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Permanent Stormwater Control Facilities Operation and Maintenance (O&M) Manual

for

SAMISH ESTATES

Located at:

528 F & S Grade Road
Sedro-Woolley, WA 98248

Prepared for:

Monte Peterson
528 F & S Grade Road
Sedro-Woolley, WA 98248
(360) 661-5649

Prepared by:

Cascade Engineering Group, P.S., Inc.
119 Grand Avenue, Suite D
Bellingham, WA 98225
(360) 306-8161

Grantor – Monte Petersen
Grantee – Sedro-Woolley Public
Parcel Number – P37166
Assessor Number – 350423-0-022-0002
Sec/Twp/Rng – Section 23 Township 35 Range 04

SAMISH ESTATES

SEDRO-WOOLLEY, WASHINGTON

STORMWATER FACILITIES
OPERATIONS & MAINTENANCE MANUAL

Prepared for:
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1.0 INTRODUCTION

This plan has been prepared for use by the system operator, the Samish Estates Homeowners Association, for the operation and maintenance of the site's stormwater facilities. This manual describes each of the stormwater system components, how they are intended to operate, and what maintenance activities shall be followed. The main components are the stormwater conveyance system and the combined detention and stormwater treatment pond. Each component is designed to operate with a minimum of maintenance; however some maintenance will be required.

The site includes six single family lots with their associated access road. The stormwater conveyance system directly captures runoff from the building roofs and the access road and routes it to the pond. Driveway and front lawn runoff is routed to and captured by the road catch basin system. The captured runoff is piped directly to the pond. Runoff in the pond is treated using a stormwater treatment wetpool, which is a planted area located at the bottom of the pond. This area of the pond is constantly underwater and contains wetland plants that will be constantly submerged. The upper three feet of the pond is used for detention. Water is detained in this area as it is slowly released through the use of a control structure. The treated and detained runoff is discharged into the roadside ditch along the north side of F & S Grade Road adjacent to the site.

The attached construction plans (Attachment 2) provide information on the stormwater conveyance system and pond.

2.0 STORMWATER CONVEYANCE SYSTEM

2.1 Piping System, Catch Basins, and Discharge Facilities

Description

Runoff from the access road is routed to a catch basin and stormwater conveyance system located along the center of the road. Roof drains for the lots are connected to stormwater service lines that are connected to the conveyance pipe located in the access road. The site is graded such that driveway and front yard lawn runoff is sloped towards the road.

The site's overall flat topography and the relatively shallow depth of the F& S Grade Road ditch into which the stormwater system must drain could affect the stormwater pipe drainage. During large intensity storms the detention pond water level will rise causing water to back up into the conveyance pipe from the pond to the catch basins. The system has been designed such that water will not rise above the catch basin rims for the 100-year or weaker storm events. After the storm, the water in the pond and the conveyance pipes will drain out. However, because there will be times with standing water in the pipe, there is the potential for sediment to buildup in the pipes. Ongoing inspection and cleaning of these pipes are necessary to ensure the system remains clear of sediment and debris to enable the system to continue to function properly.

Operation

There are no operational needs for this system other than the maintenance functions listed below.

Maintenance: Annual inspections are initially proposed. Based on a few years of experience, the maintenance schedule may be adjusted to more frequent inspections and/or cleaning if required.

Catch Basins and Control Structure:
Catch basins and the pond control structure shall be visually inspected each year. The covers shall be removed, and a light directed at the pipe invert and catch basin and manhole sumps. Any debris shall be removed. Any large build-up of sediment in the sump areas shall also be removed.

Storm Piping:
Storm conveyance pipes shall be inspected at the same time as the catch basins. Careful attention shall be given to the build-up of sediment and debris within the invert (bottom) of the pipe. If more than one-inch of sediment is observed, then the sediments shall be removed through cleaning. Any line flushing to remove sediment or debris shall only be done during periods of dry weather. This is to avoid the potential of sediment laden cleaning water from entering the downstream system and diminishing the function of the stormwater treatment or detention facilities.

Pipe Outfalls:
Pipe outfalls into the pond and the F & S Grade Road ditch shall be visually inspected a minimum of twice per year with one of these inspections occurring in September or October, prior to the beginning of the rainy season. Any debris shall be removed. Any large buildup of sediment (four to six inches) surrounding the end of the pipe shall also be removed. Quarry spall depth shall be confirmed to be in accordance with the construction details and repairs shall be made as required.

Perform additional maintenance as required and described in the Department of Ecology (DOE) *BMP Maintenance Tables*, from Volume V, Appendix A of the 2019 DOE Manual – see Attachment 3.

3.0 STORMWATER TREATMENT SYSTEM

3.1 Stormwater Treatment Wetpool

Description
A stormwater treatment wetpool, located at the bottom of the detention pond, is a designed, two cell facility that contains permanent pools of water that provide water quality treatment. The first cell of the wetpool is designed to reduce the runoff velocity and allow sediment to settle out of the stormwater. The second cell is planted with emergent wetland plants to aid in the biological uptake of pollutants in the stormwater. See Attachment 2 for the drawings associated with the facility.

Operation and Maintenance
- Stormwater treatment wetpool should be inspected at least twice per year during the first three years during both growing and non-growing seasons to observe plant species presence, abundance, and condition; bottom contours and water depths relative to the plans; and sediment, outlet, and buffer conditions.
- Maintenance should be scheduled around sensitive wildlife and vegetation seasons.
- Plants may require watering, physical support, mulching, weed removal, or replanting during the first three years.
- Nuisance plant species should be removed and desirable species should be replanted.
- The effectiveness of harvesting for nutrient control is not well documented. There are many drawbacks to harvesting, including possible damage to the wetlands and the inability to remove

nutrients in the below-ground biomass. If harvesting is practiced, it should be done in the late summer.

Perform additional maintenance as required and described in the Department of Ecology (DOE) *BMP Maintenance Tables*, from Volume V, Appendix A of the 2019 DOE Manual – see Attachment 3.

4.0 STORMWATER FLOW CONTROL

4.1 Detention Pond

Description

A stormwater detention pond is utilized to reduce the peak runoff rate at which the stormwater leaves the site. This is necessary so as not overwhelm the downstream conveyance system. Stormwater detention is provided above the wetpool (permanent or dead storage) area of the combined facility.

Operation and Maintenance

- Floating debris and accumulated petroleum products shall be removed as needed, but at least annually.
- Site vegetation around the pond area shall be trimmed as necessary to keep the pond free of leaves and to maintain the aesthetic appearance of the site. Nuisance plant species shall be removed. Slope areas that have become bare shall be re-vegetated and eroded areas shall be regraded prior to being re-vegetated.
- Pond configuration and water depth shall also be observed for sediment build up conformance to the design plans. Provide corrective measures as required.
- The detention pond's emergency overflow weir and the area between the rip-rap weir and the downstream area shall be inspected and repaired, as needed, after major storm events to ensure the area is stable and in good condition in the event of an emergency overflow.

Perform additional maintenance as required and described in the Department of Ecology (DOE) *BMP Maintenance Tables*, from Volume V, Appendix A of the 2019 DOE Manual – see Attachment 3.

5.0 MAINTENANCE RESPONSIBILITIES AND REPORTING

All on-site permanent stormwater facilities (combined water quality treatment and detention pond, stormwater conveyance pipe, and stormwater catch basins) shall be maintained in perpetuity in a manner that allows them to function as originally designed. The owner of the property, association or its designated representative, is solely responsible for the inspection, maintenance, repair and replacement of all permanent stormwater facilities located on site and any and all costs associated therewith. The City of Sedro-Woolley is under no obligation to maintain or repair permanent stormwater facilities located on this site.

The owner, association or its designated representative shall submit an annual operation and maintenance report (see Attachment 1) for the permanent stormwater facilities to the City of Sedro-Woolley Public Works Department on or before March 31st of each year for the previous year's inspection and maintenance activities. The report shall include any remedial actions taken, how the actions were completed, who performed them, any problems encountered, and any required follow-up actions such as maintenance, repair or replacement. Annual report and other maintenance records shall be maintained on-site and available to the City upon request.

The City shall have the right to enter onto the property for inspection and compliance purposes. Should inspection reports (either by the property owner, association or by the City) indicate the permanent stormwater facilities are not being properly maintained or show signs of failure and the property owner has not remedied any maintenance standards exceedances, the City of Sedro-Woolley reserves the right but not the obligation to perform work that is necessary to maintain the permanent stormwater facilities that has not been performed by the property owner, and recover any and all costs so incurred by the City from the property owner. Failure to properly maintain the permanent stormwater facilities may also result in City levied fines in accordance with Sedro-Woolley Municipal Code Title 13, Chapter 13.40.

ATTACHMENTS

1. Copy of City of Sedro-Woolley *Permanent Stormwater Facility permit, Annual Reporting Form*
2. Sheets attached from *Samish Estates Construction Plans*, Cascade Engineering Group, April 15, 2021.
    - C7 – Grading and Utility Plan
    - C8 – Access Driveway and Storm Plan and Profile
    - C12 – Storm Plan and Profile and Pond
    - C13 – Storm and Pond Details
    - C14 – Pond Planting Plan
3. WDOE Section V-A *BMP Maintenance Tables* (5 pages)
4. *Samish Estates Development Stormwater Facility Maintenance Lot Sheet*

Refer to the *Samish Estates Long Plat Stormwater Site Plan* for additional figures and information.

PERMANENT STORMWATER FACILITY PERMIT
ANNUAL REPORTING FORM

City of Sedro-Woolley
Public Works Department
RE: Permanent Stormwater Facilities Permit – Annual Reporting
325 Metcalf Street, Sedro-Woolley, WA 98284
Phone: 360-855-0771

This form must be completed and the certification signed by the Owner, its administrator, executor, successor, heir or assign. One signed copy of the completed Annual Report, including attachments, shall be submitted to the Public Works Department by March 31st for the year prior.

GENERAL INFORMATION		
Owner Name (☐ check if new):	**Reporting Period:** Jan. 1st to Dec 31st * Reports for each year are due to the City by Mar. 31st of the following year.	
Facility Address:		
Contact Person (☐ check if new) **Name:** **Phone Number(☐ check if new):** **Mailing Address (☐ check if new):**		
Have there been any major changes to or maintenance on the BMPs?	☐YES	☐ NO
Does the BMP have any major deficiencies?	☐YES	☐ NO
Do you have an updated Inspection and Maintenance Plan?	☐YES	☐ NO

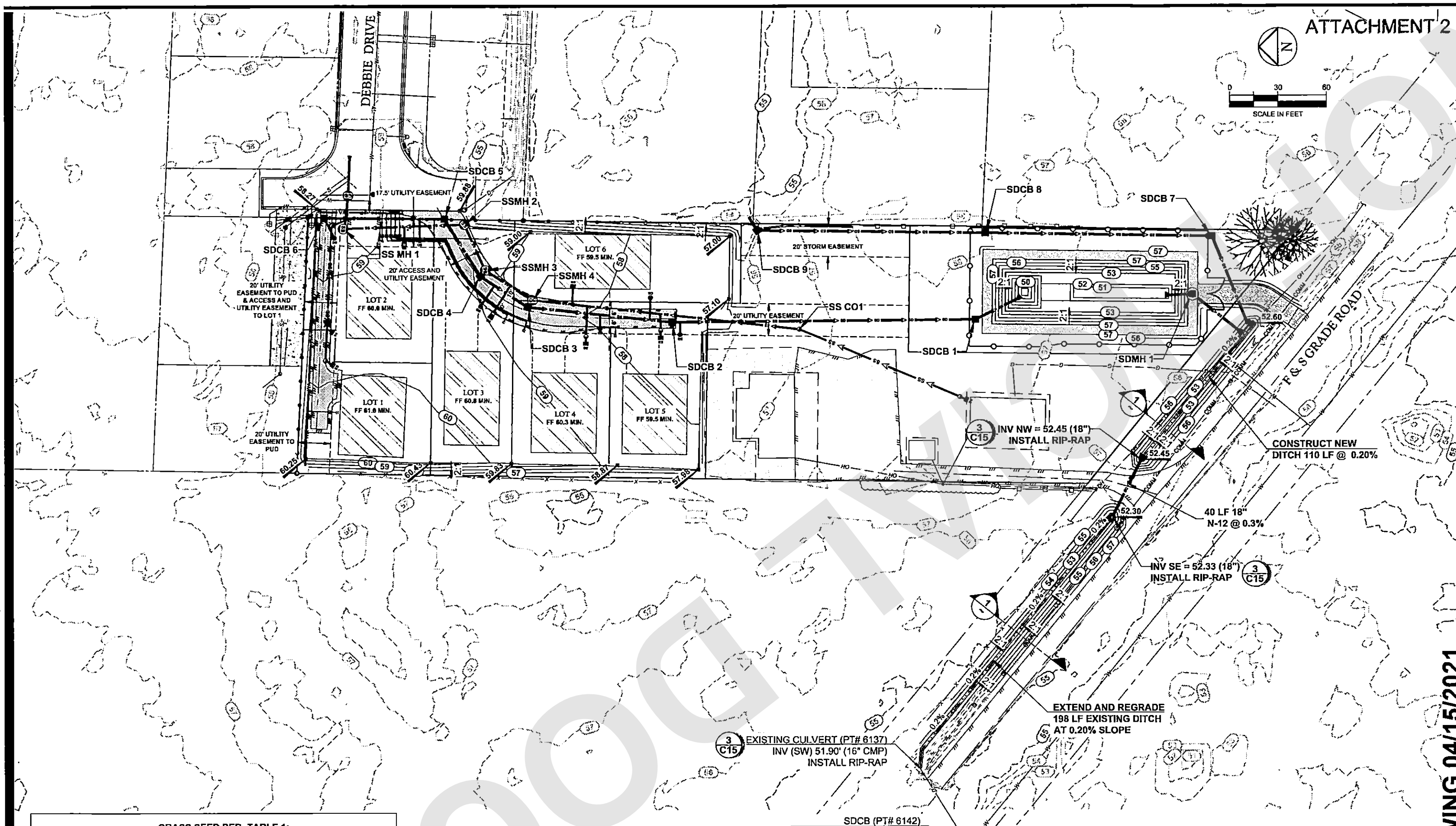
"I certify that to the best of my knowledge and belief the maintenance and inspection of the permanent BMPs is being implemented in accordance to the Stormwater Facility Operation and Maintenance Plan for this property or that a notice of any deficiencies has been provided."

_____ _____
Signature Date

ATTACHMENTS:
Inspection Log/Certification

[Attach additional information as needed. Remedial actions taken, how they were completed, and who performed them. Deficiencies to the BMPs, or problems encountered.]

ATTACHMENT 2


SCALE IN FEET
DEBBIE DRIVE
F & S GRADE ROAD
SDCB 5
SSMH 2
SDCB 6
SS MH 1
SSMH 3
SSMH 4
SDCB 4
SDCB 3
SDCB 2
SDCB 8
SDCB 7
SDCB 9
SS CO1
SDCB 1
SDMH 1
17.5' UTILITY EASEMENT
20' ACCESS AND UTILITY EASEMENT
20' STORM EASEMENT
20' UTILITY EASEMENT
20' UTILITY EASEMENT TO PUD & ACCESS AND UTILITY EASEMENT TO LOT 1
20' UTILITY EASEMENT TO PUD
INV NW = 52.45 (18")
INSTALL RIP-RAP
CONSTRUCT NEW
DITCH 110 LF @ 0.20%
40 LF 18"
N-12 @ 0.3%
INV SE = 52.33 (18")
INSTALL RIP-RAP
EXTEND AND REGRADE
198 LF EXISTING DITCH
AT 0.20% SLOPE
EXISTING CULVERT (PT# 6137)
INV (SW) 51.90' (16" CMP)
INSTALL RIP-RAP
SDCB (PT# 6142)
RIM 51.77'
INV (SSW) 48.99' (4" CPP) IN
INV (E) 48.69' (10" PVC) IN
INV (NE) 48.58' (10" PVC) IN
INV (W) 48.54' (10" PVC) OUT

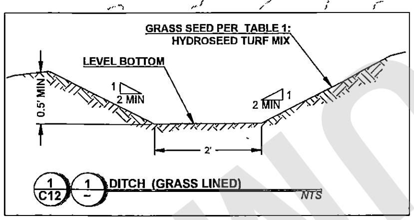


TABLE 1: HYDROSEED TURF MIX

BOTANICAL NAME:	COMMON NAME:	% WEIGHT	% PURITY	% GERMINATION	TOTAL AREA:
FESTUCA ARUNDINACEA VAR.	DWARF TALL FESCUE	45	98	90	APPROX. 10,000 SF
LOLIUM PERENNE VAR. BARCLAY	DWARF PERENNIAL RYE	30	98	90	
FESTUCA RUBRA	RED FESCUE	20	98	90	
AGROSTIS TENUIS	COLONIAL BENTGRASS	5	98	90	
FERTILIZER:	USE SLOW RELEASE FERTILIZER 10-4-6 (N-P-K) AT A RATE OF 90 LBS PER ACRE.				
MULCH:	USE BONDED FIBER MATRIX AT A MINIMUM RATE OF 3,000 LBS. PER ACRE OF MULCH WITH A 10% TACKIFIER.				

RECORD DRAWING 04/15/2021

528 F & S GRADE RD., SEDRO-WOOLLEY, WASHINGTON

SAMISH ESTATES LONG PLAT CONSTRUCTION PLANS

GRADING AND UTILITY PLAN

CASCADE ENGINEERING GROUP, P.S., INC.
119 Grand Avenue, Suite D
Bellingham, Washington 98225
(360) 306-8161

REVISIONS | DATE

DATE: 04/15/21
DESIGN: MJD
DRAWN: LCP
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SCALE: AS SHOWN

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528 F & S GRADE RD. , SEDRO-WOOLLEY, WASHINGTON

SAMISH ESTATES LONG PLAT CONSTRUCTION PLANS

ACCESS DRIVEWAY AND STORM PLAN AND PROFILE

CASCADE ENGINEERING GROUP, P.S., INC.
119 Grand Avenue, Suite D
Bellingham, Washington 98225
(360) 306-8161

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DATE: 04/15/21
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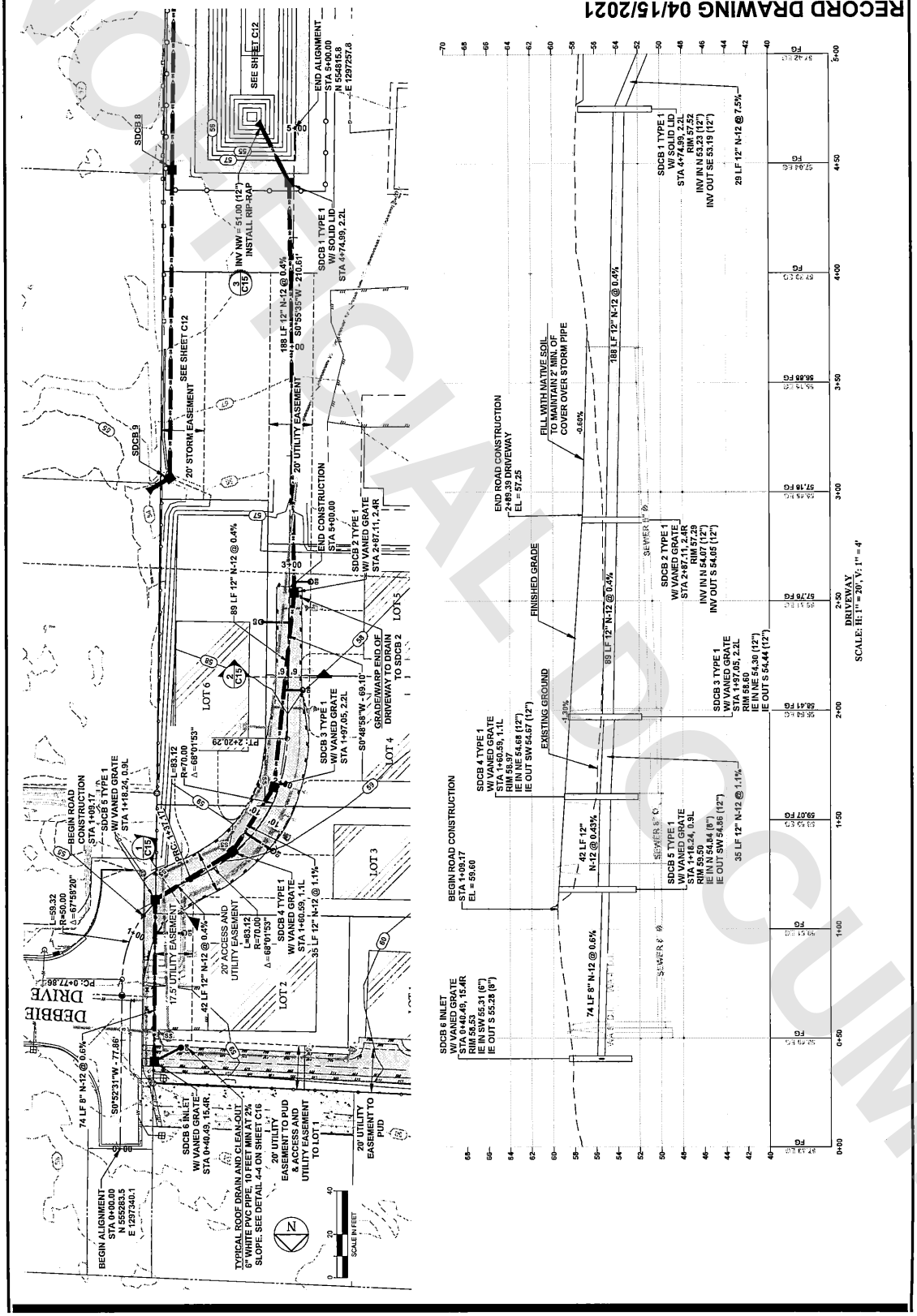

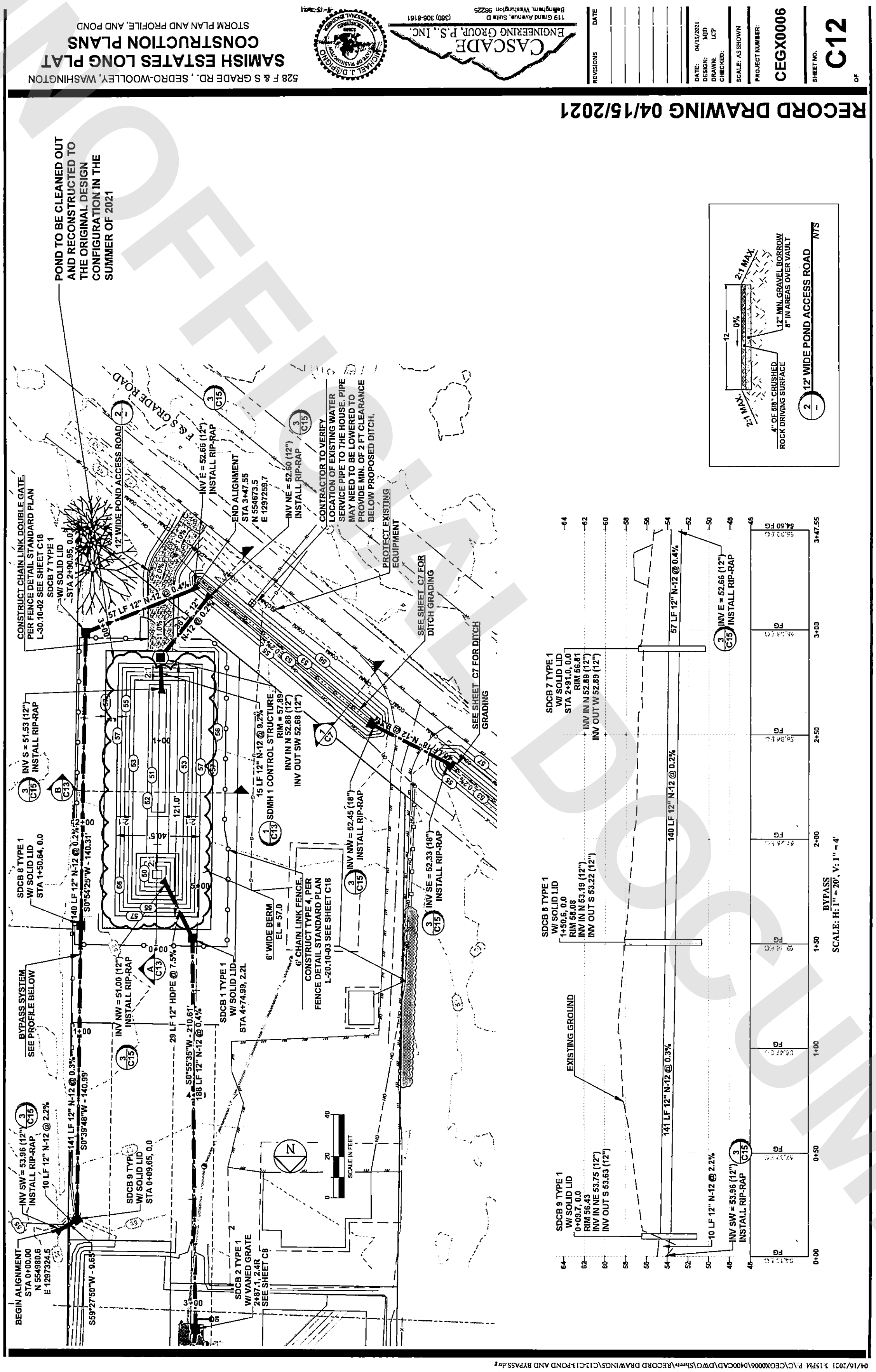

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SAMISH ESTATES LONG PLAT CONSTRUCTION PLANS

STORM AND POND DETAILS

CASCADE ENGINEERING GROUP, P.S., INC.
119 Grand Avenue, Suite D
Bellingham, Washington 98225
(360) 306-8161

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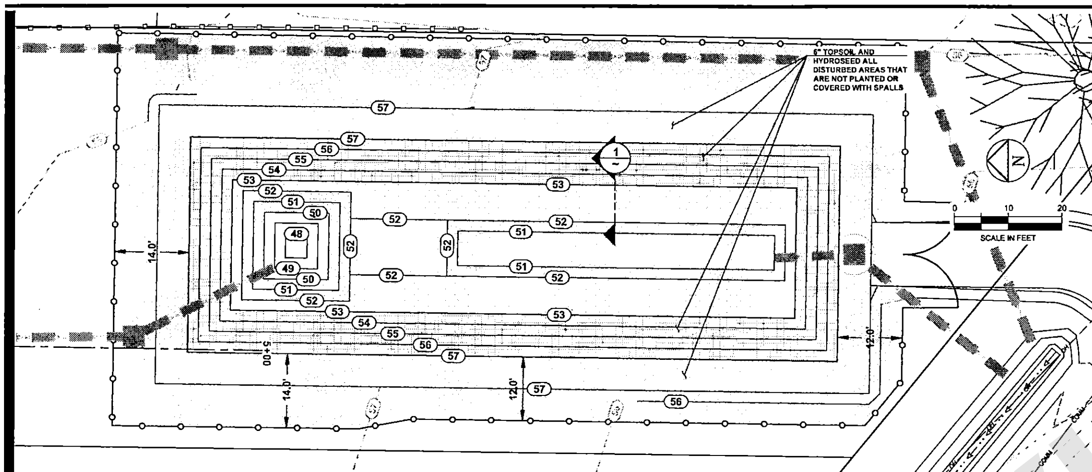


POND TO BE CLEANED OUT AND RECONSTRUCTED TO THE ORIGINAL DESIGN CONFIGURATION IN THE SUMMER OF 2021. HYDROSEEDING AND WETLAND PLANTS TO BE INSTALLED IN THE FALL OF 2021.

HYDROSEED TURF MIX*

BOTANICAL NAME.	COMMON NAME:	% WEIGHT	% PURITY	% GERMINATION	TOTAL AREA:
FESTUCA ARUNDINACEA VAR.	DWARF TALL FESCUE	45	98	90	APPROX. 10,000 SF
LOLIUM PERENNE VAR. BARCLAY	DWARF PERENNIAL RYE	30	98	90	
FESTUCA RUBRA	RED FESCUE	20	98	90	
AGROSTIS TENUIS	COLONIAL BENTGRASS	5	98	90	
FERTILIZER:	USE SLOW RELEASE FERTILIZER 10-4-6 (N-P-K) AT A RATE OF 90 LBS PER ACRE.				
MULCH:	USE BONDED FIBER MATRIX AT A MINIMUM RATE OF 3,000 LBS. PER ACRE OF MULCH WITH A 10% TACKIFIER.				

Table 10.3.1
Emergent Wetland Plant Species Recommended for Wetponds

Species	Common Name	Notes	Maximum Depth
INUNDATION TO 1-FOOT			
Agrostis exarata[1]	Spike bent grass	Prairie to coast	to 2 feet
Carex stipata	Sawbeak sedge	Wet ground	
Eleocharis palustris	Spike rush	Margins of ponds, wet meadows	to 2 feet
Glyceria occidentalis	Western mannagrass	Marshes, pond margins	to 2 feet
Juncus tenuis	Slender rush	Wet soils, wetland margins	
Oenanthe sarmentosa	Water parsley	Shallow water along stream and pond margins; needs saturated soils all summer	
Scirpus atrocinctus (formerly S. cyperinus)	Woolgrass	Tolerates shallow water; tall clumps	
Scirpus microcarpus	Small-fruited bulrush	Wet ground to 18 inches depth	18 inches
Sagittaria latifolia	Arrowhead		
INUNDATION 1 TO 2 FEET			
Agrostis exarata[1]	Spike bent grass	Prairie to coast	
Alisma plantago-aquatica	Water plantain		
Eleocharis palustris	Spike rush	Margins of ponds, wet meadows	
Glyceria occidentalis	Western mannagrass	Marshes, pond margins	
Juncus effusus	Soft rush	Wet meadows, pastures, wetland margins	
Scirpus microcarpus	Small-fruited bulrush	Wet ground to 18 inches depth	18 inches
Sparganium emersum	Bur reed	Shallow standing water, saturated soils	
INUNDATION 1 TO 3 FEET			
Carex obnupta	Slough sedge	Wet ground or standing water	1.5 to 3 feet
Beckmannia syzigachne[1]	Western sloughgrass	Wet prairie to pond margins	
Scirpus acutus[2]	Hardstem bulrush	Single tall stems, not clumping	to 3 feet
Scirpus validus[2]	Softstem bulrush		
INUNDATION GREATER THAN 3 FEET			
NO PLANTING REQUIRED			

Notes:
(1) Non-native species. *Beckmannia syzigachne* is native to Oregon. Native species are preferred.
(2) *Scirpus* tubers must be planted shallower for establishment, and protected from foraging waterfowl until established. Emerging aerial stems should project above water surface to allow oxygen transport to the roots.
Primary sources: Municipality of Metropolitan Seattle, *Water Pollution Control Aspects of Aquatic Plants*, 1990. Hortus Northwest, *Wetland Plants for Western Oregon*, Issue 2, 1991. Hitchcock and Cronquist, *Flora of the Pacific Northwest*, 1973.

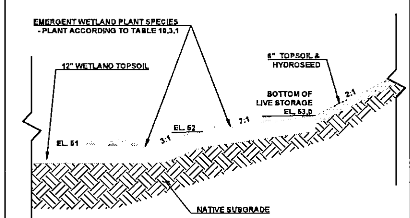
ELEV. 52.0-53.0: SELECT COMBINATION OF 3 SPECIES MINIMUM. PLANT SPACING 1 PLANT PER SQUARE FOOT. TOTAL AREA = 1,800 SF. TOTAL COUNT = 1,800. SIZE = BARE ROOT OR PLUG DEPENDENT ON SPECIES.

ELEV. 50.0-52.0: SELECT COMBINATION OF 3 SPECIES MINIMUM. PLANT SPACING 1 PLANT PER SQUARE FOOT. TOTAL AREA = 1,600 SF. TOTAL COUNT = 1,600. SIZE = BARE ROOT OR PLUG DEPENDENT ON SPECIES.

ELEV 48.0-50.0

POND NOTES:

1. NATIVE TOPSOIL, IF AVAILABLE, SHOULD BE RE-INSTALLED ON THE SIDE SLOPE EMBANKMENT ABOVE ELEV. 53.0 AND ON DISTURBED SOIL SURFACE OUTSIDE POND BEFORE SEEDING. AS DIRECTED BY THE OWNER, AREAS THAT WILL BE SEEDED AND NOT LANDSCAPED MAY NEED COMPOST OR MEAL-BASED MULCH INCLUDED IN THE HYDROSEED IN ORDER TO ESTABLISH VEGETATION.
2. ***WETLAND (ELEV. 50.0 - ELEV 53.0) TOPSOIL SPEC.*** TOPSOIL SHALL BE NATIVE, NATURALLY HYDRIC WETLAND TOPSOIL CONSISTING OF SILTS, CLAYS, AND ORGANIC MATTER IN A COMBINATION THAT IS FREE FROM SUBSTANCES DETRIMENTAL TO PLANT GROWTH, SUCH AS NOXIOUS WEEDS, UNDESIRABLE PLANT ROOTS, REFUSE, STICKS, OR OTHER MATERIALS LARGER THAN 1 ½ INCHES IN DIAMETER.



CONSTRUCTION NOTES:

1. PERMANENT EROSION CONTROL FABRIC SHALL BE C350 BY NORTH AMERICAN GREEN OR APPROVED EQUAL AND SHALL BE INSTALLED PER MANUFACTURER'S SPECIFICATIONS, 1' ABOVE OVERFLOW SPILLWAY.
2. TOPSOIL MATERIAL MUST BE DRY ENOUGH TO BE PLACED AND ROLLED TO CONSOLIDATE TO REMAIN IN PLACE. PLACEMENT TO BE INSPECTED AND APPROVED BY THE PROJECT ENGINEER.

1 TYPICAL DETENTION WETLAND SECTION
N.T.S.

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528 F & S GRADE RD., SEDRO-WOOLLEY, WASHINGTON
SAMISH ESTATES LONG PLAT
CONSTRUCTION PLANS
POND PLANTING PLAN

CASCADE ENGINEERING GROUP, P.S., INC.
119 Grand Avenue, Suite D
Bellingham, Washington 98225
(360) 306-8161

MICHAEL J. DISPIGNO, STATE OF WASHINGTON, PROFESSIONAL ENGINEER

REVISIONS	DATE

DATE: 04/15/2021
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Appendix V-A: BMP Maintenance Tables

Ecology intends the facility-specific maintenance standards contained in this section to be conditions for determining if maintenance actions are required as identified through inspection. Recognizing that Permittees have limited maintenance funds and time, Ecology does not require that a Permittee perform all these maintenance activities on all their stormwater BMPs. We leave the determination of importance of each maintenance activity and its priority within the stormwater program to the Permittee. We do expect, however, that sufficient maintenance will occur to ensure that the BMPs continue to operate as designed to protect ground and surface waters.

Ecology doesn't intend that these measures identify the facility's required condition at all times between inspections. In other words, exceedance of these conditions at any time between inspections and/or maintenance does not automatically constitute a violation of these standards. However, based upon inspection observations, the Permittee shall adjust inspection and maintenance schedules to minimize the length of time that a facility is in a condition that requires a maintenance action.

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"	

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.3: Maintenance Standards - Closed Detention Systems (Tanks/Vaults) (continued)

Maintenance Component	Defect	Conditions When Maintenance is Needed	Results Expected When Maintenance is Performed
Manhole	Cover Not in Place	Cover is missing or only partially in place. Any open manhole requires maintenance.	Manhole is closed.
	Locking Mechanism Not Working	Mechanism cannot be opened by one maintenance person with proper tools. Bolts into frame have less than 1/2 inch of thread (may not apply to self-locking lids).	Mechanism opens with proper tools.
	Cover Difficult to Remove	One maintenance person cannot remove lid after applying normal lifting pressure. Intent is to keep cover from sealing off access to maintenance.	Cover can be removed and reinstalled by one maintenance person.
	Ladder Rungs Unsafe	Ladder is unsafe due to missing rungs, misalignment, not securely attached to structure wall, rust, or cracks.	Ladder meets design standards. Allows maintenance person safe access.
Catch Basins	See Table V-A.5: Maintenance Standards - Catch Basins	See Table V-A.5: Maintenance Standards - Catch Basins	See Table V-A.5: Maintenance Standards - Catch Basins

Table V-A.4: Maintenance Standards - Control Structure/Flow Restrictor

Maintenance Component	Defect	Condition When Maintenance is Needed	Results Expected When Maintenance is Performed
General	Trash and Debris (Includes Sediment)	Material exceeds 25% of sump depth or 1 foot below orifice plate.	Control structure orifice is not blocked. All trash and debris removed.
	Structural Damage	Structure is not securely attached to manhole wall. Structure is not in upright position (allow up to 10% from plumb). Connections to outlet pipe are not watertight and show signs of rust. Any holes - other than designed holes - in the structure.	Structure securely attached to wall and outlet pipe. Structure in correct position. Connections to outlet pipe are water tight; structure repaired or replaced and works as designed. Structure has no holes other than designed holes.
Cleanout Gate	Damaged or Missing	Cleanout gate is not watertight or is missing. Gate cannot be moved up and down by one maintenance person. Chain/rod leading to gate is missing or damaged. Gate is rusted over 50% of its surface area.	Gate is watertight and works as designed. Gate moves up and down easily and is watertight. Chain is in place and works as designed. Gate is repaired or replaced to meet design standards.
Orifice Plate	Damaged or Missing	Control device is not working properly due to missing, out of place, or bent orifice plate.	Plate is in place and works as designed.
	Obstructions	Any trash, debris, sediment, or vegetation blocking the plate.	Plate is free of all obstructions and works as designed.
Overflow Pipe	Obstructions	Any trash or debris blocking (or having the potential of blocking) the overflow pipe.	Pipe is free of all obstructions and works as designed.
Manhole	See Table V-A.3: Maintenance Standards - Closed Detention Systems (Tanks/Vaults)	See Table V-A.3: Maintenance Standards - Closed Detention Systems (Tanks/Vaults)	See Table V-A.3: Maintenance Standards - Closed Detention Systems (Tanks/Vaults)
Catch Basin	See Table V-A.5: Maintenance Standards - Catch Basins	See Table V-A.5: Maintenance Standards - Catch Basins	See Table V-A.5: Maintenance Standards - Catch Basins

Table V-A.5: Maintenance Standards - Catch Basins

Maintenance Component	Defect	Conditions When Maintenance is Needed	Results Expected When Maintenance is performed
General	Trash & Debris	Trash or debris which is located immediately in front of the catch basin opening or is blocking inletting capacity of the basin by more than 10%. Trash or debris (in the basin) that exceeds 60 percent of the sump depth as measured from the bottom of basin to invert of the lowest pipe into or out of the basin, but in no case less than a minimum of six inches clearance from the debris surface to the invert of the lowest pipe. Trash or debris in any inlet or outlet pipe blocking more than 1/3 of its height. Dead animals or vegetation that could generate odors that could cause complaints or dangerous gases (e.g., methane).	No Trash or debris located immediately in front of catch basin or on grate opening. No trash or debris in the catch basin. Inlet and outlet pipes free of trash or debris. No dead animals or vegetation present within the catch basin.
	Sediment	Sediment (in the basin) that exceeds 60 percent of the sump depth as measured from the bottom of basin to invert of the lowest pipe into or out of the basin, but in no case less than a minimum of 6 inches clearance from the sediment surface to the invert of the lowest pipe.	No sediment in the catch basin
	Structure Damage to Frame and/or Top Slab	Top slab has holes larger than 2 square inches or cracks wider than 1/4 inch. (Intent is to make sure no material is running into basin). Frame not sitting flush on top slab, i.e., separation of more than 3/4 inch of the frame from the top slab. Frame not securely attached	Top slab is free of holes and cracks. Frame is sitting flush on the riser rings or top slab and firmly attached.
	Fractures or Cracks in Basin Walls/ Bottom	Maintenance person judges that structure is unsound. Grout fillet has separated or cracked wider than 1/2 inch and longer than 1 foot at the joint of any inlet/outlet pipe or any evidence of soil particles entering catch basin through cracks.	Basin replaced or repaired to design standards. Pipe is regrouted and secure at basin wall.
	Settlement/ Misalignment	If failure of basin has created a safety, function, or design problem.	Basin replaced or repaired to design standards.
	Vegetation	Vegetation growing across and blocking more than 10% of the basin opening. Vegetation growing in inlet/outlet pipe joints that is more than six inches tall and less than six inches apart.	No vegetation blocking opening to basin. No vegetation or root growth present.
	Contamination and Pollution	See Table V-A.1: Maintenance Standards - Detention Ponds	No pollution present.
Catch Basin Cover	Cover Not in Place	Cover is missing or only partially in place. Any open catch basin requires maintenance.	Cover/grate is in place, meets design standards, and is secured
	Locking Mechanism Not Working	Mechanism cannot be opened by one maintenance person with proper tools. Bolts into frame have less than 1/2 inch of thread.	Mechanism opens with proper tools.
	Cover Difficult to Remove	One maintenance person cannot remove lid after applying normal lifting pressure. (Intent is keep cover from sealing off access to maintenance.)	Cover can be removed by one maintenance person.
Ladder	Ladder Rungs Unsafe	Ladder is unsafe due to missing rungs, not securely attached to basin wall, misalignment, rust, cracks, or sharp edges.	Ladder meets design standards and allows maintenance person safe access.
Metal Grates (If Applicable)	Grate opening Unsafe	Grate with opening wider than 7/8 inch.	Grate opening meets design standards.
	Trash and Debris	Trash and debris that is blocking more than 20% of grate surface inletting capacity.	Grate free of trash and debris.
	Damaged or Missing.	Grate missing or broken member(s) of the grate.	Grate is in place, meets the design standards, and is installed and aligned with the flow path.

Table V-A.10: Maintenance Standards - Filter Strips

Maintenance Component	Defect or Problem	Condition When Maintenance is Needed	Recommended Maintenance to Correct Problem
General	Sediment Accumulation on Grass	Sediment depth exceeds 2 inches.	Remove sediment deposits, re-level so slope is even and flows pass evenly through strip.
	Vegetation	When the grass becomes excessively tall (greater than 10-inches); when nuisance weeds and other vegetation starts to take over.	Mow grass, control nuisance vegetation, such that flow not impeded. Grass should be mowed to a height between 3-4 inches.
	Trash and Debris Accumulation	Trash and debris accumulated on the filter strip.	Remove trash and Debris from filter.
	Erosion/Scouring	Eroded or scoured areas due to flow channelization, or higher flows.	For ruts or bare areas less than 12 inches wide, repair the damaged area by filling with crushed gravel. The grass will creep in over the rock in time. If bare areas are large, generally greater than 12 inches wide, the filter strip should be re-graded and re-seeded. For smaller bare areas, overseed when bare spots are evident.
	Flow spreader	Flow spreader uneven or clogged so that flows are not uniformly distributed through entire filter width.	Level the spreader and clean so that flows are spread evenly over entire filter width.

Table V-A.11: Maintenance Standards - Wetponds

Maintenance Component	Defect	Condition When Maintenance is Needed	Results Expected When Maintenance is Performed
General	Water level	First cell is empty, doesn't hold water.	Line the first cell to maintain at least 4 feet of water. Although the second cell may drain, the first cell must remain full to control turbulence of the incoming flow and reduce sediment resuspension.
	Trash and Debris	Accumulation that exceeds 1 CF per 1000-SF of pond area.	Trash and debris removed from pond.
	Inlet/Outlet Pipe	Inlet/Outlet pipe clogged with sediment and/or debris material.	No clogging or blockage in the inlet and outlet piping.
	Sediment Accumulation in Pond Bottom	Sediment accumulations in pond bottom that exceeds the depth of sediment zone plus 6-inches, usually in the first cell.	Sediment removed from pond bottom.
	Oil Sheen on Water	Prevalent and visible oil sheen.	Oil removed from water using oil-absorbent pads or vactor truck. Source of oil located and corrected. If chronic low levels of oil persist, plant wetland plants such as Juncus effusus (soft rush) which can uptake small concentrations of oil.
	Erosion	Erosion of the pond's side slopes and/or scouring of the pond bottom, that exceeds 6-inches, or where continued erosion is prevalent.	Slopes stabilized using proper erosion control measures and repair methods.
	Settlement of Pond Dike/Berm	Any part of these components that has settled 4-inches or lower than the design elevation, or inspector determines dike/berm is unsound.	Dike/berm is repaired to specifications.
	Internal Berm	Berm dividing cells should be level.	Berm surface is leveled so that water flows evenly over entire length of berm.
	Overflow Spillway	Rock is missing and soil is exposed at top of spillway or outside slope.	Rocks replaced to specifications.

Table V-A.12: Maintenance Standards - Wetvaults

Maintenance Component	Defect	Condition When Maintenance is Needed	Results Expected When Maintenance is Performed
General	Trash/Debris Accumulation	Trash and debris accumulated in vault, pipe or inlet/outlet (includes floatables	Remove trash and debris from vault.

ATTACHMENT 4

SAMISH ESTATES

STORMWATER FACILITY MAINTENANCE LOG SHEET

DATE: _____ TIME: _____

WEATHER CONDITIONS: _____ CHECKED BY: _____

SYSTEM COMPONENT	CONDITION	FOLLOW-UP ACTION	DATE ACTION COMPLETED
STORMWATER CONVEYANCE SYSTEM			
Catch Basins			
Pipes			
Pipe Outfalls			
Control Structure			

Notes:

SAMISH ESTATES

STORMWATER FACILITY MAINTENANCE LOG SHEET

SYSTEM COMPONENT	CONDITION	FOLLOW-UP ACTION	DATE ACTION COMPLETED
STORMWATER TREATMENT WETPOOL			
Sediment Level			
Wetland Plants			
Nuisance Plants			
STORMWATER DETENTION POND			
Debris			
Side Slope Ground Cover			
Nuisance Plants			
Emergency Overflow Weir			
Control Structure (interior and exterior)			
Inflow and Outflow Pipes			