Alpine Mini Storage and RV Parking

Chehalis, WA

Drainage & Erosion Control Report

Fuller Designs Project No. 2148
January 21, 2022

Prepared by:

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Project Information

Prepared for: Alpine Mini Storage and RV Parking

Contact: F & L Adventures
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Reviewing Agency

Jurisdiction: City of Chehalis
Contact: Amelia Schwartz
City of Chehalis Planner
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References: 2019 Stormwater Management Manual for Western Washington
Chehalis Municipal Code as passed June 28, 2021
Lewis County GIS Web Tool
USDA Web Soil Survey

Project Engineer

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"I hereby certify that this Drainage and Erosion Control Report for the Alpine Mini Storage and RV Parking project has been prepared by me or under my supervision. I hereby acknowledge and agree that the jurisdiction does not and will not assume liability for the sufficiency, suitability, or performance of facilities designed by me."

Contents

Drainage & Erosion Control Report

SECTION 1 – PROPOSED PROJECT DESCRIPTION

Parcel Number(s): 017765-004-002, 017896-006-003, 017896-005-000 and 017765-005-000

Site Address: 0 Hamilton Rd.
Chehalis, WA 98532

Total Site Area: 5 Acres
Zoning: CG-General Commercial
Sec, Twn, Rge: Section 10, Township 13N, Range 2W, W.M.

Proposed Improvements:

Currently zoned as general commercial, the approximate 5-ac site located along Hamilton Road, consists of parcels 017765-004-002, 017896-006-003, 017896-005-000 and 017765-005-000. The Alpine Mini Storage and RV Parking Project (Project) proposes construction of 394 storge units, 44 parking stalls, a paved parking area and a small onsite office. An underground infiltration facility and Contech Treatment Catch Basins are proposed to mitigate stormwater runoff.

SECTION 2 – EXISTING CONDITIONS DESCRIPTION

The site's existing condition includes a large field with some vegetation and a small northeast slope toward N Hamilton Rd. According to the Lewis County Online GIS tool, this site is not in any critical areas.

The USDA online tool, Web Soil Survey, depicts the site as primarily coved with Olequa Silt Loam and minor components consisting of Lacamas Silt Loam. The following pages include the USDA Web Soils Survey Report.

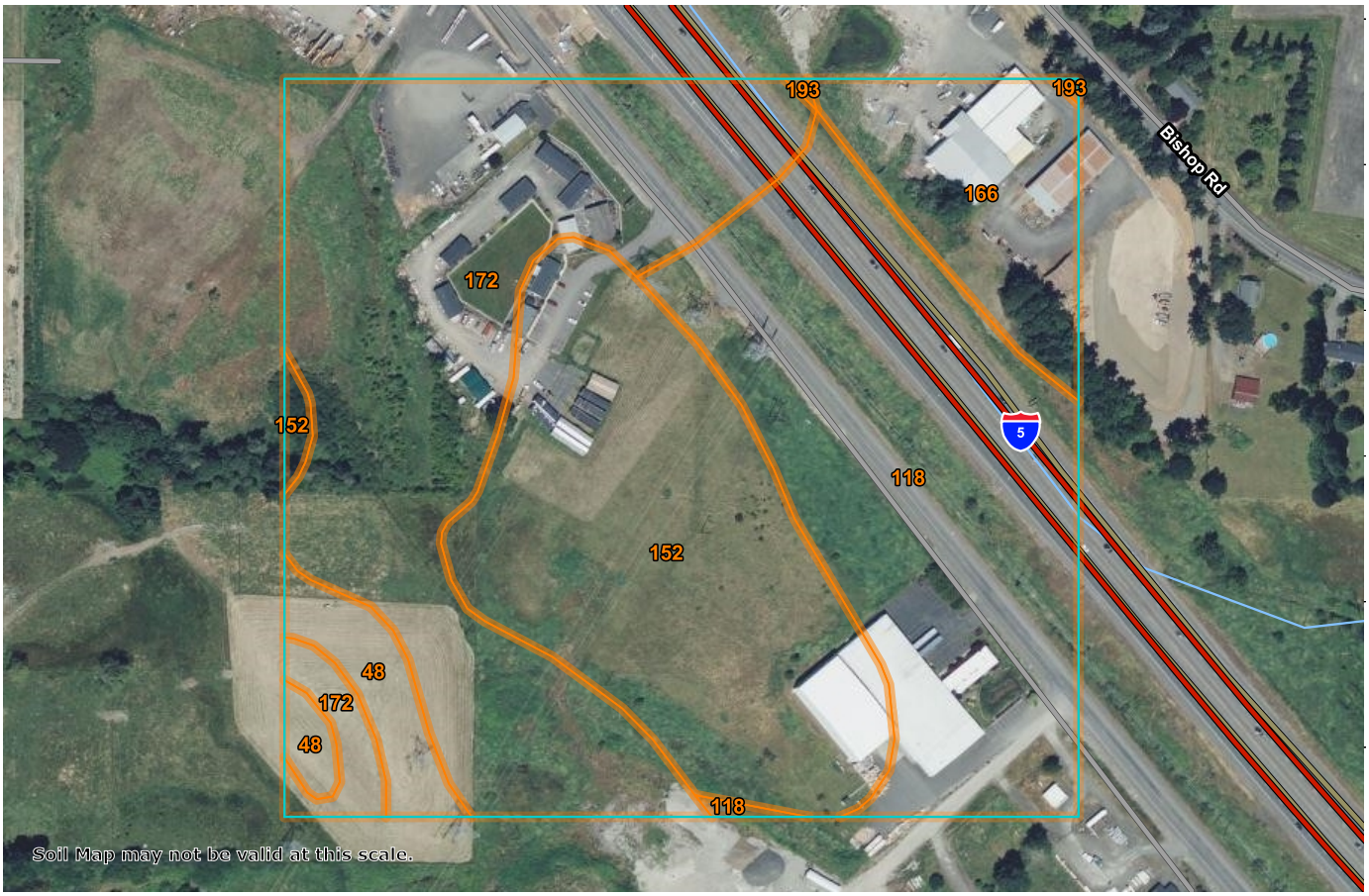
SECTION 3 – OFF-SITE ANALYSIS REPORTS

The area immediately adjacent to the Project property is:

- North – Hamilton Road
- South – Undeveloped/ vacant lot zoned as COM
- East – A commercial retail property zoned as COM
- West – A commercial retail property zoned as IND

The improvements onsite are not anticipated to impact adjacent properties. Using the online Lewis County GIS Tool, it was determined that this site is within a CARA Category I zone and in a zone of moderate to high liquefaction susceptibility. The stormwater onsite is proposed to undergo treatment before infiltration and most of the surrounding area is in the liquefaction susceptibility zone, including I-5. The improvements to this site are not anticipated to be impacted or impact the surrounding area through these critical areas.

Upstream analysis concluded that water flowing from Hamilton Road will continue to collect in the road side ditch, a culvert under the proposed driveway is intended to continue to promote the flow of stormwater. Improvements to this site are not projected to effect downstream properties as 100% of the stormwater will be treated and infiltrated onsite.



Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
48	Chehalis silty clay	1.6	3.6%
118	Lacamas silt loam, 0 to 3 percent slopes	12.3	28.0%
152	Olequa silt loam, 0 to 5 percent slopes	11.1	25.3%
166	Pits	3.7	8.4%
172	Reed silty clay loam	15.2	34.6%
193	Scamman silty clay loam, 0 to 5 percent slopes	0.1	0.1%
Totals for Area of Interest		**44.0**	**100.0%**

Lewis County Area, Washington

152—Olequa silt loam, 0 to 5 percent slopes

Map Unit Setting

National map unit symbol: 2h9v
Elevation: 40 to 300 feet
Mean annual precipitation: 40 to 60 inches
Mean annual air temperature: 50 to 52 degrees F
Frost-free period: 150 to 220 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Olequa and similar soils: 90 percent
Minor components: 3 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Olequa

Setting

Landform: Terraces

Typical profile

H1 - 0 to 10 inches: silt loam
H2 - 10 to 20 inches: silt loam
H3 - 20 to 51 inches: silty clay loam
H4 - 51 to 60 inches: silt loam

Properties and qualities

Slope: 0 to 5 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.57 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: High (about 12.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: C
Ecological site: F002XA005WA - Puget Lowlands Moist Forest
Forage suitability group: Soils with Few Limitations (G002XV502WA)
Other vegetative classification: Soils with Few Limitations (G002XV502WA)
Hydric soil rating: No

Minor Components

Lacamas

Percent of map unit: 3 percent
Landform: Terraces
Hydric soil rating: Yes

Data Source Information

Soil Survey Area: Lewis County Area, Washington
Survey Area Data: Version 21, Aug 31, 2021

Lewis County Area, Washington

119—Lacamas silt loam, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: 2h8m
Elevation: 250 to 1,200 feet
Mean annual precipitation: 40 to 70 inches
Mean annual air temperature: 48 to 52 degrees F
Frost-free period: 125 to 200 days
Farmland classification: Prime farmland if drained

Map Unit Composition

Lacamas, drained, and similar soils: 60 percent
Lacamas, undrained, and similar soils: 30 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Lacamas, Drained

Setting

Landform: Terraces

Typical profile

H1 - 0 to 7 inches: silt loam
H2 - 7 to 17 inches: silt loam
H3 - 17 to 27 inches: silty clay
H4 - 27 to 60 inches: clay

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Very low (0.00 in/hr)
Depth to water table: About 12 to 18 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Moderate (about 6.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4w
Hydrologic Soil Group: C/D
Ecological site: F001XC003OR - Mesic Aquic Forest
Forage suitability group: Seasonally Wet Soils (G002XV202WA)
Other vegetative classification: Seasonally Wet Soils (G002XV202WA)
Hydric soil rating: Yes

Description of Lacamas, Undrained

Setting

Landform: Terraces

Typical profile

H1 - 0 to 7 inches: silt loam
H2 - 7 to 17 inches: silt loam
H3 - 17 to 27 inches: silty clay
H4 - 27 to 60 inches: clay

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Very poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Very low (0.00 in/hr)
Depth to water table: About 0 to 6 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Moderate (about 6.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 5w
Hydrologic Soil Group: C/D
Ecological site: F001XC003OR - Mesic Aquic Forest
Forage suitability group: Seasonally Wet Soils (G002XV202WA)
Other vegetative classification: Seasonally Wet Soils (G002XV202WA)
Hydric soil rating: Yes

Minor Components

Klaber

Percent of map unit: 5 percent
Landform: Depressions
Hydric soil rating: Yes

Prather

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

Scamman

Percent of map unit: 2 percent
Landform: Terraces
Hydric soil rating: Yes

Data Source Information

Soil Survey Area: Lewis County Area, Washington
Survey Area Data: Version 21, Aug 31, 2021

SECTION 4 – APPLICABLE MINIMUM REQUIREMENTS

The minimum requirements for stormwater development and redevelopment sites are listed in Volume I Chapter three of the 2019 Washington State Department of Ecology Stormwater Management Manual for Western Washington (SWMMWW). Not all the minimum requirements of this section apply to all projects. Based on the thresholds given in Figures I-3.2 (Figure 4.1, right), of the SWMMWW, the proposed project's development triggers all minimum requirements, MRs, one through nine.

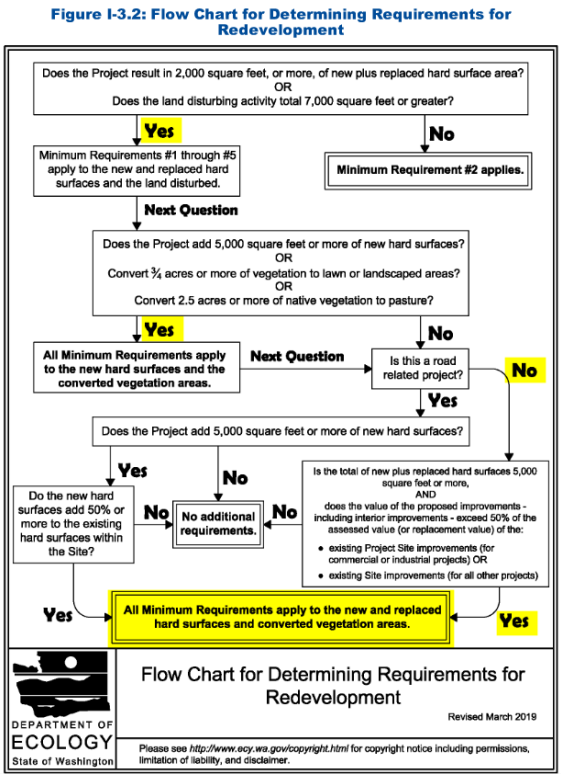


Figure 4.1 – Flow chart from the SWMMWW showing applicable minimum requirements.

MR #1 – Preparation of Drainage Control Plans

A Stormwater Site Plan has been prepared (see Erosion Control and Drainage Plans).

MR #2 – Construction Stormwater Pollution Prevention Plan

A Construction Stormwater Pollution Prevention Plan (SWPPP) has been prepared (see Section 6).

MR #3 – Source Control of Pollution

All known, available, and reasonable source control BMPs shall be applied to the Project to limit pollutants from encountering stormwater. Project-specific construction BMPs will be provided during construction, Section 6.

MR #4 – Preservation of Natural Drainage Systems and Outfalls

Improvements onsite do not propose to impact natural drainages. Post-development proposes to infiltrate all of stormwater runoff from the roof and parking lot. Therefore, improvements onsite do not propose an impact to natural drainages inside their associated buffers.

MR #5 – On-site Stormwater Management

Based on the thresholds given in Figure I-3.3 from the SWMMWW (Figure 4.2, right), the Project triggers MR #7, BMPs from lists #1, #2 and #3 of Table I-3.2 in Volume I of the SWMMWW are not applicable as the LID performance standards have been met and BMP T5.13, Post Construction Soil Quality and Depth, shall be implemented on the site.

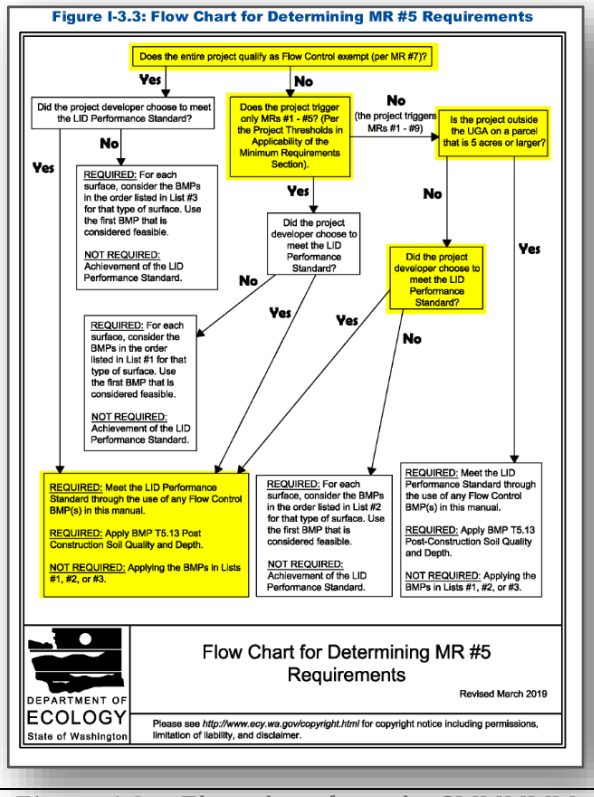


Figure 4.2 – Flow chart from the SWMMWW showing requirements for MR5.

MR #6 – Runoff Treatment

Prior to entering infiltration facility, runoff produced from the site will undergo treatment. Runoff shall travel through Contech Storm Catch Basins. Water quality flow rate was calculated (though WWHM Modeling) to be 0.1707-cfs, 76.815-gpm. This is the volume that will enter the Contech Basins as runoff produced by the roof was omitted. Roof runoff shall bypass treatment and is proposed to be directly plumbed to the infiltration facility. Each Contech Catch Basin can treat 12.53-gpm. Therefore, a total of 7 treatment basins are required. The proposed plan includes two, 2-cartridge filters and three, 1-cartrudge filters throughout the site proving ample stormwater treatment prior to entering the infiltration facility. A basin map and the WWHM report are contained in Appendix A.

MR #7 – Flow Control

BMP T7.20, Infiltration Trenches, shall be implemented to infiltrate 100% of runoff produced onsite. The northwest portion of the site proposes a 150-ft long infiltration trench, and the southeast portion of the site proposes a series of two trenches, one at 170-ft and the other at 120' in length. All trenches are prosed to include 2-ft diameter perforated pipe. The northeast trench proposes two pipes and the southeast trenches propose the use of six pipes. Trench calculations can be found in Section 5 of this document.

MR #8 – Wetlands Protection

So long as MR #5 and MR #6 are implemented correctly, no adverse impacts to wetlands are expected to occur.

MR #9 – Operation and Maintenance

All stormwater treatment and facility operation and maintenance inside the property boundary shall be the obligation of the landowner. A detailed operation manual is in Section 7 of this report.

SECTION 5 – PERMANENT STORMWATER CALCUALTIONS

Infiltration/Retention Facility

To determine the size of infiltration/retention facility needed for this site, a 5-ft deep trapezoidal pond with 0:1 (H:V) side slopes was modeled in WWHM2012. This model determined the total volume of stormwater expected to enter the facility and used to determine the facility size. The total volume, V_{TOT}, below the riser was found to be 12,262-cf.

$$V_{TOT} = 0.2815\,{}^{ac}/_{ft} * 43560\,{}^{ft}/_{ac} = 12{,}262cf$$

The area, A_{Pipe}, of two 24-in (2-ft) pipe was calculated and found to be 6.28-sf.

$$A_{Pipes} = 2\left[\frac{\pi\left(D_{Pipe}\right)^2}{4}\right] = 2\left[\frac{\pi(2ft)^2}{4}\right] = 6.28sf$$

The total area of a 4-ft deep by 6-ft wide trench was calculated. This was modeled in WWHM with a 5-ft deep pond and a riser of 4-ft (since actual depth is equal to the riser depth). The total trench area was calculated to be 24-sf.

$$A_{Trench\,TOT} = Depth * Width = (4 * 6)ft = 24sf$$

The total area of void space (space between the rocks) inside the 24-sf trench was calculated Typically, void space, *X*, is a coefficient measured between 33% and 40%. To be conservative, rock voids at 33% was evaluated. The total void space area was found to be 5.84-sf.

$$A_{Rock\,Voids} = \left[\left(A_{Trench} - A_{Pipes}\right) * X_{Void\,Space}\right] = [(24 - 6.28)sf * 33\%] = 5.84sf$$

The total area the stormwater expected to infiltrate within the trench the was calculated, by the addition of the area in the pipes and the area in the void space and found to be 12.13-sf.

$$A_{TOT} = \left(A_{pipe} + A_{Rock\,Voids}\right) = (6.28 + 5.84)sf = 12.13sf$$

The total length of the trench was found by dividing the total runoff volume by the total area in the trench. However, since the northeast portion of the site will only collect 14% of the runoff and the southeast portion will collect the remaining 86%, the volume had to be appropriately applied to each area. The total trench length for the northeast portion calculated to be 141.52-ft and the southwest portion at 869.35-ft.

$$L_{Trench\,NE} = \frac{14\%(V_{TOT})}{A_{TOT}} = \frac{1{,}716.68cf}{12.13sf} = 141.52ft$$

$$L_{Trench\,SW} = \frac{86\%(V_{TOT})}{A_{TOT}} = \frac{10{,}545.32cf}{12.13sf} = 869.35ft$$

Based on these calculations it was determined to properly infiltrate, there needs to be a trench with two, 2-ft pipes at a length of 141.52-ft each in the northeast

trench and 869.35-ft each in the southwest trench. This plan proposes a 150-ft trench with two, 2-ft pipe at 150-ft long to more than accommodate the runoff in the northeast. Due to spatial limitations, two pipes at 870-ft long were not possible in the southeast. Therefore, the trench dimensions were tripled so the pipe length could reduce by three. This resulted in six, 2-ft pipes at a length of 290-ft each. This was further split into two sections, one at 170-ft and the other at 120-ft long, so treatment catch basins could be placed throughout the site adequately treating the stormwater runoff before infiltrating into the trenches.

SECTION 6 – CONSTRUCTION SWPPP

This project is required to prepare a construction Storm Water Pollution Prevention Plan in accordance with MR #2 and must be prepared in accordance with Volume II Chapter 3 of the SWMMWW.

This drainage and erosion control report is intended to supplement the construction SWPPP by utilizing other sections in this report to cover required narrative elements. Also, the construction and erosion control plans supplied for the project are to act as the required drawing component of the construction SWPPP.

Intended BMPs which should be used during construction include, but are not limited to:

- BMP C120: Temporary and Permanent Seeding
- BMP C121: Mulching
- BMP 130: Surface Roughening
- BMP C140: Dust Control
- BMP C153: Material Delivery, Storage and Containment
- BMP C160: Certified Erosion and Sediment Control Lead
- BMP C162: Scheduling
- BMP C233: Silt Fence

Alpine Mini Storage and RV Parking

Chehalis, WA

CONSTRUCTION STORMWATER POLLUTION PREVENTION PLAN (SWPPP)

Fuller Designs Project No. 2156
January 21, 2022

Prepared by:

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Stormwater Pollution Prevention Plan

General Requirements

Clearing and grading activities for the Project shall be permitted only to the approved site development plan. These clearing and grading areas were established to preserve sensitive areas, buffers, native growth protection easements, and tree retention areas. These areas are delineated on the site plans and shall be marked on the development site.

The SWPPP shall be implemented beginning with initial land disturbance and until final stabilization. Sediment and Erosion Control BMPs shall be consistent with the BMPs contained in Chapters 3 and 4 of Volume II of the 2014 Washington State Department of Ecology (WSDOE) Stormwater Management Manual for Western Washington (SWMMWW).

Seasonal Work Limitations - From October 15 through April 1, clearing, grading, and other soil disturbing activities shall only be permitted if shown to the satisfaction of the local permitting authority that silt-laden runoff will be prevented from leaving the site through a combination of the following:

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

Project Requirements - Construction SWPPP Elements

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

Element 1: Preserve Vegetation/Mark Clearing Limits

- Before beginning land-disturbing activities, including clearing and grading, clearly mark all clearing limits, sensitive areas, and their buffers, and trees that are to be preserved within the construction area.
- Retain the duff layer, native topsoil, and natural vegetation in an undisturbed state to the maximum degree practicable.

Element 2: Establish Construction Access

- Limit construction vehicle access and exit to one route, if possible.
- Stabilize access points with a pad of quarry spalls, crushed rock, or other equivalent BMPs to minimize sediment tracking onto public roads.
- Locate wheel wash or tire baths on-site if the stabilized construction entrance is not effective in preventing tracking sediment onto roads.

- If sediment is tracked off-site, clean the affected roadway thoroughly at the end of each day, or more frequently if necessary (for example, during wet weather). Remove the sediment from roads by shoveling, sweeping, or pick up and transport the sediment to a controlled sediment disposal area.
- Conduct street washing only after the sediment is removed following the above procedure.
- Control street wash wastewater by pumping back on-site or otherwise preventing it from discharging into systems tributary to the State's waters.

Element 3: Control Flow Rates

- Protect properties and waterways downstream of development sites from erosion and the associated discharge of turbid waters due to increases in the velocity and peak volumetric flow rate of stormwater runoff from the project site.
- Where necessary to comply with the bullet above, construct stormwater retention or detention facilities as one of the first grading steps. Assure that detention facilities function properly before constructing site improvements (e.g., impervious surfaces).
- If permanent infiltration ponds are used for flow control during construction, protect these facilities from siltation during the construction phase.

Element 4: Install Sediment Controls

- Design, install, and maintain adequate erosion controls, and sediment controls to minimize pollutants' discharge.
- Construct sediment control BMPs (sediment ponds, traps, filters, etc.) as one of the first grading steps. These BMPs shall be functional before other land-disturbing activities take place.
- Minimize sediment discharges from the site. The design, installation, and maintenance of erosion and sediment controls must address factors such as the amount, frequency, intensity and duration of precipitation, the nature of resulting stormwater runoff, and soil characteristics, including the range of soil particle sizes expected to be present on the site.
- Before the runoff leaves a construction site or before the discharge to an infiltration facility, direct stormwater runoff from the disturbed areas through a sediment pond or other appropriate sediment removal BMP. Runoff from fully stabilized areas may be discharged without a sediment removal BMP but must meet the flow control performance standard in Element #3, bullet #1.
- Locate BMPs intended to trap sediment on-site to avoid interference with juvenile salmonids' movement attempting to enter off-channel areas or drainages.
- Where feasible, design outlet structures that withdraw impounded stormwater from the surface avoid discharging sediment that is still suspended lower in the water column.

Element 5: Stabilize Soils

- Stabilize exposed and unworked soils by application of effective BMPs that prevent erosion. Applicable BMPs include but are not limited to: temporary and permanent seeding, sodding, mulching, plastic covering, erosion control fabrics and matting, soil application of polyacrylamide (PAM), the early application of gravel base early on areas to be paved, and dust control.

- Control stormwater volume and velocity within the site to minimize soil erosion.
- Control stormwater discharges, including peak flow rates and total stormwater volume, to minimize erosion at outlets and minimize downstream channel and stream bank erosion.
- Soils must not remain exposed and unworked for more than the time periods set forth below to prevent erosion:
    - During the dry season (April 2 – October 14): 7 days
    - During the wet season (October 15 - April 1): 2 days
    - Note that projects performing work under an NPDES Construction Stormwater General Permit issued by Ecology will have more restrictive time periods.
- Stabilize soils at the end of the shift before a holiday or weekend, if needed, based on the weather forecast.
- Stabilize soil stockpiles from erosion, protected with sediment trapping measures, and where possible, be located away from storm drain inlets, waterways, and drainage channels.
- Minimize the amount of soil exposed during construction activity.
- Minimize the disturbance of steep slopes.
- Minimize soil compaction and, unless infeasible, preserve topsoil.

Element 6: Protect Slopes

- Design and construct cut-and-fill slopes in a manner to minimize erosion. Applicable practices include, but are not limited to, reducing the continuous length of a slope with terracing and diversions, reducing slope steepness, and roughening sloped surfaces (for example, track walking).
- Divert off-site stormwater (run-on) or groundwater away from slopes and disturbed areas with interceptor dikes, pipes, and/or swales. Off-site stormwater should be managed separately from stormwater generated on the site.
- At the top of slopes, collect drainage in pipe slope drains or protected channels to prevent erosion.
- Place excavated material on the uphill side of trenches, consistent with safety and space considerations.
- Place check dams at regular intervals within constructed channels that are cut down a slope.

Element 7: Protect Drain Inlets

- Protect all storm drain inlets made operable during construction so that stormwater runoff shall not enter the conveyance system without first being filtered or treated to remove sediment.
- Clean or remove and replace inlet protection devices when sediment has filled one-third of the available storage (unless the product manufacturer specifies a different standard).

Element 8: Stabilize Channels and Outlets

- Design, construct and stabilize all on-site conveyance channels.
- Provide stabilization, including armoring material, adequate to prevent erosion of outlets, adjacent stream banks, slopes, and downstream reaches at the outlets of all conveyance systems.

Element 9: Control Pollutants

- Design, install, implement, and maintain effective pollution prevention measures to minimize the discharge of pollutants.
- Handle and dispose of all pollutants, including waste materials and demolition debris that occur on-site in a manner that does not contaminate stormwater.
- Provide cover, containment, and protection from vandalism for all chemicals, liquid products, petroleum products, and other materials that have the potential to pose a threat to human health or the environment. On-site fueling tanks must include secondary containment. Secondary containment means placing tanks or containers within an impervious structure capable of containing 110% of the largest tank's volume within the containment structure. Double-walled tanks do not require additional secondary containment.
- Conduct maintenance, fueling, and repair of heavy equipment and vehicles using spill prevention and control measures. Clean contaminated surfaces immediately following any spill incident.
- To prevent discharge to surface water, discharge the wheel wash or tire bath wastewater to a separate on-site treatment system such as closed-loop recirculation or upland application, or the sanitary sewer, with local sewer district approval.
- Apply fertilizers and pesticides in a manner and at application rates that will not result in a chemical loss to stormwater runoff. Follow manufacturers' label requirements for application rates and procedures.
- Use BMPs to prevent contamination of stormwater runoff by pH modifying sources. The sources for this contamination include, but are not limited to: bulk cement, cement kiln dust, fly ash, new concrete washing and curing waters, waste streams generated from concrete grinding and sawing, exposed aggregate processes, dewatering concrete vaults, concrete pumping, and mixer washout waters.
- Adjust the pH of stormwater if necessary, to prevent violations of water quality standards.
- Assure that washout of concrete trucks is performed off-site or in designated concrete washout areas only. Do not wash out concrete trucks onto the ground or into storm drains, open ditches, streets, or streams. Do not dump excess concrete on-site, except in designated concrete washout areas. Concrete spillage or concrete discharge to surface waters of the State is prohibited.
- Obtain written approval from Ecology before using a chemical treatment other than CO2 or dry ice to adjust pH.

Element 10: Control De-Watering

- Discharge foundation, vault, and trench dewatering water, which has similar characteristics to stormwater runoff at the site, into a controlled conveyance system before discharge to a sediment trap or sediment pond.
- Discharge clean, non-turbid dewatering water, such as well-point groundwater, to systems tributary to, or directly into surface waters of the State, as specified in Element #8, provided the dewatering flow does not cause erosion or flooding of receiving waters. Do not route clean dewatering water through stormwater sediment ponds. Note that "surface waters of the State" may exist on a construction site as well as off-site; for example, a creek running through a site.
- Handle highly turbid or otherwise contaminated dewatering water separately from stormwater.

- Other treatment or disposal options may include:
    1. Infiltration
    2. Transport off-site in a vehicle, such as a vacuum flush truck, for legal disposal in a manner that does not pollute state waters
    3. Ecology-approved on-site chemical treatment or other suitable treatment technologies
    4. Sanitary or combined sewer discharge with local sewer district approval if there is no other option
    5. Use of a sedimentation bag that discharges to a ditch or swale for small volumes of localized dewatering

Element 11: Maintain BMPs

- Maintain and repair all temporary and permanent erosion and sediment control BMPs as needed to assure continued performance of their intended function following BMP specifications.
- Remove all temporary erosion and sediment control BMPs within 30 days after achieving final site stabilization or after the temporary BMPs are no longer needed.

Element 12: Manage the Project

- Phase development projects to the maximum degree practicable and consider seasonal work limitations.
- Inspection and monitoring – Inspect, maintain, and repair all BMPs as needed to ensure continued performance of their intended function. Projects regulated under the Construction Stormwater General Permit must conduct site inspections and monitoring in accordance with Special Condition S4 of the Construction Stormwater General Permit.
- Maintaining an updated construction SWPPP – Maintain, update, and implement the SWPPP.
- Projects that disturb one or more acres must have site inspections conducted by a Certified Erosion and Sediment Control Lead (CESCL). Project sites disturbing less than one acre may have a CESCL or a person without CESCL certification conduct inspections. By initiating construction, the SWPPP must identify the CESCL or inspector, who must always be present on-site or on-call.
- The CESCL or inspector (project sites less than one acre) must have the skills to assess the:
    - Site conditions and construction activities that could impact the quality of stormwater
    - Effectiveness of erosion and sediment control measures used to control the quality of stormwater discharges
- The CESCL or inspector must examine stormwater visually for the presence of suspended sediment, turbidity, discoloration, and oil sheen. They must evaluate the effectiveness of BMPs and determine if it is necessary to install, maintain, or repair BMPs to improve the quality of stormwater discharges.
- Based on the results of the inspection, construction site operators must correct the problems identified by:
    - Reviewing the SWPPP for compliance with the 13 construction SWPPP elements and making appropriate revisions within seven (7) calendar days of the inspection.

- Immediately begin the process of fully implementing and maintaining appropriate source control and/or treatment BMPs as soon as possible, addressing the problems not later than within ten (10) days of the inspection. If the installation of necessary treatment BMPs is not feasible within ten (10) days, the construction site operator may request an extension within the initial 10day response period.
- Documenting BMP implementation and maintenance in the site logbook (sites larger than one acre).
- The CESCL or inspector must inspect all areas disturbed by construction activities, all BMPs, and all stormwater discharge points at least once every calendar week and within 24 hours of any discharge from the site. (For purposes of this condition, individual discharge events that last more than one day do not require daily inspections. For example, if a stormwater pond discharges continuously over the course of a week, only one inspection is required that week.) The CESCL or inspector may reduce the inspection frequency for temporary stabilized, static sites to once every calendar month.

Element 13: Protect Low Impact Development BMPs

- Protect all Bioretention and Rain Garden BMPs from sedimentation through installation and maintenance of erosion and sediment control BMPs on portions of the site that drain into the Bioretention and/or Rain Garden BMPs. Restore the BMPs to their fully functioning condition if they accumulate sediment during construction. Restoring the BMP must include removing sediment and any sediment-laden Bioretention/rain garden soils and replacing the removed soils with soils meeting the design specification.
- Prevent compacting Bioretention and rain garden BMPs by excluding construction equipment and foot traffic. Protect completed lawn and landscaped areas from compaction due to construction equipment.
- Control erosion and avoid introducing sediment from surrounding land uses onto permeable pavements. Do not allow muddy construction equipment on the base material or pavement. Do not allow sediment-laden runoff onto permeable pavements or base materials.
- Pavement fouled with sediments or no longer passing an initial infiltration test must be cleaned using procedures in accordance with this manual or the manufacturer's procedures.
- Keep all heavy equipment off existing soils under LID facilities excavated to final grade to retain the soils' infiltration rate.

SECTION 7 – OPERATION AND MAINTENCE MANUAL

The following pages contains maintenance needs for the components that are part of the drainage system and components that you may not have. Let Fuller Designs know if any components are missing from these pages. Ignore the requirements that do not apply to your system. You should plan to complete a checklist for all system components on the following schedule:

1. Monthly from November through April
2. Once in late summer (preferably September)
3. After any major storm (use 1" of precipitation in 24 hours) for any items marked "S"

Using photocopies of these pages, check off the items you looked for after each inspection. Add comments on issues found and actions taken. Keep these records in your files. These files will be needed to write your annual report if required. Some items may not need reviewed time an inspection is done. Use the suggested frequency at the left of each item as a guideline for your inspection.

You may call the city for technical assistance. Please do not hesitate to reach out, especially if you are unsure whether a situation you have discovered may be a developing issue.

CONTECH®
ENGINEERED SOLUTIONS

OPERATION AND MAINTENANCE

CatchBasin StormFilter™

Important: These guidelines should be used as a part of your site stormwater plan.

Overview
The CatchBasin StormFilter™ (CBSF) consists of a multi-chamber steel, concrete, or plastic catch basin unit. The steel CBSF is offered both as a standard and as a deep unit for additional internal overflow and sediment capacity.

The CBSF is installed flush with the finished grade and is applicable for both constrained lot and retrofit applications. Steel and concrete units can accept surface and piped influent for roof leaders or similar applications.

The steel, concrete and plastic CBSF units have capacities of 4, 8 and 2 cartridges, respectively. Internal overflow capacity varies by system type from 0.5 cfs for the plastic, 1.3 cfs for the concrete and 1.0 or 1.8 cfs for the steel unit.

Design Operation
The CBSF is installed as the primary receiver of runoff, similar to a standard, grated catch basin. The steel and concrete CBSF units have an H-20 rated, traffic bearing lid that allows the filter to be installed in parking lots, and for all practical purposes, takes up no land area. Plastic units can be used in landscaped areas or other non-traffic-bearing applications.

The steel CBSF consists of a sumped inlet chamber and cartridge chamber(s). Runoff enters the sumped inlet chamber either by sheet flow from a paved surface or from an inlet pipe discharging directly to the unit vault. The inlet chamber is equipped with an internal baffle, which traps debris and floating oil and grease, and an overflow weir. While in the inlet chamber, heavier solids are allowed to settle into the deep sump, while lighter solids and soluble pollutants are directed into the cartridge chamber through a port between the baffle and the overflow weir.

The concrete and plastic units operate similarly minus the presence of the inlet chamber or deep sump.

Once in the cartridge chamber, polluted water ponds and percolates horizontally through the media in the filter cartridges. Treated water collects in the cartridge's center tube from where it is directed to the outlet chamber and discharged to the outlet pipe on the downstream side of the overflow weir.

When influent flows exceed the water quality design value, excess water spills over the overflow weir, bypassing the cartridge bay, and discharges to the outlet pipe.

Applications
The CBSF is particularly useful where small flows are being treated or for sites that have little available hydraulic head. The unit is ideal for applications in which standard catch basins are to be used. Both water quality and catchment issues can be resolved with the use of the CBSF.

Retro-Fit
The retrofit market has many possible applications for the CBSF. The CBSF can be installed by replacing an existing catch basin without having to "chase the grade," thus reducing the high cost of re piping the storm system.

CONTECH® ENGINEERED SOLUTIONS

OPERATION AND MAINTENANCE

CatchBasin StormFilter™

Maintenance Guidelines

Maintenance procedures for typical catch basins can be applied to the CatchBasin StormFilter (CBSF). The filter cartridges contained in the CBSF are easily removed and replaced during maintenance activities according to the following guidelines.

1. Establish a safe working area as per typical catch basin service activity.
2. Remove steel grate and diamond plate cover (weight 100 lbs. each) or plastic grating.
3. Turn cartridge(s) approximately ¼ turn counter-clockwise to disconnect from pipe manifold.
4. Remove cartridge(s) from catch basin by hand or with appropriate hoisting equipment.
5. Remove accumulated sediment via vactor truck from all interior chambers.
6. Rinse interior of both bays and vactor remaining water and sediment.
7. Install fresh cartridge(s), by rotating ¼ turn clockwise, taking care not to damage cartridge connectors.
8. Replace cover(s).
9. Dispose of accumulated debris and spent media in accordance with local regulations.
10. Return used, empty cartridges to Contech for refurbishing.

Media may be removed from the filter cartridges using the vactor truck before the cartridges are removed from the catch basin structure once the top cap and hood are removed. The vactor truck must be equipped with a hose capable of reaching areas of restricted clearance.

Empty cartridges can be easily removed from the catch basin structure by hand. Empty cartridges should be reassembled and returned to Contech as appropriate.

Refurbished cartridges are available from Contech on an exchange basis. Contact the maintenance department of Contech at 513-645-7770 for more information.

Onsite maintenance is estimated at 26 minutes once setup for a single cartridge unit. Add approximately 5 minutes for each additional cartridge.

Mosquito Abatement

In certain areas of the United States, mosquito abatement is desirable to reduce the incidence of vectors.

In BMPs with standing water, which could provide mosquito breeding habitat, certain abatement measures can be taken.

1. Periodic observation of the standing water to determine if the facility is harboring mosquito larvae.
2. Regular catch basin maintenance.
3. Use of larvicides containing Bacillus thuringiensis israelensis (BTI). BTI is a bacterium toxic to mosquito and black fly larvae.

In some cases, the presence of petroleum hydrocarbons may interrupt the mosquito growth cycle.

Using Larvicides in the CatchBasin StormFilter

Larvicides should be used according to manufacturer's recommendations.

Two widely available products are Mosquito Dunks and Summit B.t.i. Briquets. For more information, visit https://www.amvac.com/products/summit-bti-briquets.

The larvicide must be in contact with the permanent pool. The larvicide should also be fastened to the CatchBasin StormFilter to prevent displacement by high flows. A magnet can be used with a steel catch basin.

For more information on mosquito abatement in stormwater BMPs, refer to the following: https://anrcatalog.ucanr.edu/pdf/8125.pdf.

Table V-A.2: Maintenance Standards - Infiltration

Maintenance Component	Defect	Conditions When Maintenance Is Needed	Results Expected When Maintenance Is Performed
General	Trash & Debris	See Table V-A.1: Maintenance Standards - Detention Ponds	See Table V-A.1: Maintenance Standards - Detention Ponds
	Poisonous/Noxious Vegetation	See Table V-A.1: Maintenance Standards - Detention Ponds	See Table V-A.1: Maintenance Standards - Detention Ponds
	Contaminants and Pollution	See Table V-A.1: Maintenance Standards - Detention Ponds	See Table V-A.1: Maintenance Standards - Detention Ponds
	Rodent Holes	See Table V-A.1: Maintenance Standards - Detention Ponds	See Table V-A.1: Maintenance Standards - Detention Ponds
Storage Area	Sediment	Water ponding in infiltration pond after rainfall ceases and appropriate time allowed for infiltration. Treatment basins should infiltrate Water Quality Design Storm Volume within 48 hours, and empty within 24 hours after cessation of most rain events.	Sediment is removed and/or facility is cleaned so that infiltration system works according to design.

Table V-A.2: Maintenance Standards - Infiltration (continued)

Maintenance Component	Defect	Conditions When Maintenance Is Needed	Results Expected When Maintenance Is Performed
		(A percolation test pit or test of facility indicates facility is only working at 90% of its designed capabilities. Test every 2 to 5 years. If two inches or more sediment is present, remove).	
Filter Bags (if applicable)	Filled with Sediment and Debris	Sediment and debris fill bag more than 1/2 full.	Filter bag is replaced or system is redesigned.
Rock Filters	Sediment and Debris	By visual inspection, little or no water flows through filter during heavy rain storms.	Gravel in rock filter is replaced.
Side Slopes of Pond	Erosion	See Table V-A.1: Maintenance Standards - Detention Ponds	See Table V-A.1: Maintenance Standards - Detention Ponds
Emergency Overflow Spillway and Berms over 4 feet in height.	Tree Growth	See Table V-A.1: Maintenance Standards - Detention Ponds	See Table V-A.1: Maintenance Standards - Detention Ponds
	Piping	See Table V-A.1: Maintenance Standards - Detention Ponds	See Table V-A.1: Maintenance Standards - Detention Ponds
Emergency Overflow Spillway	Rock Missing	See Table V-A.1: Maintenance Standards - Detention Ponds	See Table V-A.1: Maintenance Standards - Detention Ponds
	Erosion	See Table V-A.1: Maintenance Standards - Detention Ponds	See Table V-A.1: Maintenance Standards - Detention Ponds
Pre-settling Ponds and Vaults	Facility or sump filled with Sediment and/or debris	6" or designed sediment trap depth of sediment.	Sediment is removed.

Table V-A.1: Maintenance Standards - Detention Ponds

Maintenance Component	Defect	Conditions When Maintenance Is Needed	Results Expected When Maintenance Is Performed
General	Trash & Debris	Any trash and debris which exceed 1 cubic feet per 1,000 square feet. In general, there should be no visual evidence of dumping. If less than threshold all trash and debris will be removed as part of next scheduled maintenance.	Trash and debris cleared from site
	Poisonous Vegetation and noxious weeds	Any poisonous or nuisance vegetation which may constitute a hazard to maintenance personnel or the public. Any evidence of noxious weeds as defined by State or local regulations. (Apply requirements of adopted IPM policies for the use of herbicides).	No danger of poisonous vegetation where maintenance personnel or the public might normally be. (Coordinate with local health department) Complete eradication of noxious weeds may not be possible. Compliance with State or local eradication policies required
	Contaminants and Pollution	Any evidence of oil, gasoline, contaminants or other pollutants (Coordinate removal/cleanup with local water quality response agency).	No contaminants or pollutants present.
	Rodent Holes	Any evidence of rodent holes if facility is acting as a dam or berm, or any evidence of water piping through dam or berm via rodent holes.	Rodents destroyed and dam or berm repaired. (Coordinate with local health department; coordinate with Ecology Dam Safety Office if pond exceeds 10 acre-feet.)
	Beaver Dams	Dam results in change or function of the facility.	Facility is returned to design function. (Coordinate trapping of beavers and removal of dams with appropriate permitting agencies)
	Insects	When insects such as wasps and hornets interfere with maintenance activities.	Insects destroyed or removed from site. Apply insecticides in compliance with adopted IPM policies
	Tree Growth and Hazard Trees	Tree growth does not allow maintenance and inspection access or interferes with maintenance activity (i.e., slope mowing, silt removal, vactoring, or equipment movements). If trees are not interfering with access or maintenance, do not remove If dead, diseased, or dying trees are identified (Use a certified Arborist to determine health of tree or removal requirements)	Trees do not hinder maintenance activities. Harvested trees should be recycled into mulch or other beneficial uses (e.g., alders for firewood). Remove hazard Trees
Side Slopes of Pond	Erosion	Eroded damage over 2 inches deep where cause of damage is still present or where there is potential for continued erosion. Any erosion observed on a compacted berm embankment.	Slopes should be stabilized using appropriate erosion control measure(s); e.g.,rock reinforcement, planting of grass, compaction. If erosion is occurring on compacted berms a licensed engineer in the state of Washington should be consulted to resolve source of erosion.
Storage Area	Sediment	Accumulated sediment that exceeds 10% of the designed pond depth unless otherwise specified or affects inletting or outletting condition of the facility.	Sediment cleaned out to designed pond shape and depth; pond reseeded if necessary to control erosion.

Table V-A.1: Maintenance Standards - Detention Ponds (continued)

Maintenance Component	Defect	Conditions When Maintenance Is Needed	Results Expected When Maintenance Is Performed
	Liner (if Applicable)	Liner is visible and has more than three 1/4-inch holes in it.	Liner repaired or replaced. Liner is fully covered.
Ponds Berms (Dikes)	Settlements	Any part of berm which has settled 4 inches lower than the design elevation If settlement is apparent, measure berm to determine amount of settlement Settling can be an indication of more severe problems with the berm or outlet works. A licensed engineer in the state of Washington should be consulted to determine the source of the settlement.	Dike is built back to the design elevation.
	Piping	Discernable water flow through pond berm. Ongoing erosion with potential for erosion to continue. (Recommend a Goethechnical engineer be called in to inspect and evaluate condition and recommend repair of condition.	Piping eliminated. Erosion potential resolved.
Emergency Overflow/ Spillway and Berms over 4 feet in height	Tree Growth	Tree growth on emergency spillways creates blockage problems and may cause failure of the berm due to uncontrolled overtopping. Tree growth on berms over 4 feet in height may lead to piping through the berm which could lead to failure of the berm.	Trees should be removed. If root system is small (base less than 4 inches) the root system may be left in place. Otherwise the roots should be removed and the berm restored. A licensed engineer in the state of Washington should be consulted for proper berm/spillway restoration.
	Piping	Discernable water flow through pond berm. Ongoing erosion with potential for erosion to continue. (Recommend a Geotechnical engineer be called in to inspect and evaluate condition and recommend repair of condition.	Piping eliminated. Erosion potential resolved.
Emergency Overflow/Spillway	Emergency Overflow/Spillway	Only one layer of rock exists above native soil in area five square feet or larger, or any exposure of native soil at the top of out flow path of spillway. (Rip-rap on inside slopes need not be replaced.)	Rocks and pad depth are restored to design standards.
	Erosion	See "Side Slopes of Pond"	

Pages 1005 - 1007 of the 2019 SWMMWW

SECTION 8 – SPECIAL REPORTS AND STUDIES

A WWHM2012 Model was ran to determine the amount runoff produced from the site and the water quality flow rate for treatment purposes. Mitigated and developed areas within the site basin are described in a Basin Map that aided the WWHM2012 Modeling. Both the WWHM report and Basin Map can be found in Appendix A.

A geotechnical report was prepared by NW Quality Geo.

SECTION 9 – MAINTAINANCE AGREEMENT

The following pages contain the maintenance agreement between the City of Chehalis and the Landowner.

AFTER RECORDING RETURN TO:

F & L Adventures (Floyd and Liz Smith)
243 Alderwood Dr. Chehalis, WA 98532
Chehalis, WA 98532

PLEASE PRINT OR TYPE ALL INFORMATION DOCUMENT TITLE(S) (OR TRANSACTIONS CONTAINED THEREIN):
Stormwater Maintenance Agreement

REFERENCE NUMBER(S) OF DOCUMENTS ASSIGNED/RELEASED:

GRANTOR/BORROWER (LAST NAME FIRST, FIRST NAME AND INITIALS):
Smith, Floyd and Smith, Liz

ADDITIONAL NAMES LISTED ON PAGE N / A OF DOCUMENT.

GRANTEE/ASSIGNEE/BENEFICIARY (LAST NAME FIRST, FIRST NAME AND INITIALS):
City of Chehalis, Washington

ADDITIONAL NAMES LISTED ON PAGE N / A OF DOCUMENT.

LEGAL DESCRIPTION (ABBREVIATED: I.E. LOT, BLOCK, PLAT OR SECTION, TOWNSHIP, RANGE)
Section 10 Township 13N Range 02W

COMPLETE LEGAL DESCRIPTION IS LISTED ON PAGE N / A OF DOCUMENT.

ASSESSOR'S TAX PARCEL NUMBER(S)

0178865-004-002, 017896-006-003, 017896-005-000 and 017765-005-000

THE AUDITOR/RECORDER WILL RELY ON THE INFORMATION PROVIDED ON THIS FORM. THE STAFF WILL NOT READ THE DOCUMENT TO VERIFY THE ACCURACY OR COMPLETENESS OF THE INDEXING INFORMATION PROVIDED HEREIN.

Parcel Number(s): 0178865-004-002, 017896-006-003, 017896-005-000, 017765-005-000

Project Name: Alpine Mini Storage and RV Parking
Address: 0 Hamilton Rd. Chehalis WA 98532

THIS AGREEMENT, made this_____day of_____, 2022, by and between Dashiell A and Jerrie L Paine, hereinafter referred to as the "Owners(s)" of the following property and City of Chehalis hereinafter referred to as the "City".

WITNESSETH, that

WHEREAS, Owner has submitted for approval by the City a permit application and Site Plan for the construction and installation of stormwater management facilities pursuant to City Code chapter 12.04.340

WHEREAS, the City Code requires, as a condition of permit approval, a maintenance agreement between the City and the Owner ensuring the Owner constructs and maintains the stormwater facilities identified in the Site Plan.

THEREFORE, the Owner of certain real property, with full authority to execute deeds, mortgages, other covenants, do hereby covenant with the City and agree as follows:

1. Owner shall construct and install stormwater management facilities as depicted and shown on the Record Drawings for the above referenced parcel number(s)

2. Owner shall continuously maintain the stormwater management facilities as shown on the Site Plan in good working order and as specified in the maintenance schedule.

3. Owner hereby grants the City, its authorized agents and employees, to enter onto the Property to inspect the stormwater facilities pursuant to Chapter 12.04.340 of the City Code.

4. In the event Owner fails to maintain the stormwater management facilities as shown on the Site Plan in good working order acceptable to the City, the City may enter the Property and take whatever steps deemed necessary and appropriate to maintain (including repair or replace) said stormwater facilities. It is expressly understood and agreed that the City is under no obligation to maintain or repair or replace said facilities, and in no event shall this Agreement be construed to impose such an obligation on the City.

5. In the event that the City performs work of any nature pursuant to section 4 of this agreement or expends any funds in performance of such work for labor, equipment, supplies or materials, Owner shall reimburse City for all reasonable costs incurred. Owner, its executors, administrators, assigns, heirs, and any other successors in interest, shall reimburse City for all costs within thirty (30) days of Owner's receipt of written

demand by the City for reasonable costs incurred, including but not limited to attorney fees, collection costs, and interest at the statutory rate.

6. It is the intent of this Agreement to ensure the continuous and proper maintenance of stormwater management facilities by the Owner, its heirs, successors and assigns; provided, however, that this Agreement shall not be deemed to create or affect any additional liability of any party for damage alleged to result from or caused by stormwater management.

7. Owner, its executors, administrators, assigns, and any other successors in interest, shall indemnify and hold the City, its agents and employees harmless from any and all damages, accidents, casualties, occurrences, or claims which might arise or be asserted against City, its agents or employees, from the construction, presence, existence, or maintenance, of the stormwater management facilities by Owner.

8. This Agreement shall be recorded among the land records of Lewis County, Washington, and shall constitute a covenant running with the land, and shall be binding upon Owner, its administrators, executors, assigns, heirs, and any other successor in interest.

Date : _____ Signature: _____

Name: _____

Title: _____

State of Washington County

of _____

I certify that I know or have satisfactory evidence that _____ (name of person) is the person who appeared before me, and said person acknowledged that (he/she) signed this instrument and acknowledged it to be (his/her) free and voluntary act for the uses and purposes mentioned in the instrument.

Dated: _____

(Seal or stamp)

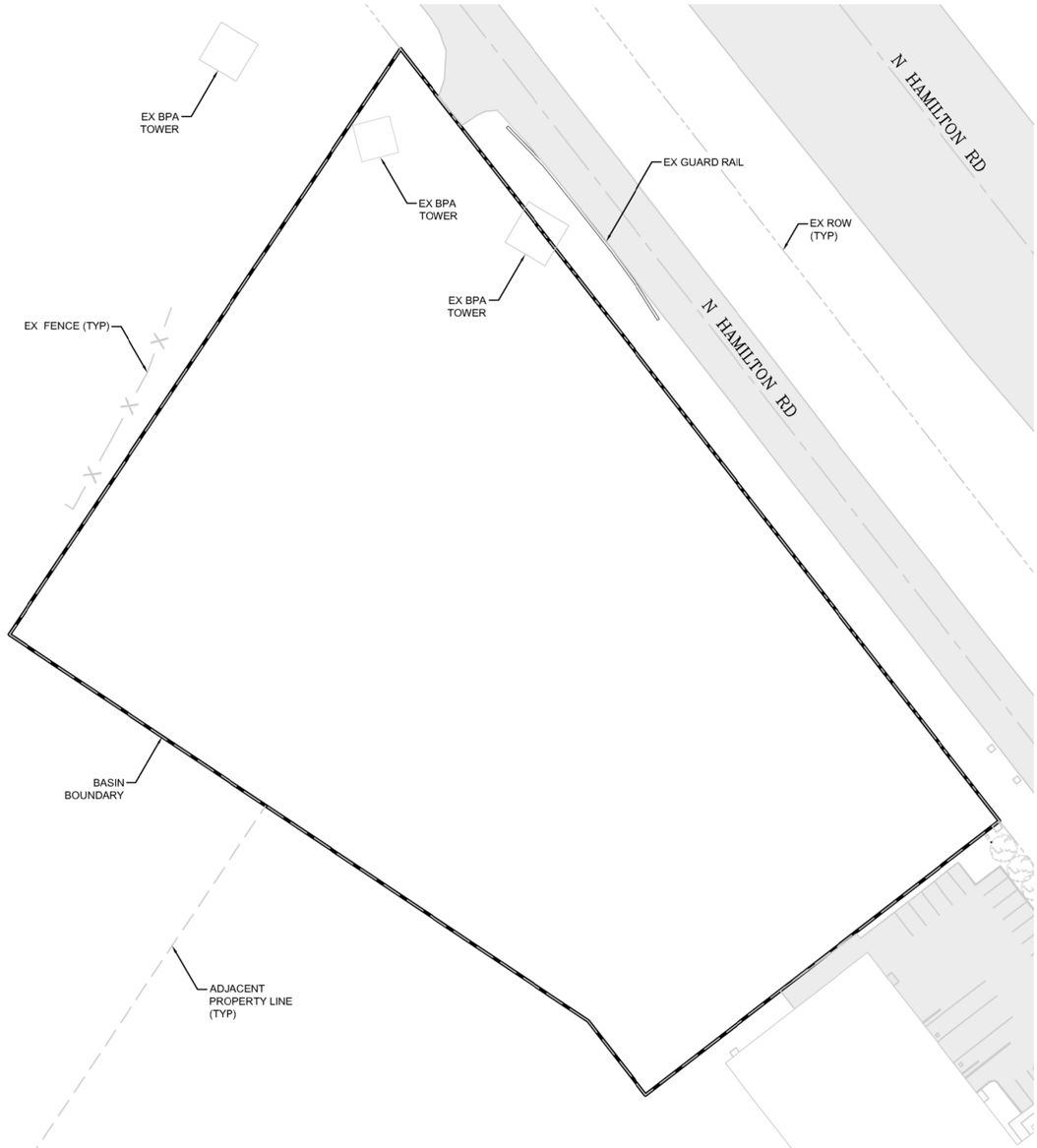
_____
Signature

_____
Title

My appointment expires: _____

APPENDIX A

SECTION 10 TOWNSHIP 13N RANGE 02W

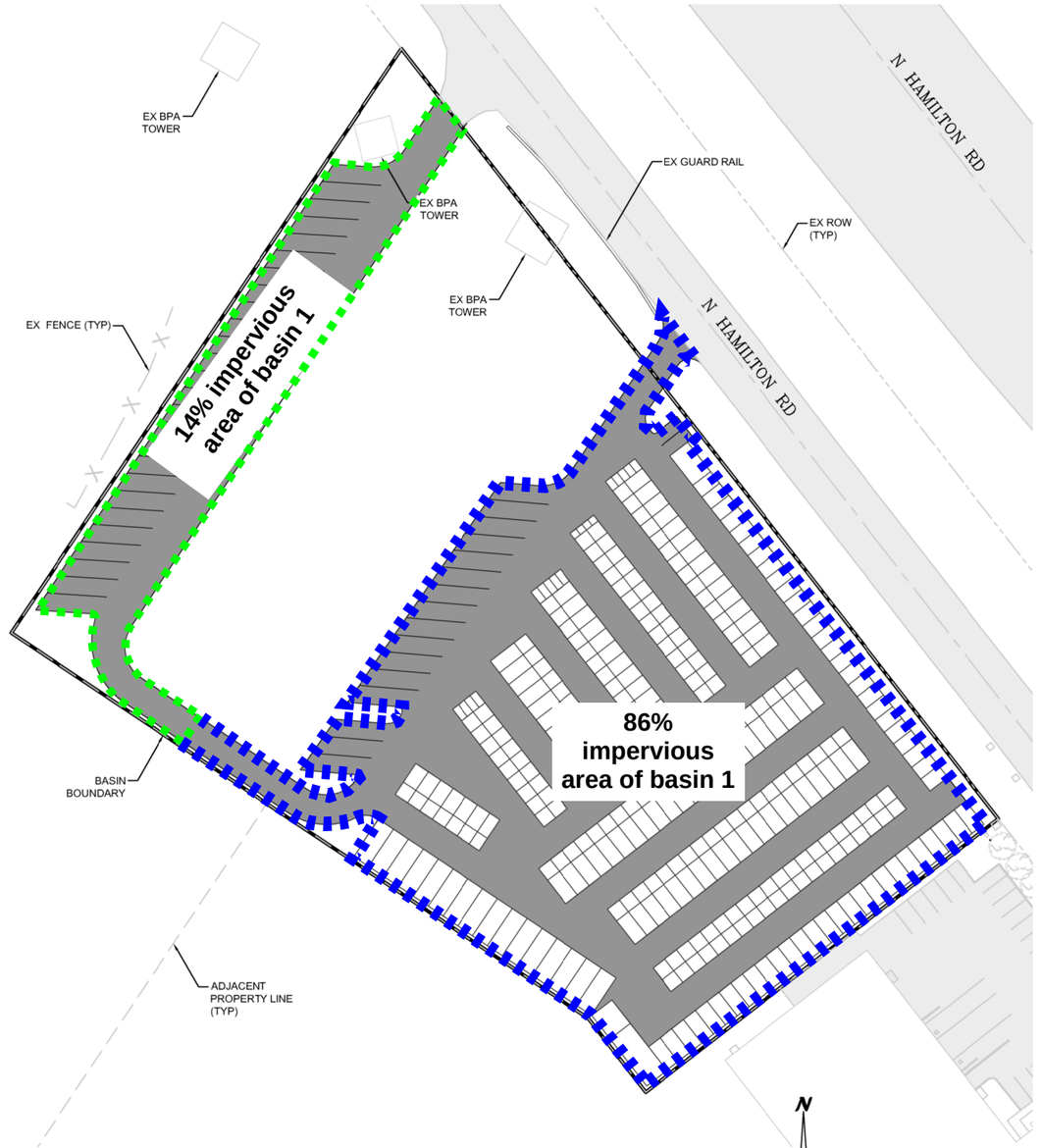


PRE DEVELOPED CONDITION:

BASIN

LANDSCAPE = 217800 SF

TOTAL AREA = 217800 SF = 5 AC

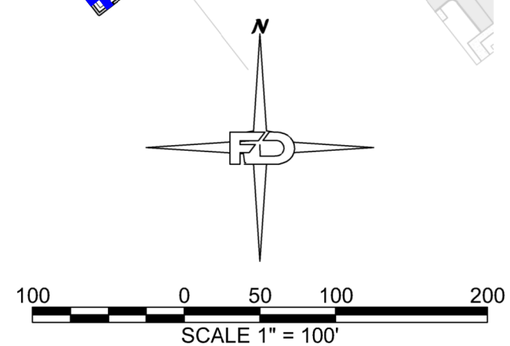


POST DEVELOPED CONDITION:

BASIN

ROOF = 50200 SF
AC PAVE = 88700 SF
LANDSCAPE = 78900 SF

TOTAL AREA = 217800 SF = 5 AC



DRAWING TITLE: BASIN MAP

SCALE: 1:100 | DATE: 1/4/22 | DRAWN: SD | CHECKED: AF

PROJECT NAME: ALPINE MINI STORAGE & RV PARKING

FULLER DESIGNS
1101 KRESKY AVE
CENTRALIA, WA 98531
(360) 807-4420

REV:	DESCRIPTION:	DATE:
0	ISSUED FOR CONSTRUCTION	1/4/22

BSN

1 OF 1

WWHM2012

PROJECT REPORT

General Model Information

Project Name:	Alpine Mini Storage
Site Name:	Alpine Mini Storage
Site Address:	N. Hamilton Road
City:	Chehalis
Report Date:	1/9/2022
Gage:	Olympia
Data Start:	1955/10/01
Data End:	2008/09/30
Timestep:	15 Minute
Precip Scale:	0.800
Version Date:	2019/09/13
Version:	4.2.17

POC Thresholds

Low Flow Threshold for POC1:	50 Percent of the 2 Year
High Flow Threshold for POC1:	50 Year
Low Flow Threshold for POC2:	50 Percent of the 2 Year
High Flow Threshold for POC2:	50 Year

Landuse Basin Data

Predeveloped Land Use

Basin 1

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
C, Pasture, Flat	5
Pervious Total	5
Impervious Land Use	acre
Impervious Total	0
Basin Total	5

Element Flows To:

Surface	Interflow	Groundwater

Mitigated Land Use

Basin 1

Bypass:	No
GroundWater:	No

Pervious Land Use	acre
C, Forest, Flat	1.82
Pervious Total	1.82

Impervious Land Use	acre
ROOF TOPS FLAT	1.15
DRIVEWAYS FLAT	2.03
Impervious Total	3.18
Basin Total	5

Element Flows To:

Surface	Interflow	Groundwater
Trapezoidal Pond 1	Trapezoidal Pond 1	

Basin 1 (no roof)

For water quality calculations only. Not used for flow control. Roof runoff will bypass treatment.

Bypass:	No
GroundWater:	No

Pervious Land Use	acre
C, Forest, Flat	1.82
Pervious Total	1.82

Impervious Land Use	acre
DRIVEWAYS FLAT	2.03
Impervious Total	2.03
Basin Total	3.85

Element Flows To:

Surface	Interflow	Groundwater

Mitigated Routing

Trapezoidal Pond 1

Bottom Length: 504.00 ft.
Bottom Width: 6.00 ft.
Depth: 5 ft.
Volume at riser head: 0.2815 acre-feet.
Infiltration On
Infiltration rate: 10.25
Infiltration safety factor: 1
Wetted surface area On
Total Volume Infiltrated (ac-ft.): 538.051
Total Volume Through Riser (ac-ft.): 0.101
Total Volume Through Facility (ac-ft.): 538.152
Percent Infiltrated: 99.98
Total Precip Applied to Facility: 0
Total Evap From Facility: 1.888
Side slope 1: 0 To 1
Side slope 2: 0 To 1
Side slope 3: 0 To 1
Side slope 4: 0 To 1
Discharge Structure
Riser Height: 4 ft.
Riser Diameter: 24 in.
Element Flows To:
Outlet 1 Outlet 2

infiltration volume needed =12262cf

0.02% of runoff will be released during large storm events. This amount is below predeveloped levels and passes duration analysis

facility will be 4' deep.

Pond Hydraulic Table

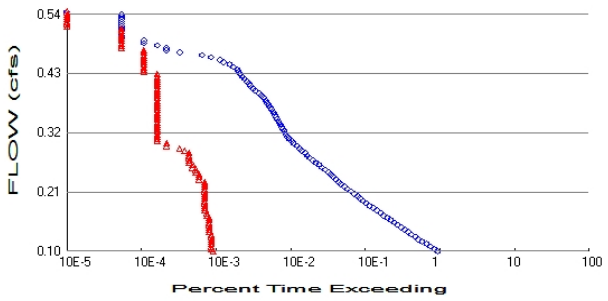
Stage(feet)	Area(ac.)	Volume(ac-ft.)	Discharge(cfs)	Infilt(cfs)
0.0000	0.069	0.000	0.000	0.000
0.0556	0.069	0.003	0.000	0.717
0.1111	0.069	0.007	0.000	0.717
0.1667	0.069	0.011	0.000	0.717
0.2222	0.069	0.015	0.000	0.717
0.2778	0.069	0.019	0.000	0.717
0.3333	0.069	0.023	0.000	0.717
0.3889	0.069	0.027	0.000	0.717
0.4444	0.069	0.030	0.000	0.717
0.5000	0.069	0.034	0.000	0.717
0.5556	0.069	0.038	0.000	0.717
0.6111	0.069	0.042	0.000	0.717
0.6667	0.069	0.046	0.000	0.717
0.7222	0.069	0.050	0.000	0.717
0.7778	0.069	0.054	0.000	0.717
0.8333	0.069	0.057	0.000	0.717
0.8889	0.069	0.061	0.000	0.717
0.9444	0.069	0.065	0.000	0.717
1.0000	0.069	0.069	0.000	0.717
1.0556	0.069	0.073	0.000	0.717
1.1111	0.069	0.077	0.000	0.717
1.1667	0.069	0.081	0.000	0.717
1.2222	0.069	0.084	0.000	0.717
1.2778	0.069	0.088	0.000	0.717
1.3333	0.069	0.092	0.000	0.717
1.3889	0.069	0.096	0.000	0.717

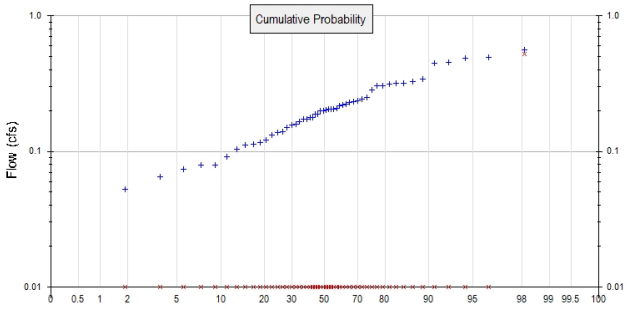
1.4444	0.069	0.100	0.000	0.717
1.5000	0.069	0.104	0.000	0.717
1.5556	0.069	0.108	0.000	0.717
1.6111	0.069	0.111	0.000	0.717
1.6667	0.069	0.115	0.000	0.717
1.7222	0.069	0.119	0.000	0.717
1.7778	0.069	0.123	0.000	0.717
1.8333	0.069	0.127	0.000	0.717
1.8889	0.069	0.131	0.000	0.717
1.9444	0.069	0.135	0.000	0.717
2.0000	0.069	0.138	0.000	0.717
2.0556	0.069	0.142	0.000	0.717
2.1111	0.069	0.146	0.000	0.717
2.1667	0.069	0.150	0.000	0.717
2.2222	0.069	0.154	0.000	0.717
2.2778	0.069	0.158	0.000	0.717
2.3333	0.069	0.162	0.000	0.717
2.3889	0.069	0.165	0.000	0.717
2.4444	0.069	0.169	0.000	0.717
2.5000	0.069	0.173	0.000	0.717
2.5556	0.069	0.177	0.000	0.717
2.6111	0.069	0.181	0.000	0.717
2.6667	0.069	0.185	0.000	0.717
2.7222	0.069	0.189	0.000	0.717
2.7778	0.069	0.192	0.000	0.717
2.8333	0.069	0.196	0.000	0.717
2.8889	0.069	0.200	0.000	0.717
2.9444	0.069	0.204	0.000	0.717
3.0000	0.069	0.208	0.000	0.717
3.0556	0.069	0.212	0.000	0.717
3.1111	0.069	0.216	0.000	0.717
3.1667	0.069	0.219	0.000	0.717
3.2222	0.069	0.223	0.000	0.717
3.2778	0.069	0.227	0.000	0.717
3.3333	0.069	0.231	0.000	0.717
3.3889	0.069	0.235	0.000	0.717
3.4444	0.069	0.239	0.000	0.717
3.5000	0.069	0.243	0.000	0.717
3.5556	0.069	0.246	0.000	0.717
3.6111	0.069	0.250	0.000	0.717
3.6667	0.069	0.254	0.000	0.717
3.7222	0.069	0.258	0.000	0.717
3.7778	0.069	0.262	0.000	0.717
3.8333	0.069	0.266	0.000	0.717
3.8889	0.069	0.270	0.000	0.717
3.9444	0.069	0.273	0.000	0.717
4.0000	0.069	0.277	0.000	0.717
4.0556	0.069	0.281	0.277	0.717
4.1111	0.069	0.285	0.784	0.717
4.1667	0.069	0.289	1.438	0.717
4.2222	0.069	0.293	2.205	0.717
4.2778	0.069	0.297	3.059	0.717
4.3333	0.069	0.300	3.979	0.717
4.3889	0.069	0.304	4.939	0.717
4.4444	0.069	0.308	5.917	0.717
4.5000	0.069	0.312	6.887	0.717
4.5556	0.069	0.316	7.826	0.717
4.6111	0.069	0.320	8.711	0.717

4.6667	0.069	0.324	9.523	0.717
4.7222	0.069	0.327	10.24	0.717
4.7778	0.069	0.331	10.86	0.717
4.8333	0.069	0.335	11.38	0.717
4.8889	0.069	0.339	11.81	0.717
4.9444	0.069	0.343	12.16	0.717
5.0000	0.069	0.347	12.46	0.717
5.0556	0.069	0.351	12.94	0.717

Analysis Results

POC 1





\+ Predeveloped x Mitigated

Predeveloped Landuse Totals for POC #1
Total Pervious Area: 5
Total Impervious Area: 0

Mitigated Landuse Totals for POC #1
Total Pervious Area: 1.82
Total Impervious Area: 3.18

Flow Frequency Method: Log Pearson Type III 17B

Flow Frequency Return Periods for Predeveloped. POC #1

Return Period	**Flow(cfs)**
2 year	0.190735
5 year	0.301382
10 year	0.376874
25 year	0.472842
50 year	0.544082
100 year	0.614761

Flow Frequency Return Periods for Mitigated. POC #1

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

No runoff leaving site in post developed scenario

Annual Peaks

Annual Peaks for Predeveloped and Mitigated. POC #1

Year	**Predeveloped**	**Mitigated**
1956	0.206	0.000
1957	0.342	0.000
1958	0.112	0.000
1959	0.155	0.000
1960	0.250	0.000
1961	0.177	0.000
1962	0.065	0.000
1963	0.317	0.000
1964	0.201	0.000
1965	0.189	0.000

1966	0.116	0.000
1967	0.188	0.000
1968	0.139	0.000
1969	0.091	0.000
1970	0.159	0.000
1971	0.205	0.000
1972	0.319	0.000
1973	0.174	0.000
1974	0.133	0.000
1975	0.453	0.000
1976	0.244	0.000
1977	0.052	0.000
1978	0.205	0.000
1979	0.306	0.000
1980	0.172	0.000
1981	0.325	0.000
1982	0.149	0.000
1983	0.283	0.000
1984	0.208	0.000
1985	0.079	0.000
1986	0.303	0.000
1987	0.487	0.000
1988	0.122	0.000
1989	0.137	0.000
1990	0.444	0.000
1991	0.559	0.000
1992	0.113	0.000
1993	0.079	0.000
1994	0.074	0.000
1995	0.199	0.000
1996	0.315	0.000
1997	0.177	0.000
1998	0.218	0.000
1999	0.219	0.000
2000	0.231	0.000
2001	0.040	0.000
2002	0.233	0.000
2003	0.104	0.000
2004	0.200	0.000
2005	0.165	0.000
2006	0.235	0.000
2007	0.223	0.000
2008	0.495	0.520

Ranked Annual Peaks

Ranked Annual Peaks for Predeveloped and Mitigated. POC #1

Rank	Predeveloped	Mitigated
1	0.5593	0.5203
2	0.4950	0.0000
3	0.4868	0.0000
4	0.4532	0.0000
5	0.4440	0.0000
6	0.3424	0.0000
7	0.3254	0.0000
8	0.3188	0.0000
9	0.3169	0.0000
10	0.3149	0.0000
11	0.3065	0.0000

12	0.3028	0.0000
13	0.2830	0.0000
14	0.2502	0.0000
15	0.2438	0.0000
16	0.2353	0.0000
17	0.2332	0.0000
18	0.2307	0.0000
19	0.2233	0.0000
20	0.2190	0.0000
21	0.2182	0.0000
22	0.2076	0.0000
23	0.2059	0.0000
24	0.2049	0.0000
25	0.2049	0.0000
26	0.2007	0.0000
27	0.1997	0.0000
28	0.1993	0.0000
29	0.1894	0.0000
30	0.1877	0.0000
31	0.1775	0.0000
32	0.1767	0.0000
33	0.1739	0.0000
34	0.1719	0.0000
35	0.1652	0.0000
36	0.1592	0.0000
37	0.1555	0.0000
38	0.1490	0.0000
39	0.1394	0.0000
40	0.1370	0.0000
41	0.1329	0.0000
42	0.1217	0.0000
43	0.1155	0.0000
44	0.1129	0.0000
45	0.1115	0.0000
46	0.1041	0.0000
47	0.0914	0.0000
48	0.0792	0.0000
49	0.0787	0.0000
50	0.0738	0.0000
51	0.0646	0.0000
52	0.0523	0.0000
53	0.0403	0.0000

Duration Flows

The Facility PASSED ← Duration passes

Flow(cfs)	Predev	Mit	Percentage	Pass/Fail
0.0954	17260	17	0	Pass
0.0999	15632	16	0	Pass
0.1044	13704	16	0	Pass
0.1090	12292	16	0	Pass
0.1135	10744	16	0	Pass
0.1180	9571	16	0	Pass
0.1226	8703	16	0	Pass
0.1271	7752	16	0	Pass
0.1316	7010	15	0	Pass
0.1362	6233	15	0	Pass
0.1407	5670	15	0	Pass
0.1452	5012	15	0	Pass
0.1498	4579	15	0	Pass
0.1543	4081	15	0	Pass
0.1588	3670	15	0	Pass
0.1634	3278	14	0	Pass
0.1679	2985	14	0	Pass
0.1724	2641	13	0	Pass
0.1770	2379	13	0	Pass
0.1815	2102	13	0	Pass
0.1860	1897	13	0	Pass
0.1905	1741	13	0	Pass
0.1951	1584	13	0	Pass
0.1996	1461	13	0	Pass
0.2041	1328	13	0	Pass
0.2087	1188	13	1	Pass
0.2132	1067	13	1	Pass
0.2177	974	13	1	Pass
0.2223	882	13	1	Pass
0.2268	823	13	1	Pass
0.2313	746	11	1	Pass
0.2359	693	11	1	Pass
0.2404	638	11	1	Pass
0.2449	599	10	1	Pass
0.2495	539	10	1	Pass
0.2540	484	9	1	Pass
0.2585	444	9	2	Pass
0.2631	400	8	2	Pass
0.2676	365	8	2	Pass
0.2721	335	8	2	Pass
0.2767	312	8	2	Pass
0.2812	289	8	2	Pass
0.2857	262	7	2	Pass
0.2903	241	6	2	Pass
0.2948	225	4	1	Pass
0.2993	202	4	1	Pass
0.3039	190	3	1	Pass
0.3084	176	3	1	Pass
0.3129	167	3	1	Pass
0.3175	159	3	1	Pass
0.3220	152	3	1	Pass
0.3265	145	3	2	Pass
0.3311	140	3	2	Pass

0.3356	135	3	2	Pass
0.3401	129	3	2	Pass
0.3447	123	3	2	Pass
0.3492	119	3	2	Pass
0.3537	114	3	2	Pass
0.3583	109	3	2	Pass
0.3628	103	3	2	Pass
0.3673	99	3	3	Pass
0.3718	94	3	3	Pass
0.3764	90	3	3	Pass
0.3809	87	3	3	Pass
0.3854	80	3	3	Pass
0.3900	76	3	3	Pass
0.3945	70	3	4	Pass
0.3990	62	3	4	Pass
0.4036	58	3	5	Pass
0.4081	53	3	5	Pass
0.4126	51	3	5	Pass
0.4172	48	3	6	Pass
0.4217	45	3	6	Pass
0.4262	42	3	7	Pass
0.4308	39	3	7	Pass
0.4353	37	2	5	Pass
0.4398	36	2	5	Pass
0.4444	32	2	6	Pass
0.4489	28	2	7	Pass
0.4534	23	2	8	Pass
0.4580	21	2	9	Pass
0.4625	16	2	12	Pass
0.4670	12	2	16	Pass
0.4716	6	2	33	Pass
0.4761	4	2	50	Pass
0.4806	4	1	25	Pass
0.4852	3	1	33	Pass
0.4897	2	1	50	Pass
0.4942	2	1	50	Pass
0.4988	1	1	100	Pass
0.5033	1	1	100	Pass
0.5078	1	1	100	Pass
0.5124	1	1	100	Pass
0.5169	1	1	100	Pass
0.5214	1	0	0	Pass
0.5260	1	0	0	Pass
0.5305	1	0	0	Pass
0.5350	1	0	0	Pass
0.5395	1	0	0	Pass
0.5441	1	0	0	Pass

LID Report

LID Technique	Used for Treatment ?	Total Volume Needs Treatment (ac-ft)	Volume Through Facility (ac-ft)	Infiltration Volume (ac-ft)	Cumulative Volume Infiltration Credit	Percent Volume Infiltrated	Water Quality	Percent Water Quality Treated	Comment
Trapezoidal Pond 1 POC	☐	489.72			☐	99.98			
Total Volume Infiltrated		489.72	0.00	0.00		99.98	0.00	0%	No Treat. Credit
Compliance with LID Standard 8% of 2-yr to 50% of 2-yr									Duration Analysis Result = Passed

LID Passes. No need for list approach for MR#5

Water Quality

Water Quality BMP Flow and Volume for POC #2

POC #2 associated with (no roof) basins. Roof runoff will bypass treatment

On-line facility volume:	0.3054 acre-feet
On-line facility target flow:	0.3026 cfs.
Adjusted for 15 min:	0.3026 cfs.
Off-line facility target flow:	0.1707 cfs.
Adjusted for 15 min:	0.1707 cfs.

Flow values needed for treatment

Model Default Modifications

Total of 0 changes have been made.

PERLND Changes

No PERLND changes have been made.

IMPLND Changes

No IMPLND changes have been made.

Appendix

Predeveloped Schematic

Mitigated Schematic