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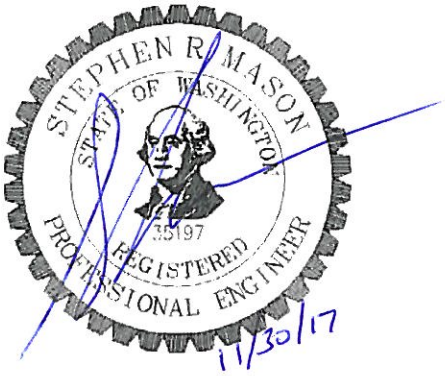
STORMWATER SITE PLAN FOR

TP HOMES
MONROE TOWNHOMES

MONROE, WASHINGTON

NOVEMBER 30, 2017



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PROJECT OVERVIEW

This Stormwater Site Plan has been prepared for the Monroe Townhomes project by TP Homes located at 17510 West Main Street in Monroe, Washington, see Figure 1: Vicinity Map. The project consists of the construction of 46 units of multifamily housing in 11 buildings on the 1.8 acre property. See Figure 3: Developed Site Map in Appendix A. A commercial building is also provided at the northern end of the site in compliance with the multi-use zoning. The total new and replaced impervious surface is approximately 1.22 acres.

METHODOLOGY

The drainage design for the project has been prepared based on the requirements of the 2014 Department of Ecology Stormwater Management Manual (DOE Manual) as adopted by the City of Monroe. WWHM2012 as provided by DOE has been used for determining basin runoff and for sizing of the stormwater facilities.

Based on the flow charts in Figure 2.3 of the DOE Manual and the site parameters, the project is subject to Minimum Requirements 1-9.

The project site parameters are:

- The project will create 5,000 sf of new or replaced impervious area.
- The project will disturb more than 7,000 sf.
- The project does not convert ¾ acre of pasture to lawn.
- The project does not convert 2.5 acres of forest to pasture.

MR 1: PREPARATION OF STORMWATER SITE PLANS

DRAINAGE PLAN DESCRIPTION
Stormwater runoff the site will be collected and conveyed to one of three infiltration facilities located around the site. The runoff from the paving areas will sheet flow to Stormfilter Catchbasins for treatment prior to the infiltration trenches. The roof runoff will be directly connected to the infiltration trenches.

WATER QUALITY MEASURES
Following is a list of the proposed construction water quality BMPs. See MR 3: Water Pollution Source Control for more information. The proposed BMPs are as follows:

BMP C101, Preserving Natural Vegetation
BMP C103, High Visibility Fence
BMP C105, Construction Entrance
BMP C107, Construction Road/Parking Area Stabilization
BMP C120, Temporary and Permanent Seeding
BMP C121, Mulching
BMP C123, Plastic Covering
BMP C125, Topsoiling/Composting
BMP C140, Dust Control
BMP C201, Grass Lined Swale
BMP C207, Check Dams
BMP C220, Storm Inlet Protection
BMP C233, Silt Fence
Temporary Infiltration Pond

DETENTION SIZING
Flow control will consist of an infiltration into the underlying soils using infiltration trenches. As a result there will be no surface runoff from the site. See Minimum Requirements #6 & 7 for additional information.

CONVEYANCE CALCULATIONS
The primary conveyance of runoff will be sheet flow in the parking areas and downspout collectors for the building. Where necessary catch basins and pipe will collect and convey runoff, but these will be kept to a minimum. The use of many smaller infiltration facilities scattered around the site will keep individual drainage basins small with corresponding low peak runoff rates. Conveyance calculations are not warranted.

STORMWATER TREATMENT BMP'S
The roof runoff is considered clean and treatment is not required. The runoff from the new parking and access drive will flow to Stormfilter Catchbasins for treatment prior to the infiltration facilities. See Minimum Requirement #6 for additional information.

PROTECTION OF WETLANDS
There are no wetlands of other critical areas on the site.

OPERATIONS AND MAINTENANCE
The specific requirements for the ongoing operation and maintenance of the proposed storm water systems is detailed in Minimum Requirement #10.

EXISTING CONDITIONS SUMMARY

DESCRIPTION
The site is located at 17510 West Main Street in Monroe, Washington, see Figure 1: Vicinity Map. Currently the site is vacant with scattered trees and grass. The 1.8 acre site is long and thin in the north-south direction and the majority is fairly level, sloping gently to the north. At the southern end of the site the slope steepens to the property line rising about 50 feet. See Figure 2: Existing Site Map in Appendix A for more information.

SOILS DESCRIPTION
Ages Engineering, LLC has performed soils exploration on the site and has documented the underlying soils in their report titled *Preliminary Geotechnical Report - W. Main Street Residential,* dated August 9, 2017. They have also prepared a memo addressing the potential for stormwater infiltration titled *Storm Water Infiltration – W. Main Street Residential, dated Octyober 10, 2017.*

Their reports document the underlying soils, ground water conditions, and general site design recommendations. They also discuss the testing procedures and processes used for determination of the infiltration rates used for the design of the proposed infiltration systems. An infiltration rate of 2.75 inches per hour has been recommended and used for the design of the infiltration trenches. For additional information see the geotechnical reports provided under separate cover.

EXISTING BASIN
Infiltration through the use of infiltration trenches is the proposed method of controlling storm water in the developed condition. Calculation of runoff from the corresponding existing condition basins is not necessary.

UPSTREAM ANALYSIS

The site is bounded by West Main Street to the north, single family residences to the east, the Monroe Family Village multi-family housing to the west, and by the Washington State Reformatory to the south.
There is a portion of the property to the south that flows onto the site. This area has been included in Basin 3 and the offsite runoff will be infiltrated in Infiltration Trench #3.

There is also a low area in the northeast corner of the site where runoff can collect before infiltrating. This low area staddles the property line with both on and offsite runoff flowing to it. The majority of the onsite water will be infiltrated in Infiltration Trench #1. An infiltration

facility, Infiltration Trench #4, will be installed with an inlet to allow surface flow from offsite to be infiltrated. This area is denoted as Basin #4.

A similar condition also exists along the west property line where the rear yards of the adjacent development flow onto the site. This area is evaluated as Basin #5 and will flow to Infiltration Trench #5.

DOWNSTREAM ANALYSIS

Infiltration of the storm water runoff from the developed site is proposed. This matches the existing conditions where there is essentially no surface discharge from the site. As such there is no downstream drainage that will be impacted by the discharge of surface water from the proposed development.

MR 2: CONSTRUCTION STORMWATER POLLUTION PREVENTION (SWPP)

See full DOE SWPPP under separate cover.

MR 3: WATER POLLUTION SOURCE CONTROL

CONSTRUCTION STORMWATER BMPs
A Storm Water Pollution Prevention Plan, SWPPP, is part of the construction drawings prepared for the project, and includes the following erosion control Best Management Practices:

Preserve Natural Vegetation (BMP C101)
Do not clear past the designated clearing limits.

High Visibility Fencing (BMP C103)
Use in combination with BMP C233, silt fence along the east boundary as indicated on the plans. High visibility fencing should be installed along the west and south property lines.

Construction Entrance (BMP C105)
Install construction entrance as located on the plans per Std Detail 206.

Construction Road/Parking Area Stabilization (BMP C107)
Once grading in future paved areas has reached subgrade, the gravel base course of material indicated on the applicable paving section is to be Placed on the subgrade to stabilize exposed surfaces. Surfaces protected this way include sidewalks, and the construction staging area and parking.

Temporary & Permanent Seeding (BMP C120)
Permanent seeding shall be used to stabilize exposed soils and shall be performed under the direction of the landscape plans and specifications.

Mulching (BMP C121)
Stabilize exposed surfaces with 4" sterile straw mulch when surfaces are to be unworked for the seasonal time frames listed in the TESC Notes and SWPPP Narrative. Mulch can be used to temporarily stabilize soils under future pavement; however, all mulch must be removed prior to Placement of base courses. Alternatively, construction road/parking stabilization can be used in future paved areas.

Plastic Covering (BMP C123)
Use plastic sheathing to protect stockpiles. Stabilize with sand bags connected with rope.

Topsoiling (BMP C125)
Strip topsoil under pavement, walks and building. Stockpile separately for use on project landscaping.

Dust Control (BMP C140)

Contractor shall implement measures to prevent wind transport of dust from soil surfaces. Such measures can include but are not limited to the following: mulching areas not used for vehicle access, reducing speeds on haul roads, sprinkle exposed surfaces with water, surface haul roads with gravel.

Grass Lined Swale (BMP C201)
Grass lined Interceptor swales will be installed to intercept site runoff before it leaves the site and to direct site it to the temporary infiltration pond.

Check Dams (BMP C207)
Check dams will be installed in the interceptor swale to slow flow velocities and allow sediment deposition.

Storm Inlet Protection (BMP C220)
West Main Street: Place inserts per plan detail in existing catch basins as indicated on the plan.

Onsite catch basins: as new catch basins are installed, these shall also be protected until the drainage area is stabilized.

Silt Fence (BMP C233)
Install silt fence in locations indicated on the plan per Std Detail 204.

Temporary Infiltration Pond
As necessary, temporary infiltration ponds will be constructed in the vicinity of grading operations.

PERMANENT SOURCE CONTROL BMPs
The following source controls apply:

- Container storage of wastes;
- Vegetation management;
- Cleaning of paved surfaces;
- Storm drainage maintenance;

MR 4: PRESERVATION OF NATURAL DRAINAGE

Infiltration of the storm water runoff from the developed site is proposed. In the current condition the site lies below West Main Street and all runoff infiltrates. Infiltrating the stormwater as proposed will match the natural predeveloped drainage patterns. As such there is no downstream drainage that will be impacted by the discharge of surface water from the proposed development. By allowing the runoff to continue to infiltrate using infiltration trenches, the natural drainage will be preserved.

MR 5: ON-SITE STORMWATER MANAGMENT

The proposed drainage system consists of collection and conveyance of the runoff from the project. In general, flow will be collected in catch basins or roof drain piping and be connected to the proposed infiltration trenches.

Being required to meet Minimum Requirements #1-9 and being a development of a less than 5 acre site inside a UGA (inside the City limits); the site will need to meet the Low Impact Development Performance Standard. This standard requires that;

> "stormwater discharges shall match developed discharge durationsto pre-developed durations for therangeof pre-developed dischargerates from 8% of the 2-year peak flow to 50% of the 2- year peak flow."

As the site is located in the City of Monroe, it can achieve this requirement either through the use of List #2 or by meeting the Low Impact Development Performance Standard. The performance standard will be met by fully infiltrating stormwater up to and including the 50 year event calculated using WWHM. Runoff from the different site areas will be managed as follows:

Pavement Areas:
The paved areas that are subject to vehicular traffic will require treatment. Storm water management for these areas will be collected, treated and infiltrated.

Roof Areas:
Storm water management for the roof will be collected and conveyed to the infiltration trenches.

Lawn and Landscaped Areas:
BMP T5.13 Post Construction Soil Quality and Depth will be implemented on disturbed and landscaped areas.

The drainage analysis consists of 5 basins. Following is a description for each drainage basin. See Figure 4: Drainage Basin Map in Appendix A.

BASIN 1
The basin consists of the northern portion of the site, including 5 buildings and adjacent access drives. It contains 0.55 acres and is tributary to Infiltration Trench #1. See MR 6 & 7 for additional information on the treatment and infiltration facility sizing. The basin consists of the following land uses:

Pavement & walks	0.22 ac
Roofs	0.26 ac
Landscaping	0.07 ac

BASIN 2

The basin consists of the southeastern portion of the site including 3 buildings and the central access drive. It contains 0.53 acres and is tributary to Infiltration Trench #2. See MR 6 & 7 for additional information on the treatment and infiltration facility sizing. The basin consists of the following land uses:

Pavement & walks	0.25 ac
Roofs	0.15 ac
Landscaping	0.13 ac

BASIN 3

The basin consists of the southwestern portion of the site including 3 buildings and the western portion of the access drive loop. It also includes offsite area to the south of the site. It contains 0.73 acres and is tributary to Infiltration Trench #3. See MR 6 & 7 for additional information on the treatment and infiltration facility sizing. The basin consists of the following land uses:

Pavement & walks	0.17 ac
Roofs	0.17 ac
Landscaping	0.39 ac

BASIN 4

The basin consists of the rear yards behind the northeastern 2 buildings (0.05 ac) and the 2 adjacent offsite lots, (0.25 ac). It contains 0.30 acres and is tributary to Infiltration Trench #4. See MR 7 for additional information on the infiltration facility sizing. The basin consists of the following land uses:

Offsite Roofs and Drives	0.05 ac
Landscaping	0.25 ac

BASIN 5

The basin consists of the rear yards behind the northwestern 3 buildings (0.085 ac) and the adjacent offsite lot, (0.065 ac). It contains 0.15 acres and is tributary to Infiltration Trench #5 See MR 7 for additional information on the infiltration facility sizing. The basin consists of the following land uses:

Walk	0.05 ac
Landscaping	0.10 ac

BMP T5.13 POST CONSTRUCTION SOIL QUALITY AND DEPTH.

Post Construction Soil Quality and Depth will be used on the site to recondition those areas that have been compacted by construction traffic. Stockpiled native topsoil or imported topsoil will be used in the planted areas as needed. The intent of this BMP is to re-establish the natural ability of the soil to infiltrate runoff as in the uncompacted predeveloped condition. Additional information is provided on the construction drawings that are part of the construction permit submittal.

MR 6: RUNOFF TREATMENT

With more than 5,000 sf of pollution generating impervious surface the site requires runoff treatment.

OIL CONTROL

Oil control is required for "high-use" sites. High-use sites are those that typically generate high concentrations of oil due to high traffic turnover or the frequent transfer of oil. High-use sites include:

- An area of a commercial or industrial site subject to an expected average daily traffic (ADT) count equal to or greater than 100 vehicles per 1,000 square feet of gross building area.
- An area of a commercial or industrial site subject to petroleum storage and transfer in excess of 1,500 gallons per year, not including routinely delivered heating oil. Some examples are discussed below.
- An area of a commercial or industrial site subject to parking, storage or maintenance of 25 or more vehicles that are over 10 tons gross weight (trucks, buses, trains, heavy equipment, etc.).
- A road intersection with a measured average daily traffic (ADT) count of 25,000 vehicles or more on the main roadway and 15,000 vehicles or more on any intersecting roadway, excluding projects proposing primarily pedestrian or bicycle use improvements.

The site does not meet the definition of a "high-use" site and special Oil Control BMPs are not required.

PHOSPHOROUS CONTROL

The local government can use the following sources of information for pursuing plans and implementing ordinances and/or regulations:

- Those waterbodies reported under section 305(b) of the Clean Water Act, and designated as not supporting beneficial uses due to phosphorous;
- Those listed in Washington State's Nonpoint Source Assessment required under section 319(a) of the Clean Water Act due to nutrients.

With use of infiltration BMPs, there is no discharge of site runoff to a receiving water, and no requirement for Phosphorous Control.

ENHANCED TREATMENT

Enhanced Treatment for reduction in dissolved metals is required for the following project sites that:

1) discharge directly to fresh waters or conveyance systems tributary to fresh waters designated for aquatic life use or that have an existing aquatic life use; or

2) use infiltration strictly for flow control – not treatment – and the discharge is within ¼ mile of a fresh water designated for aquatic life use or that has an existing aquatic life use:

- Industrial project sites,
- Commercial project sites,
- Multi-family residential project sites, and
- High AADT roads.

With use of infiltration BMPs, there is no discharge of site runoff to a receiving water nor is there an aquatic feature within ¼ mile. Therefore Enhanced Treatment BMPs are not required.

The site does not reach the definitions or thresholds for additional Oil Control, Phosphorous Control or Enhanced Treatment BMPs. Basin Treatment is addressed using Contech cartridge filter treatment catch basins as follows:

BASINS 1-3
Runoff from these basins includes areas subject to vehicular use and require treatment. Storm water treatment of the access drive will be accomplished through the use of six catch basin cartridge filter treatment systems by Contech Stormwater Solutions. The systems are approved for stand alone general use for basic treatment by the Department of Ecology and is sized to treat the water quality, 15 minute, flow rate as calculated by WWHM2012. A standard 18" cartridge is capable of treating 0.0167 cfs while a 27" "deep" cartridge is capable of treating 0.0250 cfs.

TREATMENT FACILITY SUMMARY
Following is a summary of each of the cartridge filter catch basins, the number and type of filters, the treatment flow rate of the tributary flow rate and the treatment capacity of the prescribed structure. See attached WWHM3 screen shots for treatment flow rate calculations.

CATCH BASIN ID	FACILITY TYPE	15 MIN TRIBUTARY TREATMENT RATE	TREATMENT CAPACITY
CB#1	Single Deep Filter	0.0234 cfs	0.0250 cfs
CB#2	Single Deep Filter	0.0199 cfs	0.0250 cfs
CB#3	Triple Filter	0.0433 cfs	0.0500 cfs
CB#5	Single Filter	0.0166 cfs	0.0167 cfs
CB#6	Single Filter	0.0158 cfs	0.0167 cfs
CB#7	Single Filter	0.0156 cfs	0.0167 cfs

BASINS 4-5

These basins do not include any areas subject to vehicular use and do not require treatment.

MR 7: FLOW CONTROL

INFILTRATION TRENCHES
The facilities have been designed to infiltrate 100% of the basin runoff meeting the flow control requirements. The following are common for all infiltration trenches:

Side slopes	Vertical
Design Void Ratio	40%
Design Infiltration Rate	2.75”/hr

FLOW CONTROL FACILITY SUMMARY
There are five infiltration trenches cooresponding to the matching drainage basin. The basin number, facility identification, length (area for bioretention cells), width and depth are listed for each facility. See attached WWHM3 screen shots for sizing calculations:

BASIN ID	FACILITY TYPE & ID	LENGTH (AREA)	WIDTH	DEPTH	PERCENT INFILTRATED
#1	Infiltration Trench #1	230’	6’	4.0’	100%
#2	Infiltration Trench #2	40’	32’	4.0’	100%
#3	Infiltration Trench #3	150’	10’	4.0’	100%
#4	Infiltration Trench #4	180’	2.5’	4.0’	100%
#5	Infiltration Trench #5	130’	2’	4.0’	100%

MR 8: WETLANDS PROTECTION

There are no wetlands on or near the site.

MR 9: OPERATION AND MAINTENANCE

GENERAL:

1. Proper maintenance of public and private stormwater facilities is necessary to ensure they serve their intended function.
2. Drainage systems shall be inspected at least annually. A representative of the local government shall also inspect private facilities at least annually to ensure compliance by the owner of the following maintenance requirements.
3. Any deterioration threatening the structural integrity of the facilities shall be immediately repaired. These include such things as replacement of clean-out grates, catchbasin lids, and rock in emergency spillways.
4. Warning signs (e.g. "Dump No Waste - Drains to Ground Water", "Streams", "Lakes" etc.) shall be painted or embossed on or adjacent to all storm drain inlets. They shall be repainted as needed.
5. Debris shall be regularly removed from surface basins used for either peak-rate control or stormwater treatment.
6. Parking lots shall be swept when necessary to remove debris.

STREAM BANK EROSION CONTROL INFILTRATION TRENCH

Maintenance & Inspection Schedule

• The observation well should be monitored periodically. For the first year after completion of construction, the well should be monitored on a quarterly basis and after every large storm. During the period October I through March 31 inspections shall be conducted monthly. A log book shall be maintained by the responsible person designated by the local government indicating the rate at which the facility dewaters after large storms and the depth of the well for each observation. Once the performance characteristics of the structure have been verified, the monitoring schedule can be reduced to an annual basis unless the performance data indicate that a more frequent schedule is required.

Sediment Removal

• Sediment buildup in the top foot of stone aggregate or the surface inlet should be monitored on the same schedule as the observation well. A monitoring well in the top foot of stone aggregate shall be required when the trench has a stone surface. Sediment deposits shall not be allowed to build up to the point where it will reduce the rate of infiltration into the trench.

STORM FILTER TREATMENT SYSTEM

Annual maintenance is recommended for optimum efficiency of the treatment system. StormFilter maintenance should be performed while the vault is dry, typically in the summer months.

1. Remove the cartridge hood and either manually or with a vacuum truck, dispose of the residuals.
2. Clean remaining trash, debris and sediments from the vault.
3. Replace the empty filter cartridge with a recharged cartridge provided by Contech – Stormwater Solutions that has been pre-filled with the appropriate filter media.

4. Return the empty cartridge to Contech –Stormwater Solutions.

For more information, contact Contech – Stormwater Solutions at 800-548-4667.

In addition, the following catch basin operation and maintenance guidelines are taken from the 2014 DOE Manual.

No. 5 – Catch Basins

Maintenance Component	Defect	Conditions When Maintenance is Needed	Results Expected When Maintenance is performed
Catch Basin Cover	Cover Not in Place	Cover is missing or only partially in place. Any open catch basin requires maintenance.	Catch basin cover is 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.	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 and meets design standards.

No. 5 – 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%.	No Trash or debris located immediately in front of catch basin or on grate opening.
		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.	No trash or debris in the catch basin.
		Trash or debris in any inlet or outlet pipe blocking more than 1/3 of its height.	Inlet and outlet pipes free of trash or debris.
		Dead animals or vegetation that could generate odors that could cause complaints or dangerous gases (e.g., methane).	No dead animals or vegetation present within the catch basin.
	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).	Top slab is free of holes and cracks.
		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	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.	Basin replaced or repaired to design standards.
		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.	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.	No vegetation blocking opening to basin.
		Vegetation growing in inlet/outlet pipe joints that is more than six inches tall and less than six inches apart.	No vegetation or root growth present.
	Contamination and Pollution	See "Detention Ponds" (No. 1).	No pollution present.

APPENDIX A
MAPS & SCS SOILS DESCRIPTION

FIGURE 1: VICINITY MAP

FIGURE 2: EXISTING SITE MAP

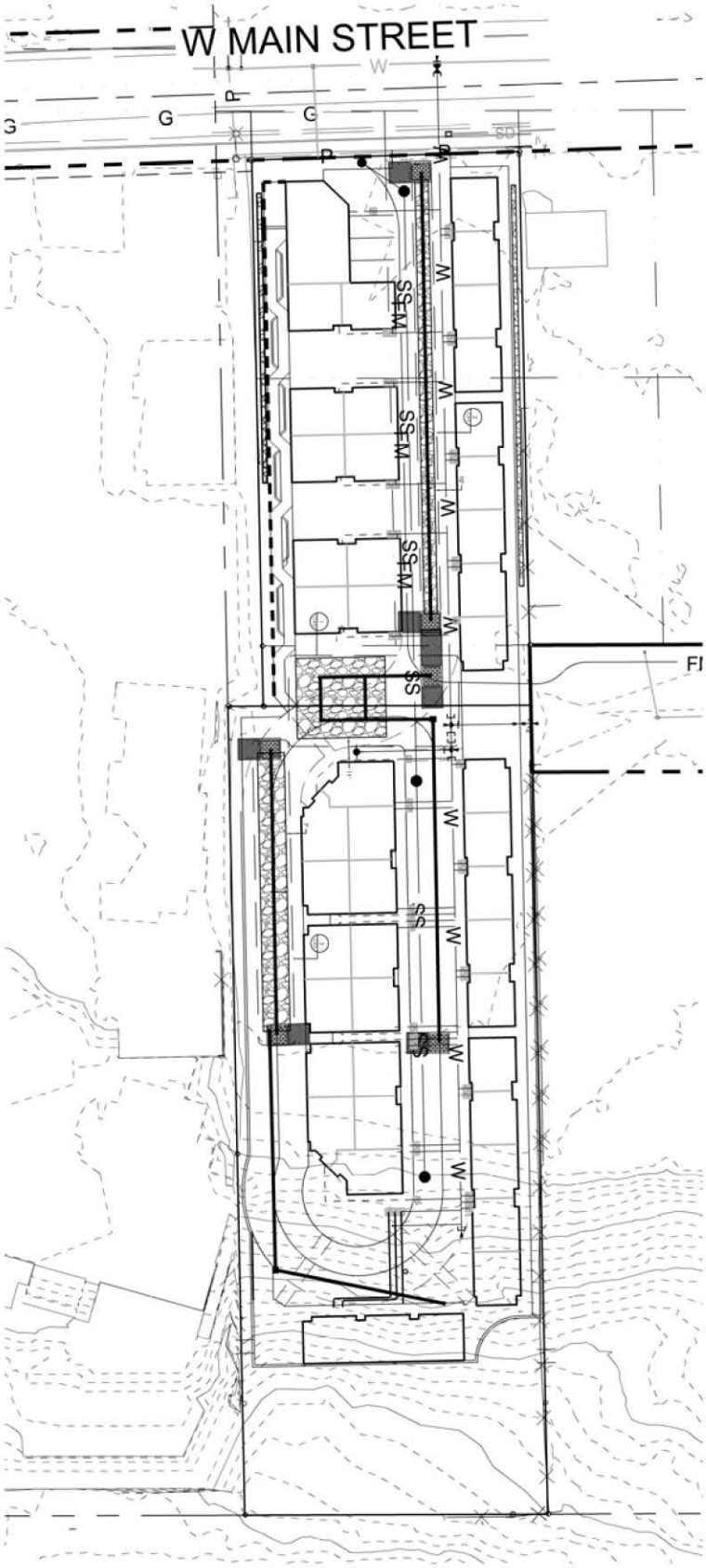


FIGURE 3: DEVELOPED SITE MAP

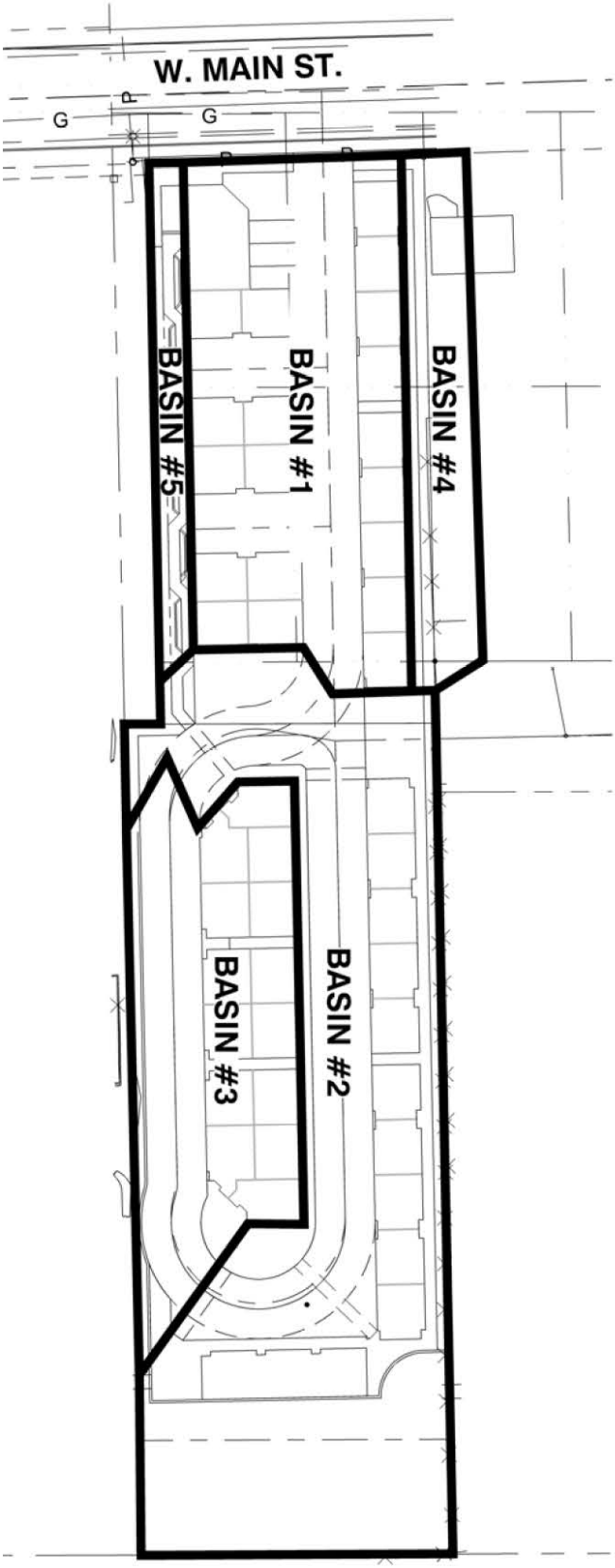
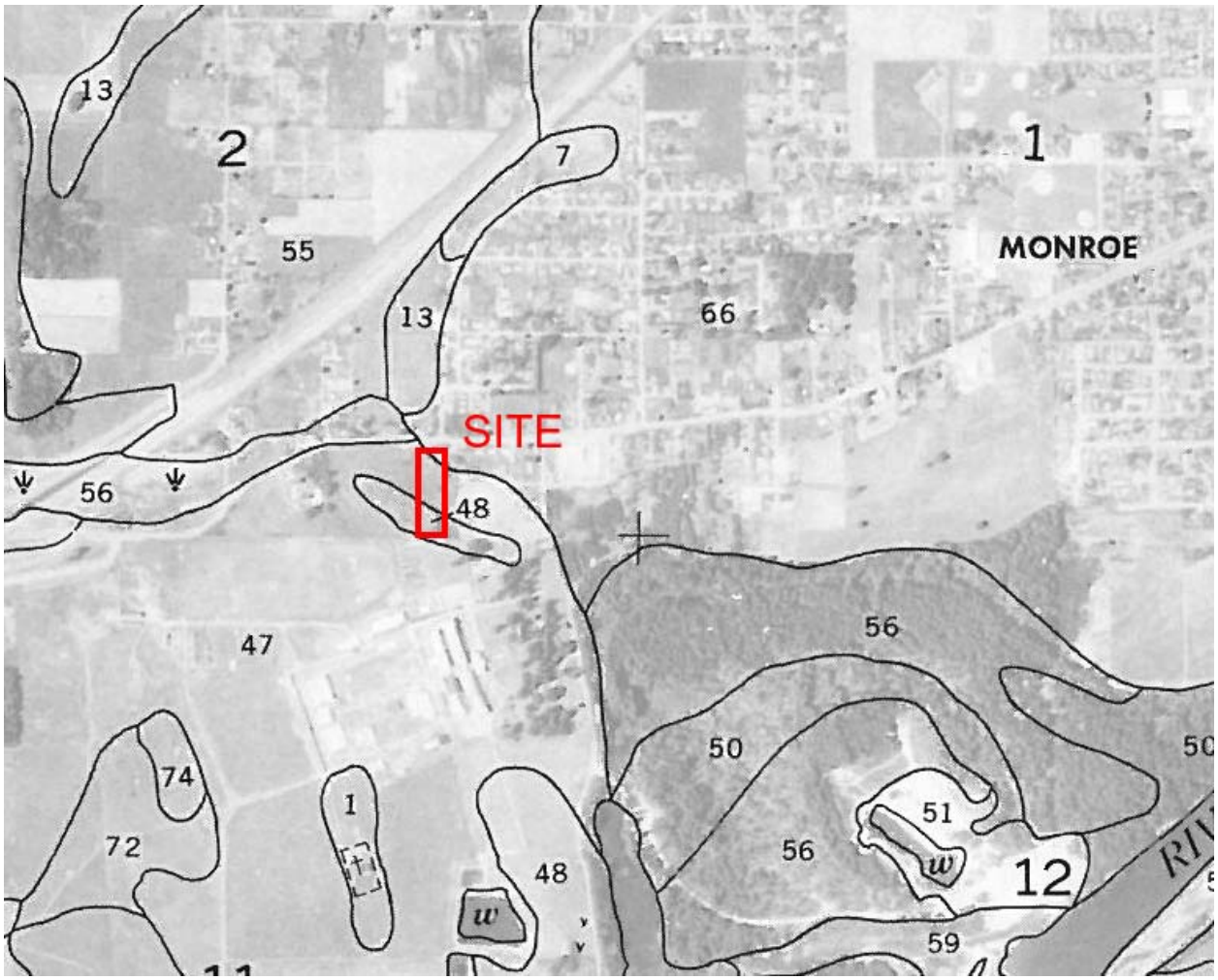


FIGURE 4: DRAINAGE BASIN MAP



SCS SOILS MAP

47—Pastik silt loam, 0 to 8 percent slopes. This very deep, moderately well drained soil is on terraces. It formed in lake sediment and volcanic ash. Areas are 20 to 100 acres in size. The native vegetation is mainly conifers. Elevation is 200 to 800 feet. The average annual precipitation is about 50 inches, the average annual air temperature is about 46 degrees F, and the average frost-free season is 140 to 200 days.

Typically, the surface layer is dark brown silt loam about 6 inches thick. The subsoil is dark brown and yellowish brown silt loam about 23 inches thick. The substratum to a depth of 60 inches or more is light olive gray silt loam. In some areas the surface layer and subsoil are fine sandy loam and loamy fine sand.

Included in this unit are areas of Bellingham soils in depressional areas, Nargar soils on high terraces, Ragnar soils on outwash plains, and Tokul soils on till plains. Included areas make up about 15 percent of the total acreage.

Permeability of this Pastik soil is slow. Available water capacity is high. Effective rooting depth is limited by a seasonal high water table that is at a depth of 18 to 30 inches from December to May. Runoff is slow, and the hazard of water erosion is slight.

This unit is used mainly as woodland. It is also used for hay and pasture and for urban development.

Douglas-fir is the main woodland species on this unit. On the basis of a 100-year site curve, the mean site index is 180. On the basis of a 50-year site curve, the mean site index is 135. The mean annual increment at culmination (CMAI) for Douglas-fir at age 60 is 191 cubic feet per acre. Among the trees of limited extent are western hemlock, western redcedar, and bigleaf maple. Among the common forest understory plants are western swordfern, brackenfern, ladyfern, red huckleberry, and deer fern.

The main limitation for the harvesting of timber is seasonal soil wetness, which limits the use of equipment to dry periods. Use of wheeled and tracked equipment when the soil in this unit is wet produces ruts, compacts the soil, and damages the roots of trees. Unsurfaced roads and skid trails are soft when wet, and they may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use. Rock for road construction is not readily available on this unit.

Reforestation can be accomplished by planting Douglas-fir seedlings. If seed trees are present, natural reforestation of cutover areas by red alder occurs readily. When openings are made in the canopy, invading brushy plants, if not controlled, can prevent reforestation. Because the rooting depth is restricted by the seasonal high water table, trees are occasionally subject to windthrow.

This unit is suited to hay and pasture. The main limitations are slope and the seasonal high water table. Grazing when the soil is wet results in compaction of the surface layer, poor tilth, and excessive runoff. Excessive water on the surface can be removed by tile drains if adequate outlets are available. Use of proper stocking rates, pasture rotation, and restricted grazing during wet periods helps to keep the pasture in good condition and to protect the soil from erosion.

Periodic mowing and clipping help to maintain uniform growth, discourage selective grazing, and reduce clumpy growth. Proper grazing practices, weed control, and fertilizer are needed for maximum quality of forage. Legumes benefit from applications of agricultural lime.

The main limitation for homesites is the seasonal high water table. Wetness can be reduced by installing drain tile around footings. The main limitations for septic tank absorption fields are the seasonal high water table and slow permeability. Use of long absorption lines helps to compensate for the slow permeability. Disturbed areas need to be seeded to grass. Temporary sediment basins are needed where construction leaves soil areas bare of cover.

This map unit is in capability subclass IIe.

SCS SOILS DESCRIPTION

APPENDIX B
WWHM3 OUTPUT & SCREEN SHOTS

WWHM2012
PROJECT REPORT

Project Name: TP MONROE
Report Date: 11/30/2017
Gage : Everett
Data Start : 1948/10/01
Data End : 2009/09/30
Precip Scale: 1.20

PREDEVELOPED LAND USE

Name : Basin 1
Bypass: No
GroundWater: No

Pervious Land Use	acre
C, Forest, Flat	.55
Pervious Total	0.55

Impervious Land Use	acre
Impervious Total	0
Basin Total	0.55

Element Flows To:

Surface	Interflow	Groundwater

Name : Basin 2
Bypass: No
GroundWater: No

Pervious Land Use	acre
C, Forest, Flat	.31
C, Forest, Mod	.28
Pervious Total	0.59

Impervious Land Use	acre
Impervious Total	0
Basin Total	0.59

Element Flows To:

Surface	Interflow	Groundwater

Name : Basin 3
Bypass: No
GroundWater: No

Pervious Land Use	acre
C, Forest, Steep	.4
C, Forest, Flat	.33
Pervious Total	0.73

Impervious Land Use	acre
Impervious Total	0
Basin Total	0.73

Element Flows To:

Surface	Interflow	Groundwater

Name : Basin 4
Bypass: No
GroundWater: No

Pervious Land Use	acre
C, Forest, Flat	.3
Pervious Total	0.3

Impervious Land Use	acre
Impervious Total	0
Basin Total	0.3

Element Flows To:

Surface	Interflow	Groundwater

Name : Basin 5
Bypass: No
GroundWater: No

Pervious Land Use	acre
C, Forest, Flat	.15
Pervious Total	0.15

Impervious Land Use	acre
Impervious Total	0
Basin Total	0.15

Element Flows To:

Surface	Interflow	Groundwater

MITIGATED LAND USE

Name : Basin 1
Bypass: No
GroundWater: No

Pervious Land Use	acre
C, Lawn, Flat	.06
Pervious Total	**0.06**

Impervious Land Use	acre
ROOF TOPS FLAT	0.26
PARKING FLAT	0.23
Impervious Total	**0.49**
Basin Total	**0.55**

Element Flows To:

Surface	Interflow	Groundwater
Gravel Trench Bed 1	Gravel Trench Bed 1	

Name : Gravel Trench Bed 1
Bottom Length: 200.00 ft.
Bottom Width: 6.00 ft.
Trench bottom slope 1: 0.001 To 1
Trench Left side slope 0: 0.001 To 1
Trench right side slope 2: 0.001 To 1
Material thickness of first layer: 4
Pour Space of material for first layer: 0.4
Material thickness of second layer: 0
Pour Space of material for second layer: 0
Material thickness of third layer: 0
Pour Space of material for third layer: 0
Infiltration On
Infiltration rate: 2.75
Infiltration safety factor: 1
Total Volume Infiltrated (ac-ft.): 101.006
Total Volume Through Riser (ac-ft.): 0.002
Total Volume Through Facility (ac-ft.): 101.008
Percent Infiltrated: 100
Total Precip Applied to Facility: 0
Total Evap From Facility: 0
Discharge Structure
Riser Height: 4.9 ft.
Riser Diameter: 12 in.

Element Flows To:

Outlet 1	Outlet 2

Gravel Trench Bed Hydraulic Table

Stage(feet)	Area(ac.)	Volume(ac-ft.)	Discharge(cfs)	Infilt(cfs)
0.0000	0.027	0.000	0.000	0.000
0.0556	0.027	0.000	0.000	0.076
0.1111	0.027	0.001	0.000	0.076
0.1667	0.027	0.001	0.000	0.076
0.2222	0.027	0.002	0.000	0.076
0.2778	0.027	0.003	0.000	0.076
0.3333	0.027	0.003	0.000	0.076
0.3889	0.027	0.004	0.000	0.076
0.4444	0.027	0.004	0.000	0.076
0.5000	0.027	0.005	0.000	0.076

0.5556	0.027	0.006	0.000	0.076
0.6111	0.027	0.006	0.000	0.076
0.6667	0.027	0.007	0.000	0.076
0.7222	0.027	0.008	0.000	0.076
0.7778	0.027	0.008	0.000	0.076
0.8333	0.027	0.009	0.000	0.076
0.8889	0.027	0.009	0.000	0.076
0.9444	0.027	0.010	0.000	0.076
1.0000	0.027	0.011	0.000	0.076
1.0556	0.027	0.011	0.000	0.076
1.1111	0.027	0.012	0.000	0.076
1.1667	0.027	0.012	0.000	0.076
1.2222	0.027	0.013	0.000	0.076
1.2778	0.027	0.014	0.000	0.076
1.3333	0.027	0.014	0.000	0.076
1.3889	0.027	0.015	0.000	0.076
1.4444	0.027	0.015	0.000	0.076
1.5000	0.027	0.016	0.000	0.076
1.5556	0.027	0.017	0.000	0.076
1.6111	0.027	0.017	0.000	0.076
1.6667	0.027	0.018	0.000	0.076
1.7222	0.027	0.019	0.000	0.076
1.7778	0.027	0.019	0.000	0.076
1.8333	0.027	0.020	0.000	0.076
1.8889	0.027	0.020	0.000	0.076
1.9444	0.027	0.021	0.000	0.076
2.0000	0.027	0.022	0.000	0.076
2.0556	0.027	0.022	0.000	0.076
2.1111	0.027	0.023	0.000	0.076
2.1667	0.027	0.023	0.000	0.076
2.2222	0.027	0.024	0.000	0.076
2.2778	0.027	0.025	0.000	0.076
2.3333	0.027	0.025	0.000	0.076
2.3889	0.027	0.026	0.000	0.076
2.4444	0.027	0.026	0.000	0.076
2.5000	0.027	0.027	0.000	0.076
2.5556	0.027	0.028	0.000	0.076
2.6111	0.027	0.028	0.000	0.076
2.6667	0.027	0.029	0.000	0.076
2.7222	0.027	0.030	0.000	0.076
2.7778	0.027	0.030	0.000	0.076
2.8333	0.027	0.031	0.000	0.076
2.8889	0.027	0.031	0.000	0.076
2.9444	0.027	0.032	0.000	0.076
3.0000	0.027	0.033	0.000	0.076
3.0556	0.027	0.033	0.000	0.076
3.1111	0.027	0.034	0.000	0.076
3.1667	0.027	0.034	0.000	0.076
3.2222	0.027	0.035	0.000	0.076
3.2778	0.027	0.036	0.000	0.076
3.3333	0.027	0.036	0.000	0.076
3.3889	0.027	0.037	0.000	0.076
3.4444	0.027	0.038	0.000	0.076
3.5000	0.027	0.038	0.000	0.076
3.5556	0.027	0.039	0.000	0.076
3.6111	0.027	0.039	0.000	0.076
3.6667	0.027	0.040	0.000	0.076
3.7222	0.027	0.041	0.000	0.076
3.7778	0.027	0.041	0.000	0.076
3.8333	0.027	0.042	0.000	0.076
3.8889	0.027	0.042	0.000	0.076
3.9444	0.027	0.043	0.000	0.076
4.0000	0.027	0.044	0.000	0.076
4.0556	0.027	0.045	0.000	0.076
4.1111	0.027	0.047	0.000	0.076

4.1667	0.027	0.048	0.000	0.076
4.2222	0.027	0.050	0.000	0.076
4.2778	0.027	0.051	0.000	0.076
4.3333	0.027	0.053	0.000	0.076
4.3889	0.027	0.054	0.000	0.076
4.4444	0.027	0.056	0.000	0.076
4.5000	0.027	0.057	0.000	0.076
4.5556	0.027	0.059	0.000	0.076
4.6111	0.027	0.061	0.000	0.076
4.6667	0.027	0.062	0.000	0.076
4.7222	0.027	0.064	0.000	0.076
4.7778	0.027	0.065	0.000	0.076
4.8333	0.027	0.067	0.000	0.076
4.8889	0.027	0.068	0.000	0.076
4.9444	0.027	0.070	0.099	0.076
5.0000	0.027	0.071	0.333	0.076

Name : Basin 2
Bypass: No
GroundWater: No

Pervious Land Use	**acre**
C, Lawn, Flat	**.13**
Pervious Total	**0.13**

Impervious Land Use	**acre**
ROOF TOPS FLAT	**0.15**
PARKING FLAT	**0.31**
Impervious Total	**0.46**
Basin Total	**0.59**

Element Flows To:

Surface	**Interflow**	**Groundwater**
Gravel Trench Bed 2	Gravel Trench Bed 2	

Name : Gravel Trench Bed 2
Bottom Length: 40.00 ft.
Bottom Width: 36.00 ft.
Trench bottom slope 1: 0.001 To 1
Trench Left side slope 0: 0.001 To 1
Trench right side slope 2: 0.001 To 1
Material thickness of first layer: 4
Pour Space of material for first layer: 0.4
Material thickness of second layer: 0
Pour Space of material for second layer: 0
Material thickness of third layer: 0
Pour Space of material for third layer: 0
Infiltration On
Infiltration rate: 2.75
Infiltration safety factor: 1
Total Volume Infiltrated (ac-ft.): 102.253
Total Volume Through Riser (ac-ft.): 0
Total Volume Through Facility (ac-ft.): 102.253
Percent Infiltrated: 100
Total Precip Applied to Facility: 0
Total Evap From Facility: 0
Discharge Structure
Riser Height: 3.9 ft.

Riser Diameter: 12 in.

Element Flows To:
Outlet 1 **Outlet 2**

Gravel Trench Bed Hydraulic Table

Stage(feet)	Area(ac.)	Volume(ac-ft.)	Discharge(cfs)	Infilt(cfs)
0.0000	0.033	0.000	0.000	0.000
0.0444	0.033	0.000	0.000	0.091
0.0889	0.033	0.001	0.000	0.091
0.1333	0.033	0.001	0.000	0.091
0.1778	0.033	0.002	0.000	0.091
0.2222	0.033	0.002	0.000	0.091
0.2667	0.033	0.003	0.000	0.091
0.3111	0.033	0.004	0.000	0.091
0.3556	0.033	0.004	0.000	0.091
0.4000	0.033	0.005	0.000	0.091
0.4444	0.033	0.005	0.000	0.091
0.4889	0.033	0.006	0.000	0.091
0.5333	0.033	0.007	0.000	0.091
0.5778	0.033	0.007	0.000	0.091
0.6222	0.033	0.008	0.000	0.091
0.6667	0.033	0.008	0.000	0.091
0.7111	0.033	0.009	0.000	0.091
0.7556	0.033	0.010	0.000	0.091
0.8000	0.033	0.010	0.000	0.091
0.8444	0.033	0.011	0.000	0.091
0.8889	0.033	0.011	0.000	0.091
0.9333	0.033	0.012	0.000	0.091
0.9778	0.033	0.012	0.000	0.091
1.0222	0.033	0.013	0.000	0.091
1.0667	0.033	0.014	0.000	0.091
1.1111	0.033	0.014	0.000	0.091
1.1556	0.033	0.015	0.000	0.091
1.2000	0.033	0.015	0.000	0.091
1.2444	0.033	0.016	0.000	0.091
1.2889	0.033	0.017	0.000	0.091
1.3333	0.033	0.017	0.000	0.091
1.3778	0.033	0.018	0.000	0.091
1.4222	0.033	0.018	0.000	0.091
1.4667	0.033	0.019	0.000	0.091
1.5111	0.033	0.020	0.000	0.091
1.5556	0.033	0.020	0.000	0.091
1.6000	0.033	0.021	0.000	0.091
1.6444	0.033	0.021	0.000	0.091
1.6889	0.033	0.022	0.000	0.091
1.7333	0.033	0.022	0.000	0.091
1.7778	0.033	0.023	0.000	0.091
1.8222	0.033	0.024	0.000	0.091
1.8667	0.033	0.024	0.000	0.091
1.9111	0.033	0.025	0.000	0.091
1.9556	0.033	0.025	0.000	0.091
2.0000	0.033	0.026	0.000	0.091
2.0444	0.033	0.027	0.000	0.091
2.0889	0.033	0.027	0.000	0.091
2.1333	0.033	0.028	0.000	0.091
2.1778	0.033	0.028	0.000	0.091
2.2222	0.033	0.029	0.000	0.091
2.2667	0.033	0.030	0.000	0.091
2.3111	0.033	0.030	0.000	0.091
2.3556	0.033	0.031	0.000	0.091
2.4000	0.033	0.031	0.000	0.091
2.4444	0.033	0.032	0.000	0.091
2.4889	0.033	0.032	0.000	0.091

2.5333	0.033	0.033	0.000	0.091
2.5778	0.033	0.034	0.000	0.091
2.6222	0.033	0.034	0.000	0.091
2.6667	0.033	0.035	0.000	0.091
2.7111	0.033	0.035	0.000	0.091
2.7556	0.033	0.036	0.000	0.091
2.8000	0.033	0.037	0.000	0.091
2.8444	0.033	0.037	0.000	0.091
2.8889	0.033	0.038	0.000	0.091
2.9333	0.033	0.038	0.000	0.091
2.9778	0.033	0.039	0.000	0.091
3.0222	0.033	0.040	0.000	0.091
3.0667	0.033	0.040	0.000	0.091
3.1111	0.033	0.041	0.000	0.091
3.1556	0.033	0.041	0.000	0.091
3.2000	0.033	0.042	0.000	0.091
3.2444	0.033	0.042	0.000	0.091
3.2889	0.033	0.043	0.000	0.091
3.3333	0.033	0.044	0.000	0.091
3.3778	0.033	0.044	0.000	0.091
3.4222	0.033	0.045	0.000	0.091
3.4667	0.033	0.045	0.000	0.091
3.5111	0.033	0.046	0.000	0.091
3.5556	0.033	0.047	0.000	0.091
3.6000	0.033	0.047	0.000	0.091
3.6444	0.033	0.048	0.000	0.091
3.6889	0.033	0.048	0.000	0.091
3.7333	0.033	0.049	0.000	0.091
3.7778	0.033	0.050	0.000	0.091
3.8222	0.033	0.050	0.000	0.091
3.8667	0.033	0.051	0.000	0.091
3.9111	0.033	0.051	0.012	0.091
3.9556	0.033	0.052	0.138	0.091
4.0000	0.033	0.052	0.333	0.091

Name : Basin 3
Bypass: No
GroundWater: No

Pervious Land Use	acre
C, Lawn, Steep	.3
C, Lawn, Flat	.09
Pervious Total	**0.39**

Impervious Land Use	acre
ROOF TOPS FLAT	0.17
PARKING FLAT	0.17
Impervious Total	**0.34**

Basin Total **0.73**

Element Flows To:

Surface	Interflow	Groundwater
Gravel Trench Bed 3	Gravel Trench Bed 3	

Name : Gravel Trench Bed 3
Bottom Length: 125.00 ft.
Bottom Width: 12.00 ft.
Trench bottom slope 1: 0.001 To 1
Trench Left side slope 0: 0.001 To 1
Trench right side slope 2: 0.001 To 1
Material thickness of first layer: 4
Pour Space of material for first layer: 0.4
Material thickness of second layer: 0
Pour Space of material for second layer: 0
Material thickness of third layer: 0
Pour Space of material for third layer: 0
Infiltration On
Infiltration rate: 2.75
Infiltration safety factor: 1
Total Volume Infiltrated (ac-ft.): 106.727
Total Volume Through Riser (ac-ft.): 0
Total Volume Through Facility (ac-ft.): 106.727
Percent Infiltrated: 100
Total Precip Applied to Facility: 0
Total Evap From Facility: 0
Discharge Structure
Riser Height: 3.9 ft.
Riser Diameter: 12 in.

Element Flows To:

Outlet 1	Outlet 2

Gravel Trench Bed Hydraulic Table

Stage(feet)	Area(ac.)	Volume(ac-ft.)	Discharge(cfs)	Infilt(cfs)
0.0000	0.034	0.000	0.000	0.000
0.0444	0.034	0.000	0.000	0.095
0.0889	0.034	0.001	0.000	0.095
0.1333	0.034	0.001	0.000	0.095
0.1778	0.034	0.002	0.000	0.095
0.2222	0.034	0.003	0.000	0.095
0.2667	0.034	0.003	0.000	0.095
0.3111	0.034	0.004	0.000	0.095
0.3556	0.034	0.004	0.000	0.095
0.4000	0.034	0.005	0.000	0.095
0.4444	0.034	0.006	0.000	0.095

0.4889	0.034	0.006	0.000	0.095
0.5333	0.034	0.007	0.000	0.095
0.5778	0.034	0.008	0.000	0.095
0.6222	0.034	0.008	0.000	0.095
0.6667	0.034	0.009	0.000	0.095
0.7111	0.034	0.009	0.000	0.095
0.7556	0.034	0.010	0.000	0.095
0.8000	0.034	0.011	0.000	0.095
0.8444	0.034	0.011	0.000	0.095
0.8889	0.034	0.012	0.000	0.095
0.9333	0.034	0.012	0.000	0.095
0.9778	0.034	0.013	0.000	0.095
1.0222	0.034	0.014	0.000	0.095
1.0667	0.034	0.014	0.000	0.095
1.1111	0.034	0.015	0.000	0.095
1.1556	0.034	0.015	0.000	0.095
1.2000	0.034	0.016	0.000	0.095
1.2444	0.034	0.017	0.000	0.095
1.2889	0.034	0.017	0.000	0.095
1.3333	0.034	0.018	0.000	0.095
1.3778	0.034	0.019	0.000	0.095
1.4222	0.034	0.019	0.000	0.095
1.4667	0.034	0.020	0.000	0.095
1.5111	0.034	0.020	0.000	0.095
1.5556	0.034	0.021	0.000	0.095
1.6000	0.034	0.022	0.000	0.095
1.6444	0.034	0.022	0.000	0.095
1.6889	0.034	0.023	0.000	0.095
1.7333	0.034	0.023	0.000	0.095
1.7778	0.034	0.024	0.000	0.095
1.8222	0.034	0.025	0.000	0.095
1.8667	0.034	0.025	0.000	0.095
1.9111	0.034	0.026	0.000	0.095
1.9556	0.034	0.026	0.000	0.095
2.0000	0.034	0.027	0.000	0.095
2.0444	0.034	0.028	0.000	0.095
2.0889	0.034	0.028	0.000	0.095
2.1333	0.034	0.029	0.000	0.095
2.1778	0.034	0.030	0.000	0.095
2.2222	0.034	0.030	0.000	0.095
2.2667	0.034	0.031	0.000	0.095
2.3111	0.034	0.031	0.000	0.095
2.3556	0.034	0.032	0.000	0.095
2.4000	0.034	0.033	0.000	0.095
2.4444	0.034	0.033	0.000	0.095
2.4889	0.034	0.034	0.000	0.095
2.5333	0.034	0.034	0.000	0.095
2.5778	0.034	0.035	0.000	0.095
2.6222	0.034	0.036	0.000	0.095
2.6667	0.034	0.036	0.000	0.095
2.7111	0.034	0.037	0.000	0.095
2.7556	0.034	0.038	0.000	0.095
2.8000	0.034	0.038	0.000	0.095
2.8444	0.034	0.039	0.000	0.095
2.8889	0.034	0.039	0.000	0.095
2.9333	0.034	0.040	0.000	0.095
2.9778	0.034	0.041	0.000	0.095
3.0222	0.034	0.041	0.000	0.095
3.0667	0.034	0.042	0.000	0.095
3.1111	0.034	0.042	0.000	0.095
3.1556	0.034	0.043	0.000	0.095
3.2000	0.034	0.044	0.000	0.095
3.2444	0.034	0.044	0.000	0.095
3.2889	0.034	0.045	0.000	0.095
3.3333	0.034	0.045	0.000	0.095

3.3778	0.034	0.046	0.000	0.095
3.4222	0.034	0.047	0.000	0.095
3.4667	0.034	0.047	0.000	0.095
3.5111	0.034	0.048	0.000	0.095
3.5556	0.034	0.049	0.000	0.095
3.6000	0.034	0.049	0.000	0.095
3.6444	0.034	0.050	0.000	0.095
3.6889	0.034	0.050	0.000	0.095
3.7333	0.034	0.051	0.000	0.095
3.7778	0.034	0.052	0.000	0.095
3.8222	0.034	0.052	0.000	0.095
3.8667	0.034	0.053	0.000	0.095
3.9111	0.034	0.053	0.012	0.095
3.9556	0.034	0.054	0.138	0.095
4.0000	0.034	0.055	0.333	0.095

Name : Basin 4
Bypass: No
GroundWater: No

Pervious Land Use	**acre**
C, Lawn, Flat	**.25**
Pervious Total	**0.25**

Impervious Land Use	**acre**
ROOF TOPS FLAT	**0.05**
Impervious Total	**0.05**
Basin Total	**0.3**

Element Flows To:

Surface	**Interflow**	**Groundwater**
Gravel Trench Bed 4	Gravel Trench Bed 4	

Name : Gravel Trench Bed 4
Bottom Length: 180.00 ft.
Bottom Width: 2.50 ft.
Trench bottom slope 1: 0.001 To 1
Trench Left side slope 0: 0.001 To 1
Trench right side slope 2: 0.001 To 1
Material thickness of first layer: 4
Pour Space of material for first layer: 0.4
Material thickness of second layer: 0
Pour Space of material for second layer: 0
Material thickness of third layer: 0
Pour Space of material for third layer: 0
Infiltration On
Infiltration rate: 2.75
Infiltration safety factor: 1
Total Volume Infiltrated (ac-ft.): 34.857
Total Volume Through Riser (ac-ft.): 0
Total Volume Through Facility (ac-ft.): 34.857
Percent Infiltrated: 100
Total Precip Applied to Facility: 0
Total Evap From Facility: 0
Discharge Structure
Riser Height: 3.9 ft.
Riser Diameter: 12 in.

Element Flows To:
Outlet 1 **Outlet 2**

Gravel Trench Bed Hydraulic Table

Stage(feet)	Area(ac.)	Volume(ac-ft.)	Discharge(cfs)	Infilt(cfs)
0.0000	0.010	0.000	0.000	0.000
0.0444	0.010	0.000	0.000	0.028
0.0889	0.010	0.000	0.000	0.028
0.1333	0.010	0.000	0.000	0.028
0.1778	0.010	0.000	0.000	0.028
0.2222	0.010	0.000	0.000	0.028
0.2667	0.010	0.001	0.000	0.028
0.3111	0.010	0.001	0.000	0.028
0.3556	0.010	0.001	0.000	0.028
0.4000	0.010	0.001	0.000	0.028
0.4444	0.010	0.001	0.000	0.028
0.4889	0.010	0.002	0.000	0.028
0.5333	0.010	0.002	0.000	0.028
0.5778	0.010	0.002	0.000	0.028
0.6222	0.010	0.002	0.000	0.028
0.6667	0.010	0.002	0.000	0.028
0.7111	0.010	0.002	0.000	0.028
0.7556	0.010	0.003	0.000	0.028
0.8000	0.010	0.003	0.000	0.028
0.8444	0.010	0.003	0.000	0.028
0.8889	0.010	0.003	0.000	0.028
0.9333	0.010	0.003	0.000	0.028
0.9778	0.010	0.004	0.000	0.028
1.0222	0.010	0.004	0.000	0.028
1.0667	0.010	0.004	0.000	0.028
1.1111	0.010	0.004	0.000	0.028
1.1556	0.010	0.004	0.000	0.028
1.2000	0.010	0.005	0.000	0.028
1.2444	0.010	0.005	0.000	0.028
1.2889	0.010	0.005	0.000	0.028
1.3333	0.010	0.005	0.000	0.028
1.3778	0.010	0.005	0.000	0.028
1.4222	0.010	0.005	0.000	0.028
1.4667	0.010	0.006	0.000	0.028
1.5111	0.010	0.006	0.000	0.028
1.5556	0.010	0.006	0.000	0.028
1.6000	0.010	0.006	0.000	0.028
1.6444	0.010	0.006	0.000	0.028
1.6889	0.010	0.007	0.000	0.028
1.7333	0.010	0.007	0.000	0.028
1.7778	0.010	0.007	0.000	0.028
1.8222	0.010	0.007	0.000	0.028
1.8667	0.010	0.007	0.000	0.028
1.9111	0.010	0.007	0.000	0.028
1.9556	0.010	0.008	0.000	0.028
2.0000	0.010	0.008	0.000	0.028
2.0444	0.010	0.008	0.000	0.028
2.0889	0.010	0.008	0.000	0.028
2.1333	0.010	0.008	0.000	0.028
2.1778	0.010	0.009	0.000	0.028
2.2222	0.010	0.009	0.000	0.028
2.2667	0.010	0.009	0.000	0.028
2.3111	0.010	0.009	0.000	0.028
2.3556	0.010	0.009	0.000	0.028
2.4000	0.010	0.009	0.000	0.028
2.4444	0.010	0.010	0.000	0.028
2.4889	0.010	0.010	0.000	0.028
2.5333	0.010	0.010	0.000	0.028

2.5778	0.010	0.010	0.000	0.028
2.6222	0.010	0.010	0.000	0.028
2.6667	0.010	0.011	0.000	0.028
2.7111	0.010	0.011	0.000	0.028
2.7556	0.010	0.011	0.000	0.028
2.8000	0.010	0.011	0.000	0.028
2.8444	0.010	0.011	0.000	0.028
2.8889	0.010	0.012	0.000	0.028
2.9333	0.010	0.012	0.000	0.028
2.9778	0.010	0.012	0.000	0.028
3.0222	0.010	0.012	0.000	0.028
3.0667	0.010	0.012	0.000	0.028
3.1111	0.010	0.012	0.000	0.028
3.1556	0.010	0.013	0.000	0.028
3.2000	0.010	0.013	0.000	0.028
3.2444	0.010	0.013	0.000	0.028
3.2889	0.010	0.013	0.000	0.028
3.3333	0.010	0.013	0.000	0.028
3.3778	0.010	0.014	0.000	0.028
3.4222	0.010	0.014	0.000	0.028
3.4667	0.010	0.014	0.000	0.028
3.5111	0.010	0.014	0.000	0.028
3.5556	0.010	0.014	0.000	0.028
3.6000	0.010	0.014	0.000	0.028
3.6444	0.010	0.015	0.000	0.028
3.6889	0.010	0.015	0.000	0.028
3.7333	0.010	0.015	0.000	0.028
3.7778	0.010	0.015	0.000	0.028
3.8222	0.010	0.015	0.000	0.028
3.8667	0.010	0.016	0.000	0.028
3.9111	0.010	0.016	0.012	0.028
3.9556	0.010	0.016	0.138	0.028
4.0000	0.010	0.016	0.333	0.028

Name : Basin 5
Bypass: No
GroundWater: No

Pervious Land Use	acre
C, Lawn, Flat	.1
Pervious Total	**0.1**

Impervious Land Use	acre
SIDEWALKS FLAT	0.05
Impervious Total	**0.05**
Basin Total	**0.15**

Element Flows To:

Surface	Interflow	Groundwater
Gravel Trench Bed 5	Gravel Trench Bed 5	

Name : Gravel Trench Bed 5
Bottom Length: 130.00 ft.
Bottom Width: 2.00 ft.
Trench bottom slope 1: 0.001 To 1
Trench Left side slope 0: 0.001 To 1
Trench right side slope 2: 0.001 To 1
Material thickness of first layer: 4
Pour Space of material for first layer: 0.4
Material thickness of second layer: 0
Pour Space of material for second layer: 0
Material thickness of third layer: 0
Pour Space of material for third layer: 0
Infiltration On
Infiltration rate: 2.75
Infiltration safety factor: 1
Total Volume Infiltrated (ac-ft.): 19.685
Total Volume Through Riser (ac-ft.): 0
Total Volume Through Facility (ac-ft.): 19.685
Percent Infiltrated: 100
Total Precip Applied to Facility: 0
Total Evap From Facility: 0
Discharge Structure
Riser Height: 3.9 ft.
Riser Diameter: 12 in.

Element Flows To:

Outlet 1	Outlet 2

Gravel Trench Bed Hydraulic Table

Stage(feet)	Area(ac.)	Volume(ac-ft.)	Discharge(cfs)	Infilt(cfs)
0.0000	0.006	0.000	0.000	0.000
0.0444	0.006	0.000	0.000	0.016
0.0889	0.006	0.000	0.000	0.016
0.1333	0.006	0.000	0.000	0.016
0.1778	0.006	0.000	0.000	0.016
0.2222	0.006	0.000	0.000	0.016
0.2667	0.006	0.000	0.000	0.016
0.3111	0.006	0.000	0.000	0.016
0.3556	0.006	0.000	0.000	0.016
0.4000	0.006	0.001	0.000	0.016
0.4444	0.006	0.001	0.000	0.016
0.4889	0.006	0.001	0.000	0.016
0.5333	0.006	0.001	0.000	0.016

0.5778	0.006	0.001	0.000	0.016
0.6222	0.006	0.001	0.000	0.016
0.6667	0.006	0.001	0.000	0.016
0.7111	0.006	0.001	0.000	0.016
0.7556	0.006	0.001	0.000	0.016
0.8000	0.006	0.001	0.000	0.016
0.8444	0.006	0.002	0.000	0.016
0.8889	0.006	0.002	0.000	0.016
0.9333	0.006	0.002	0.000	0.016
0.9778	0.006	0.002	0.000	0.016
1.0222	0.006	0.002	0.000	0.016
1.0667	0.006	0.002	0.000	0.016
1.1111	0.006	0.002	0.000	0.016
1.1556	0.006	0.002	0.000	0.016
1.2000	0.006	0.002	0.000	0.016
1.2444	0.006	0.003	0.000	0.016
1.2889	0.006	0.003	0.000	0.016
1.3333	0.006	0.003	0.000	0.016
1.3778	0.006	0.003	0.000	0.016
1.4222	0.006	0.003	0.000	0.016
1.4667	0.006	0.003	0.000	0.016
1.5111	0.006	0.003	0.000	0.016
1.5556	0.006	0.003	0.000	0.016
1.6000	0.006	0.003	0.000	0.016
1.6444	0.006	0.003	0.000	0.016
1.6889	0.006	0.004	0.000	0.016
1.7333	0.006	0.004	0.000	0.016
1.7778	0.006	0.004	0.000	0.016
1.8222	0.006	0.004	0.000	0.016
1.8667	0.006	0.004	0.000	0.016
1.9111	0.006	0.004	0.000	0.016
1.9556	0.006	0.004	0.000	0.016
2.0000	0.006	0.004	0.000	0.016
2.0444	0.006	0.004	0.000	0.016
2.0889	0.006	0.005	0.000	0.016
2.1333	0.006	0.005	0.000	0.016
2.1778	0.006	0.005	0.000	0.016
2.2222	0.006	0.005	0.000	0.016
2.2667	0.006	0.005	0.000	0.016
2.3111	0.006	0.005	0.000	0.016
2.3556	0.006	0.005	0.000	0.016
2.4000	0.006	0.005	0.000	0.016
2.4444	0.006	0.005	0.000	0.016
2.4889	0.006	0.005	0.000	0.016
2.5333	0.006	0.006	0.000	0.016
2.5778	0.006	0.006	0.000	0.016
2.6222	0.006	0.006	0.000	0.016
2.6667	0.006	0.006	0.000	0.016
2.7111	0.006	0.006	0.000	0.016
2.7556	0.006	0.006	0.000	0.016
2.8000	0.006	0.006	0.000	0.016
2.8444	0.006	0.006	0.000	0.016
2.8889	0.006	0.006	0.000	0.016
2.9333	0.006	0.007	0.000	0.016
2.9778	0.006	0.007	0.000	0.016
3.0222	0.006	0.007	0.000	0.016
3.0667	0.006	0.007	0.000	0.016
3.1111	0.006	0.007	0.000	0.016
3.1556	0.006	0.007	0.000	0.016
3.2000	0.006	0.007	0.000	0.016
3.2444	0.006	0.007	0.000	0.016
3.2889	0.006	0.007	0.000	0.016
3.3333	0.006	0.008	0.000	0.016
3.3778	0.006	0.008	0.000	0.016
3.4222	0.006	0.008	0.000	0.016

3.4667	0.006	0.008	0.000	0.016
3.5111	0.006	0.008	0.000	0.016
3.5556	0.006	0.008	0.000	0.016
3.6000	0.006	0.008	0.000	0.016
3.6444	0.006	0.008	0.000	0.016
3.6889	0.006	0.008	0.000	0.016
3.7333	0.006	0.008	0.000	0.016
3.7778	0.006	0.009	0.000	0.016
3.8222	0.006	0.009	0.000	0.016
3.8667	0.006	0.009	0.000	0.016
3.9111	0.006	0.009	0.012	0.016
3.9556	0.006	0.009	0.138	0.016
4.0000	0.006	0.009	0.333	0.016

ANALYSIS RESULTS

Stream Protection Duration Basin 1

Flow Frequency Return Periods for Predeveloped. POC #1

Return Period	**Flow(cfs)**
2 year	0.016659
5 year	0.025116
10 year	0.031413
25 year	0.040155
50 year	0.047238
100 year	0.054814

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

Stream Protection Duration
POC #1
The Facility PASSED

Stream Protection Duration Basin 2

Flow Frequency Return Periods for Predeveloped. POC #2

Return Period	Flow(cfs)
2 year	0.018398
5 year	0.028059
10 year	0.035314
25 year	0.045453
50 year	0.053716
100 year	0.062591

Flow Frequency Return Periods for Mitigated. POC #2

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

Stream Protection Duration
POC #2
The Facility PASSED

Stream Protection Duration Basin 3

Flow Frequency Return Periods for Predeveloped. POC #3

Return Period	Flow(cfs)
2 year	0.028276
5 year	0.042346
10 year	0.05277
25 year	0.067186
50 year	0.07883
100 year	0.091251

Flow Frequency Return Periods for Mitigated. POC #3

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

Stream Protection Duration
POC #3
The Facility PASSED

Stream Protection Duration Basin 4

Flow Frequency Return Periods for Predeveloped. POC #4

Return Period	Flow(cfs)
2 year	0.009087
5 year	0.0137
10 year	0.017134
25 year	0.021902
50 year	0.025766
100 year	0.029899

Flow Frequency Return Periods for Mitigated. POC #4

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

Stream Protection Duration
POC #4
The Facility PASSED

Stream Protection Duration Basin 5

Flow Frequency Return Periods for Predeveloped. POC #5

Return Period	Flow(cfs)
2 year	0.004543
5 year	0.00685
10 year	0.008567
25 year	0.010951
50 year	0.012883
100 year	0.014949

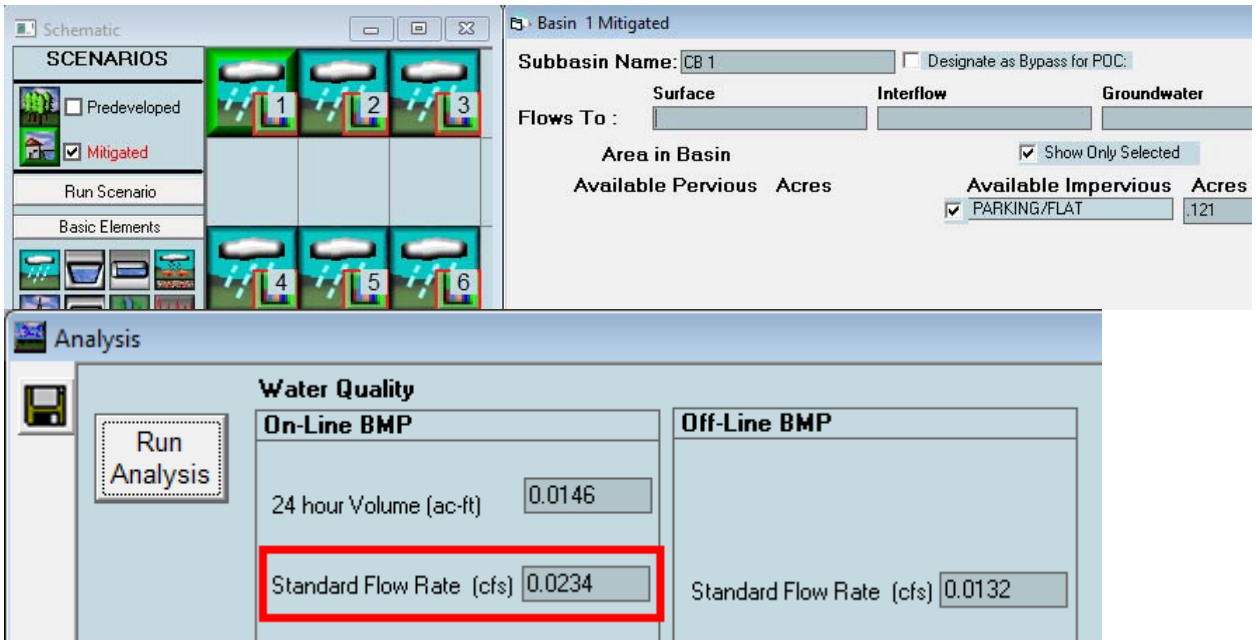
Flow Frequency Return Periods for Mitigated. POC #5

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

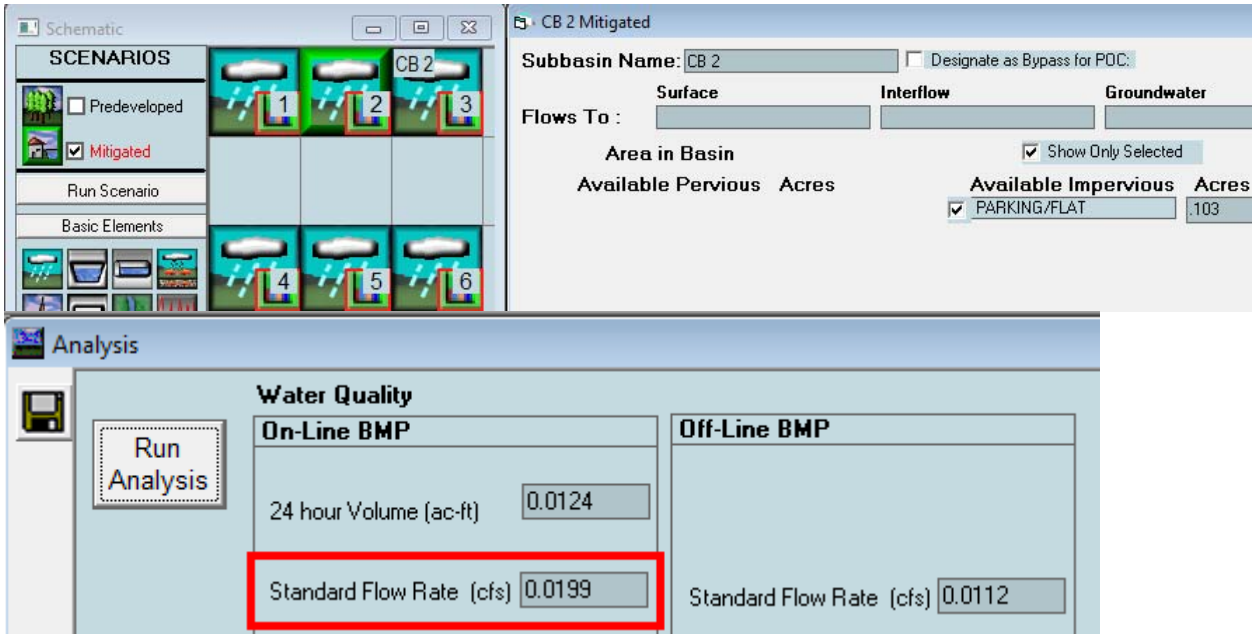
Stream Protection Duration
POC #5
The Facility PASSED

CARTRIDGE FILTER
TREATMENT CALCULATIONS

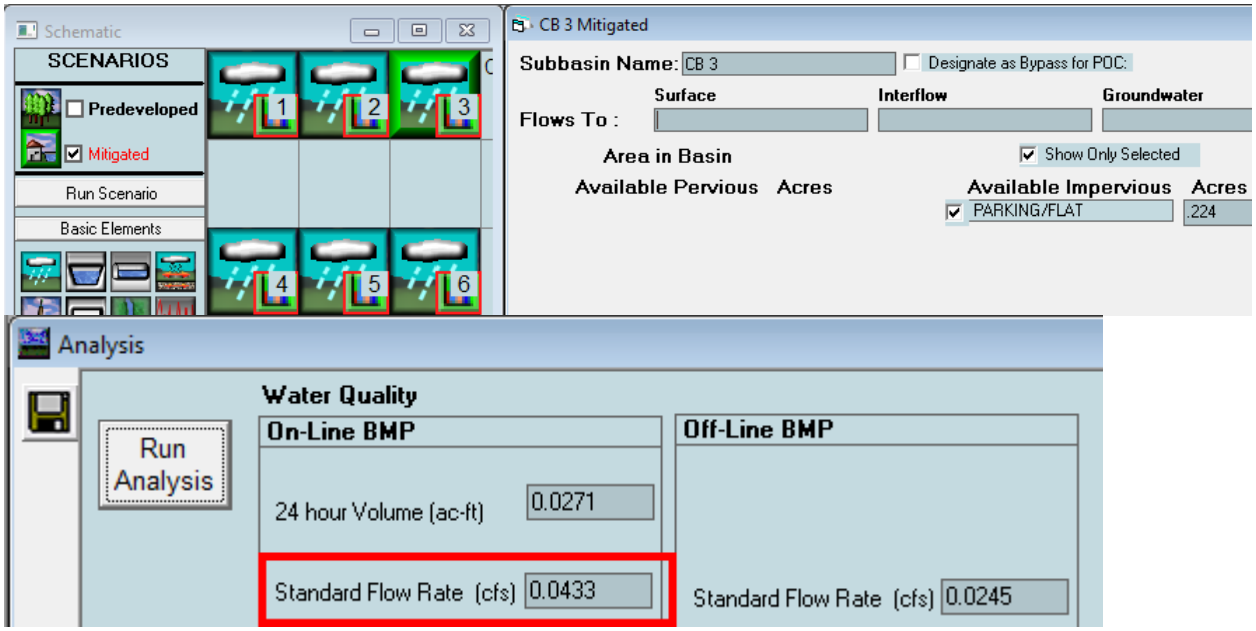
CB #1 TREATMENT FLOW RATE



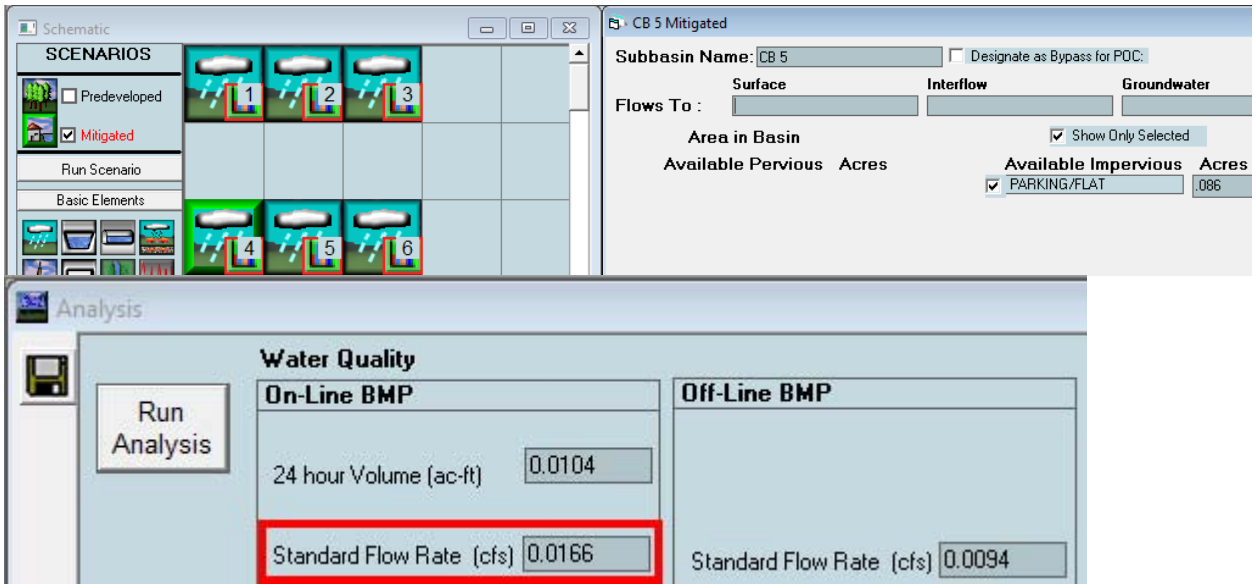
CB #2 TREATMENT FLOW RATE



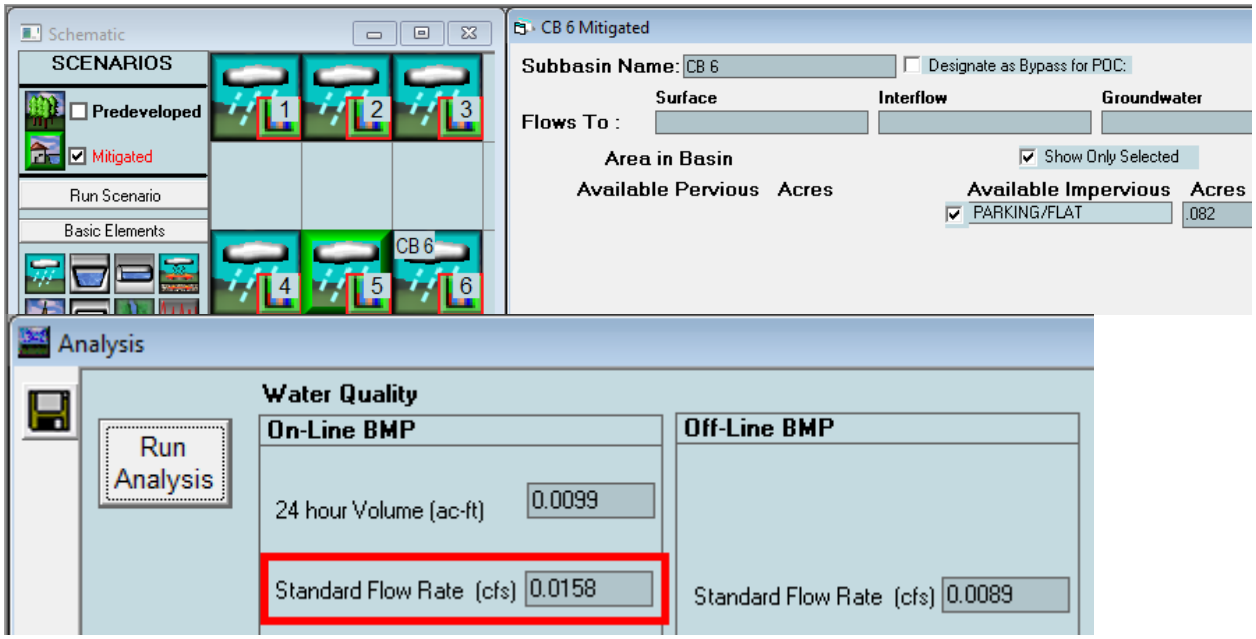
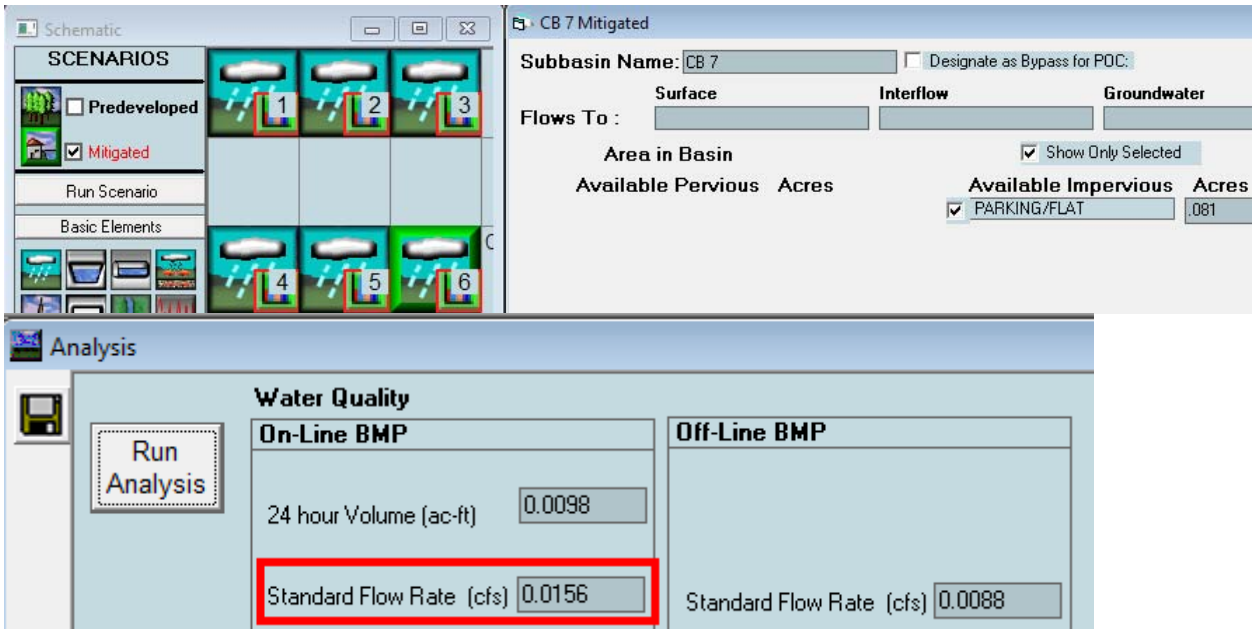
CB #3 TREATMENT FLOW RATE



CB #5 TREATMENT FLOW RATE



CB #6 TREATMENT FLOW RATE



CB #7 TREATMENT FLOW RATE