FAIRFIELD INN AND SUITES

PRELIMINARY STORM DRAINAGE REPORT

Prepared for:

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DEA JOB#: SPSL-0006

August 2018

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CHAPTER 1 - PROJECT OVERVIEW

The purpose of this preliminary storm drainage report is to support the City of Poulsbo Site Plan Review Application for the Fairfield Inn and Suites. The project site is located near the intersection of Quickstep Court and NW Reliance St, and is situated on two tax parcels (102601-2-049-2002, 102601-2-048-2003) with a combined area of 2.38 acres. See **Figure 1** for the Vicinity Map.

The project site is part of the Olhava Master Plan (OMP) area. Since a pre-existing drainage design report was prepared for the OMP area, dated June 15, 2001, this report relies upon and refers to the existing OMP drainage report as needed. The OMP drainage report was prepared based on the 1992 Department of Ecology Drainage Manual for Western Washington, which vests development of this site to the original manual. At this time, the City's current manual is the 2014 Department of Ecology Stormwater Management Manual (SWMM), and stormwater treatment systems have been designed based on the current manual. Within the OMP drainage report, multiple sub-basin areas were delineated with discharges to corresponding detention ponds. Since the project site resides within the OMP area, flow control for this project is being provided by the detention ponds previously constructed to serve the subject parcels. See **Figures 3.1 and 4.0** respectively for the proposed basin map and the offsite analysis.

Basic stormwater treatment for pollution generating impervious and pervious surfaces will be provided through the use of one StormFilter™ Vault. No onsite flow control is proposed for this project, as flow control will be provided by the previously constructed detention ponds which service the OMP area.

The disturbed area proposed is greater than one acre and therefore the applicant will be required to pursue coverage under the NPDES permit for construction related stormwater discharges from the Washington State Department of Ecology. (Also known as the Construction Stormwater General Permit.)

Figure 1 – Vicinity Map

City of Poulsbo Vicinity Map

CHAPTER 2 - EXISTING AND PROPOSED CONDITIONS SUMMARY

EXISTING CONDITIONS

The site belongs to the Olhava Master Plan (OMP) area; in its current condition the site has been cleared and rough graded as part of the OMP Phase One Grading Project. The two site parcels, which are being combined through a BLA being submitted concurrently, have a total area of 2.38 acres with no impervious surface.

The site is bounded on the west by Quickstep Court; on the south by NW Reliance Street; and on the north and east by undeveloped lots. The site has a gentle slope from north to south, and currently receives surface runoff from the undeveloped lot to the north. See **Figure 2** for the existing conditions and basin map which has been borrowed from the OMP drainage report.

Within the subject parcels, a natural ridge divides the site between two sub-basins: the west portion of the site belongs to sub-basin #1, and the central and eastern portions of the site belong to sub-basin #8. (These sub-basins are identified and delineated in the OMP Drainage Report). In an effort to continue the site's drainage in two directions, the final site grading and drainage design will separately route the building roof runoff and the site pavement/landscape surface runoff into these two basins. Each onsite basin will discharge to a separate existing catch basin in the right-of-way which will then route runoff flows to separate receiving ponds. See **Figure 2** for the existing basin map.

No offsite areas are anticipated to be disturbed by the proposed improvements. Likewise, no critical areas have been identified on site.

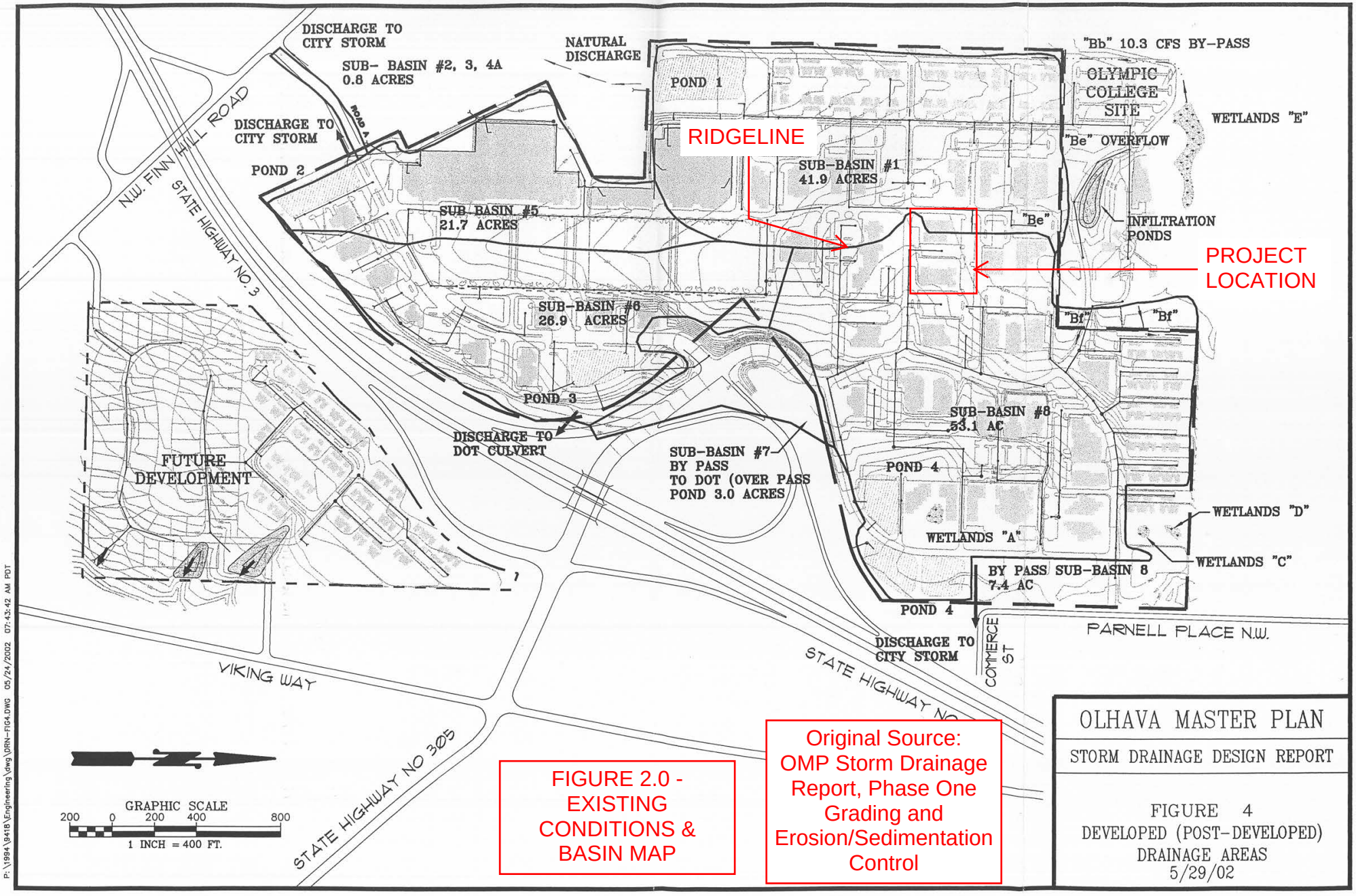


FIGURE 2.0 - EXISTING CONDITIONS & BASIN MAP

Original Source: OMP Storm Drainage Report, Phase One Grading and Erosion/Sedimentation Control

PROPOSED CONDITIONS

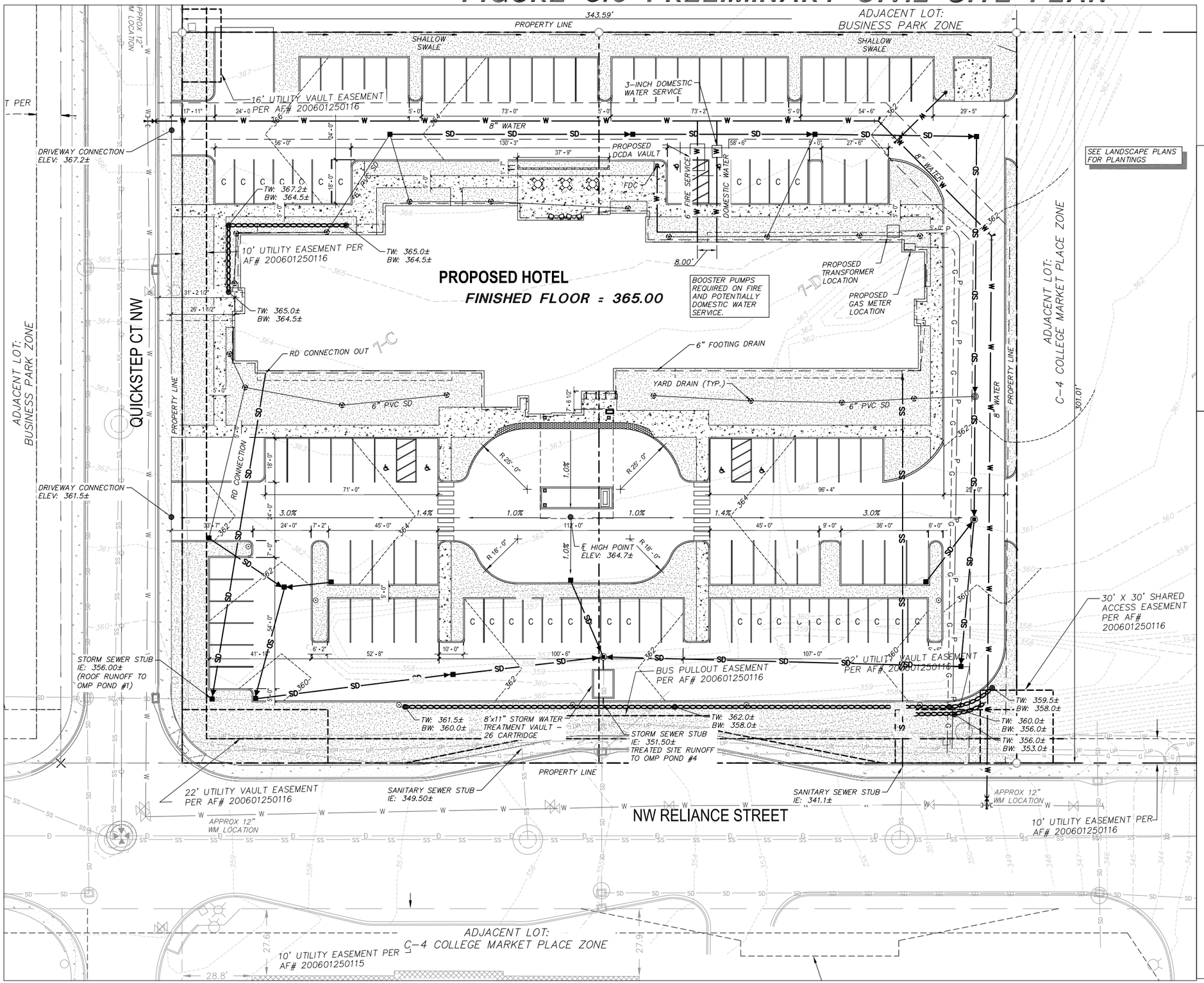
The proposed site improvements will include approximately 0.39 acres of impervious hotel roof; approximately 1.48 acres of impervious parking lot and walkway pavement; and approximately 0.69 acres of pervious landscaping per city requirements. The proposed site plan is represented in **Figure 3**.

A natural ridgeline separates the project site, as previously described in the existing conditions. To mimic the existing pre-developed site conditions, roof runoff will be collected and routed to OMP Sub-basin 1, whereas the impervious pavement runoff and pervious landscaped runoff surfaces will be collected, treated and routed to OMP Sub-basin 8. Approximately 13,000 square feet of landscaping runoff will be collected and routed to OMP Sub-basin 8, while the remaining 9,000 square feet of landscaping will bypass the onsite collection system into the right-of-way near NW Reliance St.

The onsite tributary basin area (Project basin 'A') for Sub-basin 1 will be approximately 0.39 acres; the onsite tributary basin area (Project basin 'B') for Sub-basin 8 will be approximately 1.77 acres; and the bypassed area will be approximately 0.20 acres. See **Figure 3.1** for the proposed basin map.

Currently, the undeveloped lot to the north directs some existing stormwater runoff onto the project site due to the existing grades. Since the on-site project stormwater facilities will provide basic treatment for runoff flows, it is our intention to avoid collecting offsite runoff where feasible. To this end, the shared lot line will be re-graded as necessary to divert runoff away from the project site and into the adjacent lot to the east (also owned by the Olhava Investment Group).

FIGURE 3.0 PRELIMINARY CIVIL SITE PLAN



NORTH

0 10 20 40

PRELIMINARY SITE PLAN LEGEND

- EXISTING CONTOURS
- PROPOSED CONTOURS
- PROPOSED ROCKERY WALL
- PROPOSED STORM SEWER
- CATCH BASIN TYPE 1
- CATCH BASIN TYPE 2
- YARD DRAIN
- PROPOSED SANITARY SEWER
- SANITARY SEWER CLEANOUT
- PROPOSED WATER LINE
- PROPOSED GAS LINE
- PROPOSED POWER LINE
- PROPOSED TREE
- PROPOSED CONC. PAVEMENT
- PROPOSED LANDSCAPING BED

EXISTING TOPOGRAPHY LEGEND

- AREA DRAIN
- ASPHALT SURFACE
- BOLLARD
- BUILDING
- CENTERLINE ROW
- CULVERT PIPE
- CONCRETE SURFACE
- RETAINING WALL
- DITCH (FLOWLINE)
- FENCE LINE (CHAIN LINK)
- FIRE DEPT CONNECTION
- FIRE HYDRANT
- GAS LINE
- GRAVEL SURFACE
- CATCH BASIN (TYPE 1)
- CATCH BASIN (TYPE 2)
- LUMINAIRE
- NAIL AS NOTED
- MONUMENT IN CASE (FOUND)
- POST
- POST INDICATOR
- POWER HAND HOLE
- POWER METER
- POWER POLE
- POWER POLE W/ LIGHT
- POWER SENTRY
- POWER TRANSFORMER
- POWER VAULT
- PRIVATE INLET
- REBAR AS NOTED (FOUND)
- SEWER LINE
- SEWER MANHOLE
- SIGN (AS NOTED)
- STORM MANHOLE
- STORM DRAIN LINE
- TELEPHONE HAND HOLE
- TELEPHONE PEDESTAL
- TELEPHONE SENTRY
- WATER LINE
- WATER METER
- WATER VALVE
- YARD LIGHT
- HOSE BIB
- BLOW OFF VALVE
- TELEPHONE VAULT
- TELEPHONE MANHOLE

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PRELIMINARY CIVIL SITE PLAN

HOTEL CONCEPTS

POULSBO HOTEL

POULSBO WASHINGTON

NO.	DATE	REVISION	BY	CK

REVIEWED BY:

DATE:

DESIGNED:

CADD:

PRELIMINARY

STAMP NOT VALID UNLESS SIGNED AND DATED

FIRST SUBMITTAL DATE: 8/20/18

SCALE: HORIZ.: VERT.:

PROJECT NO.

SPSL00000006

SHEET NO.

OF

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FIGURE 3.1 - PROPOSED BASIN MAP

NORTH

0 10 20 40

HATCH LEGEND

	PROJECT BASIN A (TO SUB-BASIN 1)	POJECT BASIN B (TO SUB-BASIN 8)
IMPERVIOUS (HMA/CONC)	0.0 AC	1.34 AC
IMPERVIOUS (ROOF)	0.39 AC	0.0 AC
PERVIOUS (LANDSCAPING)	0.0 AC	0.43 AC
TOTAL	0.39 AC	1.77 AC
BYPASS AREA 0.20 AC	0.01 AC	0.19 AC

NOTE
THE ONLY AREA THAT IS TRIBUTARY TO SUB-BASIN 1 IS THE BUILDING ROOF. ALL OTHER AREAS ARE TRIBUTARY TO SUB-BASIN 8

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PROPOSED BASIN MAP

HOTEL CONCEPTS

POULSBO HOTEL

POULSBO WASHINGTON

NO.	DATE	REVISION	BY	CK

REVIEWED BY:
DATE:
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FIRST SUBMITTAL DATE: 2/26/18
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PROJECT NO.
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CHAPTER 3 - OFFSITE ANALYSIS

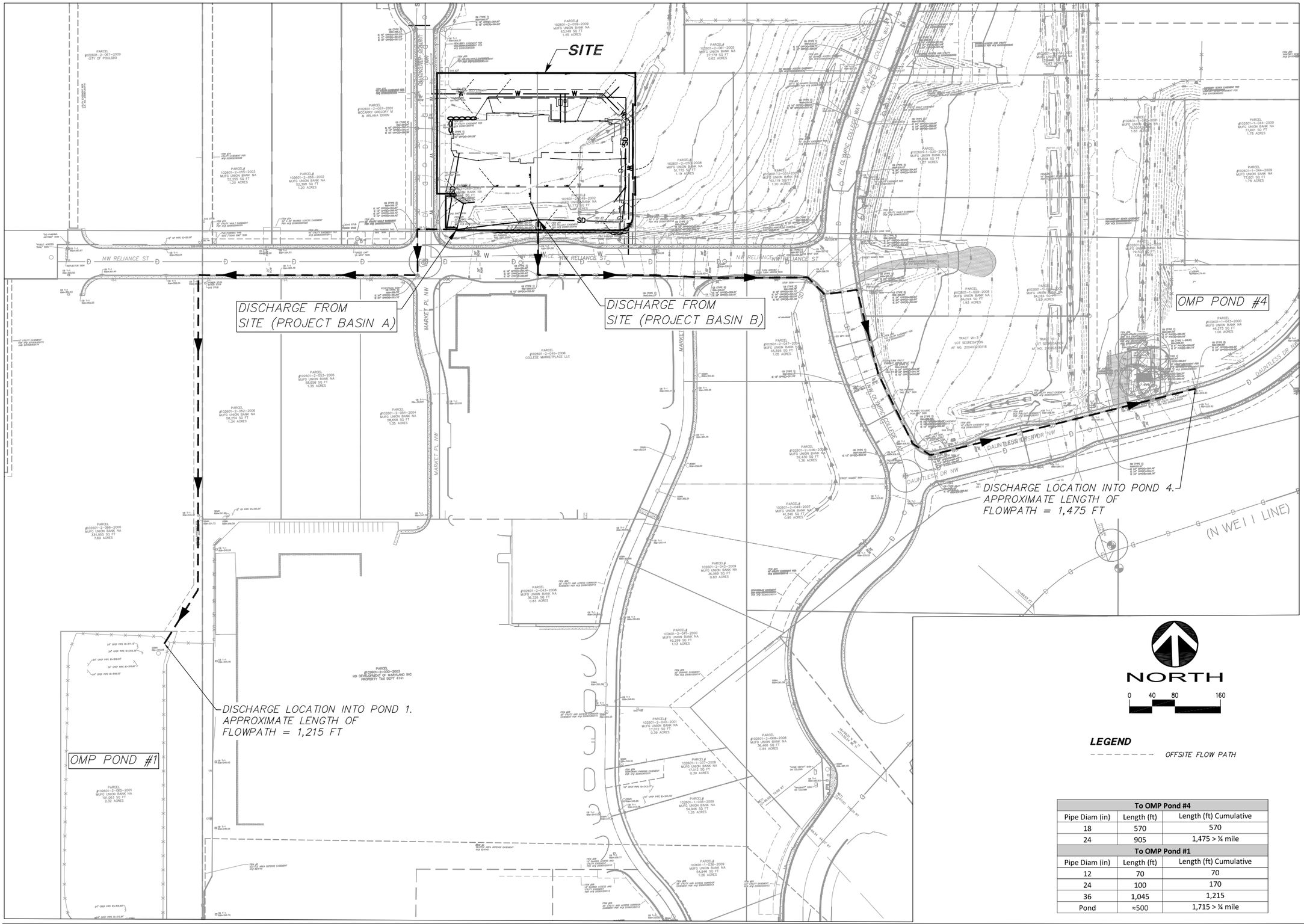
This site is designed to drain to two separate existing Sub-basins within the OMP. A downstream analysis was performed by DEA to determine the downstream path. The downstream paths were walked by DEA in May 2018 and confirmed with City drainage mapping and field observations. Stormwater will be collected and discharged into two existing drainage structures – one for each basin. The site runoff will then be conveyed through the existing stormwater network and be discharged into existing OMP detention pond #1 (OMP Sub-basin 1) and OMP detention pond number #4 (OMP Sub-basin 8). The flow paths from the site to the receiving ponds are both greater than ¼ mile, so no further offsite analysis was conducted beyond the detention ponds. **See Figure 4** for the offsite analysis areas.

The offsite conveyance system is described in Table 1, and is based upon information received from the City of Poulsbo As-Built drawings. We are not aware of any existing drainage problems for these storm drain structures, and no problems are predicted as a result of the proposed site improvements.

Table 1 – Offsite Conveyance Network

To OMP Pond #4		
Pipe Diam (in)	Length (ft)	Length (ft) Cumulative
18	570	570
24	905	1,475 > ¼ mile
To OMP Pond #1		
Pipe Diam (in)	Length (ft)	Length (ft) Cumulative
12	70	70
24	100	170
36	1,045	1,215
Pond	≈500	1,715 > ¼ mile

FIGURE 4 - OFFSITE ANALYSIS



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36	1,045	1,215
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OFFSITE ANALYSIS
HOTEL CONCEPTS
POULSBO HOTEL
POULSBO WASHINGTON

NO.	DATE	REVISION	BY	CK

REVIEWED BY:
DATE:
DESIGNED:
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SPSL00000006

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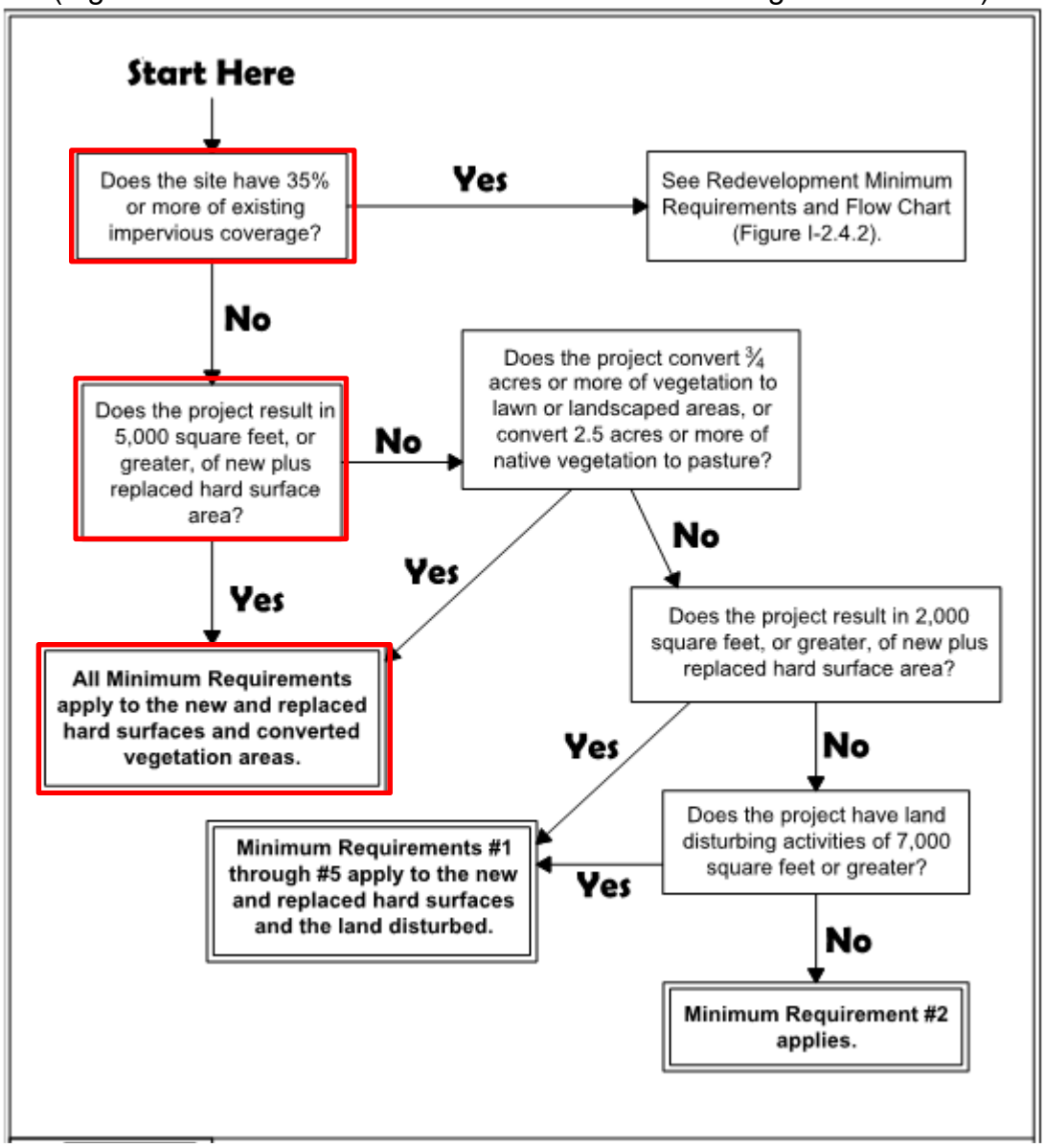
CHAPTER 4 - DISCUSSION OF MINIMUM REQUIREMENTS AND SITE LAYOUT

STORMWATER MINIMUM REQUIREMENTS SUMMARY

Since the site plan proposes over 5,000 square feet of new hardscape surfaces, the DOE "Flow Chart for Determining Requirements for New Development" requires that all applicable Minimum Requirements (MRs #1 through #9) apply to the new and replaced hard surfaces and converted vegetation areas for this project. Additionally, an offsite analysis was performed (and contained herein) in order to meet local jurisdictional minimum requirement #10. See **Figure 5** for the DOE flowchart and **Figure 3** for a summary of proposed impervious and pervious areas.

Figure 5 – Flow Chart for Determining Requirements for New Development
(Figure I-2.4.1 from the 2014 DOE Stormwater Management Manual)



MINIMUM REQUIREMENTS

MR1 – Preparation of Stormwater Site Plans
A Stormwater Site Plan has been prepared in accordance with the DOE requirements. This storm drainage report and the associated civil engineering plans fulfill this requirement.

MR2 – Construction Stormwater Pollution Prevention Plan (CSWPPP)

This project will disturb more than 7,000 square feet of land and will therefore require a Construction Stormwater Pollution Prevention Plan (SWPPP) as part of the Site Plan. A SWPPP plan will be included in the final drainage report.

MR3 – Source Control of Pollution
Construction phase Best Management Practices (BMPs) will be detailed in the final Construction Drawings. These BMPs will represent the minimum expected control measures for the interim construction site conditions. The contractor shall be responsible for adjusting and maintaining these BMPs as required by site conditions.

Permanent source control BMPs applicable to this site include, but are not limited to:

- S421 Parking and Storage for Vehicles and Equipment
- S424 Roof/Building Drains at Manufacturing and Commercial Buildings.
- S417 Maintenance of Stormwater Drainage and Treatment Systems

MR4 – Preservation of Natural Drainage Systems and Outfalls
In the existing conditions, the site drains offsite to multiple catch basins in the right-of-way and then to separate ponds which have already been constructed as a part of the OMP. The proposed conditions will preserve these two drainage directions (OMP Sub-basin 1 and OMP Sub-basin 8).

MR5 – On-Site Stormwater Management
Since this site is a part of the OMP, the site is vested under the 1992 DOE Manual. The OMP previously constructed stormwater facilities for these parcels, and additional on-site stormwater management systems are not being considered at this time.

MR6 – Runoff Treatment
Based upon the Pre application meeting with the city of Poulsbo staff, the proposed project will be required to provide basic treatment for surface runoff. This will be accomplished by means of one StormFilter™ vault prior to discharge from the site.

MR7 – Flow Control

Flow control has already been provided for this project as a part of the OMP. Runoff will be routed to existing man-made detention ponds (Pond #1 and Pond #4) which were constructed to serve the greater OMP area.

MR8 – Wetlands Protection

This minimum requirement does not apply to the site due to there being no wetland within ¼ of a mile downstream of the site.

MR9 – Operation and Maintenance

An operations and maintenance manual will be included for the final drainage report**.** A copy of the operation and maintenance manual will be retained on-site at all times by the owner.

MR10 – Offsite Analysis and Mitigation

An off-site analysis has been performed and is discussed in Chapter 3 above.

CHAPTER 5 - PERMANENT STORMWATER CONTROL PLAN

Water Quality

A new StormFilter™ Vault will be installed at the location shown on **Figure 3** – Proposed Basin Map. Sizing of the StormFilter™ Vault is based on the 2012 Western Washington Hydrology Model (WWHM) and the Department of Ecology General Use Level Designation. The full WWHM calculations and StormFilter™ Vault sizing criteria are in **Appendix A**.

The areas where treatment is provided is shown below in Table 2. Treatment provided meets the area requirements. Per WWHM simulations, the required online water quality flow rate for the treatment vault is 0.4299 cfs (193 gpm). This flow rate was used in the sizing of the Stormfilter™ Vault.

Table 2 – Treatment Areas for Vault Sizing

Area Description	Area (ac)
Pervious Lawn (PGPS)	0.29
Impervious Pavement (PGHS)	1.48
Impervious Roof	0.0
Total	1.77

***All treated runoff will be discharged toward OMP Sub-Basin 8**
**** Roof is tributary to Sub-Basin 1, and is also not treated.**

Appendix A

StormFilter™ Calculations

General Model Information

Project Name:	WQ flow rates for Stormfilter Vaults
Site Name:	
Site Address:	
City:	
Report Date:	8/20/2018
Gage:	Quilcene
Data Start:	1948/10/01
Data End:	2009/09/30
Timestep:	15 Minute
Precip Scale:	0.800
Version Date:	2017/04/14
Version:	4.2.13

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

PROJECT BASIN A

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
Pervious Total	0
Impervious Land Use	acre
ROOF TOPS FLAT	0.39
Impervious Total	0.39
Basin Total	0.39

Element Flows To:

Surface	Interflow	Groundwater

PROJECT BASIN B

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
A B, Lawn, Mod	0.293
Pervious Total	0.293
Impervious Land Use	acre
PARKING MOD	1.476
Impervious Total	1.476
Basin Total	1.769

Element Flows To:

Surface	Interflow	Groundwater

Mitigated Land Use

PROJECT BASIN B

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
A B, Lawn, Mod	0.293
Pervious Total	0.293
Impervious Land Use	acre
PARKING MOD	1.476
Impervious Total	1.476
Basin Total	1.769

HMA/CONCRETE PAVEMENT AND LANDSCAPING - TREATMENT IS REQUIRED, BUT NO ONSITE FLOW CONTROL NEEDED.

Element Flows To:

Surface	Interflow	Groundwater

PROJECT BASIN A

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
Pervious Total	0
Impervious Land Use	acre
ROOF TOPS FLAT	0.39
Impervious Total	0.39
Basin Total	0.39

ROOF RUNOFF ONLY - NO TREATMENT OR ONSITE FLOW CONTROL REQUIRED.

Element Flows To:

Surface	Interflow	Groundwater

Water Quality

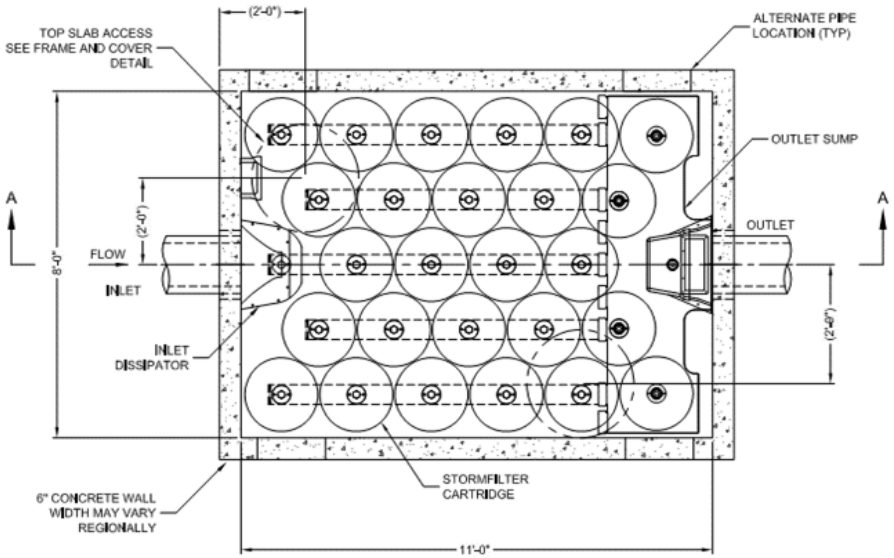
Water Quality BMP Flow and Volume for POC #1

On-line facility volume:	0.2981 acre-feet
On-line facility target flow:	0.4299 cfs.
Adjusted for 15 min:	0.4299 cfs.
Off-line facility target flow:	0.2456 cfs.
Adjusted for 15 min:	0.2456 cfs.

ONLY PROJECT BASIN B CONNECTS TO POC #1. THIS FLOW WAS USED TO SIZE THE STORMFILTER CB.

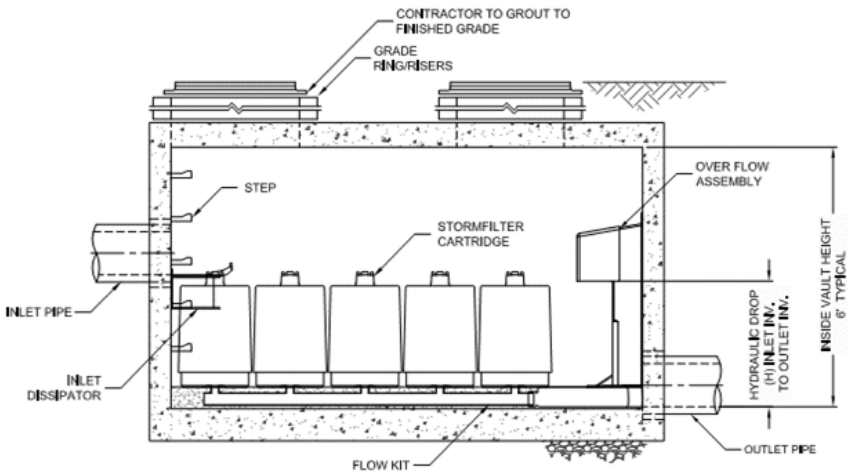
PROJECT BASIN A WQ FLOW (CFS)	0	CFS
PROJECT BASIN A WQ FLOW (GPM)	0.00	GPM
PROJECT BASIN A CARTRIDGES	0	

PROJECT BASIN B WQ FLOW (CFS)	0.4299	CFS
PROJECT BASIN B WQ FLOW (GPM)	192.95	GPM
PROJECT BASIN B CARTRIDGES (TYP HEIGHT))	26	ROUNDED UP



PLAN VIEW

VAULT STYLE: OUTLET SUMP (NIB)



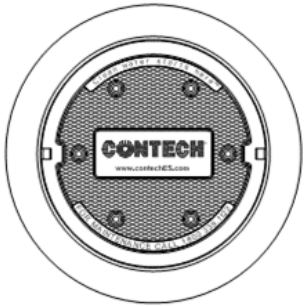
SECTION A-A

STORMFILTER DESIGN NOTES

STORMFILTER TREATMENTCAPACITY IS A FUNCTION OF THE CARTRIDGE SELECTION AND THE NUMBER OF CARTRIDGES. THE STANDARD VAULT STYLE IS SHOWN WITH THE MAXIMUM NUMBER OF CARTRIDGES (26). VAULT STYLE OPTIONS INCLUDE INLET BAY (17), INLET BAY/OUTLET BAY (12), OUTLET BAY (21), FULL HEIGHT BAFFLE WALL (17).
STORMFILTER 8X11 PEAK HYDRAULIC CAPACITY IS 1.8 CFS. IF THE SITE CONDITIONS EXCEED 1.8 CFS AN UPSTREAM BYPASS STRUCTURE IS REQUIRED.

CARTRIDGE SELECTION

CARTRIDGE HEIGHT	27"		18"		LOW DROP	
RECOMMENDED HYDRAULIC DROP (H)	3.05'		2.3'		1.8'	
SPECIFIC FLOW RATE (gpm/sf)	2 gpm/ft²	1 gpm/ft²	2 gpm/ft²	1 gpm/ft²	2 gpm/ft²	1 gpm/ft²
CARTRIDGE FLOW RATE (gpm)	22.5	11.25	15	7.5	10	5



FRAME AND COVER

(DIAMETER VARIES)
N.T.S.

SITE SPECIFIC DATA REQUIREMENTS

STRUCTURE ID	*
WATER QUALITY FLOW RATE (cfs)	*
PEAK FLOW RATE (cfs)	*
RETURN PERIOD OF PEAK FLOW (yrs)	*
# OF CARTRIDGES REQUIRED	*
CARTRIDGE FLOW RATE	*
MEDIA TYPE (CSF, PERLITE, ZPG, GAC, PHS)	*

PIPE DATA:	I.E.	MATERIAL	DIAMETER
INLET PIPE #1	*	*	*
INLET PIPE #2	*	*	*
OUTLET PIPE	*	*	*

UPSTREAM RIM ELEVATION	*
DOWNSTREAM RIM ELEVATION	*

ANTI-FLOTATION BALLAST	WIDTH	HEIGHT
	*	*

NOTES/SPECIAL REQUIREMENTS:

* PER ENGINEER OF RECORD

GENERAL NOTES

1. CONTECH TO PROVIDE ALL MATERIALS UNLESS NOTED OTHERWISE.
2. DIMENSIONS MARKED WITH ( ) ARE REFERENCE DIMENSIONS. ACTUAL DIMENSIONS MAY VARY.
3. FOR SITE SPECIFIC DRAWINGS WITH DETAILED VAULT DIMENSIONS AND WEIGHTS, PLEASE CONTACT YOUR CONTECH ENGINEERED SOLUTIONS LLC REPRESENTATIVE. www.ContechES.com
4. STORMFILTER WATER QUALITY STRUCTURE SHALL BE IN ACCORDANCE WITH ALL DESIGN DATA AND INFORMATION CONTAINED IN THIS DRAWING.
5. STRUCTURE SHALL MEET AASHTO HS20 LOAD RATING, ASSUMING EARTH COVER OF 0' - 5' AND GROUNDWATER ELEVATION AT, OR BELOW, THE OUTLET PIPE INVERT ELEVATION. ENGINEER OF RECORD TO CONFIRM ACTUAL GROUNDWATER ELEVATION. CASTINGS SHALL MEET AASHTO M306 AND BE CAST WITH THE CONTECH LOGO.
6. FILTER CARTRIDGES SHALL BE MEDIA-FILLED, PASSIVE, SIPHON ACTUATED, RADIAL FLOW, AND SELF CLEANING. RADIAL MEDIA DEPTH SHALL BE 7-INCHES. FILTER MEDIA CONTACT TIME SHALL BE AT LEAST 39 SECONDS.
7. SPECIFIC FLOW RATE IS EQUAL TO THE FILTER TREATMENT CAPACITY (gpm) DIVIDED BY THE FILTER CONTACT SURFACE AREA (sq ft).

INSTALLATION NOTES

1. ANY SUB-BASE, BACKFILL DEPTH, AND/OR ANTI-FLOTATION PROVISIONS ARE SITE-SPECIFIC DESIGN CONSIDERATIONS AND SHALL BE SPECIFIED BY ENGINEER OF RECORD.
2. CONTRACTOR TO PROVIDE EQUIPMENT WITH SUFFICIENT LIFTING AND REACH CAPACITY TO LIFT AND SET THE STORMFILTER VAULT (LIFTING CLUTCHES PROVIDED).
3. CONTRACTOR TO INSTALL JOINT SEALANT BETWEEN ALL VAULT SECTIONS AND ASSEMBLE VAULT.
4. CONTRACTOR TO PROVIDE, INSTALL, AND GROUT PIPES. MATCH OUTLET PIPE INVERT WITH OUTLET BAY FLOOR.
5. CONTRACTOR TO TAKE APPROPRIATE MEASURES TO PROTECT CARTRIDGES FROM CONSTRUCTION-RELATED EROSION RUNOFF.

CONTECH
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SF0811
STORMFILTER
STANDARD DETAIL

April 2017

GENERAL USE LEVEL DESIGNATION FOR BASIC (TSS) TREATMENT

For

CONTECH Engineered Solutions
Stormwater Management StormFilter®
With ZPG Media at 1 gpm/sq ft media surface area

Ecology's Decision:

Based on the CONTECH Engineered Solutions' (CONTECH) application submissions, Ecology hereby issues a General Use Level Designation (GULD) for the Stormwater Management StormFilter® (StormFilter):

1. **As a basic stormwater treatment practice for total suspended solids (TSS) removal,**
   - **Using ZPG™ media (zeolite/perlite/granular activated carbon), with the size distribution described below,**
   - **Sized at a hydraulic loading rate of 1 gpm/ft^2 of media surface area, per Table 1, and**
   - **Internal bypassing needs to be consistent with the design guidelines in CONTECH's current product design manual.**

Table 1. StormFilter Design Flow Rates per Cartridge

Effective Cartridge Height (inches)	12	18	27
Cartridge Flow Rate (gpm/cartridge)	5	7.5	11.3

2. **Ecology approves StormFilter systems containing ZPG™ media for treatment at the hydraulic loading rates shown in Table 1, and sized based on the water quality design flow rate for an off-line system. Contech designs their StormFilter systems to maintain treatment of the water quality design flow while routing excess flows around the treatment chamber during periods of peak bypass. The water quality design flow rates are calculated using the following procedures:**
   - **Western Washington: For treatment installed upstream of detention or retention, the water quality design flow rate is the peak 15-minute flow rate as calculated using the latest version of the Western Washington Hydrology Model or other Ecology-approved continuous runoff model.**

- **Eastern Washington: For treatment installed upstream of detention or retention, the water quality design flow rate is the peak 15-minute flow rate as calculated using one of the three methods described in Chapter 2.2.5 of the Stormwater Management Manual for Eastern Washington (SWMMEW) or local manual.**
- **Entire State: For treatment installed downstream of detention, the water quality design flow rate is the full 2-year release rate of the detention facility.**

3. **This designation has no expiration date, but Ecology may amend or revoke it.**

<u>Ecology's Conditions of Use</u>:

The StormFilter with ZPG media shall comply with the following conditions:

1. **Design, install, operate, and maintain the StormFilter with ZPG media in accordance with applicable Contech Engineered Solutions manuals, documents, and the Ecology Decision.**

2. **Install StormFilter systems to bypass flows exceeding the water quality treatment rate. Additionally, high flows will not re-suspend captured sediments. Design StormFilter systems in accordance with the performance goals in Ecology's most recent Stormwater Manual and CONTECH's *Product Design Manual Version 4.1 (April 2006)*, or most current version, unless otherwise specified.**

3. **Owners must follow the design, pretreatment, land use application, and maintenance criteria in CONTECH's Design Manual.**

4. **Pretreatment of TSS and oil and grease may be necessary, and designers shall provide pre-treatment in accordance with the most current versions of the CONTECH's *Product Design Manual (April 2006)* or the applicable Ecology Stormwater Manual. Design pre-treatment using the performance criteria and pretreatment practices provided on Ecology's "Evaluation of Emerging Stormwater Treatment Technologies" website.**

5. **Maintenance: The required maintenance interval for stormwater treatment devices is often dependent upon the degree of pollutant loading from a particular drainage basin. Therefore, Ecology does not endorse or recommend a "one size fits all" maintenance cycle for a particular model/size of manufactured filter treatment device.**

   - **Typically, CONTECH designs StormFilter systems for a target filter media replacement interval of 12 months. Maintenance includes removing accumulated sediment from the vault, and replacing spent cartridges with recharged cartridges.**

- **Indications of the need for maintenance include effluent flow decreasing to below the design flow rate, as indicated by the scumline above the shoulder of the cartridge.**
- **Owners/operators must inspect StormFilter with ZPG media for a minimum of twelve months from the start of post-construction operation to determine site-specific maintenance schedules and requirements. You must conduct inspections monthly during the wet season, and every other month during the dry season. (According to the SWMMWW, the wet season in western Washington is October 1 to April 30. According to SWMMEW, the wet season in eastern Washington is October 1 to June 30). After the first year of operation, owners/operators must conduct inspections based on the findings during the first year of inspections.**
- **Conduct inspections by qualified personnel, follow manufacturer's guidelines, and use methods capable of determining either a decrease in treated effluent flowrate and/or a decrease in pollutant removal ability.**
- **When inspections are performed, the following findings typically serve as maintenance triggers:**
  - **Accumulated vault sediment depths exceed an average of 2 inches, or**
  - **Accumulated sediment depths on the tops of the cartridges exceed an average of 0.5 inches, or**
  - **Standing water remains in the vault between rain events, or**
  - **Bypass occurs during storms smaller than the design storm.**
- **Note: If excessive floatables (trash and debris) are present, perform a minor maintenance consisting of gross solids removal, not cartridge replacement.**

6. **CONTECH shall maintain readily available reports listed under "Application Documents" (above) as public, as well as the documentation submitted with its previous conditional use designation application. CONTECH shall provide links to this information from its corporate website, and make this information available upon request, at no cost and in a timely manner.**

7. **ZPG™ media used shall conform with the following specifications:**

- **Each cartridge contains a total of approximately 2.6 cubic feet of media. The ZPG™ cartridge consists of an outer layer of perlite that is approximately 1.3 cubic feet in volume and an inner layer, consisting of a mixture of 90% zeolite and 10% granular activated carbon, which is approximately 1.3 cubic feet in volume.**

- **Perlite Media: Perlite media shall be made of natural siliceous volcanic rock free of any debris or foreign matter. The expanded perlite shall**

have a bulk density ranging from 6.5 to 8.5 lbs per cubic foot and particle sizes ranging from 0.09" (#8 mesh) to 0.38" (3/8" mesh).

- **Zeolite Media: Zeolite media shall be made of naturally occurring clinoptilolite. The zeolite media shall have a bulk density ranging from 44 to 50 lbs per cubic foot and particle sizes ranging from 0.13" (#6 mesh) to 0.19" (#4 mesh). Additionally, the cation exchange capacity (CEC) of zeolite shall range from approximately 1.0 to 2.2 meq/g.**

- **Granular Activated Carbon: Granular activated carbon (GAC) shall be made of lignite coal that has been steam-activated. The GAC media shall have a bulk density ranging from 28 to 31 lbs per cubic foot and particle sizes ranging from a 0.09" (#8 mesh) to 0.19" (#4 mesh).**

<u>Approved Alternate Configurations</u>

Peak Diversion StormFilter

1. The Peak Diversion StormFilter allows for off-line bypass within the StormFilter structure. Design capture flows and peak flows enter the inlet bay which contains an internal weir. The internal weir allows design flows to enter the cartridge bay through a transfer hole located at the bottom of the inlet bay while the unit routs higher flows around the cartridge bay.
2. To select the size of the Peak Diversion StormFilter unit, the designer must determine the number of cartridges required and size of the standard StormFilter using the site-specific water quality design flow and the **StormFilter Design Flow Rates per Cartridge** as described above.
3. New owners may not install the Peak Diversion StormFilter at an elevation or in a location where backwatering may occur.

Applicant: Contech Engineered Solutions

Applicant's Address: 11835 NE Glenn Widing Dr.
Portland, OR 97220

Application Documents:

The applicant's master report, titled, "The Stormwater Management StormFilter Basic Treatment Application for General Use Level Designation in Washington", Stormwater Management, Inc., November 1, 2004, includes the following reports:

- (Public) *Evaluation of the Stormwater Management StormFilter Treatment System: Data Validation Report and Summary of the Technical Evaluation Engineering Report (TEER) by Stormwater Management Inc.*, October 29, 2004 Ecology's technology assessment protocol requires the applicant to hire an independent consultant to complete the following work:

1. Complete the data validation report.
2. Prepare a TEER summary, including a testing summary and conclusions compared with the supplier's performance claims.
3. Provide a recommendation of the appropriate technology use level.
4. Work with Ecology to post recommend relevant information on Ecology's website.
5. Provide additional testing recommendations, if needed."
6. This report, authored by Dr. Gary Minton, Ph. D., P.E., Resource Planning Associates, satisfies the Ecology requirement.

- (Public) "Performance of the Stormwater Management StormFilter Relative to the Washington State Department of Ecology Performance Goals for Basic Treatment," is a summary of StormFilter performance that strictly adheres to the criteria listed in the Guidance for Evaluating Emerging Stormwater Treatment Technologies, Technology Assessment Protocol – Ecology (TAPE).
- "Heritage Marketplace Field Evaluation: Stormwater Management StormFilter with ZPG™ Media," is a report showing all of the information collected at Site A as stated in the SMI Quality Assurance Project Plan (QAPP). This document contains detailed information regarding each storm event collected at this site, and it provided a detailed overview of the data and project.
- "Lake Stevens Field Evaluation: Stormwater Management StormFilter with ZPG™ Media," is a report that corresponds to Site E as stated in the SMI QAPP. This document contains detailed information regarding each storm collected at this site, and includes a detailed overview of the data and project.
- (Public) "Evaluation of the Stormwater Management StormFilter for the removal of SIL-CO-SIL 106, a standardized silica product: ZPG™ at 7.5 GPM" is a report that describes laboratory testing at full design flow.
- "Factors Other Than Treatment Performance."
- "State of Washington Installations."
- "Peak Diversion StormFilter" is a technical document demonstrating the Peak Diversion StormFilter system complies with the Stormwater Management Manual for Western Washington Volume V Section 4.5.1.

Above-listed documents noted as "public" are available by contacting CONTECH.

Applicant's Use Level Request:

That Ecology grant a General Use Level Designation for Basic Treatment for the StormFilter using ZPG™ media (zeolite/perlite/granular activated carbon) at a hydraulic loading rate of 1 gpm/ft^2 of media surface area in accordance with Ecology's 2011 *Technical Guidance Manual for Evaluating Emerging Stormwater Treatment Technologies Technology Assessment Protocol – Ecology (TAPE).*

Applicant's Performance Claim:

The combined data from the two field sites reported in the TER (Heritage Marketplace and Lake Stevens) indicate that the performance of a StormFilter system configured for inline bypass with ZPG™ media and a hydraulic loading rate of 1 gpm/ft^2 of media surface area meets Ecology performance goals for Basic Treatment.

Ecology's Recommendations:

Based on the weight of the evidence and using its best professional judgment, Ecology finds that:

- StormFilter, using ZPG™ media and operating at a hydraulic loading rate of no more than 1 gpm/ft^2 of media surface area, is expected to provide effective stormwater treatment achieving Ecology's Basic Treatment (TSS removal) performance goals. Contech demonstrated this is through field and laboratory testing performed in accordance with the approved protocol. StormFilter is deemed satisfactory with respect to factors other than treatment performance (e.g., maintenance; see the protocol's Appendix B for complete list).

Findings of Fact:

- Influent TSS concentrations and particle size distributions were generally within the range of what Ecology considers "typical" for western Washington (silt-to-silt loam).
- Contech sampled thirty-two (32) storm events at two sites for storms from April 2003 to March 2004, of which Contech deemed twenty-two (22) as "qualified" and were therefore included in the data analysis set.
- Statistical analysis of these 22 storm events verifies the data set's adequacy.
- Analyzing all 22 qualifying events, the average influent and effluent concentrations and aggregate pollutant load reduction are 114 mg/L, 25 mg/L, and 82%, respectively.
- Analyzing all 22 qualifying events based on the *estimated average* flow rate during the event (versus the *measured peak* flow rate), and more heavily weighting those events near the design rate (versus events either far above or well below the design rate) does not significantly affect the reported results.
- For the 7 qualifying events with influent TSS concentrations greater than 100 mg/L, the average influent and effluent concentrations and aggregate pollutant load reduction are 241 mg/L, 34 mg/L, and 89%, respectively. If we exclude the 2 of 7 events that exceed the maximum 300 mg/L specified in Ecology's guidelines, the average influent and effluent concentrations and aggregate pollutant load reduction are 158 mg/L, 35 mg/L, and 78%, respectively.
- For the 15 qualifying events with influent TSS concentrations less than 100 mg/L, the average influent and effluent concentrations and aggregate pollutant load reduction are 55 mg/L, 20 mg/L, and 61%, respectively. If the 6 of 15 events that fall below the minimum 33 mg/L TSS specified in Ecology's guidelines are excluded, the average

influent and effluent concentrations and aggregate pollutant load reduction are 78 mg/L, 26 mg/L, and 67%, respectively.

- For the 8 qualifying events with peak discharge exceeding design flow (ranging from 120 to 257% of the design rate), results ranged from 52% to 96% TSS removal, with an average of 72%.
- Due to the characteristics of the hydrographs, the field results generally reflect flows below (ranging between 20 and 60 percent of) the tested facilities' design rate. During these sub-design flow rate periods, some of the cartridges operate at or near their *individual* full design flow rate (generally between 4 and 7.5 GPM for an 18" cartridge effective height) because their float valves have opened. Float valves remain closed on the remaining cartridges, which operate at their base "trickle" rate of 1 to 1.5 GPM.
- Laboratory testing using U.S. Silica's Sil-Co-Sil 106 fine silica product showed an average 87% TSS removal for testing at 7.5 GPM per cartridge (100% design flow rate).
- Other relevant testing at I-5 Lake Union, Greenville Yards (New Jersey), and Ski Run Marina (Lake Tahoe) facilities shows consistent TSS removals in the 75 to 85% range. *Note that the evaluators operated the I-5 Lake Union at 50%, 100%, and 125% of design flow*.
- SMI's application included a satisfactory "Factors other than treatment performance" discussion.

Note: Ecology's 80% TSS removal goal applies to 100 mg/l and greater influent TSS. Below 100 mg/L influent TSS, the goal is 20 mg/L effluent TSS.

Technology Description:

The Stormwater Management StormFilter® (StormFilter), a flow-through stormwater filtration system, improves the quality of stormwater runoff from the urban environment by removing pollutants. The StormFilter can treat runoff from a wide variety of sites including, but not limited to: retail and commercial development, residential streets, urban roadways, freeways, and industrial sites such as shipyards, foundries, etc.

Operation:

The StormFilter is typically comprised of a vault that houses rechargeable, media-filled, filter cartridges. Various media may be used, but this designation covers only the zeolite-perlite-granulated activated carbon (ZPG™) medium. Stormwater from storm drains percolates through these media-filled cartridges, which trap particulates and may remove pollutants such as dissolved metals, nutrients, and hydrocarbons. During the filtering process, the StormFilter system also removes surface scum and floating oil and grease. Once filtered through the media, the treated stormwater is directed to a collection pipe or discharged to an open channel drainage way.

This document includes a bypass schematic for flow rates exceeding the water quality design flow rate on page 8.

StormFilter Configurations:

Contech offers the StormFilter in multiple configurations: precast, high flow, catch basin, curb inlet, linear, volume, corrugated metal pipe, drywell, and CON/Span form. Most configurations use pre-manufactured units to ease the design and installation process. Systems may be either uncovered or covered underground units.

The typical precast StormFilter unit is composed of three sections: the energy dissipater, the filtration bay, and the outlet sump. As Stormwater enters the inlet of the StormFilter vault through the inlet pipe, piping directs stormwater through the energy dissipater into the filtration bay where treatment will take place. Once in the filtration bay, the stormwater ponds and percolates horizontally through the media contained in the StormFilter cartridges. After passing through the media, the treated water in each cartridge collects in the cartridge's center tube from where piping directs it into the outlet sump by a High Flow Conduit under-drain manifold. The treated water in the outlet sump discharges through the single outlet pipe to a collection pipe or to an open channel drainage way. In some applications where you anticipate heavy grit loads, pretreatment by settling may be necessary.

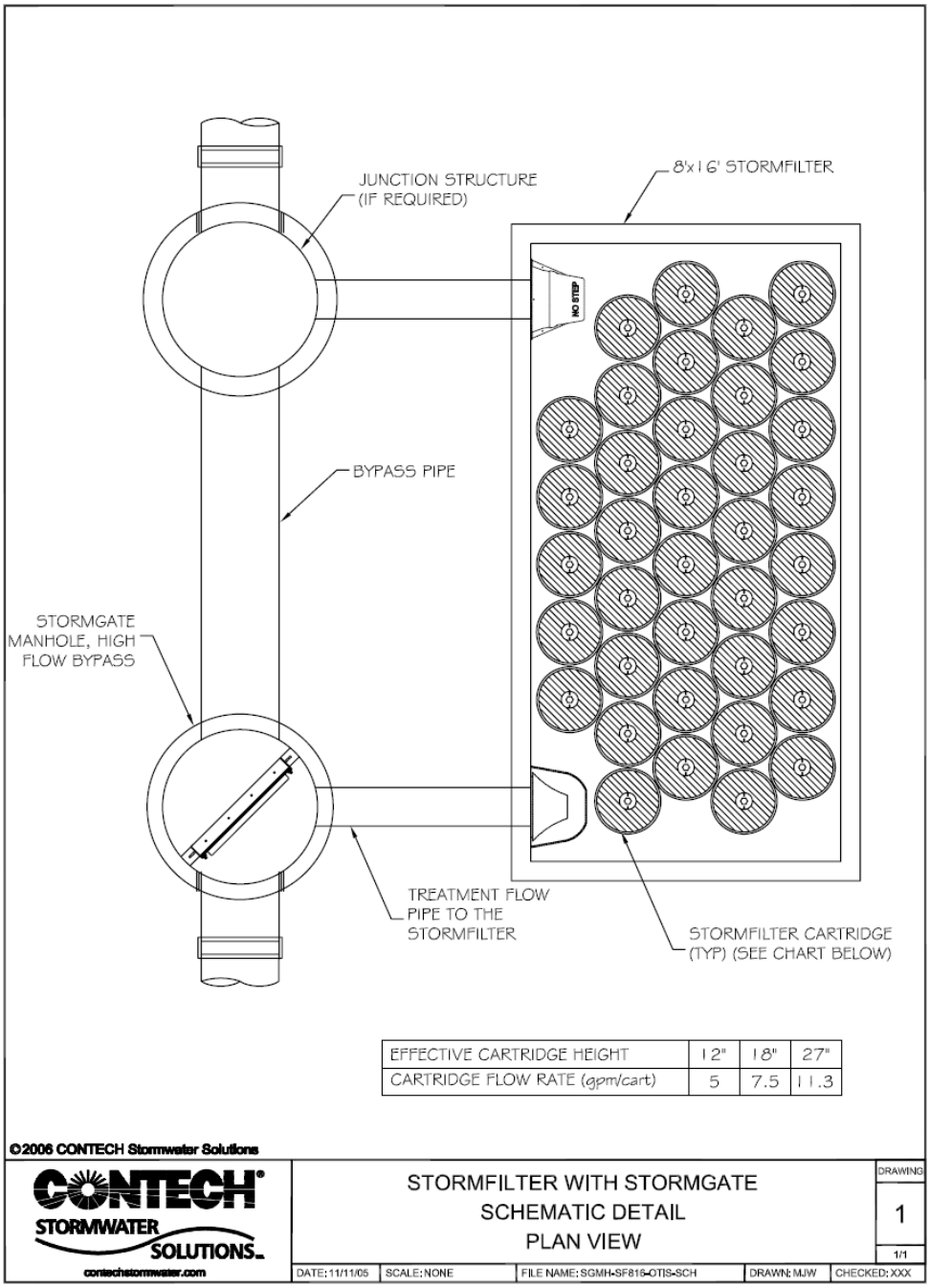

Figure 1. Stormwater Management StormFilter Configuration with Bypass

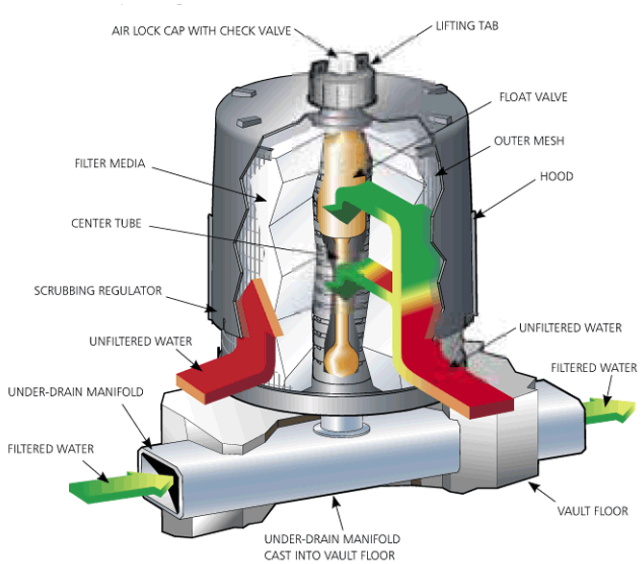

Figure 2. The StormFilter Cartridge

Cartridge Operation:

As the water level in the filtration bay begins to rise, stormwater enters the StormFilter cartridge. Stormwater in the cartridge percolates horizontally through the filter media and passes into the cartridge's center tube, where the float in the cartridge is in a closed (downward) position. As the water level in the filtration bay continues to rise, more water passes through the filter media and into the cartridge's center tube. Water displaces the air in the cartridge and it purges from beneath the filter hood through the one-way check valve located in the cap. Once water fills the center tube there is enough buoyant force on the float to open the float valve and allow the treated water to flow into the under-drain manifold. As the treated water drains, it tries to pull in air behind it. This causes the check valve to close, initiating a siphon that draws polluted water throughout the full surface area and volume of the filter. Thus, water filters through the entire filter cartridge throughout the duration of the storm, regardless of the water surface elevation in the filtration bay. This continues until the water surface elevation drops to the elevation of the scrubbing regulators. At this point, the siphon begins to break and air quickly flows beneath the hood through the scrubbing regulators, causing energetic bubbling between the inner surface of the hood and the outer surface of the filter. This bubbling agitates and cleans the surface of the filter, releasing accumulated sediments on the surface, flushing them from beneath the hood, and allowing them to settle to the vault floor.

Adjustable cartridge flow rate:

Inherent to the design of the StormFilter is the ability to control the individual cartridge flow rate with an orifice-control disc placed at the base of the cartridge. Depending on the treatment requirements and on the pollutant characteristics of the influent stream as

specified in the CONTECH *Product Design Manual*, operators may adjust the flow rate through the filter cartridges. By decreasing the flow rate through the filter cartridges, the influent contact time with the media is increased and the water velocity through the system is decreased, thus increasing both the level of treatment and the solids removal efficiencies of the filters, respectively (de Ridder, 2002).

Recommended research and development:

Ecology encourages CONTECH to pursue continuous improvements to the StormFilter. To that end, CONTECH recommends the following actions:

- Determine, through laboratory testing, the relationship between accumulated solids and flow rate through the cartridge containing the ZPG™ media. **Completed 11/05.**
- Determine the system's capabilities to meet Ecology's enhanced, phosphorus, and oil treatment goals.
- Develop easy-to-implement methods of determining that a StormFilter facility requires maintenance (cleaning and filter replacement).

Contact Information:

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Revision History

Date	**Revision**
Jan 2005	Original Use Level Designation
Dec 2007	Revision
May 2012	Maintenance requirements updated
November 2012	Design Storm and Maintenance requirements updated
January 2013	Updated format to match Ecology standard format
September 2014	Added Peak Diversion StormFilter Alternate Configuration
November 2016	Revised Contech contact information
April 2017	Revised sizing language to note sizing based on Off-line calculations

Appendix B

Operation and Maintenance Manual

[TO FOLLOW]
WITH FINAL
REPORT

Appendix C

Construction Stormwater Pollution Prevention Plan (SWPPP)

[TO FOLLOW]
WITH FINAL
REPORT