Kirkland Woodland Maker Space

Preliminary Stormwater Report

Submitted to:
City of Woodland
300 East Scott Avenue
Woodland, WA 98674

Prepared By:
Otak, Inc.
700 Washington Street, Suite 300
Vancouver, Washington 98660

June 8, 2021

Otak Project: 20078

Otak

STATEMENT OF COMPLETENESS AND FEASIBILITY

All information required by Woodland Municipal Code (WMC) 15.12 is included in this stormwater technical information report.

_____

TABLE OF CONTENTS

Tables

Appendices

Section A—Project Overview

The Woodland Maker Space project is located at 600 Mitchell Avenue, Woodland, Washington and involves the construction of three (3) buildings for "maker space" garages. Site improvements to accompany the new buildings include, a parking lot, utilities, sidewalk, and landscaping. See **Figure 1** for the Site Location Map (all figures are in **Appendix A**).

Existing conditions

The existing site consists of a grassed field that is relatively flat (0-5%), with a depression at the southeast corner of the property. The runoff is infiltrated throughout the project site. There is no runoff from adjacent properties onto the project site. There are no existing stormwater utilities along the frontage of the project on Mitchell Avenue. For the existing conditions plan, see sheet EX-01 in the preliminary construction plans located in **Appendix E.**

Project Description

The proposed improvements for the Woodland Maker Space project are shown in **Figure 2 – Basin Map,** and on sheet STRM-01 in the preliminary construction plans, located in **Appendix E**. Based on the location of the site, the well-drained soils (infiltration rates from 5-16 in/hr), and the absence of stormwater utilities along the frontage; all influenced the decision to propose CMP infiltration facilities and treatment cartridge catchbasins to meet flow control and treatment requirements. The following briefly summarizes the stormwater improvements for each drainage basin:

- **Parking Lot, Sidewalk, and Landscaping (Basin 1S-3S & 7S-8S)** – The parking lot will consist of asphalt pavement, sidewalk, and landscaped islands which will drain to the center of the drive isles to a drainage gutter. The drainage gutter will convey the runoff to stormfilter catch basins, before entering one of the two CMP infiltration facilities.
- **Building Footprints (Basin 5S, 6S, and 9S)** – The three new buildings are shown on **Figure 2**. The runoff from the rooftop is not required to be a treated based on the 1992 Pudget Sound Basin Stormwater Management Manual. Therefore, roof downspouts from the buildings will connect directly to the CMP infiltration facilities. The runoff from the roof of the most northern building will be collected by the most northern CMP infiltration facility (INFIL-1). Runoff from the middle and southern buildings will be collected by the most southern CMP infiltration facility (INFIL-2).
- **Landscaped Area (Basin 4S and 10S)** – Runoff from landscaped areas will be infiltrated, runoff that is unable to be infiltrated will sheet flow to the parking lot and be collected by a stormfilter catch basin and discharged to one of the CMP infiltration facilities.

Land Disturbing Activity Limits/ Basin Delineation

The project site is approximately 2.00 acres and the project development limits are shown in **Figure 2**. A total of 1.66 acres of new impervious area will be constructed for the on-site development. The existing groundcover is 100% pervious. In the proposed condition, the project will convert 72,472 SF of pervious surface to impervious land cover changing the site's groundcover to 17% pervious and 83% impervious surfaces **(see Table 1).**

Table 1—Existing and Proposed Ground Cover Conditions

Ground Cover	Existing Area (sf)	Proposed Area (sf)	Change (sf)
Pervious	86,976	14,504	-72,472
Impervious	0	72,472	+72,472
Total	86,976	86,976	0

Drainage basins for the proposed stormwater system were delineated using topographic survey performed by Olson Engineering Inc. in October 2020 and Google Earth aerial imagery from May 2019. The site has no additional stormwater runoff contributing to the project area from adjacent properties. As shown on the basin map on **Figure 2**, ten basins were delineated for this project. A summary of the post-developed basins is shown in **Table 2**.

Table 2—Post-Development Basin Areas Summary

Post-Development Basin Areas Summary			
	Basin Description	Impervious (sf)	Pervious (sf)
Basin 1S	Parking/Sidewalk/Landscape	7,920	2,053
Basin 2S	Parking/Sidewalk/Landscape	8,984	533
Basin 3S	Parking/Sidewalk/Landscape	8,181	1,359
Basin 4S	Landscape	0	5,645
Basin 5S	Building	17,074	0
Basin 6S	Building	16,684	0
Basin 7S	Parking/Sidewalk/Landscape	5,288	1,647
Basin 8S	Parking/Sidewalk/Landscape	5,651	890
Basin 9S	Building	2,690	0
Basin 10S	Landscape	0	2,377
Total		72,472 (1.66 ac)	14,504 (0.33 ac)
Total Ground Disturbance Area		86,976 (1.99 ac)	

Section B—Approval Condition Summary

No conditions of approvals were designated to this project. This project is to meet the requirements listed in WMC 15.12. The project provides stormwater quantity and quality control which is discussed in **Section D** and **Section F** of this report.

Section C—Downstream Analysis

All runoff produced on-site will be collected and infiltrated by two CMP infiltration facilities, which are designed to infiltrate the 100-year stormwater event. All stormwater will be infiltrated and not collected by a public stormwater system; therefore, a downstream analysis is not applicable according to WMC 15.12.080(2)(c).

Section D—Quantity Control Analysis and Design

The two proposed infiltration facilities, INFIL-1 and INFIL-2, will be Contech's corrugated metal pipe (CMP) stormwater infiltration system. This will consist of a 90 foot 42" perforated CMP facility and a 430 foot 36" perforated CMP facility for INFIL-1 and INFIL-2 (respectively) as well as drainage rock with a porosity value of 36%. Contech designs the facilities to support H-20 and H-25 live load conditions. Facility INFIL-1 will receive runoff from Basins 7S – 10S. Facility INFIL-2 will receive runoff from Basins 1S-6S, as shown in **Table 3**. The facility was designed with a design infiltration rates of 2.5 in/hr (from 0ft-6ft in depth) and 8 in/hr (from 6ft-8ft in depth). The facility will collect runoff from the parking lot, sidewalks, and roofs. The roofs will drain directly to the infiltration facility without receiving treatment. All runoff from the parking lot will receive water quality treatment prior to infiltration.

The CMP stormwater infiltration system was modeled in HydroCAD v10. The infiltration facilities were designed to

infiltrate the 100-year storm, therefore, meeting the requirements in WMC 15.12.080(3). The 100-year, 24-hour stormwater event rainfall depth, is 4.4" based on the 100-year, 24-hour isopluvial map for Western Washington. The infiltration facilities were designed to have a minimum separation of 5 feet between the bottom of the facility and the groundwater table, which meets to requirements from the 2019 version of the Washington State Department of Ecology's (Ecology) Stormwater Management Manual for Western Washington (SWMMWW). See sheets STRM-01 and STD-03 in the preliminary construction plans in **Appendix E** for detail on the configuration of the facilities. Calculations can be found in **Appendix B**. Summarized attributes of the two infiltration facilities can be found in **Table 3**. A summary of the approximate elevations of the facilities can be found in **Table 4**. According to WMC 15.12.100(1)(d), infiltration systems used for stormwater disposal shall be located at least 100 feet away from domestic water supply wells. Based on information found the Department of Ecologies well construction and licensing search tools, the closest water well is approximately 0.5 miles away.

Table 3. Infiltration Facility Storage Summary

Facility ID	Drainage Area (ac)	Basin	Tributary Impervious Area (sf)	Tributary Pervious Area (sf)	Soil Type	Design Infiltration Rate	Peak Storage Used (cf)	Storage Available (cf)
INFIL - 1 (42" CMP)	0.43	7S – 10S	13,629	4,914	A	2.5IN/HR @ elevations 28.0-22.0 8IN/HR @ elevations 22.0 and below	1,078	1,374
INFIL – 2 (36" CMP)	1.57	1S-6S	58,843	9,590	A	2.5IN/HR @ elevations 27.0-22.0 8IN/HR @ elevations 22.0 & below	4,691	5,056

Table 4. Infiltration Facility Approximate Elevation Summary

Elevations	Infiltration Facility INFIL-1	Infiltration Facility INFIL-2
Existing Grade Elevation	27.00	28.00
Future Grade Elevation	26.10	25.90
Top of Gravel Section	24.10	24.00
Top of CMP Pipe	23.60	23.50
Bottom of CMP Pipe	20.1	20.50
Bottom of Gravel Section	19.60	20.00
Ground Water Table	14.00	15.00

If either facility were to clog, the runoff would start ponding within the parking lot. Only once the storage of the parking lot was exceeded would the runoff overflow to the adjacent eastern and western properties.

Section E—Conveyance System Analysis and Design

All stormwater conveyance pipe will be analyzed in the Final Stormwater Report. The conveyance system capacity will be designed for the 100-year, 24-hour design storm as required from WMC 15.12.080(4). Assuming a manning's n value of 0.013, it was found that a 6-inch pipe at 0.5% slope will be adequate to convey the 100-year, 24-hour stormwater event. See Appendix B for the preliminary conveyance calculations. The finalized conveyance calculations will be provided in the Final Stormwater Report.

Section F—Water Quality Design

Five (5) treatment cartridge catch basins, are proposed to treat the pollution generating runoff for the 6-month, 24-hr stormwater event, as required by WMC 15.12.070(1). The 6-month, 24-hour stormwater event rainfall depth, is 1.58" based on the 6-month, 24-hour isopluvial map for Western Washington. The parking lot and the sidewalk that shed to the parking lot are the only pollution generating surfaces on the site. The location of the facilities is shown in **Figure 2** in **Appendix A** and the details can be found on sheet STD-03 in the preliminary construction plans in **Appendix E**. The project site only requires basic treatment, therefore PhosphoSorb media filters will be used to treat the stormwater from the parking lot and sidewalk. HydroCAD was used to calculate that number of 18" treatment cartridges necessary for each facility. Summarized attributes of the treatment facilities can be found in **Table 5**. See **Appendix B** for the water quality calculations.

Table 5. Runoff Treatment Summary

Facility Type	Facility ID	# of Treatment Cartridges	Drainage Basin ID	Drainage Area (ac)	Water Quality Flow Rate (cfs)	Facility Treatment Capacity (cfs)
Treatment Cartridge Catch Basin	SFCB-1	2 (18")	7S	0.16	0.04	0.05
Treatment Cartridge Catch Basin	SFCB-2	2 (18")	8S, 10S	0.20	0.05	0.05
Treatment Cartridge Catch Basin	SFCB-3	3 (18")	1S, 4S	0.36	0.06	0.08
Treatment Cartridge Catch Basin	SFCB-4	3 (18")	2S	0.22	0.07	0.08
Treatment Cartridge Catch Basin	SFCB-5	3 (18")	3S	0.22	0.07	0.08

Section G—Soil Evaluation

Soil information was obtained from the Natural Resource Conservation Service (NRCS) Web Soil Survey and has been included in **Appendix C**. The soil types in the project area are mainly classified as Newberg fine sandy loam and Pilchuck loamy fine sand, which is classified as Hydrologic Soil Group A. Hydrologic Soil Group A is defined as soils that have a high infiltration rate when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission. There are also some areas classified as Clato silt loam, which is classified as Hydrologic Soil Group B. Hydrologic Soil Group B is defined as soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Tests were performed in two locations by Redmond Geotechnical Services, LLC (RGS). The key sections of the geotechnical report by RGS can be found in **Appendix D**. The infiltration test performed is called the "Encased Falling Head Test Method". These infiltration tests were taken on August 21st, 2020. See **Table 6** for a summary of soil types and infiltration rate and certain depths. The infiltration rate from both tests TH-3 (5 in/hr) and TH-4(16 in/hr) were used to design the stormwater infiltration system design. After applying a safety factor of 2, as required by WMC 15.12.080(3), the design infiltration rate was found to be 2.5 in/hr for depths 1ft-6ft and 8 in/hr from depths 6ft-8ft. The topsoil and the first layer below the topsoil consists of clayey, sandy silt. Below these layers (approximately 6 ft in depth), the soil is slightly clayey, silt fine to medium sand. The Geotech determined that the groundwater table was at a depth of 13-ft during the time of drilling. It is the general opinion of the Geotech that the observed static groundwater of 13-ft is likely near the seasonal high groundwater elevation at the site.

Table 6—Infiltration Test Summary

Depth BGS (ft)	Soil Type	Infiltration Rate Measured (in/hr)	Design Infiltration Rate (in/hr)
1-6	Clayey, sandy silt	5	2.5
6-8	Slightly clayey, silt fine to medium sand	16	8

Section H—Special Reports and Studies

A geotechnical Investigation report was prepared by Redmond Geotechnical Services, LLC (RGS). The geotechnical report by RGS is discussed in Section G of this report and relevant pages can be found in **Appendix D**.

Section I—Other Permits

The two infiltration facilities (INFIL-1 and INFIL-2), will be registered as underground injection control (UIC).

Section J—Groundwater Monitoring Program

Based on the information from Washington State Department of Health's Source Water Assessment Program, it was found that our site is within Zone 2 (the 5-year time-of-travel boundary for groundwater) of a wellhead protection area, as shown on **Figure 3** in **Appendix A**. However, the groundwater is likely not to be contaminated, as pollution generating runoff will be treated by stormfilter cartridges before entering the infiltration facility and the risk of illegal dumping is minimal. Therefore, a groundwater monitoring program is likely not necessary.

Section K—Maintenance and Operations Manual

Maintenance of the proposed facilities will be the owner's responsibility. The facilities requiring maintenance are the treatment cartridge catch basins and the CMP stormwater infiltration systems.
Maintenance manuals specific to the facility are located in **Appendix F.**

References

Ecology, 2019. Stormwater Management Manual for Western Washington. Publication Number 19-10-021 Olympia, Washington, Washington State Department of Ecology, 2019.

Ecology, 1992. Stormwater Management Manual for the Pudget Sound Basin. Publication Number 91-75 Olympia, Washington, Washington State Department of Ecology, 1992.

NRCS, 2012. *Web Soil Survey of Clark County, Washington*, U.S. Department of Agriculture, Natural Resources Conservation Service, 2012.

Woodland, 2020. *Chapter 15.12 Stormwater Management*, Woodland Municipal Code Woodland, WA, 2020.

Appendices

Appendix A- Figures

Figure 1 – Site Location Map
Figure 2 – Basin Map
Figure 3 – Wellhead Protection Area

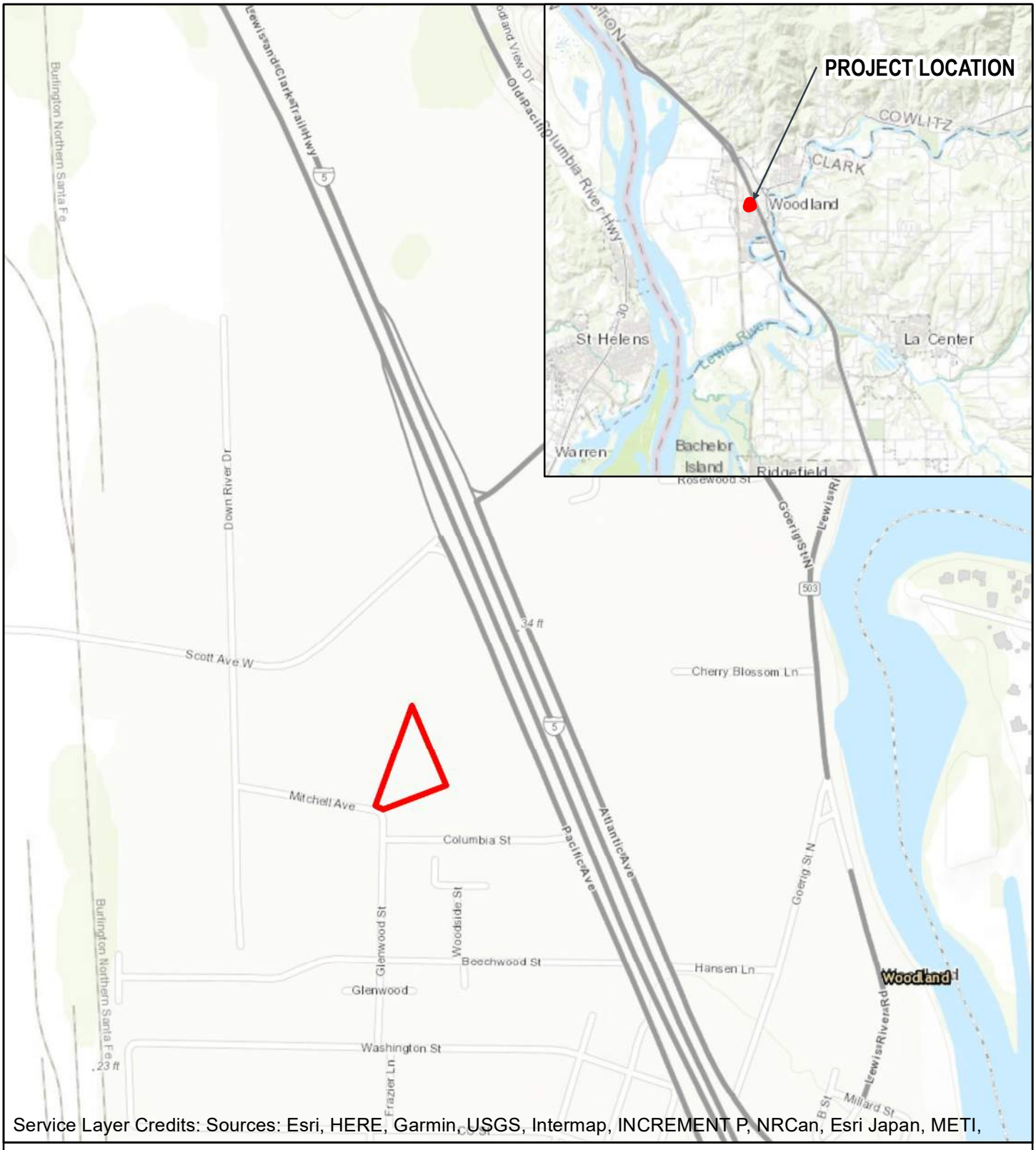


FIGURE 1

SITE LOCATION MAP

Legend

Project Area

N

WOODLAND MAKERSPACE

KIRKLAND DEVELOPMENT | WOODLAND, WA

0 0.25 0.5 Miles

Otak

MITCHELL AVE.

NEW STORMFILTER CATCH BASIN FACILITY ID: SFCB-3 # OF STORMFILTERS: 3

NEW STORMFILTER CATCH BASIN FACILITY ID: SFCB-4 # OF STORMFILTERS: 3

NEW STORMFILTER CATCH BASIN FACILITY ID: SFCB-1 # OF STORMFILTERS: 2

N 23°14'21" E 548.07' (548.09')

1S PARKING LOT

2S PARKING LOT

3S PARKING LOT

4S LANDSCAPING

5S ROOF

6S ROOF

7S PARKING LOT

8S PARKING LOT

9S ROOF

10S LANDSCAPING

SD

NEW STORMFILTER CATCH BASIN FACILITY ID: SFCB-2 # OF STORMFILTERS: 2

UNDERGROUND CMP INFILTRATOIN FACILITY FACILITY ID: INFIL-1

NEW STORMFILTER CATCH BASIN FACILITY ID: SFCB-5 # OF STORMFILTERS: 3

UNDERGROUND CMP INFILTRATOIN FACILITY FACILITY ID: INFIL-2

Post-Development Basin Areas Summary			
	Basin Description	Impervious (sf)	Pervious (sf)
Basin 1S	Parking/Sidewalk/Landscape	7,920	2,053
Basin 2S	Parking/Sidewalk/Landscape	8,984	533
Basin 3S	Parking/Sidewalk/Landscape	8,181	1,359
Basin 4S	Landscape	0	5,645
Basin 5S	Building	17,074	0
Basin 6S	Building	16,684	0
Basin 7S	Parking/Sidewalk/Landscape	5,288	1,647
Basin 8S	Parking/Sidewalk/Landscape	5,651	890
Basin 9S	Building	2,690	0
Basin 10S	Landscape	0	2,377
Total		72,472 (1.66 ac)	14,504 (0.33 ac)
Total Ground Disturbance Area		86,976 (1.99 ac)	

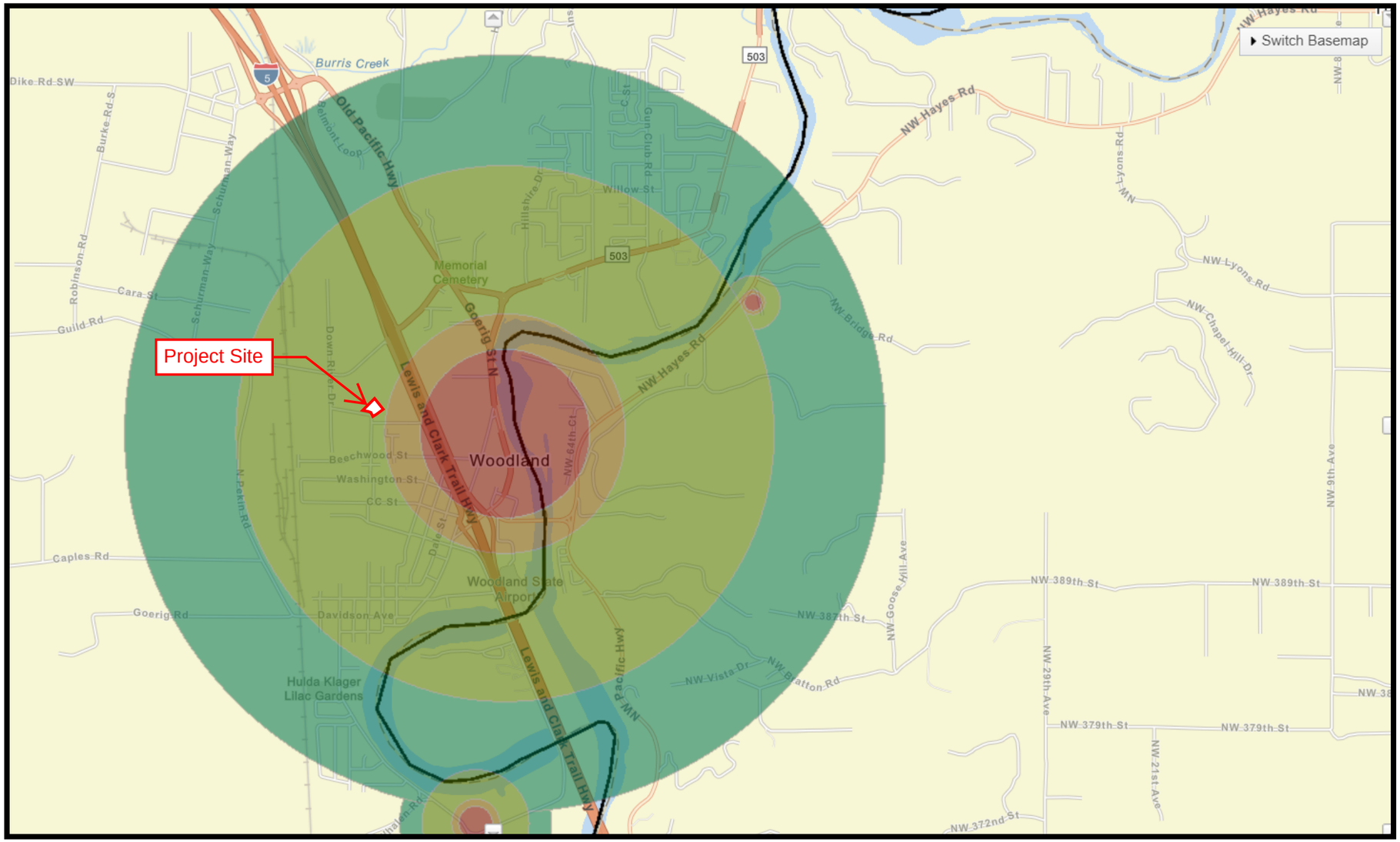
LEGEND

- NEW STORMFILTER CATCH BASIN
- SD — NEW STORM DRAIN LINE
- LANDSCAPE
- CONCRETE PAVEMENT/SIDEWALK
- PROJECT DEVELOPMENT LIMITS
- SUB-BASIN BOUNDARY
- XX — SUB-BASIN ID
- FLOW ARROWS

0 30 60
SCALE IN FEET

Otak
Otak, Inc.
700 Washington St., Suite 300
Vancouver, WA 98660
360. 737. 9613
www.otak.com

FIGURE 2.
BASIN MAP
WOODLAND MAKER SPACE



LEGEND

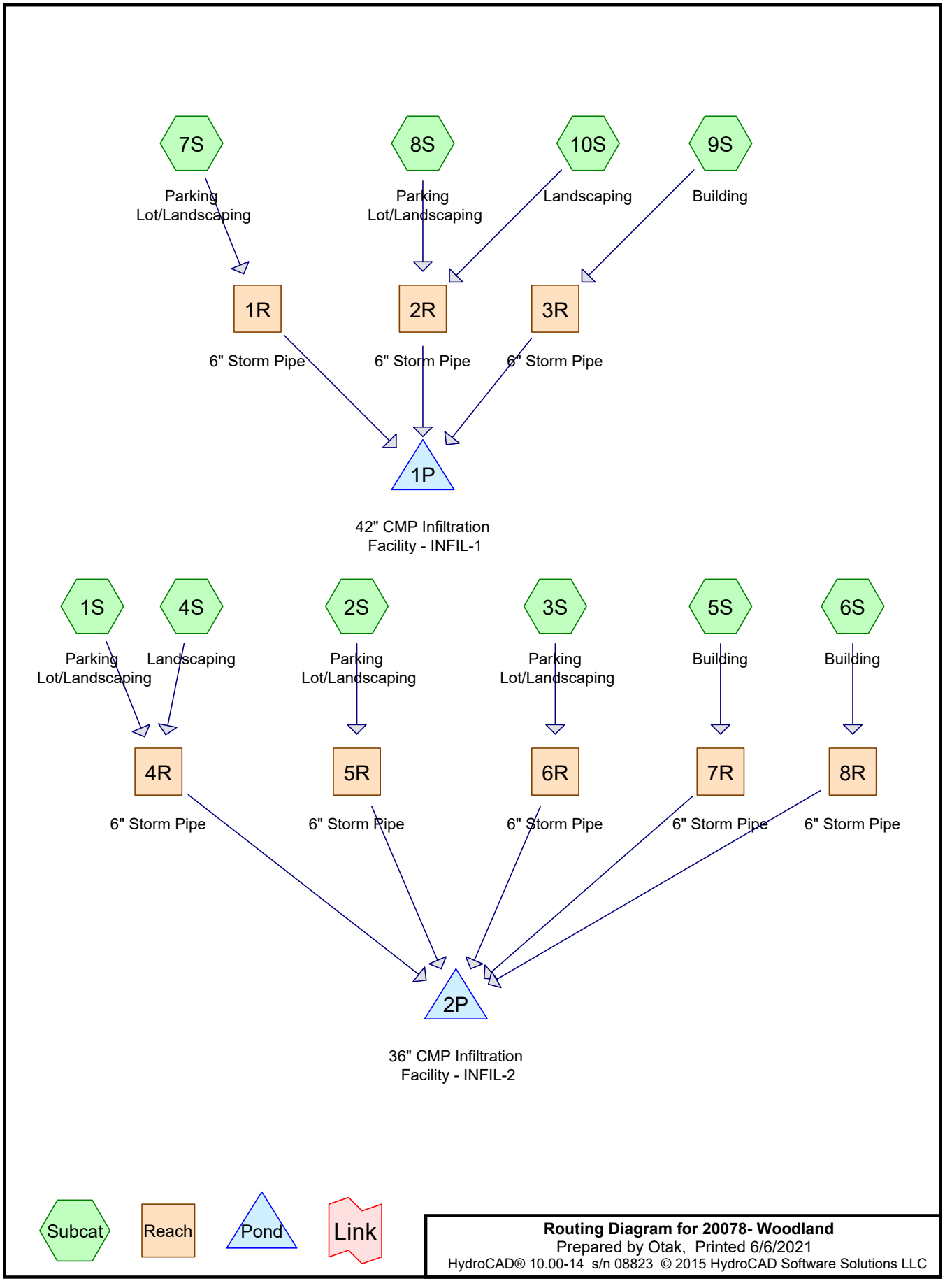
- 6 Month Time of Travel
  - (Zone 1)
- 1 Year Time of Travel
  - (Zone 1)
- 5 Year Time of Travel
  - (Zone 2)
- 10 Year Time of Travel
  - (Zone 3)

*Map is not to scale.

Otak, Inc.
700 Washington St., Suite 300
Vancouver, WA 98660
360. 737. 9613
www.otak.com

FIGURE 3
WELLHEAD PROTECTION AREA
MAKER SPACE - KIRKLAND
WOODLAND, WA

Appendix B- Calculations



Routing Diagram for 20078- Woodland
Prepared by Otak, Printed 6/6/2021

Time span=0.00-96.00 hrs, dt=0.01 hrs, 9601 points
Runoff by SBUH method, Split Pervious/Imperv.
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment1S: Parking Lot/Landscaping Runoff Area=9,973 sf 79.41% Impervious Runoff Depth=3.33"
Tc=5.0 min CN=39/98 Runoff=0.19 cfs 2,765 cf

Subcatchment2S: Parking Lot/Landscaping Runoff Area=9,517 sf 94.40% Impervious Runoff Depth=3.94"
Tc=5.0 min CN=39/98 Runoff=0.21 cfs 3,122 cf

Subcatchment3S: Parking Lot/Landscaping Runoff Area=9,540 sf 85.75% Impervious Runoff Depth=3.58"
Tc=5.0 min CN=39/98 Runoff=0.19 cfs 2,850 cf

Subcatchment4S: Landscaping Runoff Area=5,645 sf 0.00% Impervious Runoff Depth=0.10"
Tc=5.0 min CN=39/0 Runoff=0.00 cfs 45 cf

Subcatchment5S: Building Runoff Area=17,074 sf 100.00% Impervious Runoff Depth=4.16"
Tc=5.0 min CN=0/98 Runoff=0.41 cfs 5,925 cf

Subcatchment6S: Building Runoff Area=16,684 sf 100.00% Impervious Runoff Depth=4.16"
Tc=5.0 min CN=0/98 Runoff=0.40 cfs 5,790 cf

Subcatchment7S: Parking Lot/Landscaping Runoff Area=6,935 sf 76.25% Impervious Runoff Depth=3.20"
Tc=5.0 min CN=39/98 Runoff=0.13 cfs 1,848 cf

Subcatchment8S: Parking Lot/Landscaping Runoff Area=6,541 sf 86.39% Impervious Runoff Depth=3.61"
Tc=5.0 min CN=39/98 Runoff=0.13 cfs 1,968 cf

Subcatchment9S: Building Runoff Area=2,690 sf 100.00% Impervious Runoff Depth=4.16"
Tc=5.0 min CN=0/98 Runoff=0.06 cfs 933 cf

Subcatchment10S: Landscaping Runoff Area=2,377 sf 0.00% Impervious Runoff Depth=0.10"
Tc=5.0 min CN=39/0 Runoff=0.00 cfs 19 cf

Reach 1R: 6" Storm Pipe Avg. Flow Depth=0.19' Max Vel=1.79 fps Inflow=0.13 cfs 1,848 cf
6.0" Round Pipe n=0.013 L=10.0' S=0.0050 '/' Capacity=0.40 cfs Outflow=0.13 cfs 1,848 cf

Reach 2R: 6" Storm Pipe Avg. Flow Depth=0.20' Max Vel=1.83 fps Inflow=0.13 cfs 1,987 cf
6.0" Round Pipe n=0.013 L=10.0' S=0.0050 '/' Capacity=0.40 cfs Outflow=0.13 cfs 1,987 cf

Reach 3R: 6" Storm Pipe Avg. Flow Depth=0.14' Max Vel=1.48 fps Inflow=0.06 cfs 933 cf
6.0" Round Pipe n=0.013 L=10.0' S=0.0050 '/' Capacity=0.40 cfs Outflow=0.06 cfs 933 cf

Reach 4R: 6" Storm Pipe Avg. Flow Depth=0.24' Max Vel=2.00 fps Inflow=0.19 cfs 2,810 cf
6.0" Round Pipe n=0.013 L=10.0' S=0.0050 '/' Capacity=0.40 cfs Outflow=0.19 cfs 2,810 cf

Reach 5R: 6" Storm Pipe Avg. Flow Depth=0.26' Max Vel=2.06 fps Inflow=0.21 cfs 3,122 cf
6.0" Round Pipe n=0.013 L=10.0' S=0.0050 '/' Capacity=0.40 cfs Outflow=0.21 cfs 3,122 cf

Reach 6R: 6" Storm Pipe Avg. Flow Depth=0.25' Max Vel=2.01 fps Inflow=0.19 cfs 2,850 cf
6.0" Round Pipe n=0.013 L=10.0' S=0.0050 '/' Capacity=0.40 cfs Outflow=0.19 cfs 2,850 cf

Reach 7R: 6" Storm Pipe Avg. Flow Depth=0.42' Max Vel=2.30 fps Inflow=0.41 cfs 5,925 cf
6.0" Round Pipe n=0.013 L=10.0' S=0.0050 '/' Capacity=0.40 cfs Outflow=0.41 cfs 5,925 cf

Reach 8R: 6" Storm Pipe Avg. Flow Depth=0.41' Max Vel=2.30 fps Inflow=0.40 cfs 5,790 cf
6.0" Round Pipe n=0.013 L=10.0' S=0.0050 '/' Capacity=0.40 cfs Outflow=0.40 cfs 5,790 cf

Pond 1P: 42" CMP Infiltration Facility - Peak Elev=103.30' Storage=1,078 cf Inflow=0.32 cfs 4,769 cf
Outflow=0.10 cfs 4,769 cf

Pond 2P: 36" CMP Infiltration Facility - Peak Elev=103.53' Storage=4,691 cf Inflow=1.40 cfs 20,496 cf
Outflow=0.40 cfs 20,496 cf

Total Runoff Area = 86,976 sf Runoff Volume = 25,265 cf Average Runoff Depth = 3.49"
16.68% Pervious = 14,504 sf 83.32% Impervious = 72,472 sf

Summary for Subcatchment 1S: Parking Lot/Landscaping

Runoff = 0.19 cfs @ 7.88 hrs, Volume= 2,765 cf, Depth= 3.33"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Type IA 24-hr 100-year Storm Rainfall=4.40"

	Area (sf)	CN	Description
*	7,920	98	Asphalt
	2,053	39	>75% Grass cover, Good, HSG A
	9,973	86	Weighted Average
	2,053	39	20.59% Pervious Area
	7,920	98	79.41% Impervious Area

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

Summary for Subcatchment 2S: Parking Lot/Landscaping

Runoff = 0.21 cfs @ 7.88 hrs, Volume= 3,122 cf, Depth= 3.94"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Type IA 24-hr 100-year Storm Rainfall=4.40"

	Area (sf)	CN	Description
*	8,984	98	Asphalt
	533	39	>75% Grass cover, Good, HSG A
	9,517	95	Weighted Average
	533	39	5.60% Pervious Area
	8,984	98	94.40% Impervious Area

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

Summary for Subcatchment 3S: Parking Lot/Landscaping

Runoff = 0.19 cfs @ 7.88 hrs, Volume= 2,850 cf, Depth= 3.58"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Type IA 24-hr 100-year Storm Rainfall=4.40"

	Area (sf)	CN	Description
*	8,181	98	Asphalt
	1,359	39	>75% Grass cover, Good, HSG A
	9,540	90	Weighted Average
	1,359	39	14.25% Pervious Area
	8,181	98	85.75% Impervious Area

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

Summary for Subcatchment 4S: Landscaping

Runoff = 0.00 cfs @ 22.65 hrs, Volume= 45 cf, Depth= 0.10"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Type IA 24-hr 100-year Storm Rainfall=4.40"

Area (sf)	CN	Description
5,645	39	>75% Grass cover, Good, HSG A
5,645	39	100.00% Pervious Area

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

Summary for Subcatchment 5S: Building

Runoff = 0.41 cfs @ 7.88 hrs, Volume= 5,925 cf, Depth= 4.16"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Type IA 24-hr 100-year Storm Rainfall=4.40"

	Area (sf)	CN	Description
*	17,074	98	Building
	17,074	98	100.00% Impervious Area

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

Summary for Subcatchment 6S: Building

Runoff = 0.40 cfs @ 7.88 hrs, Volume= 5,790 cf, Depth= 4.16"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Type IA 24-hr 100-year Storm Rainfall=4.40"

	Area (sf)	CN	Description
*	16,684	98	Building
	16,684	98	100.00% Impervious Area

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

Summary for Subcatchment 7S: Parking Lot/Landscaping

Runoff = 0.13 cfs @ 7.88 hrs, Volume= 1,848 cf, Depth= 3.20"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Type IA 24-hr 100-year Storm Rainfall=4.40"

	Area (sf)	CN	Description
*	5,288	98	Asphalt
	1,647	39	>75% Grass cover, Good, HSG A
	6,935	84	Weighted Average
	1,647	39	23.75% Pervious Area
	5,288	98	76.25% Impervious Area

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

Summary for Subcatchment 8S: Parking Lot/Landscaping

Runoff = 0.13 cfs @ 7.88 hrs, Volume= 1,968 cf, Depth= 3.61"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Type IA 24-hr 100-year Storm Rainfall=4.40"

	Area (sf)	CN	Description
*	5,651	98	Asphalt
	890	39	>75% Grass cover, Good, HSG A
	6,541	90	Weighted Average
	890	39	13.61% Pervious Area
	5,651	98	86.39% Impervious Area

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

Summary for Subcatchment 9S: Building

Runoff = 0.06 cfs @ 7.88 hrs, Volume= 933 cf, Depth= 4.16"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Type IA 24-hr 100-year Storm Rainfall=4.40"

	Area (sf)	CN	Description
*	2,690	98	Building
	2,690	98	100.00% Impervious Area

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

Summary for Subcatchment 10S: Landscaping

Runoff = 0.00 cfs @ 22.65 hrs, Volume= 19 cf, Depth= 0.10"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Type IA 24-hr 100-year Storm Rainfall=4.40"

Area (sf)	CN	Description
2,377	39	>75% Grass cover, Good, HSG A
2,377	39	100.00% Pervious Area

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

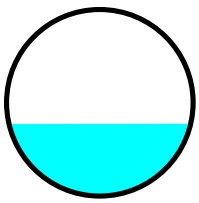
Summary for Reach 1R: 6" Storm Pipe

Inflow Area = 6,935 sf, 76.25% Impervious, Inflow Depth = 3.20" for 100-year Storm event
Inflow = 0.13 cfs @ 7.88 hrs, Volume= 1,848 cf
Outflow = 0.13 cfs @ 7.88 hrs, Volume= 1,848 cf, Atten= 0%, Lag= 0.1 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Max. Velocity= 1.79 fps, Min. Travel Time= 0.1 min
Avg. Velocity = 1.02 fps, Avg. Travel Time= 0.2 min

Peak Storage= 1 cf @ 7.88 hrs
Average Depth at Peak Storage= 0.19'
Bank-Full Depth= 0.50' Flow Area= 0.2 sf, Capacity= 0.40 cfs

6.0" Round Pipe
n= 0.013
Length= 10.0' Slope= 0.0050 '/'
Inlet Invert= 100.00', Outlet Invert= 99.95'



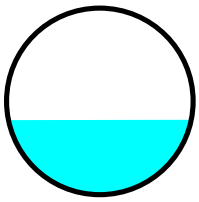
Summary for Reach 2R: 6" Storm Pipe

Inflow Area = 8,918 sf, 63.37% Impervious, Inflow Depth = 2.67" for 100-year Storm event
Inflow = 0.13 cfs @ 7.88 hrs, Volume= 1,987 cf
Outflow = 0.13 cfs @ 7.88 hrs, Volume= 1,987 cf, Atten= 0%, Lag= 0.1 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Max. Velocity= 1.83 fps, Min. Travel Time= 0.1 min
Avg. Velocity = 1.05 fps, Avg. Travel Time= 0.2 min

Peak Storage= 1 cf @ 7.88 hrs
Average Depth at Peak Storage= 0.20'
Bank-Full Depth= 0.50' Flow Area= 0.2 sf, Capacity= 0.40 cfs

6.0" Round Pipe
n= 0.013
Length= 10.0' Slope= 0.0050 '/'
Inlet Invert= 100.00', Outlet Invert= 99.95'



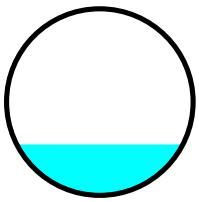
Summary for Reach 3R: 6" Storm Pipe

Inflow Area = 2,690 sf,100.00% Impervious, Inflow Depth = 4.16" for 100-year Storm event
Inflow = 0.06 cfs @ 7.88 hrs, Volume= 933 cf
Outflow = 0.06 cfs @ 7.88 hrs, Volume= 933 cf, Atten= 0%, Lag= 0.1 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Max. Velocity= 1.48 fps, Min. Travel Time= 0.1 min
Avg. Velocity = 0.84 fps, Avg. Travel Time= 0.2 min

Peak Storage= 0 cf @ 7.88 hrs
Average Depth at Peak Storage= 0.14'
Bank-Full Depth= 0.50' Flow Area= 0.2 sf, Capacity= 0.40 cfs

6.0" Round Pipe
n= 0.013
Length= 10.0' Slope= 0.0050 '/'
Inlet Invert= 100.00', Outlet Invert= 99.95'



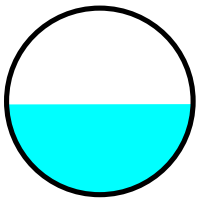
Summary for Reach 4R: 6" Storm Pipe

Inflow Area = 15,618 sf, 50.71% Impervious, Inflow Depth = 2.16" for 100-year Storm event
Inflow = 0.19 cfs @ 7.88 hrs, Volume= 2,810 cf
Outflow = 0.19 cfs @ 7.88 hrs, Volume= 2,810 cf, Atten= 0%, Lag= 0.1 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Max. Velocity= 2.00 fps, Min. Travel Time= 0.1 min
Avg. Velocity = 1.16 fps, Avg. Travel Time= 0.1 min

Peak Storage= 1 cf @ 7.88 hrs
Average Depth at Peak Storage= 0.24'
Bank-Full Depth= 0.50' Flow Area= 0.2 sf, Capacity= 0.40 cfs

6.0" Round Pipe
n= 0.013
Length= 10.0' Slope= 0.0050 '/'
Inlet Invert= 100.00', Outlet Invert= 99.95'



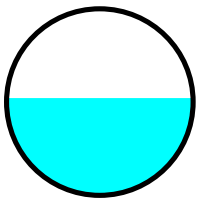
Summary for Reach 5R: 6" Storm Pipe

Inflow Area = 9,517 sf, 94.40% Impervious, Inflow Depth = 3.94" for 100-year Storm event
Inflow = 0.21 cfs @ 7.88 hrs, Volume= 3,122 cf
Outflow = 0.21 cfs @ 7.88 hrs, Volume= 3,122 cf, Atten= 0%, Lag= 0.1 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Max. Velocity= 2.06 fps, Min. Travel Time= 0.1 min
Avg. Velocity = 1.19 fps, Avg. Travel Time= 0.1 min

Peak Storage= 1 cf @ 7.88 hrs
Average Depth at Peak Storage= 0.26'
Bank-Full Depth= 0.50' Flow Area= 0.2 sf, Capacity= 0.40 cfs

6.0" Round Pipe
n= 0.013
Length= 10.0' Slope= 0.0050 '/'
Inlet Invert= 100.00', Outlet Invert= 99.95'



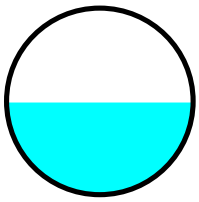
Summary for Reach 6R: 6" Storm Pipe

Inflow Area = 9,540 sf, 85.75% Impervious, Inflow Depth = 3.58" for 100-year Storm event
Inflow = 0.19 cfs @ 7.88 hrs, Volume= 2,850 cf
Outflow = 0.19 cfs @ 7.88 hrs, Volume= 2,850 cf, Atten= 0%, Lag= 0.1 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Max. Velocity= 2.01 fps, Min. Travel Time= 0.1 min
Avg. Velocity = 1.16 fps, Avg. Travel Time= 0.1 min

Peak Storage= 1 cf @ 7.88 hrs
Average Depth at Peak Storage= 0.25'
Bank-Full Depth= 0.50' Flow Area= 0.2 sf, Capacity= 0.40 cfs

6.0" Round Pipe
n= 0.013
Length= 10.0' Slope= 0.0050 '/'
Inlet Invert= 100.00', Outlet Invert= 99.95'



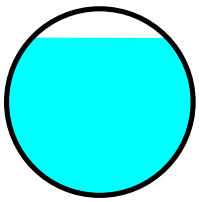
Summary for Reach 7R: 6" Storm Pipe

Inflow Area = 17,074 sf,100.00% Impervious, Inflow Depth = 4.16" for 100-year Storm event
Inflow = 0.41 cfs @ 7.88 hrs, Volume= 5,925 cf
Outflow = 0.41 cfs @ 7.88 hrs, Volume= 5,925 cf, Atten= 0%, Lag= 0.1 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Max. Velocity= 2.30 fps, Min. Travel Time= 0.1 min
Avg. Velocity = 1.43 fps, Avg. Travel Time= 0.1 min

Peak Storage= 2 cf @ 7.88 hrs
Average Depth at Peak Storage= 0.42'
Bank-Full Depth= 0.50' Flow Area= 0.2 sf, Capacity= 0.40 cfs

6.0" Round Pipe
n= 0.013
Length= 10.0' Slope= 0.0050 '/'
Inlet Invert= 100.00', Outlet Invert= 99.95'



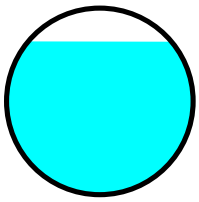
Summary for Reach 8R: 6" Storm Pipe

Inflow Area = 16,684 sf,100.00% Impervious, Inflow Depth = 4.16" for 100-year Storm event
Inflow = 0.40 cfs @ 7.88 hrs, Volume= 5,790 cf
Outflow = 0.40 cfs @ 7.88 hrs, Volume= 5,790 cf, Atten= 0%, Lag= 0.1 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Max. Velocity= 2.30 fps, Min. Travel Time= 0.1 min
Avg. Velocity = 1.42 fps, Avg. Travel Time= 0.1 min

Peak Storage= 2 cf @ 7.88 hrs
Average Depth at Peak Storage= 0.41'
Bank-Full Depth= 0.50' Flow Area= 0.2 sf, Capacity= 0.40 cfs

6.0" Round Pipe
n= 0.013
Length= 10.0' Slope= 0.0050 '/'
Inlet Invert= 100.00', Outlet Invert= 99.95'



Summary for Pond 1P: 42" CMP Infiltration Facility - INFIL-1

Inflow Area = 18,543 sf, 73.50% Impervious, Inflow Depth = 3.09" for 100-year Storm event
Inflow = 0.32 cfs @ 7.88 hrs, Volume= 4,769 cf
Outflow = 0.10 cfs @ 9.04 hrs, Volume= 4,769 cf, Atten= 70%, Lag= 69.8 min
Discarded = 0.10 cfs @ 9.04 hrs, Volume= 4,769 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Peak Elev= 103.30' @ 9.04 hrs Surf.Area= 506 sf Storage= 1,078 cf

Plug-Flow detention time= 135.9 min calculated for 4,769 cf (100% of inflow)
Center-of-Mass det. time= 135.8 min (797.8 - 661.9)

Volume	Invert	Avail.Storage	Storage Description
#1	100.50'	866 cf	**42.0" Round CMP_Round 42"** Inside #2 L= 90.0'
#2	100.00'	508 cf	**5.50'W x 92.00'L x 4.50'H Prismatoid** 2,277 cf Overall - 866 cf Embedded = 1,411 cf x 36.0% Voids
		1,374 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Discarded	100.00'	**8.000 in/hr Exfiltration over Wetted area from 100.00' - 102.40'** Excluded Wetted area = 506 sf
#2	Discarded	102.40'	**2.500 in/hr Exfiltration over Wetted area from 102.40' - 104.50'** Excluded Wetted area = 974 sf

Discarded OutFlow Max=0.10 cfs @ 9.04 hrs HW=103.30' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.09 cfs)
└**2=Exfiltration** (Exfiltration Controls 0.01 cfs)

Summary for Pond 2P: 36" CMP Infiltration Facility - INFIL-2

Inflow Area = 68,433 sf, 85.99% Impervious, Inflow Depth = 3.59" for 100-year Storm event
Inflow = 1.40 cfs @ 7.88 hrs, Volume= 20,496 cf
Outflow = 0.40 cfs @ 9.11 hrs, Volume= 20,496 cf, Atten= 71%, Lag= 73.7 min
Discarded = 0.40 cfs @ 9.11 hrs, Volume= 20,496 cf

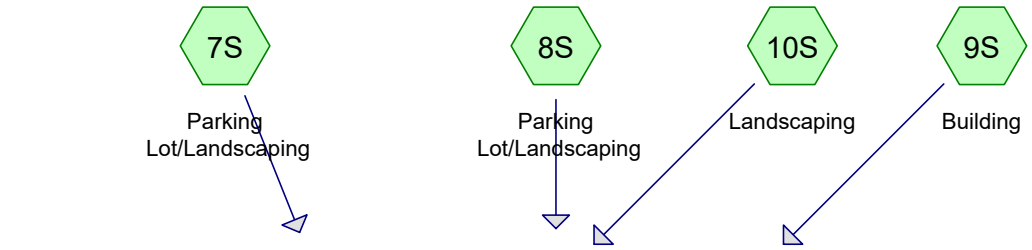
Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Peak Elev= 103.53' @ 9.11 hrs Surf.Area= 2,160 sf Storage= 4,691 cf

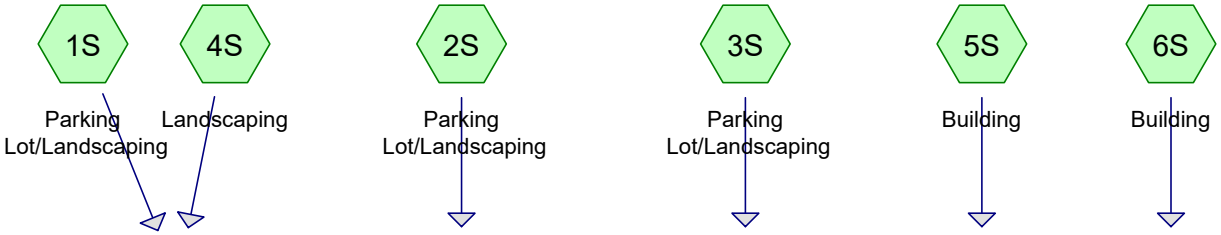
Plug-Flow detention time= 137.6 min calculated for 20,494 cf (100% of inflow)
Center-of-Mass det. time= 137.6 min (797.1 - 659.5)

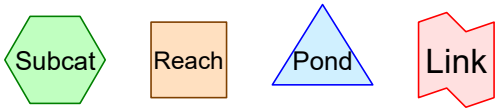
Volume	Invert	Avail.Storage	Storage Description
#1	100.50'	3,039 cf	**36.0" Round Pipe Storage** Inside #2 L= 430.0'
#2	100.00'	2,016 cf	**5.00'W x 432.00'L x 4.00'H Prismatoid** 8,640 cf Overall - 3,039 cf Embedded = 5,601 cf x 36.0% Voids
		5,056 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Discarded	100.00'	**8.000 in/hr Exfiltration over Wetted area from 100.00' - 102.00'** Excluded Wetted area = 2,160 sf
#2	Discarded	102.00'	**2.500 in/hr Exfiltration over Wetted area from 102.00' - 104.00'** Excluded Wetted area = 3,908 sf

Discarded OutFlow Max=0.40 cfs @ 9.11 hrs HW=103.53' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.32 cfs)
└**2=Exfiltration** (Exfiltration Controls 0.08 cfs)







Routing Diagram for 20078- Woodland
Prepared by Otak, Printed 6/6/2021

Time span=0.00-96.00 hrs, dt=0.01 hrs, 9601 points
Runoff by SBUH method, Split Pervious/Imperv.
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment1S: Parking Lot/Landscaping Runoff Area=9,973 sf 79.41% Impervious Runoff Depth=1.08"
Tc=5.0 min CN=39/98 Runoff=0.06 cfs 897 cf

Subcatchment2S: Parking Lot/Landscaping Runoff Area=9,517 sf 94.40% Impervious Runoff Depth=1.28"
Tc=5.0 min CN=39/98 Runoff=0.07 cfs 1,017 cf

Subcatchment3S: Parking Lot/Landscaping Runoff Area=9,540 sf 85.75% Impervious Runoff Depth=1.17"
Tc=5.0 min CN=39/98 Runoff=0.07 cfs 926 cf

Subcatchment4S: Landscaping Runoff Area=5,645 sf 0.00% Impervious Runoff Depth=0.00"
Tc=5.0 min CN=39/0 Runoff=0.00 cfs 0 cf

Subcatchment5S: Building Runoff Area=17,074 sf 100.00% Impervious Runoff Depth=1.36"
Tc=5.0 min CN=0/98 Runoff=0.14 cfs 1,934 cf

Subcatchment6S: Building Runoff Area=16,684 sf 100.00% Impervious Runoff Depth=1.36"
Tc=5.0 min CN=0/98 Runoff=0.13 cfs 1,889 cf

Subcatchment7S: Parking Lot/Landscaping Runoff Area=6,935 sf 76.25% Impervious Runoff Depth=1.04"
Tc=5.0 min CN=39/98 Runoff=0.04 cfs 599 cf

Subcatchment8S: Parking Lot/Landscaping Runoff Area=6,541 sf 86.39% Impervious Runoff Depth=1.17"
Tc=5.0 min CN=39/98 Runoff=0.05 cfs 640 cf

Subcatchment9S: Building Runoff Area=2,690 sf 100.00% Impervious Runoff Depth=1.36"
Tc=5.0 min CN=0/98 Runoff=0.02 cfs 305 cf

Subcatchment10S: Landscaping Runoff Area=2,377 sf 0.00% Impervious Runoff Depth=0.00"
Tc=5.0 min CN=39/0 Runoff=0.00 cfs 0 cf

Total Runoff Area = 86,976 sf Runoff Volume = 8,207 cf Average Runoff Depth = 1.13"
16.68% Pervious = 14,504 sf 83.32% Impervious = 72,472 sf

Summary for Subcatchment 1S: Parking Lot/Landscaping

Runoff = 0.06 cfs @ 7.89 hrs, Volume= 897 cf, Depth= 1.08"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Type IA 24-hr -WQ Rainfall=1.58"

	Area (sf)	CN	Description
*	7,920	98	Asphalt
	2,053	39	>75% Grass cover, Good, HSG A
	9,973	86	Weighted Average
	2,053	39	20.59% Pervious Area
	7,920	98	79.41% Impervious Area

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

Summary for Subcatchment 2S: Parking Lot/Landscaping

Runoff = 0.07 cfs @ 7.89 hrs, Volume= 1,017 cf, Depth= 1.28"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Type IA 24-hr -WQ Rainfall=1.58"

	Area (sf)	CN	Description
*	8,984	98	Asphalt
	533	39	>75% Grass cover, Good, HSG A
	9,517	95	Weighted Average
	533	39	5.60% Pervious Area
	8,984	98	94.40% Impervious Area

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

Summary for Subcatchment 3S: Parking Lot/Landscaping

Runoff = 0.07 cfs @ 7.89 hrs, Volume= 926 cf, Depth= 1.17"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Type IA 24-hr -WQ Rainfall=1.58"

	Area (sf)	CN	Description
*	8,181	98	Asphalt
	1,359	39	>75% Grass cover, Good, HSG A
	9,540	90	Weighted Average
	1,359	39	14.25% Pervious Area
	8,181	98	85.75% Impervious Area

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

Summary for Subcatchment 4S: Landscaping

Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Depth= 0.00"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Type IA 24-hr -WQ Rainfall=1.58"

Area (sf)	CN	Description
5,645	39	>75% Grass cover, Good, HSG A
5,645	39	100.00% Pervious Area

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

Summary for Subcatchment 5S: Building

Runoff = 0.14 cfs @ 7.89 hrs, Volume= 1,934 cf, Depth= 1.36"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Type IA 24-hr -WQ Rainfall=1.58"

	Area (sf)	CN	Description
*	17,074	98	Building
	17,074	98	100.00% Impervious Area

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

Summary for Subcatchment 6S: Building

Runoff = 0.13 cfs @ 7.89 hrs, Volume= 1,889 cf, Depth= 1.36"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Type IA 24-hr -WQ Rainfall=1.58"

	Area (sf)	CN	Description
*	16,684	98	Building
	16,684	98	100.00% Impervious Area

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

Summary for Subcatchment 7S: Parking Lot/Landscaping

Runoff = 0.04 cfs @ 7.89 hrs, Volume= 599 cf, Depth= 1.04"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Type IA 24-hr -WQ Rainfall=1.58"

	Area (sf)	CN	Description
*	5,288	98	Asphalt
	1,647	39	>75% Grass cover, Good, HSG A
	6,935	84	Weighted Average
	1,647	39	23.75% Pervious Area
	5,288	98	76.25% Impervious Area

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

Summary for Subcatchment 8S: Parking Lot/Landscaping

Runoff = 0.05 cfs @ 7.89 hrs, Volume= 640 cf, Depth= 1.17"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Type IA 24-hr -WQ Rainfall=1.58"

	Area (sf)	CN	Description
*	5,651	98	Asphalt
	890	39	>75% Grass cover, Good, HSG A
	6,541	90	Weighted Average
	890	39	13.61% Pervious Area
	5,651	98	86.39% Impervious Area

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

Summary for Subcatchment 9S: Building

Runoff = 0.02 cfs @ 7.89 hrs, Volume= 305 cf, Depth= 1.36"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Type IA 24-hr -WQ Rainfall=1.58"

	Area (sf)	CN	Description
*	2,690	98	Building
	2,690	98	100.00% Impervious Area

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

Summary for Subcatchment 10S: Landscaping

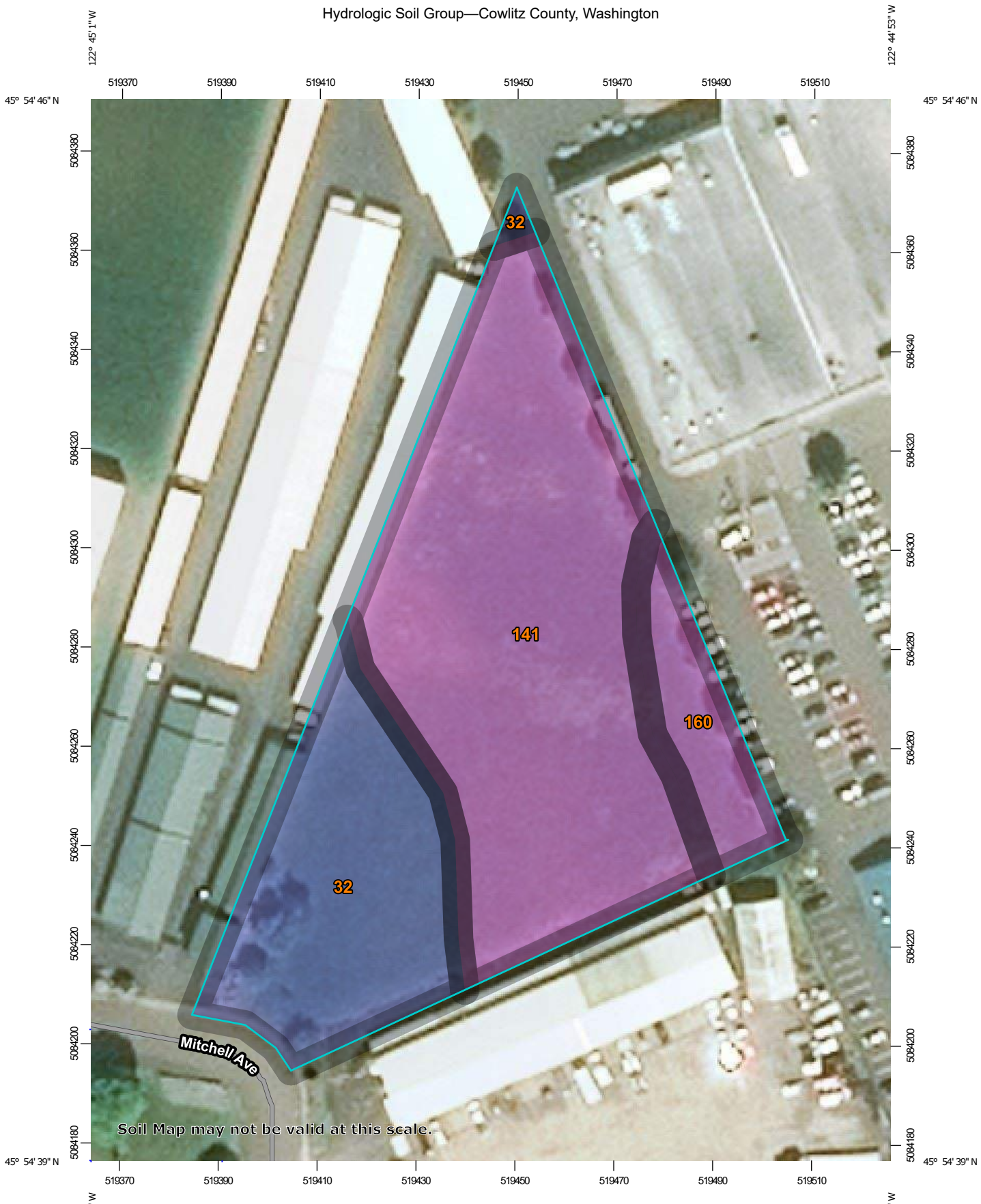
Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Depth= 0.00"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Type IA 24-hr -WQ Rainfall=1.58"

Area (sf)	CN	Description
2,377	39	>75% Grass cover, Good, HSG A
2,377	39	100.00% Pervious Area

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

Appendix C- NRCS Custom Soil Research Report



Map Scale: 1:1,040 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0 15 30 60 90

Feet: 0 50 100 200 300

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

MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Rating Polygons

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Lines

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Points

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Water Features

- Streams and Canals

Transportation

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

Background

- Aerial Photography

MAP INFORMATION

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

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

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

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

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

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

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

Soil Survey Area: Cowlitz County, Washington
Survey Area Data: Version 21, Jun 4, 2020

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

Date(s) aerial images were photographed: Apr 26, 2019—Jun 11, 2019

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

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
32	Clato silt loam, 0 to 3 percent slopes	B	0.7	28.0%
141	Newberg fine sandy loam, 0 to 3 percent slopes	A	1.5	62.7%
160	Pilchuck loamy fine sand, 0 to 8 percent slopes	A	0.2	9.4%
Totals for Area of Interest			**2.4**	**100.0%**

Description

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

Appendix D- Geotechnical Investigation Report (Key Sections)

REDMOND GEOTECHNICAL SERVICES

Geotechnical Investigation and Consultation Services

Proposed Woodland Senior Living Housing Development Site

Parcel #5042302

600 Mitchell Avenue

Woodland (Cowlitz County), Washington

for

Kirkland Development, LLC

Project No. 1014.031.G
October 2, 2020

REDMOND GEOTECHNICAL SERVICES

October 2, 2020

Mr. Dean Kirkland
Kirkland Development, LLC
2370 East 3rd Loop, Suite 100
Vancouver, Washington 98661

Dear Mr. Kirkland:

Re: Geotechnical Investigation and Consultation Services,
Proposed Woodland Senior Living Housing Development Site, Parcel #5042302,
600 Mitchell Avenue, Woodland (Cowlitz County), Washington

Submitted herewith is our report entitled "Geotechnical Investigation and Consultation Services, Proposed Woodland Senior Living Housing Development Site, Parcel #5042302, 600 Mitchell Avenue, Woodland (Cowlitz County), Washington". The scope of our services was outlined in our formal proposal to Ms. Victoria Kirkland of Kirkland Development, LLC dated July 27, 2020. Written authorization of our services was provided by Mr. Dean Kirkland on August 11, 2020.

During the course of our investigation, we have kept you and/or others advised of our schedule and preliminary findings. We appreciate the opportunity to assist you with this phase of the project. Should you have any questions regarding this report, please do not hesitate to call.

Sincerely,

Daniel M. Redmond, P.E., G.E.
President/Principal Engineer

PO Box 20547 • Portland, Oregon 97294 • Fax 503/286-7176 • Phone 503/285-0598

Specifically, the subsurface soils encountered beneath the proposed senior living and/or housing project area consist of an upper unit of medium to gray-brown, very moist, medium stiff, clayey, sandy silt to a depth of about five (5) feet beneath existing surface grades. These clayey, sandy silt subgrade soil materials are best characterized by relatively low to moderate strength and moderate compressibility. These upper clayey, sandy silt subgrade soils were inturn underlain by gray-brown to gray becoming bluish-gray at depth, very moist to wet becoming saturated at depth, loose becoming medium dense at depth, slightly clayey, silty fine to medium sand with occasional layers of organic sandy silt to a depth of at least 56.5 feet beneath existing site grades. These slightly clayey, silty fine to medium sand subgrade soil deposits are best characterized by relatively low to moderate strength and moderate compressibility. In addition to the above, the subject site and/or building area is surfaced with about 8 to 12 inches of topsoil.

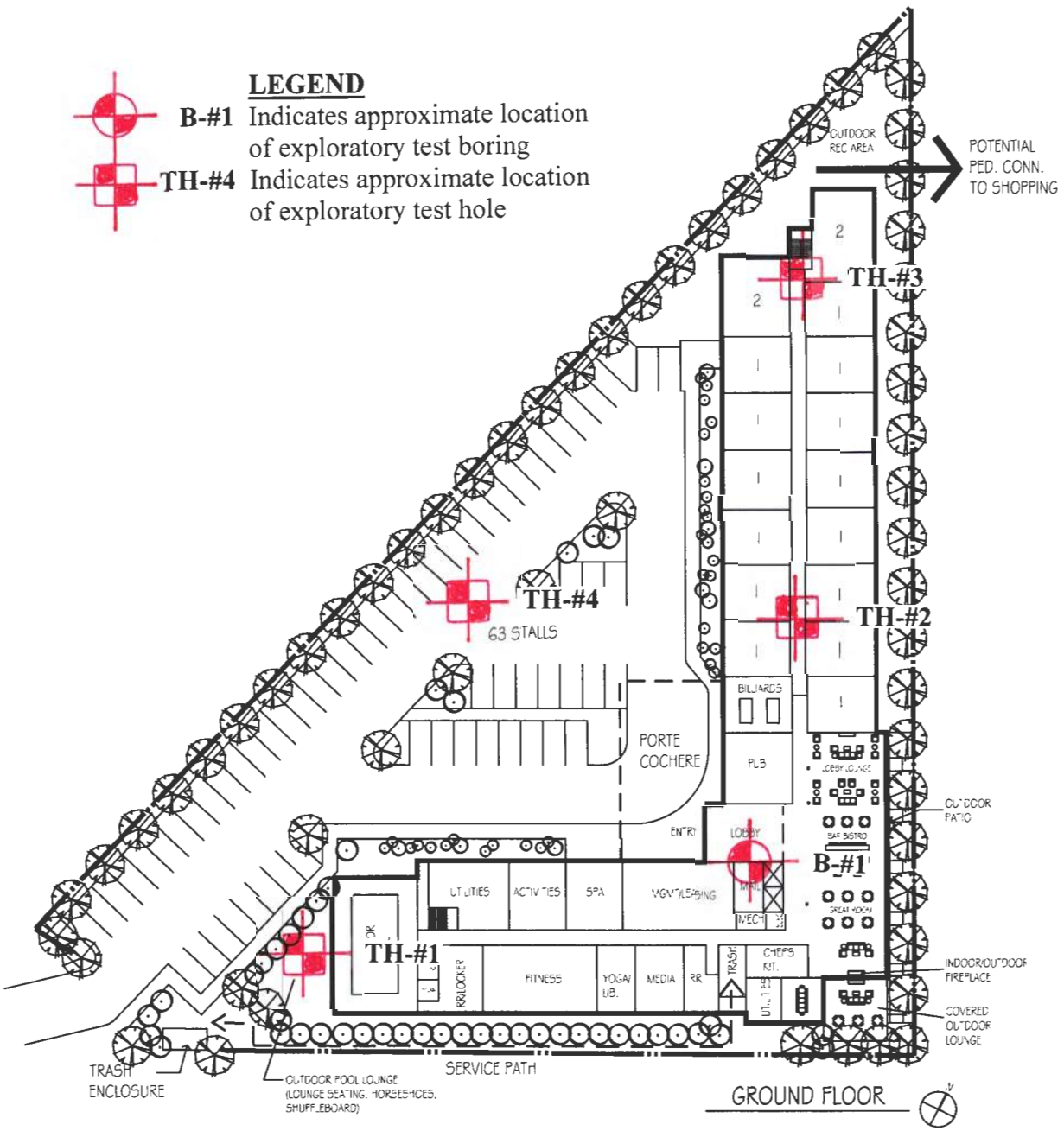
Groundwater

The mud-rotary drilling methods used as part of our field exploration work limited the ability to measure the true groundwater depth at the time the our field exploration. However, based on the results of our laboratory testing program as well as the proximity of the nearby Lewis and Columbia River, we anticipate that groundwater will be encountered at a depth of between 10.0 to 15.0 feet beneath existing site grades. Additionally, although surface ponding of water was not present across the site at the time of our field work, groundwater elevations at the site may fluctuate seasonally in accordance with rainfall conditions and may seasonally perch near surface elevations and/or lower portions of the site during periods of prolonged and/or heavy rainfall conditions.

INFILTRATION TESTING

We performed two (2) field infiltration tests at the site on August 21, 2020. The infiltration tests were performed in test holes TH-#3 and TH-#4 at a depth of between seven (7) and four (4) feet beneath the existing site and/or surface grades, respectively. The subgrade soils encountered in the infiltration test holes consisted of clayey, sandy silt and/or slightly clayey, slty fine to medium sand. The infiltration testing was performed in general conformance with current EPA and/or the City of Woodland Encased Falling Head test method which consisted of advancing a 6-inch diameter PVC pipe approximately 6 inches into the exposed soil horizon at each test location. Using a steady water flow, water was discharged into the pipe and allowed to penetrate and saturate the subgrade soils. The water level was adjusted over a two (2) hour period and allowed to achieve a saturated subgrade soil condition consistent with the bottom elevation of the surrounding test pit excavation. Following the required saturating period, water was again added into the PVC pipe and the time and/or rate at which the water level dropped was monitored and recorded. Each measurable drop in the water level was recorded until a consistent infiltration rate was observed and/or repeated.

Based on the results of the field infiltration testing at the site, we have found that the upper native clayey, sandy silt and underlying slightly clayey, silty fine to medium sand subgrade soil deposits posses an ultimate infiltration rate on the order of about 5 inches per hour (in/hr) and greater than 16 inches per hour (in/hr), respectively (see Field Infiltration Test Results, Figure No's. A-14 and A-15).



Approximate Scale: 1" = 70'

SITE EXPLORATION PLAN

WOODLAND SENIOR LIVING
600 MITCHELL AVENUE

Project No. 1014.031.G

Figure No. 2

Excavation/Slopes

Temporary excavations of up to about four (4) feet in depth may be constructed with near vertical inclinations for short periods of time provided that groundwater seepage is not present. Temporary excavations greater than about four (4) feet but less than eight (8) feet should be excavated with inclinations of at least 1 to 1 (horizontal to vertical) or properly braced/shored. Where excavations are planned to exceed about eight (8) feet, this office should be consulted. All shoring systems and/or temporary excavations including bracing as well as dewatering for the project should be the responsibility of the excavation contractor and should be made in accordance with applicable Occupational Safety and Health Administration (OSHA) and state regulations.

Depending on the time of year in which trench excavations occur, trench dewatering may be required in order to maintain dry working conditions if the invert elevations of the proposed utilities are located at and/or below the groundwater level. If groundwater is encountered during utility excavation work, we recommend placing trench stabilization materials along the base of the excavation. Trench stabilization materials should consist of 1-foot of well-graded gravel, crushed gravel, or crushed rock with a maximum particle size of 4 inches and less than 5 percent fines passing the No. 200 sieve. The material should be free of organic matter and other deleterious material and placed in a single lift and compacted until well keyed.

Surface Drainage/Groundwater

We recommend that positive measures be taken to properly finish grade the site so that drainage waters from building and/or landscaping areas as well as adjacent properties or buildings are directed away from the new senior living and/or housing structure foundations. Any roof drains and/or subsurface drainage systems should be directed into non-perforated conduits (pipes) that carry runoff water away from any new building to a suitable outfall. Roof downspouts should not be connected to foundation drains. A minimum ground slope of about 2 percent is generally recommended in unpaved areas around the structure.

Groundwater was generally encountered at the site within the exploratory test boring at the time of drilling at a depth of about 13.0 feet beneath existing site grades. Additionally, although groundwater elevations in the area may fluctuate seasonally and may temporarily pond/perch near the ground surface during periods of prolonged rainfall, based on our current understanding of the project, we are generally of the opinion that the observed static groundwater levels encountered during our field work are likely near to the seasonal high groundwater elevation(s) at the site. As such, based on our current understand of the site grading required to bring the subject site to finish design grades as well as the type of structure which will be constructed at the site, we are of the opinion that an underslab drainage system is not required for the proposed new senior living and/or housing structure. However, due to the planned use of the ground floor level of the building, we are of the opinion that a perimeter foundation drainage system should be considered at the site.

Design Infiltration Rates

Based on the results of our field infiltration testing, we recommend using the following infiltration rate to design any on-site near surface storm water infiltration and/or disposal systems for the project:

Subgrade Soil Type	Recommended Infiltration Rate
clayey, sandy SILT (ML)	2.5 inches per hour (in/hr)
slightly clayey, silty fine to medium SAND (SM)	8.0 inches per hour (in/hr)

Note: A safety factor of two (2) was used to calculate the above recommended design infiltration rate(s). Additionally, given the gradational variability of the on-site fine sandy silt and/or silty fine to medium sand subgrade soils beneath the site, it is generally recommended that field testing be performed during and/or following construction of any on-site storm water infiltration system(s) in order to confirm that the above recommended design infiltration rates are appropriate.

Seismic Design Considerations

Structures at the site should be designed to resist earthquake loading in accordance with the methodology described in the latest edition of the State of Washington Structural Specialty Code (WSSC), ASCE 7-16 and/or the 2018 International Building Code (IBC). The maximum considered earthquake ground motion for short period and 1.0 period spectral response may be determined from the Washington Structural Specialty Code (WSSC), ASCE 7-16 and/or Figures 1613 (1) and 1613 (2) of the 2015 National Earthquake Hazard Reduction Program (NEHRP) "Recommended Provisions for Seismic Regulations for New Buildings and Other Structures" published by the Building Seismic Safety Council. Assuming an IBC building category importance factor I_E = 1.0 and a seismic use group of III, we recommend a seismic design category "D" be used for design. Using this information, the structural engineer can select the appropriate site coefficient values (F_a and F_v) from ASCE 7-16 or the 2018 IBC to determine the maximum considered earthquake spectral response acceleration for the project. However, we have assumed the following response spectrum for the project:

Table 3: ASCE 7-16 Seismic Design Parameters

Site Class	S_D	S_1	Fa	Fv	S_{MS}	S_{M1}	S_{DS}	S_{D1}
D	0.820	0.392	1.200	1.908	0.985	0.748	0.656	0.498

Notes: 1. Ss and S1 were established based on the USGS 2015 mapped maximum considered earthquake spectral acceleration maps for 2% probability of exceedence in 50 years.

2. Fa and Fv were established based on ASCE 7-16 using the selected Ss and S1 values.

PRIMARY DIVISIONS			GROUP SYMBOL	SECONDARY DIVISIONS
COARSE GRAINED SOILS — MORE THAN HALF OF MATERIAL IS LARGER THAN NO. 200 SIEVE SIZE	GRAVELS — MORE THAN HALF OF COARSE FRACTION IS LARGER THAN NO. 4 SIEVE	CLEAN GRAVELS (LESS THAN 5% FINES)	GW	Well graded gravels, gravel-sand mixtures, little or no fines.
			GP	Poorly graded gravels or gravel-sand mixtures, little or no fines.
		GRAVEL WITH FINES	GM	Silty gravels, gravel-sand-silt mixtures, non-plastic fines.
			GC	Clayey gravels, gravel-sand-clay mixtures, plastic fines.
	SANDS — MORE THAN HALF OF COARSE FRACTION IS SMALLER THAN NO. 4 SIEVE	CLEAN SANDS (LESS THAN 5% FINES)	SW	Well graded sands, gravelly sands, little or no fines.
			SP	Poorly graded sands or gravelly sands, little or no fines.
		SANDS WITH FINES	SM	Silty sands, sand-silt mixtures, non-plastic fines.
			SC	Clayey sands, sand-clay mixtures, plastic fines.
FINE GRAINED SOILS — MORE THAN HALF OF MATERIAL IS SMALLER THAN NO. 200 SIEVE SIZE	SILTS AND CLAYS — LIQUID LIMIT IS LESS THAN 50%		ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity.
			CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays.
			OL	Organic silts and organic silty clays of low plasticity.
	SILTS AND CLAYS — LIQUID LIMIT IS GREATER THAN 50%		MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts.
			CH	Inorganic clays of high plasticity, fat clays.
			OH	Organic clays of medium to high plasticity, organic silts.
HIGHLY ORGANIC SOILS			Pt	Peat and other highly organic soils.

DEFINITION OF TERMS

	U.S. STANDARD SERIES SIEVE				CLEAR SQUARE SIEVE OPENINGS			
	200	40	10	4	3/4"	3"	12"	
SILTS AND CLAYS	SAND			GRAVEL		COBBLES	BOULDERS	
	FINE	MEDIUM	COARSE	FINE	COARSE			

GRAIN SIZES

SANDS, GRAVELS AND NON-PLASTIC SILTS	BLOWS/FOOT†
VERY LOOSE	0 - 4
LOOSE	4 - 10
MEDIUM DENSE	10 - 30
DENSE	30 - 50
VERY DENSE	OVER 50

RELATIVE DENSITY

CLAYS AND PLASTIC SILTS	STRENGTH‡	BLOWS/FOOT†
VERY SOFT	0 - 1/4	0 - 2
SOFT	1/4 - 1/2	2 - 4
FIRM	1/2 - 1	4 - 8
STIFF	1 - 2	8 - 16
VERY STIFF	2 - 4	16 - 32
HARD	OVER 4	OVER 32

CONSISTENCY

†Number of blows of 140 pound hammer falling 30 inches to drive a 2 inch O.D. (1-3/8 inch I.D.) split spoon (ASTM D-1586).

‡Unconfined compressive strength in tons/sq. ft. as determined by laboratory testing or approximated by the standard penetration test (ASTM D-1586), pocket penetrometer, torvane, or visual observation.

REDMOND GEOTECHNICAL SERVICES
PO BOX 20547 • PORTLAND, OREGON 97294

KEY TO EXPLORATORY BORING LOGS
Unified Soil Classification System (ASTM D-2487)

WOODLAND SENIOR LIVING
600 Mitchell Avenue

PROJECT NO.	DATE	
1014.031.G	10/02/20	Figure A-4

DRILLING COMPANY: Western States RIG: CME 75 DATE: 9/10/20

BORING DIAMETER: 3.0" DRIVE WEIGHT: 140# DROP: 30" ELEVATION:

DEPTH (FEET)	BAG SAMPLE	DRIVE SAMPLE BLOWS/FOOT	DRY DENSITY (pcf)	MOISTURE CONTENT (%)	SOIL CLASS. (U.S.C.S.)	SOIL DESCRIPTION BORING NO. B-#1
0	X	5		24.4	ML	Medium to gray-brown, very moist, medium stiff, clayey, sandy SILT with trace of organics at surface
5	X	8		15.5	SM	Gray-brown to gray, very moist, loose, silty, fine to medium SAND
10	X	4		14.8		Becomes silty to slightly silty fine SAND
						Becomes wet to saturated at 13 feet
15	X	7				Becomes bluish-gray at 15 feet
20	X	7				
25	X	5				
30						

BORING LOG

PROJECT NO. 1014.031.G1 WOODLAND SENIOR LIVING FIGURE NO. A-5

DRILLING COMPANY: Western States RIG: CME 75 DATE: 9/10/20

BORING DIAMETER: 3.0" DRIVE WEIGHT: 140# DROP: 30" ELEVATION:

DEPTH (FEET)	BAG SAMPLE	DRIVE SAMPLE BLOWS/FOOT	DRY DENSITY (pcf)	MOISTURE CONTENT (%)	SOIL CLASS. (U.S.C.S.)	SOIL DESCRIPTION BORING NO. B-#1 (con't.)
30	X	2			SM	Bluish-gray, saturated, loose, silty to slightly silty, fine SAND
35	X	8				Occasional layers of fine sandy SILT with organics
40	X	2				
45	X	5				
50	X	10				Becomes medium dense
55	X	16				
60						Total Depth = 56.5 feet Groundwater encountered at a depth of 13 feet at time of drilling

BORING LOG

PROJECT NO. 1014.031.G | WOODLAND SENIOR LIVING | FIGURE NO. A-6

BACKHOE COMPANY: Inland Company BUCKET SIZE: 24 inches DATE: 8/21/20

DEPTH (FEET)	BAG SAMPLE	DENSITY TEST	DRY DENSITY (pcf)	MOISTURE CONTENT (%)	SOIL CLASS. (U.S.C.S.)	SOIL DESCRIPTION
						TEST PIT NO. TH-#1 ELEVATION
0					ML	Dark brown, very moist, soft, organic, sandy, clayey SILT (Topsoil)
					ML	Medium to gray-brown, moist to very moist, medium stiff, clayey, sandy SILT
5					SM	Gray-brown, very moist, loose, slightly clayey, silty fine to medium SAND
						Total Depth = 7.0 feet No groundwater encountered at time of exploration
10						
15						
						TEST PIT NO. TH-#2 ELEVATION
0					ML	Dark brown, very moist, soft, organic, sandy, clayey SILT (Topsoil)
					ML	Medium to gray-brown, moist to very moist, medium stiff, clayey, sandy SILT
5					SM	Gray-brown, very moist, loose, slightly clayey, silty fine to medium SAND
						Total Depth = 6.0 feet No groundwater encountered at time of exploration
10						
15						

LOG OF TEST PITS

PROJECT NO. 1014.031.G | WOODLAND SENIOR LIVING | FIGURE NO. A-7

BACKHOE COMPANY: Inland Company BUCKET SIZE: 24 inches DATE: 8/21/20

DEPTH (FEET)	BAG SAMPLE	DENSITY TEST	DRY DENSITY (pcf)	MOISTURE CONTENT (%)	SOIL CLASS. (U.S.C.S.)	SOIL DESCRIPTION
						TEST PIT NO. TH-#3 ELEVATION
0					ML	Dark brown, very moist, soft, organic, sandy, clayey SILT (Topsoil)
					ML	Medium to gray-brown, moist to very moist, medium stiff, clayey, sandy SILT
5					SM	Gray-brown, very moist, loose, slightly cLAYEY, SILTY FINE TO MEDIUM SAND
						Total Depth = 8.0 feet No groundwater encountered at time of exploration
10						
15						
						TEST PIT NO. TH-#4 ELEVATION
0					ML	Dark brown, very moist, soft, organic, sandy, clayey SILT (Topsoil)
	X				ML	Medium to gray-brown, moist to very moist, medium stiff, clayey, sandy SILT
5						Total Depth = 5.0 feet No groundwater encountered at time of exploration
10						
15						

LOG OF TEST PITS

PROJECT NO. 1014.031.G | WOODLAND SENIOR LIVING | FIGURE NO. A-8

MAXIMUM DENSITY TEST RESULTS

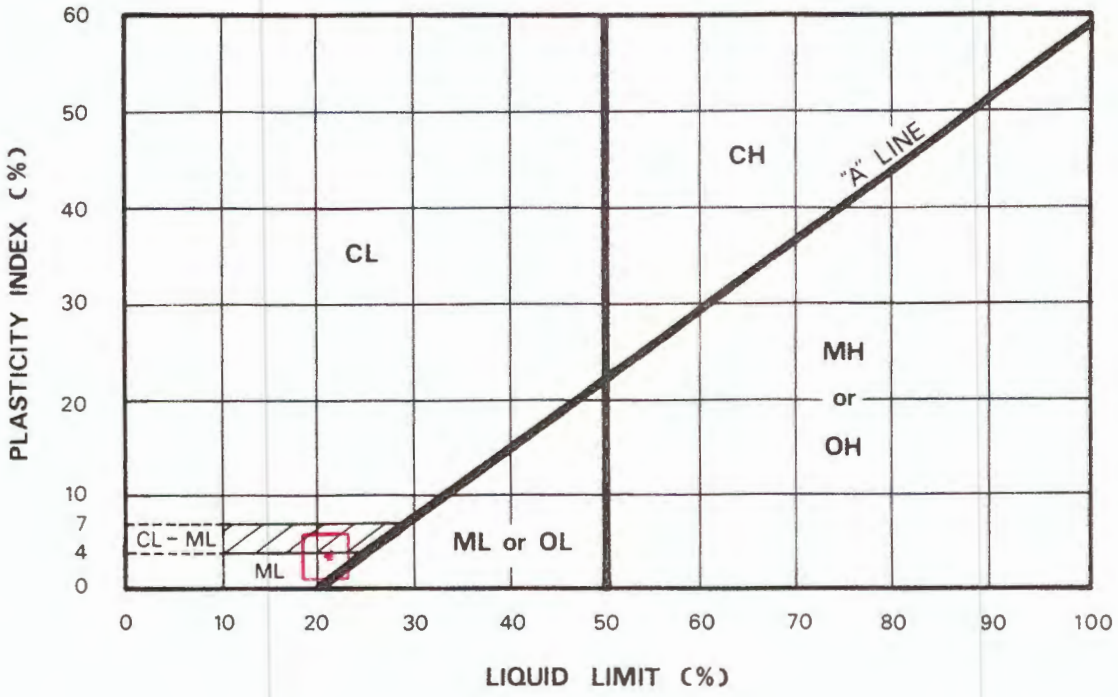
SAMPLE LOCATION	SOIL DESCRIPTION	MAXIMUM DRY DENSITY (pcf)	OPTIMUM MOISTURE CONTENT (%)
TH-#4 @ 2.0'	Medium to gray-brown, clayey, sandy SILT (ML)	110.0	16.0

EXPANSION INDEX TEST RESULTS

SAMPLE LOCATION	INITIAL MOISTURE (%)	COMPACTED DRY DENSITY (pcf)	FINAL MOISTURE (%)	VOLUMETRIC SWELL (%)	EXPANSION INDEX	EXPANSIVE CLASS.

MAXIMUM DENSITY & EXPANSION INDEX TEST RESULTS

PROJECT NO.: 1014.031.G | WOODLAND SENIOR LIVING | FIGURE NO. A-9



KEY SYMBOL	BORING NO.	SAMPLE DEPTH (feet)	NATURAL WATER CONTENT %	LIQUID LIMIT %	PLASTICITY INDEX %	PASSING NO. 200 SIEVE %	LIQUIDITY INDEX	UNIFIED SOIL CLASSIFICATION SYMBOL
▪	B-#1	3.5	24.4	21.8	4.0	77.3		ML

REDMOND GEOTECHNICAL SERVICES
PO BOX 20547 • PORTLAND, OREGON 97294

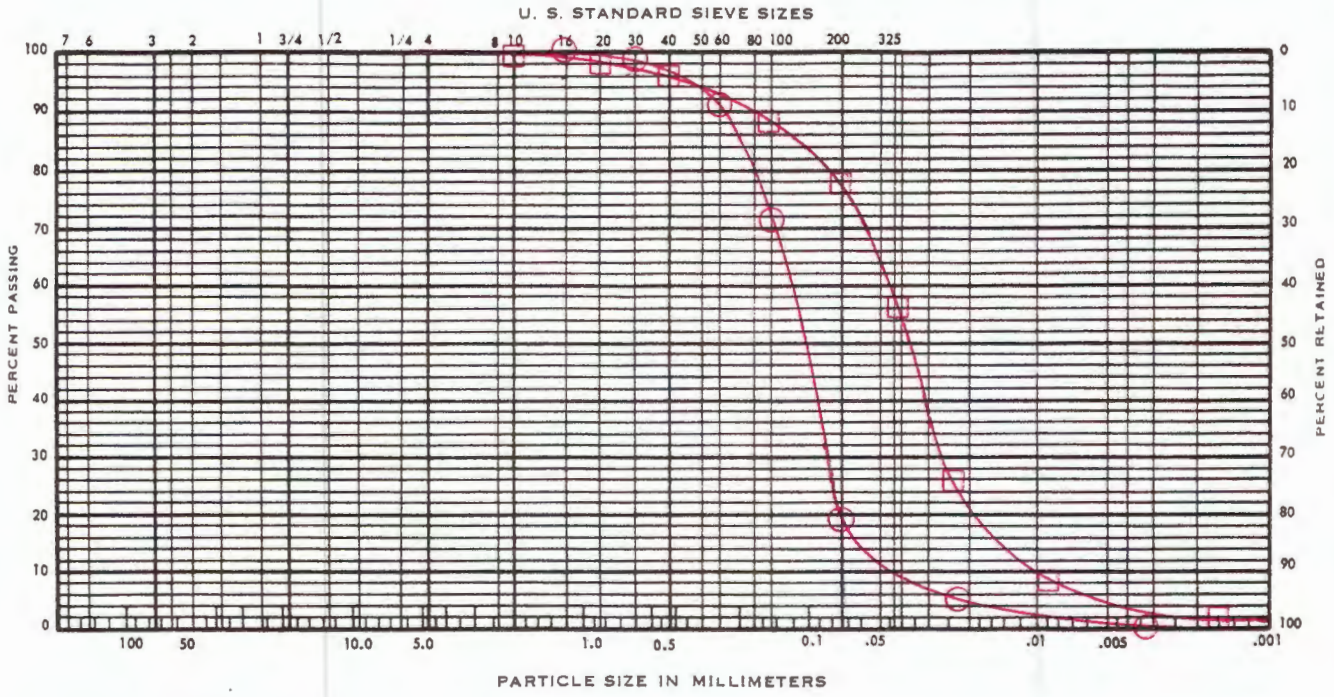
PLASTICITY CHART AND DATA

WOODLAND SENIOR LIVING
Woodland, Washington

PROJECT NO.	DATE	
1014.031.G	10/02/20	Figure A-10

UNIFIED SOIL CLASSIFICATION SYSTEM

(ASTM D 422-72)



COBBLES	GRAVEL		SAND			SILT AND CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	

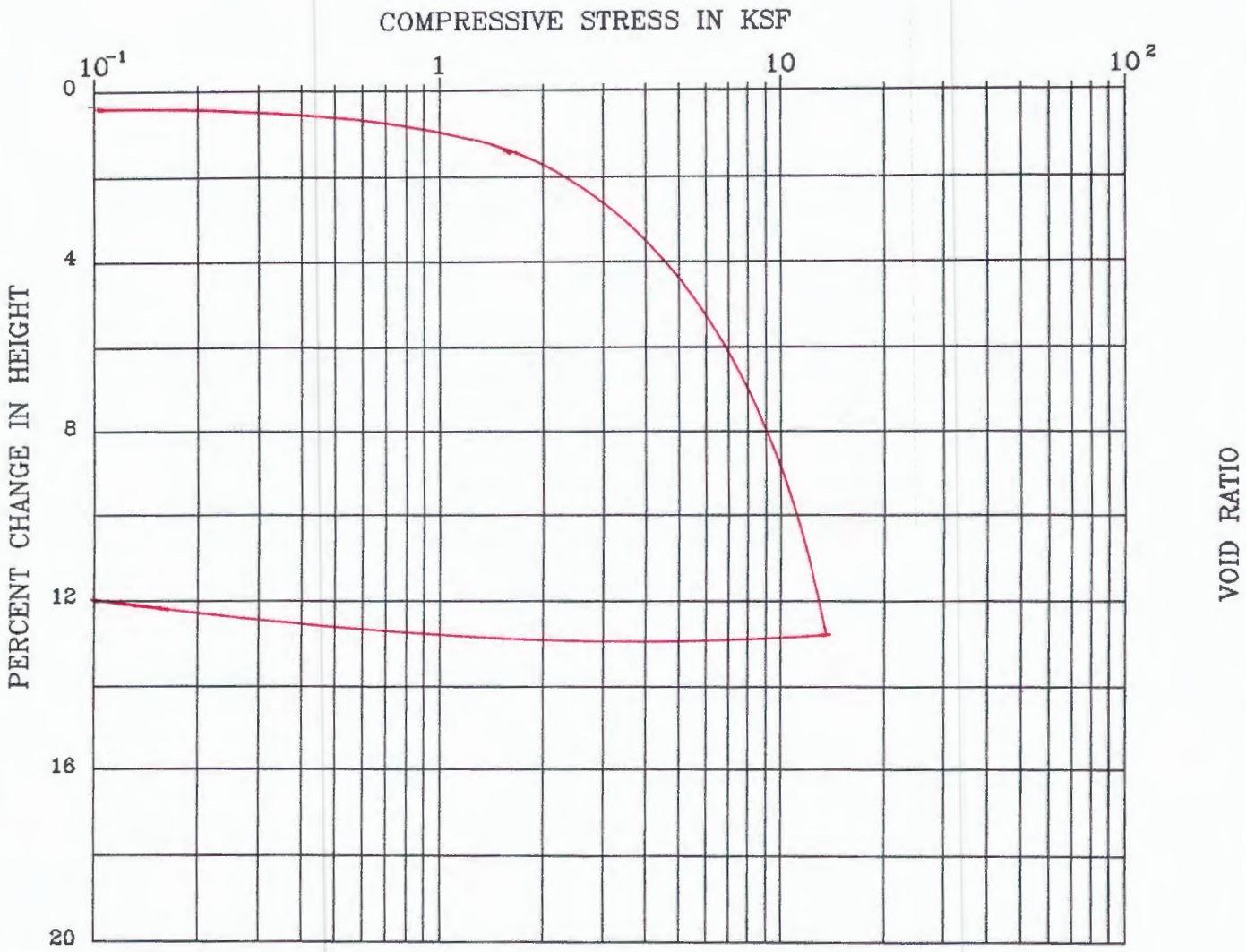
KEY SYMBOL	BORING NO.	SAMPLE DEPTH (feet)	ELEV. (feet)	UNIFIED SOIL CLASSIFICATION SYMBOL	SAMPLE DESCRIPTION
⊟	B-#1	3.5		ML	Medium to gray-brown, clayey, sandy SILT
⊖	B-#1	11.0		SM	Gray-brown, silty, fine to medium SAND

REDMOND GEOTECHNICAL SERVICES
PO Box 20547 • Portland, Oregon 97294

GRADATION TEST DATA

WOODLAND SENIOR LIVING
Woodland, Washington

PROJECT NO.	DATE	FIGURE
1014.031-.G	10/02/20	A-11



BORING : B-#1
DEPTH (ft) : 3.5
SPEC. GRAVITY : 2.5 (assumed)

DESCRIPTION : clayey, sandy SILT (ML)
LIQUID LIMIT : 21.8
PLASTIC LIMIT : 17.8

	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	PERCENT SATURATION	VOID RATIO
INITIAL	24.4	86.6	87.1	
FINAL	17.7	95.1	96.2	

REDMOND GEOTECHNICAL SERVICES
PO Box 20547 • Portland, Oregon 97294

CONSOLIDATION TEST DATA

WOODLAND SENIOR LIVING
Woodland, Washington

PROJECT NO.	DATE	
1014.031.G	10/02/20	Figure A-12

RESULTS OF R (RESISTANCE) VALUE TESTS

SAMPLE LOCATION: TH-#4

SAMPLE DEPTH: 2.0 feet bgs

Specimen	A	B	C
Exudation Pressure (psi)	219	329	431
Expansion Dial (o.ooo1")	0	0	1
Expansion Pressure (psf)	0	0	3
Moisture Content (%)	19.6	16.4	13.1
Dry Density (pcf)	99.4	104.2	109.6
Resistance Value, "R"	18	31	43
"R"-Value at 300 psi Exudation Pressure = 30			

SAMPLE LOCATION:

SAMPLE DEPTH:

Specimen	A	B	C
Exudation Pressure (psi)			
Expansion Dial (0.0001")			
Expansion Pressure (psf)			
Moisture Content (%)			
Dry Density (pcf)			
Resistance Value "R"			
"R"-Value at 300 psi Exudation Pressure =			

Field Infiltration Test Result

Location: Woodland Senior Living	**Date:** August 21, 2020	**Test Hole:** TH-#3
Depth to Bottom of Hole: 7.0 feet	**Hole Diameter:** 6 inches	**Test Method:** Encased Falling Head
Tester's Name: Daniel M. Redmond, P.E., G.E. **Tester's Company:** Redmond Geotechnical Services, LLC		**Tester's Contact Number:** 503-285-0598

Depth (feet)	Soil Characteristics
0-1.0	Dark brown Topsoil
1.0-5.0	Medium to gray-brown, clayey, sandy SILT (ML)
5.0-7.0	Gray-brown, clayey, silty fine to medium SAND (SM)

Time	Time Interval (Minutes)	Measurement (inches)	Drop in Water (inches)	Infiltration Rate (inches/hour)	Remarks
10:00	0	72.00	----		Filled w/12" water
10:20	20	73.80	1.80	5.40	
10:40	20	75.56	1.76	5.28	
11:00	20	77.29	1.73	5.19	
11:20	20	79.00	1.71	5.13	
11:40	20	73.69	1.69	5.07	Filled w/12" water
12:00	20	75.37	1.68	5.04	
12:20	20	77.04	1.67	5.01	
12:40	20	78.71	1.67	5.01	

Infiltration Test Data Table

Figure No. A-14

Field Infiltration Test Result

Location: Woodland Senior Living	**Date:** August 21, 2020	**Test Hole:** TH-#4
Depth to Bottom of Hole: 4.0 feet	**Hole Diameter:** 6 inches	**Test Method:** Encased Falling Head
Tester's Name: Daniel M. Redmond, P.E., G.E. **Tester's Company:** Redmond Geotechnical Services, LLC		**Tester's Contact Number:** 503-285-0598

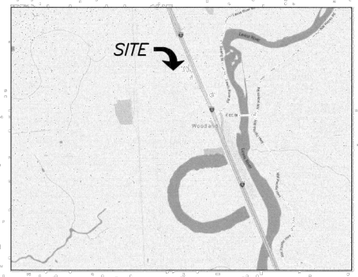
Depth (feet)	Soil Characteristics
0-1.0	Dark brown Topsoil
1.0-4.0	Medium to gray-brown, clayey, sandy SILT (ML)

Time	Time Interval (Minutes)	Measurement (inches)	Drop in Water (inches)	Infiltration Rate (inches/hour)	Remarks
10:10	0	36.00	----		Filled w/12" water
10:30	20	41.58	5.58	16.74	
10:50	20	47.08	5.50	16.50	
11:10	20	41.44	5.44	16.32	Filled w/12" water
11:30	20	47.84	5.40	16.20	
11:50	20	41.37	5.37	16.11	Filled w/12" water
12:10	20	47.72	5.35	16.05	
12:30	20	41.34	5.34	16.02	Filled w/12" water
12:50	20	47.68	5.34	16.02	

Infiltration Test Data Table

Figure No. A-15

Appendix E- Preliminary Construction Plans



VICINITY MAP
NO SCALE

LEGAL DESCRIPTION

LOT 1 OF SHORT SUBDIVISION ENTITLED "MILLWORK SHORT PLAT" AS FILED IN VOLUME 8, PAGE 36 OF SHORT PLATS AND RECORDED UNDER AUDITOR'S FILE NO. 940914011 AND BEING A PORTION OF THE SQUIRE AND MILLIE BOZARTH DONATION LAND CLAIM.
SITUATE IN THE COUNTY OF COWLITZ, STATE OF WASHINGTON.

NOTE: "LOT 1" OF MILLWORK SHORT PLAT DOES NOT TECHNICALLY EXIST. THE PLAT IDENTIFIES THIS PARCEL AS "TRACT 1", NOT LOT 1. THE CONVEYANCE LANGUAGE IN THE DEEDS HAVE HISTORICALLY (BUT ERRONEOUSLY) CALLED IT LOT 1.

ALTA/NSPS LAND TITLE SURVEY NOTES

THE FIELDWORK FOR THIS SURVEY WAS PERFORMED BY OLSON ENGINEERING, INC., OCTOBER, 2020.

2016 ALTA/NSPS LAND TITLE SURVEY TABLE A OPTIONAL SURVEY RESPONSIBILITIES AND SPECIFICATIONS AS DISCLOSED IN THE CERTIFICATION INCLUDED ON THIS SURVEY AS FOLLOWS:

2. THE ADDRESS FOR THE SURVEYED PROPERTY AS DISCLOSED IN THE PROVIDED ALTA COMMITMENT FOR TITLE INSURANCE AND COWLITZ COUNTY GIS IS:

   600 MITCHELL AVENUE
   WOODLAND, WA 98674

3. FEMA FLOOD ZONE FOR THE SURVEYED PROPERTY IS DETERMINED ACCORDING TO FLOOD INSURANCE RATE MAP (FIRM) NUMBER 53015C0886G FOR THE CITY OF WOODLAND (530035) EFFECTIVE DECEMBER 16, 2015 THIS SITE IS IN AN X ZONE (AREA WITH REDUCED FLOOD ZONE RISK DUE TO LEVEE).

4. THE TOTAL GROSS LAND AREA FOR THE SURVEYED PROPERTY IS 87,119 SQUARE FEET, WHICH EQUALS APPROXIMATELY 2.00 ACRES.

5. VERTICAL RELIEF ELEVATION CONTOURS SHOWN HEREON ARE DETERMINED FROM AN ACTUAL SURVEY ON THE GROUND FOR THE SURVEYED PROPERTY. THE ELEVATION CONTOUR INTERVAL SHOWN HEREON IS 1', THE VERTICAL DATUM UTILIZED IS NAVD 1988 UTILIZING WASHINGTON STATE DEPT. OF TRANSPORTATION BM X533, ELEVATION 30.07'.

8. SUBSTANTIAL FEATURES FOR THE SURVEYED PROPERTY WERE MAPPED BY GROUND SURVEY AND ARE SHOWN HEREON.

11. THE LOCATION OF SURFACE OBSERVABLE EVIDENCE OF UTILITIES ARE SHOWN HEREON.

    THE SURVEYOR SHALL NOT BE HELD RESPONSIBLE FOR THE ACCURACY OR COMPLETENESS OF THE UNDERGROUND UTILITIES SHOWN HEREON. UNDERGROUND UTILITIES SHOWN HEREON ARE FOR REFERENCE ONLY AND DEPICT EVIDENCE OF THE POSSIBLE EXISTENCE OF THE UTILITY. THE EXACT LOCATION OR EXISTENCE OF UNDERGROUND UTILITIES CAN ONLY BE VERIFIED BY EXCAVATION.

13. NAMES OF ADJOINING PROPERTY OWNERS ACCORDING TO CURRENT TAX RECORDS ARE SHOWN HEREON.

19. NO OFFSITE EASEMENTS ARE INDICATED IN THE TITLE REPORT.

SCHEDULE B SPECIAL EXCEPTIONS

THIS SURVEY REFLECTS INFORMATION SHOWN ON COMMITMENT FOR TITLE INSURANCE BY OLD REPUBLIC NATIONAL TITLE INSURANCE COMPANY ISSUED BY COWLITZ COUNTY TITLE, ORDER NO: COM8671, DATED MARCH 13, 2019 AT 8:00 AM.

THE ESTATE OR INTEREST IN TEH LAND DESCRIBED HEREIN AND WHICH IS COVERED BY THIS COMMITMENT IS: FEE SIMPLE.

THE ESTATE OR INTEREST REFERRED TO HEREIN IS AT DATE OF COMMITMENT VESTED IN: RUTH S. KODA, AS TO AN UNDIVIDED 50% INTEREST AND TERENCE A. WELLNER, AN UNMARRIED MAN AND THOMAS B. WELLNER AND CONNIE L. WELLNER, HUSBAND AND WIFE, AS TO AN UNDIVIDED 50% INTEREST.

EXCEPTIONS 1–3. NOT A MATTER OF SURVEY. NOT SHOWN.

EXCEPTION 4, AF #487212 IS AN EASEMENT GRANTED TO PUBLIC UTILITY DESTRICT NO. 1 OF COWLITZ COUNTY FOR THE PURPOSE OF A POWER LINE TO SERVE THE PROPERTY. THE PARCEL DESCRIBED IS LARGER PARCEL WHICH INCLUDES THE SUBJECT PROPERTY. NO WIDTH IS STATED, AND THE LOCATION IS DEFINED IN THE DOCUMENT "AS NOW STAKED" WITH NO DEFINITIVE LOCATION. NOT SHOWN.

EXCEPTION 5, AF 940727056 SURVEY VOL. 13, PG. 81 IS A SURVEY OF THE PROPERTY AND DISCLOSES NO EASEMENTS OR ENCROACHMENTS ON THE SUBJECT PROPERTY. NOT SHOWN.

EXCEPTION 6, AF # 940914011 IS THE PLAT OF THE MILLWORK SHORT SUBDIVISION AND DISCLOSES NO EASEMENTS OR ENCROACHMENTS ON THE SUBJECT PROPERTY. THE PLAT DOES STATE THAT "ALL TRACTS SHALL UTILIZE CITY OF WOODLAND SEWER AND WATER". AN AMENDMENT UNDER AF #951003001 ADDS THE ADDRESSES OF EACH TRACT. NOT SHOWN.

EXCEPTION NO 7, AF #960307010 VOL. 1223, PG. 1674, EASEMENT GRANTED TO PUBLIC UTILITY DISTRICT NO. 1 OF COWLITZ COUNTY FOR THE PURPOSE OF RIGHT OF WAY FOR UNDERGROUND POWER. THE EASEMENT IS FOR THE SOUTHWESTERLY 10.0 FEET OF LOT 2 OF MILLWORK SHORT PLAT AND DOES NOT AFFECT THE SUBJECT PARCEL. NOT SHOWN.

EXCEPTION NO 8, AF #3026769 IS A SURVEY OF THE ADJOINING PROPERTY TO THE EAST AND DISCLOSES NO ENCROACHMENTS OR NOTED BOUNDARY ISSUES. NOT SHOWN

EXCEPTIONS 9–10. NOT A MATTER OF SURVEY. NOT SHOWN.

ENCROACHMENT NOTES

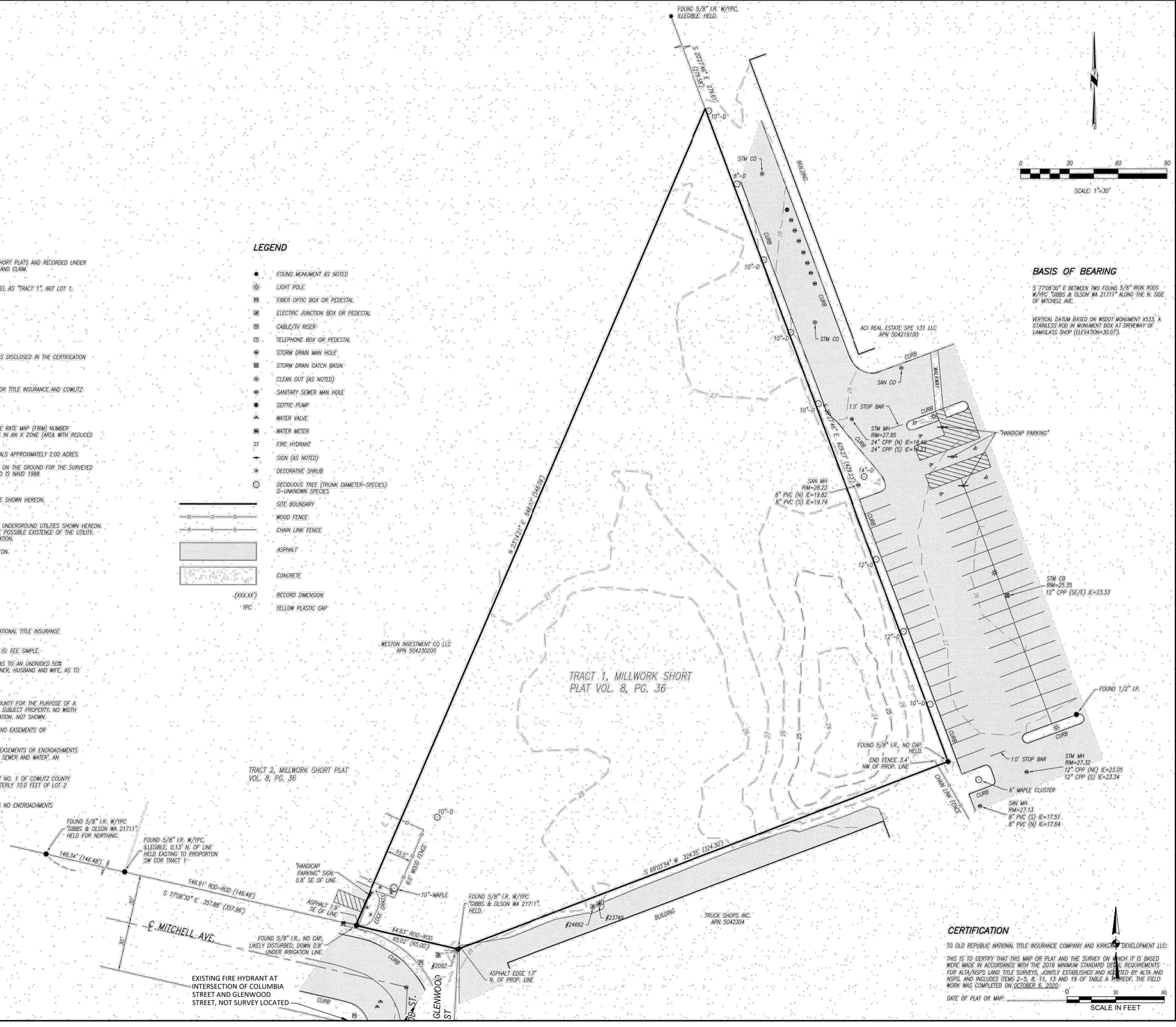
1. CHAIN LINK FENCE CROSSES THE SOUTHEASTERLY BOUNDARY LINE NEAR THE SE. CORNER OF THE SITE.
2. ASPHALT SURFACE CROSSES THE SOUTHERLY BOUNDARY NEAR THE MOST S'LY CORNER OF THE SITE.
3. ASPHALT SURFACE CROSSES THE WESTERLY BOUNDARY NEAR THE S.W. CORNER OF THE SITE.
4. LANDSCAPING, WOOD FENCE AND SIGN CROSS THE WESTERLY BOUNDARY LINE IN THE SW'LY PORTION OF THE SITE.

BOUNDARY NOTE

I HELD THE FOUND MONUMENTS AS SHOWN AND PROPORTIONED THE POSITIONS OF THE MOST N'LY CORNER AND THE SW'LY CORNER OF TRACT 1. THERE IS A 5/8" I.R. WITHOUT A CAP NEAR THE SW'LY CORNER OF LOT 1, BUT IT'S ABOUT 0.4' SE OF WHERE IT SHOULD BE, AND IS UNDER SOME SMALL IRRIGATION LINES. I DID NOT HOLD THE POSITION OF THIS ROD SINCE I BELIEVE IT HAS BEEN DISTURBED.

LEGEND

- FOUND MONUMENT AS NOTED
- LIGHT POLE
- FIBER OPTIC BOX OR PEDESTAL
- ELECTRIC JUNCTION BOX OR PEDESTAL
- CABLE/TV RISER
- TELEPHONE BOX OR PEDESTAL
- STORM DRAIN MAN HOLE
- STORM DRAIN CATCH BASIN
- CLEAN OUT (AS NOTED)
- SANITARY SEWER MAN HOLE
- SEPTIC PUMP
- WATER VALVE
- WATER METER
- FIRE HYDRANT
- SIGN (AS NOTED)
- DECORATIVE SHRUB
- DECIDUOUS TREE (TRUNK DIAMETER–SPECIES) D–UNKNOWN SPECIES
- SITE BOUNDARY
- WOOD FENCE
- CHAIN LINK FENCE
- ASPHALT
- CONCRETE
- (XXX.XX') RECORD DIMENSION
- YPC YELLOW PLASTIC CAP



BASIS OF BEARING

S 77°08'30" E BETWEEN TWO FOUND 5/8" IRON RODS W/YPC "GIBBS & OLSON WA 21711" ALONG THE N. SIDE OF MITCHELL AVE.

VERTICAL DATUM BASED ON WSDOT MONUMENT X533, A STAINLESS ROD IN MONUMENT BOX AT DRIVEWAY OF LAMIGLASS SHOP (ELEVATION=30.07').

CERTIFICATION

TO OLD REPUBLIC NATIONAL TITLE INSURANCE COMPANY AND KIRKLAND DEVELOPMENT LLC:

THIS IS TO CERTIFY THAT THIS MAP OR PLAT AND THE SURVEY ON WHICH IT IS BASED WERE MADE IN ACCORDANCE WITH THE 2016 MINIMUM STANDARD DETAIL REQUIREMENTS FOR ALTA/NSPS LAND TITLE SURVEYS, JOINTLY ESTABLISHED AND ADOPTED BY ALTA AND NSPS, AND INCLUDES ITEMS 2–3, 8, 11, 13 AND 19 OF TABLE A THEREOF. THE FIELD WORK WAS COMPLETED ON OCTOBER 6, 2020.

DATE OF PLAT OR MAP:

Otak
700 Washington Street
Suite 300
Vancouver, WA 98660
Phone: 360.737.9613
FAX: 360.737.9651
www.otak.com

PRELIMINARY

MAKERS SPACE - KIRKLAND
600 MITCHELL AVENUE, WOODLAND, WA 98674
EXISTING CONDITIONS
PRELIMINARY ENGINEERING - LU SUBMITTAL

TITLE

#	DATE	DESCRIPTION

REVISIONS

ZMG DRAWN BY — MAZ CHECKED BY

STATUS: JULY 2021

DATE: 20078

PROJECT NUMBER: EX-01

Jun. 10, 2021 – 3:24pm
L:\Project\20000\20078\CADD\ACAD\Dwg\C20078 EX-01.dwg

GENERAL NOTES

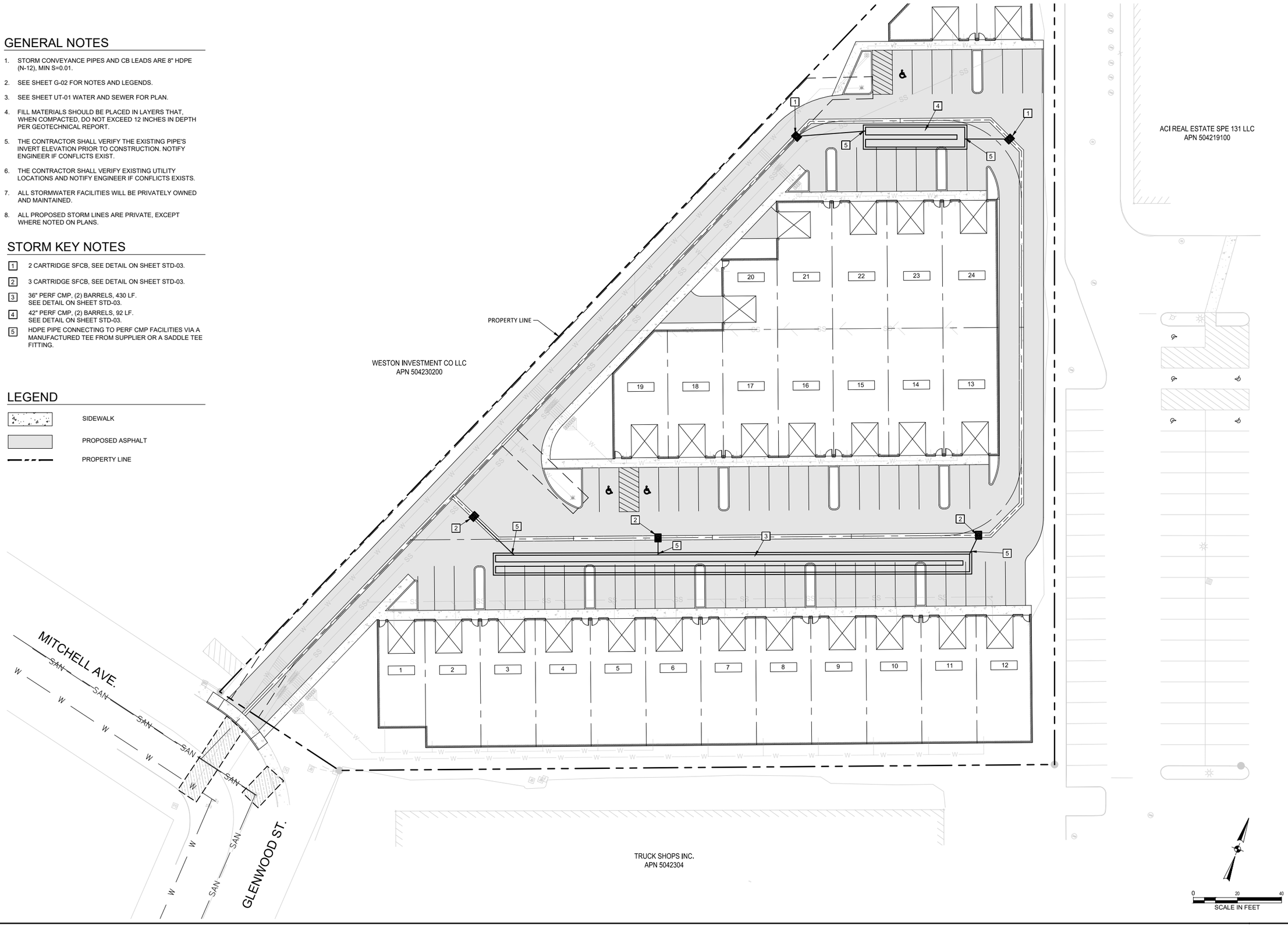
1. STORM CONVEYANCE PIPES AND CB LEADS ARE 8" HDPE (N-12), MIN S=0.01.
2. SEE SHEET G-02 FOR NOTES AND LEGENDS.
3. SEE SHEET UT-01 WATER AND SEWER FOR PLAN.
4. FILL MATERIALS SHOULD BE PLACED IN LAYERS THAT, WHEN COMPACTED, DO NOT EXCEED 12 INCHES IN DEPTH PER GEOTECHNICAL REPORT.
5. THE CONTRACTOR SHALL VERIFY THE EXISTING PIPE'S INVERT ELEVATION PRIOR TO CONSTRUCTION. NOTIFY ENGINEER IF CONFLICTS EXIST.
6. THE CONTRACTOR SHALL VERIFY EXISTING UTILITY LOCATIONS AND NOTIFY ENGINEER IF CONFLICTS EXISTS.
7. ALL STORMWATER FACILITIES WILL BE PRIVATELY OWNED AND MAINTAINED.
8. ALL PROPOSED STORM LINES ARE PRIVATE, EXCEPT WHERE NOTED ON PLANS.

STORM KEY NOTES

1. 2 CARTRIDGE SFCB, SEE DETAIL ON SHEET STD-03.
2. 3 CARTRIDGE SFCB, SEE DETAIL ON SHEET STD-03.
3. 36" PERF CMP, (2) BARRELS, 430 LF. SEE DETAIL ON SHEET STD-03.
4. 42" PERF CMP, (2) BARRELS, 92 LF. SEE DETAIL ON SHEET STD-03.
5. HDPE PIPE CONNECTING TO PERF CMP FACILITIES VIA A MANUFACTURED TEE FROM SUPPLIER OR A SADDLE TEE FITTING.

LEGEND

- SIDEWALK
- PROPOSED ASPHALT
- PROPERTY LINE



Otak
700 Washington Street
Suite 300
Vancouver, WA 98660
Phone: 360.737.9613
FAX: 360.737.9651
www.otak.com

PRELIMINARY

MAKERS SPACE - KIRKLAND
600 MITCHELL AVENUE, WOODLAND, WA 98674

STORMWATER PLAN I

PRELIMINARY ENGINEERING - LU SUBMITTAL

#	DATE	DESCRIPTION

REVISIONS

ZMG DRAWN BY | MAZ CHECKED BY

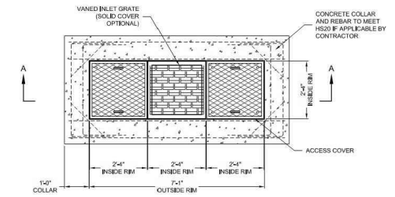
STATUS: JULY 2021

DATE: 20078

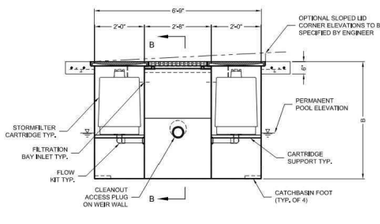
PROJECT NUMBER

STRM-01

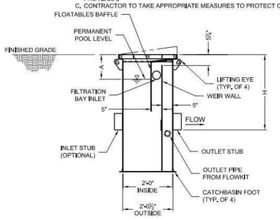
Jun 10, 2021 – 3:27pm
L:\Project\20000\20078\C40D\ACAD\Dwg\C20078 STRM-01.dwg



PLAN VIEW



SECTION A-A



SECTION B-B

STORMFILTER STEEL CATCHBASIN DESIGN NOTES

STORMFILTER TREATMENT CAPACITY IS A FUNCTION OF THE CARTRIDGE SELECTION AND THE NUMBER OF CARTRIDGES. 2 CARTRIDGE CATCHBASIN HAS A MAXIMUM OF TWO CARTRIDGES. SYSTEM IS SHOWN WITH A 27" CARTRIDGE, AND IS ALSO AVAILABLE WITH AN 18" CARTRIDGE. STORMFILTER CATCHBASIN CONFIGURATIONS ARE AVAILABLE WITH A DRY INLET BAY FOR VECTOR CONTROL.
PEAK HYDRAULIC CAPACITY PER TABLE BELOW. IF THE SITE CONDITIONS EXCEED PEAK HYDRAULIC CAPACITY, AN UPSTREAM BYPASS STRUCTURE IS REQUIRED.

CARTRIDGE SELECTION

CARTRIDGE HEIGHT	27"			18"			18" DEEP		
RECOMMENDED HYDRAULIC DROP (H)	3,05'			2,3'			3,3'		
SPECIFIC FLOW RATE (gpm/sf)	2 gpm/sf	1,67* gpm/sf	1 gpm/sf	2 gpm/sf	1,67* gpm/sf	1 gpm/sf	2 gpm/sf	1,67* gpm/sf	1 gpm/sf
CARTRIDGE FLOW RATE (gpm)	22,5	18,79	11,25	15	12,53	7,5	15	12,53	7,5
PEAK HYDRAULIC CAPACITY	1,0			1,0			1,8		
INLET PERMANENT POOL LEVEL (A)	1'-0"			1'-0"			2'-0"		
OVERALL STRUCTURE HEIGHT (B)	4'-9"			3'-9"			4'-9"		

* 1,67 gpm/sf SPECIFIC FLOW RATE IS APPROVED WITH PHOSPHOSORB® (PSORB) MEDIA ONLY

GENERAL NOTES
1. CONTECH TO PROVIDE ALL MATERIALS UNLESS NOTED OTHERWISE.
2. FOR SITE SPECIFIC DRAWINGS WITH DETAILED STORMFILTER CATCHBASIN STRUCTURE DIMENSIONS AND WEIGHTS, PLEASE CONTACT YOUR CONTECH ENGINEERED SOLUTIONS LLC REPRESENTATIVE. WWW.CONTECHES.COM
3. STORMFILTER CATCHBASIN WATER QUALITY STRUCTURE SHALL BE IN ACCORDANCE WITH ALL DESIGN DATA AND INFORMATION CONTAINED IN THIS DRAWING.
4. INLET SHOULD NOT BE LOWER THAN OUTLET. INLET (IF APPLICABLE) AND OUTLET PIPING TO BE SPECIFIED BY ENGINEER AND PROVIDED BY CONTRACTOR.
5. MANUFACTURER TO APPLY A SURFACE BEAD WELD IN THE SHAPE OF THE LETTER "O" ABOVE THE OUTLET PIPE STUB ON THE EXTERIOR SURFACE OF THE STEEL SFCB.
6. STORMFILTER CATCHBASIN EQUIPPED WITH 4 INCH (APPROXIMATE) LONG STUBS FOR INLET (IF APPLICABLE) AND OUTLET PIPING. STANDARD OUTLET STUB IS 8 INCHES IN DIAMETER; MAXIMUM OUTLET STUB IS 15 INCHES IN DIAMETER. CONNECTION TO COLLECTION PIPING CAN BE MADE USING FLEXIBLE COUPLING BY CONTRACTOR.
7. STEEL STRUCTURE TO BE MANUFACTURED OF 1/4 INCH STEEL PLATE. CASTINGS SHALL MEET AASHTO M306 LOAD RATING. TO MEET H520 LOAD RATING ON STRUCTURE, A CONCRETE COLLAR IS REQUIRED. WHEN REQUIRED, CONCRETE COLLAR WITH #4 REINFORCING BARS TO BE PROVIDED BY CONTRACTOR.
8. FILTER CARTRIDGES SHALL BE MEDIA-FILLED, PASSIVE, SIPHON ACTUATED, RADIAL FLOW, AND SELF CLEANING. RADIAL MEDIA DEPTH SHALL BE 7-INCHES. FILTER MEDIA CONTACT TIME SHALL BE AT LEAST 38 SECONDS.
9. SPECIFIC FLOW RATE IS EQUAL TO THE FILTER TREATMENT CAPACITY (gpm) DIVIDED BY THE FILTER CONTACT SURFACE AREA (sq ft).

INSTALLATION NOTES
A. ANY SUB-BASE, BACKFILL DEPTH, AND/OR ANTI-FLOTATION PROVISIONS ARE SITE-SPECIFIC DESIGN CONSIDERATIONS AND SHALL BE SPECIFIED BY ENGINEER OF RECORD.
B. CONTRACTOR TO PROVIDE EQUIPMENT WITH SUFFICIENT LIFTING AND REACH CAPACITY TO LIFT AND SET THE CATCHBASIN (LIFTING CLUTCHES PROVIDED).
C. CONTRACTOR TO TAKE APPROPRIATE MEASURES TO PROTECT CARTRIDGES FROM CONSTRUCTION-RELATED EROSION RUNOFF.

2-CARTRIDGE DEEP CATCHBASIN STORMFILTER DATA

STRUCTURE ID	XXX	
WATER QUALITY FLOW RATE (cfs)	X.XX	
PEAK FLOW RATE (<1 cfs)	X.XX	
RETURN PERIOD OF PEAK FLOW (yrs)	XXX	
CARTRIDGE FLOW RATE (gpm)	XX	
MEDIA TYPE (PERLITE, ZPG, PSORB)	XXXXX	
RIM ELEVATION	XXX.XX	
PIPE DATA:	I.E.	DIAMETER
INLET STUB	XXX.XX'	XX"
OUTLET STUB	XXX.XX'	XX"
CONFIGURATIONS	OUTLET / INLET / INLET	
SLOPED LID		YES/NO
SOLID COVER		YES/NO
NOTES/SPECIAL REQUIREMENTS:		

	DATE	REVISION DESCRIPTION	BY

CONTECH ENGINEERED SOLUTIONS LLC
www.ContechES.com
9025 Centre Pointe Dr., Suite 400, West Chester, OH 45069
800-338-1122 513-645-7000 513-645-7993 FAX

CONTECH CMP DETENTION SYSTEMS
CONTECH DYODS DRAWING

DYO3915 Woodland Makers Space
42" CMP Detention - 90LF
Woodland, WA
DETENTION SYSTEM

PROJECT No.:	2542
DEV. No.:	3915
DATE:	6/1/2021
DESIGNED:	DYO
DRAWN:	DYO
CHECKED:	DYO
APPROVED:	DYO
SHEET NO.:	D1

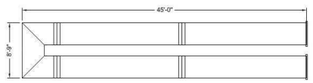
PROJECT SUMMARY

CALCULATION DETAILS
• LOADING = HS20 & HS25
• APPROX. LINEAR FOOTAGE = 92 lf.

STORAGE SUMMARY
• STORAGE VOLUME REQUIRED = 1,380 cf.
• PIPE STORAGE VOLUME = 883 cf.
• BACKFILL STORAGE VOLUME = 501 cf.
• TOTAL STORAGE PROVIDED = 1,383 cf.

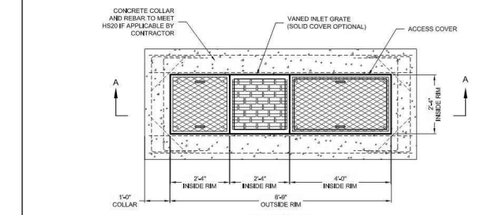
PIPE DETAILS
• DIAMETER = 42 IN.
• CORRUGATION = 2 2/3x1/2
• GAGE = 16
• COATING = ALT2
• WALL TYPE = Solid
• BARREL SPACING = 21 IN.

BACKFILL DETAILS
• WIDTH AT ENDS = 12 IN.
• ABOVE PIPE = 6 IN.
• WIDTH AT SIDES = 12 IN.
• BELOW PIPE = 6 IN.

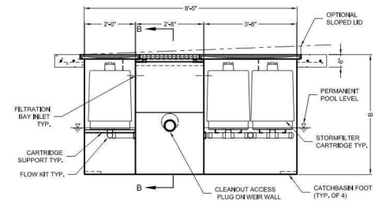


NOTES
• ALL RISER AND STUB DIMENSIONS ARE TO CENTERLINE. ALL ELEVATIONS, DIMENSIONS, AND LOCATIONS OF RISERS AND INLETS, SHALL BE VERIFIED BY THE ENGINEER OF RECORD PRIOR TO RELEASING FOR FABRICATION.
• ALL FITTINGS AND REINFORCEMENT COMPLY WITH ASTM A998.
• ALL RISERS AND STUBS ARE 2⅔" x ½" CORRUGATION AND 16 GAGE UNLESS OTHERWISE NOTED.
• RISERS TO BE FIELD TRIMMED TO GRADE.
• QUANTITY OF PIPE SHOWN DOES NOT PROVIDE EXTRA PIPE FOR CONNECTING THE SYSTEM TO EXISTING PIPE OR DRAINAGE STRUCTURES. OUR SYSTEM AS DETAILED PROVIDES NOMINAL INLET AND/OR OUTLET PIPE STUB FOR CONNECTION TO EXISTING DRAINAGE FACILITIES. IF ADDITIONAL PIPE IS NEEDED IT IS THE RESPONSIBILITY OF THE CONTRACTOR.
• BAND TYPE TO BE DETERMINED UPON FINAL DESIGN.
• THE PROJECT SUMMARY IS REFLECTIVE OF THE DYODS DESIGN, QUANTITIES ARE APPROX. AND SHOULD BE VERIFIED UPON FINAL DESIGN AND APPROVAL. FOR EXAMPLE, TOTAL EXCAVATION DOES NOT CONSIDER ALL VARIABLES SUCH AS SHORING AND ONLY ACCOUNTS FOR MATERIAL WITHIN THE ESTIMATED EXCAVATION FOOTPRINT.
• THESE DRAWINGS ARE FOR CONCEPTUAL PURPOSES AND DO NOT REFLECT ANY LOCAL PREFERENCES OR REGULATIONS. PLEASE CONTACT YOUR LOCAL CONTECH REP FOR MODIFICATIONS.

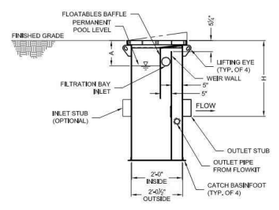
ASSEMBLY
SCALE: 1" = 10'



PLAN VIEW



SECTION A-A



SECTION B-B

STORMFILTER STEEL CATCHBASIN DESIGN NOTES

STORMFILTER TREATMENT CAPACITY IS A FUNCTION OF THE CARTRIDGE SELECTION AND THE NUMBER OF CARTRIDGES. 3 CARTRIDGE CATCHBASIN HAS A MAXIMUM OF THREE CARTRIDGES. SYSTEM IS SHOWN WITH A 27" CARTRIDGE, AND IS ALSO AVAILABLE WITH AN 18" CARTRIDGE. STORMFILTER CATCHBASIN CONFIGURATIONS ARE AVAILABLE WITH A DRY INLET BAY FOR VECTOR CONTROL.
PEAK HYDRAULIC CAPACITY PER TABLE BELOW. IF THE SITE CONDITIONS EXCEED PEAK HYDRAULIC CAPACITY, AN UPSTREAM BYPASS STRUCTURE IS REQUIRED.

CARTRIDGE SELECTION

CARTRIDGE HEIGHT	27"			18"			18" DEEP		
RECOMMENDED HYDRAULIC DROP (H)	3,05'			2,3'			3,3'		
SPECIFIC FLOW RATE (gpm/sf)	2 gpm/sf	1,67* gpm/sf	1 gpm/sf	2 gpm/sf	1,67* gpm/sf	1 gpm/sf	2 gpm/sf	1,67* gpm/sf	1 gpm/sf
CARTRIDGE FLOW RATE (gpm)	22,5	18,79	11,25	15	12,53	7,5	15	12,53	7,5
PEAK HYDRAULIC CAPACITY	1,0			1,0			1,8		
INLET PERMANENT POOL LEVEL (A)	1'-0"			1'-0"			2'-0"		
OVERALL STRUCTURE HEIGHT (B)	4'-9"			3'-9"			4'-9"		

* 1,67 gpm/sf SPECIFIC FLOW RATE IS APPROVED WITH PHOSPHOSORB® (PSORB) MEDIA ONLY

GENERAL NOTES
1. CONTECH TO PROVIDE ALL MATERIALS UNLESS NOTED OTHERWISE.
2. FOR SITE SPECIFIC DRAWINGS WITH DETAILED STORMFILTER CATCHBASIN STRUCTURE DIMENSIONS AND WEIGHTS, PLEASE CONTACT YOUR CONTECH ENGINEERED SOLUTIONS LLC REPRESENTATIVE. www.contecheS.com
3. STORMFILTER CATCHBASIN WATER QUALITY STRUCTURE SHALL BE IN ACCORDANCE WITH ALL DESIGN DATA AND INFORMATION CONTAINED IN THIS DRAWING.
4. INLET SHOULD NOT BE LOWER THAN OUTLET. INLET (IF APPLICABLE) AND OUTLET PIPING TO BE SPECIFIED BY ENGINEER AND PROVIDED BY CONTRACTOR.
5. MANUFACTURER TO APPLY A SURFACE BEAD WELD IN THE SHAPE OF THE LETTER "O" ABOVE THE OUTLET PIPE STUB ON THE EXTERIOR SURFACE OF THE STEEL SFCB.
6. STORMFILTER CATCHBASIN EQUIPPED WITH 4 INCH (APPROXIMATE) LONG STUBS FOR INLET (IF APPLICABLE) AND OUTLET PIPING. STANDARD OUTLET STUB IS 8 INCHES IN DIAMETER; MAXIMUM OUTLET STUB IS 15 INCHES IN DIAMETER. CONNECTION TO COLLECTION PIPING CAN BE MADE USING FLEXIBLE COUPLING BY CONTRACTOR.
7. STEEL STRUCTURE TO BE MANUFACTURED OF 1/4 INCH STEEL PLATE. CASTINGS SHALL MEET AASHTO M306 LOAD RATING. TO MEET H520 LOAD RATING ON STRUCTURE, A CONCRETE COLLAR IS REQUIRED. WHEN REQUIRED, CONCRETE COLLAR WITH #4 REINFORCING BARS TO BE PROVIDED BY CONTRACTOR.
8. FILTER CARTRIDGES SHALL BE MEDIA-FILLED, PASSIVE, SIPHON ACTUATED, RADIAL FLOW, AND SELF CLEANING. RADIAL MEDIA DEPTH SHALL BE 7-INCHES. FILTER MEDIA CONTACT TIME SHALL BE AT LEAST 38 SECONDS.
9. SPECIFIC FLOW RATE IS EQUAL TO THE FILTER TREATMENT CAPACITY (gpm) DIVIDED BY THE FILTER CONTACT SURFACE AREA (sq ft).

INSTALLATION NOTES
A. ANY SUB-BASE, BACKFILL DEPTH, AND/OR ANTI-FLOTATION PROVISIONS ARE SITE-SPECIFIC DESIGN CONSIDERATIONS AND SHALL BE SPECIFIED BY ENGINEER OF RECORD.
B. CONTRACTOR TO PROVIDE EQUIPMENT WITH SUFFICIENT LIFTING AND REACH CAPACITY TO LIFT AND SET THE CATCHBASIN (LIFTING CLUTCHES PROVIDED).
C. CONTRACTOR TO TAKE APPROPRIATE MEASURES TO PROTECT CARTRIDGES FROM CONSTRUCTION-RELATED EROSION RUNOFF.

3-CARTRIDGE CATCHBASIN STORMFILTER DATA

STRUCTURE ID	XXX	
WATER QUALITY FLOW RATE (cfs)	X.XX	
PEAK FLOW RATE (<1 cfs)	X.XX	
RETURN PERIOD OF PEAK FLOW (yrs)	XXX	
CARTRIDGE FLOW RATE (gpm)	XX	
MEDIA TYPE (PERLITE, ZPG, PSORB)	XXXXX	
RIM ELEVATION	XXX.XX	
PIPE DATA:	I.E.	DIAMETER
INLET STUB	XXX.XX'	XX"
OUTLET STUB	XXX.XX'	XX"
CONFIGURATION	OUTLET / OUTLET / INLET / INLET	
SLOPED LID		YES/NO
SOLID COVER		YES/NO
NOTES/SPECIAL REQUIREMENTS:		

	DATE	REVISION DESCRIPTION	BY

CONTECH ENGINEERED SOLUTIONS LLC
www.ContechES.com
9025 Centre Pointe Dr., Suite 400, West Chester, OH 45069
800-338-1122 513-645-7000 513-645-7993 FAX

CONTECH CMP DETENTION SYSTEMS
CONTECH DYODS DRAWING

3 CARTRIDGE CATCHBASIN
STORMFILTER
STANDARD DETAIL

PROJECT No.:	2542
DEV. No.:	3914
DATE:	5/7/2021
DESIGNED:	DYO
DRAWN:	DYO
CHECKED:	DYO
APPROVED:	DYO
SHEET NO.:	D1

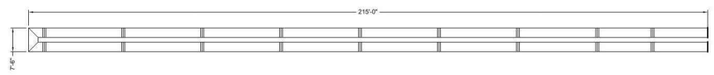
PROJECT SUMMARY

CALCULATION DETAILS
• LOADING = HS20 & HS25
• APPROX. LINEAR FOOTAGE = 432 lf.

STORAGE SUMMARY
• STORAGE VOLUME REQUIRED = N/A
• PIPE STORAGE VOLUME = 3,050 cf.
• BACKFILL STORAGE VOLUME = 1,871 cf.
• TOTAL STORAGE PROVIDED = 4,921 cf.

PIPE DETAILS
• DIAMETER = 36 IN.
• CORRUGATION = 2 2/3x1/2
• GAGE = 16
• COATING = ALT2
• WALL TYPE = Perforated
• BARREL SPACING = 18 IN.

BACKFILL DETAILS
• WIDTH AT ENDS = 12 IN.
• ABOVE PIPE = 6 IN.
• WIDTH AT SIDES = 12 IN.
• BELOW PIPE = 6 IN.



NOTES
• ALL RISER AND STUB DIMENSIONS ARE TO CENTERLINE. ALL ELEVATIONS, DIMENSIONS, AND LOCATIONS OF RISERS AND INLETS, SHALL BE VERIFIED BY THE ENGINEER OF RECORD PRIOR TO RELEASING FOR FABRICATION.
• ALL FITTINGS AND REINFORCEMENT COMPLY WITH ASTM A998.
• ALL RISERS AND STUBS ARE 2⅔" x ½" CORRUGATION AND 16 GAGE UNLESS OTHERWISE NOTED.
• RISERS TO BE FIELD TRIMMED TO GRADE.
• QUANTITY OF PIPE SHOWN DOES NOT PROVIDE EXTRA PIPE FOR CONNECTING THE SYSTEM TO EXISTING PIPE OR DRAINAGE STRUCTURES. OUR SYSTEM AS DETAILED PROVIDES NOMINAL INLET AND/OR OUTLET PIPE STUB FOR CONNECTION TO EXISTING DRAINAGE FACILITIES. IF ADDITIONAL PIPE IS NEEDED IT IS THE RESPONSIBILITY OF THE CONTRACTOR.
• BAND TYPE TO BE DETERMINED UPON FINAL DESIGN.
• THE PROJECT SUMMARY IS REFLECTIVE OF THE DYODS DESIGN, QUANTITIES ARE APPROX. AND SHOULD BE VERIFIED UPON FINAL DESIGN AND APPROVAL. FOR EXAMPLE, TOTAL EXCAVATION DOES NOT CONSIDER ALL VARIABLES SUCH AS SHORING AND ONLY ACCOUNTS FOR MATERIAL WITHIN THE ESTIMATED EXCAVATION FOOTPRINT.
• THESE DRAWINGS ARE FOR CONCEPTUAL PURPOSES AND DO NOT REFLECT ANY LOCAL PREFERENCES OR REGULATIONS. PLEASE CONTACT YOUR LOCAL CONTECH REP FOR MODIFICATIONS.

ASSEMBLY
SCALE: 1" = 20'

CONTECH ENGINEERED SOLUTIONS LLC
www.ContechES.com
9025 Centre Pointe Dr., Suite 400, West Chester, OH 45069
800-338-1122 513-645-7000 513-645-7993 FAX

CONTECH CMP DETENTION SYSTEMS
CONTECH DYODS DRAWING

DYO3914 Woodland Makers Space
36" CMP Detention - 430 LF
Woodland, WA
DETENTION SYSTEM

PROJECT No.:	2542
DEV. No.:	3914
DATE:	6/1/2021
DESIGNED:	DYO
DRAWN:	DYO
CHECKED:	DYO
APPROVED:	DYO
SHEET NO.:	D1

Otak
700 Washington Street
Suite 300
Vancouver, WA 98660
Phone: 360.737.9613
FAX: 360.737.9651
www.otak.com

PRELIMINARY

MAKERS SPACE - KIRKLAND
600 MITCHELL AVENUE, WOODLAND, WA 98674
STANDARD DETAILS III

PRELIMINARY ENGINEERING - LU SUBMITTAL

TITLE

#	DATE	DESCRIPTION

REVISIONS

ZMG DRAWN BY | MAZ CHECKED BY

STATUS
JULY 2021
DATE

20078
PROJECT NUMBER

STD-03

Jun 11, 2021 - 2:24pm
L:\Project\20000\20078\CAD\VACAD\Dwg\C20078_STD-03.dwg

Appendix F- Operation and Maintenance

Contech® CMP Detention Inspection and Maintenance Guide

Underground stormwater detention and infiltration systems must be inspected and maintained at regular intervals for purposes of performance and longevity.

Inspection

Inspection is the key to effective maintenance of CMP detention systems and is easily performed. Contech recommends ongoing, annual inspections. Sites with high trash load or small outlet control orifices may need more frequent inspections. The rate at which the system collects pollutants will depend more on-site specific activities rather than the size or configuration of the system.

Inspections should be performed more often in equipment washdown areas, in climates where sanding and/or salting operations take place, and in other various instances in which one would expect higher accumulations of sediment or abrasive/corrosive conditions. A record of each inspection is to be maintained for the life of the system.

Maintenance

CMP detention systems should be cleaned when an inspection reveals accumulated sediment or trash is clogging the discharge orifice. Accumulated sediment and trash can typically be evacuated through the manhole over the outlet orifice. If maintenance is not performed as recommended, sediment and trash may accumulate in front of the outlet orifice. Manhole covers should be securely seated following cleaning activities. Contech suggests that all systems be designed with an access/inspection manhole situated at or near the inlet and the outlet orifice. Should it be necessary to get inside the system to perform maintenance activities, all appropriate precautions regarding confined space entry and OSHA regulations should be followed.

Annual inspections are best practice for all underground systems. During this inspection if evidence of salting/de-icing agents is observed within the system, it is best practice for the system to be rinsed, including above the spring line soon after the spring thaw as part of the maintenance program for the system.

Maintaining an underground detention or infiltration system is easiest when there is no flow entering the system. For this reason, it is a good idea to schedule the cleanout during dry weather.

The foregoing inspection and maintenance efforts help ensure underground pipe systems used for stormwater storage continue to function as intended by identifying recommended regular inspection and maintenance practices. Inspection and maintenance related to the structural integrity of the pipe or the soundness of pipe joint connections is beyond the scope of this guide.

CONTECH®
CMP DETENTION SYSTEMS

CONTECH®
ENGINEERED SOLUTIONS

CONTECH®
ENGINEERED SOLUTIONS

StormFilter Inspection and Maintenance Procedures

The Stormwater Management StormFilter®

Maintenance Guidelines

The primary purpose of the Stormwater Management StormFilter® is to filter and prevent pollutants from entering our waterways. Like any effective filtration system, periodically these pollutants must be removed to restore the StormFilter to its full efficiency and effectiveness.

Maintenance requirements and frequency are dependent on the pollutant load characteristics of each site. Maintenance activities may be required in the event of a chemical spill or due to excessive sediment loading from site erosion or extreme storms. It is a good practice to inspect the system after major storm events.

Maintenance Procedures

Although there are many effective maintenance options, we believe the following procedure to be efficient, using common equipment and existing maintenance protocols. The following two-step procedure is recommended::

1. **Inspection**
   - Inspection of the vault interior to determine the need for maintenance.
2. **Maintenance**
   - Cartridge replacement
   - Sediment removal

Inspection and Maintenance Timing

At least one scheduled inspection should take place per year with maintenance following as warranted.

First, an inspection should be done before the winter season. During the inspection the need for maintenance should be determined and, if disposal during maintenance will be required, samples of the accumulated sediments and media should be obtained.

Second, if warranted, a maintenance (replacement of the filter cartridges and removal of accumulated sediments) should be performed during periods of dry weather.

In addition to these two activities, it is important to check the condition of the StormFilter unit after major storms for potential damage caused by high flows and for high sediment accumulation that may be caused by localized erosion in the drainage area. It may be necessary to adjust the inspection/ maintenance schedule depending on the actual operating conditions encountered by the system. In general, inspection activities can be conducted at any time, and maintenance should occur, if warranted, during dryer months in late summer to early fall.

Maintenance Frequency

The primary factor for determining frequency of maintenance for the StormFilter is sediment loading.

A properly functioning system will remove solids from water by trapping particulates in the porous structure of the filter media inside the cartridges. The flow through the system will naturally decrease as more and more particulates are trapped. Eventually the flow through the cartridges will be low enough to require replacement. It may be possible to extend the usable span of the cartridges by removing sediment from upstream trapping devices on a routine as-needed basis, in order to prevent material from being re-suspended and discharged to the StormFilter treatment system.

The average maintenance lifecycle is approximately 1-5 years. Site conditions greatly influence maintenance requirements. StormFilter units located in areas with erosion or active construction may need to be inspected and maintained more often than those with fully stabilized surface conditions.

Regulatory requirements or a chemical spill can shift maintenance timing as well. The maintenance frequency may be adjusted as additional monitoring information becomes available during the inspection program. Areas that develop known problems should be inspected more frequently than areas that demonstrate no problems, particularly after major storms. Ultimately, inspection and maintenance activities should be scheduled based on the historic records and characteristics of an individual StormFilter system or site. It is recommended that the site owner develop a database to properly manage StormFilter inspection and maintenance programs..

Inspection Procedures

The primary goal of an inspection is to assess the condition of the cartridges relative to the level of visual sediment loading as it relates to decreased treatment capacity. It may be desirable to conduct this inspection during a storm to observe the relative flow through the filter cartridges. If the submerged cartridges are severely plugged, then typically large amounts of sediments will be present and very little flow will be discharged from the drainage pipes. If this is the case, then maintenance is warranted and the cartridges need to be replaced.

Warning: In the case of a spill, the worker should abort inspection activities until the proper guidance is obtained. Notify the local hazard control agency and Contech Engineered Solutions immediately.

To conduct an inspection:

Important: Inspection should be performed by a person who is familiar with the operation and configuration of the StormFilter treatment unit.

1. If applicable, set up safety equipment to protect and notify surrounding vehicle and pedestrian traffic.
2. Visually inspect the external condition of the unit and take notes concerning defects/problems.
3. Open the access portals to the vault and allow the system vent.
4. Without entering the vault, visually inspect the inside of the unit, and note accumulations of liquids and solids.
5. Be sure to record the level of sediment build-up on the floor of the vault, in the forebay, and on top of the cartridges. If flow is occurring, note the flow of water per drainage pipe. Record all observations. Digital pictures are valuable for historical documentation.
6. Close and fasten the access portals.
7. Remove safety equipment.
8. If appropriate, make notes about the local drainage area relative to ongoing construction, erosion problems, or high loading of other materials to the system.
9. Discuss conditions that suggest maintenance and make decision as to weather or not maintenance is needed.

Maintenance Decision Tree

The need for maintenance is typically based on results of the inspection. The following Maintenance Decision Tree should be used as a general guide. (Other factors, such as Regulatory Requirements, may need to be considered)

1. Sediment loading on the vault floor.
   a. If >4" of accumulated sediment, maintenance is required.
2. Sediment loading on top of the cartridge.
   a. If >1/4" of accumulation, maintenance is required.
3. Submerged cartridges.
   a. If >4" of static water above cartridge bottom for more than 24 hours after end of rain event, maintenance is required. (Catch basins have standing water in the cartridge bay.)
4. Plugged media.
   a. If pore space between media granules is absent, maintenance is required.
5. Bypass condition.
   a. If inspection is conducted during an average rain fall event and StormFilter remains in bypass condition (water over the internal outlet baffle wall or submerged cartridges), maintenance is required.
6. Hazardous material release.
   a. If hazardous material release (automotive fluids or other) is reported, maintenance is required.
7. Pronounced scum line.
   a. If pronounced scum line (say ≥ 1/4" thick) is present above top cap, maintenance is required.

Maintenance

Depending on the configuration of the particular system, maintenance personnel will be required to enter the vault to perform the maintenance.

Important: If vault entry is required, OSHA rules for confined space entry must be followed.

Filter cartridge replacement should occur during dry weather. It may be necessary to plug the filter inlet pipe if base flows is occurring.

Replacement cartridges can be delivered to the site or customers facility. Information concerning how to obtain the replacement cartridges is available from Contech Engineered Solutions.

Warning: In the case of a spill, the maintenance personnel should abort maintenance activities until the proper guidance is obtained. Notify the local hazard control agency and Contech Engineered Solutions immediately.

To conduct cartridge replacement and sediment removal maintenance:

1. If applicable, set up safety equipment to protect maintenance personnel and pedestrians from site hazards.
2. Visually inspect the external condition of the unit and take notes concerning defects/problems.
3. Open the doors (access portals) to the vault and allow the system to vent.
4. Without entering the vault, give the inside of the unit, including components, a general condition inspection.
5. Make notes about the external and internal condition of the vault. Give particular attention to recording the level of sediment build-up on the floor of the vault, in the forebay, and on top of the internal components.
6. Using appropriate equipment offload the replacement cartridges (up to 150 lbs. each) and set aside.
7. Remove used cartridges from the vault using one of the following methods:

Method 1:

A. This activity will require that maintenance personnel enter the vault to remove the cartridges from the under drain manifold and place them under the vault opening for lifting (removal). Disconnect each filter cartridge from the underdrain connector by rotating counterclockwise 1/4 of a turn. Roll the loose cartridge, on edge, to a convenient spot beneath the vault access.

   Using appropriate hoisting equipment, attach a cable from the boom, crane, or tripod to the loose cartridge. Contact Contech Engineered Solutions for suggested attachment devices.

B. Remove the used cartridges (up to 250 lbs. each) from the vault.

Important: Care must be used to avoid damaging the cartridges during removal and installation. The cost of repairing components damaged during maintenance will be the responsibility of the owner.

C. Set the used cartridge aside or load onto the hauling truck.

D. Continue steps a through c until all cartridges have been removed.

Method 2:

A. This activity will require that maintenance personnel enter the vault to remove the cartridges from the under drain manifold and place them under the vault opening for lifting (removal). Disconnect each filter cartridge from the underdrain connector by rotating counterclockwise 1/4 of a turn. Roll the loose cartridge, on edge, to a convenient spot beneath the vault access.

B. Unscrew the cartridge cap.

C. Remove the cartridge hood and float.

D. At location under structure access, tip the cartridge on its side.

E. Empty the cartridge onto the vault floor. Reassemble the empty cartridge.

F. Set the empty, used cartridge aside or load onto the hauling truck.

G. Continue steps a through e until all cartridges have been removed.

8. Remove accumulated sediment from the floor of the vault and from the forebay. This can most effectively be accomplished by use of a vacuum truck.
9. Once the sediments are removed, assess the condition of the vault and the condition of the connectors.
10. Using the vacuum truck boom, crane, or tripod, lower and install the new cartridges. Once again, take care not to damage connections.
11. Close and fasten the door.
12. Remove safety equipment.
13. Finally, dispose of the accumulated materials in accordance with applicable regulations. Make arrangements to return the used **empty** cartridges to Contech Engineered Solutions.

Related Maintenance Activities - Performed on an as-needed basis

StormFilter units are often just one of many structures in a more comprehensive stormwater drainage and treatment system.

In order for maintenance of the StormFilter to be successful, it is imperative that all other components be properly maintained. The maintenance/repair of upstream facilities should be carried out prior to StormFilter maintenance activities.

In addition to considering upstream facilities, it is also important to correct any problems identified in the drainage area. Drainage area concerns may include: erosion problems, heavy oil loading, and discharges of inappropriate materials.

Material Disposal

The accumulated sediment found in stormwater treatment and conveyance systems must be handled and disposed of in accordance with regulatory protocols. It is possible for sediments to contain measurable concentrations of heavy metals and organic chemicals (such as pesticides and petroleum products). Areas with the greatest potential for high pollutant loading include industrial areas and heavily traveled roads.

Sediments and water must be disposed of in accordance with all applicable waste disposal regulations. When scheduling maintenance, consideration must be made for the disposal of solid and liquid wastes. This typically requires coordination with a local landfill for solid waste disposal. For liquid waste disposal a number of options are available including a municipal vacuum truck decant facility, local waste water treatment plant or on-site treatment and discharge.

Inspection Report

Date: Personnel:

Location: System Size:

System Type: Vault ☐ Cast-In-Place ☐ Linear Catch Basin ☐ Manhole ☐ Other ☐

Sediment Thickness in Forebay: Date:

Sediment Depth on Vault Floor:

Structural Damage:

Estimated Flow from Drainage Pipes (if available):

Cartridges Submerged: Yes ☐ No ☐ Depth of Standing Water:

StormFilter Maintenance Activities (check off if done and give description)

☐ Trash and Debris Removal:

☐ Minor Structural Repairs:

☐ Drainage Area Report

Excessive Oil Loading: Yes ☐ No ☐ Source:

Sediment Accumulation on Pavement: Yes ☐ No ☐ Source:

Erosion of Landscaped Areas: Yes ☐ No ☐ Source:

Items Needing Further Work:

Owners should contact the local public works department and inquire about how the department disposes of their street waste residuals.

Other Comments:

Review the condition reports from the previous inspection visits.

StormFilter Maintenance Report

Date: _____ Personnel: _____

Location: _____ System Size: _____

System Type: Vault ☐ Cast-In-Place ☐ Linear Catch Basin ☐ Manhole ☐ Other ☐

List Safety Procedures and Equipment Used: _____

_____

_____

System Observations

Months in Service:

Oil in Forebay (if present): Yes ☐ No ☐

Sediment Depth in Forebay (if present): _____

Sediment Depth on Vault Floor: _____

Structural Damage: _____

Drainage Area Report

Excessive Oil Loading: Yes ☐ No ☐ Source: _____

Sediment Accumulation on Pavement: Yes ☐ No ☐ Source: _____

Erosion of Landscaped Areas: Yes ☐ No ☐ Source: _____

StormFilter Cartridge Replacement Maintenance Activities

Remove Trash and Debris: Yes ☐ No ☐ Details: _____

Replace Cartridges: Yes ☐ No ☐ Details: _____

Sediment Removed: Yes ☐ No ☐ Details: _____

Quantity of Sediment Removed (estimate?):

Minor Structural Repairs: Yes ☐ No ☐ Details: _____

Residuals (debris, sediment) Disposal Methods: _____

Notes:

_____

_____

_____

_____

_____

_____

_____

RECYCLED PAPER

CONTECH®
ENGINEERED SOLUTIONS

800-338-1122

www.ContechES.com

Contech Engineered Solutions LLC provides site solutions for the civil engineering industry. Contech's portfolio includes bridges, drainage, sanitary sewer, stormwater and earth stabilization products. For information on other Contech division offerings, visit contech-cpi.com or call 800.338.1122.

Support

- Drawings and specifications are available at www.conteches.com.
- Site-specific design support is available from our engineers.

800.338.1122
www.conteches.com