the following elements:

Type of Feature and Checklist Name	Location on Site Plan
Infiltration Basins and Trenches	1
Catch Basins	2
Wet Ponds	3
Fencing/Shrubbery Screen/Other Landscaping	4
Grounds (Landscaping)	5
Conveyance Systems (Pipes and Ditches)	6

VILLAGE AT CAIN ROAD

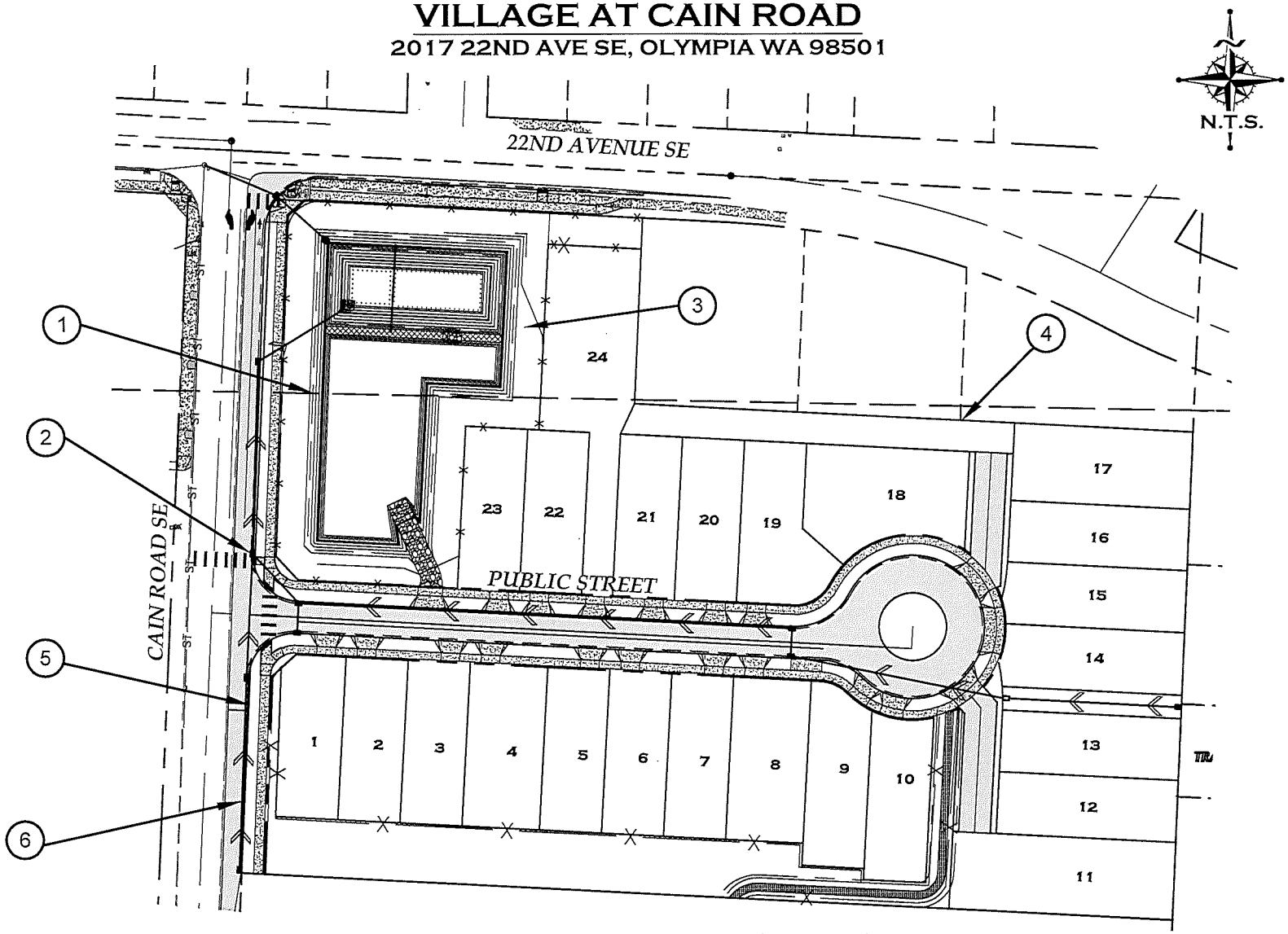
2017 22ND AVE SE, OLYMPIA WA 98501



SITE MAP

VILLAGE AT CAIN ROAD

2017 22ND AVE SE, OLYMPIA WA 98501



MAINTENANCE FACILITY KEY

Quick List

The following is an abbreviated checklist of the most common types of maintenance required. Please go over this checklist after heavy rains. The list represents minimum maintenance to be performed and should be completed in conjunction with the other checklists for an effective maintenance program.

- ❑ Inspect catch basin grates to see that they are not clogged or broken. Remove twigs, leaves or other blockages. Contact the local jurisdiction to replace the grate if it is broken.
- ❑ Inspect inlet and outlet pipes for blockages. Clear all blockages.
- ❑ Inspect filter strip, swale and pond walls for erosion or caved in areas.
- ❑ Inspect riprap (rocks) at the inlets and outlets of culverts and other pipes. If they are silted in or eroded away, replace them.

Maintenance Checklists

The Maintenance Checklists in this packet are for your use when inspecting the stormwater facilities on your property. This packet has been customized so that only the checklists for your facilities are included. If you feel you are missing a checklist, or you have additional facilities not identified or addressed in this packet, please contact your local jurisdiction.

The checklists are in tabular format for ease of use. Each describes the area to inspect, inspection frequency, what to look for and what action to take. A log sheet is included toward the end of the chapter to help you track maintenance of your storm drainage system.

Although it is not intended for the maintenance survey to involve anything too difficult or strenuous, there are a few tools that will make the job easier and safer including:

- A flashlight
- A long pole or broom handle
- Some kind of pry bar or lifting tool for pulling manhole and grate covers
- Gloves

A resource list is included in the next chapter. There you will find the phone numbers of the agencies referenced in the tables, as well as the contractors and consultants who designed and constructed your facilities.

SAFETY WARNING: In keeping with OSHA regulations, you should never stick your head or any part of your body into a manhole or other type of confined space. When looking into a manhole or catch basin, stand above it and use the flashlight to help you see. Use a long pole or broom handle to check sediment depths in confined spaces. *NO PART OF YOUR BODY SHOULD BREAK THE PLANE OF* THE *OPEN HOLE.*

#1 – Maintenance Checklist for Infiltration Basins and Trenches:

Drainage System Feature	Defect or Problem	Condition When Maintenance Is Needed	Results Expected When Maintenance Is Performed	Maintenance Frequency	Completed
General	Trash and Debris	Any trash and debris which exceed five cubic feet per 1,000 square feet. If less than threshold, all trash and debris will be removed as part of next scheduled maintenance.	Trash and debris cleared from site.		
General	Poisonous Vegetation and Noxious Weeds	Any poisonous or nuisance vegetation which may constitute a hazard to maintenance personnel or the public. Any evidence of noxious weeds as defined in the Thurston County Noxious Weeds List. (Apply requirements of adopted integrated pest management policies for the use of herbicides.)	No danger of poisonous vegetation where maintenance personnel or the public might normally be. *(Coordinate with Tacoma-Pierce County Health Department) Complete eradication of noxious weeds may not be possible. Compliance with state or local eradication policies required.*		
General	Contaminants and Pollution	Any evidence of oil, gasoline, contaminants or other pollutants.	No contaminants or pollutants present. *(Coordinate removal/cleanup with Thurston County Water Resources 360-754-4681 and/or Dept. of Ecology Spill Response 800-424-8802.)*		
General	Rodent Holes	If the facility is constructed with a dam or berm, look for rodent holes or any evidence of water piping through the dam or berm.	Rodents removed and dam or berm repaired. *(Coordinate with Thurston County; coordinate with Ecology Dam Safety Office if pond exceeds 10 acre-feet.)*		
General	Beaver Dams	Beaver dam results in an adverse change in the functioning of the facility.	Facility returned to design function. *(Contact WDFW Region 6 to identify the appropriate Nuisance Wildlife Control Operator)*		
General	Insects	When insects such as wasps and hornets interfere with maintenance activities.	Insects destroyed or removed from site. *Apply insecticides in compliance with adopted integrated pest management policies.*		
General	Performance	Check crest gauge against design expectations (see Maintenance and Source Control Manual).	Crest gauge results reflect design performance expectations. Reading recorded. County notified if not meeting design performance.		

Drainage System Feature	Defect or Problem	Condition When Maintenance Is Needed	Results Expected When Maintenance Is Performed	Maintenance Frequency	Completed
Crest Gauge	Crest Gauge Missing/ Broken	Crest gauge is not functioning properly, has been vandalized, or is missing.	Crest gauge present and functioning. Repair/replace crest gauge if missing or broken.		
Storage Area	Water Not Infiltrating	Water ponding in infiltration basin after rainfall ceases and appropriate time allowed for infiltration. Treatment basins should infiltrate Water Quality Design Storm Volume within 48 hours, and empty within 24 hours after cessation of most rain events. (A percolation test pit or test of facility indicates facility is only working at 90 percent of its designed capabilities. If 2 inches or more sediment is present, remove).	Facility infiltrates as designed. Sediment is removed and/or facility is cleaned so that infiltration system works according to design.		
Filter Bags (if applicable)	Filled with Sediment and Debris	Sediment and debris fill bag more than one-half full.	Filter bag less than one-half full. Filter bag is replaced or system is redesigned.		
Rock Filters	Sediment and Debris	By visual inspection, little or no water flows through filter during heavy rain storms.	Water flows through filter. Replace gravel in rock filter if needed.		
Trenches	Observation Well (Use Surface of Trench if Well is Not Present)	Water ponds at surface during storm events. Less than 90 percent of design infiltration rate.	Remove and replace/clean rock and geomembrane.		
Ponds	Vegetation	Exceeds 18 inches.	Grass or groundcover mowed to a height no greater than 6 inches.		
Ponds	Vegetation	Bare spots.	No bare spots. Revegetate and stabilize immediately.		
Side Slopes of Pond	Erosion	Erosion damage over 2 inches deep where cause of damage is still present or where there is potential for continued erosion.	Slopes stabilized using appropriate erosion control measure(s); e.g., rock reinforcement, planting of grass, compaction. *If erosion is occurring on compacted slope, a professional engineer should be consulted to resolve source of erosion.*		

Drainage System Feature	Defect or Problem	Condition When Maintenance Is Needed	Results Expected When Maintenance Is Performed	Maintenance Frequency	Completed
Pond Berms (Dikes)	Settlements	Any part of berm which has settled 4 inches lower than the design elevation. If settlement is apparent, measure berm to determine amount of settlement. Settling can be an indication of more severe problems with the berm or outlet works.	Dike is built back to the design elevation. *If settlement is significant, a professional engineer should be consulted to determine the cause of the settlement.*		
Pond Berms (Dikes)	Piping	Discernable water flow through pond berm. Ongoing erosion with potential for erosion to continue.	No water flow through pond berm. Piping eliminated. Erosion potential eliminated. *Recommend a geotechnical engineer be called in to inspect and evaluate condition and recommend repair of condition.*		
General	Hazard Trees	If dead, diseased, or dying trees are identified.	Hazard trees removed. (*Use a certified Arborist to determine health of tree or removal requirements).*		
General	Tree Growth and Dense Vegetation	Tree growth and dense vegetation which impedes inspection, maintenance access or interferes with maintenance activity (i.e., slope mowing, silt removal, vactoring, or equipment movements).	Trees and vegetation do not hinder inspection or maintenance activities. Harvested trees should be recycled into mulch or other beneficial uses (e.g., alders for firewood).		
Pond Berms (Dikes)	Tree Growth	Tree growth on berms over 4 feet in height may lead to piping through the berm which could lead to failure of the berm.	Trees on berms removed. *If root system is small (base less than 4 inches) the root system may be left in place. Otherwise the roots should be removed and the berm restored. A professional engineer should be consulted for proper berm/spillway restoration.*		
Emergency Overflow/ Spillway	Tree Growth	Tree growth on emergency spillways creates blockage problems and may cause failure of the berm due to uncontrolled overtopping.	Trees on emergency spillways removed. *If root system is small (base less than 4 inches) the root system may be left in place. Otherwise the roots should be removed and the berm restored. A professional engineer should be consulted for proper berm/spillway restoration.*		

Drainage System Feature	Defect or Problem	Condition When Maintenance Is Needed	Results Expected When Maintenance Is Performed	Maintenance Frequency	Completed
Emergency Overflow/ Spillway	Rock Missing	Only one layer of rock exists above native soil in area five square feet or larger, or any exposure of native soil at the top of outflow path of spillway.	Rocks and pad depth restored to design standards. (Riprap on inside slopes need not be replaced.)		
Emergency Overflow/ Spillway	Erosion	Erosion damage over 2 inches deep where cause of damage is still present or where there is potential for continued erosion. Any erosion observed on a compacted berm embankment.	Slopes stabilized using appropriate erosion control measure(s); e.g., rock reinforcement, planting of grass, compaction. *If erosion is occurring on compacted berms a professional engineer should be consulted to resolve source of erosion.*		
Presettling Ponds and Vaults	Facility or sump filled with Sediment and/or Debris	6 inches or designed sediment trap depth of sediment.	No sediment present in presettling pond or vault. Sediment is removed.		
Drain Rock	Water Ponding	If water enters the facility from the surface, inspect to see if water is ponding at the surface during storm events. If buried drain rock, observe drawdown through observation port or cleanout.	No water ponding on surface during storm events. *Clear piping through facility when ponding occurs. Replace rock material/sand reservoirs as necessary. Tilling of subgrade below reservoir may be necessary (for trenches) prior to backfill.*		

If you are unsure whether a problem exists, contact a professional engineer.

#2 – Maintenance Checklist for Catch Basins:

Drainage System Feature	Defect or Problem	Condition When Maintenance Is Needed	Results Expected When Maintenance Is Performed	Maintenance Frequency	Completed
General	"Dump no pollutants" (or similar) stencil or stamp not visible	Stencil or stamp should be visible and easily read.	Warning signs (e.g., "Dump No Waste-Drains to Stream" or "Only rain down the drain"/ "Puget Sound starts here") painted or embossed on or adjacent to all storm drain inlets.		
General	Trash and Debris	Trash or debris which is located immediately in front of the catch basin opening or is blocking inlet capacity by more than 10 percent.	No trash or debris located immediately in front of catch basin or on grate opening.		
General	Trash and Debris	Trash or debris (in the basin) that exceeds 1/3 of the sump depth as measured from the bottom of basin to invert of the lowest pipe into or out of the basin, but in no case less than a minimum of 6 inches clearance from the debris surface to the invert of the lowest pipe.	No trash or debris in the catch basin.		
General	Trash and Debris	Trash or debris in any inlet or outlet pipe blocking more than one-third of its height.	Inlet and outlet pipes free of trash or debris.		
General	Trash and Debris	Dead animals or vegetation that could generate odors that could cause complaints or dangerous gases (e.g., methane).	No dead animals or vegetation present within the catch basin.		
General	Sediment	Sediment (in the basin) that exceeds 1/3 of the sump depth as measured from the bottom of basin to invert of the lowest pipe into or out of the basin, but in no case less than a minimum of 6 inches clearance from the sediment surface to the invert of the lowest pipe.	No sediment in the catch basin.		
General	Structure Damage to Frame and/or Top Slab	Top slab has holes larger than 2 square inches or cracks wider than one-fourth inch.	No holes and cracks in the top slab allowing material to run into the basin.		
General	Structure Damage to Frame and/or Top Slab	Frame not sitting flush on top slab, i.e., separation of more than three-fourth inch of the frame from the top slab. Frame not securely attached.	Frame is sitting flush on the riser rings or top slab and firmly attached.		

Drainage System Feature	Defect or Problem	Condition When Maintenance Is Needed	Results Expected When Maintenance Is Performed	Maintenance Frequency	Completed
General	Fractures or Cracks in Basin Walls/ Bottom	Maintenance person judges that structure is unsound.	Basin replaced or repaired to design standards.		
General	Fractures or Cracks in Basin Walls/ Bottom	Grout fillet has separated or cracked wider than one-half-inch and longer than 1 foot at the joint of any inlet/outlet pipe or any evidence of soil particles entering catch basin through cracks.	Pipe is regrouted and secure at basin wall.		
General	Settlement/ Misalignment	If failure of basin has created a safety, function, or design problem.	Basin replaced or repaired to design standards.		
General	Vegetation	Vegetation growing across and blocking more than 10 percent of the basin opening.	No vegetation blocking opening to basin.		
General	Vegetation	Vegetation growing in inlet/outlet pipe joints that is more than 6 inches tall and less than 6 inches apart.	No vegetation or root growth present.		
General	Contamination and Pollution	Any evidence of oil, gasoline, contaminants or other pollutants.	No contaminants or pollutants present. *(Coordinate removal/cleanup with Thurston County Water Resources 360-754-4681 and/or Dept. of Ecology Spill Response 800- 424-8802.)*		
Catch Basin Cover	Cover Not in Place	Cover is missing or only partially in place. Any open catch basin requires maintenance.	Catch basin cover is in place and secured.		
Catch Basin Cover	Locking Mechanism Not Working	Mechanism cannot be opened by one maintenance person with proper tools. Bolts into frame have less than one-half-inch of thread.	Mechanism opens with proper tools.		
Catch Basin Cover	Cover Difficult to Remove	One maintenance person cannot remove lid after applying normal lifting pressure. (Intent is keep cover from sealing off access to maintenance.)	Cover can be removed by one maintenance person.		
Ladder	Ladder Rungs Unsafe	Ladder is unsafe due to missing rungs, not securely attached to basin wall, misalignment, rust, cracks, or sharp edges.	Ladder meets design standards and allows maintenance person safe access.		

Drainage System Feature	Defect or Problem	Condition When Maintenance Is Needed	Results Expected When Maintenance Is Performed	Maintenance Frequency	Completed
Grates	Grate Opening Unsafe	Grate with opening wider than seven-eighths of an inch.	Grate opening meets design standards.		
Grates	Trash and Debris	Trash and debris that is blocking more than 20 percent of grate surface inletting capacity.	Grate free of trash and debris.		
Grates	Damaged or Missing	Grate missing or broken member(s) of the grate.	Grate is in place and meets design standards.		

If you are unsure whether a problem exists, contact a professional engineer

#3 – Maintenance Checklist for Wet Ponds:

Drainage System Feature	Defect or Problem	Condition When Maintenance Is Needed	Results Expected When Maintenance Is Performed	Maintenance Frequency	Completed
General	Water level	First cell is empty, does not hold water.	Water retained in first cell for most of the year. *Line the first cell to maintain at least 4 feet of water. Although the second cell may drain, the first cell must remain full to control turbulence of the incoming flow and reduce sediment resuspension.*		
	Trash and Debris	Accumulation that exceeds one cubic foot per 1,000 square feet of pond area.	No trash or debris on site. Any trash and debris removed from pond.		
	Inlet/Outlet Pipe	Inlet/Outlet pipe clogged with sediment and/or debris material.	No clogging or blockage in the inlet and outlet piping.		
	Sediment Accumulation in Pond Bottom	Sediment accumulations in pond bottom that exceeds the depth of sediment zone plus 6 inches, usually in the first cell.	Sediment removed from pond bottom. (*If sediment contamination is a potential problem, sediment should be tested regularly to determine leaching potential prior to disposal.)*		
	Oil Sheen on Water	Prevalent and visible oil sheen.	Oil removed from water using oil-absorbent pads or vactor truck. Source of oil located and corrected. *If chronic low levels of oil persist, plant wetland plants such as Juncus effusus (soft rush) which can uptake small concentrations of oil.*		
	Erosion	Erosion of the pond's side slopes and/or scouring of the pond bottom that exceeds 6 inches, or where continued erosion is prevalent.	Slopes stabilized using proper erosion control measures and repair methods.		
	Settlement of Pond Dike/Berm	Any part of these components that has settled 4 inches or lower than the design elevation, or inspector determines dike/berm is unsound.	Dike/berm is repaired to specifications.		
	Internal Berm	Berm dividing cells should be level.	Berm surface is leveled so that water flows evenly over entire length of berm.		
	Overflow Spillway	Rock is missing and soil is exposed at top of spillway or outside slope.	Rocks replaced to specifications.		

#4 – Maintenance Checklist for Fencing/Shrubbery Screen/Other Landscaping:

Drainage System Feature	Defect or Problem	Condition When Maintenance Is Needed	Results Expected When Maintenance Is Performed	Maintenance Frequency	Completed
General	Missing or Broken Parts/Dead Shrubbery	Any defect in the fence or screen that permits easy entry to a facility.	Fence is mended or shrubs replaced to form a solid barrier to entry.		
General	Erosion	Erosion has resulted in an opening under a fence that allows entry by people or pets.	Soil under fence replaced so that no opening exceeds 4 inches in height.		
General	Unruly Vegetation	Shrubbery is growing out of control or is infested with weeds. See also Thurston County Noxious weeds list.	Shrubbery is trimmed and weeded to provide appealing aesthetics. Do not use chemicals to control weeds.		
Fences	Damaged Parts	Posts out of plumb more than 6 inches.	Posts plumb to within 1.5 inches of plumb.		
Fences	Damaged Parts	Top rails bent more than 6 inches.	Top rail free of bends greater than 1 inch.		
Fences	Damaged Parts	Any part of fence (including posts, top rails, and fabric) more than 1 foot out of design alignment.	Fence is aligned and meets design standards.		
Fences	Damaged Parts	Missing or loose tension wire.	Tension wire in place and holding fabric.		
Fences	Damaged Parts	Missing or loose barbed wire that is sagging more than 2.5 inches between posts.	Barbed wire in place with less than three-fourth inch sag between posts.		
Fences	Damaged Parts	Extension arm missing, broken, or bent out of shape more than 1.5 inches.	Extension arm in place with no bends larger than three-fourth inch.		
Fences	Deteriorated Paint or Protective Coating	Part or parts that have a rusting or scaling condition that has affected structural adequacy.	Structurally adequate posts or parts with a uniform protective coating.		
Fences	Openings in Fabric	Openings in fabric are such that an 8-inch diameter ball could fit through.	No openings in fabric.		

#5 – Maintenance Checklist for Grounds (Landscaping):

Drainage System Feature	Defect or Problem	Condition When Maintenance Is Needed	Results Expected When Maintenance Is Performed	Maintenance Frequency	Completed
General	Weeds (nonpoisonous)	Weeds growing in more than 20 percent of the landscaped area (trees and shrubs only). See also Thurston County Noxious weeds list.	Weeds present in less than five percent of the landscaped area.		
General	Insect Hazard	Any presence of poison ivy or other poisonous vegetation or insect nests.	No poisonous vegetation or insect nests present in landscaped area.		
General	Trash or Litter	See Detention Ponds (Checklist #1).	See Detention Ponds (Checklist #1).		
General	Erosion of Ground Surface	Noticeable rills are seen in landscaped areas.	Causes of erosion are identified and steps taken to slow down/spread out the water. Eroded areas are filled, contoured, and seeded.		
Trees and shrubs	Damage	Limbs or parts of trees or shrubs that are split or broken which affect more than 25 percent of the total foliage of the tree or shrub.	Trim trees/shrubs to restore shape. Replace trees/shrubs with severe damage.		
Trees and shrubs	Damage	Trees or shrubs that have been blown down or knocked over.	Tree replanted, inspected for injury to stem or roots. Replace if severely damaged.		
Trees and shrubs	Damage	Trees or shrubs which are not adequately supported or are leaning over, causing exposure of the roots.	Stakes and rubber-coated ties placed around young trees/shrubs for support.		

#6 – Maintenance Checklist for Conveyance Systems (Pipes and Ditches):

Drainage System Feature	Defect or Problem	Condition When Maintenance Is Needed	Results Expected When Maintenance Is Performed	Maintenance Frequency	Completed
Pipes	Sediment & Debris	Accumulated sediment that exceeds 20 percent of the diameter of the pipe.	Pipe cleaned of all sediment and debris.		
Pipes	Vegetation	Vegetation that reduces free movement of water though pipes.	Vegetation does not impeded free movement of water through pipes. *Prohibit use of sand and sealant application and protect from construction runoff.*		
Pipes	Damaged (Rusted, Bent or Crushed)	Protective coating is damaged: rust is causing more than 50 percent deterioration to any part of pipe.	Pipe repaired or replaced.		
Pipes	Damaged (Rusted, Bent or Crushed)	Any dent that significantly impedes flow (i.e. decreases the cross section area of pipe by more than 20 percent).	Pipe repaired or replaced.		
Pipes	Damaged (Rusted, Bent or Crushed)	Pipe has major cracks or tears allowing groundwater leakage.	Pipe repaired or replaced.		
Open Ditches	Trash & Debris	Dumping of yard wastes such as grass clippings and branches. Unsightly accumulation of non-degradable materials such as glass, plastic, metal, foam, and coated paper.	No trash or debris present. Trash and debris removed and disposed of as prescribed by the County.		
Open Ditches	Sediment Buildup	Accumulated sediment that exceeds 20 percent of the design depth.	Ditch cleaned of all sediment and debris so that it matches design.		
Open Ditches	Vegetation	Vegetation (e.g. weedy shrubs or saplings) that reduces free movements of water through ditches.	Water flows freely though ditches. Grassy vegetation should be left alone.		
Open Ditches	Erosion Damage to Slopes	Erosion damage over 2 inches deep where cause of damage is still present or where there is potential for continued erosion.	No erosion damage present. Slopes stabilized using appropriate erosion control measure(s); e.g., rock reinforcement, planting of grass, compaction.		
Open Ditches	Erosion Damage to Slopes	Any erosion observed on a compacted berm embankment.	*If erosion is occurring on compacted berms a professional engineer should be consulted to resolve source of erosion.*		

Drainage System Feature	Defect or Problem	Condition When Maintenance Is Needed	Results Expected When Maintenance Is Performed	Maintenance Frequency	Completed
Open Ditches	Rock Lining Out of Place or Missing (If Applicable)	Native soil is exposed beneath the rock lining.	Rocks replaced to design standards.		

Resource Listing

If you suspect a problem exists, please contact your local jurisdiction at one of the numbers below and ask for Technical Assistance.

CONTACT NUMBERS

City of Olympia Public Works	(360) 753-8333
Thurston County (Storm & Surface Water)	(360) 754-4681
WSU Cooperative Extension	(360) 786-5445

DEVELOPER INFORMATION

Summit Land Development, LLC
1868 State Ave NE
Olympia, WA 98506
(360) 754-7010

ENGINEER'S INFORMATION

HATTON GODAT PANTIER
3910 Martin Way E., Suite B
Olympia, WA 98506
(360) 943-1599

Log Sheet

Use log sheets to track maintenance checks and what items, if any, are repaired or altered. Make copies of this page; use a fresh copy for each inspection. The completed sheets will serve as a record of maintenance activity and will provide valuable information about how your facilities are operating. Log sheets should be kept in a dry, readily accessible place.

INSPECTION DATE: _____

PERFORMED BY: _____

PHONE NUMBER: _____ ADDRESS: _____

POSITION ON HOA: _____ CITY, ST, ZIP: _____

PART OF FACILITY INSPECTED	OBSERVATIONS (LIST REQUIRED MAINTENANCE ACTIVITIES)	ACTION TAKEN	DATE OF ACTION

Attachment "B"
Pollution Source Control Program

III. POLLUTION SOURCE CONTROL PROGRAM

Purpose

Many products and practices commonly used in and around the home are hazardous to both the environment and us. Many of these products can end up in our stormwater systems and groundwater. This document gives alternatives, where possible, for those types of products and practices. The Best Management Practices (BMPs) described here include "good housekeeping" practices that everyone can use.

Recommended Pollution Control Practices For Homeowners

It has been said that the average home today contains more chemicals than the average chemical lab of 100 years ago. When many of these chemicals are used industrially, they can be subject to various health and safety standards; yet these same substances are used freely and often carelessly in our homes.

The BMPs in this section are divided into four categories: **Household Hazardous Wastes**, **Pesticides** and **Remodeling.** Each section includes information on available alternatives.

Household Hazardous Wastes

Many of the cleaning agents, solvents, polishes, etc. commonly used in the home are considered hazardous. These products may be toxic, corrosive, reactive, flammable and/or carcinogenic. It is critical that these products are handled with care and are disposed of properly. A list of common household hazardous materials is presented in Table 1.

In addition, many hazardous household chemicals persist for long periods of time in the environment. Manufacturers may truthfully state that a product is "biodegradable"; most products are biodegradable, but what is important is the rate at which they are broken down and the products into which they are broken down. The term "biodegradable" on its own is misleading at best, unless the product is rapidly degraded into harmless substances.

It is important to note here that the term "biodegradable" currently has no legal definition in this state. This means that any product can use this term according to the manufacturer's own definition. This definition may not be at all similar to the consumer's perception. The following ideas will help you reduce the risks of stormwater and groundwater contamination from many household products.

Household Product Management

1. Read product labels before purchasing. Toxic product labels will carry many warnings. Either bypass such products or purchase in small quantities. If you cannot use the entire product, try to give it away instead of disposing of it. Thurston County periodically facilitates product exchanges for leftover paints and other hazardous wastes. Call the Thurston County Health Department at (360) 754-4111 for more information.

2. Buy only those detergents that contain little or no phosphorus. Phosphorus can cause algae blooms if washed into lakes or streams. Most detergents that are low in phosphates or phosphate free are labeled as such.

3. Use no more than the manufacturer's suggested amount of any cleanser. More is not necessarily better.

4. Products such as oven cleanser, floor wax, furniture polish, drain cleaners and spot removers often contain toxic chemicals. Buy the least toxic product available or use a non-toxic substitute if one can be found. For example, ovens can be cleaned by applying table salt to spills then scrubbing with a solution of baking soda and water. Table 2 lists substitutes for many commonly used household products.

   If it is necessary to use a product that contains toxic chemicals, use the product only as directed. Do not combine products, as they may become more dangerous when mixed (e.g., mixing chlorine bleach and ammonia produces dangerous gases). Use eye protection and rubber gloves as appropriate.

   Contact the Hazardous Substance Hotline at 1-800-633-7585 if you have any questions regarding disposal of a product or empty container. The County has both hazardous waste collection days and permanent facilities where residents can bring hazardous wastes. Call the Thurston County Health Department at (360) 754-4111 for more information.

5. Chemicals left over from activities such as photography and auto repair are hazardous and should not be flushed down the sink. This is especially important if your home is hooked up to a septic system. Toxic chemicals can kill the beneficial bacteria in the tank used to treat sewage and can pollute water supply wells.

6. Be sure all containers are clearly labeled.

7. Common batteries (not automobile) are one of the largest sources of heavy metals (such as lead, nickel, cadmium and mercury) found in landfills. Instead of throwing them away, dispose of them at a hazardous waste collection site.

Automotive Usage, Care and Maintenance

From a waste management standpoint, automobile maintenance is best done by professionals at facilities designed to handle, store and dispose of the waste products properly. Many of these facilities do an excellent job of dealing with waste oils, antifreezes, other fluids, batteries and tires. They often charge a small fee to cover the added expenses, but it's worth it. However, if you repair your car at home, please consider these helpful tips

1. Cars should be serviced regularly. Leaky lines or valves should be replaced.

2. Dumping oil, degreasers, antifreeze and other automotive liquids into a stream or a storm drain violates city, county and state laws or ordinances. Do not dump them onto the ground because they will end up in stormwater runoff or in groundwater. Do not use oil to reduce dust levels on unpaved areas. Instead, recycle used oil and antifreeze. Keep them in separate containers. Call the Recycling Hotline at 1-800-RECYCLE or call the Thurston County Health Department for the location of the nearest recycling center, or inquire

whether your local automotive service center recycles oil. Some may also take used oil filters.

3. Wrap empty oil or antifreeze containers in several layers of newspaper, tie securely and place in a covered trashcan. Antifreeze is sweet tasting but poisonous to people, fish, pets and wildlife.

4. Sweep your driveway instead of hosing it down. Fluids and heavy metals associated with automobiles can build up on driveway surfaces and be washed into local surface or groundwater when driveways are hosed down.

5. When washing vehicles, do so over your lawn or where you can direct soapsuds onto the lawn or another vegetated area to keep the soap from washing into the storm drain system or local surface water. Your stormwater pond cannot cleanse soapy water.

6. Small spills of oil and other fluids can be absorbed with materials such as kitty litter or sawdust. Wrap the used absorbent and any contaminated soil in a plastic bag and place in the garbage.

   If a spill reaches surface water, you must notify the nearest regional office of the Department of Ecology immediately! The Southwest Regional Office phone number is (360) 407-6300, or call 911. There are fines for failure to notify the appropriate agency when a spill occurs.

7. De-icing chemicals (various types of salt) can harm concrete less than three years of age, burn vegetation and be corrosive to cars and other metal objects. De-icing chemicals and their additives can be toxic. (Cyanide is formed from the breakdown of a common anti-caking agent used in de-icing chemicals.)

   Urea salts are an alternative to other types of salt de-icers, but great care must be used in applying them. These salts contain large quantities of nitrogen, which can severely burn plants and encourage algae growth if over-applied.

   The use of these chemicals should be minimized or avoided. Instead, shovel walks clear and apply a dusting of sand to improve footing.

Table 1 Hazardous Household Substances List

Auto, Boat and Equipment Maintenance	Repair and Remodeling	Cleansing Agents
Batteries	Adhesives, glues, cements	Oven cleaners
Waxes and cleansers	Roof coatings, sealants	Degreasers and spot removers
Paints, solvents and thinners	Caulking and sealants	Toilet, drain and septic tank cleaners
Additives	Epoxy resins	Polishes, waxes and strippers
Gasoline	Solvent-based paints	Deck, patio and chimney cleaners
Flushes	Solvents and thinners	Solvent cleaning fluids
Auto repair materials	Paint removers and strippers	
Motor oil		
Diesel oil		
Antifreeze		
Pesticides	**Hobby and Recreation**	**Miscellaneous**
Insecticides	Paints, thinners and solvents	Ammunition
Fungicides	Chemicals (photo and pool)	Asbestos
Rodenticides	Glues and cements	Fireworks
Molluscicides	Inks and dyes	
Wood preservatives	Glazes	
Moss retardants	Chemistry sets	
Herbicides	Bottled gas	
Fertilizers	White gas	
	Charcoal starter fluid	

Source: Guidelines for Local Hazardous Waste Planning, Ecology, No. 87-18 1987.

Table 2. Non- or Less Toxic Alternatives to Toxic Products

Hazardous Product	Alternative(s)
Air fresheners	Set out a dish of vinegar; simmer cinnamon or cloves in water; set out herbal bouquets or potpourri in open dishes; burn scented candles.
Bleach	Borax or oxygen bleaches or reduce bleach by ½ and add ¼ - ½ C baking soda; line dry clothes.
Brass polish	Worcestershire sauce
Chrome polish	Apple cider vinegar; a paste of baking soda and water; a lemon
Coffee pot cleaner	Vinegar; remove coffee stains with moist salt paste.
Copper cleaner	Mixture of lemon juice and salt or tomato catsup.
Drain cleaner	Use a plunger followed by ½ C baking soda mixed with ½ C vinegar. Let sit 15 minutes; pour into drain followed by 2 qt. boiling water.
Furniture polish	Linseed, olive or almond oils; a mixture of 3 parts olive oil to 1 part white vinegar; a mixture of 1 T lemon oil and 1 pint mineral oil
Garbage disposal deodorizer	Lemon rind or baking soda.
Glass cleaner	Mixture of 2 T vinegar and 1 quart water
Grease remover	Paste of borax and water on damp cloth
Ink stain remover	Spray with non-aerosol hairspray before washing.
Laundry soap	Borax; baking soda; washing soda
Linoleum floor cleaner	Mixture of 1 C white vinegar and 2 gallons water
Mildew remover	Equal parts vinegar and salt
Mothballs	Cedar chips or blocks; dried tansy, lavender or peppercorns
Oil spills	Kitty litter; sawdust
Oil stain remover	White chalk rubbed into stain prior to washing
Oven cleaner	Cover fresh spills with salt; scrape off after the oven cools. A soda water solution will cut grease. Paint ammonia on spills with a paintbrush, then rinse off.
Paint brush softener	Hot vinegar
Paint stripper	Use mechanical sanding instead of chemical strippers.
Paint or grease remover	Wear gloves or try baby oil
Pet odor remover	Cider vinegar
Pitch or sap remover	Butter, margarine or vegetable shortening.
Porcelain stain remover	Baking soda
Refrigerator deodorizer	Open box of baking soda
Rug/carpet cleaner	(General) Use a soap-based non-aerosol rug shampoo; vacuum when dry. (Spots) Pour club soda or sprinkle cornmeal or cornstarch on the rug; let sit for at least 30 minutes; vacuum.
Rust remover	Lemon juice and sunlight
Rusty bolt remover	Carbonated beverage
Scorch mark remover	Grated onion
Scouring powder	Baking soda or non-chlorine scouring powder.
Silver polish	Soak silver in warm water with 1 T soda, 1 T salt and a piece of aluminum foil.
Stainless steel polish	Mineral oil
Toilet bowl cleaner	Paste mixture of borax and lemon juice
Tub and tile cleaner	¼ C soda and ½ C white vinegar mixed with warm water
Upholstery spot remover	Club soda
Water mark remover	Toothpaste

Pesticides[1] and Fertilizers

Pesticides and fertilizers are commonly used by homeowners in their quest for bigger, healthier plants and greener, lusher lawns. These chemicals are often overused and misapplied. These chemicals are easily introduced into stormwater runoff and can cause algae blooms (fertilizers) or kill off aquatic organisms (pesticides).

Fertilizer Management

Fertilizing a lawn can be done in an environmentally sensitive manner. Here are some ideas.

1. Before fertilizing, test your soil's pH by using a readily available kit or through tests provided by WSU Cooperative Extension. Use only the recommended amount of fertilizer and any soil amendments, such as lime, that are recommended in your test results.
2. Use fertilizers that are appropriate for your area and for the types of plants you are growing. Work the fertilizer into the soil directly around the plant's drip line. By incorporating the fertilizer in the soil, there will be less likelihood of contaminated runoff. Contact the Thurston Conservation District for more information.
3. Water before fertilizing. Water enough to dampen the ground thoroughly but not enough to cause surface runoff. Dampening the soil prevents fertilizer from being washed from the surface of dry soil in the first rain or watering after application.
4. Many soils can benefit from the use of organic fertilizers such as compost or peat. Not only do these substances add nutrients to soil; they also increase the porosity of the soil and increase its ability to hold water.
5. Slow release fertilizers (which are generally resin-coated) can be used in addition to organic fertilizers. They are not mobile in the soil and are applied only once.

Integrated Pest Management

Rather than bringing out the sprayer whenever a pest infestation occurs in the garden, consider using Integrated Pest Management (also known as IPM). IPM emphasizes the evaluation of all factors including environmental effects before chemicals are applied. Pesticides should only be used as a last resort. Some of the tactics that can be used to decrease or eliminate the use of pesticides include:

1. Use of Natural Predators or Pathogens: Because chemical sprays generally kill many beneficial insects instead of just the target pest, it may be necessary to introduce natural predators back into the garden. Ladybugs, lacewings, predatory wasps and nematodes are all commercially available. Garter snakes and toads are also predators and should not be eliminated from the garden.

   There are some bacteria, viruses and insect parasites that are specific to pests and will not harm other insects or animals. A commonly used bacterium in the Puget Sound area is *Bacillus thuringiensis* (Bt), which is intended to control infestations of tent caterpillars. Products containing Bt are available at your nursery.

[1] As used here, the word pesticide can mean any herbicide, insecticide, rodenticide, miticide or other chemicals used in a similar manner.

2. Habitat Changes: Many times a change of habitat can control pest infestations. Removal of old tires can cut down on the mosquito population by removing a convenient water-filled location for them to breed in. Crop rotation, even in a small garden, can reduce the number of pest infestations. Removing last year's leaves from under rose bushes can cut down on the incidence of mildew and blackspot, as these fungi overwinter in dead leaves.
3. Timing: Crops that can overwinter (such as leeks or carrots) should be planted in the fall. This gives them time to become established before pests arrive in the spring.
4. Mechanical: Many eggs, larvae, cocoons and adult insects can be removed by hand. Be sure that the insect is properly identified prior to removing it so those beneficial insects are not destroyed in error. Drowning insects in plain water or spraying them with soapy water are alternatives to squashing them.
5. Resistant Plants: Plants that are native to this area are often more resistant to pests and tolerant of the climate than are introduced plants. Many plant cultivars have been developed which are resistant to such diseases as verticilium wilt and peach leaf curl. Grass seed mixes are also available for lawns that need much less watering, mowing and chemical use.
6. Growing Conditions: Plants, such as hostas, that require some shade are more susceptible to pests when they are growing in the sun. Improperly fertilized or watered plants are less vigorous in growth and tend to attract pests. Plants that prefer an acid soil, such as azaleas, will perform better and be less susceptible to pests when they are grown in soil with the proper pH.
7. Chemicals: Chemicals are a small part of the IPM plan and should be applied only as needed after reviewing all other alternatives.

Pesticide Management

When use of a chemical is the best or only option, follow these simple guidelines:

1. Know your target pest before spraying. Use the pesticide according to the manufacturer's instructions, and buy only the needed quantity. Many pesticides have a limited shelf life and may be useless or degrade into even more toxic compounds if stored for extended periods of time.
2. Do not apply more than the specified amount. Overuse can be dangerous to your health as well as the health of wildlife and the environment. If more than one chemical can be used to control the pest, choose the least toxic. The word "caution" on the label means that the chemical is less toxic than one that is labeled "warning".
3. Do not spray on windy days, in the morning of what will be a very hot day or when rain is likely. Herbicides can drift and injure valuable ornamental plants. Do not water heavily after application. Plants should be lightly watered before application to prevent burning of the foliage and to help evenly spread the chemical.
4. Never apply pesticides near streams, ponds or wetlands (exception: approved applications for aquatic weeds). Do not apply pesticides to bare eroded ground (exception: use of low toxicity herbicides such as Round-Up to allow growth of desired planting in small areas).

Many pesticides bind to soil particles and can be easily carried into a stream or storm drain.

5. Pesticides should be stored well away from living areas. Ideally, the storage area should have a cement floor and be insulated from temperature extremes. Always keep pesticides in their original containers with labels in tact. Labels often corrode and become illegible in this climate and may have to be taped onto the container.
6. Federal law now requires that all pesticides be labeled with the appropriate disposal method. Leftovers should never be dumped anywhere, including a landfill. Take unwanted pesticides to the County's hazardous waste collection days or Hazo House at the landfill.
7. Empty containers should be triple-rinsed and the rinse water used as spray. Once containers are triple-rinsed, they are not considered hazardous waste and may be disposed of in most landfills. However, call your local landfill before putting the container in the garbage.
8. If a pesticide is spilled onto pavement, it can be absorbed using kitty litter or sawdust. The contaminated absorbent should be bagged, labeled and taken to Hazo House.
9. If the pesticide is spilled onto dirt, dig up the dirt, place it in a plastic bag and take it to Hazo House.
10. Many pest control companies and licensed applicators have access to pesticides that are more toxic than those available to the consumer. Check with the company before they spray indoors or outdoors to find out what spray they will be using and what precautions, if any, are necessary after the operator leaves.

Home Remodeling

Remodeling uses some of the most toxic substances found in the home. Paints, preservatives, strippers, brush cleaners and solvents all contain a wide range of chemicals, some of which are suspected to be carcinogenic (cancer causing). These products should never be dumped in a landfill or put down a sewer or septic system.

1. When building a deck consider using wood or wood alternatives such as recycled wood/plastic decking instead of concrete. Wood decking allows rainwater to drip onto the ground below, keeping it from becoming surface runoff
2. Decks and sidewalks can also be built out of brick interlocking pavers or modular concrete. If these surfaces are placed on a bed of well-drained soil gravel or sand, rainwater can infiltrate into the ground around them.
3. To reduce disposal problems, buy only the needed amount. Used turpentine or brush cleaner can be filtered and reused. Paint cans should be allowed to dry and then be disposed of during a hazardous waste collection day or at Hazo House.
4. Leftover paint can be given away, for example to a theater group. Contact the Thurston County Health Department at (360) 754-4111 for other options.

5. Roof downspouts can be adjusted to infiltrate runoff to a well drained area. The runoff from them can enter a gravel bed where it can infiltrate into the ground. For design criteria, see your jurisdiction's drainage manual.
6. When gardening on slopes, reduce the potential for surface runoff by using terraces across the face of the hill. These can be as simple as little soil "bumps" or more elaborate using timbers, masonry or rock walls.

References

Puget Sound Water Quality Authority, Managing Nonpoint Pollution - An Action Plan for Puget Sound Watersheds, 88-31, June 1989.

Washington State Dept. of Ecology, Water Quality Guide - Recommended Pollution Control Practices for Homeowners and Small Farm Operators 87-30, revised June 1991.

Washington State Dept. of Ecology, Hazardous Waste Pesticides, 89-41, August 1989.

IV. GLOSSARY

BEST MANAGEMENT PRACTICE (BMP) - Structures, conservation practices or regulations that improve quality of runoff or reduce the impact of development on the quantity of runoff.

BIOFILTER (SWALE) - A wider and flatter vegetated version of a ditch over which runoff flows at uniform depth and velocity. Biofilters perform best when vegetation has a thick mat of roots, leaves and stems at the soil interface (such as grass).

BIOFILTRATION - The process through which pollutant concentrations in runoff are reduced by filtering runoff through vegetation.

BUFFER - The zone that protects aquatic resources by providing protection of slope stability, attenuation of runoff and reduction of landslide hazards. An integral part of a stream or wetland ecosystem, it provides shading, input of organic debris and coarse sediments to streams. It also allows room for variation in stream or wetland boundaries, habitat for wildlife and protection from harmful intrusion.

CATCH BASIN - An inlet for stormwater set into the ground, usually rectangular, made of concrete and capped with a grate that allows stormwater to enter.

CHECK DAM - A dam (e.g., rock, earthen, log) used in channels to reduce water velocities, promote sediment deposition and/or enhance infiltration.

COMPOST STORMWATER FILTER - A treatment facility that removes sediment and pollutants from stormwater by percolating water through a layer of specially prepared big leaf maple compost.

CONSTRUCTED WETLAND - A wet pond with dead storage at varied depths and planted with wetland plants to enhance its treatment capabilities.

CONTROL STRUCTURE (FLOW RESTRICTOR) - A manhole and/or pipe structure with a flow-regulating or metering device such as a weir or plates with small holes known as orifices. This structure controls the rate at which water leaves the pond.

CONVEYANCE - A mechanism or device for transporting water including pipes, channels (natural and man-made), culverts, gutters, manholes, etc.

CRITICAL AREA – Areas, such as wetlands, streams and steep slopes, defined by ordinance or resolution of the jurisdiction. Also known as "environmentally sensitive areas."

CULVERT - A conveyance device (e.g., concrete box, pipe) that conveys water from a ditch, swale or stream under (usually across) a roadway or embankment.

DEAD STORAGE - The volume of storage in a pond below the outlet that does not drain after a storm event. This storage area provides treatment of the stormwater by allowing sediments to settle out.

DETENTION FACILITY - A facility (e.g., pond, vault, pipe) in which surface and stormwater is temporarily stored.

DETENTION POND - A detention facility in the form of an open pond.

DISPERSION TRENCH - An open-top trench filled with riprap or gravel that takes the discharge from a pond, spreads it out and spills (bubbles) the flow out along its entire length. Dispersion trenches are used to simulate "sheet flow" of stormwater from an area and are often used to protect sensitive adjacent areas, such as wetlands.

DRAINAGE SYSTEM - The combination of Best Management Practices (BMPs), conveyances, treatment, retention, detention and outfall features or structures on a project.

DROP STRUCTURE - A structure for dropping water to a lower elevation and/or dissipating energy. A drop may be vertical or inclined.

DRY POND - A detention facility that drains completely after a storm. This type of pond has a pipe outlet at the bottom.

EASEMENT - A right afforded a person to make limited use of another's real property. Typical easements are for pipes or access to ponds; they may be 15 to 20 feet wide.

EMERGENCY OVERFLOW OR SPILLWAY - An area on the top edge of the pond that is slightly lower in elevation than areas around it. This area is normally lined with riprap. The emergency overflow is used only if the primary and secondary outlets of the pond fail, in the event of extreme storms or if the infiltration capability of the pond becomes significantly diminished. If the emergency overflow ever comes into play, it may indicate the pond needs to be upgraded.

ENERGY DISSIPATER - A rock pad at an outlet designed to slow the water's velocity, spread out the water leaving the pipe or channel and reduce the potential for erosion.

FREEBOARD - The vertical distance between the design high water mark and the elevation of the top of the pond. Most ponds have one to two feet of freeboard to prevent them from overflowing.

INFILTRATION - The soaking of water through the soil surface into the ground (percolation). (Many ponds are designed to fully infiltrate stormwater and thus do not have a regularly used discharge pipe.)

INFILTRATION FACILITY (or STRUCTURE) - A facility (pond or trench) that retains and percolates stormwater into the ground, having no discharge (to any surface water) under normal operating conditions.

JUNCTION - Point where two or more drainage pipes or channels converge (e.g., a manhole).

JURISDICTION - Olympia, Lacey, Tumwater or Thurston County (as applicable).

LINED POND or CONVEYANCE - A facility, the bottom and sides of which have been made impervious (using, for example, a plastic liner or clay/silt soil layer) to the transmission of liquids.

LIVE STORAGE - The volume of storage in a pond above the outlet that drains after a storm event. This storage area provides flood control and habitat protection for nearby streams.

MANHOLE - A larger version of a catch basin, often round, with a solid lid. Manholes allow access to underground stormwater pipes for maintenance.

NATURAL CHANNEL - Stream, creek, river, lake, wetland, estuary, gully, swale, ravine or any open conduit where water will concentrate and flow intermittently or continuously.

OIL-WATER SEPARATOR - A structure or device used to remove oil and greasy solids from water. They operate by using gravity separation of liquids that have different densities. Many catch basins have a downturned elbow that provides some oil-water separation.

OUTFALL - The point where water flows from a man-made conduit, channel or drain into a water body or other natural drainage feature.

RETENTION FACILITY - An infiltration facility.

RETENTION POND - A retention facility that is an open pond.

REVETMENTS - Materials such as rock or keystones used to sustain an embankment, such as in a retaining wall.

RIPRAP - Broken rock, cobbles or boulders placed on earth surfaces, such as on top of a berm for the emergency overflow, along steep slopes or at the outlet of a pipe, for protection against the action of water. Also used for entrances to construction sites.

RUNOFF - Stormwater.

SAND FILTER - A treatment facility that removes sediment and pollutants from stormwater by percolating water through a layer of sand.

STORMWATER - That portion of precipitation that falls on property and that does not naturally percolate into the ground or evaporate but flows via overland flow, channels or pipes into a defined surface water channel or a constructed infiltration facility. Stormwater includes washdown water and other wastewater that enters the drainage system.

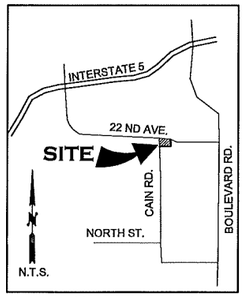
SWALE - A shallow drainage conveyance with relatively gentle side slopes, generally with flow depths less than one foot. This term is used interchangeably with "BIOFILTER".

TRASH RACK or BAR SCREEN - A device (usually a screen or bars) that fits over a pipe opening to prevent large debris such as rocks or branches from entering and partially blocking the pipe.

WET POND - A stormwater treatment pond designed with a dead storage area to maintain a continuous or seasonal static water level below the pond outlet elevation.

VILLAGE AT CAIN ROAD

2017 22ND AVENUE SE, OLYMPIA, WA 98501



VICINITY MAP

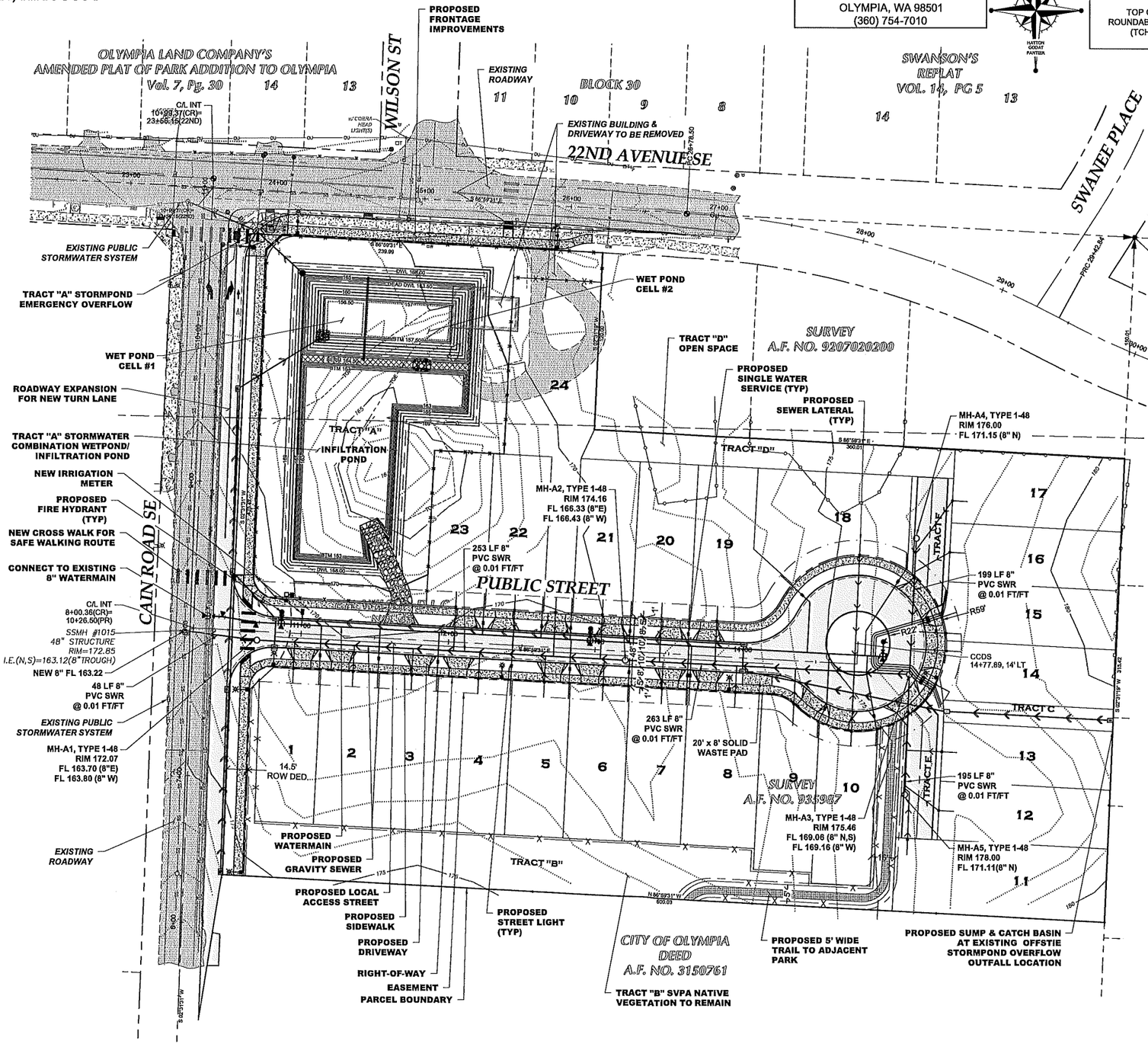
LEGEND

- EX. FIRE HYDRANT
- EX. WATER VALVE COVER
- EX. WATER METER
- EX. SANITARY SEWER MANHOLE
- EX. STORM DRAIN MANHOLE
- EX. CATCH BASIN
- EX. POWER POLE
- EX. POLE ANCHOR
- EX. GUY POLE
- EX. TELEPHONE PEDESTAL
- EX. JUNCTION BOX
- EX. STREET LIGHT
- EX. POWER VAULT
- EX. DECIDUOUS TREE
- EX. SIGN
- EX. MAILBOX
- EX. CHAINLINK FENCE
- EX. WOOD FENCE
- PAINTED LOCATE (YELLOW) APWA UNIFORM COLOR CODE FOR GASEOUS MATERIALS
- PAINTED LOCATE (BLUE) APWA UNIFORM COLOR CODE FOR POTABLE WATER
- PAINTED LOCATE (ORANGE) APWA UNIFORM COLOR CODE FOR COMMUNICATIONS
- EX. STORM DRAINAGE LINE
- EX. SANITARY SEWER LINE
- EX. OVERHEAD UTILITIES (POWER, COMMUNICATIONS)
- EX. BUILDING FOOTPRINT
- EX. CONCRETE
- EX. ASPHALT
- NEW ASPHALT
- 100 EX. MAJOR CONTOUR
- 103 EX. MINOR CONTOUR
- NEW WATERMETER
- NEW HYDRANT
- NEW VALVE
- NEW BLIND FLANGE
- NEW BLOCKING
- NEW BLOWOFF ASSEMBLY
- NEW WATERMAIN
- NEW CATCHBASIN TYPE 1
- NEW STORM MAIN LINE
- NEW SEWER CLEANOUT
- NEW SEWER MANHOLE
- NEW GRAVITY SEWER LINE
- NEW HIGH MAST STREET LIGHT
- NEW LIGHTING J BOX
- NEW TRANSFROMER & SERVICE DISCONNECT
- 100 FINISH MAJOR CONTOUR
- 103 FINISH MINOR CONTOUR

THIS DRAWING DOES NOT REPRESENT A RECORD DOCUMENT, UNLESS CERTIFIED BY HATTON GODAT PANTIER.

ANY ALTERATIONS TO THE DESIGN SHOWN HEREON MUST BE REVIEWED AND APPROVED BY HATTON GODAT PANTIER.

NOTE: THE CONTRACTOR SHALL BE FULLY RESPONSIBLE FOR THE LOCATION AND PROTECTION OF ALL EXISTING UTILITIES. THE CONTRACTOR SHALL VERIFY ALL UTILITY LOCATIONS PRIOR TO CONSTRUCTION BY CALLING THE UNDERGROUND LOCATE LINE AT 811 A MINIMUM OF 48 HOURS PRIOR TO ANY EXCAVATION.



PREPARED FOR

SUMMIT LAND DEVELOPMENT, LLC
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OLYMPIA, WA 98501
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HATTON GODAT PANTIER

CITY OF OLYMPIA

VERTICAL DATUM - NAVD88	MERIDIAN HORIZONTAL DATUM
CITY OF OLYMPIA 2" BRASS CAP (LS-46310) TOP OF CONC CURB SE SIDE OF ROUNDABOUT OF BOULEVARD RD & 22nd (TCHP CONTROL POINT #6153) ELEVATION = 205.29	CITY OF OLYMPIA COORDINATE SYSTEM BASED ON THE NORTH LINE OF WILSON D.L.C. NO. 45

40 20 0 40 80
SCALE: 1" = 40'

SHEET INDEX

1. PRELIMINARY SITE PLAN
2. PRELIMINARY CONSTRUCTION NOTES
3. PRELIMINARY EROSION CONTROL PLAN & DEMOLITION PLAN
4. PRELIMINARY EROSION CONTROL NOTES & DETAILS
5. PRELIMINARY GRADING & DRAINAGE PLAN
6. PRELIMINARY FRONTAGE IMPROVEMENTS
7. PRELIMINARY STREET DETAILS
8. PRELIMINARY UTILITY PLAN
9. PRELIMINARY WATER DETAILS
10. PRELIMINARY SEWER DETAILS

LEGAL DESCRIPTION

THE NORTH 756 FEET OF THE WILSON DONATION CLAIM NO. 45, IN SECTION 24, TOWNSHIP 18 NORTH, RANGE 2 WEST, W.M., EXCEPT THE NORTH 150 FEET OF THE EAST 360 FEET. ALSO EXCEPTING THEREFROM THAT PORTION CONVEYED TO THE CITY OF OLYMPIA BY DEED RECORDED APRIL 30, 1998 UNDER AUDITOR'S FILE NO. 3150761. ALSO EXCEPTING 22ND AVENUE ALONG THE NORTH BOUNDARY. IN THURSTON COUNTY, WASHINGTON.

SITE DATA

ASSESSOR PARCEL NO.:	09940068005
ZONING:	R-6-12
TOTAL AREA:	5.01 ACRES
TREE TRACTS:	0.39 ACRES
STORM DRAINAGE:	0.85 ACRES
NET AREA:	3.77 ACRES
NO. OF LOTS:	24
DENSITY:	6.36 DU/ACRE
LENGTH OF PUBLIC ROADS:	435 L.F.
AREA OF PUBLIC ROADS:	0.60 ACRES
LENGTH OF PRIVATE ACCESS LANE:	167 L.F.
AREA OF PRIVATE ACCESS LANE:	0.11 ACRES
MINIMUM LOT AREA:	4,000 S.F.
AVERAGE LOT AREA:	4,772 S.F.
OPEN SPACE:	1.39 ACRES (28%)
NEW HARD SURFACES:	1.96 AC
ZONING:	OLYMPIA
WATER:	OLYMPIA
SCHOOLS:	OLYMPIA HIGH SCHOOL WASHINGTON MIDDLE SCHOOL PIONEER ELEMENTARY SCHOOL

TRACT USAGE

TRACT "A" STORM/TREE TRACT:	0.85 ACRES
TRACT "B" TREE TRACT:	0.39 ACRES
TRACT "C" PEDESTRIAN TRAIL:	0.04 ACRES
TRACT "D" OPEN SPACE:	0.11 ACRES
TRACT "E" PRIVATE ACCESS LANE:	0.06 ACRES
TRACT "F" PRIVATE ACCESS LANE:	0.05 ACRES

BUILDING SETBACKS

FRONT:	20'
SIDE:	5' (3' ZERO LOT LINE LOTS)
SIDE FLANKING STREET:	10'
REAR:	20'

SOIL INFORMATION

BASIN:	INDIAN MOXLIE
WATERSHED:	BUDD/DESCHUTES
WELLHEAD PROTECTION AREA:	NO
CRITICAL AREAS:	NONE
SOIL REPORT:	INSIGHT GEOLOGIC 04/16/2018
SOIL TYPE:	YELM FINE SANDY LOAM
SOIL TYPE DESCRIPTION:	FINE TO MEDIUM SAND WITH FEW FINES
DEPTH TO GROUNDWATER:	APPROXIMATELY 6 TO 9 FEET
USDA/NRCS HYDROLOGIC SOIL GROUP:	C

PLAT NOTES

1. TRACTS "A", "B", "C", "D", "E" & "F" TO BE OWNED AND MAINTAINED BY THE HOMEOWNERS ASSOCIATION.
2. ALL KNOWN WATER SUPPLIES WITHIN 200 FEET OF THE PROJECT BOUNDARY ARE IDENTIFIED HEREON (LOCATIONS ARE BASED ON FIELD SURVEY)
3. ALL EXISTING STRUCTURES TO BE DEMOLISHED WITH SITE DEVELOPMENT
4. SEE ORIGINALS - SURVEY 3/11/19

TP# 09940068005

DESIGNED BY: LDT
DRAWN BY: BSM/JW
CHECKED BY: RBW
DATE: MARCH 2019
SCALE: H 1" = 40'
V N/A

ROLAND BLAKE WILKERSON — STATE OF WASHINGTON — 44751 — REGISTERED PROFESSIONAL ENGINEER

REVISIONS: DATE:
CITY COMMENTS 11/4/18

HATTON GODAT PANTIER
ENGINEERS AND SURVEYORS
3910 MARTIN WAY E, SUITE B
OLYMPIA, WA 98506
TEL: 360.943.1599 FAX: 360.357.6299
hattonpantier.com

VILLAGE AT CAIN ROAD
2017 22ND AVENUE SE, OLYMPIA, WA 98501

A PORTION OF THE NE & SE 1/4 OF THE SE 1/4 OF SECTION 24, TOWNSHIP 18 NORTH, RANGE 2 WEST, W.M.

PRELIMINARY SITE PLAN

AGENCY NO. 18-3178
SHEET: 1 OF 10
E:\dgn\17-000\17-104\Preliminary
INDEX:17-104 pre-cov.dwg
JOB: 17-104

REQUIRED GENERAL NOTES FOR ALL PROJECTS:

1. ALL WORK AND MATERIALS SHALL BE COMPLETED IN ACCORDANCE WITH THE FOLLOWING:
   A. THE CITY OF OLYMPIA'S (2018) ENGINEERING DESIGN AND DEVELOPMENT STANDARDS (EDDS),
   B. THE MOST CURRENT "STANDARD SPECIFICATIONS FOR ROAD, BRIDGE, AND MUNICIPAL CONSTRUCTION" FROM THE WASHINGTON STATE DEPARTMENT OF TRANSPORTATION,
   C. THE CITY OF OLYMPIA'S 2016 DRAINAGE AND EROSION CONTROL MANUAL, AND
   D. THE CITY OF OLYMPIA SUPPLEMENTAL SPECIFICATIONS, THE CONTRACT SPECIFICATIONS AND SPECIAL PROVISIONS, AS APPLICABLE.
2. A PRE-CONSTRUCTION CONFERENCE SHALL BE HELD WITH THE CITY PRIOR TO THE START OF CONSTRUCTION. ALL PRIVATE DEVELOPMENT (PERMITTED) PROJECTS MUST SCHEDULE THE PRE-CONSTRUCTION CONFERENCE USING THE CITY'S SMARTGOV PERMITTING SYSTEM.
3. UNLESS NOTED OTHERWISE, UTILITIES SHOWN ON THE PLAN AND PROFILE ARE EXISTING, AND ARE LOCATED TO THE BEST INFORMATION AVAILABLE AT THE TIME OF PRINTING. THE CONTRACTOR SHALL VERIFY PRIOR TO CONSTRUCTION AND TAKE EXTRAORDINARY CARE WHEN EXCAVATING NEAR OR AROUND UTILITY CROSSINGS INCLUDING "HAND" EXCAVATION AND POT HOLING. IN THE EVENT OF A CONFLICT, THE CONTRACTOR SHALL COORDINATE WITH THE ENGINEER AND THE PRIVATE UTILITY TO RAISE, RELOCATE, OR LOWER THE CONFLICTING APPURTENANCES.
4. THE CONTRACTOR SHALL BE FULLY RESPONSIBLE FOR THE LOCATION AND PROTECTION OF ALL EXISTING UTILITIES. THE CONTRACTOR SHALL VERIFY ALL UTILITY LOCATIONS PRIOR TO CONSTRUCTION BY CALLING 811, THE UNDERGROUND LOCATE LINE, A MINIMUM OF 48 HOURS (TWO WORKING DAYS) PRIOR TO ANY EXCAVATION. IT IS THE RESPONSIBILITY OF THE REQUESTER TO MAINTAIN THE MARKINGS AFTER THE INITIAL LOCATE IN ACCORDANCE WITH RCW 19.122.
5. EROSION CONTROL SHALL BE IN ACCORDANCE WITH THE REQUIREMENTS OF THE CURRENT "DRAINAGE DESIGN AND EROSION CONTROL MANUAL FOR OLYMPIA" (DRAINAGE MANUAL).
6. CONTRACTOR SHALL PROTECT ALL TREES AND VEGETATION THAT ARE NOT TO BE REMOVED AS DIRECTED BY THE ENGINEER.
7. ALL DRAINAGE STRUCTURES, SANITARY MANHOLES, WATER METERS, WATER VALVES OR OTHER APPURTENANCES SHALL BE ADJUSTED TO FINAL GRADE BY THE CONTRACTOR UNLESS OTHERWISE NOTED ON THE PLANS.
8. CONTRACTOR SHALL MAINTAIN FUNCTION OF ALL EXISTING UTILITIES DURING CONSTRUCTION, UNLESS OTHERWISE AGREED.
9. CONTRACTOR SHALL TAKE CARE NOT TO DAMAGE EXISTING SIDEWALK AND ROAD SURFACES OUTSIDE OF THE PROJECT LIMITS. ALL DAMAGE OR UNDERMINING SHALL BE THE CONTRACTOR'S RESPONSIBILITY TO IMMEDIATELY REPAIR TO CITY STANDARDS AT THE CONTRACTOR'S EXPENSE.
10. ALL EXISTING SIGNS THAT INTERFERE WITH CONSTRUCTION SHALL BE RELOCATED AS DIRECTED BY THE ENGINEER.
11. ACCESS TO PRIVATE PROPERTY SHALL BE MAINTAINED AT ALL TIMES UNLESS PRIOR APPROVAL AND COORDINATION HAS OCCURRED.
12. THE CONTRACTOR WILL BE RESPONSIBLE FOR ALL TRAFFIC CONTROL IN ACCORDANCE WITH THE U.S. DEPARTMENT OF TRANSPORTATION MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES (MUTCD). PRIOR TO DISRUPTION OF ANY TRAFFIC, TRAFFIC CONTROL PLANS WILL BE PREPARED AND SUBMITTED TO THE CITY FOR APPROVAL. NO WORK WILL COMMENCE UNTIL ALL APPROVED TRAFFIC CONTROL IS IN PLACE.
13. IT SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR TO HAVE A COPY OF THE APPROVED CONSTRUCTION PLANS ON SITE AT ALL TIMES.
14. ANY CHANGES TO THE DESIGN SHALL FIRST BE REVIEWED AND APPROVED BY THE ENGINEER.
15. CITY OF OLYMPIA VERTICAL DATUM IS NAVD 88 AND SHALL BE USED FOR ALL VERTICAL CONTROL.

STANDARD NOTES FOR EROSION AND SEDIMENT CONTROL PLANS:

THE FOLLOWING STANDARD NOTES ARE REQUIRED FOR USE IN EROSION AND SEDIMENT CONTROL PLANS. PLANS SHOULD ALSO IDENTIFY WITH PHONE NUMBERS THE PERSON OR FIRM RESPONSIBLE FOR THE PREPARATION OF AND MAINTENANCE OF THE EROSION CONTROL PLAN.

1. NO CONSTRUCTION RELATED ACTIVITY SHALL CONTRIBUTE TO THE DEGRADATION OF THE ENVIRONMENT, ALLOW MATERIAL TO ENTER SURFACE OR GROUND WATER, OR ALLOW PARTICULATE EMISSIONS TO THE ATMOSPHERE, WHICH EXCEED STATE OR FEDERAL STANDARDS. ANY ACTION THAT POTENTIALLY ALLOW A DISCHARGE TO STATE WATERS MUST HAVE PRIOR APPROVAL.
2. A CERTIFIED EROSION AND SEDIMENT CONTROL LEAD (CESCL) IS REQUIRED FOR ALL CONSTRUCTION PROJECTS. THE NAMED PERSON OR FIRM SHALL BE ON-SITE OR ON-CALL AT ALL TIMES. FOR THIS SITE, THE PERSON/FIRM IS TBD AND THEIR OFFICE AND CELL TELEPHONE NUMBERS ARE TBD.
3. APPROVAL OF THIS EROSION/SEDIMENTATION CONTROL (ESC) PLAN DOES NOT CONSTITUTE AN APPROVAL OF PERMANENT STREET OR DRAINAGE DESIGN (E.G. SIZE AND LOCATION OF ROADS, PIPES, RESTRICTORS, CHANNELS, RETENTION FACILITIES, UTILITIES, ETC.).
4. THE IMPLEMENTATION OF THESE ESC PLANS AND THE CONSTRUCTION, MAINTENANCE, REPLACEMENT, AND UPGRADING OF THESE ESC FACILITIES IS THE RESPONSIBILITY OF THE APPLICANT/CONTRACTOR UNTIL ALL CONSTRUCTION IS COMPLETED AND APPROVED AND VEGETATION/LANDSCAPING IS ESTABLISHED.
5. STORMWATER FACILITY INFILTRATIVE SURFACES SHALL BE PROTECTED FROM SEDIMENTATION AND COMPACTION THROUGHOUT CONSTRUCTION. NOTE THAT POST-CONSTRUCTION VERIFICATION TESTING IS REQUIRED FOR ALL STORMWATER INFILTRATION FACILITIES. STORMWATER INFILTRATION FACILITIES THAT FAIL TO PERFORM AS DESIGNED MUST BE RECONSTRUCTED OR EXPANDED TO SUBSTANTIALLY MEET THE DESIGNED PERFORMANCE.
6. THE BOUNDARIES OF THE CLEARING LIMITS SHOWN ON THIS PLAN SHALL BE CLEARLY FLAGGED IN THE FIELD PRIOR TO CONSTRUCTION. DURING THE CONSTRUCTION PERIOD, NO DISTURBANCE BEYOND THE FLAGGED CLEARING LIMITS SHALL BE PERMITTED. THE FLAGGING SHALL BE MAINTAINED BY THE APPLICANT/CONTRACTOR FOR THE DURATION OF CONSTRUCTION.
7. STABILIZED CONSTRUCTION ENTRANCES SHALL BE INSTALLED AT THE BEGINNING OF CONSTRUCTION AND MAINTAINED FOR THE DURATION OF THE PROJECT. ADDITIONAL MEASURES MAY BE REQUIRED TO INSURE THAT ALL PAVED AREAS ARE KEPT CLEAN FOR THE DURATION OF THE PROJECT.
8. THE ESC FACILITIES SHOWN ON THIS PLAN MUST BE CONSTRUCTED IN CONJUNCTION WITH ALL CLEARING AND GRADING ACTIVITIES, AND IN SUCH A MANNER AS TO INSURE THAT SEDIMENT AND SEDIMENT LADEN WATER DO NOT ENTER THE DRAINAGE SYSTEM, ROADWAYS, OR VIOLATE APPLICABLE WATER STANDARDS.
9. THE ESC FACILITIES SHOWN ON THIS PLAN ARE THE MINIMUM REQUIREMENTS FOR ANTICIPATED SITE CONDITIONS. DURING THE CONSTRUCTION PERIOD, THESE ESC FACILITIES SHALL BE UPGRADED AS NEEDED FOR UNEXPECTED STORM EVENTS AND TO ENSURE THAT SEDIMENT AND SEDIMENT-LADEN WATER DO NOT LEAVE THE SITE.
10. THE ESC FACILITIES SHALL BE INSPECTED DAILY BY THE APPLICANT/CONTRACTOR AND MAINTAINED AS NECESSARY TO ENSURE THEIR CONTINUED FUNCTIONING.
11. THE ESC FACILITIES ON INACTIVE SITES SHALL BE INSPECTED AND MAINTAINED A MINIMUM OF ONCE A MONTH OR WITHIN 48 HOURS FOLLOWING A MAJOR STORM EVENT.
12. AT NO TIME SHALL MORE THAN ONE FOOT OF SEDIMENT BE ALLOWED TO ACCUMULATE WITHIN A TRAPPED CATCH BASIN. ALL CATCH BASINS AND CONVEYANCE LINES SHALL BE HIGH VELOCITY CLEANED AND PRESSURE TESTED PRIOR TO PAVING. THE CLEANING OPERATION SHALL NOT FLUSH SEDIMENT LADEN WATER INTO THE DOWNSTREAM SYSTEM.
13. ROADS SHALL BE CLEANED THOROUGHLY AS NEEDED TO PROTECT DOWNSTREAM WATER RESOURCES OR STORMWATER INFRASTRUCTURE. SEDIMENT SHALL BE REMOVED FROM ROADS BY SHOVELING OR PICKUP SWEEPING AND SHALL BE TRANSPORTED TO A CONTROLLED SEDIMENT DISPOSAL AREA.
14. FROM OCTOBER 15 THROUGH APRIL 1, NO SOILS SHALL REMAIN EXPOSED AND UNWORKED FOR MORE THAN 2 DAYS. FROM APRIL 2 TO OCTOBER 14, NO SOILS SHALL REMAIN EXPOSED AND UNWORKED FOR MORE THAN 7 DAYS. SOILS SHALL BE STABILIZED AT THE END OF THE SHIFT BEFORE A HOLIDAY OR WEEKEND IF NEEDED BASED ON THE WEATHER FORECAST. LINEAR CONSTRUCTION ACTIVITIES, SUCH AS RIGHT-OF-WAY AND EASEMENT CLEARING, ROADWAY DEVELOPMENT, PIPELINES, AND TRENCHING FOR UTILITIES, SHALL COMPLY WITH THESE REQUIREMENTS. THESE STABILIZATION REQUIREMENTS APPLY TO ALL SOILS ON SITE, WHETHER AT FINAL GRADE OR NOT. THE LOCAL PERMITTING AUTHORITY MAY ADJUST THESE TIME LIMITS IF IT CAN BE SHOWN THAT A DEVELOPMENT SITE'S EROSION OR RUNOFF POTENTIAL JUSTIFIES A DIFFERENT STANDARD.
15. FROM OCTOBER 15 THROUGH APRIL 1, CLEARING, GRADING, AND OTHER SOIL-DISTURBING ACTIVITIES SHALL ONLY BE PERMITTED IF SHOWN TO THE SATISFACTION OF THE LOCAL PERMITTING AUTHORITY THAT THE TRANSPORT OF SEDIMENT FROM THE CONSTRUCTION SITE TO RECEIVNG WATERS WILL BE PREVENTED.
16. SOIL STOCKPILES MUST BE STABILIZED AND PROTECTED WITH SEDIMENT-TRAPPING MEASURES.
17. ALL POLLUTANTS, INCLUDING WASTE MATERIALS AND DEMOLITION DEBRIS, THAT OCCUR ON SITE DURING CONSTRUCTION SHALL BE HANDLED AND DISPOSED OF IN A MANNER THAT DOES NOT CAUSE CONTAMINATION OF STORMWATER. WOODY DEBRIS MAY BE CHOPPED AND SPREAD ON SITE.
18. MAINTENANCE AND REPAIR OF HEAVY EQUIPMENT AND VEHICLES AND OTHER ACTIVITIES WHICH MAY RESULT IN DISCHARGE OR SPILLAGE OF POLLUTANTS TO THE GROUND OR INTO STORMWATER RUNOFF MUST BE CONDUCTED USING SPILL PREVENTION MEASURES, SUCH AS DRIP PANS. REPORT ALL SPILLS TO 911.
19. WATER FROM MOST DEWATERING OPERATIONS SHALL BE DISCHARGED INTO A SEDIMENT TRAP OR POND. CLEAN, NOT-TURBID WATER MAY BE DISCHARGED TO STATE SURFACE WATERS, PROVIDED THE DISCHARGE DOES NOT CAUSE EROSION OR FLOODING. HIGHLY TURBID OR CONTAMINATED DEWATERING WATER FROM CONSTRUCTION EQUIPMENT OPERATION, CLAMSHELL DIGGING, CONCRETE TREMIE POUR, OR WORK INSIDE A COFFERDAM SHALL BE HANDLED SEPARATELY FROM STORMWATER AND PROPERLY DISPOSED.

STREET CONSTRUCTION:

1. ALL CURB, CURB AND GUTTER, STREET GRADES, SIDEWALK GRADES, AND ANY OTHER VERTICAL AND/OR HORIZONTAL ALIGNMENT WILL BE STAKED BY ENGINEERING OR SURVEYING FIRMS CAPABLE OF PERFORMING SUCH WORK.
2. ASPHALT CONCRETE PAVEMENT FOR WEARING COURSE WILL NOT BE PLACED ON ANY TRAVELED WAY BETWEEN OCTOBER 1ST AND APRIL 1ST WITHOUT WRITTEN APPROVAL FROM THE CITY ENGINEER.
3. WHERE NEW ASPHALT JOINS EXISTING, THE EXISTING ASPHALT WILL BE CUT TO A NEAT VERTICAL EDGE AND TACKED WITH ASPHALT EMULSION TYPE CSS-1 IN ACCORDANCE WITH THE STANDARD SPECIFICATIONS.
4. COMPACTION OF SUBGRADE, ROCK, AND ASPHALT WILL BE IN ACCORDANCE WITH THE STANDARD SPECIFICATIONS.
5. ALL JOINT (CONTRACTION, CONSTRUCTION, ISOLATION, ETC.) LAYOUT PLANS SHALL BE APPROVED ONE WEEK BEFORE PLACING CONCRETE.
6. FORM AND SUBGRADE INSPECTION BY THE CITY IS REQUIRED BEFORE PLACING CONCRETE. TWENTY-FOUR HOURS' NOTICE IS REQUIRED FOR FORM INSPECTION.
7. TESTING AND SAMPLING FREQUENCIES WILL BE AS DESCRIBED IN THE CURRENT WSDOT STANDARD SPECIFICATIONS AND CHAPTER 4 OF THE EDDS.

STORMWATER CONSTRUCTION:

1. ALL STORM CONVEYANCES AND RETENTION/DETENTION AREAS WILL BE STAKED FOR GRADE AND ALIGNMENT BY AN ENGINEERING OR SURVEYING FIRM CAPABLE OF PERFORMING SUCH WORK.
2. SPECIAL STRUCTURES, OIL/WATER SEPARATORS, AND OUTLET CONTROLS WILL BE INSTALLED PURSUANT TO PLANS AND MANUFACTURER'S RECOMMENDATIONS.
3. WHERE CONNECTIONS REQUIRE "FIELD VERIFICATIONS", CONNECTION POINTS WILL BE EXPOSED BY CONTRACTOR AND FITTINGS VERIFIED 48 HOURS PRIOR TO DISTRIBUTING SHUTDOWN NOTICES.
4. ALL STORM LINES AND CATCH BASINS SHALL BE HIGH-VELOCITY CLEANED AND PRESSURE TESTED IN ACCORDANCE WITH DIVISION 7 OF THE STANDARD SPECIFICATIONS PRIOR TO PAVING IN CONFORMANCE WITH THE ABOVE-REFERENCED SPECIFICATIONS. HYDRANT FLUSHING OF LINES IS NOT AN ACCEPTABLE CLEANING METHOD.
5. TESTING OF THE STORM PIPING WILL INCLUDE TELEVISION INSPECTION, COMPATIBLE WITH GRANITE XP SOFTWARE, AT THE CONTRACTOR'S EXPENSE. ADDITIONAL TELEVISING THAT IS DEEMED NECESSARY WILL ALSO BE AT THE CONTRACTOR'S EXPENSE. ALL TELEVISION INSPECTIONS SHALL BE COMPLETED IN THE MANNER AS REQUIRED BY THE PACP. IMMEDIATELY PRIOR TO TELEVISION INSPECTING, ENOUGH WATER WILL BE RUN DOWN THE LINE SO IT COMES OUT THE LOWER MANHOLE AND THE LINE IS FLUSHED CLEAN. ACCEPTANCE OF THE LINE WILL BE MADE AFTER THE TELEVISION INSPECTION TAPE HAS BEEN REVIEWED AND APPROVED BY THE INSPECTOR.
6. ALL CATCH BASINS SHALL HAVE A CURB MARKER, ANTI-DUMPING DISC INSTALLED AS SPECIFIED IN THE EDDS.
7. ALL SOLID ROUND CATCH BASIN COVERS SHALL BE CITY OF OLYMPIA DECORATIVE STANDARD (PER STANDARD DRAWING 5-12).
8. ALL SURFACE STORM WATER FACILITIES SHALL HAVE INFORMATIONAL SIGNS INSTALLED ADJACENT TO STREETS, SIDEWALKS AND PATHS.

WATER MAIN CONSTRUCTION:

1. ALL LINES WILL BE CHLORINATED AND TESTED IN CONFORMANCE AMERICAN WATER WORKS ASSOCIATION STANDARDS.
2. ALL WATER MAINS WILL BE STAKED FOR GRADES AND ALIGNMENT BY AN ENGINEERING OR SURVEYING FIRM CAPABLE OF PERFORMING SUCH WORK. STAKING WILL BE MAINTAINED THROUGHOUT CONSTRUCTION.
3. ALL WATER SYSTEM CONNECTIONS TO SERVE BUILDINGS OR PROPERTIES WITH DOMESTIC POTABLE WATER, FIRE SPRINKLER SYSTEMS, OR IRRIGATION SYSTEMS WILL COMPLY WITH THE MINIMUM BACKFLOW PREVENTION REQUIREMENTS AS ESTABLISHED BY THE WASHINGTON STATE DEPARTMENT OF HEALTH AND THE CITY OF OLYMPIA IN ITS CROSS CONNECTION PROGRAM.
4. THE CITY REQUIRES 10 WORKING DAYS WRITTEN NOTICE TO SCHEDULE SHUTDOWNS. THE WRITTEN NOTICE WILL BE COORDINATED WITH THE CITY INSPECTOR. THE CITY OF OLYMPIA DRINKING WATER OPERATIONS OR CITY INSPECTOR WILL PERFORM THE SHUTDOWN.
5. AT ANY CONNECTION TO AN EXISTING LINE WHERE A NEW VALVE IS NOT INSTALLED, THE EXISTING VALVE MUST BE PRESSURE TESTED TO CITY STANDARDS BY THE CONTRACTOR PRIOR TO CONNECTION. IF AN EXISTING VALVE FAILS TO PASS THE TEST, THE CONTRACTOR WILL MAKE THE NECESSARY PROVISIONS TO TEST THE NEW LINE PRIOR TO CONNECTION TO THE EXISTING SYSTEM OR INSTALL A NEW VALVE.
6. AT ANY WATER MAIN TAP TO EXISTING CITY MAINS WHERE THE CONTRACTOR ENCOUNTERS A COUPLING OR EXISTING ASSEMBLIES, THE CONTRACTOR WILL PROVIDE A MINIMUM OF 18 INCHES OF CLEARANCE FROM COUPLING OR ASSEMBLIES TO EDGE OF TAPPING SLEEVE.
7. ANY WATER MAIN TAP OR CONNECTION WILL BE BLOCKED ACCORDING TO THE CITY OF OLYMPIA STANDARD DRAWINGS.
8. ANY EXCAVATION THAT EXPOSES AN ASBESTOS CEMENT (AC) WATER MAIN OR THE CITY'S 36-INCH WATER TRANSMISSION MAIN SHALL BE BEDDED WITH CONTROLLED DENSITY FILL (CDF) PURSUANT TO THE WSDOT SPECIFICATIONS FOR CDF. AS AN OPTION THE CONTRACTOR MAY CHOOSE TO REPLACE THE AC PIPE AT ANY CROSSING WITH DUCTILE IRON PIPE BENCHED INTO BOTH TRENCH WALLS. THE CONTRACTOR WILL COORDINATE WITH THE CITY INSPECTOR TO HAVE A CITY OF OLYMPIA DRINKING WATER OPERATIONS STAFF MEMBER ON SITE BEFORE CONSTRUCTION BEGINS.
9. BEFORE CUTTING OR REMOVING ANY EXISTING AC PIPE, THE CONTRACTOR WILL SUPPLY THE CITY OF OLYMPIA INSPECTOR A COPY OF THE WORKMAN'S CERTIFICATIONS TO WORK WITH AC PIPE. THE CONTRACTOR WILL CONFORM TO ALL REGULATIONS AND GUIDANCE RELATED TO ASBESTOS WORK PROVIDED BY THE OLYMPIC REGION CLEAN AIR AGENCY.

SANITARY SEWER CONSTRUCTION:

1. IF CONSTRUCTION IS TO TAKE PLACE IN THE COUNTY RIGHT-OF-WAY, THE CONTRACTOR SHALL NOTIFY THE COUNTY AND OBTAIN ALL THE REQUIRED APPROVALS AND PERMITS.
2. THE CITY OF OLYMPIA CONSTRUCTION INSPECTOR SHALL BE NOTIFIED A MINIMUM OF 48 HOURS (TWO WORKING DAYS) IN ADVANCE OF A TAP CONNECTION TO AN EXISTING MAIN. THE INSPECTOR SHALL BE PRESENT AT THE TIME OF THE TAP.
3. ALL SEWER MAINS SHALL BE FIELD STAKED FOR GRADES AND ALIGNMENT BY A LICENSED ENGINEERING OR SURVEYING FIRM QUALIFIED TO PERFORM SUCH WORK. STAKING SHALL BE MAINTAINED THROUGHOUT CONSTRUCTION.
4. WHEN TEMPORARY STREET PATCHES ARE ALLOWED BY THE CITY, COLD MIX ASPHALT SHALL BE PLACED AND COMPACTED TO A MAXIMUM DEPTH OF 2 INCHES. CONTRACTOR SHALL BE RESPONSIBLE FOR MAINTENANCE AS REQUIRED BY THE CITY.
5. AFTER BACKFILLING, BUT PRIOR TO PAVING, ALL MAINS AND APPURTENANCES SHALL BE INSPECTED AND APPROVED BY THE CITY OF OLYMPIA CONSTRUCTION INSPECTOR. APPROVAL DOES NOT CONSTITUTE FINAL ACCEPTANCE OF THE SEWER LINE. THE CONTRACTOR SHALL RETAIN THE RESPONSIBILITY TO REPAIR ALL DEFICIENCIES AND FAILURES REVEALED DURING ALL REQUIRED TESTING FOR ACCEPTANCE AND THROUGH THE DURATION OF THE WARRANTY. IT SHALL BE THE CONTRACTOR'S RESPONSIBILITY TO NOTIFY THE CITY OF OLYMPIA FOR THE REQUIRED INSPECTIONS. ANY MAIN OR APPURTENANCE BACKFILLED PRIOR TO INSPECTION SHALL BE RE-EXCAVATED FOR INSPECTION.
6. ALL LINES WILL BE HIGH-VELOCITY CLEANED AND SUBJECTED TO A LOW-PRESSURE AIR TEST PURSUANT TO CURRENT WSDOT STANDARD SPECIFICATIONS AFTER BACKFILLING, BUT PRIOR TO PAVING. HYDRANT FLUSHING OF LINES IS NOT AN ACCEPTABLE CLEANING METHOD.
7. TESTING OF THE SANITARY SEWER MAIN WILL INCLUDE TELEVISION INSPECTION, COMPATIBLE WITH GRANITE XP SOFTWARE, AT THE CONTRACTOR'S EXPENSE. ADDITIONAL TELEVISING THAT IS DEEMED NECESSARY WILL ALSO BE AT THE CONTRACTOR'S EXPENSE. ALL TELEVISION INSPECTIONS SHALL BE COMPLETED IN THE MANNER REQUIRED BY THE PACP. IMMEDIATELY PRIOR TO TELEVISION INSPECTION, ENOUGH WATER WILL BE RUN DOWN THE LINE SO IT COMES OUT THE LOWER MANHOLE AND THE LINE IS FLUSHED CLEAN. ACCEPTANCE OF THE LINE WILL BE MADE AFTER THE TELEVISION INSPECTION TAPE HAS BEEN REVIEWED AND APPROVED BY THE CITY INSPECTOR.
8. A TEST OF ALL MANHOLES IN ACCORDANCE WITH OLYMPIA STANDARD IS ALSO REQUIRED. TESTING WILL TAKE PLACE AFTER ALL UNDERGROUND UTILITIES ARE INSTALLED AND COMPACTION OF THE ROADWAY SUBGRADE IS COMPLETED.

IN ADDITION, THE FOLLOWING SPECIFIC NOTES PERTAINING TO STEP SYSTEMS AND LIFT STATIONS AND FORCE MAINS WILL BE INCLUDED WHEN THESE UTILITIES ARE PART OF THE PROJECT.

STEP SEWERS:

1. ALL BURIED POWER FOR STEP SYSTEMS WILL BE INSTALLED WITH CONTINUOUS TRACER TAPE INSTALLED 12 INCHES ABOVE THE BURIED POWER. THE MARKER WILL BE PLASTIC NON-BIODEGRADABLE METAL-CORE BACKING MARKED "POWER". TAPE WILL BE FURNISHED BY CONTRACTOR.
2. ALL STEP MAINS WILL BE HYDROSTATICALLY TESTED AT 200 PSI AND ACCORDING TO THE METHODS FOR HYDROSTATIC TESTING OF WATER LINES IN THE CURRENT VERSION OF THE WSDOT SPECIFICATIONS.

LIFT STATION AND FORCE MAIN SEWERS:

1. CONTRACTORS SHALL BE RESPONSIBLE FOR CLEANUP OF ANY DEBRIS IN THE WET WELL, TANKS, VAULTS AND SITE ASSOCIATED WITH THE PROJECT PRIOR TO START UP.
2. PRIOR TO BACKFILL, ALL MAINS, DRY WELL, WET WELL AND VAULTS SHALL BE INSPECTED AND APPROVED BY THE CITY OF OLYMPIA CONSTRUCTION INSPECTOR. APPROVAL SHALL NOT RELIEVE THE CONTRACTOR FOR CORRECTION OF ANY DEFICIENCIES AND/OR FAILURES AS DETERMINED BY SUBSEQUENT TESTING AND INSPECTIONS. IT SHALL BE THE CONTRACTOR'S RESPONSIBILITY TO NOTIFY THE CITY OF OLYMPIA FOR THE REQUIRED INSPECTIONS.
3. ALL WORK SHALL BE DONE PER NATIONAL ELECTRICAL CODE (NEC) AND THE CITY OF OLYMPIA STANDARDS. THE CITY OF OLYMPIA STANDARDS MAY EXCEED THE NEC. THE DEVELOPER SHALL OBTAIN ALL PERMITS AND ARRANGE INSPECTIONS.
4. THE DEVELOPER SHALL COORDINATE POWER SERVICE WITH SERVING UTILITIES AND MAKE ARRANGEMENTS FOR POWER SERVICE CONNECTION.
5. PRIOR TO TESTING AND START-UP OF THE LIFT STATION, FIVE (5) COPIES OF THE OPERATION AND MAINTENANCE MANUAL, TOGETHER WITH THE NUMBER OF APPROVED COPIES REQUIRED BY THE DEVELOPER, SHALL BE SUBMITTED TO THE CITY FOR REVIEW AND APPROVAL.
6. THE DEVELOPER, AT ITS OWN EXPENSE, WITH THE DESIGN ENGINEER, SHALL ARRANGE FOR AN AUTHORIZED FACTORY-TRAINED REPRESENTATIVE OF THE COMPANY OR COMPANIES SUPPLYING THE VARIOUS ITEMS OF EQUIPMENT TO CHECK THE INSTALLATION, AND TO ADJUST AND TEST THE EQUIPMENT FURNISHED BEFORE THE ACCEPTANCE OF THE WORK BY THE CITY. THE FACTORY REPRESENTATIVE SHALL BE RESPONSIBLE TO CHECK AND RESOLVE ANY UNACCEPTABLE VIBRATION OF THE PUMP ASSEMBLIES. FURTHERMORE, THE DEVELOPER SHALL ASSIST AND INSTRUCT THE CITY'S OPERATING STAFF IN ADJUSTING AND OPERATING THE EQUIPMENT DURING INITIAL START-UP PERIOD. SAID REPRESENTATIVE SHALL BE EXPERIENCED AND KNOWLEDGEABLE OF THE EQUIPMENT BEING TESTED.
7. THE DEVELOPER AT ITS OWN EXPENSE SHALL CONDUCT AN INSTRUCTION PROGRAM FOR UP TO FIVE (5) PERSONNEL DESIGNATED BY THE CITY. DEVELOPER SHALL FURNISH THE SERVICES OF QUALIFIED INSTRUCTORS FROM THE VARIOUS EQUIPMENT MANUFACTURERS. PROGRAM SHALL INCLUDE INSTRUCTION COVERING BASIC SYSTEM OPERATION THEORY, ROUTINE MAINTENANCE AND REPAIR, AND "HANDS ON" OPERATION OF EQUIPMENT. TRAINING SHALL NOT PROCEED UNTIL ALL OPERATION MAINTENANCE MANUALS ARE COMPLETE AND ACCEPTED BY THE CITY.
8. ALL EQUIPMENT SHALL BE TESTED AND DEVELOPER SHALL DEMONSTRATE TO CITY PERSONNEL THAT PROPER OPERATION AND CAPACITY HAVE BEEN FULLY OBTAINED. THE CITY WILL NOT ACCEPT ANY FACILITY UNTIL SUCCESSFUL FULL OPERATION OF ALL COMPONENTS HAS BEEN DEMONSTRATED BY THE DEVELOPER.
9. IT IS THE DEVELOPER'S RESPONSIBILITY TO CONSTRUCT AND START-UP A COMPLETE AND TROUBLE-FREE SYSTEM. THE DEVELOPER SHALL BE RESPONSIBLE FOR CORRECTING ALL DESIGN ERRORS AND/OR CONSTRUCTION DEFECTS THAT ARE DISCOVERED IN THE START-UP OR DURING THE WARRANTY PERIOD OF THE AGREEMENT WITH THE CITY.
10. LEFT STATION AND GENERATOR, SITE, DRIVEWAY, ACCESS, CONCRETE AREAS, LIGHTING AND WATER SERVICE SHALL ALL BE COMPLETED PRIOR TO START UP REQUEST AND INSPECTION.
11. TELEMETRY SHALL CONSIST OF A RIGID PLC AND OTHER ACCESSORIES LISTED IN SECTION 7D.030. PRIOR TO ORDERING THE ABOVE EQUIPMENT, THE DEVELOPER WILL CONTACT THE PUMP STATIONS SUPERVISOR, CITY OF OLYMPIA PUBLIC WORKS, FOR COMPLETE ORDERING SPECIFICATIONS FOR THE ABOVE TELEMETRY. NOMINAL LEAD TIME IS 12 WEEKS.
12. SPARE PARTS SHALL BE PROVIDED FOR THE STATION AT TIME OF START UP ACCEPTANCE.
    - ONE SET MECHANICAL SEALS, FILTERS AND VOLUTE GASKETS.
    - ONE SET OF PUMP WEAR RINGS.
    - FOUR SETS OF OPERATION AND MAINTENANCE MANUALS.
    - A LIST OF THE NEAREST DEALERS FOR SPARE PARTS AND REPAIR WILL BE PROVIDED.

    ADDITIONALLY, ANY SPECIAL TOOLS SPECIFIC TO THE PUMP MANUFACTURER SHALL BE PROVIDED TO THE CITY OF OLYMPIA AT START UP.
19. A 6-INCH THICK CONCRETE COLLAR SHALL BE INSTALLED AROUND ALL VALVES. STANDARD DRAWING 6-12, STANDARD VALVE BOX, DETAIL SHALL BE USED.
20. ALL FORCE MAINS SHALL BE HYDROSTATIC TESTED AT 200 PSI AND ACCORDING TO THE METHODS FOR HYDROSTATIC TESTING OF WATER LINES IN THE CURRENT VERSION OF THE WSDOT SPECIFICATIONS.

APPROVED BY	REVISED DATE	CITY OF OLYMPIA	STD. DWG.NO.
FRAN R. EIDE, PE CITY ENGINEER	7/25/2017	CONSTRUCTION PLAN NOTES	3-1

DESIGNED BY: LDT
DRAWN BY: BSM/JW
CHECKED BY: RBW
DATE: MARCH 2019
SCALE: H N/A
V N/A

ROLAND BLAKE WILKERSON
STATE OF WASHINGTON
44751
REGISTERED
PROFESSIONAL ENGINEER

HATTON GODAT PANTIER
ENGINEERS AND SURVEYORS
3910 MARTIN WAY E, SUITE B
OLYMPIA, WA 98506
TEL: 360.943.1599 FAX: 360.357.6299
hattonpantier.com

REVISIONS: DATE:
CITY COMMENTS 11/4/18

VILLAGE AT CAIN ROAD
2017 22ND AVENUE SE, OLYMPIA, WA 98501

PRELIMINARY
CONSTRUCTION NOTES

A PORTION OF THE NE & SE 1/4 OF THE SE 1/4 OF SECTION 24, TOWNSHIP 18 NORTH, RANGE 2 WEST, W.M.

TP# 09940068005

AGENCY NO. 18-3178
SHEET: 2 OF 10
E:\dgn\17-000\17-104\Preliminary
INDEX: 17-104 pre-del.dwg
JOB: 17-104

CITY OF OLYMPIA	
VERTICAL DATUM - NAVD88 CITY OF OLYMPIA 2" BRASS CAP (LS-46310) TOP OF CONC CURB SE SIDE OF ROUNDABOUT OF BOULEVARD RD & 22nd (TCHP CONTROL POINT #6153) ELEVATION = 205.29	MERIDIAN HORIZONTAL DATUM CITY OF OLYMPIA COORDINATE SYSTEM BASED ON THE NORTH LINE OF WILSON D.L.C. NO. 45

40 20 0 40 80
SCALE: 1" = 40'

LEGEND

- CLEARING LIMITS
- TREE PROTECTION FENCING
- FILTER FABRIC FENCING
- INLET SEDIMENT PROTECTION

WET PONDS TO BE USED AS TEMPORARY SEDIMENT TRAPS

FILTER FABRIC FENCING, TYP (SEE DETAIL SHEET 3)

ALL CATCH BASINS WITH INLET GRATES TO HAVE INLET SEDIMENT PROTECTION UNTIL SITE HAS BEEN STABILIZED (TYP) (SEE DETAIL SHEET 3)

REMOVE EXISTING SIDEWALK, DRIVEWAY & ADD RAMPS ON 22ND AVENUE ACROSS PROJECT FRONTAGE

INSTALL TREE PROTECTION FENCING ALONG NORTH BOUNDARY OF LOT 24 NORTH TO NORTH PROPERTY BOUNDARY EAST ALONG RIGHT-OF-WAY TO EAST PROPERTY BOUNDARY

EXISTING WATER SYSTEM PRESSURE REDUCING STATION TO BE RELOCATED

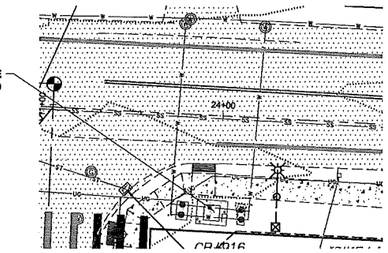
DEMOLISH & REMOVE ALL EXISTING IMPROVEMENTS INCLUDING BUT NOT LIMITED TO ALL BUILDINGS, FENCING, SIDEWALKS, DRIVEWAYS, PARKING AREAS, UTILITIES, TANKS, GATES ETC.

PROVIDE STABILIZED CONSTRUCTION ENTRANCE (SEE DETAIL SHEET 3)

ASPHALT CUT LINE (TYP)

INSTALL TREE PROTECTION FENCING AROUND TRACT "B" (SUPA) BOUNDARY (SEE DETAIL SHEET 3)

CLEARING LIMITS FOR NATIVE VEGETATION & LAND DISTURBING ACTIVITIES



1:20
SE CORNER OF 22ND & CAIN

THIS DRAWING DOES NOT REPRESENT A RECORD DOCUMENT, UNLESS CERTIFIED BY HATTON GODAT PANTIER.

ANY ALTERATIONS TO THE DESIGN SHOWN HEREON MUST BE REVIEWED AND APPROVED BY HATTON GODAT PANTIER.

NOTE: THE CONTRACTOR SHALL BE FULLY RESPONSIBLE FOR THE LOCATION AND PROTECTION OF ALL EXISTING UTILITIES. THE CONTRACTOR SHALL VERIFY ALL UTILITY LOCATIONS PRIOR TO CONSTRUCTION BY CALLING THE UNDERGROUND LOCATE LINE AT 811 A MINIMUM OF 48 HOURS PRIOR TO ANY EXCAVATION.

N.T.S.

INLET SEDIMENT PROTECTION NOTES:

1. INSTALL INSERT PER THE MANUFACTURER'S SPECIFICATIONS
2. MAINTAIN AND REPLACE INSERTS AS RECOMMENDED BY THE MANUFACTURER, AS REQUIRED BY THE INSPECTOR OR PROJECT ENGINEER, AND AS OTHERWISE NECESSARY.

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DESIGNED BY: LDT
DRAWN BY: BSM/AW
CHECKED BY: RBW
DATE: MARCH 2019
SCALE: H 1" = 40'
V N/A

REVISIONS: DATE:
CITY COMMENTS 11/4/18

ROLAND BLAKE WILKERSON
STATE OF WASHINGTON
44751
REGISTERED
PROFESSIONAL ENGINEER

VILLAGE AT CAIN ROAD
2017 22ND AVENUE SE, OLYMPIA, WA 98501
TPN 09940068005

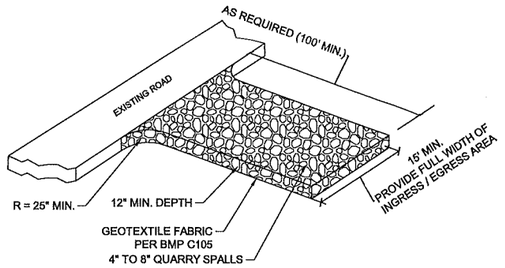
PRELIMINARY
EROSION CONTROL PLAN & DEMOLITION PLAN

A PORTION OF THE NE & SE 1/4 OF THE SE 1/4 OF SECTION 24, TOWNSHIP 18 NORTH, RANGE 2 WEST, W.M.

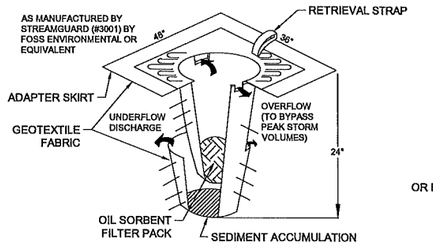
AGENCY NO. 18-3178
SHEET: 3 OF 10
E:\dgn\17-000\17-104\Preliminary
INDEX: 17-104 pre-ec.dwg
JOB: 17-104

STABILIZED CONSTRUCTION ENTRANCE NOTES:

1. MATERIAL SHALL BE 4 INCH TO 8 INCH QUARRY SPALLS AND MAY BE TOP-DRESSED WITH 1 INCH TO 3 INCH ROCK. (STATE STANDARD SPECIFICATIONS.)
2. THE ROCK PAD SHALL BE AT LEAST 12 INCHES THICK AND 100 FEET LONG. WIDTH SHALL BE 15' MINIMUM. SMALLER PADS MAY BE APPROVED FOR SINGLE-FAMILY RESIDENTIAL AND SMALL COMMERCIAL SITES.
3. ADDITIONAL ROCK SHALL BE ADDED PERIODICALLY TO MAINTAIN PROPER FUNCTION OF THE PAD.
4. IF THE PAD DOES NOT ADEQUATELY REMOVE THE MUD FROM THE VEHICLE WHEELS, THE WHEELS SHALL BE HOSED OFF BEFORE THE VEHICLE ENTERS A PAVED STREET. THE WASHING SHALL BE DONE ON AN AREA COVERED WITH CRUSHED ROCK AND WASH WATER SHALL DRAIN TO A SEDIMENT RETENTION FACILITY OR THROUGH A SILT FENCE.



STABILIZED CONSTRUCTION ENTRANCE
N.T.S.



1. INSTALL INSERT PER THE MANUFACTURERS SPECIFICATIONS.
2. MAINTAIN AND REPLACE INSERTS AS RECOMMENDED BY THE MANUFACTURER, AS REQUIRED BY THE INSPECTOR OR PROJECT ENGINEER, AND AS OTHERWISE NECESSARY.

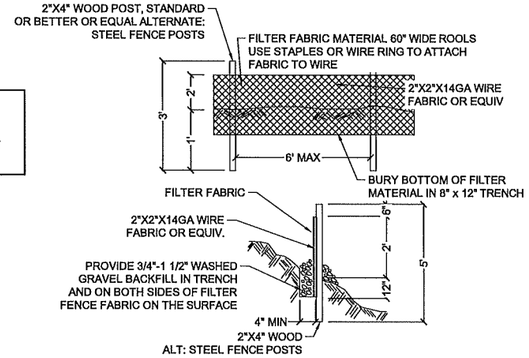
INLET SEDIMENT PROTECTION
N.T.S.

PROCESS OF TREE PROTECTION FENCE INSTALLATION

a. CONTACT PROJECT FORESTER TO IDENTIFY LOCATION FOR TREE PROTECTION FENCE ON SITE
b. CONTRACTOR TO INSTALL TREE FENCE
c. PROJECT FORESTER INSPECTS LOCATION AND INSTALLATION OF TREE FENCE AND SENDS CITY OF OLYMPIA FORESTER INSPECTION NOTICE OF APPROVAL
d. CITY FORESTER NOTIFIES INSPECTOR THE PRECONSTRUCTION CONFERENCE MAY BE SCHEDULED
e. CONTACT PROJECT FORESTER TO ATTEND THE PRECONSTRUCTION CONFERENCE TO DISCUSS THE PROTECTION ISSUES
f. REMOVAL OF TREES AND GRADING MAY BEGIN WITHIN THE CLEARING LIMITS IN THE CONSTRUCTION AREA
g. MAINTAIN AL TREE PROTECTION FENCES THROUGHOUT CONSTRUCTION
h. IF ANY UNPLANNED CONSTRUCTION ACTIVITY WILL AFFECT A SAVE TREE, CONTACT PROJECT FORESTER PRIOR TO THE IMPACT. PROJECT FORESTER ASSESSES THE PROPOSED IMPACT AND RECOMMENDS CULTURAL CARE, MITIGATION, OR REMOVAL. PROJECT FORESTER SENDS EMAILS TO CITY OF OLYMPIA FORESTER FOR FINAL APPROVAL
i. OFF SITE TREE-SUCH AS ABUTTING MCGRATH WOODS PARK AND PROPERTIES TO THE NORTH (3 PARCELS) AND EAST (4 PARCELS) SHALL NOT BE DISTURBED, THE PROTECTION MEASURES LISTED ABOVE SHALL APPLY TO TREES IMMEDIATELY OFF SITE AND ABUTTING THE DEVELOPMENT SITE

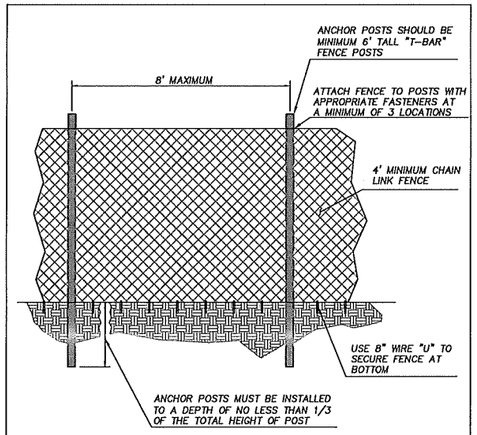
FILTER FABRIC FENCE NOTES:

1. FILTER FABRIC SHALL BE PURCHASED IN A CONTINUOUS ROLL CUT TO THE LENGTH OF THE BARRIER TO AVOID USE OF JOINTS. WHEN JOINTS ARE NECESSARY, FILTER CLOTH SHALL BE SPLICED TOGETHER ONLY AT A SUPPORT POST, WITH A MINIMUM 6-INCH OVERLAP, AND SECURELY FASTENED AT BOTH ENDS TO POST
2. POSTS SHALL BE SPACED A MAXIMUM OF 6 FEET APART AND DRIVEN SECURELY INTO THE GROUND (MINIMUM OF 30 INCHES).
3. A TRENCH SHALL BE EXCAVATED APPROXIMATELY 8 INCHES WIDE AND 12 INCHES DEEP ALONG THE LINE OF POSTS AND UPSLOPE FROM THE BARRIER.
4. WHEN STANDARD STRENGTH FILTER FABRIC IS USED, A WIRE MESH SUPPORT FENCE SHALL BE FASTENED SECURELY TO THE UPSLOPE SIDE OF THE POSTS USING HEAVY-DUTY WIRE STAPLES AT LEAST 1 INCH LONG, TIE WIRES OR HOG RINGS. THE WIRE SHALL EXTEND INTO THE TRENCH A MINIMUM OF 4 INCHES AND SHALL NOT EXTEND MORE THAN 36 INCHES ABOVE THE ORIGINAL GROUND SURFACE.
5. THE STANDARD STRENGTH FILTER FABRIC SHALL BE STAPLED OR WIRED TO THE FENCE, AND 20 INCHES OF THE FABRIC SHALL BE EXTENDED INTO THE TRENCH. THE FABRIC SHALL NOT EXTEND MORE THAN 36 INCHES ABOVE THE ORIGINAL GROUND SURFACE. FILTER FABRIC SHALL NOT BE STAPLED TO EXISTING TREES.
6. WHEN EXTRA-STRENGTH FILTER FABRIC AND CLOSER POST SPACING IS USED, THE WIRE MESH SUPPORT FENCE MAY BE ELIMINATED. IN SUCH A CASE, THE FILTER FABRIC IS STAPLED OR WIRED DIRECTLY TO THE POSTS WITH ALL OTHER PROVISIONS OF ABOVE NOTES APPLYING.
7. FILTER FABRIC FENCES SHALL NOT BE REMOVED BEFORE THE UPSLOPE AREA HAS BEEN PERMANENTLY STABILIZED.
8. FILTER FABRIC FENCES SHALL BE INSPECTED IMMEDIATELY AFTER EACH RAINFALL AND AT LEAST DAILY DURING PROLONGED RAINFALL. ANY REQUIRED REPAIRS SHALL BE MADE IMMEDIATELY.



FILTER FABRIC FENCE DETAIL
N.T.S.

FILTER FABRIC FENCING TO BE INSTALLED AT A MINIMUM AS SHOWN ON THESE PLANS. ADDITIONAL FILTER FABRIC FENCING TO BE INSTALLED AT ANY LOCATION WHERE RUNOFF COULD LEAVE THE SITE. WITH INSPECTOR APPROVAL, FILTER FABRIC FENCING AND CLEARING LIMITS FENCING MAY BE COMBINED BY USING ORANGE FILTER FABRIC FENCING.



NOTES:
1. *THE TREE, SOIL AND VEGETATION PROTECTION FENCE SHOULD BE MAINTAINED THROUGHOUT THE CONSTRUCTION AND GRADING, AND NOT TO BE REMOVED UNTIL FINAL LANDSCAPING IS IN PROGRESS AND WITH APPROVAL BE PROJECT FORESTER.*
2. *AT NO TIME SHALL EQUIPMENT ENTER INTO THE CRITICAL ROOT ZONE (CRZ).*
3. *ALL BRUSH CLEANUP WITHIN THE CRZ SHOULD BE COMPLETED BY HAND TO PREVENT DISTURBANCE OF NATIVE GROUND COVERS.*
4. *NO CUTS OR FILLS. UTILITY TRENCHING, MODIFICATIONS TO DRAINAGE, OR CONCRETE RINSE WATER SHOULD IMPACT THE CRZ.*
5. *NO WIRES, CABLES, OR OTHER DEVICES SHOULD BE ATTACHED TO PROTECTED TREES DURING CONSTRUCTION.*
6. *IF IMPACTS MUST OCCUR WITHIN THE CRZ, CONTACT PROJECT FORESTER PRIOR TO THE OPERATIONS TO DETERMINE THE PROPER PROCEDURE TO PROTECT THE TREE'S HEALTH.*

APPROVED BY	REVISED DATE	CITY OF OLYMPIA	STD. DWG. NO.
FRAN R. EIDE, PE CITY ENGINEER	12/08/2017	TREE PROTECTION FENCE	5-20

TREE PROTECTION MEASURES

PLACING MATERIALS NEAR TREES

NO PERSON MAY CONDUCT ANY ACTIVITY WITHIN THE PROTECTED AREA OF ANY TREE DESIGNATED TO REMAIN INCLUDING BUT NOT LIMITED TO PARKING EQUIPMENT, PLACING SOLVENTS,STORING BUILDING MATERIALS AND SOILS DEPOSITS, DUMPING CONCRETE WASHOUT AND LOCATION BURN HOLES.

ATTACHMENTS TO TREES

DURING CONSTRUCTION NO PERSON SHALL ATTACH ANY OBJECT TO ANY TREE DESIGNATED FOR PROTECTION

PROTECTIVE BARRIER

BEFORE DEVELOPMENT, LAND CLEARING, FILLING OR ANY LAND ALTERATION FOR WHICH A TREE REMOVAL PERMIT IS REQUIRED, THE APPLICANT;

SHALL ERECT AND MAINTAIN READILY VISIBLE PROTECTIVE THE FENCING ALONG THE OUTER EDGE AND COMPLETELY SURROUNDING THE PROTECTED AREA OF ALL PROTECTED TREES OR GROUPS OF TRESS. FENCES SHALL BE CONSTRUCTED OF CHAIN LINK AND AT LEAST FOUR FEET HIGH, UNLESS OTHER TYPE OF FENCING IS AUTHORIZED BY THE URBAN FORESTER.

SHALL MAINTAIN THE PROTECTIVE BARRIERS IN PLACE UNTIL THE URBAN FORESTER AUTHORIZES THEIR REMOVAL, OR A FINAL CERTIFICATE OF OCCUPANCY IS ISSUED, WHICHEVER OCCURS FIRST.

SHALL ENSURE THAT ANY LANDSCAPING DONE IN THE PROTECTED ZONE SUBSEQUENT TO THE REMOVAL OF THE SHALL BE ACCOMPLISHED WITH LIGHT MACHINERY OR HAND LABOR

GRADE

TO THE GREATEST EXTENT PRACTICAL, UTILITY TRENCHES SHALL BE LOCATED OUTSIDE OF THE CRITICAL ROOT ZONE OF TREES TO BE RETAINED. THE URBAN FORESTER MA REQUIRE THAT UTILITIES BE TUNNELED UNDER THE ROOTS OF TREES TO BE RETAINED IF THE URBAN FORESTER DETERMINES THAT TRENCHING WOULD SIGNIFICANTLY REDUCE THE CHANCES OF TREES SURVIVAL. THERE ARE NO LOCATIONS WHERE TUNNELING WILL OCCUR.

TREE AND OTHER VEGETATION TO BE RETAINED SHALL BE PROTECTED FROM EROSION AND SEDIMENT.

DESIGNED BY: LDT
DRAWN BY: BSH/AW
CHECKED BY: RBW
DATE: MARCH 2019
SCALE: H N/A
V N/A

ROLAND BLAKE WILKERSON
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hattonpantier.com

REVISIONS: DATE:
CITY COMMENTS 11/4/18

VILLAGE AT CAIN ROAD
2017 22ND AVENUE SE, OLYMPIA, WA 98501
TP# 09940068005

PRELIMINARY EROSION CONTROL NOTES & DETAILS

A PORTION OF THE NE & SE 1/4 OF THE SE 1/4 OF SECTION 24, TOWNSHIP 18 NORTH, RANGE 2 WEST, W.M.

AGENCY NO. 18-3178
SHEET: 4 OF 10
E:\dgn\17-000\17-104\Preliminary
INDEX:17-104 pre-det.dwg
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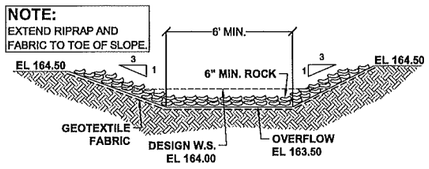
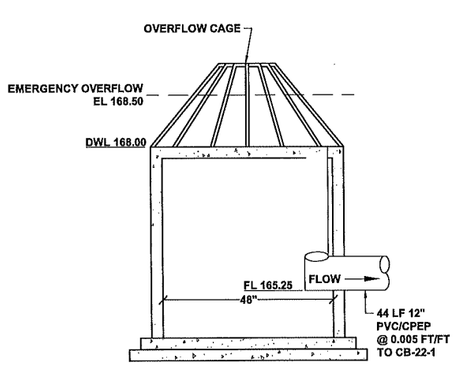
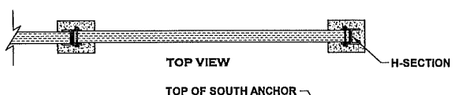
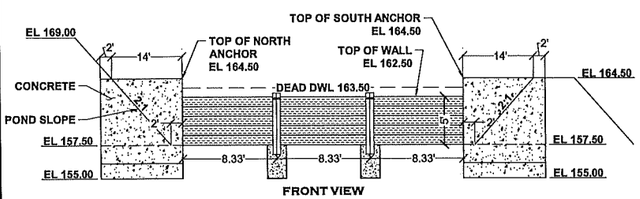


WET POND OVERFLOW SPILLWAY
N.T.S.



POND OUTLET STRUCTURE
N.T.S.





BAFFLE WALL DETAIL
N.T.S.

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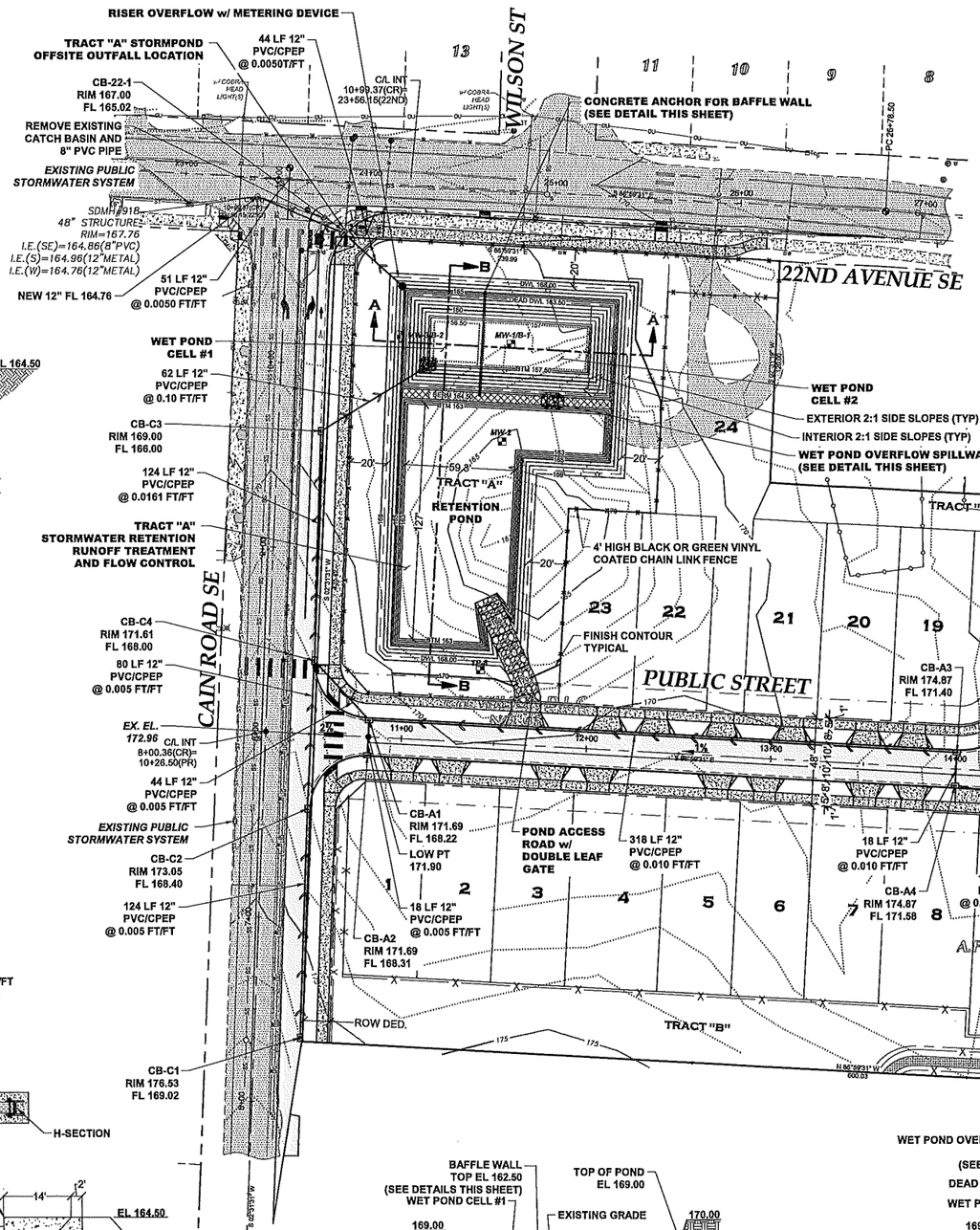
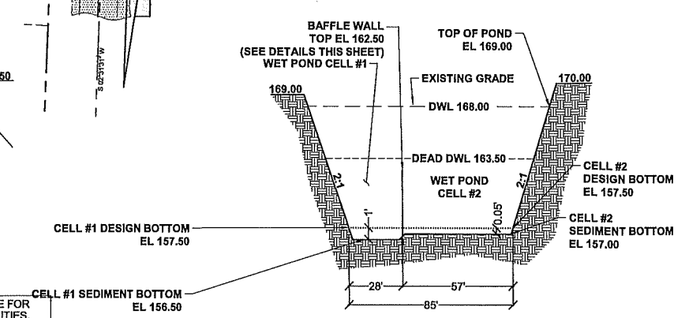
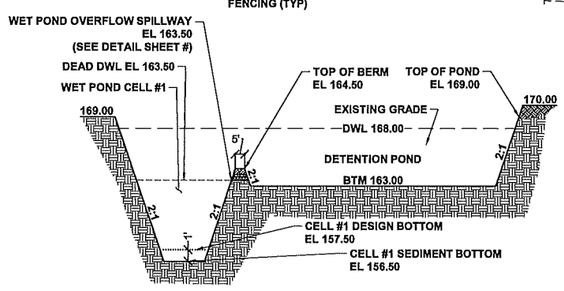




DRAINAGE FACILITY SECTION A-A
N.T.S.



DRAINAGE FACILITY SECTION B-B
N.T.S.

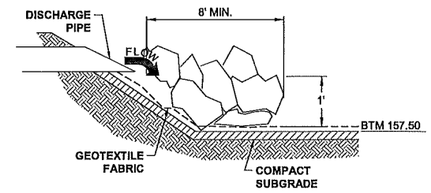
RIP RAP NOTE:

RIPRAP SHALL CONFORM WITH SECTION 9-13.1 OF THE STANDARD SPECIFICATIONS

RIP RAP SHALL BE A REASONABLY WELL GRADED ASSORTMENT OF ROCK WITH THE FOLLOWING GRADATION:

ARMOR POND A MIN. OF 6' IN EACH SIDE OF OUTFALL

MAXIMUM STONE SIZE..... 12-INCHES
MEDIAN STONE SIZE 8-INCHES
MINIMUM STONE SIZE 2-INCHES



RIP RAP OUTFALL DETAIL
N.T.S.

CITY OF OLYMPIA	
VERTICAL DATUM - NAVD88	MERIDIAN HORIZONTAL DATUM
CITY OF OLYMPIA 2" BRASS CAP (LS-46310) TOP OF CONC CURB SE SIDE OF ROUNDABOUT OF BOULEVARD RD & 22nd (TCHP CONTROL POINT #6153) ELEVATION = 205.29	CITY OF OLYMPIA COORDINATE SYSTEM BASED ON THE NORTH LINE OF WILSON D.L.C. NO. 45

40 20 0 40 80
SCALE: 1" = 40'

DESIGNED BY: LDT
DRAWN BY: BSM/JW
CHECKED BY: RBW
DATE: MARCH 2019
SCALE: H 1" = 40' V N/A

ROLAND BLAKE WILKERSON 44751 REGISTERED PROFESSIONAL ENGINEER STATE OF WASHINGTON

REVISIONS: DATE:
CITY COMMENTS 11/4/19

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VILLAGE AT CAIN ROAD
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PRELIMINARY GRADING & DRAINAGE PLAN

A PORTION OF THE NE & SE 1/4 OF THE SE 1/4 OF SECTION 24, TOWNSHIP 18 NORTH, RANGE 2 WEST, WM.

AGENCY NO. 18-3178
SHEET: 5 OF 10
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CITY OF OLYMPIA	
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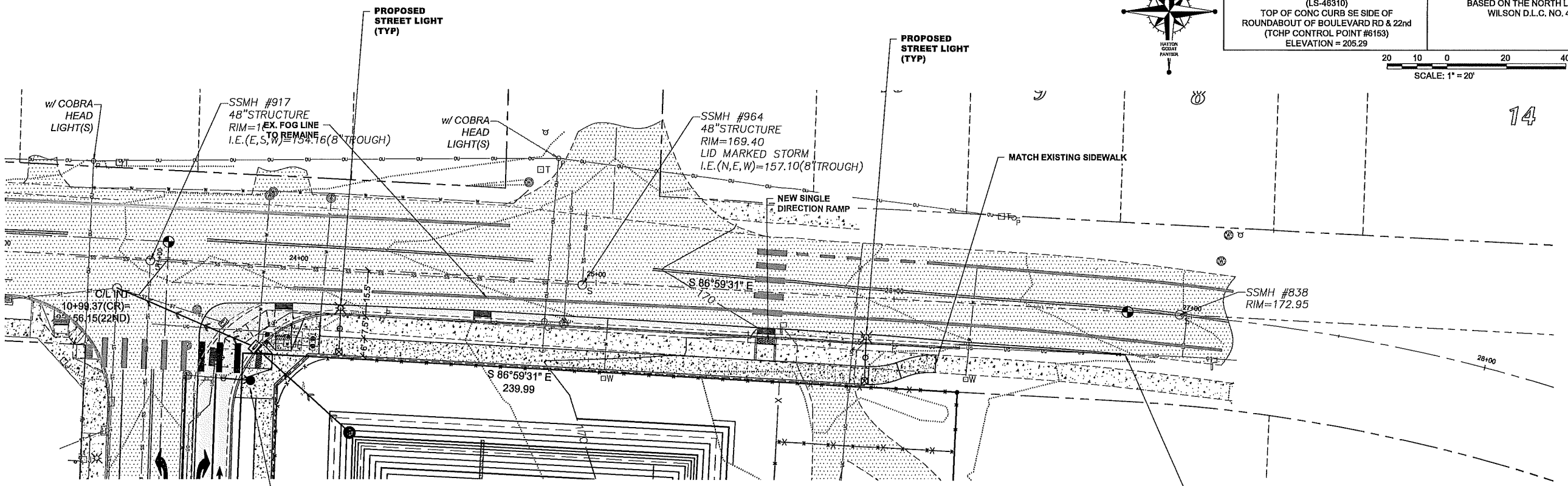
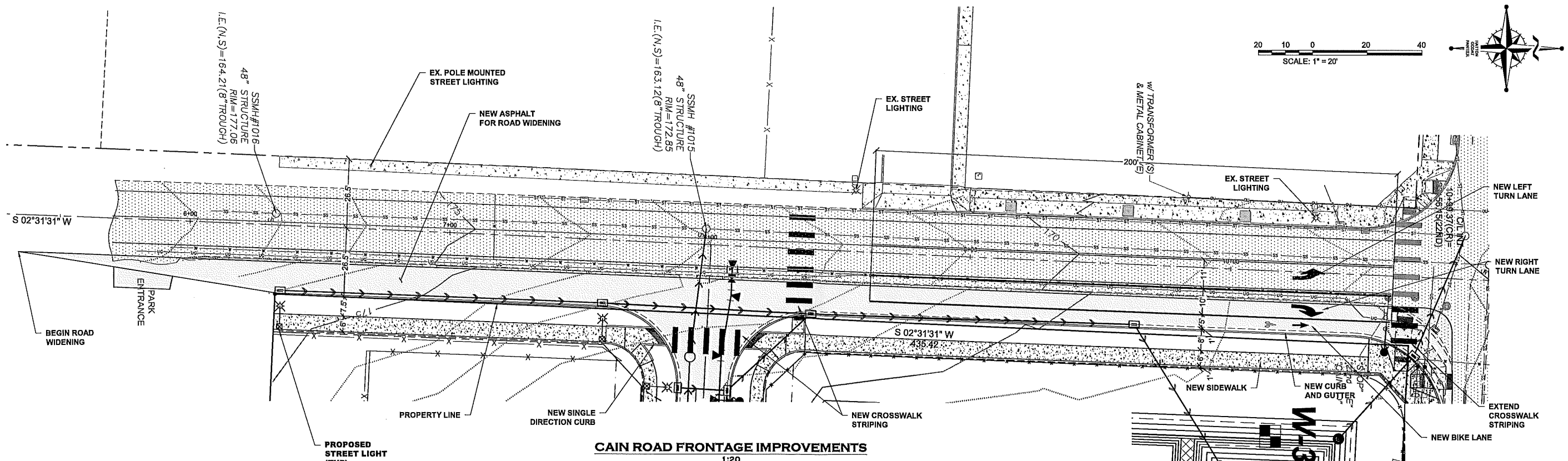


22ND AVE FRONTAGE IMPROVEMENTS
1:20



CAIN ROAD FRONTAGE IMPROVEMENTS
1:20

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DESIGNED BY: LDT
DRAWN BY: BSM/AW
CHECKED BY: RBW
DATE: MARCH 2019
SCALE: H 1" = 20'
V N/A

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REVISIONS: DATE:
CITY COMMENTS 11/4/19

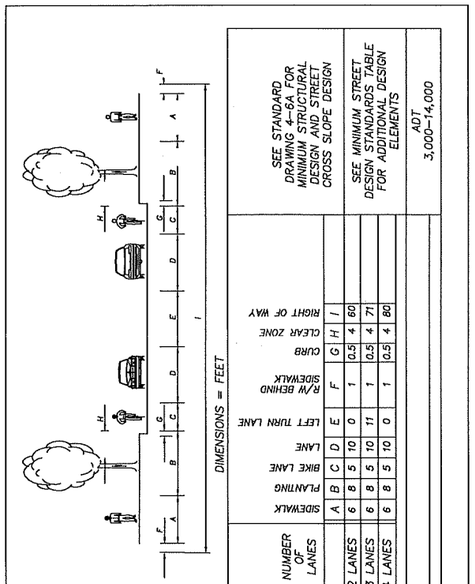
VILLAGE AT CAIN ROAD
2017 22ND AVENUE SE, OLYMPIA, WA 98501

TP# 09940068005

PRELIMINARY FRONTAGE IMPROVEMENTS

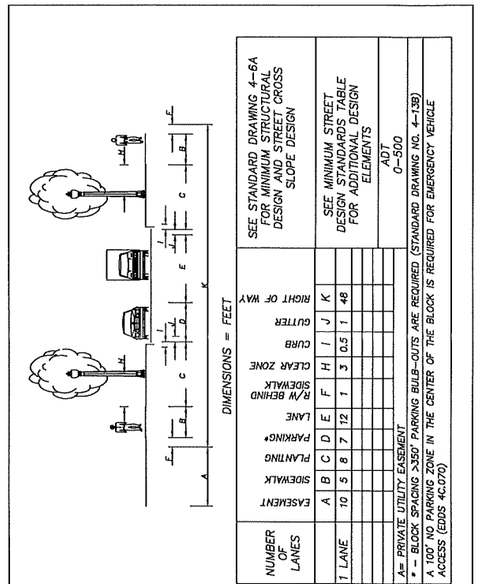
A PORTION OF THE NE & SE 1/4 OF THE SE 1/4 OF SECTION 34, TOWNSHIP 18 NORTH, RANGE 2 WEST, W.M.

AGENCY NO. 18-3178
SHEET: 6 OF 10
E:\dgn\17-000\17-104\Preliminary
INDEX: 17-104 pre-fi.dwg
JOB: 17-104



NUMBER OF LANES	SIDEWALK A	PLANTING B	BIKE LANE C	LANE D	LEFT TURN LANE E	R/W BEHIND SIDEWALK F	CURB G	CLEAR ZONE H	RIGHT OF WAY I
SEE STANDARD DRAWING 4-6A FOR MINIMUM STRUCTURAL DESIGN AND STREET CROSS SLOPE DESIGN									
SEE MINIMUM STREET DESIGN STANDARDS TABLE FOR ADDITIONAL DESIGN ELEMENTS									
ADT 3,000-14,000									
2 LANES	6	5	10	10	0	1	0.5	4	60
3 LANES	6	8	5	10	11	1	0.5	4	71
4 LANES	6	8	5	10	0	1	0.5	4	80

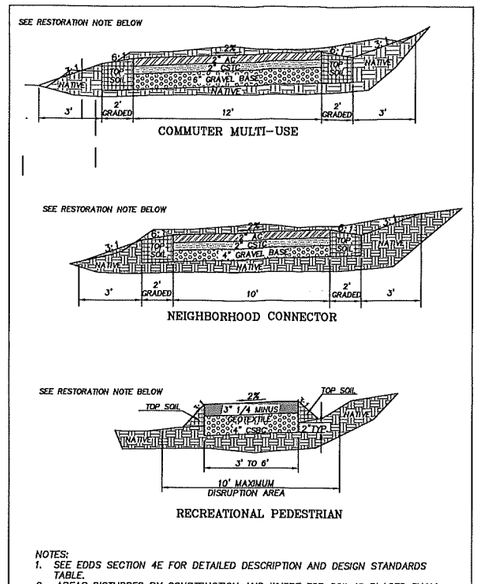
APPROVED BY	REVISED DATE	CITY OF OLYMPIA	STD. DWG. NO.
FRAN R. EIDE, PE	8/10/2015	MAJOR COLLECTOR	4-2G
CITY ENGINEER			



NUMBER OF LANES	EASEMENT A	SIDEWALK B	PLANTING C	BIKE LANE D	PARKING* E	LANE F	R/W BEHIND SIDEWALK H	CURB I	GUTTER J	RIGHT OF WAY K
SEE STANDARD DRAWING 4-6A FOR MINIMUM STRUCTURAL DESIGN AND STREET CROSS SLOPE DESIGN										
SEE MINIMUM STREET DESIGN STANDARDS TABLE FOR ADDITIONAL DESIGN ELEMENTS										
ADT 0-500										
1 LANE	10	5	8	7	12	1	3	0.5	1	48

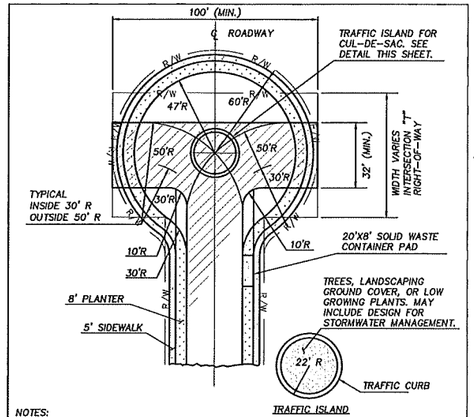
A= PRIVATE UTILITY EASEMENT
* - BLOCK SPACING >350' PARKING BULB-OUTS ARE REQUIRED (STANDARD DRAWING NO. 4-13B)
A 100' NO PARKING ZONE IN THE CENTER OF THE BLOCK IS REQUIRED FOR EMERGENCY VEHICLE ACCESS (EDDS 4C.070)

APPROVED BY	REVISED DATE	CITY OF OLYMPIA	STD. DWG. NO.
FRAN R. EIDE, PE	8/10/2015	LOCAL ACCESS STREET	4-2J
CITY ENGINEER			



NOTES:
1. SEE EDDS SECTION 4E FOR DETAILED DESCRIPTION AND DESIGN STANDARDS TABLE.
2. AREAS DISTURBED BY CONSTRUCTION AND WHERE TOP SOIL IS PLACED SHALL BE RE-SEEDED WITH GRASS FOR RESTORATION.

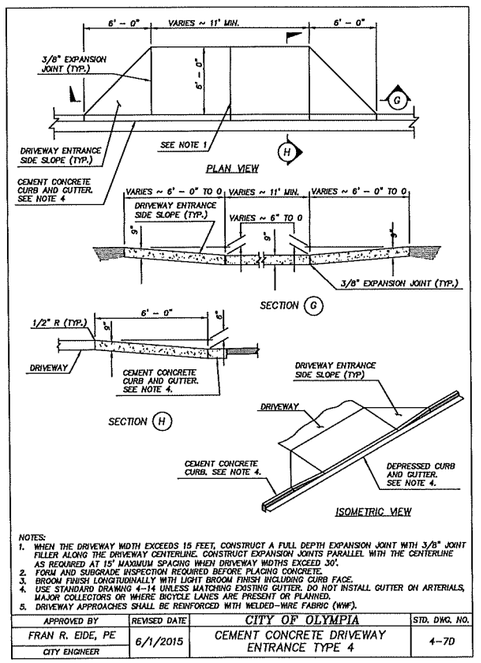
APPROVED BY	REVISED DATE	CITY OF OLYMPIA	STD. DWG. NO.
FRAN R. EIDE, PE	9/1/2015	TRAILS / SHARED-USE PATH	4-2L
CITY ENGINEER			



NOTES:
1. INTERSECTION "T" PERMITTED ONLY IN SINGLE FAMILY DEVELOPMENTS AND ON DEDICATED RIGHT-OF-WAY. THE "T" SEGMENT ORIENTATION MAY VARY TO MATCH LOCAL CONDITION.
2. THE TEMPORARY TEE CONFIGURATION MAY ONLY BE USED UPON WRITTEN APPROVAL FROM THE PUBLIC WORKS DEPARTMENT.
3. CUL-DE-SACS AND INTERSECTION "T" MUST BE FREE OF OBSTRUCTIONS AND SIGNED "NO PARKING ANY TIME".
4. R/W IS DEPENDENT UPON ROADWAY WIDTH REQUIREMENTS.
5. TRAFFIC ISLAND IS REQUIRED WITH CUL-DE-SAC CONSTRUCTION.

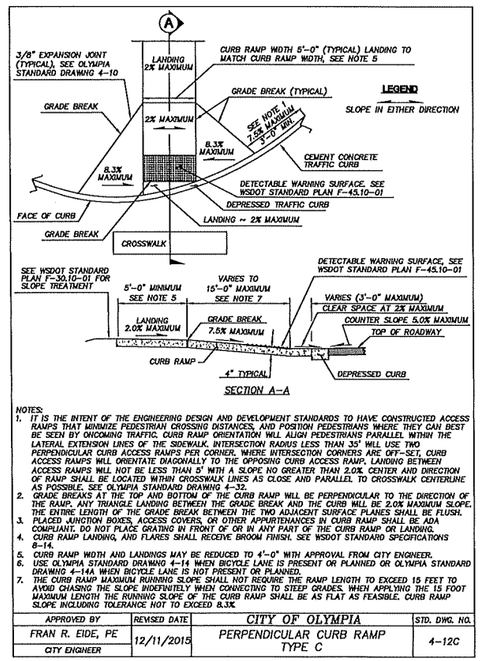
LEGEND:
R/W — DEDICATED RIGHT-OF-WAY
PAVING
DEPICTS THE TEMPORARY "T" CONFIGURATION

APPROVED BY	REVISED DATE	CITY OF OLYMPIA	STD. DWG. NO.
FRAN R. EIDE, PE	12/10/2015	CUL-DE-SAC OR TEMPORARY INTERSECTION "T"	4-5
CITY ENGINEER			



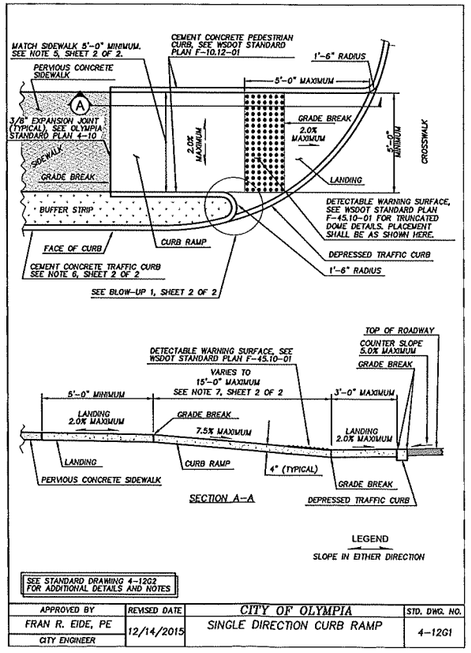
NOTES:
1. WHEN THE DRIVEWAY WIDTH EXCEEDS 15 FEET, CONSTRUCT A FULL DEPTH EXPANSION JOINT WITH 3/8" JOINT FILLER ALONG THE DRIVEWAY CENTERLINE. CONSTRUCT EXPANSION JOINTS PARALLEL WITH THE CENTERLINE AS REQUIRED AT 15' MAXIMUM SPACING WHEN DRIVEWAY WIDTHS EXCEED 30'.
2. FORM AND SUBGRADE INSPECTION REQUIRED BEFORE PLACING CONCRETE.
3. BROOM FINISH LONGITUDINALLY WITH LIGHT BROOM FINISH INCLUDING CURB FACE.
4. USE STANDARD DRAWING 4-14 UNLESS MATCHING EXISTING GUTTER. DO NOT INSTALL GUTTER ON ARTERIALS, MAJOR COLLECTORS OR WHERE BICYCLE LANES ARE PRESENT OR PLANNED.
5. DRIVEWAY APPROACHES SHALL BE REINFORCED WITH WELDED-WIRE FABRIC (WW).

APPROVED BY	REVISED DATE	CITY OF OLYMPIA	STD. DWG. NO.
FRAN R. EIDE, PE	6/1/2015	CEMENT CONCRETE DRIVEWAY ENTRANCE TYPE 4	4-7D
CITY ENGINEER			



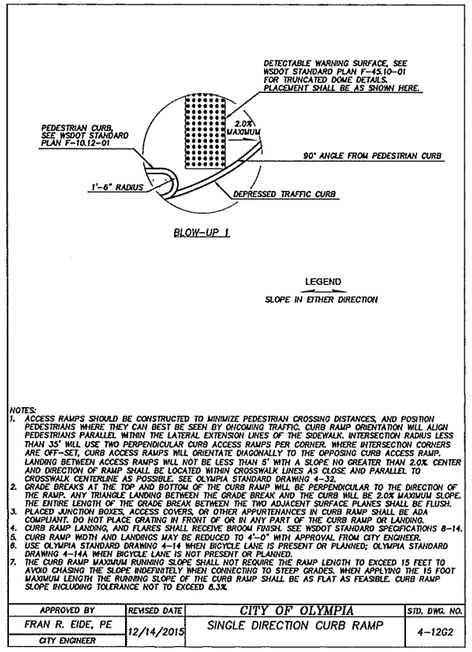
NOTES:
1. IT IS THE INTENT OF THE ENGINEERING DESIGN AND DEVELOPMENT STANDARDS TO HAVE CONSTRUCTED ACCESS RAMPS THAT MINIMIZE PEDESTRIAN CROSSING DISTANCES, AND POSITION PEDESTRIANS WHERE THEY CAN BEST BE SEEN BY ONCOMING TRAFFIC. CURB RAMP ORIENTATION WILL ALIGN PEDESTRIANS PARALLEL WITHIN THE LATERAL EXTENSION LINES OF THE SIDEWALK. INTERSECTION RADIUS LESS THAN 35' WILL USE TWO PERPENDICULAR CURB ACCESS RAMPS PER CORNER. WHERE INTERSECTION CORNERS ARE OFF-SET, CURB ACCESS RAMPS WILL ORIENTATE DIAGONALLY TO THE OPPOSING CURB ACCESS RAMP. LANDING BETWEEN ACCESS RAMPS WILL NOT BE LESS THAN 5' WITH A SLOPE NO GREATER THAN 2.0% CENTER AND DIRECTION OF RAMP SHALL BE LOCATED WITHIN CROSSWALK LINES AS CLOSE AND PARALLEL TO CROSSWALK CENTERLINE AS POSSIBLE. SEE OLYMPIA STANDARD DRAWING 4-32.
2. GRADE BREAKS AT THE TOP AND BOTTOM OF THE CURB RAMP WILL BE PERPENDICULAR TO THE DIRECTION OF THE RAMP. ANY TRIANGLE LANDING BETWEEN THE GRADE BREAK AND THE CURB WILL BE 2.0% MAXIMUM SLOPE. THE ENTIRE LENGTH OF THE GRADE BREAK BETWEEN THE TWO ADJACENT SURFACE PLANES SHALL BE FLUSH.
3. PLACED JUNCTION BOXES, ACCESS COVERS, OR OTHER APPURTENANCES IN CURB RAMP SHALL BE ADA COMPLIANT. DO NOT PLACE GRATING IN FRONT OF OR IN ANY PART OF THE CURB RAMP OR LANDING.
4. CURB RAMP LANDING, AND FLARES SHALL RECEIVE BROOM FINISH. SEE WSDOT STANDARD SPECIFICATIONS 8-14.
5. CURB RAMP WIDTH AND LANDINGS MAY BE REDUCED TO 4'-0" WITH APPROVAL FROM CITY ENGINEER.
6. USE OLYMPIA STANDARD DRAWING 4-14 WHEN BICYCLE LANE IS PRESENT OR PLANNED OR OLYMPIA STANDARD DRAWING 4-14A WHEN BICYCLE LANE IS NOT PRESENT OR PLANNED.
7. THE CURB RAMP MAXIMUM RUNNING SLOPE SHALL NOT REQUIRE THE RAMP LENGTH TO EXCEED 15 FEET TO AVOID CHASING THE SLOPE INDEFINITELY WHEN CONNECTING TO STEEP GRADES. WHEN APPLYING THE 15 FOOT MAXIMUM LENGTH THE RUNNING SLOPE OF THE CURB RAMP SHALL BE AS FLAT AS FEASIBLE. CURB RAMP SLOPE INCLUDING TOLERANCE NOT TO EXCEED 8.3%.

APPROVED BY	REVISED DATE	CITY OF OLYMPIA	STD. DWG. NO.
FRAN R. EIDE, PE	12/11/2015	PERPENDICULAR CURB RAMP TYPE C	4-12C
CITY ENGINEER			



SEE STANDARD DRAWING 4-12G2 FOR ADDITIONAL DETAILS AND NOTES

APPROVED BY	REVISED DATE	CITY OF OLYMPIA	STD. DWG. NO.
FRAN R. EIDE, PE	12/14/2015	SINGLE DIRECTION CURB RAMP	4-12G1
CITY ENGINEER			



NOTES:
1. ACCESS RAMPS SHOULD BE CONSTRUCTED TO MINIMIZE PEDESTRIAN CROSSING DISTANCES, AND POSITION PEDESTRIANS WHERE THEY CAN BEST BE SEEN BY ONCOMING TRAFFIC. CURB RAMP ORIENTATION WILL ALIGN PEDESTRIANS PARALLEL WITHIN THE LATERAL EXTENSION LINES OF THE SIDEWALK. INTERSECTION RADIUS LESS THAN 35' WILL USE TWO PERPENDICULAR CURB ACCESS RAMPS PER CORNER. WHERE INTERSECTION CORNERS ARE OFF-SET, CURB ACCESS RAMPS WILL ORIENTATE DIAGONALLY TO THE OPPOSING CURB ACCESS RAMP. LANDING BETWEEN ACCESS RAMPS WILL NOT BE LESS THAN 5' WITH A SLOPE NO GREATER THAN 2.0% CENTER AND DIRECTION OF RAMP SHALL BE LOCATED WITHIN CROSSWALK LINES AS CLOSE AND PARALLEL TO CROSSWALK CENTERLINE AS POSSIBLE. SEE OLYMPIA STANDARD DRAWING 4-32.
2. GRADE BREAKS AT THE TOP AND BOTTOM OF THE CURB RAMP WILL BE PERPENDICULAR TO THE DIRECTION OF THE RAMP. ANY TRIANGLE LANDING BETWEEN THE GRADE BREAK AND THE CURB WILL BE 2.0% MAXIMUM SLOPE. THE ENTIRE LENGTH OF THE GRADE BREAK BETWEEN THE TWO ADJACENT SURFACE PLANES SHALL BE FLUSH.
3. PLACED JUNCTION BOXES, ACCESS COVERS, OR OTHER APPURTENANCES IN CURB RAMP SHALL BE ADA COMPLIANT. DO NOT PLACE GRATING IN FRONT OF OR IN ANY PART OF THE CURB RAMP OR LANDING.
4. CURB RAMP LANDING, AND FLARES SHALL RECEIVE BROOM FINISH. SEE WSDOT STANDARD SPECIFICATIONS 8-14.
5. CURB RAMP WIDTH AND LANDINGS MAY BE REDUCED TO 4'-0" WITH APPROVAL FROM CITY ENGINEER.
6. USE OLYMPIA STANDARD DRAWING 4-14 WHEN BICYCLE LANE IS PRESENT OR PLANNED; OLYMPIA STANDARD DRAWING 4-14A WHEN BICYCLE LANE IS NOT PRESENT OR PLANNED.
7. THE CURB RAMP MAXIMUM RUNNING SLOPE SHALL NOT REQUIRE THE RAMP LENGTH TO EXCEED 15 FEET TO AVOID CHASING THE SLOPE INDEFINITELY WHEN CONNECTING TO STEEP GRADES. WHEN APPLYING THE 15 FOOT MAXIMUM LENGTH THE RUNNING SLOPE OF THE CURB RAMP SHALL BE AS FLAT AS FEASIBLE. CURB RAMP SLOPE INCLUDING TOLERANCE NOT TO EXCEED 8.3%.

APPROVED BY	REVISED DATE	CITY OF OLYMPIA	STD. DWG. NO.
FRAN R. EIDE, PE	12/14/2015	SINGLE DIRECTION CURB RAMP	4-12G2
CITY ENGINEER			

DESIGNED BY: LDT
DRAWN BY: BSM/JW
CHECKED BY: RBW
DATE: MARCH 2019
SCALE: H N/A
V N/A

ROLAND BLAKE WILKERSON
STATE OF WASHINGTON
44751
REGISTERED
PROFESSIONAL ENGINEER

HATTON GODAT PANTIER
ENGINEERS AND SURVEYORS
3910 MARTIN WAY E, SUITE B
OLYMPIA, WA 98506
TEL: 360.943.1599 FAX: 360.357.6299
hattonpantier.com

REVISIONS: DATE:
CITY COMMENTS 11/14/18

VILLAGE AT CAIN ROAD
2017 22ND AVENUE SE, OLYMPIA, WA 98501

PRELIMINARY
STREET DETAILS

A PORTION OF THE NE 1/4 & SE 1/4 OF SECTION 14, TOWNSHIP 18 NORTH, RANGE 2 WEST, W.M.

TPN# 09940068005

AGENCY NO. 18-3178
SHEET: 7 OF 10
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JOB: 17-104

CITY OF OLYMPIA	
VERTICAL DATUM - NAVD88 CITY OF OLYMPIA 2" BRASS CAP (LS-46310) TOP OF CONC CURB SE SIDE OF ROUNDABOUT OF BOULEVARD RD & 22nd (TCHP CONTROL POINT #6153) ELEVATION = 205.29	**MERIDIAN HORIZONTAL DATUM** CITY OF OLYMPIA COORDINATE SYSTEM BASED ON THE NORTH LINE OF WILSON D.L.C. NO. 45

HATTON GODAT PANTIER

40 20 0 40 80

SCALE: 1" = 40'

WILSON ST

22ND AVENUE SE

PROPOSED STREET LIGHT (TYP)

C/L INT 10+99.37(CR)= 23+56.15(22ND)

EXISTING STREET LIGHT (TYP)

MH-A2, TYPE 1-48
RIM 174.16
FL 166.33 (8"E)
FL 166.43 (8" W)

PROPOSED SINGLE WATER SERVICE (TYP)

PROPOSED SEWER LATERAL (TYP)

MH-A4, TYPE 1-48
RIM 176.00
FL 171.15 (8" N)

TRACT "A" RETENTION POND

TRACT "D"

NEW IRRIGATION METER

PROPOSED FIRE HYDRANT (TYP)

CONNECT TO EXISTING 8" WATERMAIN

C/L INT 8+00.36(CR)= 10+26.50(PR)

SSMH #1015
48" STRUCTURE
RIM=172.85
I.E.(N,S)=163.12(8"TROUGH)

NEW 8" FL 163.22

48 LF 8" PVC SWR @ 0.01 FT/FT

253 LF 8" PVC SWR @ 0.01 FT/FT

PUBLIC STREET

199 LF 8" PVC SWR @ 0.01 FT/FT

CCDS 14+77.89, 14' LT

MH-A3, TYPE 1-48
RIM 175.46
FL 169.06 (8" N,S)
FL 169.16 (8" W)

TRACT C

MH-A1, TYPE 1-48
RIM 172.07
FL 163.70 (8"E)
FL 163.80 (8" W)

ROW DED.

CAIN ROAD SE

SURVEY A.F. NO. 935907

195 LF 8" PVC SWR @ 0.01 FT/FT

TRACT "B"

PROPOSED WATERMAIN

PROPOSED GRAVITY SEWER

PROPOSED STREET LIGHT (TYP)

CITY OF OLYMPIA DEED A.F. NO. 3150761

PROPOSED STREET LIGHT (TYP)

263 LF 8" PVC SWR @ 0.01 FT/FT

MH-A5, TYPE 1-48
RIM 178.00
FL 171.11(8" N)

THIS DRAWING DOES NOT REPRESENT A RECORD DOCUMENT, UNLESS CERTIFIED BY HATTON GODAT PANTIER.

ANY ALTERATIONS TO THE DESIGN SHOWN HEREON MUST BE REVIEWED AND APPROVED BY HATTON GODAT PANTIER.

NOTE: THE CONTRACTOR SHALL BE FULLY RESPONSIBLE FOR THE LOCATION AND PROTECTION OF ALL EXISTING UTILITIES. THE CONTRACTOR SHALL VERIFY ALL UTILITY LOCATIONS PRIOR TO CONSTRUCTION BY CALLING THE UNDERGROUND LOCATE LINE AT 811 A MINIMUM OF 48 HOURS PRIOR TO ANY EXCAVATION.

DESIGNED BY: LDT
DRAWN BY: BSM/JW
CHECKED BY: RBW
DATE: MARCH 2019
SCALE: H 1" = 40'
V N/A

ROLAND BLAKE WILKERSON
STATE OF WASHINGTON
44751
REGISTERED
PROFESSIONAL ENGINEER

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OLYMPIA, WA 98506
TEL: 360.943.1599 FAX: 360.357.6299
hattonpantier.com

REVISIONS: DATE:
CITY COMMENTS 11/4/18

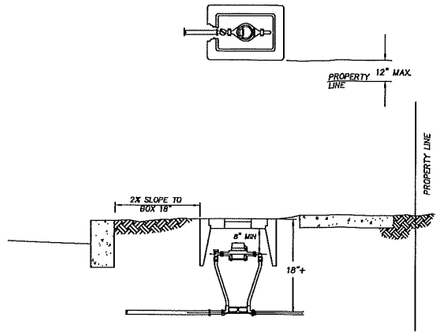
TP# 09940068005

VILLAGE AT CAIN ROAD
2017 22ND AVENUE SE, OLYMPIA, WA 98501

PRELIMINARY UTILITY PLAN

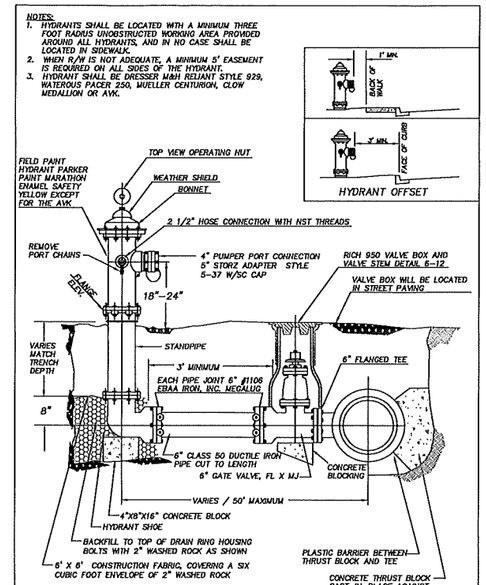
A PORTION OF THE NE & SE 1/4 OF THE SE 1/4 OF SECTION 24, TOWNSHIP 18 NORTH, RANGE 2 WEST, W.M.

AGENCY NO. 18-3178
SHEET: 8 OF 10
E:\dgn\17-000\17-104\Preliminary
INDEX: 17-104 pre-util.dwg
JOB: 17-104

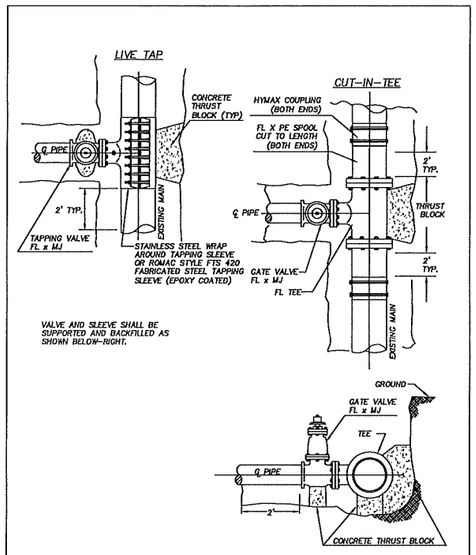


APPROVED BY	REVISED DATE	CITY OF OLYMPIA	STD. DWG. NO.
FRAN R. EIDE, PE CITY ENGINEER	DATE	TYPICAL METER PLACEMENT	6-7

NOTES:
1. HYDRANTS SHALL BE LOCATED WITH A MINIMUM THREE FOOT RADIUS UNOBSTRUCTED WORKING AREA PROVIDED AROUND ALL HYDRANTS, AND IN NO CASE SHALL BE LOCATED IN SIDEWALK.
2. WHEN R/W IS NOT ADEQUATE, A MINIMUM 5' EASEMENT IS REQUIRED ON ALL SIDES OF THE HYDRANT.
3. HYDRANT SHALL BE DRESSER W&H RELIANT STYLE 929, WATEROUS PACER 250, MUELLER CENTURION, CLOW MEDALLION OR AVK.

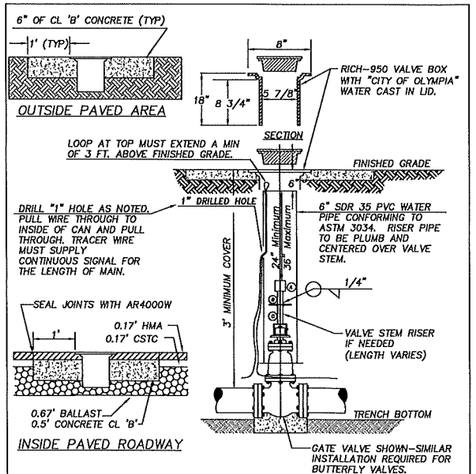


APPROVED BY	REVISED DATE	CITY OF OLYMPIA	STD. DWG. NO.
FRAN R. EIDE, PE CITY ENGINEER	DATE	HYDRANT ASSEMBLY	6-8



NOTES:
1. 11 MIL PLASTIC OR CONSTRUCTION FABRIC SHALL BE WRAPPED AROUND PIPE AND FITTINGS BEFORE THRUST BLOCKS ARE POURED.
2. SUPPORT VALVE AND SLEEVE CONTINUOUSLY THROUGH INSTALLATION.

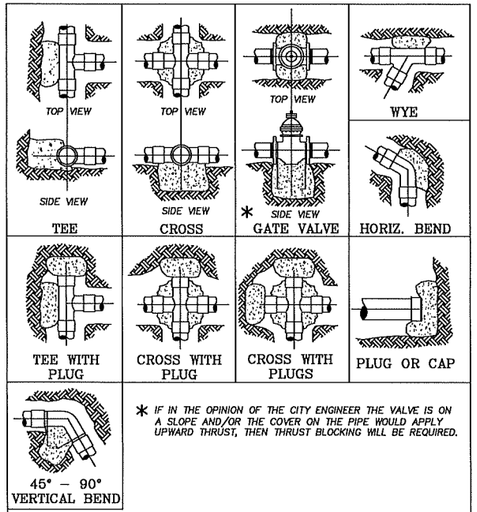
APPROVED BY	REVISED DATE	CITY OF OLYMPIA	STD. DWG. NO.
FRAN R. EIDE, PE CITY ENGINEER	DATE	CONNECTION TO EXISTING MAIN	6-11



VALVE STEM EXTENSION LEGEND
- A. VALVE OPERATING NUT OR 1 7/8" X 1 7/8" X 2" HIGH GRADE STEEL WELDED TO GUIDE PLATE.
- B. 3/16" THICK X 5 1/5" DIA STEEL GUIDE PLATE WELDED TO RISER SHAFT.
- C. 2"x2"x 3/16" SQUARE STRUCTURAL STEEL TUBING TO FIT OPERATING NUT. LENGTH AS REQUIRED.

NOTE:
1. ALL WELDS TO SHAFT SHALL BE FILLET WELD ALL AROUND, AS SPECIFIED ABOVE.

APPROVED BY	REVISED DATE	CITY OF OLYMPIA	STD. DWG. NO.
FRAN R. EIDE, PE CITY ENGINEER	DATE	STANDARD VALVE BOX	6-12



* IF IN THE OPINION OF THE CITY ENGINEER THE VALVE IS ON A SLOPE AND/OR THE COVER ON THE PIPE WOULD APPLY UPWARD THRUST, THEN THRUST BLOCKING WILL BE REQUIRED.

NOTES:
1. CONCRETE THRUST BLOCKING TO BE POURED AGAINST UNDISTURBED EARTH.
2. PLASTIC BARRIER SHALL BE PLACED BETWEEN ALL THRUST BLOCKS & FITTINGS.
3. ANCHOR REBAR SHALL BE #5 ON 12" DIA. AND LESS WITH 30" EMBEDMENT, #5 ON 16"-24" DIAMETER WITH 36" EMBEDMENT.
4. PLUGS TO BE MINIMUM OF 5' FROM TEE, WYE, CROSS ON VALVE.

APPROVED BY	REVISED DATE	CITY OF OLYMPIA	STD. DWG. NO.
FRAN R. EIDE, PE CITY ENGINEER	DATE	STANDARD BLOCKING DETAIL	6-14

THRUST LOADS

THRUST AT FITTINGS IN POUNDS AT 200 POUNDS PER SQUARE INCH OF WATER PRESSURE

PIPE DIAMETER	90° BEND	45° BEND	22-1/2° BEND	11-1/4° BEND	DEAD END OR TEE
4"	3,600	2,000	1,000	500	2,600
6"	8,000	4,400	2,300	1,200	5,700
8"	14,300	7,700	4,000	2,000	10,100
10"	22,300	12,100	6,200	3,100	15,800
12"	32,000	17,400	8,900	4,500	22,700
14"	43,600	23,600	12,100	6,100	30,800
16"	57,000	30,800	15,700	7,900	40,300

NOTES:
1. BLOCKING SHALL BE CEMENT CONCRETE CLASS "B" POURED IN PLACE AGAINST UNDISTURBED EARTH. FITTING SHALL BE ISOLATED FROM CONCRETE THRUST BLOCK WITH PLASTIC OR SIMILAR MATERIAL.
2. TO DETERMINE THE BEARING AREA OF THE THRUST BLOCK IN SQUARE FEET (SF) EXAMPLE:
   12" - 90° BEND IN SAND AND GRAVEL
   32,000 LBS ÷ 3000 LB/SF = 10.7 SF OF AREA
3. AREAS MUST BE ADJUSTED FOR OTHER PIPE SIZE, PRESSURES AND SOIL CONDITIONS.
4. BLOCKING SHALL BE ADEQUATE TO WITHSTAND FULL TEST PRESSURE AS WELL AS TO CONTINUOUSLY WITHSTAND OPERATING PRESSURE UNDER ALL CONDITIONS OF SERVICE.

SAFE SOIL BEARING LOADS

FOR HORIZONTAL THRUSTS WHEN THE DEPTH OF COVER OVER THE PIPE EXCEEDS 2 FEET

SOIL	POUNDS PER SQUARE FOOT
MUCK, PEAT	0
SOFT CLAY	1,000
SAND	2,000
SAND & GRAVEL	3,000
SAND & GRAVEL CEMENTED WITH CLAY	4,000
HARD SHALE	10,000

APPROVED BY	REVISED DATE	CITY OF OLYMPIA	STD. DWG. NO.
FRAN R. EIDE, PE CITY ENGINEER	DATE	THRUST LOADS	6-15

DESIGNED BY: LDT
DRAWN BY: BSM/AW
CHECKED BY: RBW
DATE: MARCH 2019
SCALE: H N/A
V N/A

ROLAND BLAKE WILKERSON
STATE OF WASHINGTON
44751
REGISTERED
PROFESSIONAL ENGINEER

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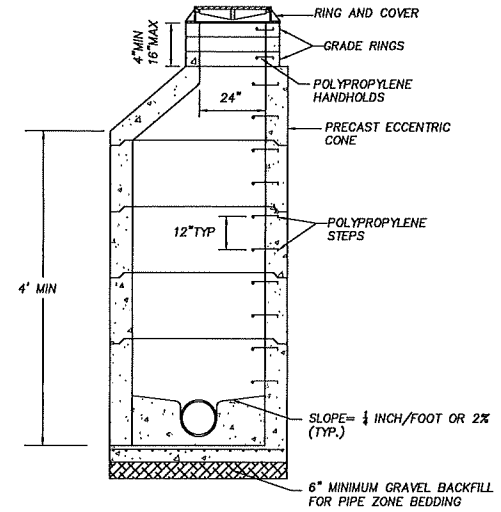
REVISIONS: DATE:
CITY COMMENTS 11/4/18

VILLAGE AT CAIN ROAD
2017 22ND AVENUE SE, OLYMPIA, WA 98501
TP# 09940068005

PRELIMINARY
WATER DETAILS

A PORTION OF THE NE & SE 1/4 OF THE SE 1/4 OF SECTION 24, TOWNSHIP 18 NORTH, RANGE 2 WEST, W.M.

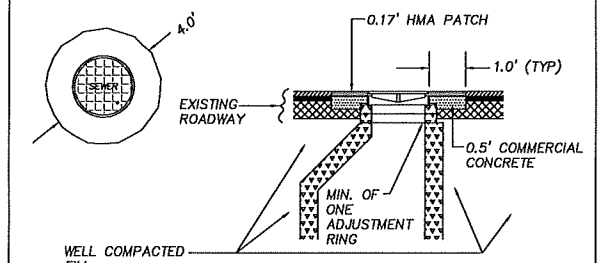
AGENCY NO. 18-3178
SHEET: 9 OF 10
E:\dgn\17-000\17-104\Preliminary
INDEX: 17-104 pre-det.dwg
JOB: 17-104



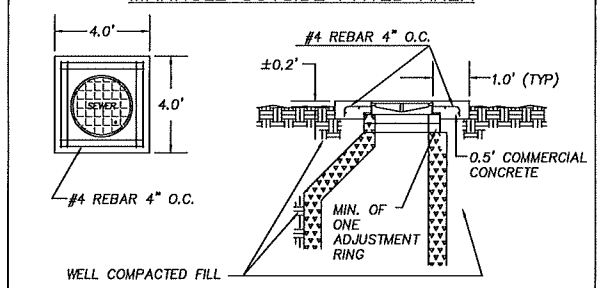
NOTES:
1. THIS DETAIL OUTLINES THE CITY OF OLYMPIA MODIFICATIONS TO THE WSDOT TYPE 1-48 INCH, 54 INCH AND 60 INCH MANHOLE.
2. PRECAST MANHOLES SHALL MEET THE REQUIREMENTS OF ASTM C478. JOINTS SHALL BE RUBBER GASKETED, CONFORMING TO ASTM C443 AND SHALL BE GROUTED FROM THE INSIDE. LIFT HOLES SHALL BE GROUTED FROM THE OUTSIDE AND INSIDE OF THE MANHOLE.
3. THE FIRST STEP OR HANDHOLD SHALL BE A MAXIMUM OF 12 INCHES FROM THE TOP OF THE COVER.
4. CONNECTION TO MANHOLE SHALL BE MADE BY KOR-N-SEAL FITTING ONLY. KOR-N-SEAL SHALL BE INSTALLED ACCORDING TO MANUFACTURERS SPECIFICATIONS. KNOCKOUTS WILL NOT BE ALLOWED.
5. SEE OLYMPIA STANDARD DRAWING 7-3 FOR MANHOLE COLLAR INSTALLATION.
6. A EAST JORDAN WATERTITE CASTING SHALL BE INSTALLED IN ANY MANHOLE SUBJECT TO FLOODING.

APPROVED BY	REVISED DATE	CITY OF OLYMPIA	STD. DWG. NO.
FRAN R. EIDE, PE	DATE	TYPE 1 MANHOLE	7-1
CITY ENGINEER			

MANHOLE IN PAVED AREA

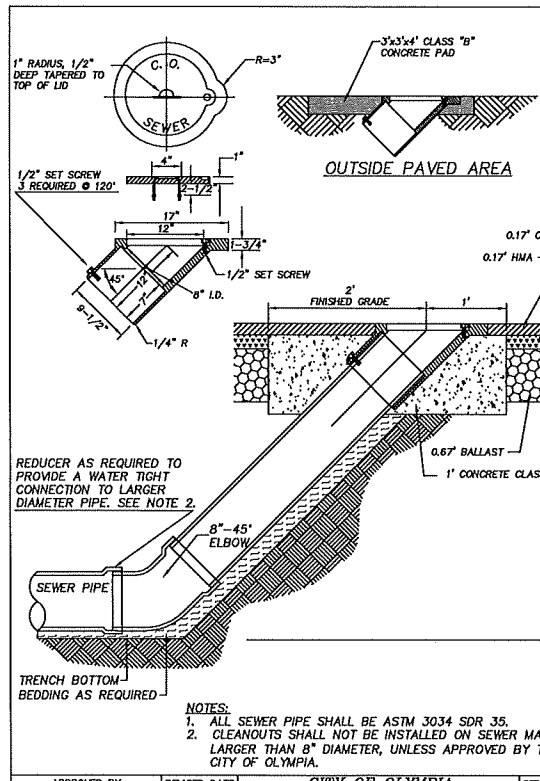


MANHOLE OUTSIDE PAVED AREA



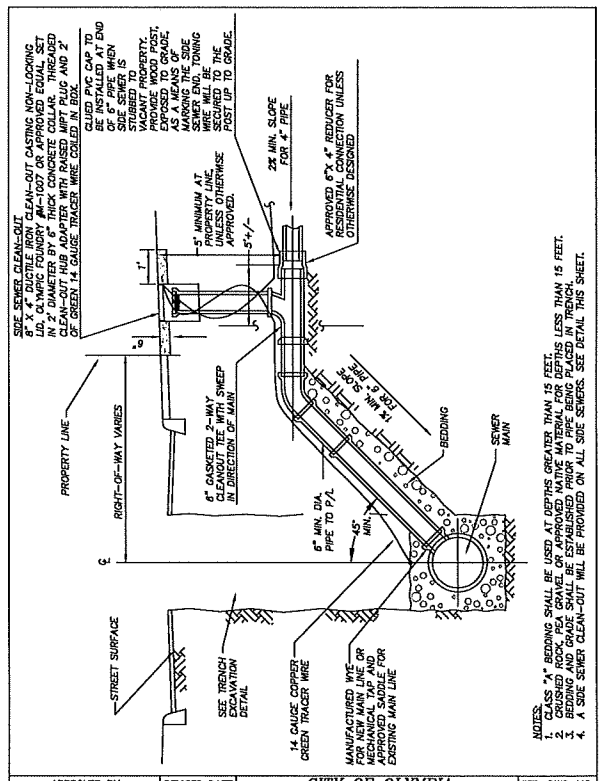
NOTES:
1. ON MANHOLE OUTSIDE ASPHALT, ADD REINFORCING STEEL AS SHOWN ABOVE. DEFORMED BAR TO MEET ASTM A615 GRADE 60, FY=60,000 P.S.I.
2. OPENING IN LID FOR USE OF MANHOLE HOOK IS REQUIRED.

APPROVED BY	REVISED DATE	CITY OF OLYMPIA	STD. DWG. NO.
FRAN R. EIDE, PE	DATE	MANHOLE COLLAR	7-3
CITY ENGINEER			



NOTES:
1. ALL SEWER PIPE SHALL BE ASTM 3034 SDR 35.
2. CLEANOUTS SHALL NOT BE INSTALLED ON SEWER MAINS LARGER THAN 8" DIAMETER, UNLESS APPROVED BY THE CITY OF OLYMPIA.

APPROVED BY	REVISED DATE	CITY OF OLYMPIA	STD. DWG. NO.
FRAN R. EIDE, PE	DATE	CLEANOUT	7-5
CITY ENGINEER			



NOTES:
1. CLASS 2 BEDDING SHALL BE USED AT DEPTHS GREATER THAN 15 FEET.
2. 4" SIDE SEWER MAY BE USED AT DEPTHS LESS THAN 15 FEET.
3. BEDDING AND GRADE SHALL BE ESTABLISHED PRIOR TO PIPE BEING PLACED IN TRENCH.
4. A SIDE SEWER CLEAN-OUT WILL BE PROVIDED ON ALL SIDE SEWERS. SEE DETAIL THIS SHEET.

APPROVED BY	REVISED DATE	CITY OF OLYMPIA	STD. DWG. NO.
FRAN R. EIDE, PE	DATE	SANITARY SEWER SIDE SEWER	7-19
CITY ENGINEER			

TPN 09940068005

DESIGNED BY: LDT
DRAWN BY: BSM/JW
CHECKED BY: RBW
DATE: MARCH 2019
SCALE: H N/A
V N/A

ROLAND BLAKE WILKERSON
STATE OF WASHINGTON
44751
REGISTERED
PROFESSIONAL ENGINEER

HATTON GODAT PANTIER
ENGINEERS AND SURVEYORS
3910 MARTIN WAY E, SUITE B
OLYMPIA, WA 98506
TEL: 360.943.1599 FAX: 360.357.6299
hattonpantier.com

REVISIONS: DATE:
CITY COMMENTS 11/4/18

VILLAGE AT CAIN ROAD
2017 22ND AVENUE SE, OLYMPIA, WA 98501

PRELIMINARY SEWER DETAILS

A PORTION OF THE NE & SE 1/4 OF THE SE 1/4 OF SECTION 24, TOWNSHIP 18 NORTH, RANGE 2 WEST, W.M.

AGENCY NO. 18-3178
SHEET: 10 OF 10
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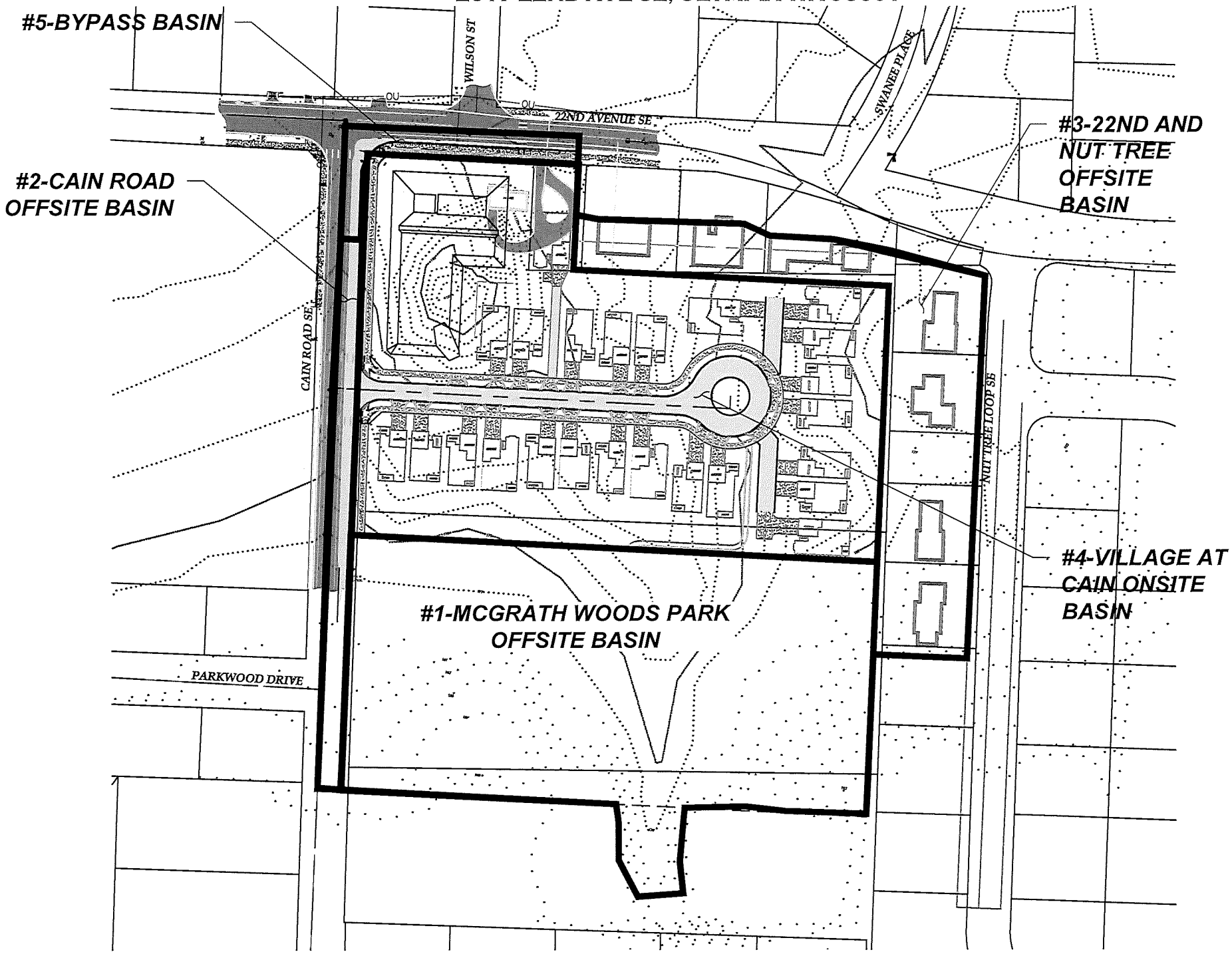
INDEX:17-104 pre-det.dwg
JOB: 17-104

APPENDIX A – Site Development Drawings

VILLAGE AT CAIN ROAD

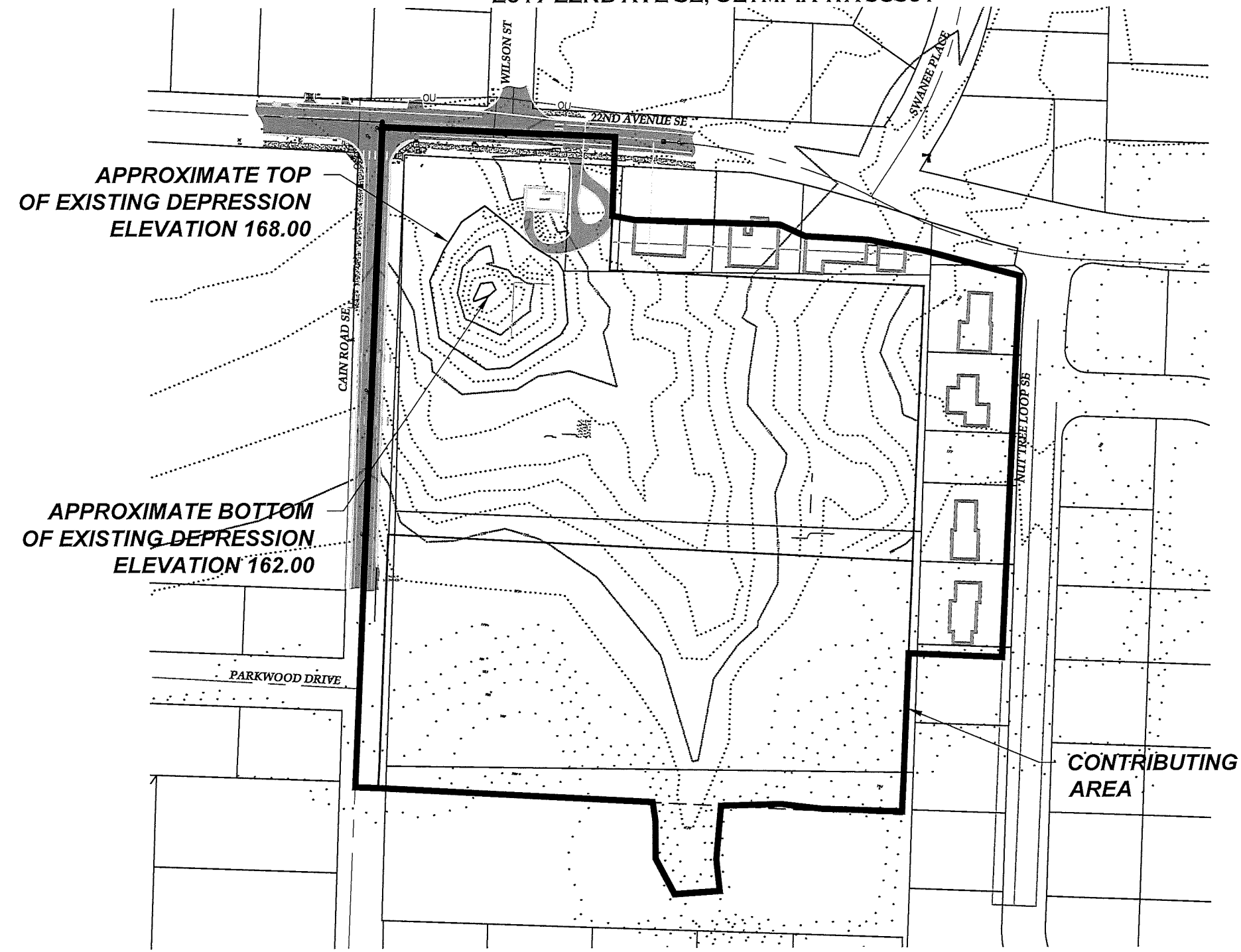
2017 22ND AVE SE, OLYMPIA WA 98501



BASIN MAP

VILLAGE AT CAIN ROAD

2017 22ND AVE SE, OLYMPIA WA 98501



CLOSED DEPRESSION ANALYSIS

APPENDIX B – Soils Report

INSIGHT GEOLOGIC, INC.

April 16, 2018

Evergreen Heights, LLC
1868 State Avenue NE
Olympia, Washington 98506
Attention: Rob Rice

Report
Geotechnical and Stormwater Investigation
Cain Road Subdivision
Cain Road and 22nd Avenue SE
Olympia, Washington
Project No. 608-006-01

INTRODUCTION

Insight Geologic, Inc. is pleased to provide our report regarding our investigation of subsurface conditions at the location of the proposed Cain Road Subdivision located southeast of the intersection between Cain Road SE and 22nd Avenue SE in Olympia, Washington. The location of the property is shown relative to surrounding physical features in the Vicinity Map, Figure 1. The site of the proposed subdivision consists of a single parcel of property comprising approximately 5 acres. The project will include residential homesites as well as paved streets through the development. Stormwater runoff from roads and homes is to be infiltrated to the subsurface in the northwest portion of the site.

We proposed to conduct our stormwater services in general accordance with the guidelines outlined in the City's 2016 Drainage Design and Erosion Control Manual. The guidelines require the investigation of soil conditions in the area of the stormwater ponds to a depth of five times the ponded water depth or approximately 25 feet below existing ground surface in two locations at the stormwater pond. We understand that monitoring wells were previously installed on the site, however, no soil samples were collected for stormwater infiltration analysis.

Our services were performed in general accordance with our proposal dated January 9, 2018 and authorized on January 15, 2018.

SCOPE OF SERVICES

The purpose of our services was to evaluate subsurface conditions as they pertain to stormwater infiltration and geotechnical parameters. We proposed to conduct our stormwater services in general accordance with the guidelines outlined in the City of Olympia's 2016 Drainage Design and Erosion Control Manual (2016 Manual). Our specific scope of services included the following tasks:

Stormwater Investigation

1. Provided for the location of subsurface utilities on the site. We conducted this task by notifying the "One Call" utility locate system.
2. Conducted a site reconnaissance to evaluate and mark proposed boring locations at the site and for truck-mounted drilling rig access.
3. Advanced two (2) borings at the site in the location of the proposed stormwater infiltration pond. The borings were completed at a depth of 25 feet below ground surface (bgs).
4. Maintained logs of the soil encountered in the soil borings. Soils were described in general accordance with the Unified Soil Classification System and presented on the field logs.
5. Monitored the depth to groundwater in the existing monitoring wells on a weekly basis in accordance with the 2016 Manual. Water level measurements will be made to the nearest 0.01 foot.

Geotechnical Investigation

6. Excavated eight (8) shallow, exploratory test pits on the project site using a small, track-mounted excavator. The test pits were excavated to depths of 8 feet bgs.
7. Collected representative soil samples from the test pits for laboratory analysis.
8. Logged the soils exposed in the test pits in general accordance with ASTM D2487-06.
9. Provided for laboratory testing of the soils. We performed gradation analyses to evaluate geotechnical parameters, as well as stormwater infiltration calculations.
10. Prepared a report summarizing our field activities, including our recommendations for site preparation and grading, bearing capacity, seismic class, temporary and final cut slopes, earth pressures, and suitability of the on-site soils for use as fill. Additionally, we have provided design infiltration rates for the stormwater infiltration pond. Please understand that these rates may be adjusted following the completion of our winter groundwater monitoring.

FINDINGS

Surface Conditions

The project site is situated at an elevation of approximately 170 feet above mean sea level (MSL). The site is bounded by residential properties to the north and east, Cain Road to the west, and McGrath Woods Park to the south. The site is currently undeveloped and wooded with Big Leaf Maple, Western Red Cedar and Douglas Fir trees, along with an understory of moderately thick vegetation consisting of sword fern and salal. The site slopes gently down to the northwest with an elevation change of approximately 10 feet.

Geology

Based on our review of available published geologic maps, Vashon age glacial recessional outwash deposits underlie the project site and surrounding area. The outwash material is described as fine to medium sand with few fines. These sediments were deposited in and around the margins of glacial lakes by meltwater streams during the waning stages of the most recent glacial epoch in the Puget

Sound lowlands; the Fraser Stade of the Vashon glaciation. The outwash is typically found in a loose to moderately dense condition and is not glacially consolidated.

Subsurface Explorations

We explored subsurface conditions at the site between March 5 and March 8, 2018 by advancing two boings and excavating eight test pits in the locations as shown on the Site Plan, Figure 2. The test pits were excavated using a track-mounted excavator. The borings were completed with a truck-mounted direct push drill rig. A geologist from Insight Geologic monitored the explorations and maintained a log of the conditions encountered. The test pits were completed to a depth of 8 feet bgs. The borings were completed at a depth of 25 feet bgs. The soils were visually classified in general accordance with the system described in ASTM D2487-06. The exploration logs are contained in Attachment A.

During our exploration activities, we located the three monitoring wells previously installed on-site. These monitoring wells were installed to a depth of 25 feet bgs by American Pump and Electric.

Soil Conditions

Soil conditions encountered were generally variable across the site. Underlying approximately 12 inches of forest duff, we generally encountered between 1.5 to 8 feet of brown silt containing varying quantities of fine sand (ML), in a soft to stiff and moist condition across the site. Underlying this initial silt unit, we encountered brown silty fine to medium sand (SM), in a loose to medium dense and moist condition to the base of the test pits. Underlying these units and encountered within the lower 17 feet of the soil borings, we encountered interbedded sands and silts (SP, ML), in loose to medium dense or soft and wet condition to a depth of 25 feet bgs.

One exception to this description was observed within test pit TP-7 and boring B-1, in which we did not encounter the initial silt layer but encountered silty sand (SM) below the forest duff unit.

The surficial soils encountered are generally consistent with Yelm fine sandy loam, which is mapped for the area. These soils are generally formed from glacial outwash and generally have restrictive layers occurring at depths greater than 7 feet below grade according to the U.S. Department of Agriculture Soil Survey.

Groundwater Conditions

Perched water was encountered within each of the borings completed at the site at a depth of approximately 8 to 9 feet bgs and directly below the upper silt unit. However nearby monitoring wells were dry to a depth of approximately 25 feet bgs.

Laboratory Testing

We selected eight soil samples for gradation analyses in general accordance with ASTM D422 to define soil class, obtain geotechnical parameters and develop stormwater infiltration rates. Our geotechnical laboratory test results are presented in Attachment B.

STORMWATER INFILTRATION

We completed a stormwater infiltration rate evaluation in general accordance with the 2016 City of Olympia Drainage Design and Erosion Control Manual (2016 Manual). The 2016 Manual uses a detailed method that utilizes the relationship between the D_{10}, D_{60}, and D_{90} results of the ASTM grain-size distribution analyses, along with site specific correction factors to estimate long-term design infiltration rates.

Based on our gradation analyses, we estimate that the long-term design infiltration rate (F_{design}) for the proposed stormwater infiltration pond is approximately 0.1 inches per hour, and the stormwater infiltration rates for roof downspouts is 0.2 to 0.01 inches per hour depending on the infiltration location, after applying the appropriate correction factors. Our calculations assume that the stormwater infiltration will occur at a depth of approximately 3 feet bgs. We further assumed that winter groundwater rises to within 8 feet of ground surface or infiltrating stormwater otherwise encounters an impermeable silt unit at that depth.

Table 1. Design Infiltration Rates – Detailed Method

Exploration	Unit	Depth Range (feet)	D_{10} Value	D_{60} Value	D_{90} Value	Long Term Design Infiltration Rate (Inches per hour)
B-1	SM	2.0 – 7.0	0.0	0.12	0.21	0.1
B-2	ML	3.0 – 7.0	0.0	0.0	0.14	0.01
TP-2	ML	2.0 – 8.0	0.0	0.0	0.2	0.01
TP-4	SM	5.0 – 8.0	0.0	0.22	0.36	0.1
TP-5	ML	1.0 – 3.5	0.0	0.08	0.40	0.05
TP-7	SM	1.0 – 3.5	0.0	0.19	2.8	0.2
TP-8	SM	3.0 – 5.0	0.0	0.11	0.19	0.1

SEISMIC DESIGN CONSIDERATIONS

General

We understand that seismic design will likely be performed using the 2015 IBC standards. The following parameters may be used in computing seismic base shear forces:

Table 2. 2015 IBC Seismic Design Parameters

Spectral Response Accel. at Short Periods (SS) = 1.32
Spectral Response Accel. at 1 Second Periods (S1) = 0.54
Site Class = D
Site Coefficient (FA) = 1.0
Site Coefficient (FV) = 1.5

A full report for the seismic design parameters is presented in Attachment C.

Ground Rupture

Because of the location of the site with respect to the nearest known active crustal faults, and the presence of a relatively thick layer of glacial outwash deposits, it is our opinion that the risk of ground rupture at the site due to surface faulting is low.

Soil Liquefaction

Liquefaction refers to a condition where vibration or shaking of the ground, usually from earthquake forces, results in the development of excess pore water pressures in saturated soils, and a subsequent loss of stiffness in the soil occurs. Liquefaction also causes a temporary reduction of soil shear strength and bearing capacity, which can cause settlement of the ground surface above the liquefied soil layers. In general, soils that are most susceptible to liquefaction include saturated, loose to medium dense, clean to silty sands and non-plastic silts within 50 feet of ground surface.

Based on our review of the *Liquefaction Susceptibility Map of Thurston County (Palmer, 2004)*, the project site is identified to have a low to moderate potential risk for soil liquefaction. Based on our experience with detailed seismic studies in the Olympia area, including areas that are mapped within the same recessional outwash soil deposits as the project site, we concur with the reviewed map. It is our opinion that there is a moderate risk for soil liquefaction at the site based on site soils as well as the relatively high groundwater. Additional investigation and evaluation would be needed to further define this risk.

Seismic Compression

Seismic compression is defined as the accrual of contractive volumetric strains in unsaturated soils during strong shaking from earthquakes (Stewart et al., 2004). Loose to medium dense clean sands and non-plastic silts are particularly prone to seismic compression settlement. Seismic compression settlement is most prevalent on slopes, but it can also occur on flat ground. It is our opinion that the upper 8 feet of the soil profile at the site has a moderate risk for seismic compression settlement.

Seismic Settlement Discussion

Based on the materials encountered in our explorations, it is our preliminary opinion that seismic settlements (liquefaction-induced plus seismic compression) could potentially total a few inches at the site as the result of an IBC design level earthquake. We are available upon request to perform deep subsurface explorations and detailed seismic settlement estimates during the design phase.

Seismic Slope Instability

The maximum inclination of the site is generally less than 15 percent and we did not observe signs of slope instability during our site work. In our opinion, there is a low risk of seismic slope instability at the project site under current conditions.

Lateral Spreading

Lateral spreading involves the lateral displacement of surficial blocks of non-liquefied soil when an underlying soil layer liquefies. Lateral spreading generally develops in areas where sloping ground or large grade changes are present. Based on our understanding of the subsurface conditions, it is our

opinion that there is a low risk for the development of lateral spreading as a result of an IBC design level earthquake.

CONCLUSIONS AND RECOMMENDATIONS

General

Based on the results of our review, subsurface explorations and engineering analyses, it is our opinion that the proposed development is feasible from a geotechnical standpoint. We recommend that the proposed structures be supported on shallow concrete foundations that are designed using an allowable soil bearing capacity of 1,500 pounds per square foot (psf) for the upper silt soils at the site. If higher loads are anticipated, small diameter pilings, or a robust structural fill section may be used to increase the bearing strength of the soils beneath the buildings.

The soils encountered in our explorations are typically in a soft condition near ground surface. To limit the potential for structure settlement, we recommend that shallow foundations and slabs-on-grade be established on a minimum 1-foot thick layer of structural fill. It is our recommendation that the on-site silt soils should not be used as structural fill. It will likely be difficult or impossible to compact this material without significant effort to reduce the moisture content.

Stormwater infiltration at the site is marginally feasible at the currently planned stormwater pond location. We have calculated a design infiltration rate of 0.1 inches per hour for the area of the proposed stormwater infiltration pond based on the high groundwater encountered and the silty fine sand soils. Additionally, a rate of 0.1 inches per hour may be used for roof downspout infiltration for the homes.

Earthwork

General

We anticipate that site development earthwork will include clearing and stripping of existing vegetation, preparing subgrades, excavating for utility trenches, and placing and compacting structural fill. We expect that the majority of site grading can be accomplished with conventional earthmoving equipment in proper working order.

Our explorations did not encounter appreciable amounts of debris or unsuitable soils associated with past site development. Still, it is possible that concrete slabs, abandoned utility lines or other development features from previous or existing onsite development could be encountered during construction. The contractor should be prepared to deal with these conditions during site grading activities.

Clearing and Stripping

Clearing and stripping should consist of removing surface and subsurface deleterious materials including sod/topsoil, trees, brush, debris and other unsuitable loose/soft or organic materials. Stripping and clearing should extend at least 5 feet beyond all structures and areas to receive structural fill.

We estimate that a stripping depth of about 12 inches will be required to remove the vegetation encountered in our explorations. Deeper stripping depths may be required if additional unsuitable soils are exposed during stripping operations.

Subgrade Preparation

After stripping and excavating to the proposed subgrade elevation, and before placing structural fill or foundation concrete, the exposed subgrade should be thoroughly compacted to a firm and unyielding condition. The exposed subgrade should then be proof-rolled using loaded, rubber-tired heavy equipment. We recommend that Insight Geologic be retained to observe the proof-rolling prior to placement of structural fill or foundation concrete. Areas of limited access that cannot be proof-rolled can be evaluated using a steel probe rod. If soft or otherwise unsuitable areas are revealed during proof-rolling or probing, that cannot be compacted to a stable and uniformly firm condition, we generally recommend that: 1) the subgrade soils be scarified (e.g., with a ripper or farmer's disc), aerated and recompacted; or 2) the unsuitable soils be over-excavated and replaced with structural fill.

Temporary Excavations and Groundwater Handling

Excavations deeper than 4 feet should be shored or laid back at a stable slope if workers are required to enter. Shoring and temporary slope inclinations must conform to the provisions of Title 296 Washington Administrative Code (WAC), Part N, "Excavation, Trenching and Shoring." Regardless of the soil type encountered in the excavation, shoring, trench boxes or sloped sidewalls were required under the Washington Industrial Safety and Health Act (WISHA). The contract documents should specify that the contractor is responsible for selecting excavation and dewatering methods, monitoring the excavations for safety and providing shoring, as required, to protect personnel and structures.

In general, temporary cut slopes should be inclined no steeper than about 1.5H:1V (horizontal: vertical). This guideline assumes that all surface loads are kept at a minimum distance of at least one-half the depth of the cut away from the top of the slope, and that significant seepage is not present on the slope face. Flatter cut slopes were necessary where significant seepage occurs or if large voids are created during excavation. Some sloughing and raveling of cut slopes should be expected. Temporary covering with heavy plastic sheeting should be used to protect slopes during periods of wet weather.

We anticipate that if perched groundwater is encountered during construction it can be handled adequately with sumps, pumps, and/or diversion ditches. Groundwater handling needs will generally be lower during the late summer and early fall months. We recommend that the contractor performing the work be made responsible for controlling and collecting groundwater encountered during construction.

Permanent Slopes

Permanent slopes will only be utilized for the proposed project within the stormwater infiltration pond. If additional permanent slopes are necessary, we recommend the slopes be constructed at a maximum inclination of 2H:1V. Where 2H:1V permanent slopes are not feasible, protective facings and/or retaining structures should be considered.

To achieve uniform compaction, we recommend that fill slopes be overbuilt and subsequently cut back to expose well-compacted fill. Fill placement on slopes should be benched into the slope face and include keyways. The configuration of the bench and keyway depends on the equipment being used.

Bench excavations should be level and extend into the slope face. We recommend that a vertical cut of about 3 feet be maintained for benched excavations. Keyways should be about 1-1/2 times the width of the equipment used for grading or compaction.

Erosion Control

We anticipate that erosion control measures such as silt fences, straw bales and sand bags will generally be adequate during development. Temporary erosion control should be provided during construction activities and until permanent erosion control measures are functional. Surface water runoff should be properly contained and channeled using drainage ditches, berms, swales, and tightlines, and should not discharge onto sloped areas. Any disturbed sloped areas should be protected with a temporary covering until new vegetation can take effect. Jute or coconut fiber matting, excelsior matting or clear plastic sheeting is suitable for this purpose. Graded or disturbed slopes should be tracked in-place with the equipment running perpendicular to the slope contours so that the track marks provide a texture to help resist erosion. Ultimately, erosion control measures should be in accordance with local regulations and should be clearly described on project plans.

Wet Weather Earthwork

The majority of the near surface soils contain up to about 56 percent fines. When the moisture content of the soil is more than a few percent above the optimum moisture content, the soil will become unstable and it may become difficult or impossible to meet the required compaction criteria. Disturbance of near surface soils should be expected if earthwork is completed during periods of wet weather.

The wet weather season in this area generally begins in October and continues through May. However, periods of wet weather may occur during any month of the year. If wet weather earthwork is unavoidable, we recommend that:

- The ground surface is sloped so that surface water is collected and directed away from the work area to an approved collection/dispersion point.
- Earthwork activities not take place during periods of heavy precipitation.
- Slopes with exposed soil be covered with plastic sheeting or otherwise protected from erosion.
- Measures are taken to prevent on-site soil and soil stockpiles from becoming wet or unstable. Sealing the surficial soil by rolling with a smooth-drum roller prior to periods of precipitation should reduce the extent that the soil becomes wet or unstable.
- Construction traffic is restricted to specific areas of the site, preferably areas that are surfaced with materials not susceptible to wet weather disturbance.
- A minimum 1-foot thick layer of 4- to 6-inch quarry spalls is used in high traffic areas of the site to protect the subgrade soil from disturbance.

- Contingencies are included in the project schedule and budget to allow for the above elements.

Structural Fill Materials

General

Material used for structural fill should be free of debris, organic material and rock fragments larger than 3 inches. The workability of material for use as structural fill will depend on the gradation and moisture content of the soil. As the amount of fines increases, soil becomes increasingly more sensitive to small changes in moisture content and adequate compaction becomes more difficult or impossible to achieve.

On-Site Soil

We anticipate that the majority of the on-site soils encountered during construction will consist of the silty sand and sandy silt located at or near the surface of the site. It is our opinion that the granular silty sand material is a suitable source for structural fill during a limited portion of the year. However, we anticipate that thin lifts (6-inches thick or less) will likely be needed to obtain structural fill compaction specifications. Proper moisture conditioning will be critical for reuse of these soils. On-site materials used as structural fill should be free of roots, organic matter and other deleterious materials and particles larger than 3 inches in diameter. It is our opinion that silts encountered at the site is **not** a suitable source for structural fill during a significant portion of the year. It will likely be difficult or impossible to compact this material without significant effort to reduce the moisture content. It is our opinion that the silts encountered during excavation and grading should be wasted and hauled off-site, as it is not reusable as structural fill.

Select Granular Fill

Select granular fill should consist of imported, well-graded sand and gravel or crushed rock with a maximum particle size of 3 inches and less than 5 percent passing a U.S. Standard No. 200 sieve based on the minus ¾-inch fraction. Organic matter, debris or other deleterious material should not be present. In our experience, "gravel borrow" as described in Section 9-03.14(1) of the 2018 WSDOT Standard Specifications is typically a suitable source for select granular fill during periods of wet weather, provided that the percent passing a U.S. Standard No. 200 sieve is less than 5 percent based on the minus ¾-inch fraction.

Structural Fill Placement and Compaction

General

Structural fill should be placed on an approved subgrade that consists of uniformly firm and unyielding inorganic native soils or compacted structural fill. Structural fill should be compacted at a moisture content near optimum. The optimum moisture content varies with the soil gradation and should be evaluated during construction.

Structural fill should be placed in uniform, horizontal lifts and uniformly densified with vibratory compaction equipment. The maximum lift thickness will vary depending on the material and compaction equipment used, but should generally not exceed the loose thicknesses provided on Table

3. Structural fill materials should be compacted in accordance with the compaction criteria provided in Table 4.

Table 3. Recommended Uncompacted Lift Thickness

Compaction Equipment	Recommended Uncompacted Fill Thickness (inches)	
	Granular Materials Maximum Particle Size ≤ 1 1/2 inch	Granular Materials Maximum Particle Size > 1 1/2 inch
Hand Tools (Plate Compactors and Jumping Jacks)	4 – 8	Not Recommended
Rubber-tire Equipment	10 – 12	6 – 8
Light Roller	10 – 12	8 – 10
Heavy Roller	12 – 18	12 – 16
Hoe Pack Equipment	18 – 24	12 – 16

Note: The above table is intended to serve as a guideline and should not be included in the project specifications.

Table 4. Recommended Compaction Criteria in Structural Fill Zones

Fill Type	Percent Maximum Dry Density Determined by ASTM Test Method D 1557 at ±3% of Optimum Moisture		
	0 to 2 Feet Below Subgrade	> 2 Feet Below Subgrade	Pipe Zone
Imported or On-site Granular, Maximum Particle Size < 1-1/4-inch	95	95	-----
Imported or On-site Granular, Maximum Particle Size >1-1/4-inch	N/A (Proof-roll)	N/A (Proof-roll)	-----
Trench Backfill[1]	95	92	90

Note: [1]Trench backfill above the pipe zone in nonstructural areas should be compacted to at least 85 percent.

Shallow Foundation Support

General

We recommend that proposed structures be founded on continuous wall or isolated column footings, bearing on a minimum 1-foot thick over-excavation and replacement with compacted structural fill. The structural fill zone should extend to a horizontal distance equal to the over-excavation depth on each side of the footing. The actual over-excavation depth will vary, depending on the conditions encountered.

We recommend that an experienced geotechnical owner-representative observe the foundation surfaces before over-excavation, and before placing structural fill in over-excavations. This representative should confirm that adequate bearing surfaces have been prepared and that the soil conditions are as anticipated. Unsuitable foundation bearing soils should be recompacted or removed and replaced with compacted structural fill, as recommended by the geotechnical engineer.

Bearing Capacity and Footing Dimensions

Due to the variable nature of the site and the unknown grading requirements and footing depths, we recommend an allowable soil bearing pressure of 1,500 psf for shallow foundations that are supported as recommended. This allowable bearing pressure applies to long-term dead and live loads exclusive of the weight of the footing and any overlying backfill. The allowable soil bearing pressure can be increased by one-third when considering total loads, including transient loads such as those induced by wind and seismic forces.

We recommend a minimum width of 18 inches for continuous wall footings and 2 feet for isolated column footings. For settlement considerations, we have assumed a maximum width of 4 feet for continuous wall footings and 6 feet for isolated column footings.

Perimeter footings should be embedded at least 12 inches below the lowest adjacent grade where the ground is flat. Interior footings should be embedded a minimum of 6 inches below the nearest adjacent grade.

Settlement

We estimate that total settlement of footings that are designed and constructed as recommended should be less than 1 inch. We estimate that differential settlements should be ½ inch or less between comparably loaded isolated footings or along 50 feet of continuous footing. We anticipate that the settlement will occur essentially as loads are applied during construction.

Lateral Load Resistance

Lateral loads on shallow foundation elements may be resisted by passive resistance on the sides of footings and by friction on the base of footings. Passive resistance may be estimated using an equivalent fluid density of 300 pounds per cubic foot (pcf), assuming that the footings are backfilled with structural fill. Frictional resistance may be estimated using 0.25 for the coefficient of base friction.

The lateral resistance values provided above incorporate a factor of safety of 1.5. The passive earth pressure and friction components can be combined, provided that the passive component does not exceed two-thirds of the total. The top foot of soil should be neglected when calculating passive resistance, unless the foundation perimeter area is covered by a slab-on-grade or pavement.

Slabs-On-Grade

Slabs-on-grade should be established on a minimum 1-foot thick section of structural fill extending to an approved bearing surface. A modulus of vertical subgrade reaction (subgrade modulus) can be used to design slabs-on-grade. The subgrade modulus varies based on the dimensions of the slab and the magnitude of applied loads on the slab surface; slabs with larger dimensions and loads are influenced by soils to a greater depth. We recommend a modulus value of 150 pounds per cubic inch (pci) for design of on-grade floor slabs with floor loads up to 500 psf. We are available to provide alternate subgrade modulus recommendations during design, based on specific loading information.

We recommend that slabs-on-grade in interior spaces be underlain by a minimum 4-inch thick capillary break layer to reduce the potential for moisture migration into the slab. The capillary break material

should consist of a well-graded sand and gravel or crushed rock containing less than 5 percent fines based on the fraction passing the ¾-inch sieve. The 4-inch thick capillary break layer can be included when calculating the minimum 1-foot thick structural fill section beneath the slab.

If dry slabs are required (e.g., where adhesives are used to anchor carpet or tile to the slab), a waterproofing liner should be placed below the slab to act as a vapor barrier.

Subsurface Drainage

Based on the high silt content of a majority of the near surface soils it is our opinion that foundation footing drains are likely necessary for the proposed structures. The site soils consist of silts and silty sands, which is generally poorly draining. Footing drains should be routed to existing on-site or planned storm drainage.

Conventional Retaining Walls

General

The following sections provide general guidelines for retaining wall design on this site. We should be contacted during the design phase to review retaining wall plans and provide supplemental recommendations, if needed.

Drainage

Positive drainage is imperative behind any retaining structure. This can be accomplished by using a zone of free-draining material behind the wall with perforated pipes to collect water seepage. The drainage material should consist of coarse sand and gravel containing less than 5 percent fines based on the fraction of material passing the 3/4-inch sieve. The wall drainage zone should extend horizontally at least 12 inches from the back of the wall. If a stacked block wall is constructed, we recommend that a barrier such as a non-woven geotextile filter fabric be placed against the back of the wall to prevent loss of the drainage material through the wall joints.

A perforated smooth-walled rigid PVC pipe, having a minimum diameter of 4 inches, should be placed at the bottom of the drainage zone along the entire length of the wall. Drainpipes should discharge to a tightline leading to an appropriate collection and disposal system. An adequate number of cleanouts should be incorporated into the design of the drains in order to provide access for regular maintenance. Roof downspouts, perimeter drains or other types of drainage systems should not be connected to retaining wall drain systems.

Design Parameters

We recommend an active lateral earth pressure of 39 pcf for a level backfill condition. This assumes that the top of the wall is not structurally restrained and is free to rotate. For restrained walls that are fixed against rotation (at-rest condition), an equivalent fluid density of 55 pcf can be used for the level backfill condition. For seismic conditions, we recommend a uniform lateral pressure of 14H psf (where H is the height of the wall) be added to the lateral pressures. This seismic pressure assumes a peak ground acceleration of 0.32 g. Note that if the retaining system is designed as a braced system but is

expected to yield a small amount during a seismic event, the active earth pressure condition may be assumed and combined with the seismic surcharge.

The recommended earth pressure values do not include the effects of surcharges from surface loads or structures. If vehicles will be operated within one-half the height of the wall, a traffic surcharge should be added to the wall pressure. The traffic surcharge can be approximated by the equivalent weight of an additional 2 feet of backfill behind the wall. Other surcharge loads, such as construction equipment, staging areas and stockpiled fill, should be considered on a case-by-case basis.

DOCUMENT REVIEW AND CONSTRUCTION OBSERVATION

We recommend that we be retained to review the portions of the plans and specifications that pertain to earthwork construction and stormwater infiltration. We recommend that monitoring, testing and consultation be performed during construction to confirm that the conditions encountered are consistent with our explorations and our stated design assumptions. Insight Geologic would be pleased to provide these services upon request.

REFERENCES

City of Olympia, Drainage Design and Erosion Control Manual, 2016.

International Code Council, "International Building Code", 2015.

Seismic Compression of As-compacted Fill Soils with Variable Levels of Fines Content and Fines Plasticity, Department of Civil and Environmental Engineering, University of California, Los Angeles, July 2004.

Washington State Department of Transportation (WSDOT), Standard Specifications for Road, Bridge and Municipal Construction Manual, 2018.

LIMITATIONS

We have prepared this geotechnical and stormwater investigation report for the exclusive use of Evergreen Heights, LLC and their authorized agents for the proposed Cain Road Subdivision to be located at Cain Road and 22nd Avenue SE in Olympia, Washington.

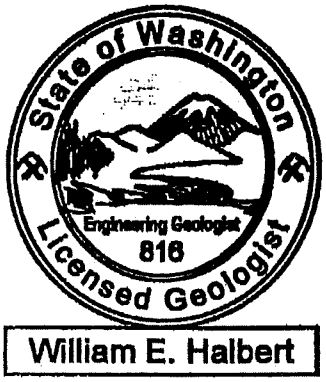
Within the limitations of scope, schedule and budget, our services have been executed in accordance with generally accepted practices in the field of geotechnical engineering in this area at the time this report was prepared. No warranty or other conditions, expressed or implied, should be understood.

Please refer to Attachment D titled "Report Limitations and Guidelines for Use" for additional information pertaining to use of this report.

We appreciate the opportunity to be of service to you on this project. Please contact us if you have questions or require additional information.

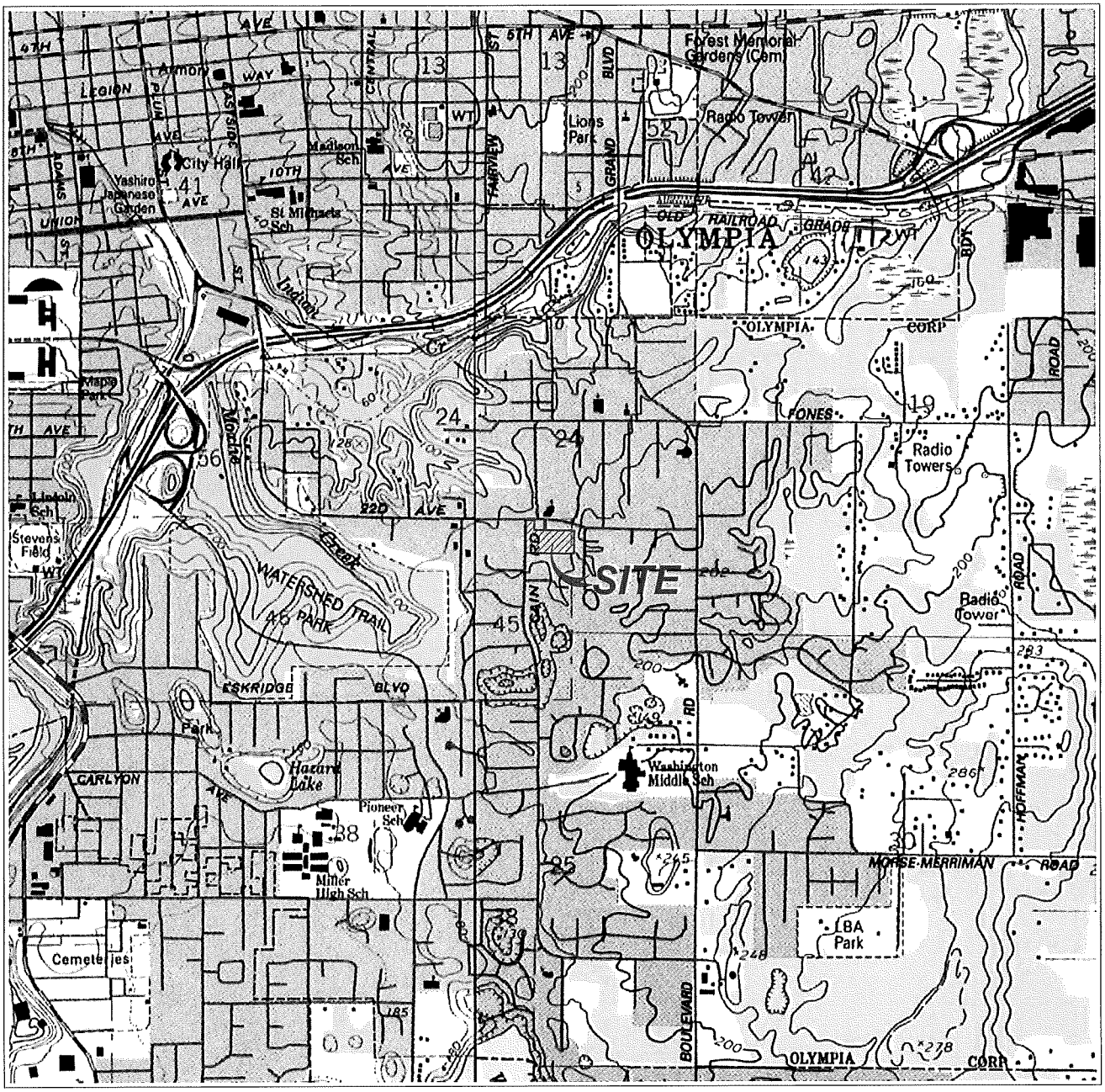
Respectfully Submitted,
INSIGHT GEOLOGIC, INC.

William E. Halbert, L.E.G., L.HG.
Principal



Attachments

FIGURES



LACEY, WASHINGTON
7.5 MINUTE QUADRANGLE
Year 1994

SCALE: 1: 24000

EVERGREEN HEIGHTS
CAIN ROAD SUBDIVISION

OLYMPIA, WASHINGTON

INSIGHT GEOLOGIC, INC.

Figure 1
Vicinity Map

LEGEND:

⊕ **B-1**	APPROXIMATE BORING LOCATION
◒ **TP-1**	APPROXIMATE TEST PIT LOCATION
⊕ **MW-1**	APPROXIMATE MONITORING WELL LOCATION
———	APPROXIMATE PROJECT BOUNDARY

SCALE: 1" = 100'

EVERGREEN HEIGHTS
CAIN ROAD SUBDIVISION

OLYMPIA, WASHINGTON

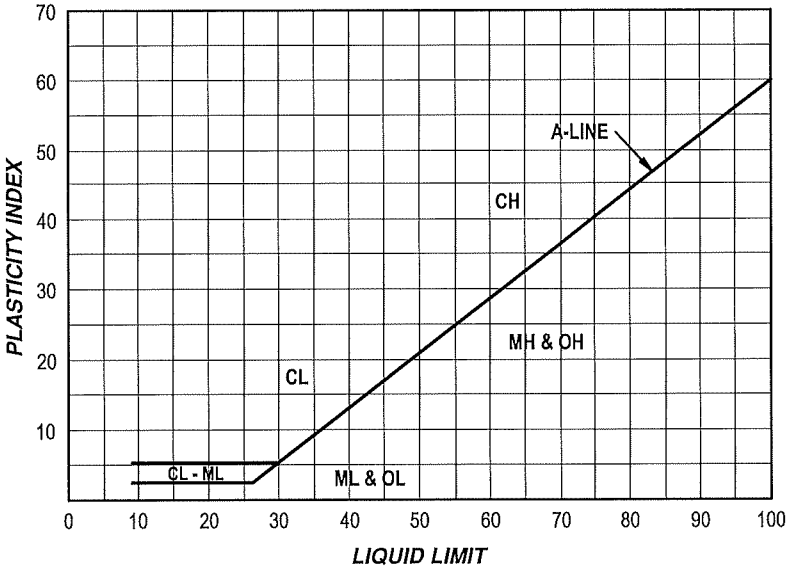
INSIGHT GEOLOGIC, INC.

Figure 2
Site Plan

ATTACHMENT A
EXPLORATION LOGS

SOIL CLASSIFICATION CHART

MAJOR DIVISIONS			SYMBOLS		GROUP NAME
COARSE GRAINED SOILS MORE THAN 50% RETAINED ON NO. 200 SIEVE	GRAVEL AND GRAVELLY SOILS MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	CLEAN GRAVEL <5% FINES		GW	WELL-GRADED GRAVEL, FINE TO COARSE GRAVEL
				GP	POORLY GRADED GRAVEL
		GRAVEL WITH FINES >12% FINES		GM	SILTY GRAVEL
				GC	CLAYEY GRAVEL
	SAND AND SANDY SOILS MORE THAN 50% OF COARSE FRACTION PASSING NO. 4 SIEVE	CLEAN SAND <5% FINES		SW	WELL-GRADED SAND, FINE TO COARSE SAND
				SP	POORLY GRADED SAND
		SAND WITH FINES >12% FINES		SM	SILTY SAND
				SC	CLAYEY SAND
FINE GRAINED SOILS MORE THAN 50% PASSING NO. 200 SIEVE	SILTS AND CLAYS LIQUID LIMIT LESS THAN 50	INORGANIC		ML	SILT
				CL	CLAY
		ORGANIC		OL	ORGANIC SILT, ORGANIC CLAY
	SILTS AND CLAYS LIQUID LIMIT 50 OR MORE	INORGANIC		MH	SILT OF HIGH PLASTICITY, ELASTIC SILT
				CH	CLAY OF HIGH PLASTICITY, FAT CLAY
		ORGANIC		OH	ORGANIC CLAY, ORGANIC SILT
HIGHLY ORGANIC SOILS				PT	PEAT



SOIL MOISTURE MODIFIERS:
DRY - ABSENCE OF MOISTURE, DUSTY, DRY TO THE TOUCH
MOIST - DAMP, BUT NO VISIBLE WATER
WET - VISIBLE FREE WATER OR SATURATED, USUALLY SOIL IS OBTAINED BELOW WATER TABLE

ADDITIONAL MATERIAL SYMBOLS

SYMBOLS		TYPICAL DESCRIPTION
	CC	CEMENT CONCRETE
	AC	ASPHALT CONCRETE
	CR	CRUSHED ROCK / QUARRY SPALLS
	TS	TOPSOIL/SOD/DUFF

GROUNDWATER EXPLORATION SYMBOLS

- MEASURED GROUNDWATER LEVEL IN EXPLORATION, WELL, OR PIEZOMETER
- GROUNDWATER OBSERVED AT TIME OF EXPLORATION
- PERCHED WATER OBSERVED AT TIME OF EXPLORATION
- MEASURED FREE PRODUCT IN WELL OR PIEZOMETER

STRATIGRAPHIC CONTACT

- APPROXIMATE CONTACT BETWEEN SOIL STRATA OR GEOLOGIC UNIT
- APPROXIMATE LOCATION OF SOIL STRATA CHANGE WITHIN GEOLOGIC SOIL UNIT
- APPROXIMATE GRADUAL CHANGE BETWEEN SOIL STRATA OR GEOLOGIC SOIL UNIT
- APPROXIMATE GRADUAL CHANGE OF SOIL STRATA WITHIN GEOLOGIC SOIL UNIT

LABORATORY / FIELD TEST CLASSIFICATIONS

%F PERECENT FINES
AL ATTERBERG LIMITS
CA CHEMICAL ANALYSIS
CP LABORATORY COMPACTION TEST
CS CONSOLIDATION TEST
DS DIRECT SHEAR
HA HYDROMETER ANALYSIS
MC MOISTURE CONTENT
MD MOISTURE CONTENT AND DRY DENSITY
OC ORGANIC COMPOUND
PM PERMEABILITY OR HYDRAULIC CONDUCTIVITY
PP POCKET PENETROMETER
SA SIEVE ANALYSIS
TX TRIAXIAL COMPRESSION
UC UNCONFINED COMPRESSION
VS VANE SHEAR

SAMPLER SYMBOLS

- 2.4 INCH I.D. SPLIT BARREL
- DIRECT-PUSH
- STANDARD PENETRATION TEST
- SHELBY TUBE
- PISTON
- BULK OR GRAB

SHEEN CLASSIFICATIONS

NS NO VISIBLE SHEEN
SS SLIGHT SHEEN
MS MODERATE SHEEN
HS HEAVY SHEEN
NT NOT TESTED

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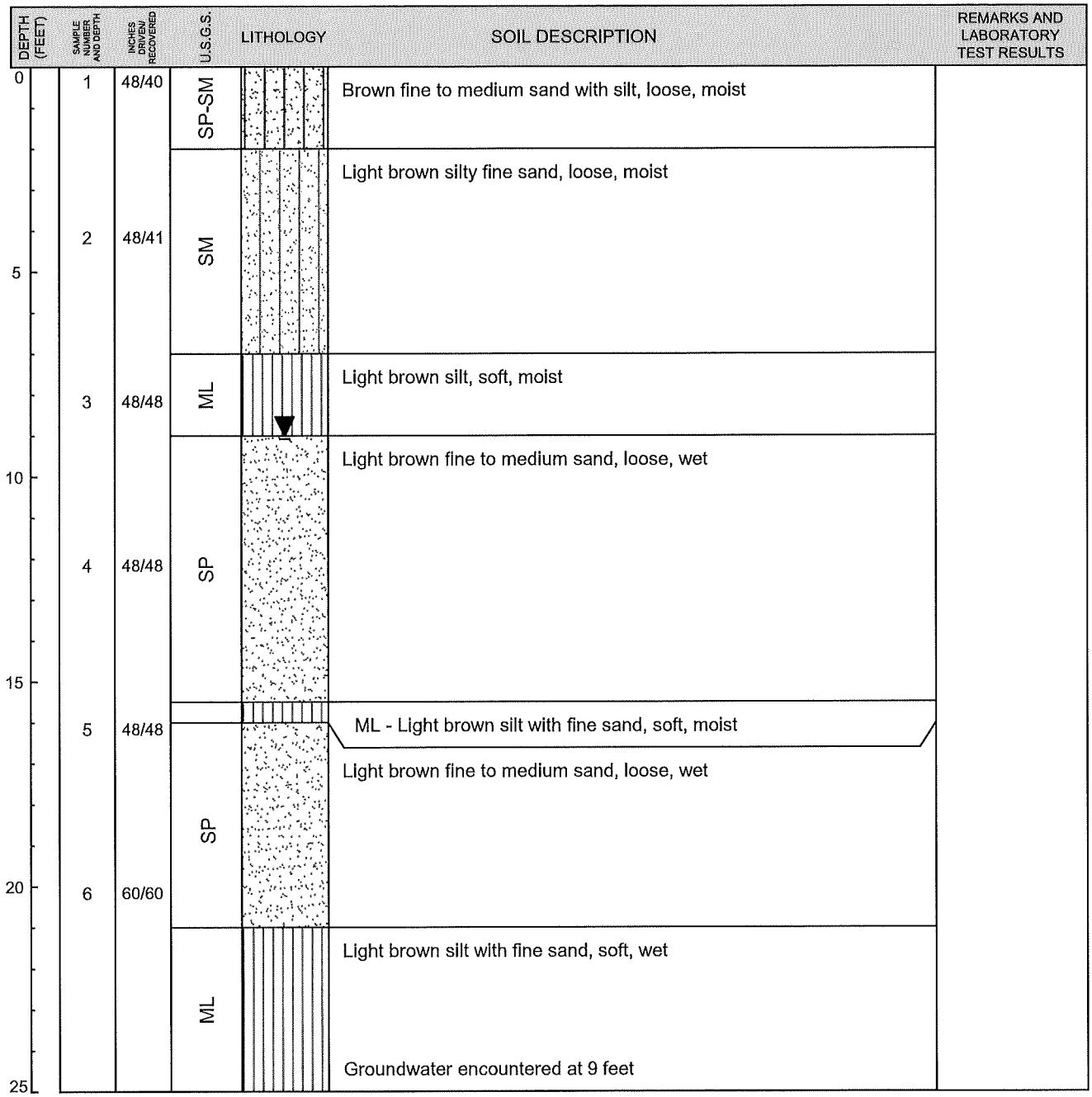
Key to Exploration Logs

B-1



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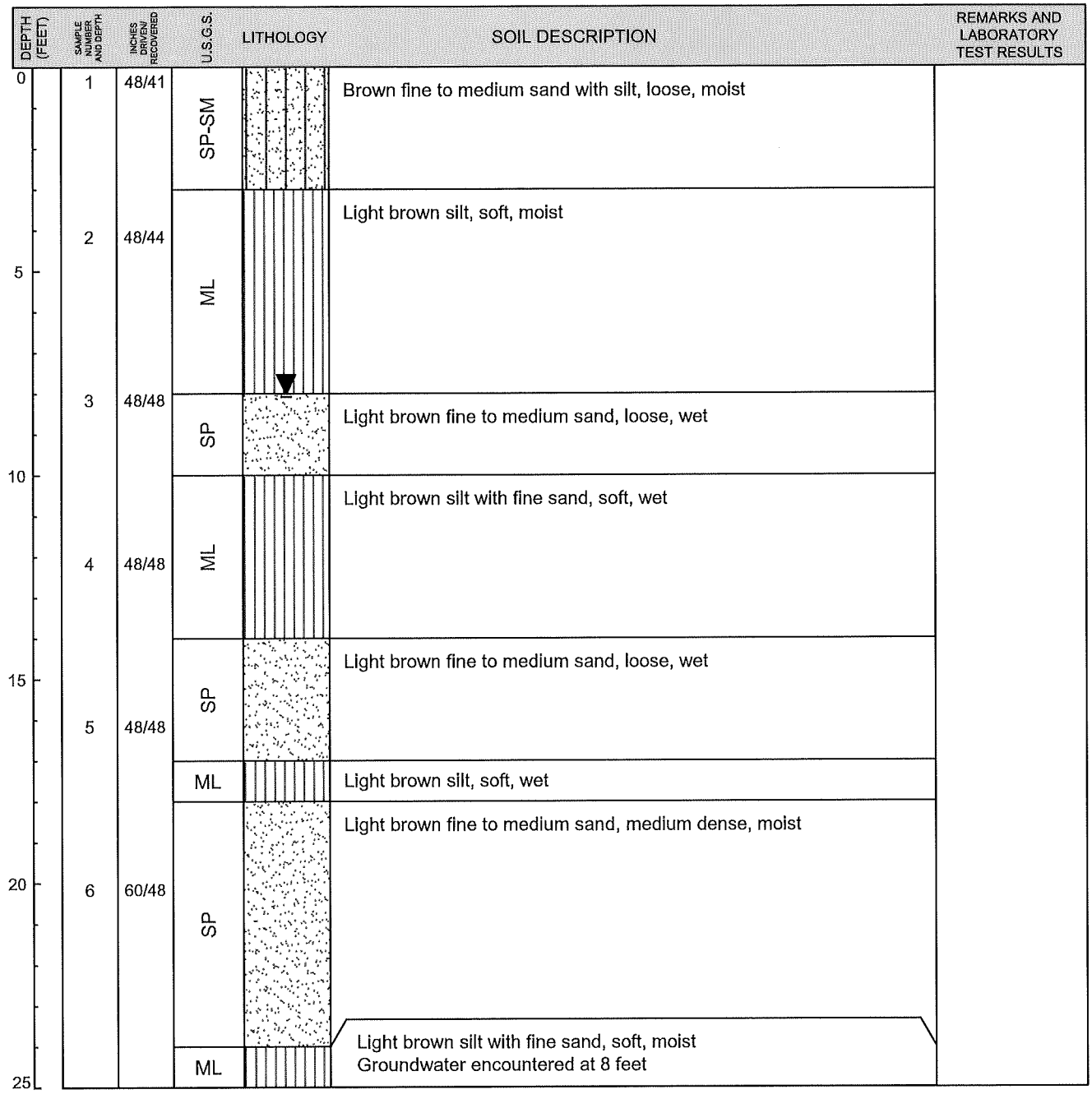
DATE: MARCH 8, 2018
TOTAL DEPTH: 25 FEET
DRILLING CONTRACTOR: STANDARD ENVIRONMENTAL PROBE
DRILLING EQUIPMENT: GEOPROBE 5410
DRILLING METHOD: DIRECT PUSH
LOGGED BY: KEVIN VANDEHEY

EVERGREEN HEIGHTS
CAIN ROAD SUBDIVISION
OLYMPIA, WASHINGTON

INSIGHT GEOLOGIC, INC.

Exploration Log B-1

B-2



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DATE: MARCH 8, 2018
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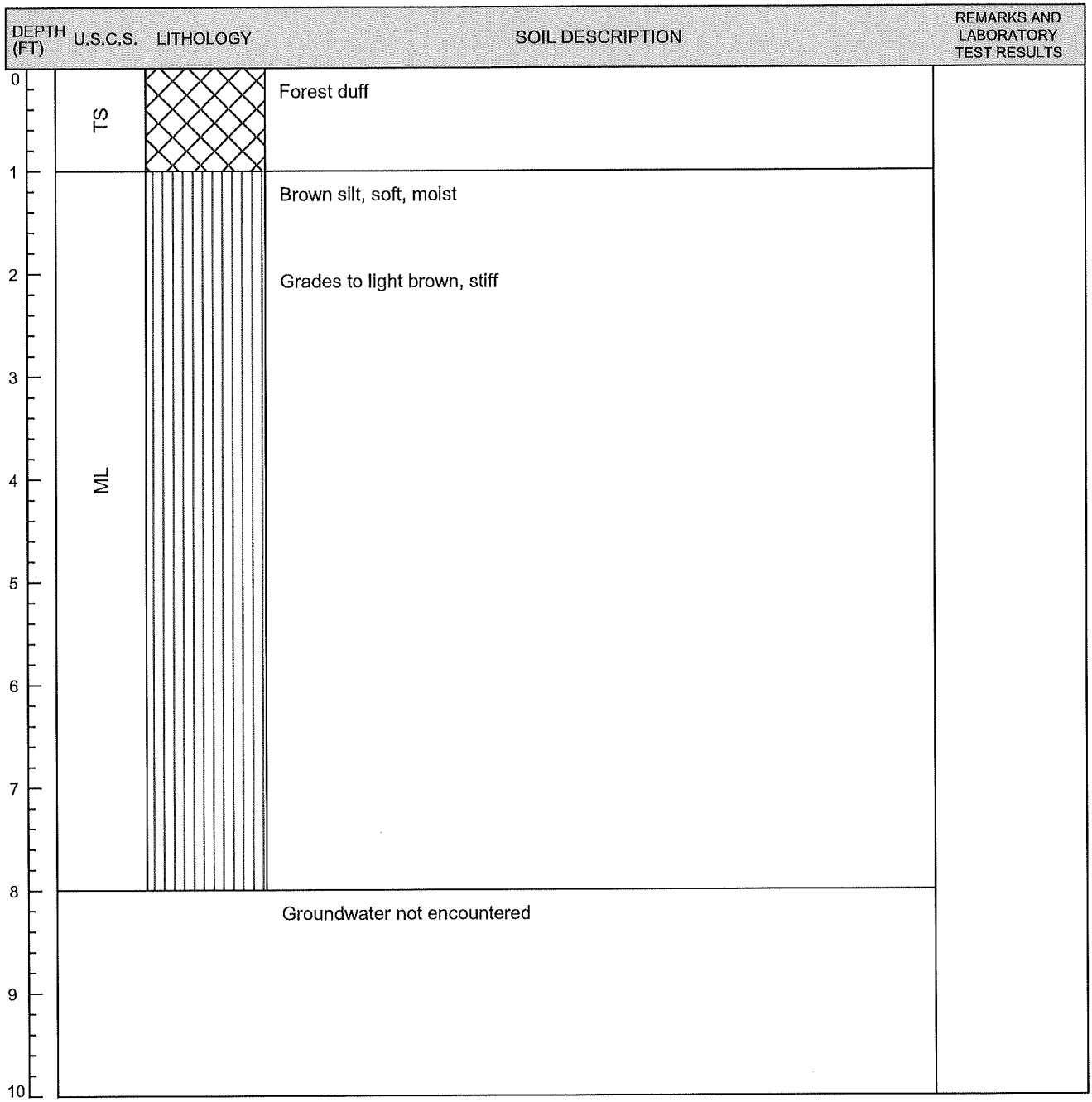
DRILLING CONTRACTOR: STANDARD ENVIRONMENTAL PROBE
DRILLING EQUIPMENT: GEOPROBE 5410
DRILLING METHOD: DIRECT PUSH
LOGGED BY: KEVIN VANDEHEY

EVERGREEN HEIGHTS
CAIN ROAD SUBDIVISION
OLYMPIA, WASHINGTON

INSIGHT GEOLOGIC, INC.

Exploration Log B-2

TP-1



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LOGGED BY: KEVIN VANDEHEY

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OLYMPIA, WASHINGTON

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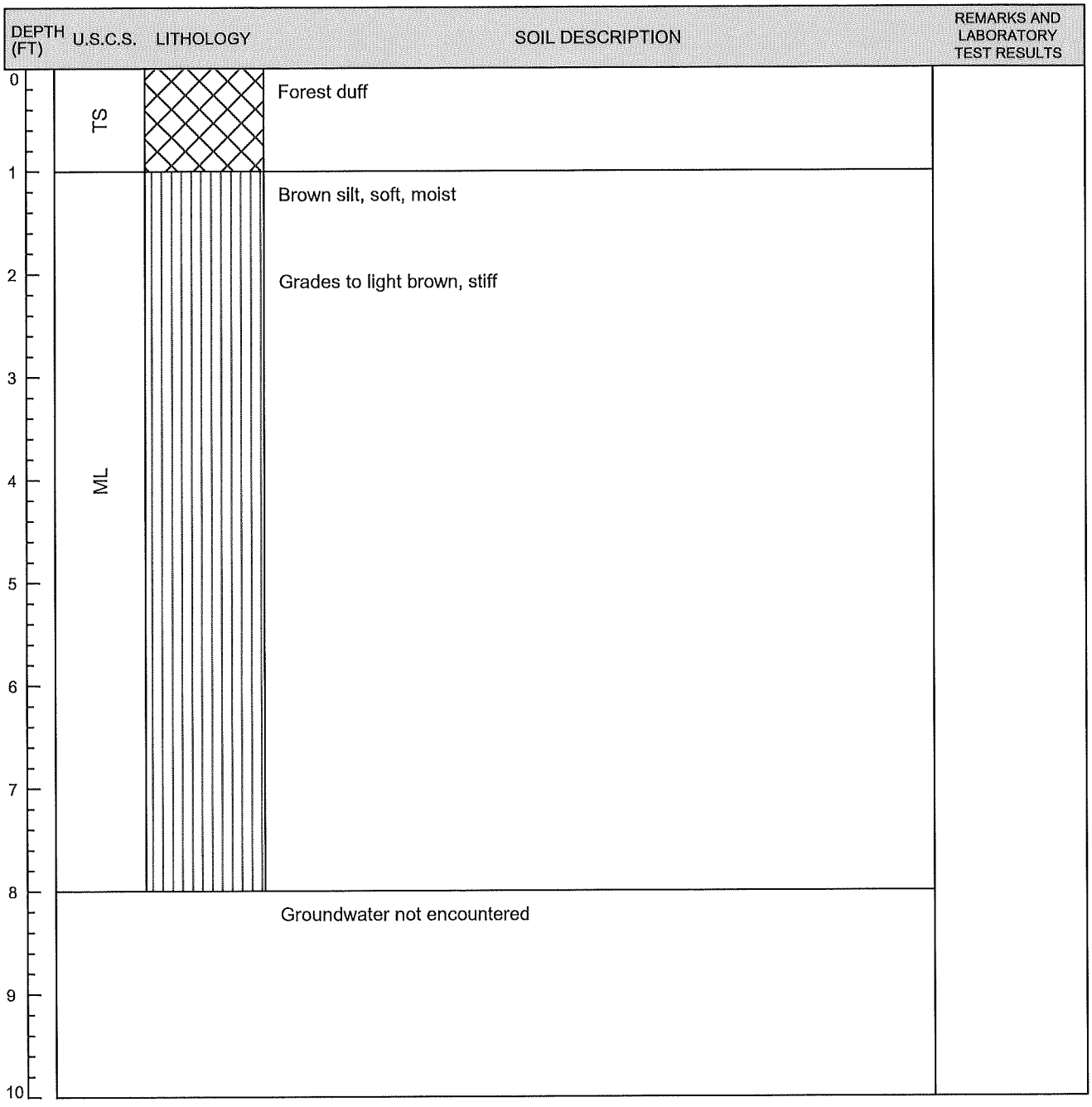
Exploration Log TP-1

TP-2



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DATE: MARCH 5, 2018
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LOGGED BY: KEVIN VANDEHEY

EVERGREEN HEIGHTS
CAIN ROAD SUBDIVISION
OLYMPIA, WASHINGTON

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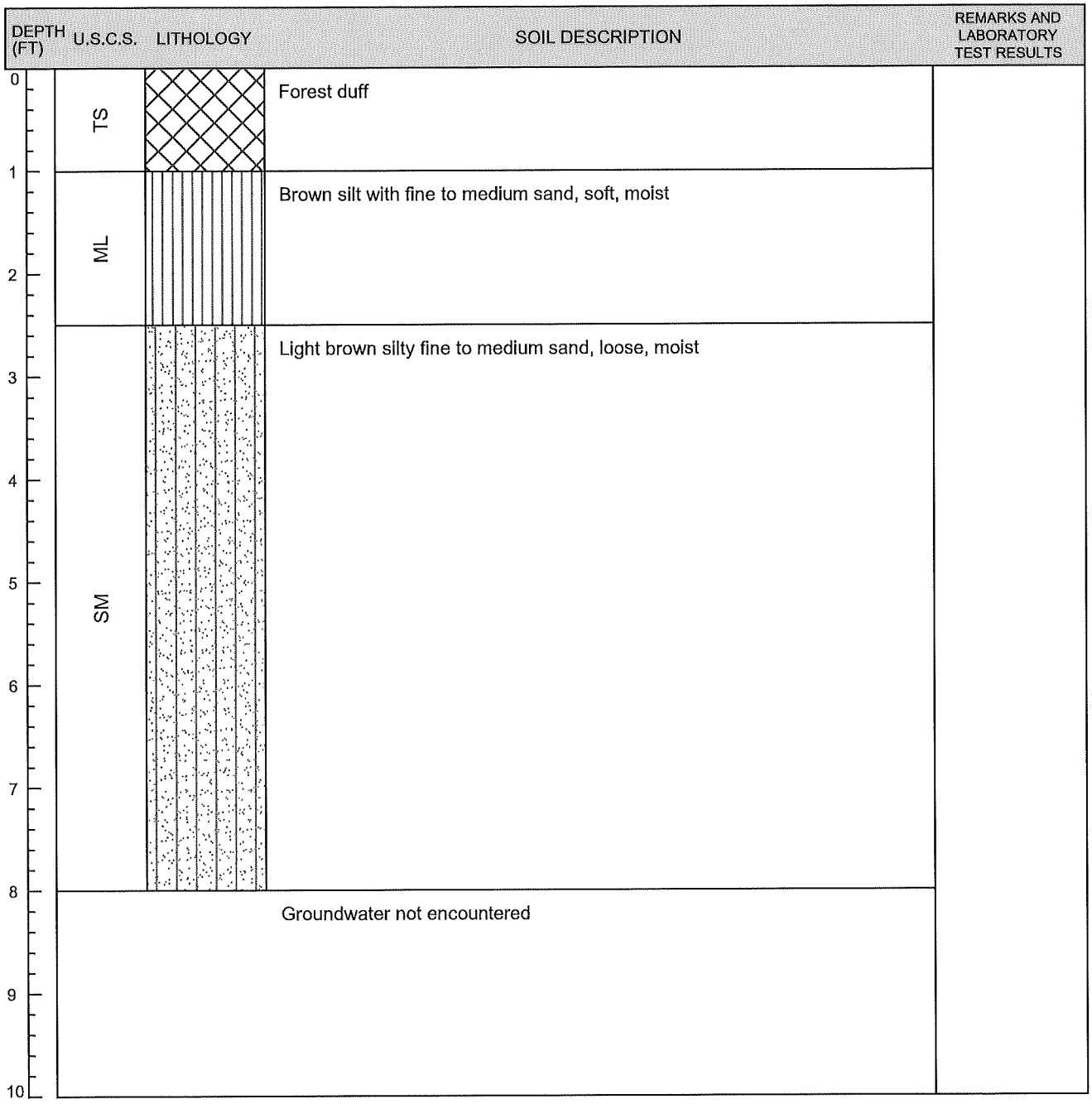
Exploration Log TP-2

TP-3



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DATE: MARCH 5, 2018
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DRILLING EQUIPMENT: EXCAVATOR
LOGGED BY: KEVIN VANDEHEY

EVERGREEN HEIGHTS
CAIN ROAD SUBDIVISION
OLYMPIA, WASHINGTON

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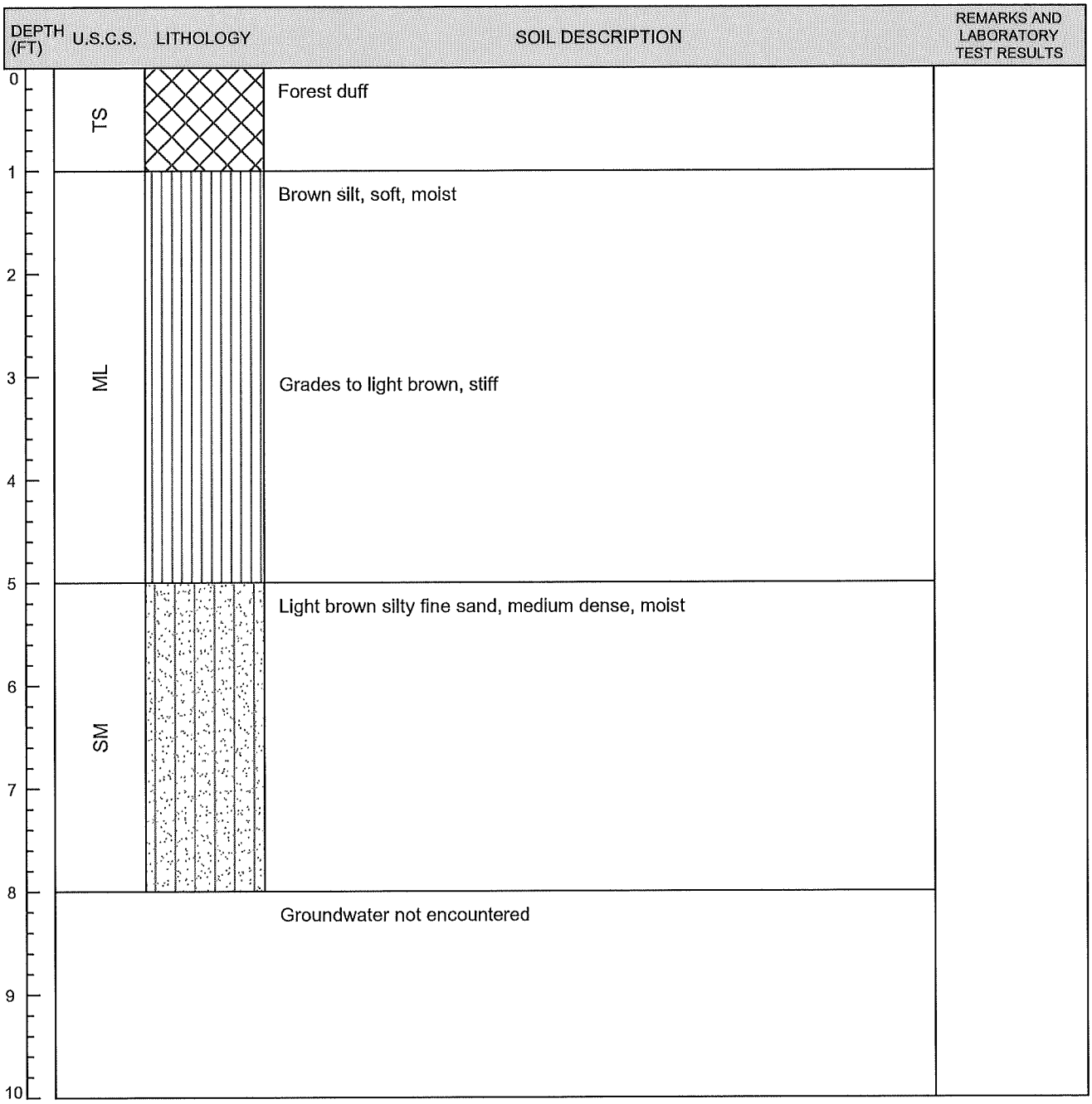
Exploration Log TP-3

TP-4



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DATE: MARCH 5, 2018
TOTAL DEPTH: 8 FEET
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LOGGED BY: KEVIN VANDEHEY

EVERGREEN HEIGHTS
CAIN ROAD SUBDIVISION
OLYMPIA, WASHINGTON

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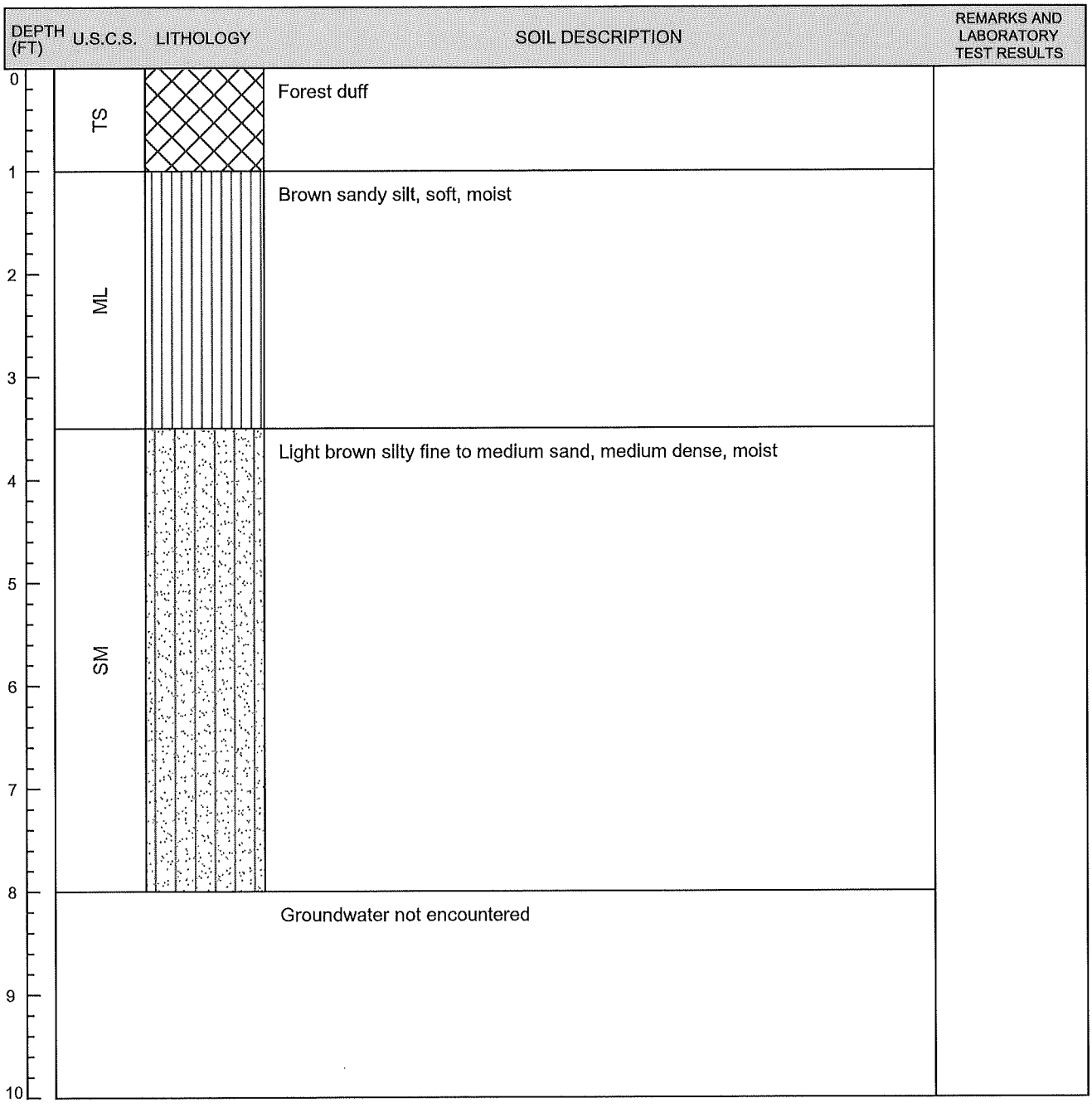
Exploration Log TP-4

TP-5



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LOGGED BY: KEVIN VANDEHEY

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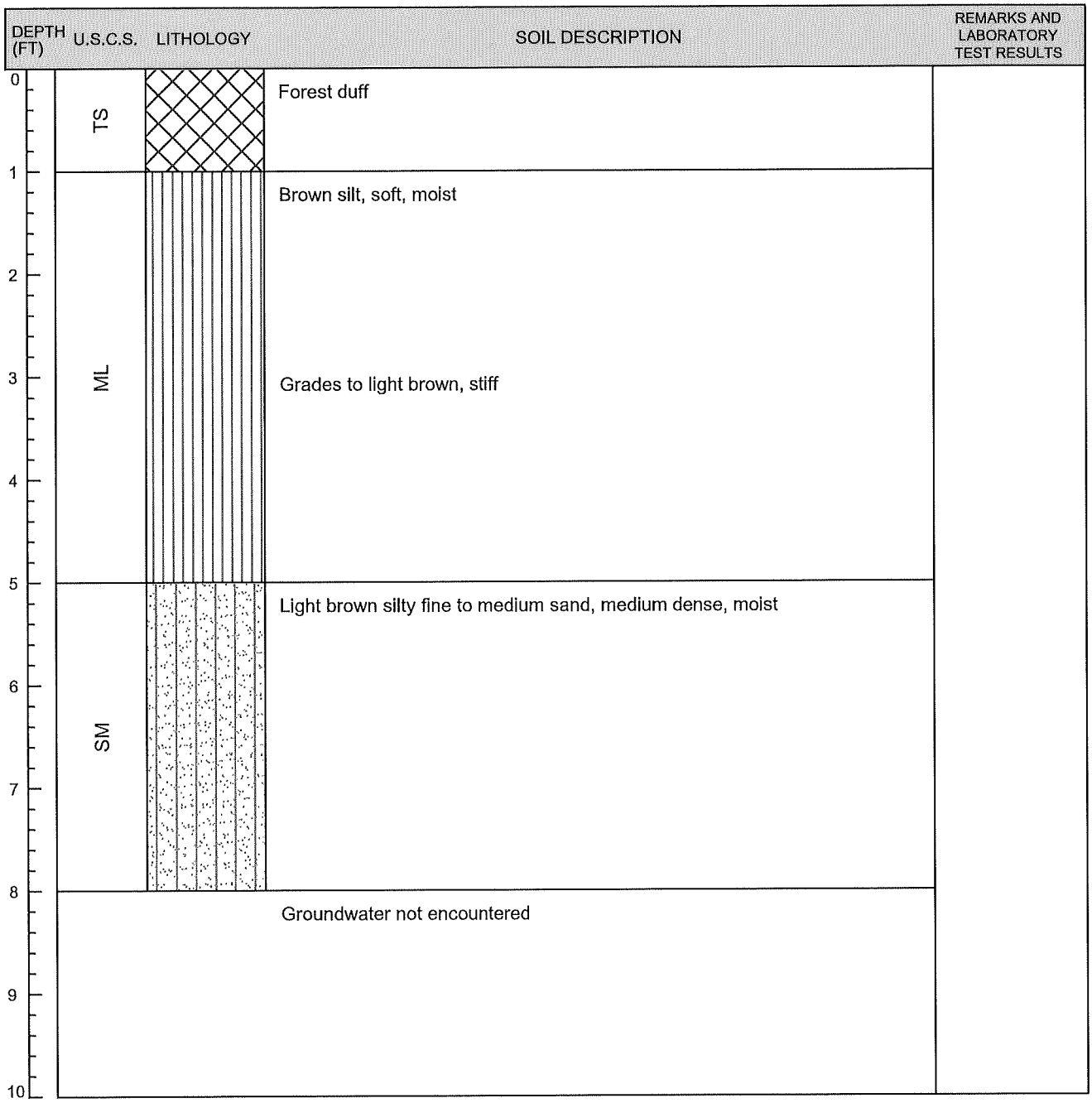
Exploration Log TP-5

TP-6



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LOGGED BY: KEVIN VANDEHEY

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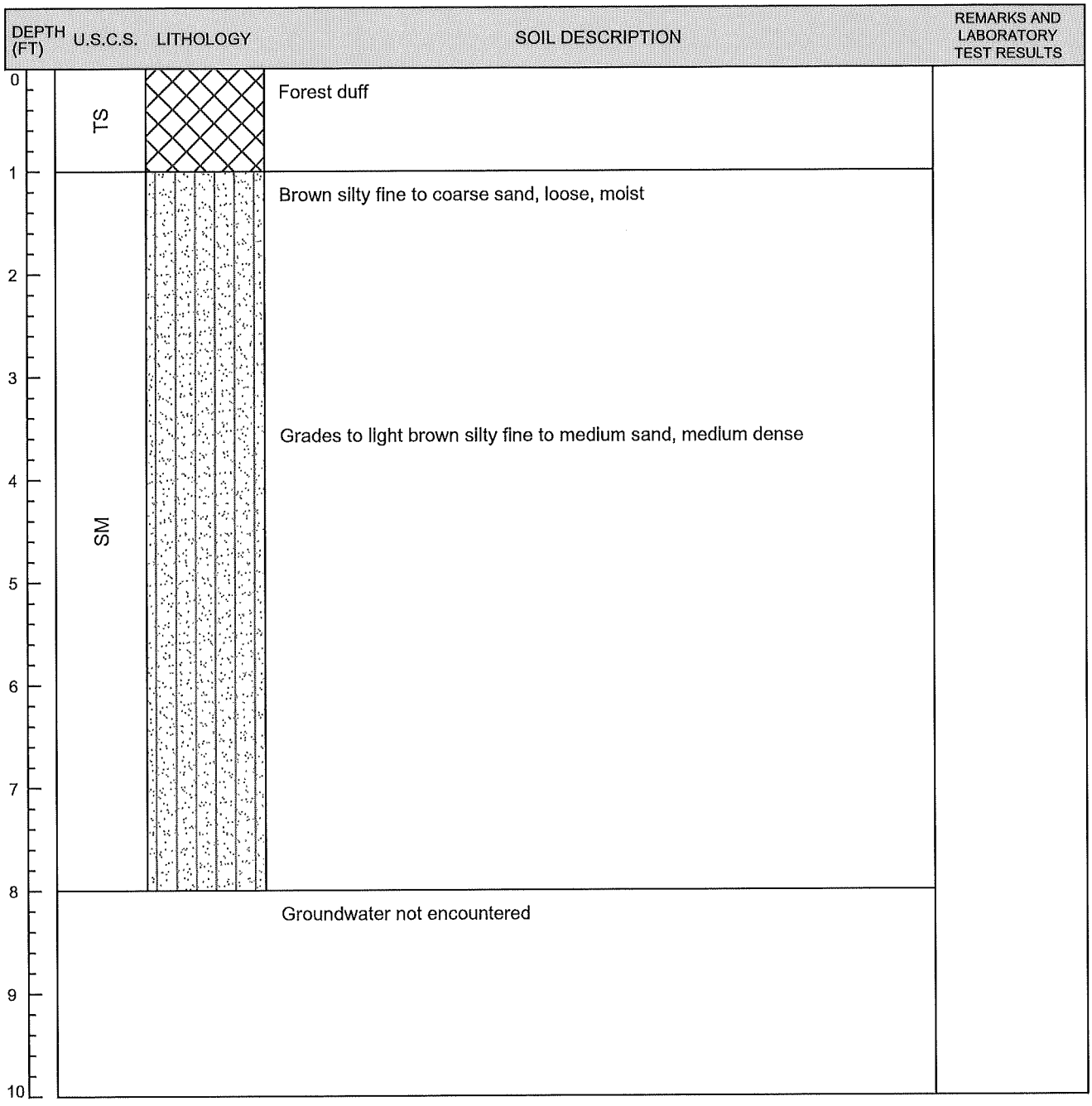
INSIGHT GEOLOGIC, INC.

Exploration Log TP-6

TP-7



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DATE: MARCH 5, 2018
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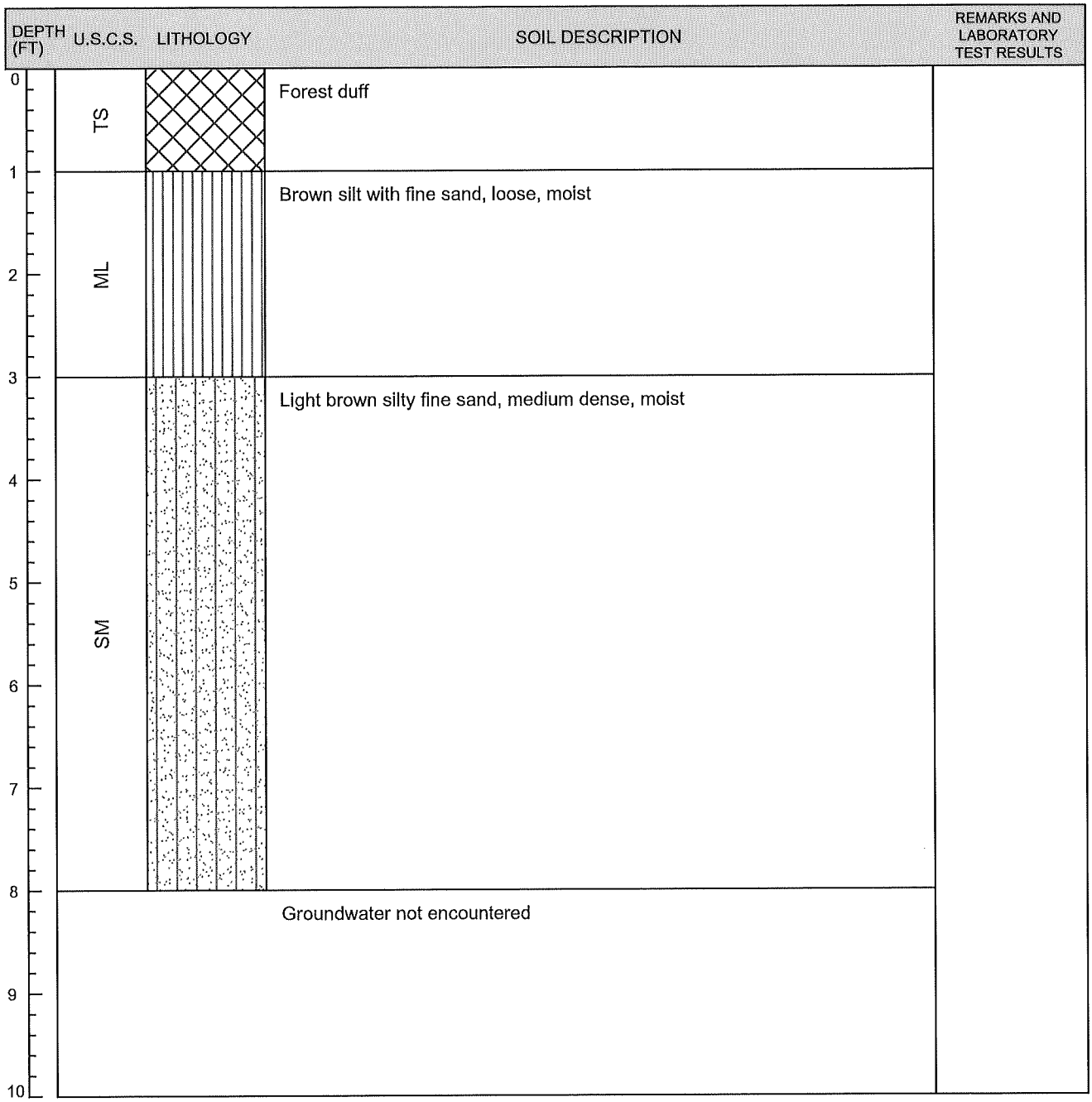
DRILLING EQUIPMENT: EXCAVATOR
LOGGED BY: KEVIN VANDEHEY

EVERGREEN HEIGHTS
CAIN ROAD SUBDIVISION
OLYMPIA, WASHINGTON

INSIGHT GEOLOGIC, INC.

Exploration Log TP-7

TP-8



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PROJECT NO.: 608-006-01
DATE: MARCH 5, 2018
TOTAL DEPTH: 8 FEET
DRILLING EQUIPMENT: EXCAVATOR
LOGGED BY: KEVIN VANDEHEY

EVERGREEN HEIGHTS
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OLYMPIA, WASHINGTON

INSIGHT GEOLOGIC, INC.

Exploration Log TP-8

ATTACHMENT B
LABORATORY ANALYSES RESULTS

Gradation Analysis Summary Data

Job Name: Evergreen Heights Cain Road Subdivision
Job Number: 608-006-01
Date Tested: 3/9/18
Tested By: Kevin Vandehey

Sample Location: B-1
Sample Name: B-1 2.0'-7.0'
Depth: 2 - 7 Feet

Moisture Content (%) 31.5%

Sieve Size	Percent Passing
3.0 in. (75.0)	100.0
1.5 in. (37.5)	100.0
3/4 in. (19.0)	100.0
3/8 in. (9.5-mm)	100.0
No. 4 (4.75-mm)	99.2
No. 10 (2.00-mm)	99.2
No. 20 (.850-mm)	99.0
No. 40 (.425-mm)	97.7
No. 60 (.250-mm)	93.7
No. 100 (.150-mm)	83.8
No. 200 (.075-mm)	22.1

Size Fraction	Percent by Weight
Coarse Gravel	0.0
Fine Gravel	0.8
Coarse Sand	0.1
Medium Sand	1.5
Fine Sand	75.6
Fines	22.1
Total	**100.0**

LL --
PL --
PI --

D_{10} 0.00
D_{30} 0.081
D_{60} 0.12
D_{90} 0.21

Cc --
Cu --

ASTM Classification
Group Name: **Silty Sand**
Symbol: **SM**

INSIGHT GEOLOGIC, INC.

Gradation Analysis Summary Data

Job Name: Evergreen Heights Cain Road Subdivision
Job Number: 608-006-01
Date Tested: 3/9/18
Tested By: Kevin Vandehey

Sample Location: B-1
Sample Name: B-1 7.0'-9.0'
Depth: 7 - 9 Feet

Moisture Content (%) 34.9%

Sieve Size	Percent Passing
3.0 in. (75.0)	100.0
1.5 in. (37.5)	100.0
3/4 in. (19.0)	100.0
3/8 in. (9.5-mm)	100.0
No. 4 (4.75-mm)	100.0
No. 10 (2.00-mm)	100.0
No. 20 (.850-mm)	99.9
No. 40 (.425-mm)	99.8
No. 60 (.250-mm)	99.7
No. 100 (.150-mm)	99.5
No. 200 (.075-mm)	97.7

Size Fraction	Percent by Weight
Coarse Gravel	0.0
Fine Gravel	0.0
Coarse Sand	0.0
Medium Sand	0.2
Fine Sand	2.1
Fines	97.7
Total	**100.0**

LL --
PL --
PI --

D_{10} 0.00
D_{30} 0.00
D_{60} 0.00
D_{90} 0.00

Cc --
Cu --

ASTM Classification
Group Name: **Silt**
Symbol: **ML**

INSIGHT GEOLOGIC, INC.

Gradation Analysis Summary Data

Job Name: Evergreen Heights Cain Road Subdivision
Job Number: 608-006-01
Date Tested: 3/9/18
Tested By: Kevin Vandehey

Sample Location: B-2
Sample Name: B-2 3.0'-7.0'
Depth: 3 - 7 Feet

Moisture Content (%) 27.8%

Sieve Size	Percent Passing
3.0 in. (75.0)	100.0
1.5 in. (37.5)	100.0
3/4 in. (19.0)	100.0
3/8 in. (9.5-mm)	100.0
No. 4 (4.75-mm)	100.0
No. 10 (2.00-mm)	99.8
No. 20 (.850-mm)	99.6
No. 40 (.425-mm)	99.0
No. 60 (.250-mm)	97.8
No. 100 (.150-mm)	92.2
No. 200 (.075-mm)	76.2

Size Fraction	Percent by Weight
Coarse Gravel	0.0
Fine Gravel	0.0
Coarse Sand	0.2
Medium Sand	0.8
Fine Sand	22.8
Fines	76.2
Total	**100.0**

LL --
PL --
PI --

D_{10} 0.00
D_{30} 0.00
D_{60} 0.00
D_{90} 0.14

Cc --
Cu --

ASTM Classification
Group Name: **Silt**
Symbol: **ML**

INSIGHT GEOLOGIC, INC.

Gradation Analysis Summary Data

Job Name: Evergreen Heights Cain Road Subdivision
Job Number: 608-006-01
Date Tested: 3/9/18
Tested By: Kevin Vandehey

Sample Location: TP-2
Sample Name: TP-2 2.0'-8.0'
Depth: 2 - 8 Feet

Moisture Content (%) 32.2%

Sieve Size	Percent Passing
3.0 in. (75.0)	100.0
1.5 in. (37.5)	100.0
3/4 in. (19.0)	100.0
3/8 in. (9.5-mm)	100.0
No. 4 (4.75-mm)	100.0
No. 10 (2.00-mm)	100.0
No. 20 (.850-mm)	99.2
No. 40 (.425-mm)	95.7
No. 60 (.250-mm)	91.4
No. 100 (.150-mm)	87.7
No. 200 (.075-mm)	82.3

Size Fraction	Percent by Weight
Coarse Gravel	0.0
Fine Gravel	0.0
Coarse Sand	0.0
Medium Sand	4.3
Fine Sand	13.3
Fines	82.3
Total	**100.0**

LL	- -
PL	- -
PI	- -
D_{10}	0.00
D_{30}	0.00
D_{60}	0.00
D_{90}	0.20
Cc	- -
Cu	- -

ASTM Classification
Group Name: **Silt**
Symbol: **ML**

INSIGHT GEOLOGIC, INC.

Gradation Analysis Summary Data

Job Name: Evergreen Heights Cain Road Subdivision
Job Number: 608-006-01
Date Tested: 3/9/18
Tested By: Kevin Vandehey

Sample Location: TP-4
Sample Name: TP-4 5.0'-8.0'
Depth: 5 - 8 Feet

Moisture Content (%) 8.6%

Sieve Size	Percent Passing
3.0 in. (75.0)	100.0
1.5 in. (37.5)	100.0
3/4 in. (19.0)	100.0
3/8 in. (9.5-mm)	100.0
No. 4 (4.75-mm)	100.0
No. 10 (2.00-mm)	99.9
No. 20 (.850-mm)	99.3
No. 40 (.425-mm)	96.1
No. 60 (.250-mm)	68.2
No. 100 (.150-mm)	35.7
No. 200 (.075-mm)	15.0

Size Fraction	Percent by Weight
Coarse Gravel	0.0
Fine Gravel	0.0
Coarse Sand	0.1
Medium Sand	3.8
Fine Sand	81.1
Fines	15.0
Total	**100.0**

LL --
PL --
PI --

D_{10} 0.00
D_{30} 0.14
D_{60} 0.22
D_{90} 0.36

Cc --
Cu --

ASTM Classification
Group Name: **Silty Sand**
Symbol: **SM**

INSIGHT GEOLOGIC, INC.

Gradation Analysis Summary Data

Job Name: Evergreen Heights Cain Road Subdivision
Job Number: 608-006-01
Date Tested: 3/9/18
Tested By: Kevin Vandehey

Sample Location: TP-5
Sample Name: TP-5 1.0'-3.5'
Depth: 1 - 3.5 Feet

Moisture Content (%) 28.9%

Sieve Size	Percent Passing
3.0 in. (75.0)	100.0
1.5 in. (37.5)	100.0
3/4 in. (19.0)	100.0
3/8 in. (9.5-mm)	100.0
No. 4 (4.75-mm)	97.2
No. 10 (2.00-mm)	94.7
No. 20 (.850-mm)	93.1
No. 40 (.425-mm)	90.9
No. 60 (.250-mm)	86.8
No. 100 (.150-mm)	79.7
No. 200 (.075-mm)	56.4

Size Fraction	Percent by Weight
Coarse Gravel	0.0
Fine Gravel	2.8
Coarse Sand	2.6
Medium Sand	3.7
Fine Sand	34.5
Fines	56.4
Total	**100.0**

LL --
PL --
PI --

D_{10} 0.000
D_{30} 0.000
D_{60} 0.082
D_{90} 0.400

Cc --
Cu --

ASTM Classification
Group Name: **Sandy Silt**
Symbol: **ML**

INSIGHT GEOLOGIC, INC.

Gradation Analysis Summary Data

Job Name: Evergreen Heights Cain Road Subdivision
Job Number: 608-006-01
Date Tested: 3/9/18
Tested By: Kevin Vandehey

Sample Location: TP-7
Sample Name: TP-7 1.0'-3.5'
Depth: 1 - 3.5 Feet

Moisture Content (%) 25.6%

Sieve Size	Percent Passing
3.0 in. (75.0)	100.0
1.5 in. (37.5)	100.0
3/4 in. (19.0)	100.0
3/8 in. (9.5-mm)	100.0
No. 4 (4.75-mm)	95.2
No. 10 (2.00-mm)	87.0
No. 20 (.850-mm)	81.1
No. 40 (.425-mm)	75.6
No. 60 (.250-mm)	67.5
No. 100 (.150-mm)	53.2
No. 200 (.075-mm)	25.7

Size Fraction	Percent by Weight
Coarse Gravel	0.0
Fine Gravel	4.8
Coarse Sand	8.2
Medium Sand	11.4
Fine Sand	49.8
Fines	25.7
Total	**100.0**

LL --
PL --
PI --

D_{10} 0.000
D_{30} 0.084
D_{60} 0.190
D_{90} 2.800

Cc --
Cu --

ASTM Classification
Group Name: **Silty Sand**
Symbol: **SM**

INSIGHT GEOLOGIC, INC.

Gradation Analysis Summary Data

Job Name: Evergreen Heights Cain Road Subdivision
Job Number: 608-006-01
Date Tested: 3/9/18
Tested By: Kevin Vandehey

Sample Location: TP-8
Sample Name: TP-8 3.0'-8.0'
Depth: 3 - 8 Feet

Moisture Content (%) 18.0%

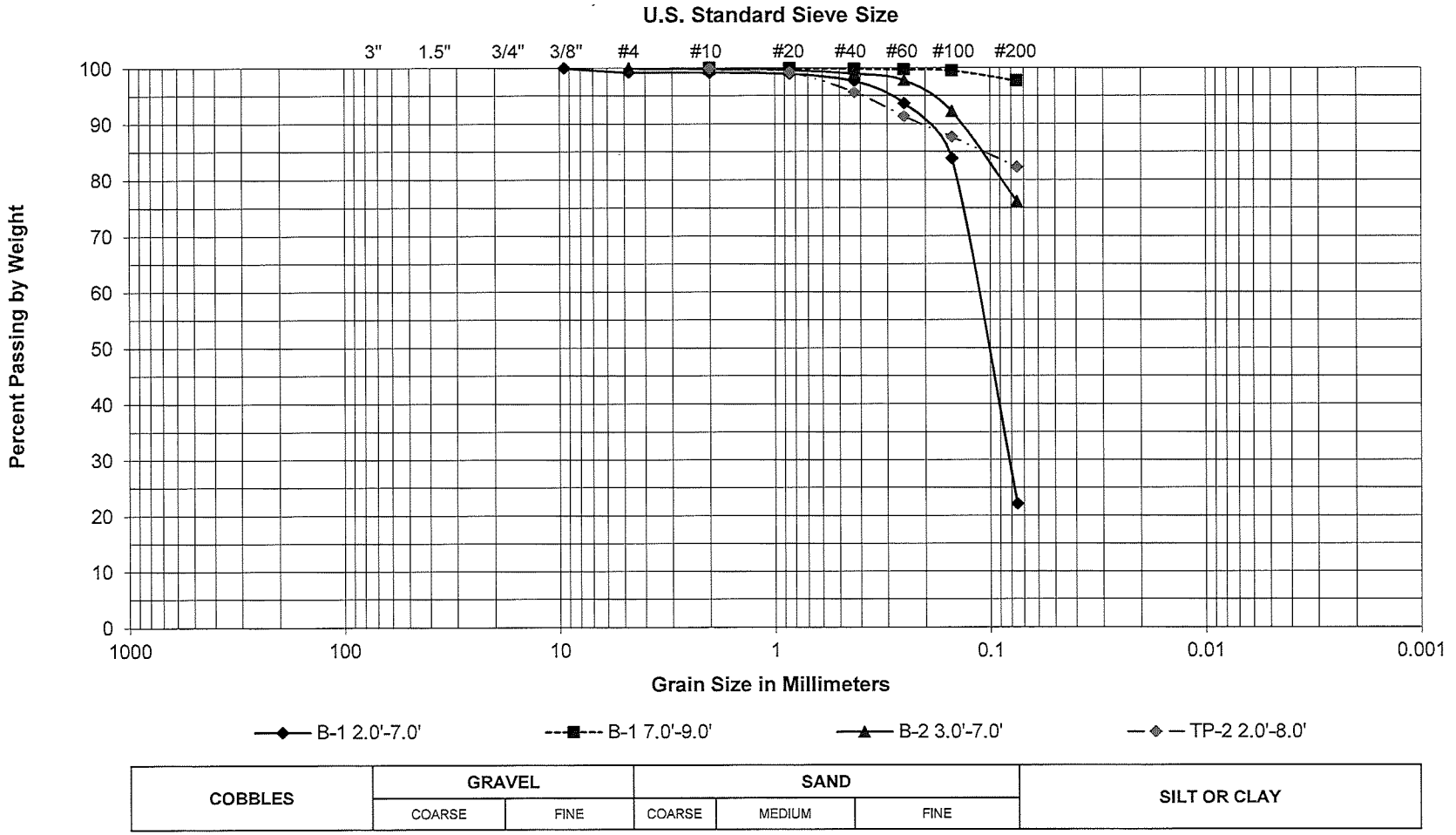
Sieve Size	Percent Passing
3.0 in. (75.0)	100.0
1.5 in. (37.5)	100.0
3/4 in. (19.0)	100.0
3/8 in. (9.5-mm)	100.0
No. 4 (4.75-mm)	98.6
No. 10 (2.00-mm)	97.7
No. 20 (.850-mm)	97.0
No. 40 (.425-mm)	96.1
No. 60 (.250-mm)	94.0
No. 100 (.150-mm)	82.4
No. 200 (.075-mm)	34.4

Size Fraction	Percent by Weight
Coarse Gravel	0.0
Fine Gravel	1.4
Coarse Sand	0.9
Medium Sand	1.6
Fine Sand	61.7
Fines	34.4
Total	**100.0**

LL	- -
PL	- -
PI	- -
D_{10}	0.00
D_{30}	0.00
D_{60}	0.11
D_{90}	0.19
Cc	- -
Cu	- -

ASTM Classification
Group Name: **Silty Sand**
Symbol: **SM**

INSIGHT GEOLOGIC, INC.



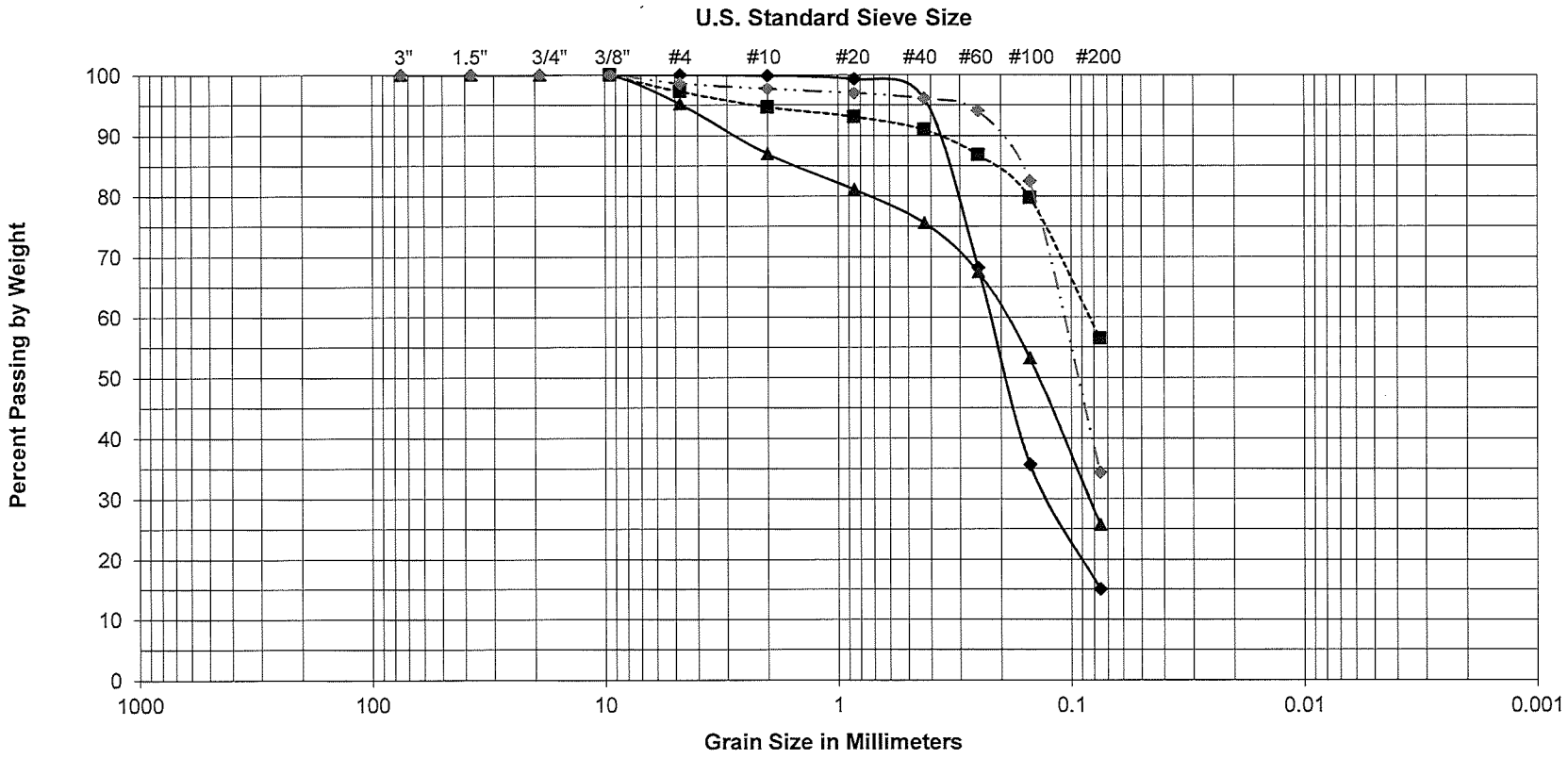
COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	

EVERGREEN HEIGHTS CAIN ROAD SUBDIVISION

OLYMPIA, WASHINGTON

INSIGHT GEOLOGIC, INC.

Graph 1
Gradation Analysis Results



COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	

EVERGREEN HEIGHTS CAIN ROAD SUBDIVISION

OLYMPIA, WASHINGTON

INSIGHT GEOLOGIC, INC.

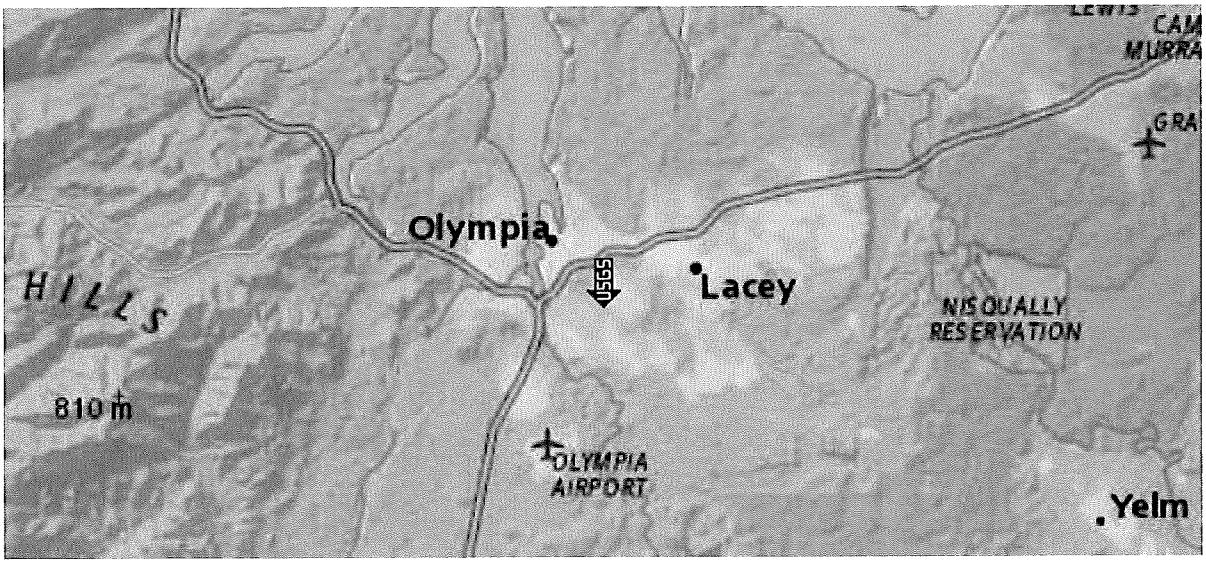
Graph 2
Gradation Analysis Results

ATTACHMENT C
SEISMIC DESIGN PARAMETERS

USGS Design Maps Summary Report

User–Specified Input

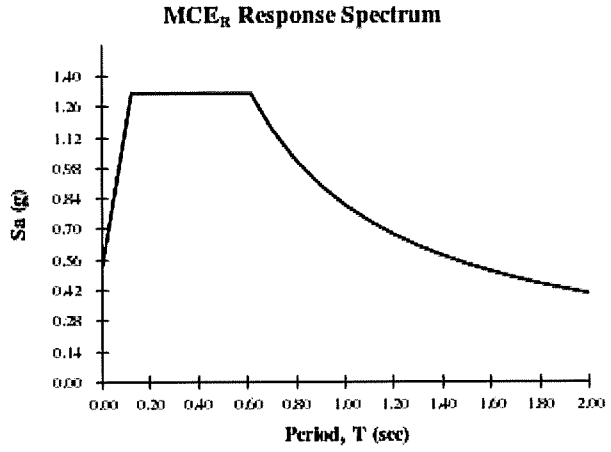
Report Title	Evergreen Heights Cain Road Subdivision Tue April 10, 2018 22:36:27 UTC
Building Code Reference Document	2012/2015 International Building Code (which utilizes USGS hazard data available in 2008)
Site Coordinates	47.02857°N, 122.87253°W
Site Soil Classification	Site Class D – "Stiff Soil"
Risk Category	I/II/III

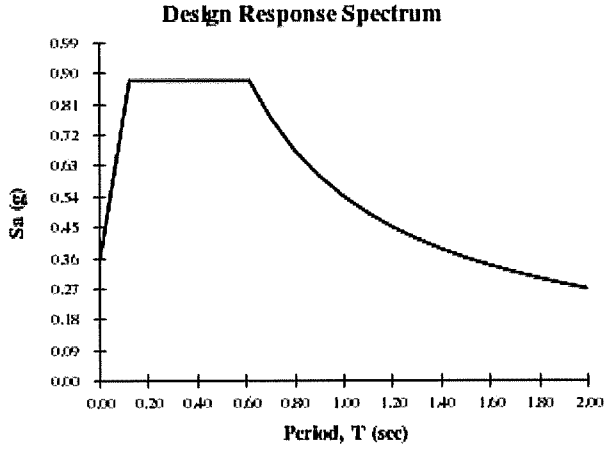


USGS–Provided Output

S_S =	1.319 g	S_{MS} =	1.319 g	S_{DS} =	0.879 g
S_1 =	0.540 g	S_{M1} =	0.810 g	S_{D1} =	0.540 g

For information on how the SS and S1 values above have been calculated from probabilistic (risk-targeted) and deterministic ground motions in the direction of maximum horizontal response, please return to the application and select the "2009 NEHRP" building code reference document.





USGS Design Maps Detailed Report

2012/2015 International Building Code (47.02857°N, 122.87253°W)

Site Class D – "Stiff Soil", Risk Category I/II/III

Section 1613.3.1 — Mapped acceleration parameters

Note: Ground motion values provided below are for the direction of maximum horizontal spectral response acceleration. They have been converted from corresponding geometric mean ground motions computed by the USGS by applying factors of 1.1 (to obtain S_S) and 1.3 (to obtain S_1). Maps in the 2012/2015 International Building Code are provided for Site Class B. Adjustments for other Site Classes are made, as needed, in Section 1613.3.3.

From Figure 1613.3.1(1) [1] $S_S = 1.319$ g

From Figure 1613.3.1(2) [2] $S_1 = 0.540$ g

Section 1613.3.2 — Site class definitions

The authority having jurisdiction (not the USGS), site-specific geotechnical data, and/or the default has classified the site as Site Class D, based on the site soil properties in accordance with Section 1613.

2010 ASCE-7 Standard – Table 20.3-1
SITE CLASS DEFINITIONS

Site Class	$\bar{v}_s$	$\bar{N}$ or $\bar{N}_{ch}$	$\bar{s}_u$
A. Hard Rock	>5,000 ft/s	N/A	N/A
B. Rock	2,500 to 5,000 ft/s	N/A	N/A
C. Very dense soil and soft rock	1,200 to 2,500 ft/s	>50	>2,000 psf
D. Stiff Soil	600 to 1,200 ft/s	15 to 50	1,000 to 2,000 psf
E. Soft clay soil	<600 ft/s	<15	<1,000 psf
	Any profile with more than 10 ft of soil having the characteristics: • Plasticity index PI > 20, • Moisture content $w \geq 40\%$, and • Undrained shear strength $\bar{s}_u$ < 500 psf		
F. Soils requiring site response analysis in accordance with Section 21.1	See Section 20.3.1		

For SI: 1ft/s = 0.3048 m/s 1lb/ft² = 0.0479 kN/m²

Section 1613.3.3 — Site coefficients and adjusted maximum considered earthquake spectral response acceleration parameters

TABLE 1613.3.3(1)
VALUES OF SITE COEFFICIENT F_a

Site Class	Mapped Spectral Response Acceleration at Short Period				
	$S_S \leq 0.25$	$S_S = 0.50$	$S_S = 0.75$	$S_S = 1.00$	$S_S \geq 1.25$
A	0.8	0.8	0.8	0.8	0.8
B	1.0	1.0	1.0	1.0	1.0
C	1.2	1.2	1.1	1.0	1.0
D	1.6	1.4	1.2	1.1	1.0
E	2.5	1.7	1.2	0.9	0.9
F	See Section 11.4.7 of ASCE 7				

Note: Use straight-line interpolation for intermediate values of S_S

For Site Class = D and S_S = 1.319 g, F_a = 1.000

TABLE 1613.3.3(2)
VALUES OF SITE COEFFICIENT F_v

Site Class	Mapped Spectral Response Acceleration at 1-s Period				
	$S_1 \leq 0.10$	$S_1 = 0.20$	$S_1 = 0.30$	$S_1 = 0.40$	$S_1 \geq 0.50$
A	0.8	0.8	0.8	0.8	0.8
B	1.0	1.0	1.0	1.0	1.0
C	1.7	1.6	1.5	1.4	1.3
D	2.4	2.0	1.8	1.6	1.5
E	3.5	3.2	2.8	2.4	2.4
F	See Section 11.4.7 of ASCE 7				

Note: Use straight-line interpolation for intermediate values of S_1

For Site Class = D and S_1 = 0.540 g, F_v = 1.500

Equation (16-37): $S_{MS} = F_a S_S = 1.000 \times 1.319 = 1.319$ g

---

Equation (16-38): $S_{M1} = F_v S_1 = 1.500 \times 0.540 = 0.810$ g

---

Section 1613.3.4 — Design spectral response acceleration parameters

Equation (16-39): $S_{DS} = \frac{2}{3} S_{MS} = \frac{2}{3} \times 1.319 = 0.879$ g

---

Equation (16-40): $S_{D1} = \frac{2}{3} S_{M1} = \frac{2}{3} \times 0.810 = 0.540$ g

---

Section 1613.3.5 — Determination of seismic design category

TABLE 1613.3.5(1)
SEISMIC DESIGN CATEGORY BASED ON SHORT-PERIOD (0.2 second) RESPONSE ACCELERATION

VALUE OF S_{DS}	RISK CATEGORY		
	I or II	III	IV
$S_{DS} < 0.167g$	A	A	A
$0.167g \le S_{DS} < 0.33g$	B	B	C
$0.33g \le S_{DS} < 0.50g$	C	C	D
$0.50g \le S_{DS}$	D	D	D

For Risk Category = I and S_{DS} = 0.879 g, Seismic Design Category = D

TABLE 1613.3.5(2)
SEISMIC DESIGN CATEGORY BASED ON 1-SECOND PERIOD RESPONSE ACCELERATION

VALUE OF S_{D1}	RISK CATEGORY		
	I or II	III	IV
$S_{D1} < 0.067g$	A	A	A
$0.067g \le S_{D1} < 0.133g$	B	B	C
$0.133g \le S_{D1} < 0.20g$	C	C	D
$0.20g \le S_{D1}$	D	D	D

For Risk Category = I and S_{D1} = 0.540 g, Seismic Design Category = D

Note: When S_1 is greater than or equal to 0.75g, the Seismic Design Category is **E** for buildings in Risk Categories I, II, and III, and **F** for those in Risk Category IV, irrespective of the above.

Seismic Design Category ≡ "the more severe design category in accordance with Table 1613.3.5(1) or 1613.3.5(2)" = D

Note: See Section 1613.3.5.1 for alternative approaches to calculating Seismic Design Category.

References

1. *Figure 1613.3.1(1)*: https://earthquake.usgs.gov/hazards/designmaps/downloads/pdfs/IBC-2012-Fig1613p3p1(1).pdf
2. *Figure 1613.3.1(2)*: https://earthquake.usgs.gov/hazards/designmaps/downloads/pdfs/IBC-2012-Fig1613p3p1(2).pdf

ATTACHMENT D

REPORT LIMITATIONS AND GUIDELINES FOR USE

ATTACHMENT D

REPORT LIMITATIONS AND GUIDELINES FOR USE[1]

This attachment provides information to help you manage your risks with respect to the use of this report.

GEOTECHNICAL SERVICES ARE PERFORMED FOR SPECIFIC PURPOSES, PERSONS AND PROJECTS

This report has been prepared for the exclusive use of Evergreen Heights, LLC (Client) and their authorized agents. This report may be made available to regulatory agencies for review. This report is not intended for use by others, and the information contained herein is not applicable to other sites.

Insight Geologic Inc. structures our services to meet the specific needs of our clients. For example, a geotechnical or geologic study conducted for a civil engineer or architect may not fulfill the needs of a construction contractor or even another civil engineer or architect that are involved in the same project. Because each geotechnical or geologic study is unique, each geotechnical engineering or geologic report is unique, prepared solely for the specific client and project site. Our report is prepared for the exclusive use of our Client. No other party may rely on the product of our services unless we agree in advance to such reliance in writing. This is to provide our firm with reasonable protection against open-ended liability claims by third parties with whom there would otherwise be no contractual limits to their actions. Within the limitations of scope, schedule and budget, our services have been executed in accordance with our Agreement with the Client and generally accepted geotechnical practices in this area at the time this report was prepared. This report should not be applied for any purpose or project except the one originally contemplated.

A GEOTECHNICAL ENGINEERING OR GEOLOGIC REPORT IS BASED ON A UNIQUE SET OF PROJECT-SPECIFIC FACTORS

Insight Geologic, Inc. considered a number of unique, project-specific factors when establishing the scope of services for this project and report. Unless Insight Geologic specifically indicates otherwise, do not rely on this report if it was:

- not prepared for you,
- not prepared for your project,
- not prepared for the specific site explored, or
- completed before important project changes were made.

For example, changes that can affect the applicability of this report include those that affect:

- the function of the proposed structure;
- elevation, configuration, location, orientation or weight of the proposed structure;
- composition of the design team; or
- project ownership.

If important changes are made after the date of this report, Insight Geologic should be given the opportunity to review our interpretations and recommendations and provide written modifications or confirmation, as appropriate.

---

[1] Developed based on material provided by ASFE, Professional Firms Practicing in the Geosciences; www.asfe.org .

SUBSURFACE CONDITIONS CAN CHANGE

This geotechnical or geologic report is based on conditions that existed at the time the study was performed. The findings and conclusions of this report may be affected by the passage of time, by manmade events such as construction on or adjacent to the site, or by natural events such as floods, earthquakes, slope instability or ground water fluctuations. Always contact Insight Geologic before applying a report to determine if it remains applicable.

MOST GEOTECHNICAL AND GEOLOGIC FINDINGS ARE PROFESSIONAL OPINIONS

Our interpretations of subsurface conditions are based on field observations from widely spaced sampling locations at the site. Site exploration identifies subsurface conditions only at those points where subsurface tests are conducted or samples are taken. Insight Geologic reviewed field and laboratory data and then applied our professional judgment to render an opinion about subsurface conditions throughout the site. Actual subsurface conditions may differ, sometimes significantly, from those indicated in this report. Our report, conclusions and interpretations should not be construed as a warranty of the subsurface conditions.

GEOTECHNICAL ENGINEERING REPORT RECOMMENDATIONS ARE NOT FINAL

Do not over-rely on the preliminary construction recommendations included in this report. These recommendations are not final, because they were developed principally from Insight Geologic's professional judgment and opinion. Insight Geologic's recommendations can be finalized only by observing actual subsurface conditions revealed during construction. Insight Geologic cannot assume responsibility or liability for this report's recommendations if we do not perform construction observation.

Sufficient monitoring, testing and consultation by Insight Geologic should be provided during construction to confirm that the conditions encountered are consistent with those indicated by the explorations, to provide recommendations for design changes should the conditions revealed during the work differ from those anticipated, and to evaluate whether or not earthwork activities are completed in accordance with our recommendations. Retaining Insight Geologic for construction observation for this project is the most effective method of managing the risks associated with unanticipated conditions.

A GEOTECHNICAL ENGINEERING OR GEOLOGIC REPORT COULD BE SUBJECT TO MISINTERPRETATION

Misinterpretation of this report by other design team members can result in costly problems. You could lower that risk by having Insight Geologic confer with appropriate members of the design team after submitting the report. Also retain Insight Geologic to review pertinent elements of the design team's plans and specifications. Contractors can also misinterpret a geotechnical engineering or geologic report. Reduce that risk by having Insight Geologic participate in pre-bid and pre-construction conferences, and by providing construction observation.

DO NOT REDRAW THE EXPLORATION LOGS

Geotechnical engineers and geologists prepare final boring and testing logs based upon their interpretation of field logs and laboratory data. To prevent errors or omissions, the logs included in a

geotechnical engineering or geologic report should never be redrawn for inclusion in architectural or other design drawings. Only photographic or electronic reproduction is acceptable, but recognize that separating logs from the report can elevate risk.

GIVE CONTRACTORS A COMPLETE REPORT AND GUIDANCE

Some owners and design professionals believe they can make contractors liable for unanticipated subsurface conditions by limiting what they provide for bid preparation. To help prevent costly problems, give contractors the complete geotechnical engineering or geologic report, but preface it with a clearly written letter of transmittal. In that letter, advise contractors that the report was not prepared for purposes of bid development and that the report's accuracy is limited; encourage them to confer with Insight Geologic and/or to conduct additional study to obtain the specific types of information they need or prefer. A pre-bid conference can also be valuable. Be sure contractors have sufficient time to perform additional study. Only then might an owner be in a position to give contractors the best information available, while requiring them to at least share the financial responsibilities stemming from unanticipated conditions. Further, a contingency for unanticipated conditions should be included in your project budget and schedule.

CONTRACTORS ARE RESPONSIBLE FOR SITE SAFETY ON THEIR OWN CONSTRUCTION PROJECTS

Our geotechnical recommendations are not intended to direct the contractor's procedures, methods, schedule or management of the work site. The contractor is solely responsible for job site safety and for managing construction operations to minimize risks to on-site personnel and to adjacent properties.

READ THESE PROVISIONS CLOSELY

Some clients, design professionals and contractors may not recognize that the geoscience practices (geotechnical engineering or geology) are far less exact than other engineering and natural science disciplines. This lack of understanding can create unrealistic expectations that could lead to disappointments, claims and disputes. Insight Geologic includes these explanatory "limitations" provisions in our reports to help reduce such risks. Please confer with Insight Geologic if you are unclear how these "Report Limitations and Guidelines for Use" apply to your project or site.

GEOTECHNICAL, GEOLOGIC AND ENVIRONMENTAL REPORTS SHOULD NOT BE INTERCHANGED

The equipment, techniques and personnel used to perform an environmental study differ significantly from those used to perform a geotechnical or geologic study and vice versa. For that reason, a geotechnical engineering or geologic report does not usually relate any environmental findings, conclusions or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. Similarly, environmental reports are not used to address geotechnical or geologic concerns regarding a specific project.

INSIGHT GEOLOGIC, INC.

July 19, 2018

Evergreen Heights, LLC
1868 State Avenue NE
Olympia, Washington 98506
Attention: Rob Rice

Report
Winter Groundwater Monitoring
Cain Road Subdivision
Cain Road and 22nd Avenue SE
Olympia, Washington
Project No. 608-006-01

INTRODUCTION

Insight Geologic, Inc. is pleased to provide our report for winter groundwater monitoring as it relates to the infiltration and disposal of stormwater at the location of the proposed Cain Road Subdivision located southeast of the intersection between Cain Road SE and 22nd Avenue SE in Olympia, Washington. The location of the site is shown relative to surrounding physical features in the Vicinity Map, Figure 1.

The site of the proposed subdivision consists of a single parcel of property comprising approximately 5 acres. The project will include residential homesites as well as paved streets through the development. Stormwater runoff from roads and homes is to be infiltrated to the subsurface in the northwest portion of the site.

Three groundwater monitoring wells were previously installed on the site by American Pump and Electric.

SCOPE OF SERVICES

The purpose of our services was to evaluate subsurface conditions as they pertain to stormwater infiltration. We performed our evaluation in general accordance with the procedures outlined in the City of Olympia's 2016 Drainage Design and Erosion Control Manual (DDECM). The specific tasks performed are outlined below:

1. Monitored the depth to groundwater in the previously installed monitoring wells on a weekly basis for a period of two months. Water level measurements were made to the nearest 0.01 foot.
2. Prepared a report for review summarizing our groundwater monitoring data, estimated high groundwater elevations, and any appropriate changes to the stormwater infiltration rate presented in our initial report titled "*Report – Geotechnical and Stormwater Infiltration Evaluation – Cain Road Subdivision,*" dated April 11, 2018.

FINDINGS

Monitoring Wells

The three groundwater monitoring wells, previously installed by American Pump and Electric, consisting of 2-inch diameter casing and screen, are shown on the site plan, Figure 2. The wells were installed with an above-ground, tamper-resistant steel cover. Based on measurements taken at the beginning of the monitoring period, the wells were installed to a depth of approximately 22 to 25 feet below ground surface. For the purposes of this report, groundwater elevations were based on ground surface elevations obtained the client provided survey.

Data logging pressure transducers were installed in the monitoring wells by American Pump and Electric. However, upon retrieval at the conclusion of the monitoring period, the transducers did not contain useable data regarding water levels in the wells.

Insight Geologic collected groundwater measurements manually on a weekly basis during the monitoring period. Groundwater monitoring data for the manual measurements are contained in Attachment A. Groundwater hydrographs for the monitoring wells are shown in Figures 3 through 5.

Groundwater Conditions

Groundwater was not encountered in monitoring wells MW-1 and MW-3 during the monitoring period at the site.

Groundwater elevations in monitoring well MW-2 did not appear to fluctuate greatly over the monitoring period. Groundwater elevations in monitoring well MW-2 were between 145.89 and 145.17 feet above mean sea level. The highest groundwater elevation was measured on March 28, 2018, at a depth of 18.11 feet below ground surface. A summary of groundwater measurements is shown in Table 1, below.

Table 1. Summary of Maximum and Minimum Measured Groundwater Levels

Well Number	Depth to Groundwater (feet below ground surface)		Groundwater Elevation (feet above mean sea level)	
	Low	High	Low	High
MW - 1	Dry (>24.08)	Dry (>24.08)	<144.92	<144.92
MW - 2	18.83	18.11	145.17	145.89
MW - 3	Dry (>24.22)	Dry (>24.22)	<144.78	<144.78

OPINION

We have performed an evaluation of groundwater conditions at the proposed Cain Road Subdivision located southeast of the intersection between Cain Road SE and 22nd Avenue SE in Olympia, Washington. Groundwater elevations beneath the site were monitored for the period between March 21, 2018 to May 1, 2018. The peak groundwater elevation measured in the monitoring well network was 18.83 feet below ground surface or at an elevation of approximately 145 feet above mean sea

level. Based on the results of our winter groundwater monitoring study and consultation with the City of Olympia Stormwater Manual, we recommend a design infiltration rate of 0.1 inches per hour for the proposed stormwater infiltration pond, based on the depth to the restrictive silt units as described in our previous report titled "*Report – Geotechnical and Stormwater Infiltration Evaluation – Cain Road Subdivision,*" and dated April 11, 2018.

LIMITATIONS

We have prepared this report for use by Evergreen Heights, LLC and their authorized agents. This report may be made available to regulatory agencies.

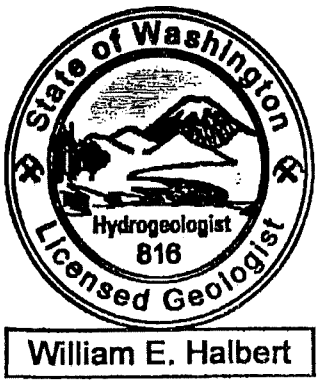
Within the limitations of scope, schedule and budget, our services have been executed in accordance with generally accepted practices in this area at the time this report was prepared. No warranty or other conditions, express or implied, should be understood.

Please refer to the Attachment B titled "Report Limitations and Guidelines for Use" for additional information pertaining to use of this report.

We appreciate the opportunity to be of service to you on this project. Please contact us if you have questions or require additional information.

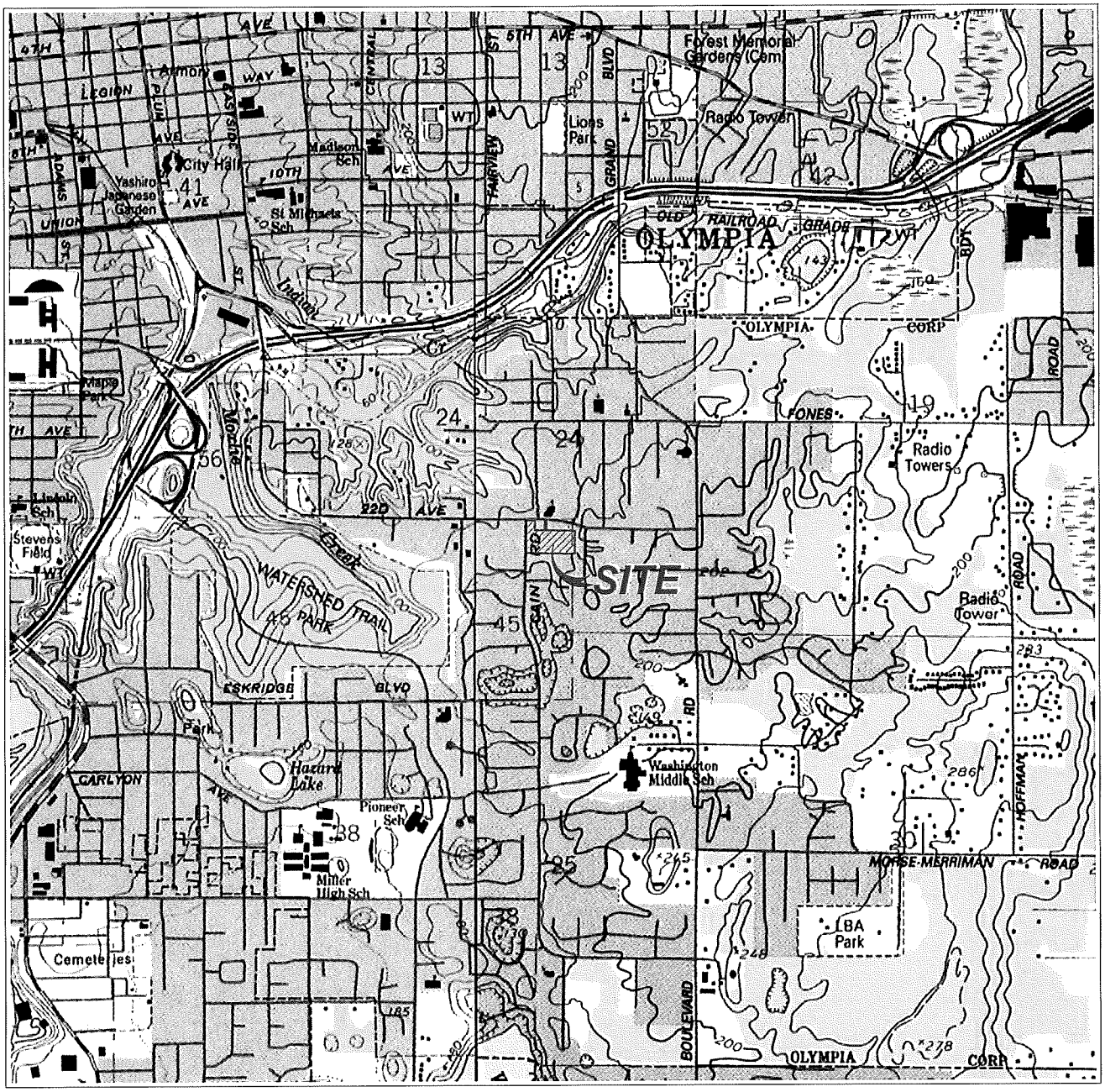
Respectfully Submitted,
INSIGHT GEOLOGIC, INC.

William E. Halbert, L.E.G., L.HG.
Principal



Attachments

FIGURES



LACEY, WASHINGTON
7.5 MINUTE QUADRANGLE
Year 1994

SCALE: 1: 24000

EVERGREEN HEIGHTS
CAIN ROAD SUBDIVISION

OLYMPIA, WASHINGTON

INSIGHT GEOLOGIC, INC.

Figure 1
Vicinity Map

LEGEND:

MW-1 APPROXIMATE MONITORING WELL LOCATION

APPROXIMATE PROJECT BOUNDARY

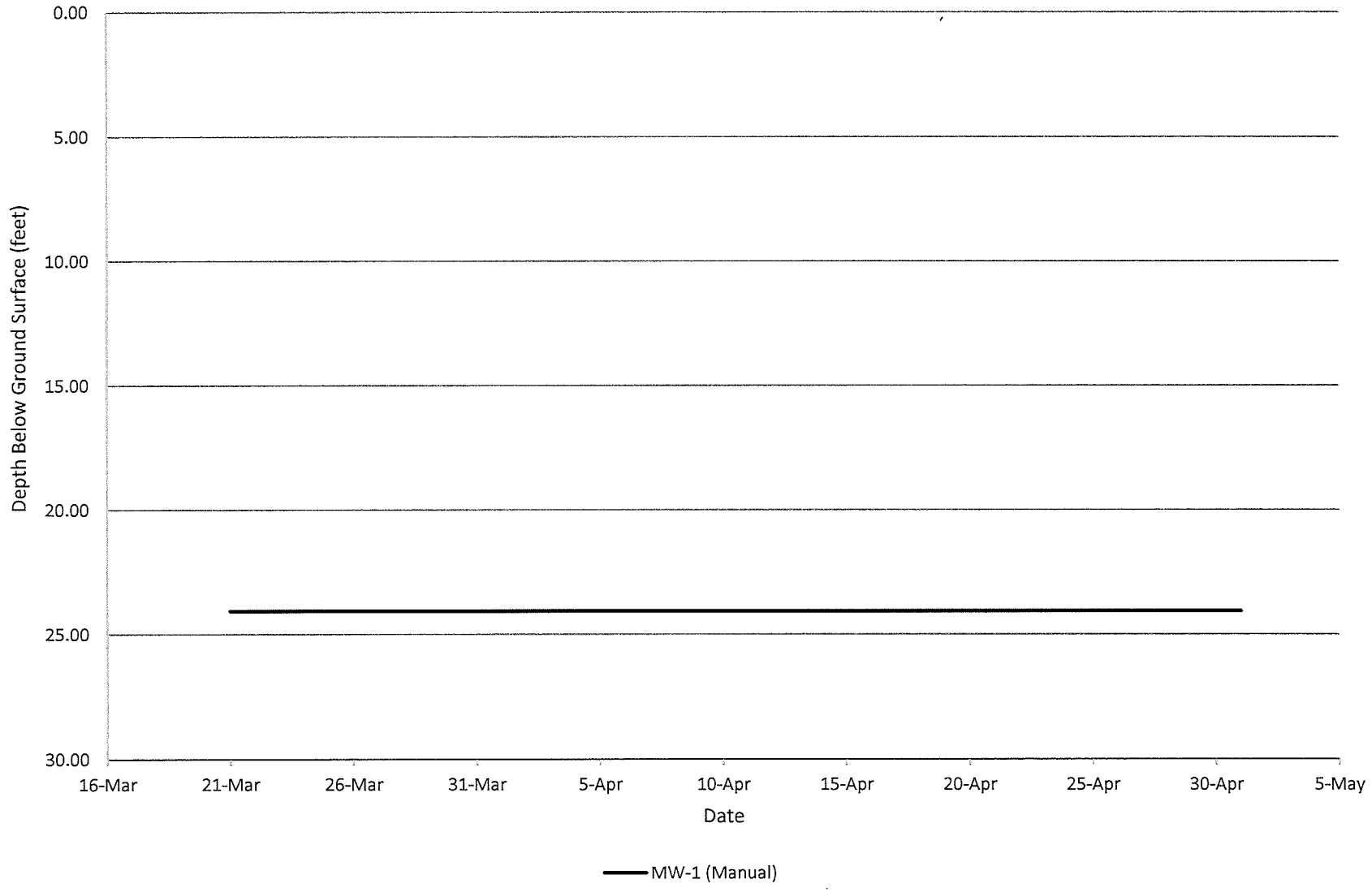
SCALE: 1" = 100'

EVERGREEN HEIGHTS
CAIN ROAD SUBDIVISION

OLYMPIA, WASHINGTON

INSIGHT GEOLOGIC, INC.

Figure 2
Site Plan



INSIGHT GEOLOGIC, INC.

FIGURE 3
HYDROGRAPH MW-1

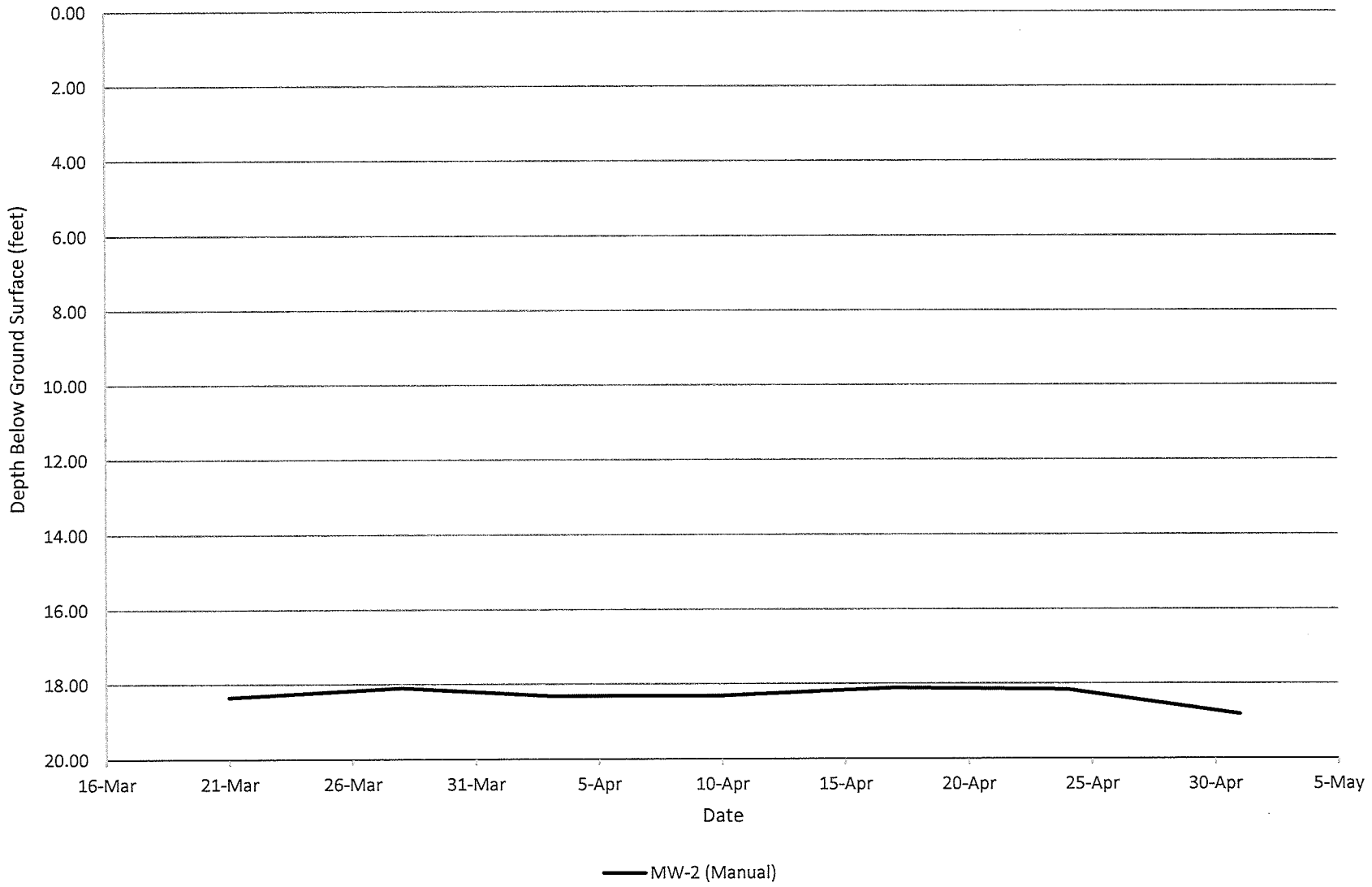


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FIGURE 4
HYDROGRAPH MW-2

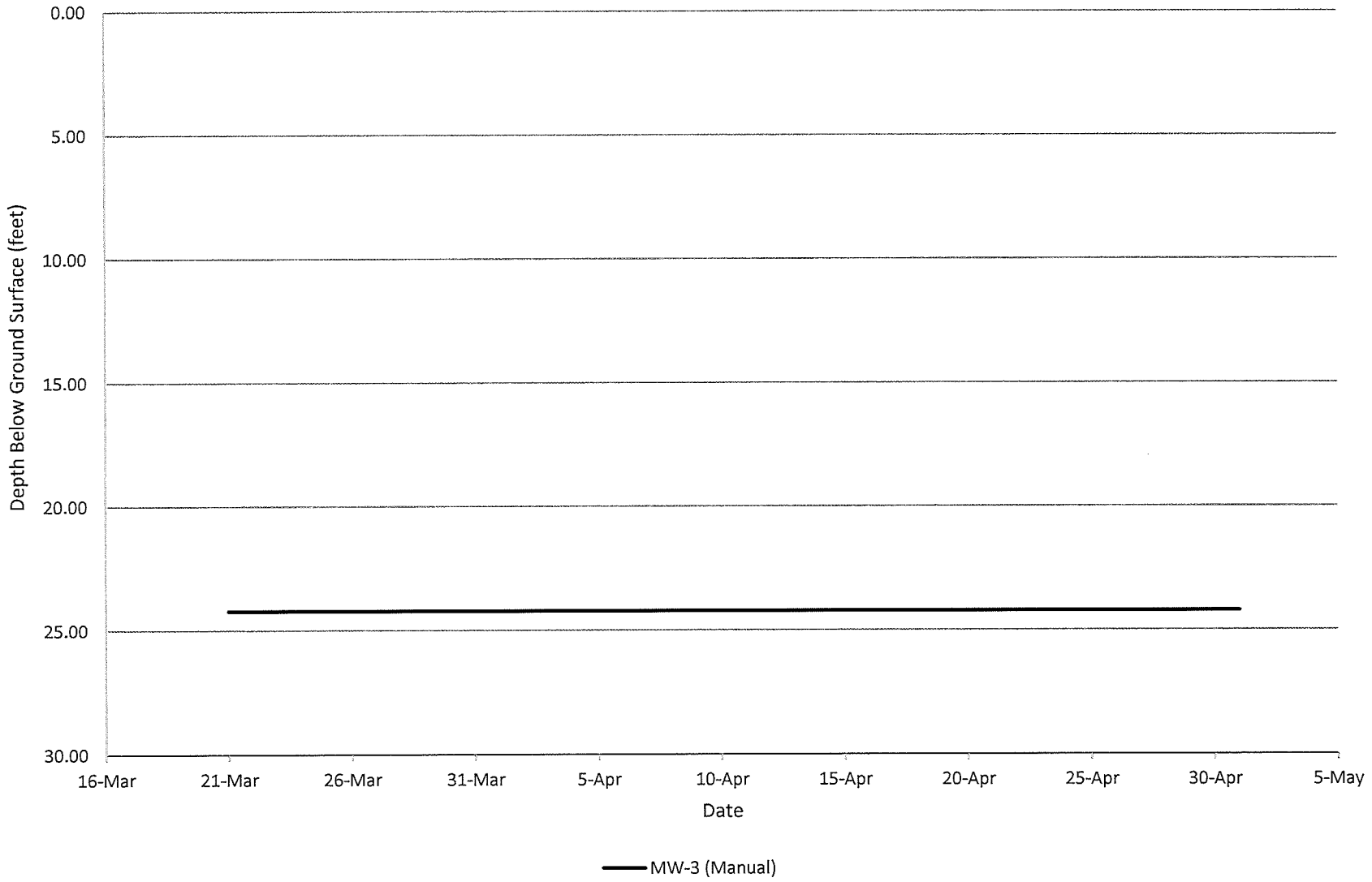

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FIGURE 5
HYDROGRAPH MW-3

ATTACHMENT A
GROUNDWATER MONITORING DATA

Manual Groundwater Measurements

Cain Road - Olympia

Project # 608-006-01

Date	MW-1	MW-2	MW-3
3/21/2018	Dry (<24.08)	18.36	Dry (<24.22)
3/28/2018	Dry (<24.08)	18.11	Dry (<24.22)
4/3/2018	Dry (<24.08)	18.32	Dry (<24.22)
4/10/2018	Dry (<24.08)	18.32	Dry (<24.22)
4/17/2018	Dry (<24.08)	18.12	Dry (<24.22)
4/24/2018	Dry (<24.08)	18.17	Dry (<24.22)
5/1/2018	Dry (<24.08)	18.83	Dry (<24.22)

Measurements are presented in feet below ground surface

ATTACHMENT B

REPORT LIMITATIONS AND GUIDELINES FOR USE

ATTACHMENT B

REPORT LIMITATIONS AND GUIDELINES FOR USE[1]

This attachment provides information to help you manage your risks with respect to the use of this report.

HYDROGEOLOGIC SERVICES ARE PERFORMED FOR SPECIFIC PURPOSES, PERSONS AND PROJECTS

This report has been prepared for the exclusive use of Evergreen Heights, LLC (Client) and their authorized agents. This report may be made available to regulatory agencies for review. This report is not intended for use by others, and the information contained herein is not applicable to other sites.

Insight Geologic structures our services to meet the specific needs of our clients. For example, a hydrogeologic or geologic study conducted for a civil engineer or architect may not fulfill the needs of a construction contractor or even another civil engineer or architect that are involved in the same project. Because each hydrogeologic or geologic study is unique, each hydrogeologic or geologic report is unique, prepared solely for the specific client and project site. Our report is prepared for the exclusive use of our Client. No other party may rely on the product of our services unless we agree in advance to such reliance in writing. This is to provide our firm with reasonable protection against open-ended liability claims by third parties with whom there would otherwise be no contractual limits to their actions. Within the limitations of scope, schedule and budget, our services have been executed in accordance with our Agreement with the Client and generally accepted hydrogeologic practices in this area at the time this report was prepared. This report should not be applied for any purpose or project except the one originally contemplated.

A HYDROGEOLOGIC OR GEOLOGIC REPORT IS BASED ON A UNIQUE SET OF PROJECT-SPECIFIC FACTORS

Insight Geologic considered a number of unique, project-specific factors when establishing the scope of services for this project and report. Unless Insight Geologic specifically indicates otherwise, do not rely on this report if it was:

- not prepared for you,
- not prepared for your project,
- not prepared for the specific site explored, or
- completed before important project changes were made.

If important changes are made after the date of this report, Insight Geologic should be given the opportunity to review our interpretations and recommendations and provide written modifications or confirmation, as appropriate.

SUBSURFACE CONDITIONS CAN CHANGE

This hydrogeologic or geologic report is based on conditions that existed at the time the study was performed. The findings and conclusions of this report may be affected by the passage of time, by

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[1] Developed based on material provided by ASFE, Professional Firms Practicing in the Geosciences; www.asfe.org .

manmade events such as construction on or adjacent to the site, or by natural events such as floods, earthquakes, slope instability or ground water fluctuations. Always contact Insight Geologic before applying a report to determine if it remains applicable.

MOST HYDROGEOLOGIC AND GEOLOGIC FINDINGS ARE PROFESSIONAL OPINIONS

Our interpretations of subsurface conditions are based on field observations from widely spaced sampling locations at the site. Site exploration identifies subsurface conditions only at those points where subsurface tests are conducted or samples are taken. Insight Geologic reviewed field and laboratory data and then applied our professional judgment to render an opinion about subsurface conditions throughout the site. Actual subsurface conditions may differ, sometimes significantly, from those indicated in this report. Our report, conclusions and interpretations should not be construed as a warranty of the subsurface conditions.

HYDROGEOLOGIC REPORT RECOMMENDATIONS ARE NOT FINAL

Do not over-rely on the preliminary recommendations included in this report. These recommendations are not final, because they were developed principally from Insight Geologic's professional judgment and opinion. Insight Geologic's recommendations can be finalized only by observing actual subsurface conditions revealed during construction.

A HYDROGEOLOGIC OR GEOLOGIC REPORT COULD BE SUBJECT TO MISINTERPRETATION

Misinterpretation of this report by other design team members can result in costly problems. You could lower that risk by having Insight Geologic confer with appropriate members of the design team after submitting the report. Also retain Insight Geologic to review pertinent elements of the design team's plans and specifications. Contractors can also misinterpret a hydrogeologic engineering or geologic report. Reduce that risk by having Insight Geologic participate in pre-bid and preconstruction conferences, and by providing construction observation.

DO NOT REDRAW THE EXPLORATION LOGS

Hydrogeologic engineers and geologists prepare final boring and test pit logs based upon their interpretation of field logs and laboratory data. To prevent errors or omissions, the logs included in a hydrogeologic engineering or geologic report should never be redrawn for inclusion in architectural or other design drawings. Only photographic or electronic reproduction is acceptable, but recognize that separating logs from the report can elevate risk.

READ THESE PROVISIONS CLOSELY

Some clients, design professionals and contractors may not recognize that the geoscience practices (hydrogeologic engineering or geology) are far less exact than other engineering and natural science disciplines. This lack of understanding can create unrealistic expectations that could lead to disappointments, claims and disputes. Insight Geologic includes these explanatory "limitations" provisions in our reports to help reduce such risks. Please confer with Insight Geologic if you are unclear how these "Report Limitations and Guidelines for Use" apply to your project or site.

HYDROGEOLOGIC, GEOLOGIC AND ENVIRONMENTAL REPORTS SHOULD NOT BE INTERCHANGED

The equipment, techniques and personnel used to perform an environmental study differ significantly from those used to perform a hydrogeologic or geologic study and vice versa. For that reason, a hydrogeologic engineering or geologic report does not usually relate any environmental findings, conclusions or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. Similarly, environmental reports are not used to address hydrogeologic or geologic concerns regarding a specific project.

INSIGHT GEOLOGIC, INC.

January 8, 2019

Evergreen Heights, LLC
1868 State Avenue NE
Olympia, Washington 98506
Attention: Rob Rice

Supplemental Report
Stormwater Investigation
Village at Cain Road Subdivision
Cain Road SE and 22nd Avenue SE
Olympia, Washington
Project No. 608-006-01

INTRODUCTION

Insight Geologic, Inc. is pleased to provide our supplemental report for the proposed Village at Cain Road Subdivision located southeast of the intersection between Cain Road SE and 22nd Avenue SE in Olympia, Washington. The location of the property is shown relative to surrounding physical features in the Vicinity Map, Figure 1. The site of the proposed subdivision consists of two parcels comprising approximately 5.34 acres. The project will include residential homesites as well as paved streets through the development. Stormwater runoff from roads and homes is to be infiltrated to the subsurface in the northwest portion of the site.

This report is supplemental to our reports titled "*Report – Geotechnical and Stormwater Infiltration Evaluation – Cain Road Subdivision,*" dated April 11, 2018 and "*Report – Winter Groundwater Monitoring – Cain Road Subdivision,*" dated July 19, 2018 and is to further evaluate the proposed stormwater infiltration location.

SCOPE OF SERVICES

The purpose of our services was to evaluate subsurface conditions as they pertain to stormwater infiltration. We proposed to conduct our stormwater services in general accordance with the guidelines outlined in the City of Olympia's 2016 Drainage Design and Erosion Control Manual. Our specific scope of services included the following tasks:

1. Provided for the location of subsurface utilities on the site. We conducted this task by notifying the "One Call" utility locate system.
2. Conducted a site reconnaissance to evaluate and mark proposed boring locations at the site and for truck-mounted drilling rig access.
3. Advanced four (4) borings at the site in the location of the proposed stormwater infiltration pond. The borings were completed to depths ranging from 20 to 28 feet below ground surface (bgs).

4. Maintained logs of the soils encountered in the borings. Soils were described in general accordance with the Unified Soil Classification System and presented on the field logs.
5. Provided for laboratory testing of the soils. We performed gradation analyses to evaluate stormwater infiltration parameters.
6. Prepared a report summarizing our field activities including design infiltration rates for the stormwater infiltration pond.

FINDINGS

Surface Conditions

The project site is situated at an elevation of approximately 170 feet above mean sea level (MSL). The site is bounded by residential properties to the north and east, Cain Road SE to the west, and McGrath Woods Park to the south. The site is currently undeveloped and wooded with Big Leaf Maple, Western Red Cedar and Douglas Fir trees, along with an understory of moderately thick vegetation consisting of sword fern and salal. The overall site slopes gently down to the northwest with an elevation change of approximately 10 feet. A small glacial kettle is located near the northwest corner of the site in the area of the proposed stormwater pond. The base of the kettle has an elevation of approximately 162 feet MSL.

Geology

Based on our review of available published geologic maps, Vashon age glacial recessional outwash deposits underlie the project site and surrounding area. The outwash material is described as fine to medium sand with few fines. These sediments were deposited in and around the margins of glacial lakes by meltwater streams during the waning stages of the most recent glacial epoch in the Puget Sound lowlands; the Fraser Stade of the Vashon glaciation. The outwash is typically found in a loose to moderately dense condition and is not glacially consolidated.

Subsurface Explorations

We explored subsurface conditions in the area of the proposed stormwater pond on November 27, 2018 by advancing four boings in the locations as shown on the Site Plan, Figure 2 and Survey Reference Map, Figure 3. The borings were completed with a truck-mounted direct push drill rig owned and operated by Standard Environmental Probe. A geologist from Insight Geologic monitored the explorations and maintained a log of the conditions encountered. The borings were completed at depths ranging from 20 to 28 feet bgs. The soils were visually classified in general accordance with the system described in ASTM D2487-06. The exploration logs are contained in Attachment A.

Soil Conditions

Soil conditions encountered were generally consistent across the borings completed near the proposed stormwater infiltration pond. Underlying approximately 12 inches of forest duff, we generally encountered between 9 to 11.5 feet of brown silty fine to medium sand (SM) in a loose and moist condition. Underlying this silty sand unit, we encountered between 5 to 6.5 feet of brown silt to sandy silt (ML) in a soft and moist condition. Underlying this silt unit, at an approximate depth of 16 feet bgs, we encountered interbedded units of silty sand (SM), silt (ML), and fine sand (SP), in soft or loose and

moist to wet condition to the base of the borings. These interbedded units were generally 1 to 2 feet in thickness.

One exception to this description was observed within boring B-5, located near the base of the glacial kettle, in which we encountered the silt layer at a depth of 11 feet bgs to the base of the boring at a depth of 20 feet bgs. A generalized geologic cross section through the boring locations is shown in Figure 4.

The surficial soils encountered are generally consistent with Yelm fine sandy loam, which is mapped for the area. These soils are generally formed from glacial outwash and generally have restrictive layers occurring at depths greater than 7 feet below grade according to the U.S. Department of Agriculture Soil Survey.

Groundwater Conditions

Groundwater was encountered within boring B-4 at a depth of 22 feet bgs and in boring B-5 at a depth of 16 feet bgs.

Laboratory Testing

We selected seven soil samples for gradation analyses in general accordance with ASTM D422 to define soil class and develop stormwater infiltration rates. Our geotechnical laboratory test results are presented in Attachment B.

STORMWATER INFILTRATION

We completed a stormwater infiltration rate evaluation in general accordance with the 2016 City of Olympia Drainage Design and Erosion Control Manual (2016 Manual). The 2016 Manual uses a detailed method that utilizes the relationship between the D_{10}, D_{60}, and D_{90} results of the ASTM grain-size distribution analyses, along with site specific correction factors to estimate long-term design infiltration rates.

Based on our gradation analyses, we estimate that the long-term design infiltration rate (F_{design}) for the proposed stormwater infiltration pond is approximately 0.14 inch per hour. Our calculations assume that the stormwater infiltration will occur at a depth of approximately 2 feet bgs. We further assumed that winter groundwater rises to approximately 20 feet bgs or an elevation of 143 feet MSL based on our initial investigations performed at the site.

Table 1. Design Infiltration Rates – Detailed Method

Exploration	Unit	Depth Range (feet)	D_{10} Value	D_{60} Value	D_{90} Value	Long Term Design Infiltration Rate (Inches per hour)
B-4	SM	1.0 – 7.0	0.0	0.14	0.25	0.1
B-4	SM	7.0 – 11.5	0.0	0.17	0.37	0.2
B-4	ML	11.5 – 12.0	0.0	0.0	0.29	0.02
B-4	ML	12.0 – 16.0	0.0	0.0	0.08	0.02
B-4	ML	18.0 – 20.0	0.0	0.0	0.0	0.01
B-6	ML	5.0 – 7.0	0.0	0.0	0.08	0.01
B-7	ML	9.0 – 15.0	0.0	0.0	0.13	0.01

CONCLUSIONS AND RECOMMENDATIONS

We have performed a supplemental evaluation of subsurface conditions for the stormwater infiltration location for the proposed Village at Cain Road Subdivision located southeast of the intersection between Cain Road SE and 22nd Avenue SE in Olympia, Washington. Soil conditions were generally consistent across the borings located at the proposed infiltration pond area and consisted of approximately 10 feet of silty find to medium sand overlying a sandy silt to silt unit. Based on our observations and evaluation, the underlying silt unit is effectively impermeable, and groundwater raises to within the lower portion of the upper sandy silt unit. Based on the results of our evaluation and consultation with the City of Olympia Stormwater Manual, we recommend a design infiltration rate of 0.1 inch per hour for the proposed stormwater infiltration pond, based on the depth to the restrictive silt units as described in our previous reports titled "*Report – Geotechnical and Stormwater Infiltration Evaluation – Cain Road Subdivision,*" dated April 11, 2018 and "*Report – Winter Groundwater Monitoring – Cain Road Subdivision,*" dated July 19, 2018. This infiltration rate is consistent with the design infiltration rate provided previously.

LIMITATIONS

We have prepared this supplemental stormwater investigation report for the exclusive use of Evergreen Heights, LLC and their authorized agents for the proposed Village at Cain Road Subdivision to be located at Cain Road SE and 22nd Avenue SE in Olympia, Washington.

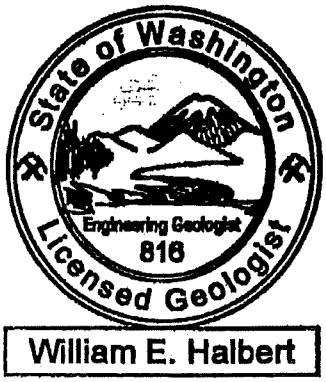
Within the limitations of scope, schedule and budget, our services have been executed in accordance with generally accepted practices in the field of geotechnical engineering in this area at the time this report was prepared. No warranty or other conditions, expressed or implied, should be understood.

Please refer to Attachment C titled "Report Limitations and Guidelines for Use" for additional information pertaining to use of this report.

We appreciate the opportunity to be of service to you on this project. Please contact us if you have questions or require additional information.

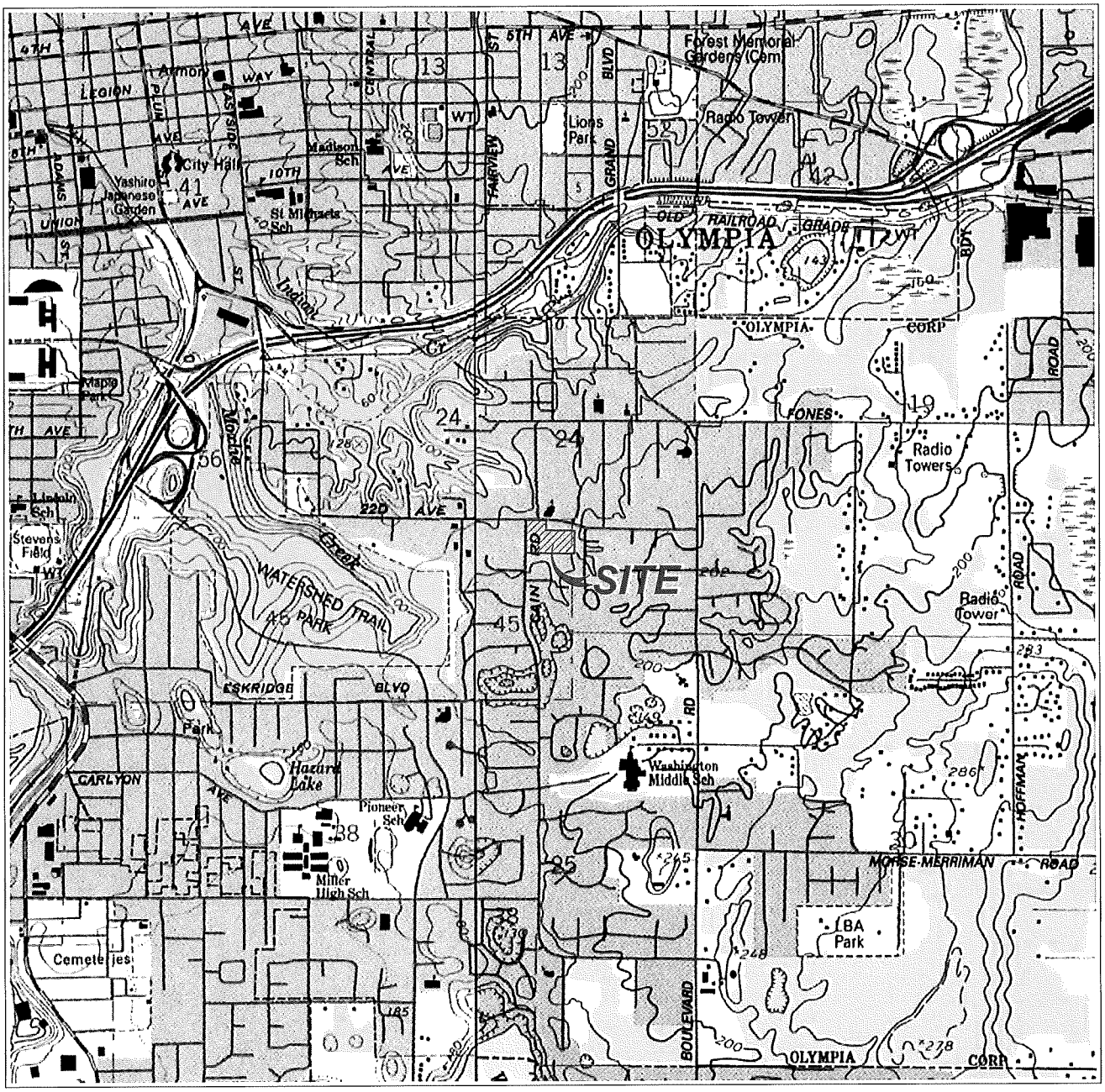
Respectfully Submitted,
INSIGHT GEOLOGIC, INC.

William E. Halbert, L.E.G., L.HG.
Principal



Attachments

FIGURES



LACEY, WASHINGTON
7.5 MINUTE QUADRANGLE
Year 1994

SCALE: 1: 24000

VILLAGE AT CAIN ROAD SUBDIVISION

OLYMPIA, WASHINGTON

INSIGHT GEOLOGIC, INC.

Figure 1
Vicinity Map

LEGEND:

B-4 APPROXIMATE BORING LOCATION

APPROXIMATE PROJECT BOUNDARY

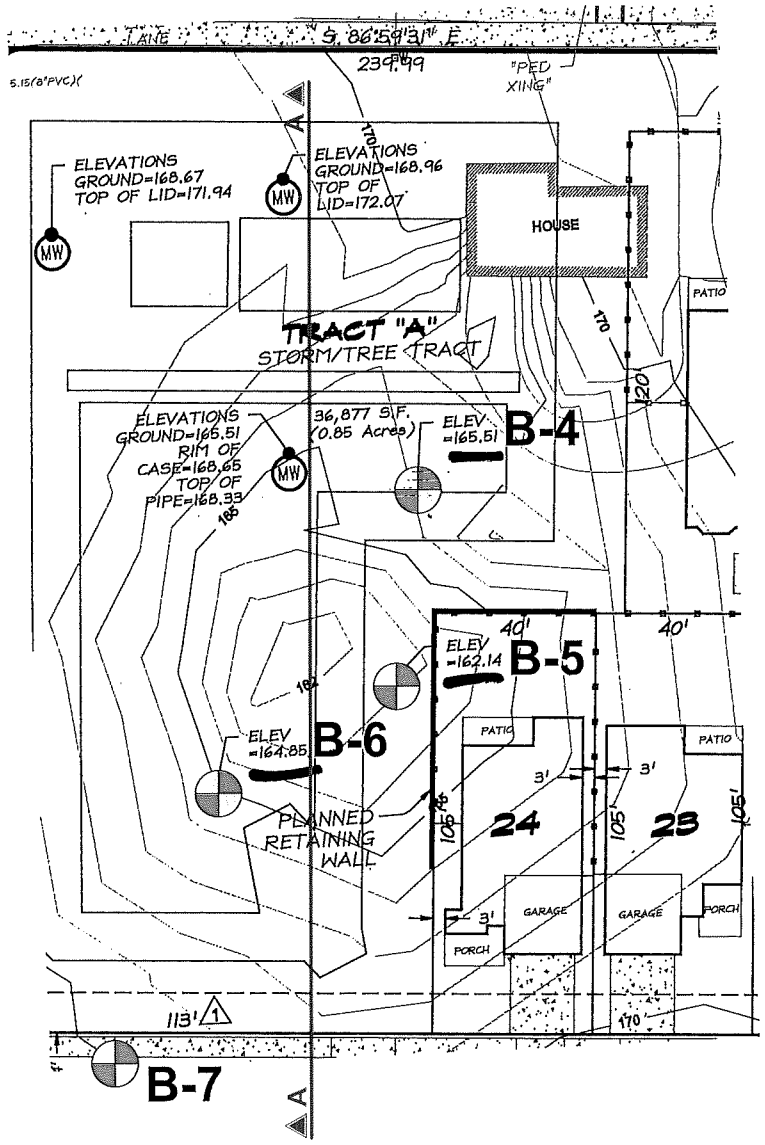
SCALE: 1" = 100'

VILLAGE AT CAIN ROAD SUBDIVISION

OLYMPIA, WASHINGTON

INSIGHT GEOLOGIC, INC.

Figure 2
Site Plan



LEGEND:

B-4 APPROXIMATE BORING LOCATION

A A CROSS SECTION (SEE FIGURE 4)

*MEASUREMENTS ARE APPROXIMATE

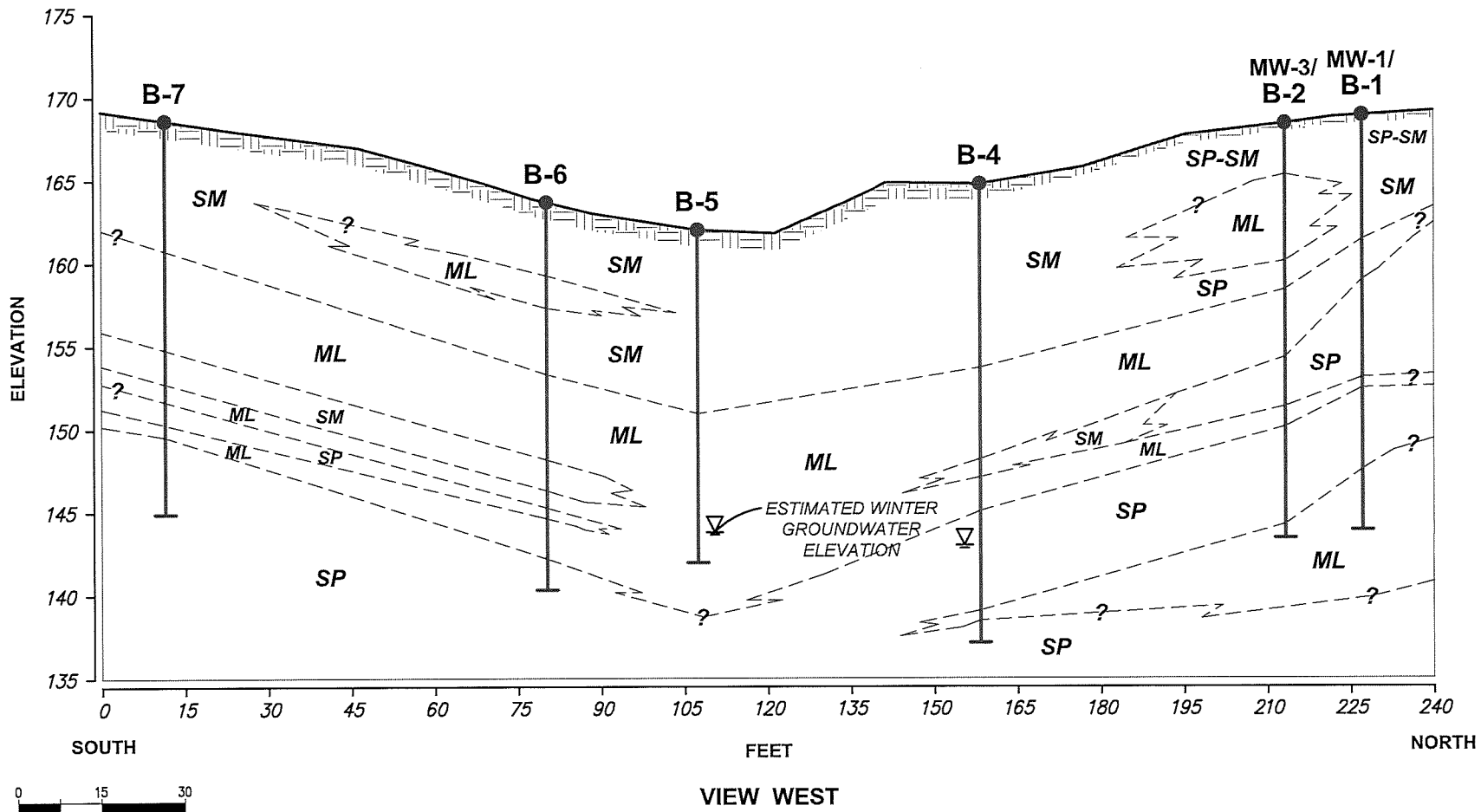
SCALE: 1" = 50'
SOURCE: ROB RICE

VILLAGE AT CAIN ROAD SUBDIVISION

OLYMPIA, WASHINGTON

INSIGHT GEOLOGIC, INC.

Figure 3
Survey Reference Map



0 15 30

HORIZONTAL SCALE: 1" = 30'

0 5 10

VERTICAL SCALE: 1" = 10'

NOTE: GENERALIZED CROSS SECTION WITH APPROXIMATE MEASUREMENTS
BORING LOCATIONS ARE PROJECTED TO SECTION

VILLAGE AT CAIN ROAD SUBDIVISION

OLYMPIA, WASHINGTON

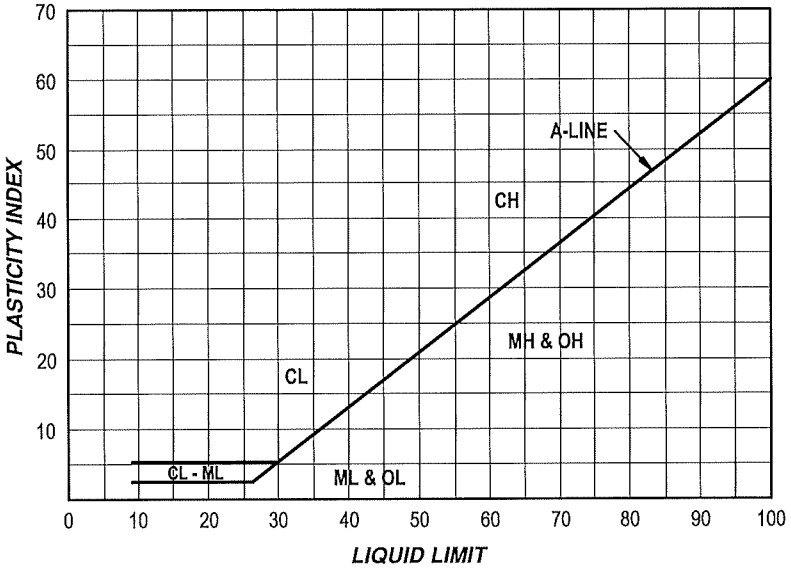
INSIGHT GEOLOGIC, INC.

Figure 4
Cross Section

ATTACHMENT A
EXPLORATION LOGS

SOIL CLASSIFICATION CHART

MAJOR DIVISIONS			SYMBOLS	GROUP NAME
COARSE GRAINED SOILS	GRAVEL AND GRAVELLY SOILS MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	CLEAN GRAVEL <5% FINES	GW	WELL-GRADED GRAVEL, FINE TO COARSE GRAVEL
			GP	POORLY GRADED GRAVEL
		GRAVEL WITH FINES >12% FINES	GM	SILTY GRAVEL
			GC	CLAYEY GRAVEL
MORE THAN 50% RETAINED ON NO. 200 SIEVE	SAND AND SANDY SOILS MORE THAN 50% OF COARSE FRACTION PASSING NO. 4 SIEVE	CLEAN SAND <5% FINES	SW	WELL-GRADED SAND, FINE TO COARSE SAND
			SP	POORLY GRADED SAND
		SAND WITH FINES >12% FINES	SM	SILTY SAND
			SC	CLAYEY SAND
FINE GRAINED SOILS	SILTS AND CLAYS LIQUID LIMIT LESS THAN 50	INORGANIC	ML	SILT
			CL	CLAY
		ORGANIC	OL	ORGANIC SILT, ORGANIC CLAY
MORE THAN 50% PASSING NO. 200 SIEVE	SILTS AND CLAYS LIQUID LIMIT 50 OR MORE	INORGANIC	MH	SILT OF HIGH PLASTICITY, ELASTIC SILT
			CH	CLAY OF HIGH PLASTICITY, FAT CLAY
		ORGANIC	OH	ORGANIC CLAY, ORGANIC SILT
HIGHLY ORGANIC SOILS			PT	PEAT



SOIL MOISTURE MODIFIERS:
DRY - ABSENCE OF MOISTURE, DUSTY, DRY TO THE TOUCH
MOIST - DAMP, BUT NO VISIBLE WATER
WET - VISIBLE FREE WATER OR SATURATED, USUALLY SOIL IS OBTAINED BELOW WATER TABLE

ADDITIONAL MATERIAL SYMBOLS

SYMBOLS	TYPICAL DESCRIPTION
CC	CEMENT CONCRETE
AC	ASPHALT CONCRETE
CR	CRUSHED ROCK / QUARRY SPALLS
TS	TOPSOIL/SOD/DUFF

GROUNDWATER EXPLORATION SYMBOLS

- MEASURED GROUNDWATER LEVEL IN EXPLORATION, WELL, OR PIEZOMETER
- GROUNDWATER OBSERVED AT TIME OF EXPLORATION
- PERCHED WATER OBSERVED AT TIME OF EXPLORATION
- MEASURED FREE PRODUCT IN WELL OR PIEZOMETER

STRATIGRAPHIC CONTACT

- APPROXIMATE CONTACT BETWEEN SOIL STRATA OR GEOLOGIC UNIT
- APPROXIMATE LOCATION OF SOIL STRATA CHANGE WITHIN GEOLOGIC SOIL UNIT
- APPROXIMATE GRADUAL CHANGE BETWEEN SOIL STRATA OR GEOLOGIC SOIL UNIT
- APPROXIMATE GRADUAL CHANGE OF SOIL STRATA WITHIN GEOLOGIC SOIL UNIT

LABORATORY / FIELD TEST CLASSIFICATIONS

- **%F** PERECENT FINES
- **AL** ATTERBERG LIMITS
- **CA** CHEMICAL ANALYSIS
- **CP** LABORATORY COMPACTION TEST
- **CS** CONSOLIDATION TEST
- **DS** DIRECT SHEAR
- **HA** HYDROMETER ANALYSIS
- **MC** MOISTURE CONTENT
- **MD** MOISTURE CONTENT AND DRY DENSITY
- **OC** ORGANIC COMPOUND
- **PM** PERMEABILITY OR HYDRAULIC CONDUCTIVITY
- **PP** POCKET PENETROMETER
- **SA** SIEVE ANALYSIS
- **TX** TRIAXIAL COMPRESSION
- **UC** UNCONFINED COMPRESSION
- **VS** VANE SHEAR

SAMPLER SYMBOLS

- 2.4 INCH I.D. SPLIT BARREL
- DIRECT-PUSH
- STANDARD PENETRATION TEST
- SHELBY TUBE
- PISTON
- BULK OR GRAB

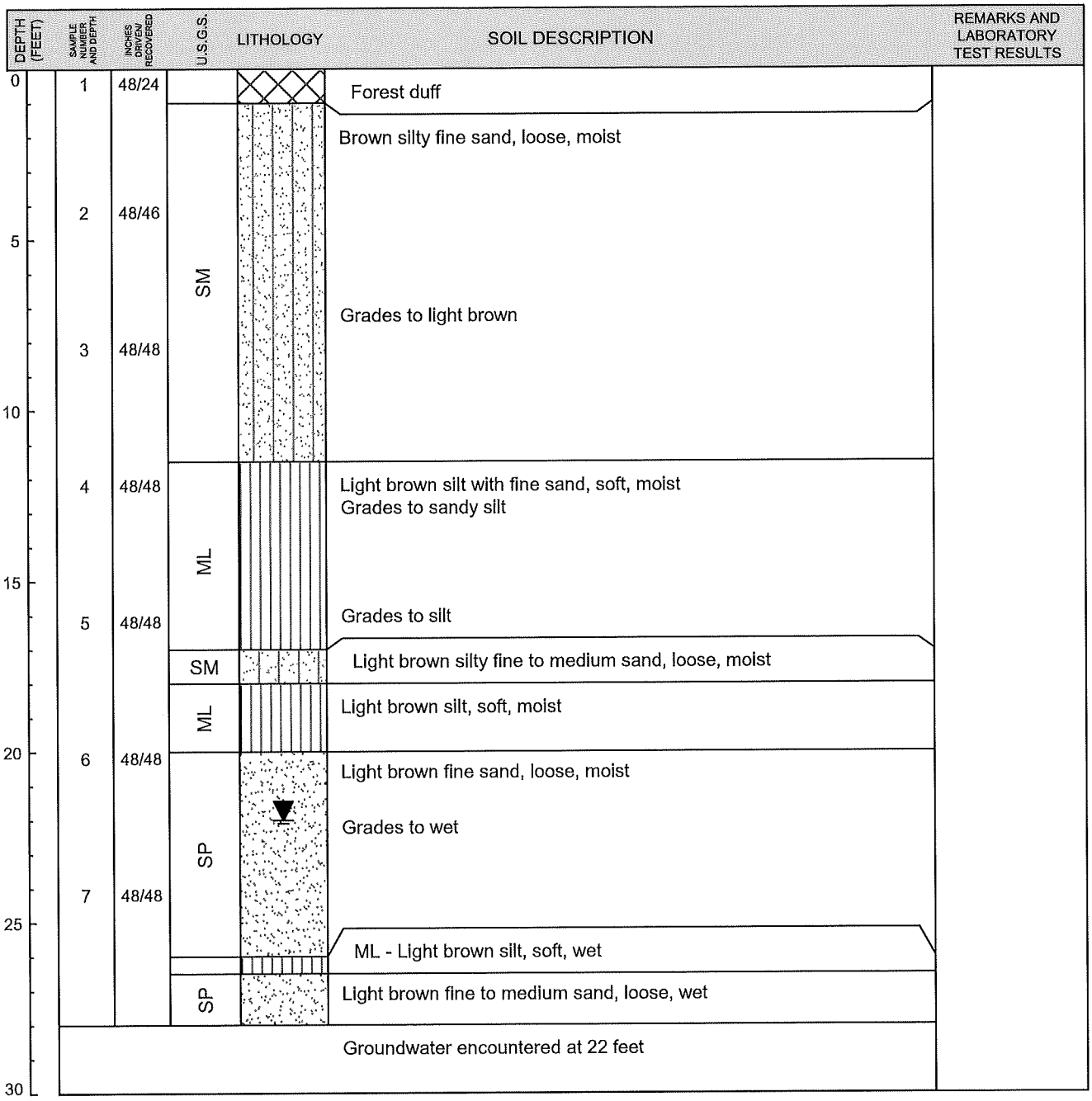
SHEEN CLASSIFICATIONS

- **NS** NO VISIBLE SHEEN
- **SS** SLIGHT SHEEN
- **MS** MODERATE SHEEN
- **HS** HEAVY SHEEN
- **NT** NOT TESTED

INSIGHT GEOLOGIC, INC.

Key to Exploration Logs

B-4



LEGEND:

PROJECT NO.: 608-006-01
DATE: NOVEMBER 27, 2018
TOTAL DEPTH: 28 FEET
DRILLING CONTRACTOR: STANDARD ENVIRONMENTAL PROBE
DRILLING EQUIPMENT: GEOPROBE 5200
DRILLING METHOD: DIRECT PUSH
LOGGED BY: KEVIN VANDEHEY

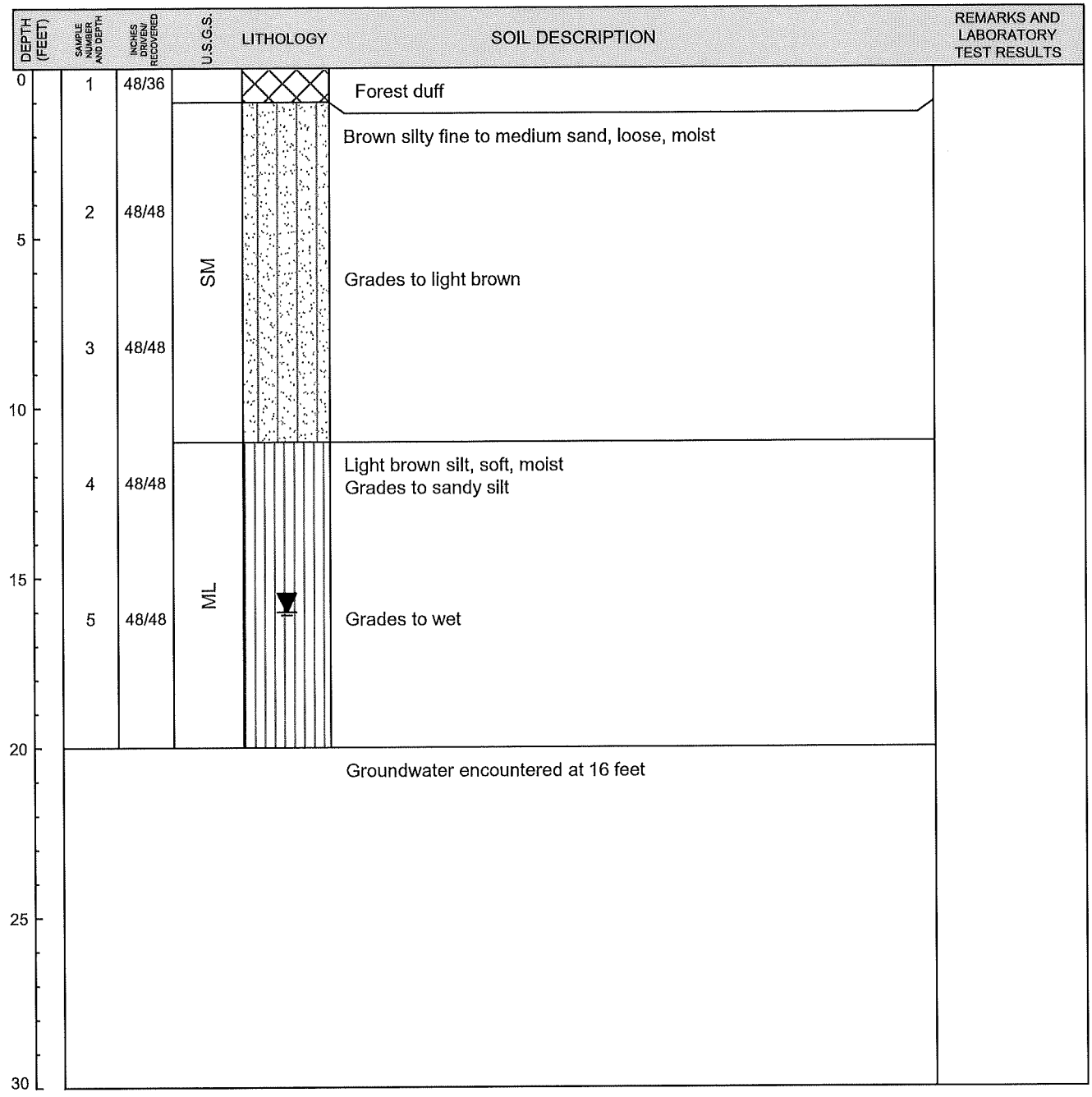
VILLAGE AT CAIN ROAD SUBDIVISION

OLYMPIA, WASHINGTON

INSIGHT GEOLOGIC, INC.

Exploration Log B-4

B-5



LEGEND:

PROJECT NO.: 608-006-01
DATE: NOVEMBER 27, 2018
TOTAL DEPTH: 20 FEET
DRILLING CONTRACTOR: STANDARD ENVIRONMENTAL PROBE
DRILLING EQUIPMENT: GEOPROBE 5200
DRILLING METHOD: DIRECT PUSH
LOGGED BY: KEVIN VANDEHEY

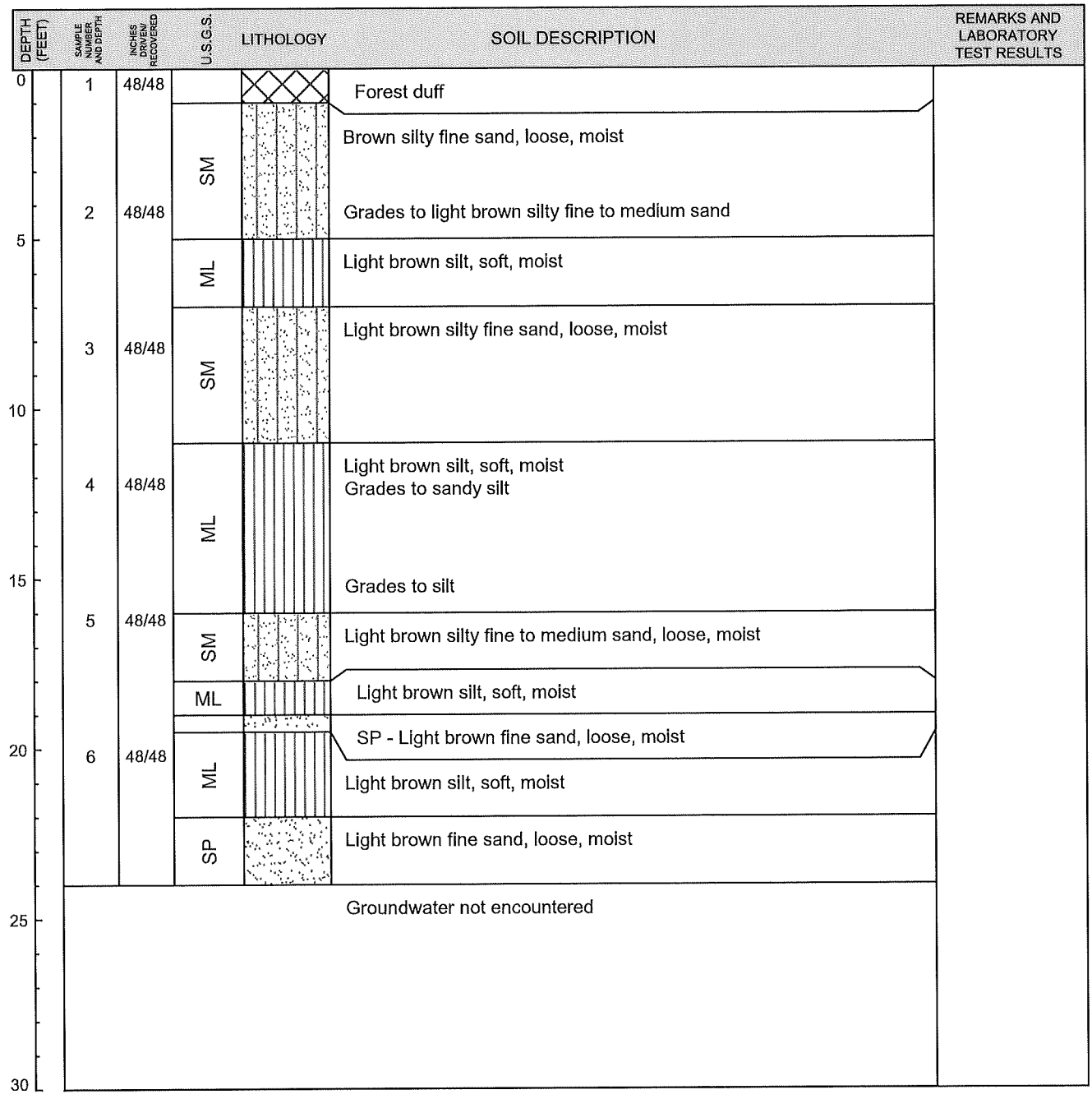
VILLAGE AT CAIN ROAD SUBDIVISION

OLYMPIA, WASHINGTON

INSIGHT GEOLOGIC, INC.

Exploration Log B-5

B-6



LEGEND:

PROJECT NO.: 608-006-01
DATE: NOVEMBER 27, 2018
TOTAL DEPTH: 24 FEET
DRILLING CONTRACTOR: STANDARD ENVIRONMENTAL PROBE
DRILLING EQUIPMENT: GEOPROBE 5200
DRILLING METHOD: DIRECT PUSH
LOGGED BY: KEVIN VANDEHEY

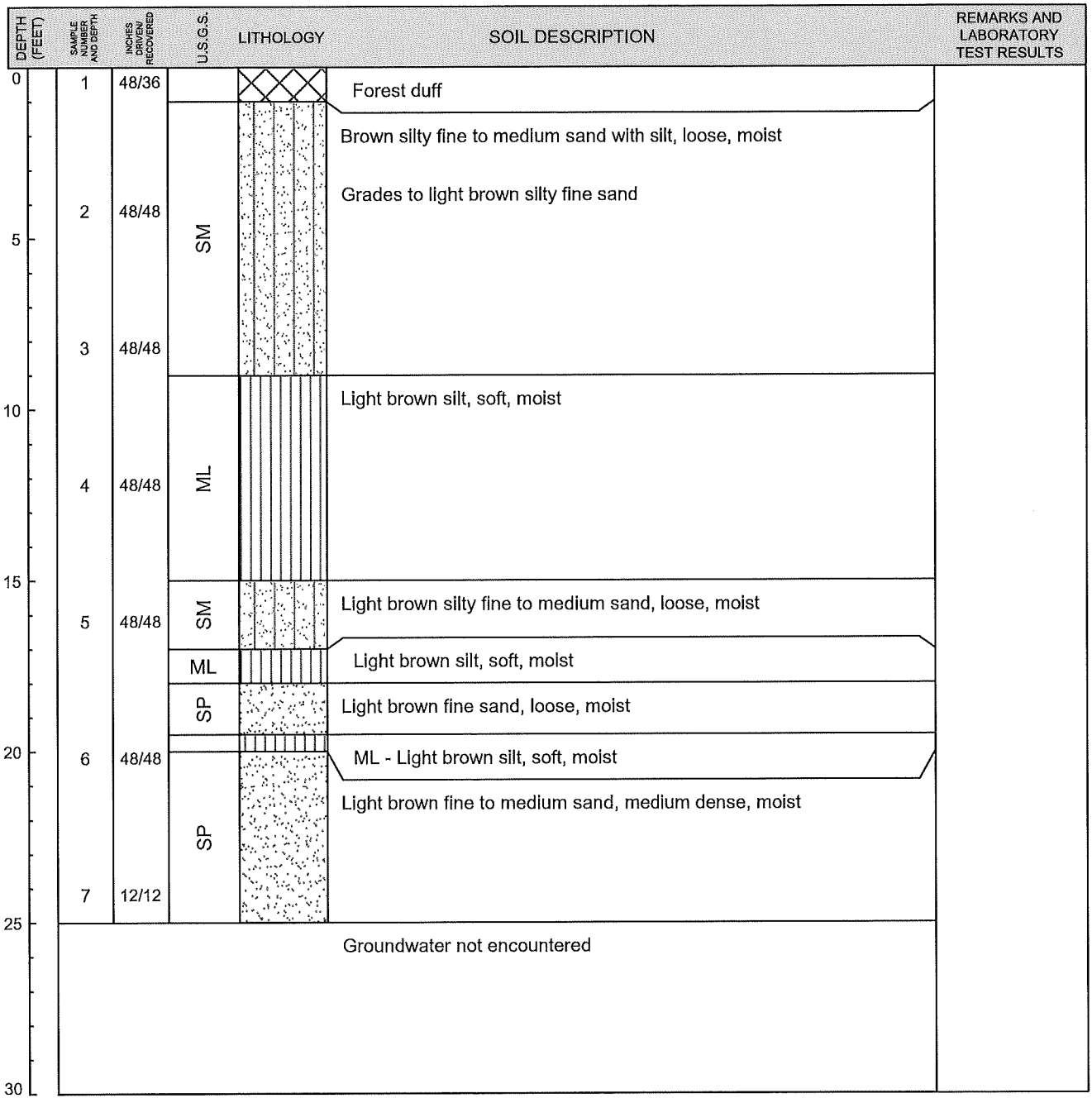
VILLAGE AT CAIN ROAD SUBDIVISION

OLYMPIA, WASHINGTON

INSIGHT GEOLOGIC, INC.

Exploration Log B-6

B-7



LEGEND:

PROJECT NO.: 608-006-01
DATE: NOVEMBER 27, 2018
TOTAL DEPTH: 25 FEET
DRILLING CONTRACTOR: STANDARD ENVIRONMENTAL PROBE
DRILLING EQUIPMENT: GEOPROBE 5200
DRILLING METHOD: DIRECT PUSH
LOGGED BY: KEVIN VANDEHEY

VILLAGE AT CAIN ROAD SUBDIVISION

OLYMPIA, WASHINGTON

INSIGHT GEOLOGIC, INC.

Exploration Log B-7

ATTACHMENT B
LABORATORY ANALYSES RESULTS

Gradation Analysis Summary Data

Job Name: Village at Cain Road Subdivision
Job Number: 608-006-01
Date Tested: 12/17/18
Tested By: Kevin Vandehey

Sample Location: B-4
Sample Name: B-4 1.0' - 7.0'
Depth: 1 - 7 Feet

Moisture Content (%) 7.1%

Sieve Size	Percent Passing
3.0 in. (75.0)	100.0
1.5 in. (37.5)	100.0
3/4 in. (19.0)	100.0
3/8 in. (9.5-mm)	100.0
No. 4 (4.75-mm)	100.0
No. 10 (2.00-mm)	99.7
No. 20 (.850-mm)	99.4
No. 40 (.425-mm)	97.6
No. 60 (.250-mm)	90.4
No. 100 (.150-mm)	72.2
No. 200 (.075-mm)	32.0

Size Fraction	Percent by Weight
Coarse Gravel	0.0
Fine Gravel	0.0
Coarse Sand	0.3
Medium Sand	2.1
Fine Sand	65.7
Fines	32.0
Total	**100.0**

LL --
PL --
PI --

D_{10} 0.00
D_{30} 0.00
D_{60} 0.14
D_{90} 0.25

Cc --
Cu --

ASTM Classification
Group Name: **Silty Fine Sand**
Symbol: **SM**

INSIGHT GEOLOGIC, INC.

Gradation Analysis Summary Data

Job Name: Village at Cain Road Subdivision
Job Number: 608-006-01
Date Tested: 12/17/18
Tested By: Kevin Vandehey

Sample Location: B-4
Sample Name: B-4 7.0' - 11.5'
Depth: 7 - 11.5 Feet

Moisture Content (%) 9.7%

Sieve Size	Percent Passing
3.0 in. (75.0)	100.0
1.5 in. (37.5)	100.0
3/4 in. (19.0)	100.0
3/8 in. (9.5-mm)	100.0
No. 4 (4.75-mm)	100.0
No. 10 (2.00-mm)	100.0
No. 20 (.850-mm)	99.4
No. 40 (.425-mm)	93.6
No. 60 (.250-mm)	76.4
No. 100 (.150-mm)	57.6
No. 200 (.075-mm)	22.5

Size Fraction	Percent by Weight
Coarse Gravel	0.0
Fine Gravel	0.0
Coarse Sand	0.0
Medium Sand	6.4
Fine Sand	71.2
Fines	22.5
Total	**100.0**

LL	- -
PL	- -
PI	- -
D_{10}	0.00
D_{30}	0.08
D_{60}	0.17
D_{90}	0.37
Cc	- -
Cu	- -

ASTM Classification
Group Name: **Silty Fine Sand**
Symbol: **SM**

INSIGHT GEOLOGIC, INC.

Gradation Analysis Summary Data

Job Name: Village at Cain Road Subdivision
Job Number: 608-006-01
Date Tested: 12/17/18
Tested By: Kevin Vandehey

Sample Location: B-4
Sample Name: B-4 11.5' - 12.0'
Depth: 11.5 - 12 Feet

Moisture Content (%) 35.0%

Sieve Size	Percent Passing
3.0 in. (75.0)	100.0
1.5 in. (37.5)	100.0
3/4 in. (19.0)	100.0
3/8 in. (9.5-mm)	100.0
No. 4 (4.75-mm)	100.0
No. 10 (2.00-mm)	99.9
No. 20 (.850-mm)	99.0
No. 40 (.425-mm)	96.3
No. 60 (.250-mm)	88.2
No. 100 (.150-mm)	82.9
No. 200 (.075-mm)	76.2

Size Fraction	Percent by Weight
Coarse Gravel	0.0
Fine Gravel	0.0
Coarse Sand	0.1
Medium Sand	3.6
Fine Sand	20.1
Fines	76.2
Total	**100.0**

LL --
PL --
PI --

D_{10} 0.00
D_{30} 0.00
D_{60} 0.00
D_{90} 0.29

Cc --
Cu --

ASTM Classification
Group Name: **Silt with Fine Sand**
Symbol: **ML**

INSIGHT GEOLOGIC, INC.

Gradation Analysis Summary Data

Job Name: Village at Cain Road Subdivision
Job Number: 608-006-01
Date Tested: 12/17/18
Tested By: Kevin Vandehey

Sample Location: B-4
Sample Name: B-4 12.0' - 16.0'
Depth: 12 - 16 Feet

Moisture Content (%) 22.4%

Sieve Size	Percent Passing
3.0 in. (75.0)	100.0
1.5 in. (37.5)	100.0
3/4 in. (19.0)	100.0
3/8 in. (9.5-mm)	100.0
No. 4 (4.75-mm)	100.0
No. 10 (2.00-mm)	100.0
No. 20 (.850-mm)	99.8
No. 40 (.425-mm)	99.5
No. 60 (.250-mm)	98.7
No. 100 (.150-mm)	96.4
No. 200 (.075-mm)	68.6

Size Fraction	Percent by Weight
Coarse Gravel	0.0
Fine Gravel	0.0
Coarse Sand	0.0
Medium Sand	0.5
Fine Sand	30.9
Fines	68.6
Total	**100.0**

LL	- -
PL	- -
PI	- -
D_{10}	0.00
D_{30}	0.00
D_{60}	0.00
D_{90}	0.076
Cc	- -
Cu	- -

ASTM Classification
Group Name: **Sandy Silt**
Symbol: **ML**

INSIGHT GEOLOGIC, INC.

Gradation Analysis Summary Data

Job Name: Village at Cain Road Subdivision
Job Number: 608-006-01
Date Tested: 12/17/18
Tested By: Kevin Vandehey

Sample Location: B-4
Sample Name: B-4 18.0' - 20.0'
Depth: 18 - 20 Feet

Moisture Content (%) 37.9%

Sieve Size	Percent Passing
3.0 in. (75.0)	100.0
1.5 in. (37.5)	100.0
3/4 in. (19.0)	100.0
3/8 in. (9.5-mm)	100.0
No. 4 (4.75-mm)	100.0
No. 10 (2.00-mm)	100.0
No. 20 (.850-mm)	99.9
No. 40 (.425-mm)	99.8
No. 60 (.250-mm)	99.5
No. 100 (.150-mm)	98.3
No. 200 (.075-mm)	96.0

Size Fraction	Percent by Weight
Coarse Gravel	0.0
Fine Gravel	0.0
Coarse Sand	0.0
Medium Sand	0.2
Fine Sand	3.8
Fines	96.0
Total	**100.0**

LL --
PL --
PI --

D_{10} 0.00
D_{30} 0.00
D_{60} 0.00
D_{90} 0.00

Cc --
Cu --

ASTM Classification
Group Name: **Silt**
Symbol: **ML**

INSIGHT GEOLOGIC, INC.

Gradation Analysis Summary Data

Job Name: Village at Cain Road Subdivision
Job Number: 608-006-01
Date Tested: 12/17/18
Tested By: Kevin Vandehey

Sample Location: B-6
Sample Name: B-6 5.0' - 7.0'
Depth: 5 - 7 Feet

Moisture Content (%) 20.7%

Sieve Size	Percent Passing
3.0 in. (75.0)	100.0
1.5 in. (37.5)	100.0
3/4 in. (19.0)	100.0
3/8 in. (9.5-mm)	100.0
No. 4 (4.75-mm)	100.0
No. 10 (2.00-mm)	100.0
No. 20 (.850-mm)	99.9
No. 40 (.425-mm)	99.3
No. 60 (.250-mm)	98.6
No. 100 (.150-mm)	97.2
No. 200 (.075-mm)	88.9

Size Fraction	Percent by Weight
Coarse Gravel	0.0
Fine Gravel	0.0
Coarse Sand	0.0
Medium Sand	0.7
Fine Sand	10.5
Fines	88.9
Total	**100.0**

LL --
PL --
PI --

D_{10} 0.00
D_{30} 0.00
D_{60} 0.00
D_{90} 0.08

Cc --
Cu --

ASTM Classification
Group Name: **Silt**
Symbol: **ML**

INSIGHT GEOLOGIC, INC.

Gradation Analysis Summary Data

Job Name: Village at Cain Road Subdivision
Job Number: 608-006-01
Date Tested: 12/17/18
Tested By: Kevin Vandehey

Sample Location: B-7
Sample Name: B-7 9.0' - 15.0'
Depth: 9 - 15 Feet

Moisture Content (%) 33.4%

Sieve Size	Percent Passing
3.0 in. (75.0)	100.0
1.5 in. (37.5)	100.0
3/4 in. (19.0)	100.0
3/8 in. (9.5-mm)	100.0
No. 4 (4.75-mm)	100.0
No. 10 (2.00-mm)	99.7
No. 20 (.850-mm)	99.6
No. 40 (.425-mm)	98.8
No. 60 (.250-mm)	96.7
No. 100 (.150-mm)	93.5
No. 200 (.075-mm)	84.5

Size Fraction	Percent by Weight
Coarse Gravel	0.0
Fine Gravel	0.0
Coarse Sand	0.3
Medium Sand	0.9
Fine Sand	14.3
Fines	84.5
Total	**100.0**

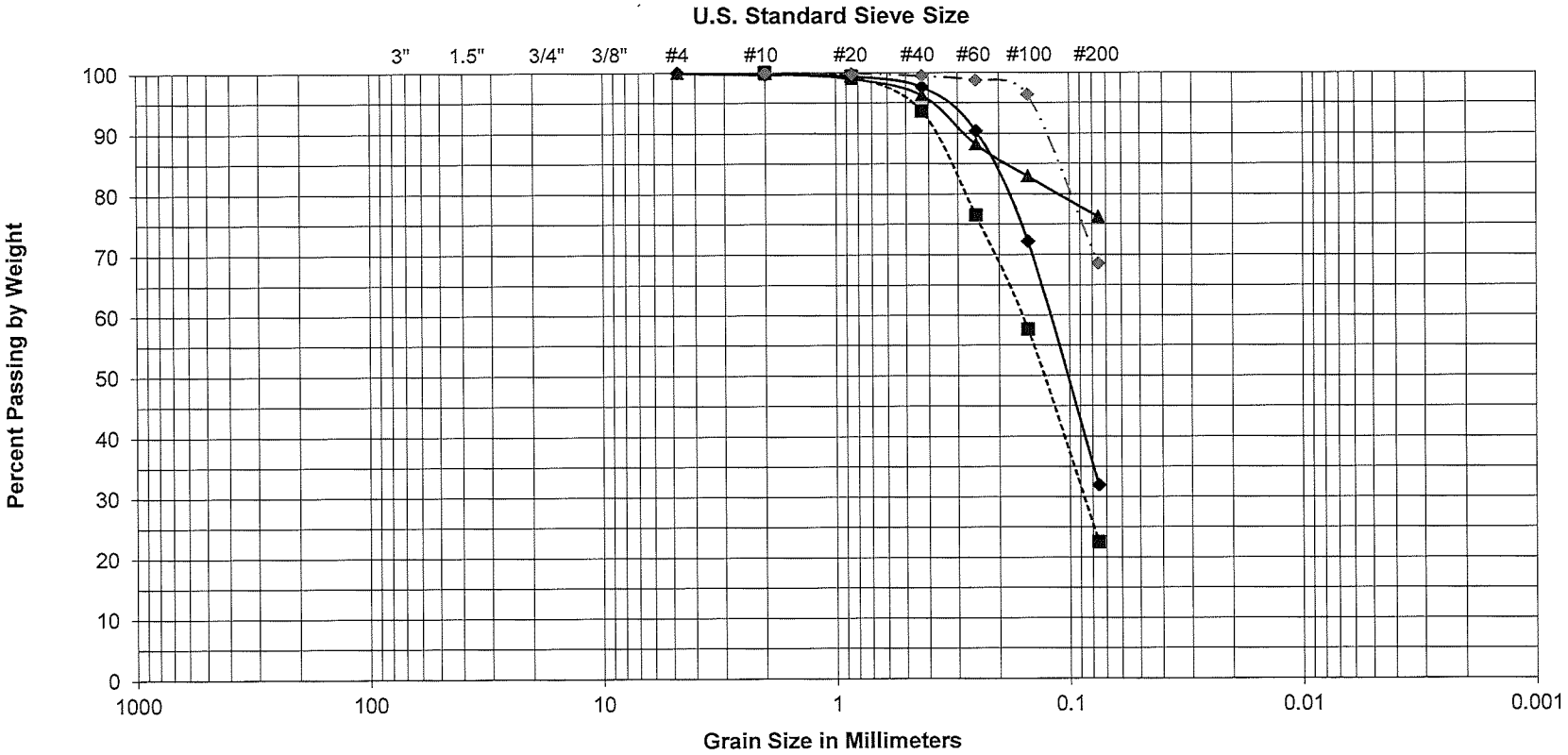
LL --
PL --
PI --

D_{10} 0.00
D_{30} 0.00
D_{60} 0.00
D_{90} 0.13

Cc --
Cu --

ASTM Classification
Group Name: **Silt**
Symbol: **ML**

INSIGHT GEOLOGIC, INC.



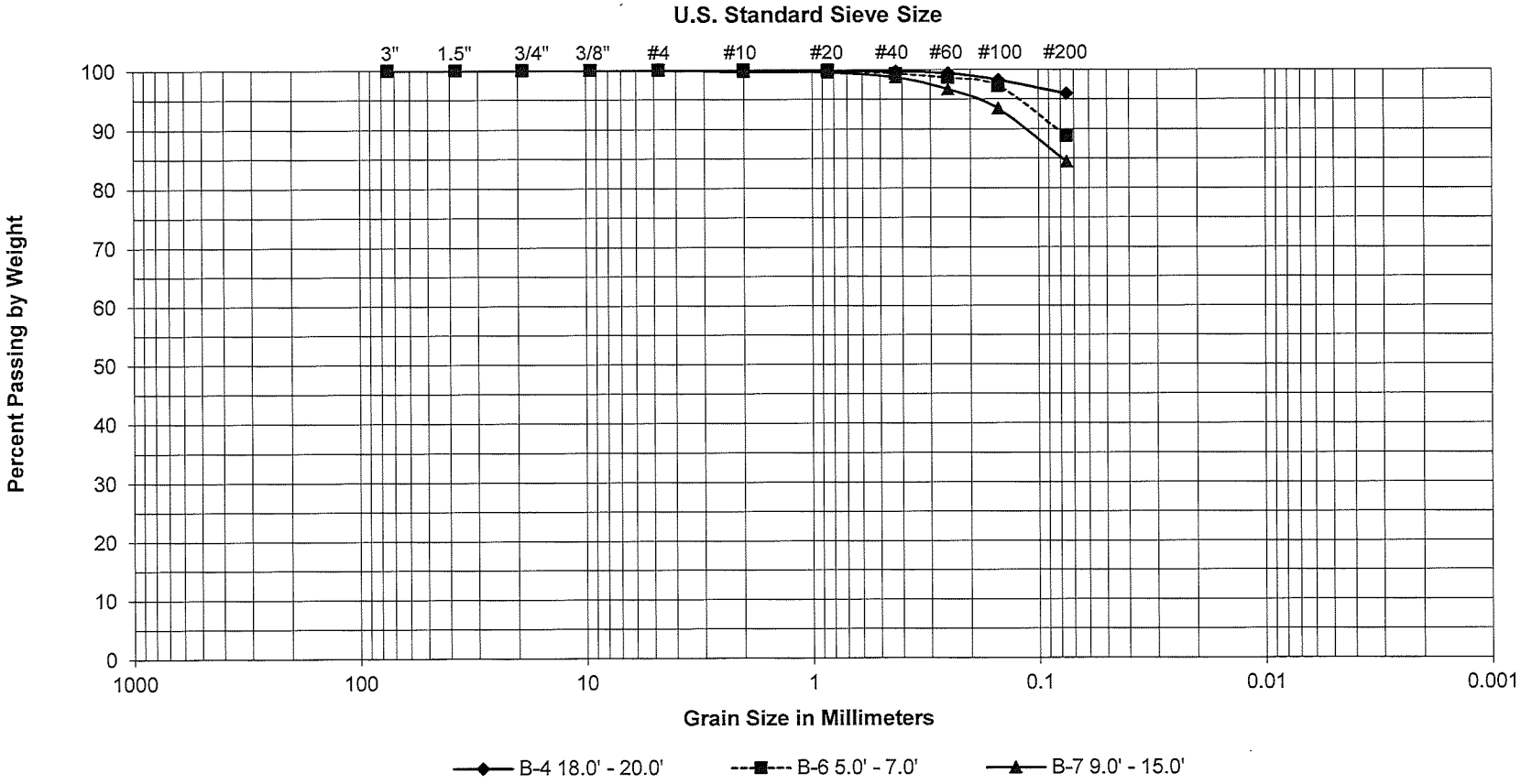
COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	

VILLAGE AT CAIN ROAD SUBDIVISON

OLYMPIA, WASHINGTON

INSIGHT GEOLOGIC, INC.

Graph 1
Gradation Analysis Results



COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	

VILLAGE AT CAIN ROAD SUBDIVISION

OLYMPIA, WASHINGTON

INSIGHT GEOLOGIC, INC.

Graph 2
Gradation Analysis Results

ATTACHMENT C
REPORT LIMITATIONS AND GUIDELINES FOR USE

ATTACHMENT C

REPORT LIMITATIONS AND GUIDELINES FOR USE[1]

This attachment provides information to help you manage your risks with respect to the use of this report.

GEOTECHNICAL SERVICES ARE PERFORMED FOR SPECIFIC PURPOSES, PERSONS AND PROJECTS

This report has been prepared for the exclusive use of Evergreen Heights, LLC (Client) and their authorized agents. This report may be made available to regulatory agencies for review. This report is not intended for use by others, and the information contained herein is not applicable to other sites.

Insight Geologic Inc. structures our services to meet the specific needs of our clients. For example, a geotechnical or geologic study conducted for a civil engineer or architect may not fulfill the needs of a construction contractor or even another civil engineer or architect that are involved in the same project. Because each geotechnical or geologic study is unique, each geotechnical engineering or geologic report is unique, prepared solely for the specific client and project site. Our report is prepared for the exclusive use of our Client. No other party may rely on the product of our services unless we agree in advance to such reliance in writing. This is to provide our firm with reasonable protection against open-ended liability claims by third parties with whom there would otherwise be no contractual limits to their actions. Within the limitations of scope, schedule and budget, our services have been executed in accordance with our Agreement with the Client and generally accepted geotechnical practices in this area at the time this report was prepared. This report should not be applied for any purpose or project except the one originally contemplated.

A GEOTECHNICAL ENGINEERING OR GEOLOGIC REPORT IS BASED ON A UNIQUE SET OF PROJECT-SPECIFIC FACTORS

Insight Geologic, Inc. considered a number of unique, project-specific factors when establishing the scope of services for this project and report. Unless Insight Geologic specifically indicates otherwise, do not rely on this report if it was:

- not prepared for you,
- not prepared for your project,
- not prepared for the specific site explored, or
- completed before important project changes were made.

For example, changes that can affect the applicability of this report include those that affect:

- the function of the proposed structure;
- elevation, configuration, location, orientation or weight of the proposed structure;
- composition of the design team; or
- project ownership.

If important changes are made after the date of this report, Insight Geologic should be given the opportunity to review our interpretations and recommendations and provide written modifications or confirmation, as appropriate.

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[1] Developed based on material provided by ASFE, Professional Firms Practicing in the Geosciences; www.asfe.org .

SUBSURFACE CONDITIONS CAN CHANGE

This geotechnical or geologic report is based on conditions that existed at the time the study was performed. The findings and conclusions of this report may be affected by the passage of time, by manmade events such as construction on or adjacent to the site, or by natural events such as floods, earthquakes, slope instability or ground water fluctuations. Always contact Insight Geologic before applying a report to determine if it remains applicable.

MOST GEOTECHNICAL AND GEOLOGIC FINDINGS ARE PROFESSIONAL OPINIONS

Our interpretations of subsurface conditions are based on field observations from widely spaced sampling locations at the site. Site exploration identifies subsurface conditions only at those points where subsurface tests are conducted or samples are taken. Insight Geologic reviewed field and laboratory data and then applied our professional judgment to render an opinion about subsurface conditions throughout the site. Actual subsurface conditions may differ, sometimes significantly, from those indicated in this report. Our report, conclusions and interpretations should not be construed as a warranty of the subsurface conditions.

GEOTECHNICAL ENGINEERING REPORT RECOMMENDATIONS ARE NOT FINAL

Do not over-rely on the preliminary construction recommendations included in this report. These recommendations are not final, because they were developed principally from Insight Geologic's professional judgment and opinion. Insight Geologic's recommendations can be finalized only by observing actual subsurface conditions revealed during construction. Insight Geologic cannot assume responsibility or liability for this report's recommendations if we do not perform construction observation.

Sufficient monitoring, testing and consultation by Insight Geologic should be provided during construction to confirm that the conditions encountered are consistent with those indicated by the explorations, to provide recommendations for design changes should the conditions revealed during the work differ from those anticipated, and to evaluate whether or not earthwork activities are completed in accordance with our recommendations. Retaining Insight Geologic for construction observation for this project is the most effective method of managing the risks associated with unanticipated conditions.

A GEOTECHNICAL ENGINEERING OR GEOLOGIC REPORT COULD BE SUBJECT TO MISINTERPRETATION

Misinterpretation of this report by other design team members can result in costly problems. You could lower that risk by having Insight Geologic confer with appropriate members of the design team after submitting the report. Also retain Insight Geologic to review pertinent elements of the design team's plans and specifications. Contractors can also misinterpret a geotechnical engineering or geologic report. Reduce that risk by having Insight Geologic participate in pre-bid and pre-construction conferences, and by providing construction observation.

DO NOT REDRAW THE EXPLORATION LOGS

Geotechnical engineers and geologists prepare final boring and testing logs based upon their interpretation of field logs and laboratory data. To prevent errors or omissions, the logs included in a

geotechnical engineering or geologic report should never be redrawn for inclusion in architectural or other design drawings. Only photographic or electronic reproduction is acceptable, but recognize that separating logs from the report can elevate risk.

GIVE CONTRACTORS A COMPLETE REPORT AND GUIDANCE

Some owners and design professionals believe they can make contractors liable for unanticipated subsurface conditions by limiting what they provide for bid preparation. To help prevent costly problems, give contractors the complete geotechnical engineering or geologic report, but preface it with a clearly written letter of transmittal. In that letter, advise contractors that the report was not prepared for purposes of bid development and that the report's accuracy is limited; encourage them to confer with Insight Geologic and/or to conduct additional study to obtain the specific types of information they need or prefer. A pre-bid conference can also be valuable. Be sure contractors have sufficient time to perform additional study. Only then might an owner be in a position to give contractors the best information available, while requiring them to at least share the financial responsibilities stemming from unanticipated conditions. Further, a contingency for unanticipated conditions should be included in your project budget and schedule.

CONTRACTORS ARE RESPONSIBLE FOR SITE SAFETY ON THEIR OWN CONSTRUCTION PROJECTS

Our geotechnical recommendations are not intended to direct the contractor's procedures, methods, schedule or management of the work site. The contractor is solely responsible for job site safety and for managing construction operations to minimize risks to on-site personnel and to adjacent properties.

READ THESE PROVISIONS CLOSELY

Some clients, design professionals and contractors may not recognize that the geoscience practices (geotechnical engineering or geology) are far less exact than other engineering and natural science disciplines. This lack of understanding can create unrealistic expectations that could lead to disappointments, claims and disputes. Insight Geologic includes these explanatory "limitations" provisions in our reports to help reduce such risks. Please confer with Insight Geologic if you are unclear how these "Report Limitations and Guidelines for Use" apply to your project or site.

GEOTECHNICAL, GEOLOGIC AND ENVIRONMENTAL REPORTS SHOULD NOT BE INTERCHANGED

The equipment, techniques and personnel used to perform an environmental study differ significantly from those used to perform a geotechnical or geologic study and vice versa. For that reason, a geotechnical engineering or geologic report does not usually relate any environmental findings, conclusions or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. Similarly, environmental reports are not used to address geotechnical or geologic concerns regarding a specific project.

INSIGHT GEOLOGIC, INC.

1015 East 4th Avenue
Olympia, Washington 98506
Telephone: (360) 754-2128
Fax: (360) 754-9299

MEMORANDUM

TO: Blake Wilkerson, P.E.

FROM: William Halbert, L.E.G., L.Hg.

DATE: March 14, 2019

PROJECT: Village at Cain Road

SUBJECT: Supplemental Infiltration Rate Evaluation

At the request of Jeff Pantier, of Hatton Godat Pantier we have conducted a supplemental evaluation for the proposed stormwater infiltration pond at the Village at Cain Road Road Subdivision to be located southeast of the intersection between Cain Road SE and 22nd Avenue SE in Olympia, Washington.

Our previous investigations and evaluation of design storm water infiltration rates for the project using the "Detailed Method" as described in the 2016 City of Olympia Drainage Design and Erosion Control Manual (2016 Manual) produced artificially low infiltration rates for the site. It was decided that we also run a full-scale Pilot Infiltration Test (PIT) as a more realistic method of determining the infiltration rate of the soil. On February 6, 2019, we completed a stormwater infiltration rate evaluation in general accordance with the 2016 Manual consisting of a full-scale PIT. The PIT was performed within the proposed stormwater infiltration pond at the proposed base of pond elevation.

For the PIT, a 10 foot by 10 foot area was excavated to a depth of about 1.5 feet below the base of a shallow depression located near the northwest corner of the site and within the area of the proposed storm water pond. The base of the excavation correlated to the approximate elevation of the base of the proposed storm water infiltration pond. The soil exposed in the base of the excavation consisted of silty, fine to medium sand which was consistent with our previous observations.

Water was added to the excavation for a period of about 6 hours (9 am to 3 pm) to maintain a level of water in the excavation and to saturate the underlying soils. The source of the water used was a City of Olympia fire hydrant. A datalogging pressure transducer was placed in the bottom of the excavation to provide a constant record of the water level in the excavation. The water level over time is shown in Figure 1, below. Following the soaking period, the water flow into the excavation was stopped and the water was allowed to drain. The initial infiltration rate was calculated using the fall of the water level in inches over time.

We then applied the appropriate correction factors to the initial infiltration rate of 13.16 inches per hour as shown in Table 1, below. We also added an additional correction factor of 0.5 to account for thin silt layers observed in our test explorations. Our final design infiltration rate is 4.0 inches per hour.

Figure 1.

PIT Hydrograph

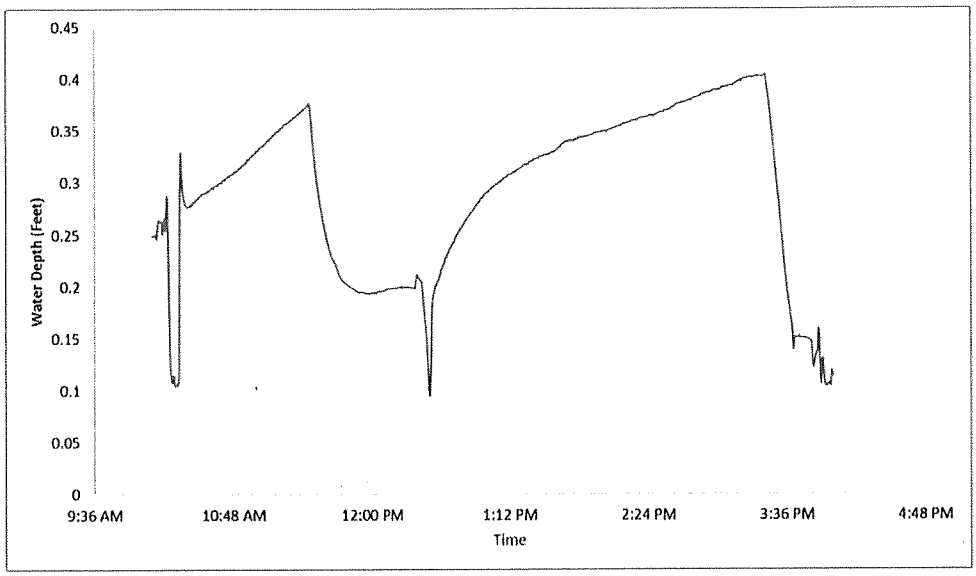


Table 1.

Design Infiltration Rate Calculation

PIT	Initial Infiltration Rate (in./hr.)	Testing Methodology Correction Factor	Site Variability Correction Factor	Plugging Correction Factor	Discretionary Correction Factor	Design Infiltration Rate (in./hr.)
PIT-1	12.69	0.75	0.9	0.9	0.5	3.8

We trust this meets your current requirements. Please contact us if you have questions regarding our testing.

Raw Infiltration Data

3:25:13 PM	2/6/2019 15:25	0.4048
3:25:43 PM	2/6/2019 15:25	0.3977
3:26:13 PM	2/6/2019 15:26	0.3914
3:26:43 PM	2/6/2019 15:26	0.384
3:27:13 PM	2/6/2019 15:27	0.3761
3:27:43 PM	2/6/2019 15:27	0.367
3:28:13 PM	2/6/2019 15:28	0.357
3:28:43 PM	2/6/2019 15:28	0.3484
3:29:13 PM	2/6/2019 15:29	0.3388
3:29:43 PM	2/6/2019 15:29	0.3287
3:30:13 PM	2/6/2019 15:30	0.3196
3:30:43 PM	2/6/2019 15:30	0.3098
3:31:13 PM	2/6/2019 15:31	0.3007
3:31:43 PM	2/6/2019 15:31	0.2906
3:32:13 PM	2/6/2019 15:32	0.2818
3:32:43 PM	2/6/2019 15:32	0.2711
3:33:13 PM	2/6/2019 15:33	0.2609
3:33:43 PM	2/6/2019 15:33	0.2506
3:34:13 PM	2/6/2019 15:34	0.2406
3:34:43 PM	2/6/2019 15:34	0.2288
3:35:13 PM	2/6/2019 15:35	0.2198
3:35:43 PM	2/6/2019 15:35	0.2101
3:36:13 PM	2/6/2019 15:36	0.2009
3:36:43 PM	2/6/2019 15:36	0.1924
3:37:13 PM	2/6/2019 15:37	0.1861
3:37:43 PM	2/6/2019 15:37	0.18
3:38:13 PM	2/6/2019 15:38	0.1719
3:38:43 PM	2/6/2019 15:38	0.1675
3:39:13 PM	2/6/2019 15:39	0.157
3:39:43 PM	2/6/2019 15:39	0.1398

APPENDIX C – Hydraulic Analysis

Village at Cain Road

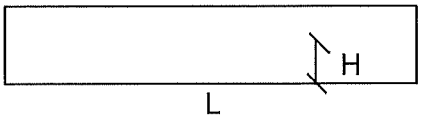
Basin	Onsite Area (sq ft)	Offsite Area (sq ft)	Total Area (sq ft)	Total Area (acre)	Total Roofs	Roof* Area (sq ft)	Drywell Roof Area (sq ft)	Pond Roof Area (sq ft)	Onsite Road Area (sq ft)	Offsite Road Area (sq ft)	Driveway Area (sq ft)	OnsiteSidewalk Area (sq ft)	Offsite Sidewalk Area (sq ft)	Forest Area (sq ft)	Lawn/Landscaping Area (sq ft)	Pond Area (sq ft)	Net Area	Net Impervious	Net Pervious	Percent Impervious
#1-Mcgrath Woods Park	0	180785	180785	4.15	0	0	0	0	0	0	0	0	0	180785	0		4.15	0.00	4.15	0.00%
#2-Cain Road Half Street	0	17300	17300	0.40	0	0	0	0	0	17300	0	0	0	0	0		0.40	0.40	0.00	100.00%
#3-22nd and Nut Tree Contributing Lawn Areas	0	50835	50835	1.17	0	0	0	0	0	0	0	0	0	0	50835	0	1.17	0.00	1.17	0.00%
#4-Village at Cain Plat	218150	0	218150	5.01	24	47560	0	47560	17330	0	9585	10790	0	36845	73710	22330	5.01	1.96	2.54	39.09%
Infiltration Pond Total	218150	248920	467070	10.72	24	47560	0	47560	17330	17300	9585	10790	0	217630	124545	22330	10.72	2.35	7.86	21.96%
#5-Bypass Total	0	10628	10628	0.24	0	0	0	0	0	7140	0	0	1815	0	1673	0	0.24	0.21	0.04	84.26%
Total TDA	218150	259548	477698	10.97	24	47560	0	47560	17330	24440	9585	10790	1815	217630	126218	22330	10.97	2.56	7.89	23.35%

WWHM (areas in acres)	Infiltration Pond Existing	Infiltration Pond Proposed		Bypass Existing	Bypass Proposed
Forest	10.72	5.00			0.00
Lawn/Landscaping**		2.86		0.08	0.04
Roads		0.79		0.12	0.16
Roofs (Pond)		1.09			0.00
Driveways		0.22			0.00
Sidewalks		0.25		0.04	0.04
Pond		0.51			0.00
Total	10.72	10.72		0.24	0.24
Total Impervious	0.00	2.35		0.16	0.21
Total Pervious	10.72	8.37		0.08	0.04

*Roof Areas area measured + 200sf per lot for patio and porch areas
**Lawn/Landscaping areas will be modeled as Pasture (LID.02 Flow Credits)

Emergency Overflow Riser

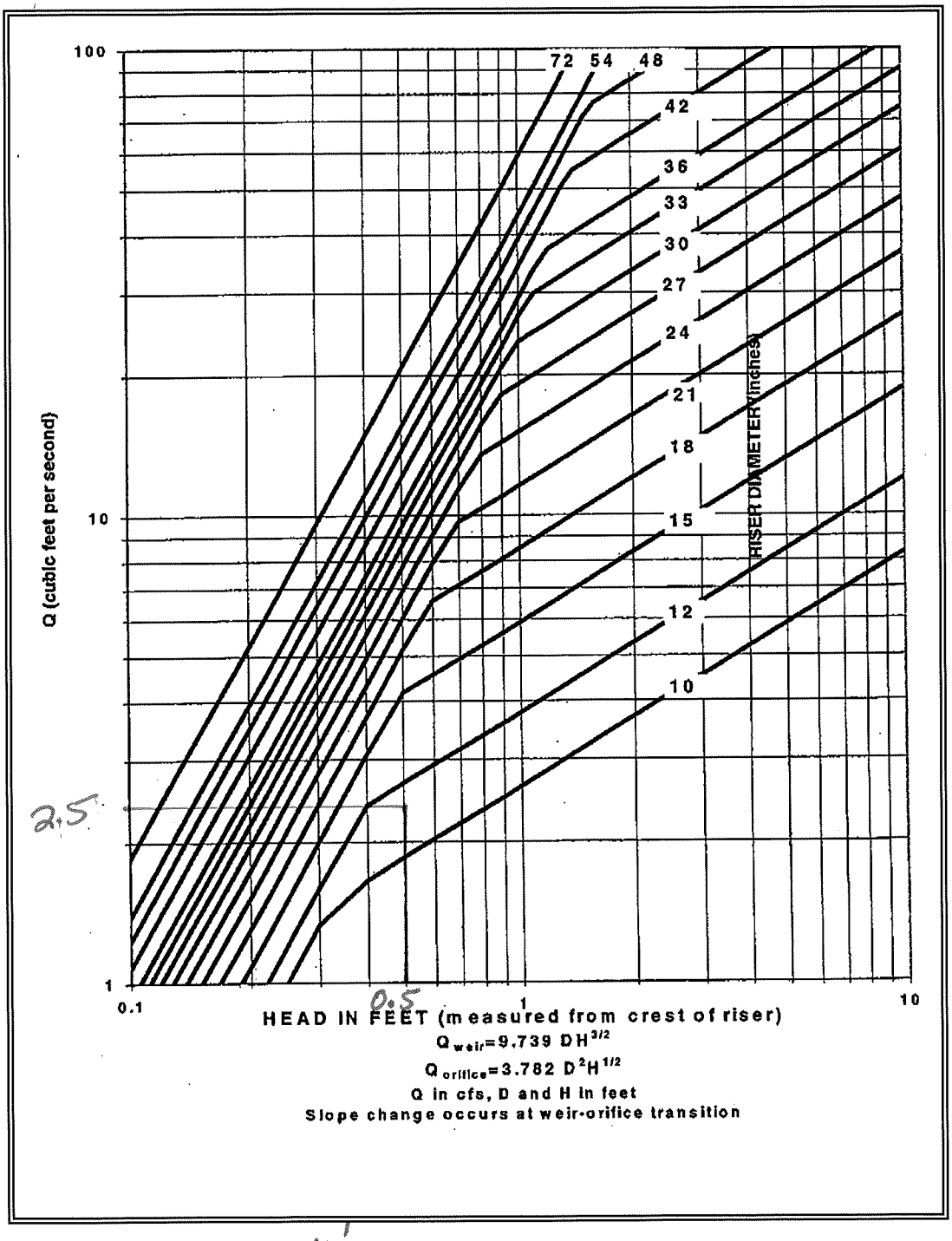
Sharp Crested Weir



For this weir $Q_{100} = C\sqrt{2g}\,2/3\,LH^{3/2}$

C =	**0.62**	discharge coefficient
L =	**4.00'**	
H =	**0.50'**	flow depth
Q =	**4.69**	cfs (110% of 100-year flow = 2.58742 cfs)
V =	2.35	fps

Figure 3.2.15 - Riser Inflow Curves



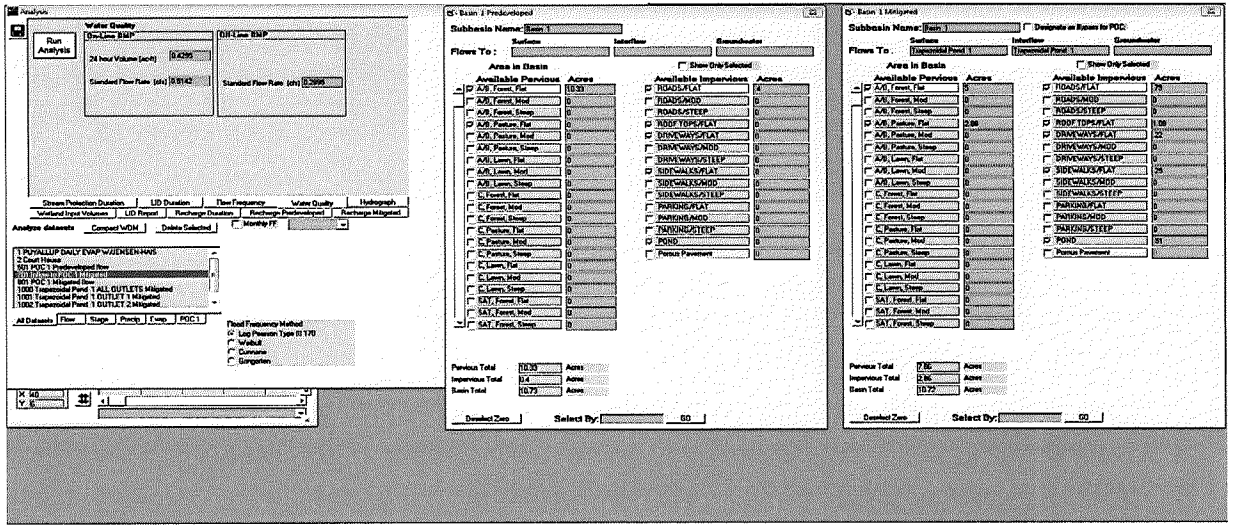
D = 4'
H = 0.5'

WetPond Sizing

Required WQ Vol (ac-ft) = 0.4295

Required WQ Vol (cf) = 18709

Depth =	6	L:W 3:1		
Bottom Width (ft)	Botton Length (ft)	Bttom Area (ft2)	Top Area (ft2)	Total Vol
10	30	300	3036	10008
12	36	432	3456	11664
14	42	588	3900	13464
15	45	675	4131	14418
18	54	972	4860	17496
20	**60**	**1200**	**5376**	**19728**
22	**66**	**1452**	**5916**	**22104**



POND VOLUME

Elevation	Area (sf)	Volume	Cumulative Volume (cf)		
163	8131				
163.5	14007	5468	5468		
164	14846	7212	12680		
164.5	15705	7637	20317		
165	16914	8153	28470		
166	18229	17568	46037		
167	19570	18895	64933		
168	20935	20248	85181		
169	22335	21631	106813		

APPENDIX D – CSWPPP

TO BE INCLUDED WITH CONSTRUCTION DOCUMENTS.

APPENDIX E -Other Documents

Infiltration Pond

WWHM2012

PROJECT REPORT

Landuse Basin Data

Predeveloped Land Use

Basin 1

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
A B, Forest, Flat	10.72
Pervious Total	10.72
Impervious Land Use	acre
Impervious Total	0
Basin Total	10.72

Element Flows To:

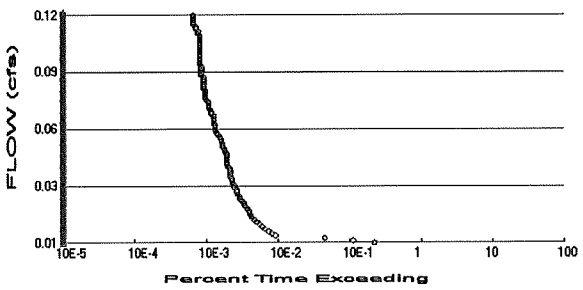
Surface	Interflow	Groundwater

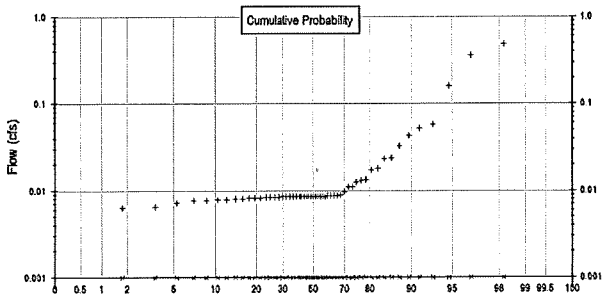
Routing Elements
Predeveloped Routing

1.8000	0.216	0.362	0.000	0.656
1.8667	0.218	0.376	0.000	0.656
1.9333	0.219	0.391	0.000	0.656
2.0000	0.220	0.405	0.000	0.656
2.0667	0.221	0.420	0.000	0.656
2.1333	0.222	0.435	0.000	0.656
2.2000	0.224	0.450	0.000	0.656
2.2667	0.225	0.465	0.000	0.656
2.3333	0.226	0.480	0.000	0.656
2.4000	0.227	0.495	0.000	0.656
2.4667	0.229	0.510	0.000	0.656
2.5333	0.230	0.526	0.000	0.656
2.6000	0.231	0.541	0.000	0.656
2.6667	0.232	0.557	0.000	0.656
2.7333	0.233	0.572	0.000	0.656
2.8000	0.235	0.588	0.000	0.656
2.8667	0.236	0.603	0.000	0.656
2.9333	0.237	0.619	0.000	0.656
3.0000	0.238	0.635	0.000	0.656
3.0667	0.240	0.651	0.000	0.656
3.1333	0.241	0.667	0.000	0.656
3.2000	0.242	0.683	0.000	0.656
3.2667	0.243	0.699	0.000	0.656
3.3333	0.245	0.716	0.000	0.656
3.4000	0.246	0.732	0.000	0.656
3.4667	0.247	0.749	0.000	0.656
3.5333	0.248	0.765	0.000	0.656
3.6000	0.250	0.782	0.000	0.656
3.6667	0.251	0.799	0.000	0.656
3.7333	0.252	0.815	0.000	0.656
3.8000	0.254	0.832	0.000	0.656
3.8667	0.255	0.849	0.000	0.656
3.9333	0.256	0.866	0.000	0.656
4.0000	0.257	0.883	0.000	0.656
4.0667	0.259	0.901	0.000	0.656
4.1333	0.260	0.918	0.000	0.656
4.2000	0.261	0.935	0.000	0.656
4.2667	0.263	0.953	0.000	0.656
4.3333	0.264	0.970	0.000	0.656
4.4000	0.265	0.988	0.000	0.656
4.4667	0.267	1.006	0.000	0.656
4.5333	0.268	1.024	0.000	0.656
4.6000	0.269	1.042	0.000	0.656
4.6667	0.271	1.060	0.000	0.656
4.7333	0.272	1.078	0.000	0.656
4.8000	0.273	1.096	0.000	0.656
4.8667	0.275	1.114	0.000	0.656
4.9333	0.276	1.133	0.000	0.656
5.0000	0.277	1.151	0.000	0.656
5.0667	0.279	1.170	1.522	0.656
5.1333	0.280	1.188	4.305	0.656
5.2000	0.281	1.207	7.907	0.656
5.2667	0.283	1.226	12.17	0.656
5.3333	0.284	1.245	17.00	0.656
5.4000	0.285	1.264	22.34	0.656
5.4667	0.287	1.283	28.14	0.656
5.5333	0.288	1.302	34.36	0.656
5.6000	0.290	1.322	40.98	0.656

Analysis Results

POC 1





\+ Predeveloped x Mitigated

Predeveloped Landuse Totals for POC #1
Total Pervious Area: 10.72
Total Impervious Area: 0

Mitigated Landuse Totals for POC #1
Total Pervious Area: 7.86
Total Impervious Area: 2.86

Flow Frequency Method: Log Pearson Type III 17B

Flow Frequency Return Periods for Predeveloped. POC #1

Return Period	**Flow(cfs)**
2 year	0.011042
5 year	0.025524
10 year	0.042565
25 year	0.077828
50 year	0.118758
100 year	0.177612

Flow Frequency Return Periods for Mitigated. POC #1

Return Period	**Flow(cfs)**
2 year	0
5 year	0
10 year	0
25 year	0
50 year	0
100 year	0

Annual Peaks

Annual Peaks for Predeveloped and Mitigated. POC #1

Year	**Predeveloped**	**Mitigated**
1956	0.018	0.000
1957	0.009	0.000
1958	0.009	0.000
1959	0.009	0.000
1960	0.013	0.000
1961	0.009	0.000
1962	0.008	0.000
1963	0.009	0.000
1964	0.013	0.000
1965	0.013	0.000

9	0.0231	0.0000
10	0.0181	0.0000
11	0.0174	0.0000
12	0.0133	0.0000
13	0.0131	0.0000
14	0.0126	0.0000
15	0.0111	0.0000
16	0.0110	0.0000
17	0.0098	0.0000
18	0.0089	0.0000
19	0.0086	0.0000
20	0.0086	0.0000
21	0.0086	0.0000
22	0.0086	0.0000
23	0.0086	0.0000
24	0.0086	0.0000
25	0.0086	0.0000
26	0.0086	0.0000
27	0.0086	0.0000
28	0.0086	0.0000
29	0.0086	0.0000
30	0.0086	0.0000
31	0.0086	0.0000
32	0.0086	0.0000
33	0.0086	0.0000
34	0.0085	0.0000
35	0.0085	0.0000
36	0.0085	0.0000
37	0.0085	0.0000
38	0.0085	0.0000
39	0.0085	0.0000
40	0.0085	0.0000
41	0.0084	0.0000
42	0.0084	0.0000
43	0.0083	0.0000
44	0.0083	0.0000
45	0.0082	0.0000
46	0.0082	0.0000
47	0.0081	0.0000
48	0.0080	0.0000
49	0.0079	0.0000
50	0.0078	0.0000
51	0.0078	0.0000
52	0.0077	0.0000
53	0.0072	0.0000
54	0.0065	0.0000
55	0.0063	0.0000
56	0.0060	0.0000

0.0661	25	0	0	Pass
0.0673	25	0	0	Pass
0.0684	25	0	0	Pass
0.0696	23	0	0	Pass
0.0707	23	0	0	Pass
0.0719	22	0	0	Pass
0.0730	21	0	0	Pass
0.0741	21	0	0	Pass
0.0753	21	0	0	Pass
0.0764	20	0	0	Pass
0.0776	19	0	0	Pass
0.0787	19	0	0	Pass
0.0799	19	0	0	Pass
0.0810	19	0	0	Pass
0.0822	18	0	0	Pass
0.0833	18	0	0	Pass
0.0844	18	0	0	Pass
0.0856	18	0	0	Pass
0.0867	18	0	0	Pass
0.0879	18	0	0	Pass
0.0890	17	0	0	Pass
0.0902	17	0	0	Pass
0.0913	17	0	0	Pass
0.0925	17	0	0	Pass
0.0936	17	0	0	Pass
0.0947	16	0	0	Pass
0.0959	16	0	0	Pass
0.0970	16	0	0	Pass
0.0982	16	0	0	Pass
0.0993	16	0	0	Pass
0.1005	16	0	0	Pass
0.1016	16	0	0	Pass
0.1027	16	0	0	Pass
0.1039	16	0	0	Pass
0.1050	16	0	0	Pass
0.1062	16	0	0	Pass
0.1073	16	0	0	Pass
0.1085	16	0	0	Pass
0.1096	15	0	0	Pass
0.1108	15	0	0	Pass
0.1119	14	0	0	Pass
0.1130	14	0	0	Pass
0.1142	13	0	0	Pass
0.1153	13	0	0	Pass
0.1165	13	0	0	Pass
0.1176	13	0	0	Pass
0.1188	13	0	0	Pass

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
Trapezoidal Pond 1 POC	☐	465.61			☐	100.00			
Total Volume Infiltrated		465.61	0.00	0.00		100.00	0.00	0%	No Treat. Credit
Compliance with LID Standard 8% of 2-yr to 50% of 2-yr									Duration Analysis Result = Passed

Appendix
Predeveloped Schematic

Predeveloped UCI File

```
RUN

GLOBAL
  WWHM4 model simulation
  START       1955 10 01         END    2011 09 30
  RUN INTERP OUTPUT LEVEL    3    0
  RESUME     0 RUN     1                    UNIT SYSTEM     1
END GLOBAL

FILES
<File>  <Un#>   <-----------File Name------------------------------>***
<-ID->                                                               ***
WDM         26   17-104 Cain Road Infiltration Pond 3.18.19.wdm
MESSU       25   Pre17-104 Cain Road Infiltration Pond 3.18.19.MES
            27   Pre17-104 Cain Road Infiltration Pond 3.18.19.L61
            28   Pre17-104 Cain Road Infiltration Pond 3.18.19.L62
            30   POC17-104 Cain Road Infiltration Pond 3.18.191.dat
END FILES

OPN SEQUENCE
    INGRP               INDELT 00:15
      PERLND       1
      COPY       501
      DISPLY       1
    END INGRP
END OPN SEQUENCE
DISPLY
  DISPLY-INFO1
    # -  #<----------Title----------->***TRAN PIVL DIG1 FIL1  PYR DIG2 FIL2 YRND
    1        Basin  1                    MAX                    1    2   30    9
  END DISPLY-INFO1
END DISPLY
COPY
  TIMESERIES
    # -  #  NPT  NMN ***
    1          1    1
  501          1    1
  END TIMESERIES
END COPY
GENER
  OPCODE
    #    # OPCD ***
  END OPCODE
  PARM
    #    #          K ***
  END PARM
END GENER
PERLND
  GEN-INFO
    <PLS ><-------Name------->NBLKS   Unit-systems   Printer ***
    # -  #                         User  t-series Engl Metr ***
                                      in  out           ***
    1     A/B, Forest, Flat       1    1    1    1   27    0
  END GEN-INFO
  *** Section PWATER***

  ACTIVITY
    <PLS > ************* Active Sections ****************************
    # -  # ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC ***
    1          0    0    1    0    0    0    0    0    0    0    0    0
  END ACTIVITY

  PRINT-INFO
    <PLS > ***************** Print-flags **************************** PIVL  PYR
    # -  # ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC  *********
    1          0    0    4    0    0    0    0    0    0    0    0    0    1    9
  END PRINT-INFO
```

```
END IMPLND

SCHEMATIC
<-Source->                  <--Area-->      <-Target->   MBLK   ***
<Name>   #                  <-factor->      <Name>   #   Tbl#   ***
Basin  1***
PERLND   1                       10.72      COPY   501     12
PERLND   1                       10.72      COPY   501     13

******Routing******
END SCHEMATIC

NETWORK
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   #        <Name> # #<-factor->strg <Name>   #   #        <Name> # #  ***
COPY   501 OUTPUT MEAN   1 1   48.4        DISPLY   1     INPUT  TIMSER 1



<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   #        <Name> # #<-factor->strg <Name>   #   #        <Name> # #  ***
END NETWORK

RCHRES
  GEN-INFO
    RCHRES       Name        Nexits   Unit Systems   Printer                ***
    # -  #<------------------><---> User T-series  Engl Metr LKFG           ***
                                       in  out                              ***
  END GEN-INFO
  *** Section RCHRES***

  ACTIVITY
    <PLS > ************* Active Sections ****************************
    # -  # HYFG ADFG CNFG HTFG SDFG GQFG OXFG NUFG PKFG PHFG ***
  END ACTIVITY

  PRINT-INFO
    <PLS > ***************** Print-flags ******************** PIVL  PYR
    # -  # HYDR ADCA CONS HEAT  SED  GQL OXRX NUTR PLNK PHCB PIVL  PYR  *********
  END PRINT-INFO

  HYDR-PARM1
    RCHRES  Flags for each HYDR Section                                  ***
    # -  #  VC A1 A2 A3  ODFVFG for each *** ODGTFG for each     FUNCT  for each
            FG FG FG FG  possible  exit  *** possible  exit      possible  exit
             *  *  *  *    *  *  *  *  *       *  *  *  *  *         ***
  END HYDR-PARM1

  HYDR-PARM2
    # -  #    FTABNO       LEN      DELTH     STCOR        KS       DB50       ***
  <------><--------><--------><--------><--------><--------><--------->       ***
  END HYDR-PARM2
  HYDR-INIT
    RCHRES  Initial conditions for each HYDR section                     ***
    # -  # ***   VOL     Initial  value  of COLIND     Initial  value  of OUTDGT
          *** ac-ft     for each possible exit        for each possible exit
  <------><-------->     <---><---><---><---><---> *** <---><---><---><---><--->
  END HYDR-INIT
END RCHRES

SPEC-ACTIONS
END SPEC-ACTIONS
FTABLES
END FTABLES

EXT SOURCES
<-Volume-> <Member> SsysSgap<--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   # <Name> # tem strg<-factor->strg <Name>   #   #        <Name> # #  ***
WDM      2 PREC     ENGL    0.9            PERLND   1 999 EXTNL  PREC
WDM      2 PREC     ENGL    0.9            IMPLND   1 999 EXTNL  PREC
```

Mitigated UCI File

```
RUN

GLOBAL
  WWHM4 model simulation
  START       1955 10 01         END    2011 09 30
  RUN INTERP OUTPUT LEVEL    3    0
  RESUME     0 RUN     1                    UNIT SYSTEM     1
END GLOBAL

FILES
<File>  <Un#>   <-----------File Name------------------------------>***
<-ID->                                                              ***
WDM         26   17-104 Cain Road Infiltration Pond 3.18.19.wdm
MESSU       25   Mit17-104 Cain Road Infiltration Pond 3.18.19.MES
            27   Mit17-104 Cain Road Infiltration Pond 3.18.19.L61
            28   Mit17-104 Cain Road Infiltration Pond 3.18.19.L62
            30   POC17-104 Cain Road Infiltration Pond 3.18.191.dat
END FILES

OPN SEQUENCE
    INGRP               INDELT 00:15
      PERLND        1
      PERLND        4
      IMPLND        1
      IMPLND        4
      IMPLND        5
      IMPLND        8
      IMPLND       14
      RCHRES        1
      COPY          1
      COPY        501
      DISPLY        1
    END INGRP
END OPN SEQUENCE
DISPLY
  DISPLY-INFO1
    # -  #<----------Title---------->***TRAN PIVL DIG1 FIL1  PYR DIG2 FIL2 YRND
    1        Trapezoidal Pond  1         MAX                    1    2   30    9
  END DISPLY-INFO1
END DISPLY
COPY
  TIMESERIES
    # -  #  NPT  NMN ***
    1          1    1
  501          1    1
  END TIMESERIES
END COPY
GENER
  OPCODE
    #    # OPCD ***
  END OPCODE
  PARM
    #    #          K ***
  END PARM
END GENER
PERLND
  GEN-INFO
    <PLS ><-------Name-------->NBLKS   Unit-systems   Printer ***
    # -  #                          User  t-series Engl Metr ***
                                        in  out             ***
    1     A/B, Forest, Flat       1    1    1    1   27    0
    4     A/B, Pasture, Flat      1    1    1    1   27    0
  END GEN-INFO
  *** Section PWATER***

  ACTIVITY
    <PLS > ************* Active Sections ****************************
    # -  # ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC ***
```

```
  PRINT-INFO
    <ILS > ******** Print-flags ******** PIVL  PYR
    # -   # ATMP SNOW IWAT  SLD  IWG IQAL    *********
    1          0    0    4    0    0    0    1    9
    4          0    0    4    0    0    0    1    9
    5          0    0    4    0    0    0    1    9
    8          0    0    4    0    0    0    1    9
   14          0    0    4    0    0    0    1    9
  END PRINT-INFO

  IWAT-PARM1
    <PLS >  IWATER variable monthly parameter value flags  ***
    # -   # CSNO RTOP  VRS  VNN RTLI     ***
    1          0    0    0    0    0
    4          0    0    0    0    0
    5          0    0    0    0    0
    8          0    0    0    0    0
   14          0    0    0    0    0
  END IWAT-PARM1

  IWAT-PARM2
    <PLS >       IWATER input info: Part 2          ***
    # -   # ***  LSUR     SLSUR      NSUR     RETSC
    1            400      0.01       0.1       0.1
    4            400      0.01       0.1       0.1
    5            400      0.01       0.1       0.1
    8            400      0.01       0.1       0.1
   14            400      0.01       0.1       0.1
  END IWAT-PARM2

  IWAT-PARM3
    <PLS >       IWATER input info: Part 3          ***
    # -   # ***PETMAX    PETMIN
    1              0         0
    4              0         0
    5              0         0
    8              0         0
   14              0         0
  END IWAT-PARM3

  IWAT-STATE1
    <PLS > *** Initial conditions at start of simulation
    # -   # ***  RETS      SURS
    1              0         0
    4              0         0
    5              0         0
    8              0         0
   14              0         0
  END IWAT-STATE1

END IMPLND

SCHEMATIC
<-Source->                <--Area-->     <-Target->   MBLK   ***
<Name>   #                <-factor->     <Name>   #   Tbl#   ***
Basin  1***
PERLND   1                        5      RCHRES   1      2
PERLND   1                        5      RCHRES   1      3
PERLND   4                     2.86      RCHRES   1      2
PERLND   4                     2.86      RCHRES   1      3
IMPLND   1                     0.79      RCHRES   1      5
IMPLND   4                     1.09      RCHRES   1      5
IMPLND   5                     0.22      RCHRES   1      5
IMPLND   8                     0.25      RCHRES   1      5
IMPLND  14                     0.51      RCHRES   1      5

******Routing******
PERLND   1                        5      COPY     1     12
PERLND   4                     2.86      COPY     1     12
```

(ft)	(acres)	(acre-ft)	(cfs)	(cfs)	(ft/sec)	(Minutes)***
0.000000	0.185950	0.000000	0.000000	0.000000		
0.066667	0.187054	0.012433	0.000000	0.656250		
0.133333	0.188161	0.024941	0.000000	0.656250		
0.200000	0.189271	0.037522	0.000000	0.656250		
0.266667	0.190384	0.050177	0.000000	0.656250		
0.333333	0.191501	0.062906	0.000000	0.656250		
0.400000	0.192621	0.075710	0.000000	0.656250		
0.466667	0.193744	0.088589	0.000000	0.656250		
0.533333	0.194870	0.101543	0.000000	0.656250		
0.600000	0.196000	0.114572	0.000000	0.656250		
0.666667	0.197133	0.127676	0.000000	0.656250		
0.733333	0.198269	0.140857	0.000000	0.656250		
0.800000	0.199409	0.154112	0.000000	0.656250		
0.866667	0.200551	0.167444	0.000000	0.656250		
0.933333	0.201697	0.180853	0.000000	0.656250		
1.000000	0.202847	0.194338	0.000000	0.656250		
1.066667	0.203999	0.207899	0.000000	0.656250		
1.133333	0.205155	0.221538	0.000000	0.656250		
1.200000	0.206314	0.235253	0.000000	0.656250		
1.266667	0.207476	0.249046	0.000000	0.656250		
1.333333	0.208642	0.262917	0.000000	0.656250		
1.400000	0.209811	0.276865	0.000000	0.656250		
1.466667	0.210983	0.290892	0.000000	0.656250		
1.533333	0.212158	0.304996	0.000000	0.656250		
1.600000	0.213337	0.319180	0.000000	0.656250		
1.666667	0.214519	0.333441	0.000000	0.656250		
1.733333	0.215704	0.347782	0.000000	0.656250		
1.800000	0.216893	0.362202	0.000000	0.656250		
1.866667	0.218084	0.376701	0.000000	0.656250		
1.933333	0.219279	0.391280	0.000000	0.656250		
2.000000	0.220478	0.405939	0.000000	0.656250		
2.066667	0.221679	0.420677	0.000000	0.656250		
2.133333	0.222884	0.435496	0.000000	0.656250		
2.200000	0.224092	0.450395	0.000000	0.656250		
2.266667	0.225303	0.465375	0.000000	0.656250		
2.333333	0.226518	0.480436	0.000000	0.656250		
2.400000	0.227736	0.495578	0.000000	0.656250		
2.466667	0.228957	0.510801	0.000000	0.656250		
2.533333	0.230181	0.526105	0.000000	0.656250		
2.600000	0.231409	0.541491	0.000000	0.656250		
2.666667	0.232640	0.556960	0.000000	0.656250		
2.733333	0.233874	0.572510	0.000000	0.656250		
2.800000	0.235111	0.588143	0.000000	0.656250		
2.866667	0.236352	0.603858	0.000000	0.656250		
2.933333	0.237596	0.619657	0.000000	0.656250		
3.000000	0.238843	0.635538	0.000000	0.656250		
3.066667	0.240093	0.651503	0.000000	0.656250		
3.133333	0.241347	0.667551	0.000000	0.656250		
3.200000	0.242604	0.683682	0.000000	0.656250		
3.266667	0.243865	0.699898	0.000000	0.656250		
3.333333	0.245128	0.716198	0.000000	0.656250		
3.400000	0.246395	0.732582	0.000000	0.656250		
3.466667	0.247665	0.749050	0.000000	0.656250		
3.533333	0.248938	0.765604	0.000000	0.656250		
3.600000	0.250215	0.782242	0.000000	0.656250		
3.666667	0.251495	0.798966	0.000000	0.656250		
3.733333	0.252778	0.815775	0.000000	0.656250		
3.800000	0.254064	0.832670	0.000000	0.656250		
3.866667	0.255354	0.849650	0.000000	0.656250		
3.933333	0.256647	0.866717	0.000000	0.656250		
4.000000	0.257943	0.883870	0.000000	0.656250		
4.066667	0.259243	0.901110	0.000000	0.656250		
4.133333	0.260545	0.918436	0.000000	0.656250		
4.200000	0.261851	0.935849	0.000000	0.656250		
4.266667	0.263160	0.953349	0.000000	0.656250		
4.333333	0.264473	0.970937	0.000000	0.656250		
4.400000	0.265789	0.988613	0.000000	0.656250		
4.466667	0.267108	1.006376	0.000000	0.656250		
4.533333	0.268430	1.024227	0.000000	0.656250		

```
IMPLND      IWATER SURO        0.083333      COPY            INPUT   MEAN
  END MASS-LINK    15

  MASS-LINK        17
RCHRES      OFLOW  OVOL    1               COPY            INPUT   MEAN
  END MASS-LINK    17


END MASS-LINK

END RUN
```

Mitigated HSPF Message File

Bypass Basin

WWHM2012

PROJECT REPORT

Landuse Basin Data

Predeveloped Land Use

Basin 1

Bypass:	No
GroundWater:	No

Pervious Land Use	acre
A B, Lawn, Flat	0.08
Pervious Total	0.08

Impervious Land Use	acre
ROADS FLAT	0.12
SIDEWALKS FLAT	0.04
Impervious Total	0.16
Basin Total	0.24

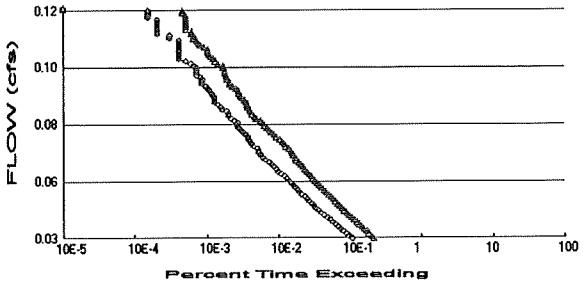
Element Flows To:

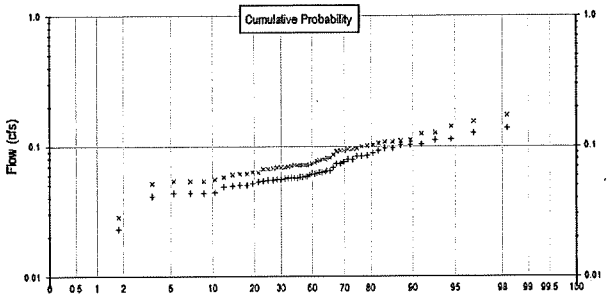
Surface	Interflow	Groundwater

Routing Elements
Predeveloped Routing

Analysis Results

POC 1





\+ Predeveloped x Mitigated

Predeveloped Landuse Totals for POC #1
Total Pervious Area: 0.08
Total Impervious Area: 0.16

Mitigated Landuse Totals for POC #1
Total Pervious Area: 0.04
Total Impervious Area: 0.2

Flow Frequency Method: Log Pearson Type III 17B

Flow Frequency Return Periods for Predeveloped. POC #1

Return Period	**Flow(cfs)**
2 year	0.065323
5 year	0.086448
10 year	0.098807
25 year	0.112874
50 year	0.122393
100 year	0.131208

Flow Frequency Return Periods for Mitigated. POC #1

Return Period	**Flow(cfs)**
2 year	0.079258
5 year	0.103515
10 year	0.117572
25 year	0.133472
50 year	0.144178
100 year	0.154057

Annual Peaks

Annual Peaks for Predeveloped and Mitigated. POC #1

Year	**Predeveloped**	**Mitigated**
1956	0.050	0.063
1957	0.096	0.110
1958	0.061	0.071
1959	0.058	0.072
1960	0.127	0.155
1961	0.049	0.058
1962	0.049	0.062
1963	0.111	0.125
1964	0.063	0.079
1965	0.061	0.072

9	0.0960	0.1079
10	0.0931	0.1056
11	0.0887	0.1024
12	0.0845	0.1007
13	0.0838	0.0993
14	0.0835	0.0964
15	0.0795	0.0950
16	0.0786	0.0947
17	0.0758	0.0926
18	0.0741	0.0921
19	0.0737	0.0919
20	0.0687	0.0859
21	0.0652	0.0815
22	0.0650	0.0812
23	0.0636	0.0795
24	0.0635	0.0794
25	0.0628	0.0780
26	0.0618	0.0773
27	0.0613	0.0753
28	0.0612	0.0736
29	0.0604	0.0723
30	0.0589	0.0720
31	0.0587	0.0719
32	0.0578	0.0716
33	0.0578	0.0715
34	0.0575	0.0715
35	0.0570	0.0713
36	0.0569	0.0710
37	0.0568	0.0692
38	0.0560	0.0689
39	0.0554	0.0687
40	0.0553	0.0684
41	0.0551	0.0680
42	0.0548	0.0667
43	0.0538	0.0665
44	0.0532	0.0629
45	0.0514	0.0627
46	0.0505	0.0617
47	0.0502	0.0616
48	0.0493	0.0608
49	0.0486	0.0578
50	0.0443	0.0553
51	0.0438	0.0543
52	0.0435	0.0539
53	0.0434	0.0538
54	0.0414	0.0518
55	0.0229	0.0287
56	0.0210	0.0263

0.0816	39	83	212	Fail
0.0825	37	79	213	Fail
0.0834	32	77	240	Fail
0.0843	30	72	240	Fail
0.0852	28	72	257	Fail
0.0861	25	69	276	Fail
0.0870	25	65	260	Fail
0.0880	25	60	240	Fail
0.0889	24	57	237	Fail
0.0898	23	55	239	Fail
0.0907	21	54	257	Fail
0.0916	20	50	250	Fail
0.0925	19	45	236	Fail
0.0934	17	42	247	Fail
0.0943	17	41	241	Fail
0.0952	17	38	223	Fail
0.0961	16	37	231	Fail
0.0970	14	36	257	Fail
0.0979	14	35	250	Fail
0.0988	14	35	250	Fail
0.0997	14	33	235	Fail
0.1006	13	33	253	Fail
0.1015	12	28	233	Fail
0.1025	10	26	260	Fail
0.1034	8	24	300	Fail
0.1043	8	22	275	Fail
0.1052	8	21	262	Fail
0.1061	8	20	250	Fail
0.1070	8	20	250	Fail
0.1079	8	18	225	Fail
0.1088	8	16	200	Fail
0.1097	8	15	187	Fail
0.1106	8	14	175	Fail
0.1115	6	13	216	Fail
0.1124	6	13	216	Fail
0.1133	4	12	300	Fail
0.1142	4	12	300	Fail
0.1151	4	10	250	Fail
0.1160	4	10	250	Fail
0.1170	4	10	250	Fail
0.1179	4	10	250	Fail
0.1188	4	10	250	Fail
0.1197	3	10	333	Fail
0.1206	3	10	333	Fail
0.1215	3	9	300	Fail
0.1224	3	9	300	Fail

The development has an increase in flow durations from 1/2 Predeveloped 2 year flow to the 2 year flow or more than a 10% increase from the 2 year to the 50 year flow.
The development has an increase in flow durations for more than 50% of the flows for the range of the duration analysis.

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
Total Volume Infiltrated		0.00	0.00	0.00		0.00	0.00	0%	No Treat. Credit
Compliance with LID Standard 8% of 2-yr to 50% of 2-yr									Duration Analysis Result = Failed

Appendix
Predeveloped Schematic

Predeveloped UCI File

```
RUN

GLOBAL
  WWHM4 model simulation
  START       1955 10 01         END    2011 09 30
  RUN INTERP OUTPUT LEVEL    3    0
  RESUME     0 RUN     1                    UNIT SYSTEM     1
END GLOBAL

FILES
<File>  <Un#>   <-----------File Name------------------------------>***
<-ID->                                                               ***
WDM         26   17-104 Cain Road Bypass 3.11.19.wdm
MESSU       25   Pre17-104 Cain Road Bypass 3.11.19.MES
            27   Pre17-104 Cain Road Bypass 3.11.19.L61
            28   Pre17-104 Cain Road Bypass 3.11.19.L62
            30   POC17-104 Cain Road Bypass 3.11.191.dat
END FILES

OPN SEQUENCE
    INGRP               INDELT 00:15
      PERLND        7
      IMPLND        1
      IMPLND        8
      COPY        501
      DISPLY        1
    END INGRP
END OPN SEQUENCE
DISPLY
  DISPLY-INFO1
    # -  #<----------Title---------->***TRAN PIVL DIG1 FIL1  PYR DIG2 FIL2 YRND
    1        Basin  1                    MAX                   1    2   30    9
  END DISPLY-INFO1
END DISPLY
COPY
  TIMESERIES
    # -  #  NPT  NMN ***
    1          1    1
  501          1    1
  END TIMESERIES
END COPY
GENER
  OPCODE
    #    # OPCD ***
  END OPCODE
  PARM
    #    #          K ***
  END PARM
END GENER
PERLND
  GEN-INFO
    <PLS ><-------Name------->NBLKS   Unit-systems   Printer ***
    # -  #                          User  t-series Engl Metr ***
                                       in  out           ***
    7     A/B, Lawn, Flat         1    1    1    1   27    0
  END GEN-INFO
  *** Section PWATER***

  ACTIVITY
    <PLS > ************ Active Sections ******************************
    # -  # ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC ***
    7          0    0    1    0    0    0    0    0    0    0    0    0
  END ACTIVITY

  PRINT-INFO
    <PLS > ***************** Print-flags ***************************** PIVL  PYR
    # -  # ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC  *********
    7          0    0    4    0    0    0    0    0    0    0    0    0    1    9
```

```
  END IWAT-PARM2

  IWAT-PARM3
    <PLS >       IWATER input info: Part 3          ***
    # -  # ***PETMAX    PETMIN
    1               0         0
    8               0         0
  END IWAT-PARM3

  IWAT-STATE1
    <PLS > *** Initial conditions at start of simulation
    # -  # ***  RETS      SURS
    1               0         0
    8               0         0
  END IWAT-STATE1

END IMPLND

SCHEMATIC
<-Source->                  <--Area-->     <-Target->   MBLK   ***
<Name>   #                  <-factor->     <Name>   #   Tbl#   ***
Basin  1***
PERLND   7                        0.08     COPY   501     12
PERLND   7                        0.08     COPY   501     13
IMPLND   1                        0.12     COPY   501     15
IMPLND   8                        0.04     COPY   501     15

******Routing******
END SCHEMATIC

NETWORK
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   #        <Name> # #<-factor->strg <Name>   #   #        <Name> # #  ***
COPY   501 OUTPUT MEAN   1 1   48.4        DISPLY   1     INPUT  TIMSER 1



<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   #        <Name> # #<-factor->strg <Name>   #   #        <Name> # #  ***
END NETWORK

RCHRES
  GEN-INFO
    RCHRES       Name        Nexits   Unit Systems   Printer                ***
    # -  #<------------------><---> User T-series  Engl Metr LKFG           ***
                                       in  out                              ***
  END GEN-INFO
  *** Section RCHRES***

  ACTIVITY
    <PLS > ************* Active Sections ****************************
    # -  # HYFG ADFG CNFG HTFG SDFG GQFG OXFG NUFG PKFG PHFG ***
  END ACTIVITY

  PRINT-INFO
    <PLS > ***************** Print-flags ****************** PIVL  PYR
    # -  # HYDR ADCA CONS HEAT  SED  GQL OXRX NUTR PLNK PHCB PIVL  PYR  *********
  END PRINT-INFO

  HYDR-PARM1
    RCHRES  Flags for each HYDR Section                                    ***
    # -  #  VC A1 A2 A3  ODFVFG for each *** ODGTFG for each     FUNCT  for each
            FG FG FG FG  possible  exit  *** possible  exit      possible  exit
             *  *  *  *    *  *  *  *  *       *  *  *  *  *         ***
  END HYDR-PARM1

  HYDR-PARM2
    # -  #    FTABNO       LEN      DELTH     STCOR       KS       DB50       ***
  <------><--------><--------><--------><--------><--------><--------->       ***
  END HYDR-PARM2
```

Mitigated UCI File

```
RUN

GLOBAL
  WWHM4 model simulation
  START       1955 10 01         END    2011 09 30
  RUN INTERP OUTPUT LEVEL    3    0
  RESUME     0 RUN     1                    UNIT SYSTEM     1
END GLOBAL

FILES
<File>  <Un#>   <-----------File Name------------------------------>***
<-ID->                                                              ***
WDM         26   17-104 Cain Road Bypass 3.11.19.wdm
MESSU       25   Mit17-104 Cain Road Bypass 3.11.19.MES
            27   Mit17-104 Cain Road Bypass 3.11.19.L61
            28   Mit17-104 Cain Road Bypass 3.11.19.L62
            30   POC17-104 Cain Road Bypass 3.11.191.dat
END FILES

OPN SEQUENCE
    INGRP               INDELT 00:15
      PERLND       4
      IMPLND       1
      IMPLND       8
      COPY       501
      DISPLY       1
    END INGRP
END OPN SEQUENCE
DISPLY
  DISPLY-INFO1
    # -  #<----------Title----------->***TRAN PIVL DIG1 FIL1  PYR DIG2 FIL2 YRND
    1        Basin  1                    MAX                   1    2   30    9
  END DISPLY-INFO1
END DISPLY
COPY
  TIMESERIES
    # -  #  NPT  NMN ***
    1          1    1
  501          1    1
  END TIMESERIES
END COPY
GENER
  OPCODE
    #    # OPCD ***
  END OPCODE
  PARM
    #    #          K ***
  END PARM
END GENER
PERLND
  GEN-INFO
    <PLS ><-------Name------->NBLKS   Unit-systems   Printer ***
    # -  #                          User  t-series Engl Metr ***
                                       in  out           ***
    4     A/B, Pasture, Flat      1    1    1    1   27    0
  END GEN-INFO
  *** Section PWATER***

  ACTIVITY
    <PLS > ************ Active Sections ****************************
    # -  # ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC ***
    4          0    0    1    0    0    0    0    0    0    0    0
  END ACTIVITY

  PRINT-INFO
    <PLS > ***************** Print-flags **************************** PIVL  PYR
    # -  # ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC  *********
    4          0    0    4    0    0    0    0    0    0    0    0    0    1    9
```

```
  END IWAT-PARM2

  IWAT-PARM3
    <PLS >       IWATER input info: Part 3          ***
    # -   # ***PETMAX     PETMIN
    1                0          0
    8                0          0
  END IWAT-PARM3

  IWAT-STATE1
    <PLS > *** Initial conditions at start of simulation
    # -   # ***  RETS       SURS
    1                0          0
    8                0          0
  END IWAT-STATE1

END IMPLND

SCHEMATIC
<-Source->                  <--Area-->      <-Target->   MBLK    ***
<Name>   #                  <-factor->      <Name>   #   Tbl#    ***
Basin  1***
PERLND   4                        0.04      COPY   501      12
PERLND   4                        0.04      COPY   501      13
IMPLND   1                        0.16      COPY   501      15
IMPLND   8                        0.04      COPY   501      15

******Routing******
END SCHEMATIC

NETWORK
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   #        <Name> # #<-factor->strg <Name>   #   #        <Name> # #  ***
COPY   501 OUTPUT MEAN   1 1   48.4        DISPLY   1     INPUT  TIMSER 1



<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   #        <Name> # #<-factor->strg <Name>   #   #        <Name> # #  ***
END NETWORK

RCHRES
  GEN-INFO
    RCHRES       Name         Nexits   Unit Systems   Printer                ***
    # -   #<------------------><---> User T-series  Engl Metr LKFG           ***
                                       in   out                               ***
  END GEN-INFO
  *** Section RCHRES***

  ACTIVITY
    <PLS > ************* Active Sections ****************************
    # -   # HYFG ADFG CNFG HTFG SDFG GQFG OXFG NUFG PKFG PHFG ***
  END ACTIVITY

  PRINT-INFO
    <PLS > ****************** Print-flags ******************* PIVL  PYR
    # -   # HYDR ADCA CONS HEAT  SED  GQL OXRX NUTR PLNK PHCB PIVL  PYR  *********
  END PRINT-INFO

  HYDR-PARM1
    RCHRES  Flags for each HYDR Section                                    ***
    # -   #  VC A1 A2 A3  ODFVFG for each *** ODGTFG for each     FUNCT  for each
             FG FG FG FG  possible  exit  *** possible  exit      possible  exit
              *  *  *  *    *  *  *  *  *       *  *  *  *  *         ***
  END HYDR-PARM1

  HYDR-PARM2
    # -   #    FTABNO       LEN      DELTH      STCOR        KS       DB50       ***
  <------><--------><--------><--------><--------><--------><--------><--------> ***
  END HYDR-PARM2
```

Predeveloped HSPF Message File

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Closed Depression Analysis

WWHM2012

PROJECT REPORT

Landuse Basin Data

Predeveloped Land Use

Existing Depression

Bypass:	No
GroundWater:	No

Pervious Land Use	acre
A B, Forest, Flat	10.73
Pervious Total	10.73

Impervious Land Use	acre
Impervious Total	0
Basin Total	10.73

Element Flows To:

Surface	Interflow	Groundwater
Trapezoidal Pond 1	Trapezoidal Pond 1	

Routing Elements

Predeveloped Routing

Trapezoidal Pond 1

Bottom Length:	29.00 ft.	
Bottom Width:	10.83 ft.	
Depth:	7 ft.	
Volume at riser head:	1.0489 acre-feet.	
Infiltration On		
Infiltration rate:	3.5	
Infiltration safety factor:	1	
Wetted surface area On		
Total Volume Infiltrated (ac-ft.):		2.336
Total Volume Through Riser (ac-ft.):		0
Total Volume Through Facility (ac-ft.):		2.336
Percent Infiltrated:		100
Total Precip Applied to Facility:		0
Total Evap From Facility:		0
Side slope 1:	9.68 To 1	
Side slope 2:	10 To 1	
Side slope 3:	10 To 1	
Side slope 4:	10 To 1	
Discharge Structure		
Riser Height:	6 ft.	
Riser Diameter:	12 in.	
Element Flows To:		
Outlet 1	Outlet 2	

Pond Hydraulic Table

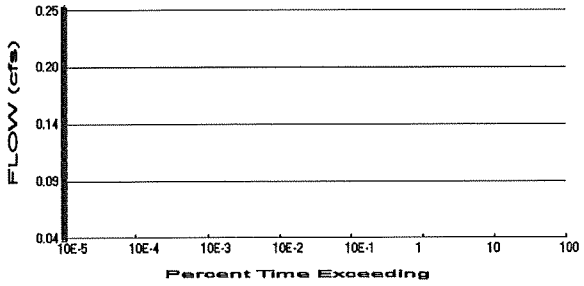
Stage(feet)	Area(ac.)	Volume(ac-ft.)	Discharge(cfs)	Infilt(cfs)
162.00	0.007	0.000	0.000	0.000
162.08	0.008	0.000	0.000	0.030
162.16	0.010	0.001	0.000	0.036
162.23	0.011	0.002	0.000	0.042
162.31	0.013	0.003	0.000	0.048
162.39	0.015	0.004	0.000	0.055
162.47	0.017	0.005	0.000	0.062
162.54	0.019	0.007	0.000	0.069
162.62	0.022	0.008	0.000	0.077
162.70	0.024	0.010	0.000	0.085
162.78	0.026	0.012	0.000	0.094
162.86	0.029	0.014	0.000	0.103
162.93	0.031	0.017	0.000	0.112
163.01	0.034	0.019	0.000	0.122
163.09	0.037	0.022	0.000	0.132
163.17	0.040	0.025	0.000	0.143
163.24	0.043	0.028	0.000	0.154
163.32	0.046	0.032	0.000	0.165
163.40	0.050	0.036	0.000	0.177
163.48	0.053	0.040	0.000	0.189
163.56	0.057	0.044	0.000	0.201
163.63	0.060	0.049	0.000	0.214
163.71	0.064	0.053	0.000	0.228
163.79	0.068	0.059	0.000	0.241

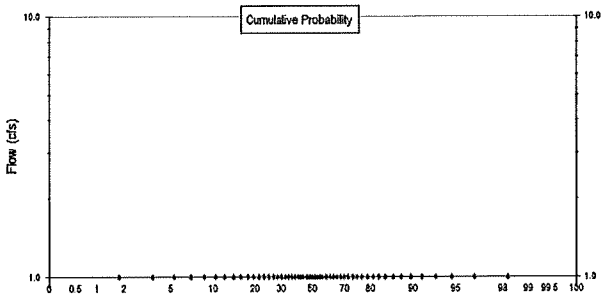
168.38	0.490	1.195	1.879	1.729
168.46	0.500	1.233	2.114	1.766
168.53	0.511	1.272	2.300	1.803
168.61	0.521	1.313	2.462	1.840
168.69	0.532	1.354	2.614	1.878
168.77	0.543	1.395	2.757	1.917
168.84	0.554	1.438	2.894	1.955
168.92	0.565	1.482	3.024	1.995
169.00	0.576	1.526	3.149	2.034
169.08	0.587	1.571	3.269	2.074

164.02	0.080	0.076	0.000	0.284
164.10	0.085	0.082	0.000	0.300
164.18	0.089	0.089	0.000	0.315
164.26	0.093	0.096	0.000	0.331
164.33	0.098	0.104	0.000	0.347
164.41	0.103	0.112	0.000	0.364
164.49	0.108	0.120	0.000	0.381
164.57	0.113	0.129	0.000	0.399
164.64	0.118	0.138	0.000	0.417
164.72	0.123	0.147	0.000	0.435
164.80	0.128	0.157	0.000	0.454
164.88	0.134	0.167	0.000	0.473
164.96	0.139	0.178	0.000	0.492
165.03	0.145	0.189	0.000	0.512
165.11	0.150	0.200	0.000	0.532
165.19	0.156	0.212	0.000	0.553
165.27	0.162	0.225	0.000	0.574
165.34	0.168	0.237	0.000	0.595
165.42	0.174	0.251	0.000	0.617
165.50	0.181	0.265	0.000	0.639
165.58	0.187	0.279	0.000	0.661
165.66	0.194	0.294	0.000	0.684
165.73	0.200	0.309	0.000	0.708
165.81	0.207	0.325	0.000	0.731
165.89	0.214	0.341	0.000	0.755
165.97	0.221	0.358	0.000	0.780
166.04	0.228	0.376	0.000	0.805
166.12	0.235	0.394	0.000	0.830
166.20	0.242	0.412	0.000	0.855
166.28	0.249	0.432	0.000	0.881
166.36	0.257	0.451	0.000	0.908
166.43	0.264	0.472	0.000	0.935
166.51	0.272	0.493	0.000	0.962
166.59	0.280	0.514	0.000	0.989
166.67	0.288	0.536	0.000	1.017
166.74	0.296	0.559	0.000	1.045
166.82	0.304	0.582	0.000	1.074
166.90	0.312	0.606	0.000	1.103
166.98	0.321	0.631	0.000	1.133
167.06	0.329	0.656	0.000	1.162
167.13	0.338	0.682	0.000	1.193
167.21	0.346	0.709	0.000	1.223
167.29	0.355	0.736	0.000	1.254
167.37	0.364	0.764	0.000	1.286
167.44	0.373	0.793	0.000	1.318
167.52	0.382	0.822	0.000	1.350
167.60	0.391	0.852	0.000	1.382
167.68	0.401	0.883	0.000	1.415
167.76	0.410	0.915	0.000	1.448
167.83	0.420	0.947	0.000	1.482
167.91	0.429	0.980	0.000	1.516
167.99	0.439	1.014	0.000	1.551
168.07	0.449	1.048	0.182	1.586
168.14	0.459	1.084	0.572	1.621
168.22	0.469	1.120	1.046	1.656
168.30	0.479	1.157	1.509	1.693
168.38	0.490	1.195	1.879	1.729
168.46	0.500	1.233	2.114	1.766

Analysis Results

POC 1





\+ Predeveloped x Mitigated

Predeveloped Landuse Totals for POC #1
Total Pervious Area: 10.73
Total Impervious Area: 0

Mitigated Landuse Totals for POC #1
Total Pervious Area: 10.73
Total Impervious Area: 0

Flow Frequency Method: Log Pearson Type III 17B

Flow Frequency Return Periods for Predeveloped. POC #1

Return Period	**Flow(cfs)**
2 year	0
5 year	0
10 year	0
25 year	0
50 year	0
100 year	0

Flow Frequency Return Periods for Mitigated. POC #1

Return Period	**Flow(cfs)**
2 year	0
5 year	0
10 year	0
25 year	0
50 year	0
100 year	0

Annual Peaks

Annual Peaks for Predeveloped and Mitigated. POC #1

Year	**Predeveloped**	**Mitigated**
1956	0.000	0.000
1957	0.000	0.000
1958	0.000	0.000
1959	0.000	0.000
1960	0.000	0.000
1961	0.000	0.000
1962	0.000	0.000
1963	0.000	0.000
1964	0.000	0.000
1965	0.000	0.000

9	0.0000	0.0000
10	0.0000	0.0000
11	0.0000	0.0000
12	0.0000	0.0000
13	0.0000	0.0000
14	0.0000	0.0000
15	0.0000	0.0000
16	0.0000	0.0000
17	0.0000	0.0000
18	0.0000	0.0000
19	0.0000	0.0000
20	0.0000	0.0000
21	0.0000	0.0000
22	0.0000	0.0000
23	0.0000	0.0000
24	0.0000	0.0000
25	0.0000	0.0000
26	0.0000	0.0000
27	0.0000	0.0000
28	0.0000	0.0000
29	0.0000	0.0000
30	0.0000	0.0000
31	0.0000	0.0000
32	0.0000	0.0000
33	0.0000	0.0000
34	0.0000	0.0000
35	0.0000	0.0000
36	0.0000	0.0000
37	0.0000	0.0000
38	0.0000	0.0000
39	0.0000	0.0000
40	0.0000	0.0000
41	0.0000	0.0000
42	0.0000	0.0000
43	0.0000	0.0000
44	0.0000	0.0000
45	0.0000	0.0000
46	0.0000	0.0000
47	0.0000	0.0000
48	0.0000	0.0000
49	0.0000	0.0000
50	0.0000	0.0000
51	0.0000	0.0000
52	0.0000	0.0000
53	0.0000	0.0000
54	0.0000	0.0000
55	0.0000	0.0000
56	0.0000	0.0000

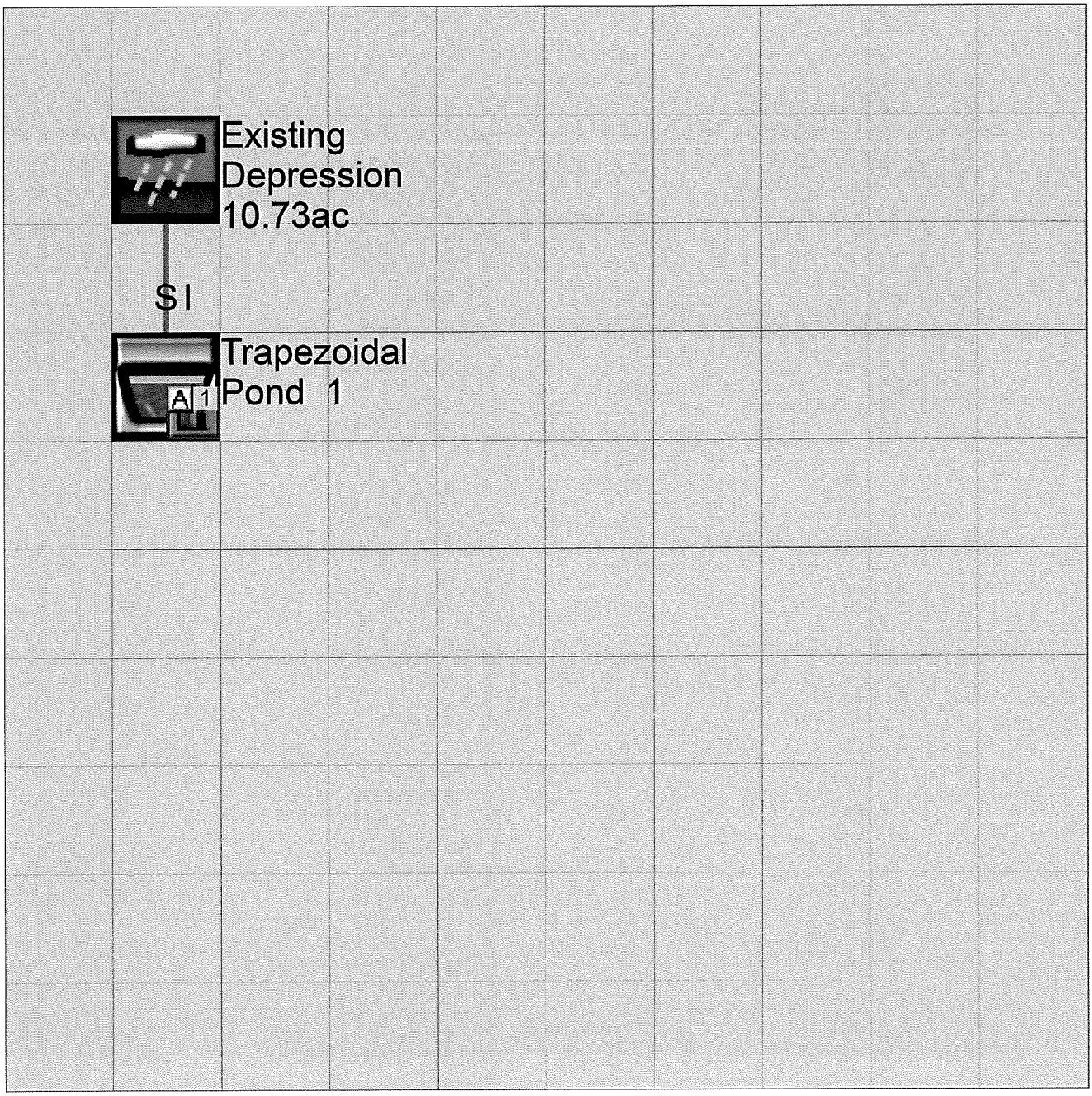
0.1509	0	0	0	Pass
0.1530	0	0	0	Pass
0.1551	0	0	0	Pass
0.1572	0	0	0	Pass
0.1593	0	0	0	Pass
0.1614	0	0	0	Pass
0.1635	0	0	0	Pass
0.1656	0	0	0	Pass
0.1677	0	0	0	Pass
0.1698	0	0	0	Pass
0.1719	0	0	0	Pass
0.1740	0	0	0	Pass
0.1761	0	0	0	Pass
0.1782	0	0	0	Pass
0.1803	0	0	0	Pass
0.1824	0	0	0	Pass
0.1845	0	0	0	Pass
0.1866	0	0	0	Pass
0.1887	0	0	0	Pass
0.1908	0	0	0	Pass
0.1929	0	0	0	Pass
0.1950	0	0	0	Pass
0.1971	0	0	0	Pass
0.1992	0	0	0	Pass
0.2013	0	0	0	Pass
0.2034	0	0	0	Pass
0.2055	0	0	0	Pass
0.2076	0	0	0	Pass
0.2097	0	0	0	Pass
0.2118	0	0	0	Pass
0.2139	0	0	0	Pass
0.2160	0	0	0	Pass
0.2181	0	0	0	Pass
0.2202	0	0	0	Pass
0.2223	0	0	0	Pass
0.2244	0	0	0	Pass
0.2265	0	0	0	Pass
0.2286	0	0	0	Pass
0.2307	0	0	0	Pass
0.2328	0	0	0	Pass
0.2349	0	0	0	Pass
0.2370	0	0	0	Pass
0.2391	0	0	0	Pass
0.2412	0	0	0	Pass
0.2433	0	0	0	Pass
0.2454	0	0	0	Pass
0.2475	0	0	0	Pass

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
Trapezoidal Pond 1 POC	☐	2.13			☐	100.00			
Total Volume Infiltrated		2.13	0.00	0.00		100.00	0.00	0%	No Treat. Credit
Compliance with LID Standard 8% of 2-yr to 50% of 2-yr									Duration Analysis Result = Passed

Appendix

Predeveloped Schematic



Predeveloped UCI File

```
RUN

GLOBAL
  WWHM4 model simulation
  START       1955 10 01         END    2011 09 30
  RUN INTERP OUTPUT LEVEL    3    0
  RESUME     0 RUN     1                    UNIT SYSTEM     1
END GLOBAL

FILES
<File>  <Un#>   <-----------File Name------------------------------>***
<-ID->                                                               ***
WDM         26   17-104 Cain Closed Depression Analysis 03.18.19.wdm
MESSU       25   Pre17-104 Cain Closed Depression Analysis 03.18.19.MES
            27   Pre17-104 Cain Closed Depression Analysis 03.18.19.L61
            28   Pre17-104 Cain Closed Depression Analysis 03.18.19.L62
            30   POC17-104 Cain Closed Depression Analysis 03.18.191.dat
END FILES

OPN SEQUENCE
    INGRP               INDELT 00:15
      PERLND        1
      RCHRES        1
      COPY        501
      DISPLY        1
    END INGRP
END OPN SEQUENCE
DISPLY
  DISPLY-INFO1
    # -  #<----------Title---------->***TRAN PIVL DIG1 FIL1  PYR DIG2 FIL2 YRND
    1        Trapezoidal Pond  1         MAX                    1    2   30    9
  END DISPLY-INFO1
END DISPLY
COPY
  TIMESERIES
    # -  #  NPT  NMN ***
    1         1    1
  501         1    1
  END TIMESERIES
END COPY
GENER
  OPCODE
    #    # OPCD ***
  END OPCODE
  PARM
    #    #          K ***
  END PARM
END GENER
PERLND
  GEN-INFO
    <PLS ><-------Name-------->NBLKS   Unit-systems   Printer ***
    # -  #                          User  t-series Engl Metr ***
                                       in  out           ***
    1     A/B, Forest, Flat       1    1    1    1   27    0
  END GEN-INFO
  *** Section PWATER***

  ACTIVITY
    <PLS > ************* Active Sections ****************************
    # -  # ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC ***
    1         0    0    1    0    0    0    0    0    0    0    0    0
  END ACTIVITY

  PRINT-INFO
    <PLS > ***************** Print-flags **************************** PIVL  PYR
    # -  # ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC  *********
    1         0    0    4    0    0    0    0    0    0    0    0    0    1    9
  END PRINT-INFO
```

```
END IMPLND

SCHEMATIC
<-Source->                  <--Area-->      <-Target->   MBLK   ***
<Name>   #                  <-factor->      <Name>   #   Tbl#   ***
Existing Depression***
PERLND   1                      10.73       RCHRES   1      2
PERLND   1                      10.73       RCHRES   1      3

******Routing******
RCHRES   1                          1       COPY   501     17
END SCHEMATIC

NETWORK
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   #        <Name> # #<-factor->strg <Name>   #   #        <Name> # #  ***
COPY   501 OUTPUT MEAN   1 1   48.4        DISPLY   1     INPUT  TIMSER 1



<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   #        <Name> # #<-factor->strg <Name>   #   #        <Name> # #  ***
END NETWORK

RCHRES
  GEN-INFO
    RCHRES       Name         Nexits   Unit Systems   Printer                ***
    # -  #<------------------><---> User T-series  Engl Metr LKFG            ***
                                       in  out                               ***
    1     Trapezoidal Pond-009    2    1    1    1   28    0    1
  END GEN-INFO
  *** Section RCHRES***

  ACTIVITY
    <PLS > ************* Active Sections ******************************
    # -  # HYFG ADFG CNFG HTFG SDFG GQFG OXFG NUFG PKFG PHFG ***
    1          1    0    0    0    0    0    0    0    0    0
  END ACTIVITY

  PRINT-INFO
    <PLS > ***************** Print-flags ******************* PIVL  PYR
    # -  # HYDR ADCA CONS HEAT  SED  GQL OXRX NUTR PLNK PHCB PIVL  PYR  *********
    1          4    0    0    0    0    0    0    0    0    0    1    9
  END PRINT-INFO

  HYDR-PARM1
    RCHRES  Flags for each HYDR Section                                    ***
    # -  #  VC A1 A2 A3  ODFVFG for each *** ODGTFG for each     FUNCT  for each
            FG FG FG FG  possible  exit  *** possible  exit      possible  exit
             *  *  *  *    *  *  *  *  *       *  *  *  *  *         ***
    1        0  1  0  0    4  5  0  0  0       0  0  0  0  0         2  2  2  2  2
  END HYDR-PARM1

  HYDR-PARM2
    # -  #    FTABNO       LEN      DELTH     STCOR        KS       DB50        ***
  <------><--------><--------><--------><--------><--------><--------->       ***
    1              1      0.01       0.0     162.0       0.5       0.0
  END HYDR-PARM2
  HYDR-INIT
    RCHRES  Initial conditions for each HYDR section                       ***
    # -  # ***   VOL     Initial  value  of COLIND     Initial  value  of OUTDGT
          *** ac-ft     for each possible exit        for each possible exit
  <------><-------->     <---><---><---><---><---> *** <---><---><---><---><--->
    1            0         4.0  5.0  0.0  0.0  0.0       0.0  0.0  0.0  0.0  0.0
  END HYDR-INIT
END RCHRES

SPEC-ACTIONS
END SPEC-ACTIONS
```

```
  5.055556  0.329523  0.656639  0.000000  1.162942
  5.133333  0.338090  0.682601  0.000000  1.193174
  5.211111  0.346765  0.709235  0.000000  1.223792
  5.288889  0.355550  0.736547  0.000000  1.254796
  5.366667  0.364444  0.764547  0.000000  1.286185
  5.444444  0.373448  0.793242  0.000000  1.317960
  5.522222  0.382561  0.822643  0.000000  1.350121
  5.600000  0.391783  0.852756  0.000000  1.382668
  5.677778  0.401115  0.883591  0.000000  1.415601
  5.755556  0.410556  0.915156  0.000000  1.448919
  5.833333  0.420106  0.947460  0.000000  1.482624
  5.911111  0.429765  0.980510  0.000000  1.516714
  5.988889  0.439534  1.014316  0.000000  1.551190
  6.066667  0.449412  1.048886  0.182234  1.586051
  6.144444  0.459400  1.084229  0.572643  1.621299
  6.222222  0.469497  1.120353  1.046030  1.656932
  6.300000  0.479703  1.157266  1.509672  1.692952
  6.377778  0.490018  1.194978  1.879270  1.729357
  6.455556  0.500443  1.233495  2.114227  1.766147
  6.533333  0.510977  1.272829  2.300165  1.803324
  6.611111  0.521621  1.312985  2.462179  1.840887
  6.688889  0.532374  1.353974  2.614172  1.878835
  6.766667  0.543236  1.395803  2.757800  1.917169
  6.844444  0.554207  1.438481  2.894310  1.955889
  6.922222  0.565288  1.482017  3.024665  1.994995
  7.000000  0.576478  1.526419  3.149630  2.034486
  END FTABLE  1
END FTABLES

EXT SOURCES
<-Volume-> <Member> SsysSgap<--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   # <Name> # tem strg<-factor->strg <Name>   #   #        <Name> # #  ***
WDM      2 PREC     ENGL    0.9            PERLND   1 999 EXTNL  PREC
WDM      2 PREC     ENGL    0.9            IMPLND   1 999 EXTNL  PREC
WDM      1 EVAP     ENGL    0.76           PERLND   1 999 EXTNL  PETINP
WDM      1 EVAP     ENGL    0.76           IMPLND   1 999 EXTNL  PETINP

END EXT SOURCES

EXT TARGETS
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Volume-> <Member> Tsys Tgap Amd ***
<Name>   #        <Name> # #<-factor->strg <Name>   # <Name>    tem strg strg***
RCHRES   1 HYDR   RO      1 1        1      WDM   1004 FLOW     ENGL      REPL
RCHRES   1 HYDR   O       1 1        1      WDM   1005 FLOW     ENGL      REPL
RCHRES   1 HYDR   O       2 1        1      WDM   1006 FLOW     ENGL      REPL
RCHRES   1 HYDR   STAGE   1 1        1      WDM   1007 STAG     ENGL      REPL
COPY   501 OUTPUT MEAN    1 1     48.4      WDM    501 FLOW     ENGL      REPL
END EXT TARGETS

MASS-LINK
<Volume>   <-Grp> <-Member-><--Mult-->     <Target>       <-Grp> <-Member->***
<Name>             <Name> # #<-factor->     <Name>                <Name> # #***
  MASS-LINK        2
PERLND     PWATER SURO       0.083333      RCHRES         INFLOW IVOL
  END MASS-LINK    2

  MASS-LINK        3
PERLND     PWATER IFWO       0.083333      RCHRES         INFLOW IVOL
  END MASS-LINK    3

  MASS-LINK        17
RCHRES     OFLOW  OVOL   1                 COPY           INPUT  MEAN
  END MASS-LINK    17


END MASS-LINK

END RUN
```

```
  END PRINT-INFO

  PWAT-PARM1
    <PLS >  PWATER variable monthly parameter value flags  ***
    # -  # CSNO RTOP UZFG  VCS  VUZ  VNN VIFW VIRC  VLE INFC  HWT ***
    1         0    0    0    0    0    0    0    0    0    0    0
  END PWAT-PARM1

  PWAT-PARM2
    <PLS >      PWATER input info: Part 2          ***
    # -  # ***FOREST      LZSN    INFILT      LSUR     SLSUR      KVARY      AGWRC
    1              0         5         2       400      0.05        0.3      0.996
  END PWAT-PARM2

  PWAT-PARM3
    <PLS >      PWATER input info: Part 3          ***
    # -  # ***PETMAX    PETMIN    INFEXP    INFILD    DEEPFR    BASETP    AGWETP
    1              0         0         2         2         0         0         0
  END PWAT-PARM3
  PWAT-PARM4
    <PLS >     PWATER input info: Part 4                                  ***
    # -  #     CEPSC      UZSN      NSUR     INTFW       IRC     LZETP ***
    1          0.2       0.5      0.35         0       0.7       0.7
  END PWAT-PARM4

  PWAT-STATE1
    <PLS > *** Initial conditions at start of simulation
             ran from 1990 to end of 1992 (pat 1-11-95) RUN 21 ***
    # -  # ***  CEPS      SURS       UZS      IFWS       LZS      AGWS       GWVS
    1              0         0         0         0         3         1         0
  END PWAT-STATE1

END PERLND

IMPLND
  GEN-INFO
    <PLS ><-------Name------->   Unit-systems   Printer ***
    # -  #                     User  t-series Engl Metr ***
                                     in  out           ***
  END GEN-INFO
  *** Section IWATER***

  ACTIVITY
    <PLS > ************* Active Sections ****************************
    # -  # ATMP SNOW IWAT  SLD  IWG IQAL   ***
  END ACTIVITY

  PRINT-INFO
    <ILS > ******** Print-flags ******** PIVL  PYR
    # -  # ATMP SNOW IWAT  SLD  IWG IQAL    *********
  END PRINT-INFO

  IWAT-PARM1
    <PLS >  IWATER variable monthly parameter value flags  ***
    # -  # CSNO RTOP  VRS  VNN RTLI     ***
  END IWAT-PARM1

  IWAT-PARM2
    <PLS >      IWATER input info: Part 2          ***
    # -  # ***  LSUR     SLSUR      NSUR     RETSC
  END IWAT-PARM2

  IWAT-PARM3
    <PLS >      IWATER input info: Part 3          ***
    # -  # ***PETMAX    PETMIN
  END IWAT-PARM3

  IWAT-STATE1
    <PLS > *** Initial conditions at start of simulation
    # -  # ***  RETS      SURS
```

SPEC-ACTIONS
END SPEC-ACTIONS
FTABLES
FTABLE 1
91 5

Depth (ft)	Area (acres)	Volume (acre-ft)	Outflow1 (cfs)	Outflow2 (cfs)	Velocity (ft/sec)	Travel Time*** (Minutes)***
0.000000	0.007209	0.000000	0.000000	0.000000		
0.077778	0.008669	0.000617	0.000000	0.030595		
0.155556	0.010239	0.001353	0.000000	0.036134		
0.233333	0.011918	0.002214	0.000000	0.042060		
0.311111	0.013706	0.003211	0.000000	0.048371		
0.388889	0.015604	0.004351	0.000000	0.055068		
0.466667	0.017611	0.005642	0.000000	0.062151		
0.544444	0.019727	0.007094	0.000000	0.069620		
0.622222	0.021953	0.008715	0.000000	0.077475		
0.700000	0.024288	0.010514	0.000000	0.085715		
0.777778	0.026732	0.012498	0.000000	0.094342		
0.855556	0.029286	0.014676	0.000000	0.103354		
0.933333	0.031948	0.017057	0.000000	0.112752		
1.011111	0.034721	0.019650	0.000000	0.122535		
1.088889	0.037602	0.022463	0.000000	0.132705		
1.166667	0.040593	0.025504	0.000000	0.143260		
1.244444	0.043693	0.028781	0.000000	0.154201		
1.322222	0.046903	0.032305	0.000000	0.165528		
1.400000	0.050222	0.036082	0.000000	0.177241		
1.477778	0.053650	0.040121	0.000000	0.189340		
1.555556	0.057187	0.044432	0.000000	0.201824		
1.633333	0.060834	0.049021	0.000000	0.214694		
1.711111	0.064590	0.053899	0.000000	0.227950		
1.788889	0.068456	0.059073	0.000000	0.241592		
1.866667	0.072431	0.064552	0.000000	0.255620		
1.944444	0.076515	0.070344	0.000000	0.270033		
2.022222	0.080708	0.076458	0.000000	0.284833		
2.100000	0.085011	0.082903	0.000000	0.300018		
2.177778	0.089423	0.089687	0.000000	0.315589		
2.255556	0.093944	0.096817	0.000000	0.331545		
2.333333	0.098575	0.104304	0.000000	0.347888		
2.411111	0.103315	0.112156	0.000000	0.364616		
2.488889	0.108165	0.120380	0.000000	0.381731		
2.566667	0.113123	0.128985	0.000000	0.399231		
2.644444	0.118191	0.137981	0.000000	0.417116		
2.722222	0.123369	0.147375	0.000000	0.435388		
2.800000	0.128655	0.157176	0.000000	0.454046		
2.877778	0.134051	0.167392	0.000000	0.473089		
2.955556	0.139556	0.178033	0.000000	0.492518		
3.033333	0.145171	0.189105	0.000000	0.512333		
3.111111	0.150895	0.200619	0.000000	0.532534		
3.188889	0.156728	0.212582	0.000000	0.553120		
3.266667	0.162671	0.225003	0.000000	0.574093		
3.344444	0.168723	0.237891	0.000000	0.595451		
3.422222	0.174884	0.251253	0.000000	0.617195		
3.500000	0.181155	0.265099	0.000000	0.639325		
3.577778	0.187534	0.279437	0.000000	0.661840		
3.655556	0.194024	0.294275	0.000000	0.684742		
3.733333	0.200622	0.309623	0.000000	0.708029		
3.811111	0.207330	0.325488	0.000000	0.731702		
3.888889	0.214147	0.341878	0.000000	0.755761		
3.966667	0.221074	0.358804	0.000000	0.780206		
4.044444	0.228109	0.376272	0.000000	0.805036		
4.122222	0.235255	0.394292	0.000000	0.830253		
4.200000	0.242509	0.412871	0.000000	0.855855		
4.277778	0.249873	0.432019	0.000000	0.881843		
4.355556	0.257346	0.451745	0.000000	0.908216		
4.433333	0.264928	0.472055	0.000000	0.934976		
4.511111	0.272620	0.492960	0.000000	0.962121		
4.588889	0.280421	0.514467	0.000000	0.989653		
4.666667	0.288331	0.536585	0.000000	1.017570		
4.744444	0.296351	0.559323	0.000000	1.045873		

```
  END MASS-LINK    13

  MASS-LINK        17
RCHRES      OFLOW  OVOL    1                 COPY            INPUT   MEAN
  END MASS-LINK    17


END MASS-LINK

END RUN
```

Mitigated HSPF Message File