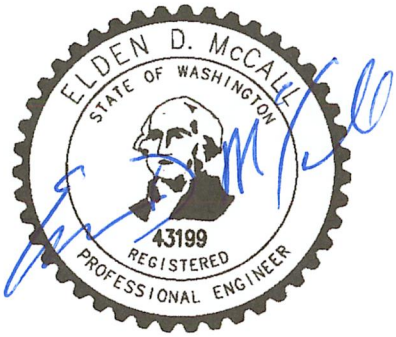
PRELIMINARY DRAINAGE REPORT

FOR

GHAG

(PRELIMINARY MULTI-FAMILY DEVELOPMENT)



DATE: 11/18/22

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SECTION I

EXECUTIVE SUMMARY

The data provided in this Preliminary Drainage Report will be included as a part of the Stormwater Site Plan and Stormwater Pollution Prevention Plan (SWPPP). This additional technical information is provided for the purpose of evaluating the proposed new development and to comply with the minimum requirements set by the Marysville Municipal Code (MMC) (14.15.151) and The State Department of Ecology 2019 Stormwater Management Manual for Western Washington (SMMWW).

The project site is located at 6506 Armar Road in Marysville, WA, within City of Marysville limits. The project site is approximately 0.92 acres and has ground slopes that range from 0% to 18% to the southwest. The site is developed land with an existing single-family residence (SFR), existing garage, and existing shed. The site takes access from Armar Road off the southeastern property line via an existing asphalt driveway. All existing structures and hard surfaces will be removed. The natural discharge location is to the southwest. The majority of the site is covered with lawn and landscaping.

On-site soils are consistent with Ragnar fine sandy loam. On-site stormwater appears to sheet flow and infiltrate into the existing native vegetated areas.

The proposed project consists of half street frontage improvements along Armar Road, construction of a private roadway system, 3 townhome buildings, and utilities (stormwater drainage, sanitary sewer, and potable water). Stormwater runoff from the proposed development will be infiltrated into the ground; thus, recharging the groundwater table. For additional details and information refer to the content and body of this report.

EXISTING SITE CONDITIONS

The project site is located approximately 500 ft northeast of Liberty Street at 6506 Armar Road in Marysville, WA, within City of Marysville limits (Parcel #: 30052800402700). The project site is approximately 0.92 acres and has ground slopes that range from 0% to 18% to the southwest (Figure 1: Existing Site Plan). The site is developed land with an existing SFR, existing garage, and existing shed (Figure 2: Site Photographs). The site takes access from Armar Road off the southeastern property line via an existing asphalt driveway. All existing structures and hard surfaces will be removed. The natural discharge location is to the southwest. The majority of the site is covered with lawn and landscaping.

National Resources Conservation Service (NRCS) Soil Map (Refer to Section V, USDA NRCS Soil Map and Description) indicates on-site soils consistent with Ragnar material. Ragnar soils are fine sandy loam material that was derived from glacial outwash and is commonly found on outwash plains. Ragnar soils are well draining material with a hydrologic soil group "A"; however, SMMWW, Volume III, Table III-2.4 classifies Ragnar soils as hydrologic soil group "B."

Mac Engineering dug Soil Logs/Test Pits (TP) on the site on August 10, 2022. On-site soils were found to be consistent with fine and loamy sands (Refer to Section V, Mac Engineering Soil Logs). Soil samples from depths of 6 in were sent to Northwest Agricultural Consultants to determine the organic content and cation exchange capacity. Based on test results, existing topsoil meets requirements from SMMWW Volume V, BMP T5.13; therefore, topsoil will be stockpiled for final stabilization (Refer to Section V, Northwest Agricultural Report). Soil at the depth of 6 in also met the criteria of SMMWW Volume III, Section 3.3.7, SSC-6 Soil Physical and Chemical Suitability for Treatment. A geotechnical study will be performed to determine soil characteristics at greater depths.

Based on on-site field observation, stormwater runoff from the site sheet flows through existing native vegetation and infiltrates into the ground; thus, recharging the groundwater table. There are no signs of erosion present.

DEVELOPED SITE CONDITIONS

The proposed project consists of half street frontage improvements along Armar Road, construction of a private roadway system, utilities, and 3 townhome buildings. Stormwater drainage analysis and flow controls, used to achieve best management practices (BMPs), designed for this proposed development will comply with the minimum requirements set by the 2019 DOE SMMWW and City of Marysville Code.

The proposed half street frontage improvements are classified as non-pollution generating impervious surface (NPGIS). The proposed half street improvements will create a curb and gutter and a 6 ft sidewalk (See Figure 3: Developed Site Plan). The proposed improvements will remove approximately 800 sf of asphalt and 240 sf of concrete curb and gutter and replace it with ±1,025 sf of concrete sidewalk and curbs. Stormwater runoff from the proposed sidewalks will sheet flow to the southwest through a minimum 10 ft of vegetation in accordance with BMP

T5.12 Sheet Flow Dispersion. Stormwater runoff from the existing asphalt road will collect in the proposed gutter and two proposed catchbasins, then be conveyed and discharged to the existing storm drainage system along Armar Road.

The proposed muti-family development will create new asphalt drive aisles and a parking area (±8,365 sf). The proposed asphalt is classified as pollution generating impervious surface (PGIS). The proposed asphalt will create a 20 ft wide drive aisle that takes access from Armar Road and extends northwest approximately 205 ft (See Figure 3). There will be a 20 ft by 69 ft asphalt parking area located to the east of units 1-6. The proposed drive aisle will have a 22 ft wide spur that extends approximately 135 ft to the southwest to provide access to the driveways for units 7-17. Stormwater runoff from the proposed drive aisle system will be conveyed and discharge into the proposed Infiltration Trench located within the site.

The proposed concrete walkways (±4,345 sf) within the lot are classified as non-pollution generating impervious surface (NPGIS). The walkways adjacent to the 20 ft wide drive aisle will be 6 ft wide and constructed to provide fire truck access (See Figure 3). There will be a 21 ft by 21 ft trash enclosure at the end of the drive aisle east of units 1-6. The walkways along the spur drive aisle and to units 1-6 will be 5 ft wide. The lot walkways connecting units 12-17 to the proposed sidewalk along Armar Road will be 4 ft wide. Stormwater runoff from the proposed walkways between units 12-17 and Armar Road will sheet flow through vegetated ground cover with soils satisfying BMP T5.13. Stormwater runoff from the remainder of the proposed lot walkways will sheet flow towards the drive aisles where it will be conveyed and discharge into the proposed Infiltration Trench located within the site.

The proposed concrete driveways (±1,985 sf) are classified as PGIS. The proposed driveways will connect townhome units 7-17 to the spur drive aisle, and provide pedestrian paths to the proposed walkways (See Figure 3). The proposed driveways will be 13 ft wide and 19 feet long. Stormwater runoff from the proposed driveways will sheet flow towards the spur drive aisle and be conveyed and discharge into the proposed Infiltration Trench located within the site.

The proposed development will construct 3 townhouse buildings. Units 1-6 (±4,545 sf w/overhang) will be located in the northern portion of the parcel (See Figure 3). Units 7-11 (±4,725 sf w/overhang) will be located in the central portion of the parcel. Units 12-17 (±5,650 sf w/overhang) will be located in the southern portion of the parcel. Stormwater runoff from the proposed buildings will collect in gutters and downspouts. A maximum of 700 sf of roof surface may directly discharge to a single downspout per SMMWW Volume III, Section 3.1.2 Downspout Dispersion Systems BMP T5.10B. Downspouts will be tightlined to the proposed catchbasins and then discharged to the proposed Infiltration Trench.

WWHM was used to estimate the size of the proposed infiltration systems (Refer to Section III, Infiltration Calculations). Similar projects in the vicinity had a design infiltration rate of roughly 4 in/hr; Therefore, an infiltration rate of 3.5 was used as a factor of safety. WWHM indicates an approximate infiltration trench size of 130 ft long by 13 ft wide, with a 2 ft thick drain rock layer underlain by 1.5 ft of treatment soils, to infiltrate 100 percent of the runoff from the proposed buildings, drive aisles, driveways, and walkways. The size of the infiltration trench will be

finalized during the construction design phase of this project based on findings of the future geotechnical study.

The remaining portion of the lots will be lawn/landscaped areas. Stormwater runoff from the lawn/landscaped areas is expected to sheet flow to the southwest through vegetation and infiltrate into the ground.

All on-site disturbed areas not covered with impervious surface will be amended with existing topsoil in accordance with SMMWW Volume V, BMP T5.13. Due to the type of soils and vegetation on-site, the distance from the developed areas to the property line, and with the BMP's used on this proposed project, it is expected to meet the intent to provide flow control and stormwater quality.

OFF-SITE ANALYSIS

Upstream Analysis:

Based on on-site field observations and county contour maps, there is an upstream basin area of approximately 1.5 ac to the northeast of the parcel (Figure 4: Off-Site Drainage Map). The upstream basin area consists of developed SFR lots with lawn and landscaping. The upstream area is not expected to negatively impact the proposed project, nor is the proposed project expected to have an adverse impact on upstream properties.

Downstream Analysis:

Stormwater runoff from the site discharges along the western and southwestern property lines. Stormwater runoff sheet flows to the southwest through developed multifamily and SFR lots (See Figure 4). Stormwater along 47th Ave NE is collected in catch basins and discharged into infiltration pipes (Figure 5: Drainage Inventory Map). Stormwater runoff along Armar Road collects in catch basins and is conveyed east to Allen Creek, a fish habitat (Figure 6: Stream Inventory Map). Allen Creek flows southwest beyond a distance of ¼ mile from the project site. Due to the types of soils and length of flow path, the proposed project is not expected to have an adverse impact to downstream properties.

COMPLIANCE WITH APPLICABLE MINIMUM REQUIREMENTS

Based on SMMWW, Volume I, Figure 1.1 (Figure 7: Minimum Requirements Flow Chart) this proposed new development project will comply with Minimum Requirements #1 through #9. The purpose of the requirements is to prevent and control adverse impacts of the drainage and stormwater on the public health, safety and general welfare. To meet these requirements, a Construction Stormwater Pollution Prevention Plan (SWPPP) has been provided. The following addresses Minimum Requirements 1 to 9:

Minimum Requirement #1: **Preparation of stormwater site plan**

A Stormwater Site Plan/Building Site Plan has been prepared.

Minimum Requirement #2: **Stormwater Pollution Prevention Plans (SWPPP)**

SWPPP drawings and the required elements have been prepared and are a stand-alone document from this report. The BMP's indicated on the plans will be implemented during construction. Additional BMP's may be used on the site depending upon weather conditions.

Minimum Requirement #3: **Source Control of Pollution**

During construction SWPPP BMP's will be implemented, based on Volume II, Chapter 4, as shown on the SWPP plans. This project is not required to have source control BMP's after construction is completed.

Minimum Requirement #4: **Preservation of natural drainage and outfalls**

The proposed site development is not expected to have off-site drainage impacts. This project will not alter the natural discharge locations of stormwater runoff. On-site BMPs will be used to mitigate potential erosion issues and control runoff. For more information about BMP details and placement please refer to Section I of this report and Site Plans associated with this project.

Minimum Requirement #5: **On-site Stormwater Management**

The proposed project triggers Minimum Requirements 1 through 9 and the site is located inside the Urban Growth Area (UGA); therefore, the proposed project will utilize BMP's from List #2 per SMMWW Table I-2.5.1.

Lawn and Landscaped Areas:

- Post-Construction Soil Quality and Depth
  - is feasible in accordance with BMP T5.13. Existing topsoil will be stockpiled for final stabilization.

Roofs:

- Full Dispersion
  - is infeasible due to the lack of 100 ft vegetated flow path.
- Full Infiltration
  - Is feasible. Stormwater runoff from the proposed townhome roofs will tightline to the proposed infiltration trench in accordance with BMP T7.20.

Other Hard Surfaces:

- *Full Dispersion*
  - *Is infeasible due to the lack of 100 ft vegetated flow path*
- *Full Infiltration*
  - Is feasible. Stormwater runoff from the proposed drive aisles, driveways, and a portion of walkways will use the proposed infiltration trench in accordance with BMP T7.20.

Due to topographic constraints, a portion of the lot walkways and Frontage sidewalk will use sheet flow dispersion in accordance with BMP T5.12.

Minimum Requirement #6: **Runoff Treatment**

SWWMM Volume V, Chapter 2, Section 2.1, Figure 2.1.1 – Treatment Facility Selection Flow Chart is used to determine the necessary treatment facility for the proposed development.

Oil control devices and facilities are applied to project site that have "high use sites." A "high use site" is defined as the following:

- *An area of a commercial or industrial site subject to an expected average daily traffic (ADT) count equal to or greater than 100 vehicles over 1,000 square feet of gross building area.*
  - The proposed project is not a commercial or industrial site.

- *An area of commercial or industrial site subject to petroleum storage and transfer in excess of 1,500 gallons per year, not including routinely delivered heating oil.*
  - The proposed project is not a commercial or industrial site.

- *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.).*
  - The proposed project is not a commercial or industrial site.

- *A road intersection with a measured ADT count of 25,000 vehicles or more on the main roadway and 15,000 vehicles or more on any intersecting roadway, excluding project proposing primarily pedestrian or bicycle use improvements.*
  - The proposed project does not have a measured ADT count of 25,000 vehicles or more on the main roadway and 15,000 vehicles or more on any intersecting roadway.

- *The following land uses may have areas that fall within the definition of "high use sites" and require oil control treatment.*
  - *Industrial Machinery and equipment, and railroad equipment maintenance areas*
    - The proposed project is not an industrial machinery or railroad maintenance area.

- *Log storage and sorting yards*
  - The proposed project is not a log storage or sorting yard.

- *Aircraft maintenance areas*
  - The proposed project is not an aircraft maintenance area.

- *Railroad yards*
  - The proposed project is not a railroad yard.

- *Fueling stations*
  - The proposed project is not a fueling station.

- *Vehicle maintenance and repair sites*
  - The proposed project is not a vehicle maintenance or repair site.

- *Construction businesses (paving, heavy equipment storage and maintenance, storage of petroleum products.)*
  - The proposed project is not a construction business.

Phosphorous control devices and facilities are applied to project site that met any one of the following:

- *Those waterbodies reported under section 305(b) of the Clean Water Act, and designated as not supporting beneficial uses due to phosphorous;*
  - The proposed project is not reported under section 305(b) of the Clean Water Act.

- *Those listed in Washington State's Nonpoint Source Assessment required under section 319(a) of the Clean Water Act due to nutrients.*
  - The proposed project is not listed in section 319(a) of the Clean Water Act.

The proposed project will provide basic water quality for stormwater runoff from the proposed development. Water quality measures will be achieved prior to stormwater runoff discharging the site. Stormwater runoff from the proposed project will collect in Contech Stormfilter catch basins to separate out oil and debris before being discharged into the proposed infiltration trench. The proposed infiltration trench will be underlain with 18 in of stockpiled existing topsoil in order to achieve water quality before infiltrating into existing subsoils. Stormwater analysis and water quality sizing will be designed during the construction design phase of this project.

Minimum Requirement #7: **Flow Control**

Flow control shall be provided for the proposed project if any of the following thresholds are met:

- 10,000 sf or more of effective impervious surface within a threshold discharge area
    - The proposed project does not exceed 10,000 sf of effective impervious surface in any threshold discharge area. Proposed new impervious surfaces which are fully infiltrated are classified as ineffective impervious surfaces.

- ¾ acres or more of forest converted to lawn or landscape and surface water is discharged from the site into a conveyance system or receiving water
    - The proposed project does not convert ¾ acres from forest to lawn.

- 2.5 acres of forest converted to pasture and surface water is discharged from the site into a conveyance system or receiving water
    - The proposed project does not convert 2.5 acres of forest to pasture.

- A combination of hard surfaces and converted pervious surfaces cause a 0.15 CFS, 15-minute time steps, or greater increase in the 100-year flow frequency from a threshold discharge area as estimated using WWHM2012
    - WWHM2012 (15-minute time step) was used to determine the pre-developed and mitigated discharge volumes from the site under developed conditions. The proposed project will not increase stormwater runoff, for the 100-year return period, more than 0.15 CFS. Pre-developed runoff for the 100-year return period is 0.04 CFS. Mitigated runoff for the 100-year return period is 0.05 CFS (Refer to Section III, Site Calculations). All road, roof, and driveway surfaces which are fully infiltrated do not need to be modeled per hydrologic modeling credits and were therefore modeled as forest in both the predeveloped and mitigated scenario.

Minimum Requirement #8: **Wetlands Protection**

No development will occur within any critical areas. Stormwater runoff from the proposed development will not discharge to any on-site critical areas.

Minimum Requirement #9: **Operation and Maintenance**

Refer to Section IV of this report for operation and maintenance requirements.

SECTION II

SWPPP ELEMENTS

1 – PRESERVE VEGETATION/MARK CLEARING LIMITS

The land disturbance activities for development requires the consideration to be given to minimize the removal of existing trees, disturbance and compaction of native soils, except as needed for building purposes. The duff layer, native soil and vegetation shall be retained in an undisturbed state to the maximum degree practicable.

Best Management Practices (BMPs) to be used:

- BMP C101: Preserving Natural Vegetation
- BMP C103: High Visibility Plastic or Metal Fence
- BMP C233: Silt Fence

2-ESTABLISH CONSTRUCTION ACCESS

A temporary construction entrance is required.

Best Management Practices (BMPs) to be used:

- BMP C105: Stabilized Construction Entrance

3-CONTROL FLOW RATES

Flow rates will be controlled by using SWPPP Element #4, sediment controls.

4-INSTALL SEDIMENT CONTROLS

Due to the permeability of the site soils and the primarily level surface of the site, surface flows from the site are expected to be negligible and therefore no sediment controls are needed. However, silt fence will be placed along the southwestern edge of the proposed development as a precautionary measure.

Best Management Practices (BMPs) to be used:

- BMP C233: Silt Fence

5-STABILIZED SOILS

Existing topsoil will be stockpiled for final stabilization. If required, all exposed soil and any soil stockpile will be stabilized. The soil stockpile will be located within the disturbed area shown on the SWPPP plan. Any stockpiles will be covered in plastic if left un-worked. No soils shall remain exposed and un-worked for more than 2 days between October 1 and April 30 and more than 7 days from May 1 to September 30. The land disturbed areas that will not be covered with impervious surfaces will be permanently seeded.

Best Management Practices (BMPs) to be used:

- BMP C120 Temporary & Permanent Seeding
- BMP C123 Plastic Covering
- BMP C140 Dust Control

6-PROTECT SLOPES

There are no cut or fill slopes with this project.

Best Management Practices (BMPs) to be used:

- None Required

7-PROTECT PERMANENT DRAIN INLETS

All existing and proposed storm drain inlets shall be protected from sediment and silt-laden water. Inlet protection will be installed to minimize dirty water from entering the existing and proposed drainage system.

Best Management Practices (BMPs) to be used:

- BMP C220: Storm Drain Inlet Protection

8-STABILIZE CHANNELS AND OUTLETS

There are no existing channels and the proposed construction does not create new channels.

Best Management Practices (BMPs) to be used:

- None Required

9-CONTROL POLLUTANTS

Any and all chemicals, liquid projects, petroleum projects, and other materials that have the potential to pose a threat to human or the environment will be covered, contained and protected from vandalism. All such products will either be locked in a trailer or locked in a leak proof container. Any on-site fueling will have secondary containment to prevent possibility of spills. Any heavy equipment/vehicles will only be on-site temporarily. Any spills will be cleaned immediately. Fertilizers and pesticides will be applied per the manufacturers label requirements for application rate and procedures. No pH modifying sources such as cement kiln dust, fly ash, concrete washing treatment, curing waters, etc. are anticipated; if however they are, we will contain and/or remove the polluted substance from the site per manufacturer's recommendations.

Best Management Practices (BMPs) to be used:

- BMP C151: Concrete Handling
- BMP C152: Saw cutting and Surface Pollution Prevention

- BMP C153: Material, Delivery, Storage and Containment
- BMP C154: Concrete Washout Area

10-CONTROL DEWATERING

Due to the depth of water table, dewatering is not expected to be required; thus, dewatering control will not be required for this project.

Best Management Practices (BMPs) to be used:
- None Required

11-MAINTAIN BEST MAINAGEMENT PRACTICES

BMPs will be inspected and maintained after storms and during construction.

Best Management Practices (BMPs) to be used:
- BMP C150: Materials on Hand

12-MANAGE THE PROJECT

This SWPPP will be implemented at all times and will be modified whenever there is a significant change to the site conditions. The Erosion control BMPs will be implemented in the following sequence:

1. Arrange and attend Pre-Construction Meeting with City pf Marysville
2. Flag clearing limits and install SWPP measures
3. Construct private road network with drainage, sewer, and water
4. Any necessary on-site grading
5. Stabilize disturbed land surfaces

Best Management Practices (BMPs) to be used:
- BMP C150: Materials on Hand
- BMP C162: Scheduling

13-PROTECT ON-SITE STORMWATER BMPS

On-site stormwater BMPs, existing and proposed, will be protected at all times from siltation and compaction during construction. The approved plans have both construction sequencing and appropriate SWPPP BMPs to minimize the risk to stormwater BMPs.

Best Management Practices (BMPs) to be used:
- BMP C103: High Visibility Fence
- BMP C233: Silt Fence

SECTION III

WWHM2012

PROJECT REPORT

INFILTRATION
CALCULATIONS

General Model Information

Project Name:	22-10-19-INFIL CALCS-220638
Site Name:	GHAG ARMAR
Site Address:	6506 ARMAR RD
City:	MARYSVILLE
Report Date:	10/19/2022
Gage:	Everett
Data Start:	1948/10/01
Data End:	2009/09/30
Timestep:	15 Minute
Precip Scale:	1.000
Version Date:	2019/09/13
Version:	4.2.17

POC Thresholds

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

Landuse Basin Data

Predeveloped Land Use

Basin 1

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
A B, Forest, Flat	0.68
Pervious Total	0.68
Impervious Land Use	acre
Impervious Total	0
Basin Total	0.68

Element Flows To:

Surface	Interflow	Groundwater

Mitigated Land Use

Basin 1

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
Pervious Total	0
Impervious Land Use	acre
ROADS FLAT	0.238
ROOF TOPS FLAT	0.342
SIDEWALKS FLAT	0.1
Impervious Total	0.68
Basin Total	0.68

Element Flows To:

Surface	Interflow	Groundwater
Gravel Trench Bed 1	Gravel Trench Bed 1	

Routing Elements
Predeveloped Routing

Mitigated Routing

Gravel Trench Bed 1

Bottom Length:	130.00 ft.
Bottom Width:	13.00 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:	4.5
Pour Space of material for first layer:	0.333
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:	3.5
Infiltration safety factor:	1
Total Volume Infiltrated (ac-ft.):	105.72
Total Volume Through Riser (ac-ft.):	0
Total Volume Through Facility (ac-ft.):	105.72
Percent Infiltrated:	100
Total Precip Applied to Facility:	0
Total Evap From Facility:	0
Discharge Structure	
Riser Height:	3.5 ft.
Riser Diameter:	18 in.
Element Flows To:	
Outlet 1	Outlet 2

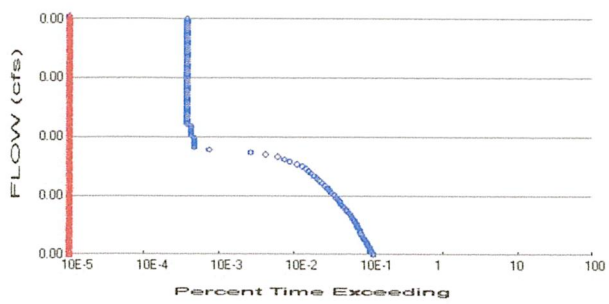
Gravel Trench Bed Hydraulic Table

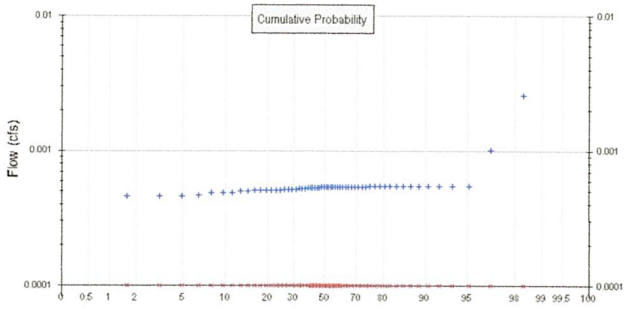
Stage(feet)	Area(ac.)	Volume(ac-ft.)	Discharge(cfs)	Infilt(cfs)
0.0000	0.038	0.000	0.000	0.000
0.0500	0.038	0.000	0.000	0.136
0.1000	0.038	0.001	0.000	0.136
0.1500	0.038	0.001	0.000	0.136
0.2000	0.038	0.002	0.000	0.136
0.2500	0.038	0.003	0.000	0.136
0.3000	0.038	0.003	0.000	0.136
0.3500	0.038	0.004	0.000	0.136
0.4000	0.038	0.005	0.000	0.136
0.4500	0.038	0.005	0.000	0.136
0.5000	0.038	0.006	0.000	0.136
0.5500	0.038	0.007	0.000	0.136
0.6000	0.038	0.007	0.000	0.136
0.6500	0.038	0.008	0.000	0.136
0.7000	0.038	0.009	0.000	0.136
0.7500	0.038	0.009	0.000	0.136
0.8000	0.038	0.010	0.000	0.136
0.8500	0.038	0.011	0.000	0.136
0.9000	0.038	0.011	0.000	0.136
0.9500	0.038	0.012	0.000	0.136
1.0000	0.038	0.012	0.000	0.136
1.0500	0.038	0.013	0.000	0.136
1.1000	0.038	0.014	0.000	0.136
1.1500	0.038	0.014	0.000	0.136

1.2000	0.038	0.015	0.000	0.136
1.2500	0.038	0.016	0.000	0.136
1.3000	0.038	0.016	0.000	0.136
1.3500	0.038	0.017	0.000	0.136
1.4000	0.038	0.018	0.000	0.136
1.4500	0.038	0.018	0.000	0.136
1.5000	0.038	0.019	0.000	0.136
1.5500	0.038	0.020	0.000	0.136
1.6000	0.038	0.020	0.000	0.136
1.6500	0.038	0.021	0.000	0.136
1.7000	0.038	0.022	0.000	0.136
1.7500	0.038	0.022	0.000	0.136
1.8000	0.038	0.023	0.000	0.136
1.8500	0.038	0.023	0.000	0.136
1.9000	0.038	0.024	0.000	0.136
1.9500	0.038	0.025	0.000	0.136
2.0000	0.038	0.025	0.000	0.136
2.0500	0.038	0.026	0.000	0.136
2.1000	0.038	0.027	0.000	0.136
2.1500	0.038	0.027	0.000	0.136
2.2000	0.038	0.028	0.000	0.136
2.2500	0.038	0.029	0.000	0.136
2.3000	0.038	0.029	0.000	0.136
2.3500	0.038	0.030	0.000	0.136
2.4000	0.038	0.031	0.000	0.136
2.4500	0.038	0.031	0.000	0.136
2.5000	0.038	0.032	0.000	0.136
2.5500	0.038	0.033	0.000	0.136
2.6000	0.038	0.033	0.000	0.136
2.6500	0.038	0.034	0.000	0.136
2.7000	0.038	0.034	0.000	0.136
2.7500	0.038	0.035	0.000	0.136
2.8000	0.038	0.036	0.000	0.136
2.8500	0.038	0.036	0.000	0.136
2.9000	0.038	0.037	0.000	0.136
2.9500	0.038	0.038	0.000	0.136
3.0000	0.038	0.038	0.000	0.136
3.0500	0.038	0.039	0.000	0.136
3.1000	0.038	0.040	0.000	0.136
3.1500	0.038	0.040	0.000	0.136
3.2000	0.038	0.041	0.000	0.136
3.2500	0.038	0.042	0.000	0.136
3.3000	0.038	0.042	0.000	0.136
3.3500	0.038	0.043	0.000	0.136
3.4000	0.038	0.043	0.000	0.136
3.4500	0.038	0.044	0.000	0.136
3.5000	0.038	0.045	0.000	0.136
3.5500	0.038	0.045	0.177	0.136
3.6000	0.038	0.046	0.502	0.136
3.6500	0.038	0.047	0.919	0.136
3.7000	0.038	0.047	1.404	0.136
3.7500	0.038	0.048	1.938	0.136
3.8000	0.038	0.049	2.501	0.136
3.8500	0.038	0.049	3.072	0.136
3.9000	0.038	0.050	3.632	0.136
3.9500	0.038	0.051	4.160	0.136
4.0000	0.038	0.051	4.639	0.136
4.0500	0.038	0.052	5.055	0.136

4.1000	0.038	0.053	5.401	0.136
4.1500	0.038	0.053	5.676	0.136
4.2000	0.038	0.054	5.892	0.136
4.2500	0.038	0.054	6.071	0.136
4.3000	0.038	0.055	6.338	0.136
4.3500	0.038	0.056	6.533	0.136
4.4000	0.038	0.056	6.723	0.136
4.4500	0.038	0.057	6.907	0.136
4.5000	0.038	0.058	7.086	0.136

Analysis Results
POC 1





+ Predeveloped x Mitigated

Predeveloped Landuse Totals for POC #1
Total Pervious Area: 0.68
Total Impervious Area: 0

Mitigated Landuse Totals for POC #1
Total Pervious Area: 0
Total Impervious Area: 0.68

Flow Frequency Method: Log Pearson Type III 17B

Flow Frequency Return Periods for Predeveloped. POC #1

Return Period	Flow(cfs)
2 year	0.000537
5 year	0.000654
10 year	0.00073
25 year	0.000825
50 year	0.000895
100 year	0.000966

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

Annual Peaks

Annual Peaks for Predeveloped and Mitigated. POC #1

Year	Predeveloped	Mitigated
1949	0.000	0.000
1950	0.001	0.000
1951	0.001	0.000
1952	0.000	0.000
1953	0.001	0.000
1954	0.001	0.000
1955	0.001	0.000
1956	0.001	0.000
1957	0.001	0.000
1958	0.001	0.000

1959	0.001	0.000
1960	0.001	0.000
1961	0.001	0.000
1962	0.001	0.000
1963	0.000	0.000
1964	0.001	0.000
1965	0.001	0.000
1966	0.000	0.000
1967	0.001	0.000
1968	0.001	0.000
1969	0.001	0.000
1970	0.001	0.000
1971	0.001	0.000
1972	0.001	0.000
1973	0.000	0.000
1974	0.001	0.000
1975	0.001	0.000
1976	0.001	0.000
1977	0.001	0.000
1978	0.001	0.000
1979	0.001	0.000
1980	0.001	0.000
1981	0.001	0.000
1982	0.001	0.000
1983	0.001	0.000
1984	0.001	0.000
1985	0.001	0.000
1986	0.001	0.000
1987	0.001	0.000
1988	0.001	0.000
1989	0.001	0.000
1990	0.001	0.000
1991	0.001	0.000
1992	0.001	0.000
1993	0.000	0.000
1994	0.001	0.000
1995	0.001	0.000
1996	0.001	0.000
1997	0.003	0.000
1998	0.001	0.000
1999	0.001	0.000
2000	0.001	0.000
2001	0.000	0.000
2002	0.001	0.000
2003	0.001	0.000
2004	0.000	0.000
2005	0.001	0.000
2006	0.001	0.000
2007	0.001	0.000
2008	0.001	0.000
2009	0.001	0.000

Ranked Annual Peaks

Ranked Annual Peaks for Predeveloped and Mitigated. POC #1

Rank	Predeveloped	Mitigated
1	0.0026	0.0000
2	0.0010	0.0000
3	0.0005	0.0000

4	0.0005	0.0000
5	0.0005	0.0000
6	0.0005	0.0000
7	0.0005	0.0000
8	0.0005	0.0000
9	0.0005	0.0000
10	0.0005	0.0000
11	0.0005	0.0000
12	0.0005	0.0000
13	0.0005	0.0000
14	0.0005	0.0000
15	0.0005	0.0000
16	0.0005	0.0000
17	0.0005	0.0000
18	0.0005	0.0000
19	0.0005	0.0000
20	0.0005	0.0000
21	0.0005	0.0000
22	0.0005	0.0000
23	0.0005	0.0000
24	0.0005	0.0000
25	0.0005	0.0000
26	0.0005	0.0000
27	0.0005	0.0000
28	0.0005	0.0000
29	0.0005	0.0000
30	0.0005	0.0000
31	0.0005	0.0000
32	0.0005	0.0000
33	0.0005	0.0000
34	0.0005	0.0000
35	0.0005	0.0000
36	0.0005	0.0000
37	0.0005	0.0000
38	0.0005	0.0000
39	0.0005	0.0000
40	0.0005	0.0000
41	0.0005	0.0000
42	0.0005	0.0000
43	0.0005	0.0000
44	0.0005	0.0000
45	0.0005	0.0000
46	0.0005	0.0000
47	0.0005	0.0000
48	0.0005	0.0000
49	0.0005	0.0000
50	0.0005	0.0000
51	0.0005	0.0000
52	0.0005	0.0000
53	0.0005	0.0000
54	0.0005	0.0000
55	0.0005	0.0000
56	0.0005	0.0000
57	0.0005	0.0000
58	0.0005	0.0000
59	0.0005	0.0000
60	0.0005	0.0000
61	0.0004	0.0000

Duration Flows

The Facility PASSED

Flow(cfs)	Predev	Mit	Percentage	Pass/Fail
0.0003	2505	0	0	Pass
0.0003	2391	0	0	Pass
0.0003	2286	0	0	Pass
0.0003	2205	0	0	Pass
0.0003	2122	0	0	Pass
0.0003	2031	0	0	Pass
0.0003	1946	0	0	Pass
0.0003	1869	0	0	Pass
0.0003	1761	0	0	Pass
0.0003	1706	0	0	Pass
0.0003	1651	0	0	Pass
0.0003	1591	0	0	Pass
0.0003	1519	0	0	Pass
0.0004	1458	0	0	Pass
0.0004	1389	0	0	Pass
0.0004	1330	0	0	Pass
0.0004	1263	0	0	Pass
0.0004	1194	0	0	Pass
0.0004	1125	0	0	Pass
0.0004	1067	0	0	Pass
0.0004	996	0	0	Pass
0.0004	942	0	0	Pass
0.0004	896	0	0	Pass
0.0004	846	0	0	Pass
0.0004	796	0	0	Pass
0.0004	748	0	0	Pass
0.0004	691	0	0	Pass
0.0004	648	0	0	Pass
0.0004	610	0	0	Pass
0.0005	563	0	0	Pass
0.0005	520	0	0	Pass
0.0005	470	0	0	Pass
0.0005	439	0	0	Pass
0.0005	403	0	0	Pass
0.0005	369	0	0	Pass
0.0005	338	0	0	Pass
0.0005	309	0	0	Pass
0.0005	281	0	0	Pass
0.0005	238	0	0	Pass
0.0005	188	0	0	Pass
0.0005	163	0	0	Pass
0.0005	131	0	0	Pass
0.0005	90	0	0	Pass
0.0005	56	0	0	Pass
0.0005	16	0	0	Pass
0.0006	10	0	0	Pass
0.0006	10	0	0	Pass
0.0006	10	0	0	Pass
0.0006	10	0	0	Pass
0.0006	10	0	0	Pass
0.0006	9	0	0	Pass
0.0006	9	0	0	Pass
0.0006	9	0	0	Pass

0.0006	9	0	0	Pass
0.0006	9	0	0	Pass
0.0006	8	0	0	Pass
0.0006	8	0	0	Pass
0.0006	8	0	0	Pass
0.0006	8	0	0	Pass
0.0006	8	0	0	Pass
0.0006	8	0	0	Pass
0.0007	8	0	0	Pass
0.0007	8	0	0	Pass
0.0007	8	0	0	Pass
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0.0007	8	0	0	Pass
0.0007	8	0	0	Pass
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0.0007	8	0	0	Pass
0.0007	8	0	0	Pass
0.0007	8	0	0	Pass
0.0007	8	0	0	Pass
0.0007	8	0	0	Pass
0.0008	8	0	0	Pass
0.0008	8	0	0	Pass
0.0008	8	0	0	Pass
0.0008	8	0	0	Pass
0.0008	8	0	0	Pass
0.0008	8	0	0	Pass
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0.0008	8	0	0	Pass
0.0008	8	0	0	Pass
0.0008	8	0	0	Pass
0.0009	8	0	0	Pass
0.0009	8	0	0	Pass
0.0009	8	0	0	Pass
0.0009	8	0	0	Pass
0.0009	8	0	0	Pass
0.0009	8	0	0	Pass
0.0009	8	0	0	Pass

Water Quality

Water Quality BMP Flow and Volume for POC #1

On-line facility volume:	0 acre-feet
On-line facility target flow:	0 cfs.
Adjusted for 15 min:	0 cfs.
Off-line facility target flow:	0 cfs.
Adjusted for 15 min:	0 cfs.

LID Report

LID Technique	Used for Treatment ?	Total Volume Needs Treatment (ac-ft)	Volume Through Facility (ac-ft)	Infiltration Volume (ac-ft)	Cumulative Volume Infiltration Credit	Percent Volume Infiltrated	Water Quality	Percent Water Quality Treated	Comment
Gravel Trench Bed 1 POC	☐	96.21			☐	100.00			
Total Volume Infiltrated		96.21	0.00	0.00		100.00	0.00	0%	No Treat. Credit
Compliance with LID Standard 8% of 2-yr to 50% of 2-yr									Duration Analysis Result = Passed

Model Default Modifications

Total of 0 changes have been made.

PERLND Changes

No PERLND changes have been made.

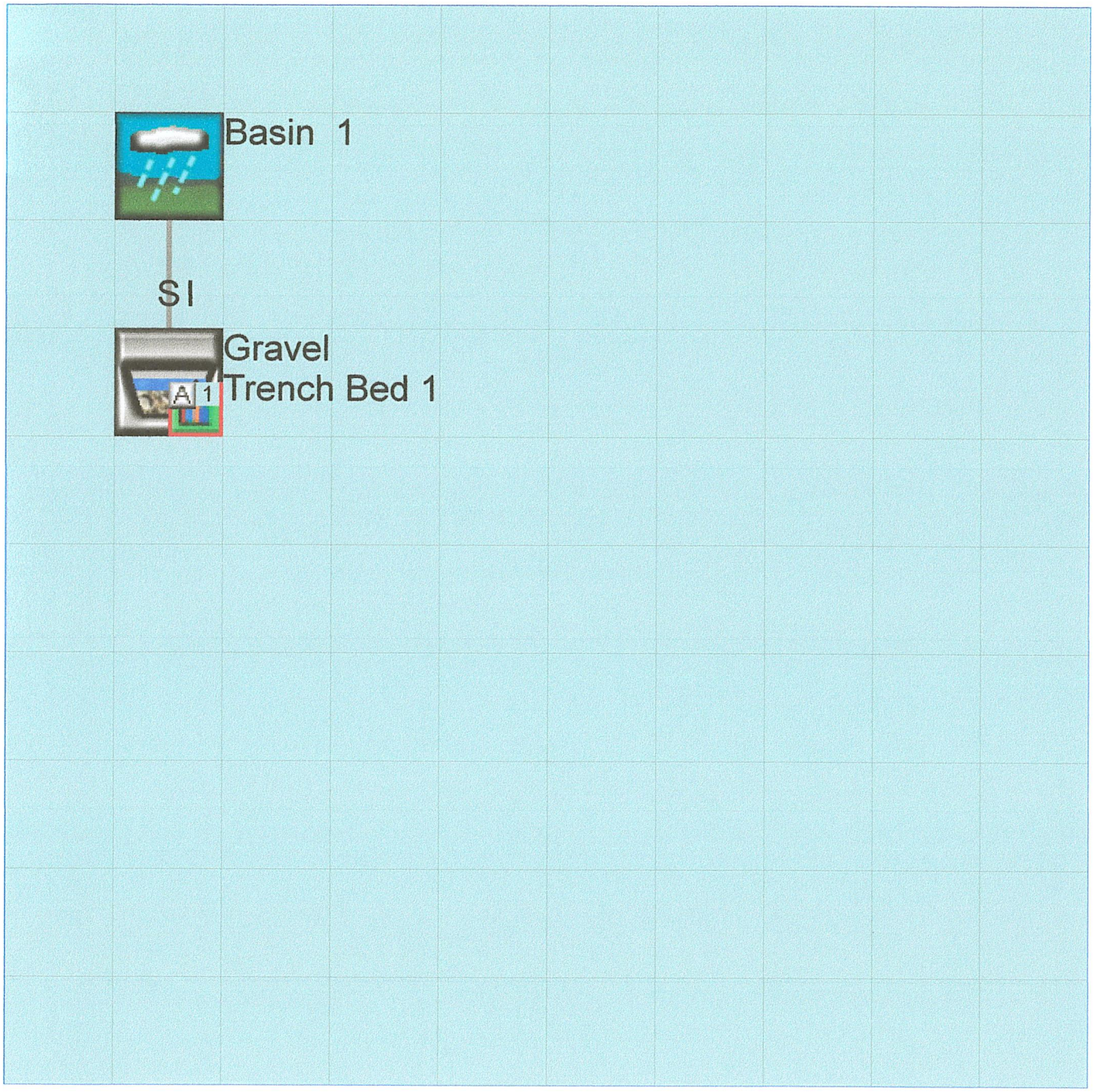
IMPLND Changes

No IMPLND changes have been made.

Appendix
Predeveloped Schematic

Basin 1
0.68ac

Mitigated Schematic



Predeveloped UCI File

Predeveloped HSPF Message File

Mitigated HSPF Message File

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WWHM2012

PROJECT REPORT

SITE CALCULATIONS

General Model Information

Project Name:	22-08-30-SITE CALCS-220638
Site Name:	GHAG
Site Address:	6506 ARMAR RD
City:	MARYSVILLE
Report Date:	8/30/2022
Gage:	Everett
Data Start:	1948/10/01
Data End:	2009/09/30
Timestep:	15 Minute
Precip Scale:	1.000
Version Date:	2017/07/05
Version:	4.2.13

POC Thresholds

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

Landuse Basin Data

Predeveloped Land Use

Basin 1

Bypass:	No
GroundWater:	No

Pervious Land Use	acre
A B, Forest, Flat	0.61
A B, Lawn, Flat	0.252
Pervious Total	0.862

Impervious Land Use	acre
ROADS FLAT	0.023
Impervious Total	0.023
Basin Total	0.885

Element Flows To:

Surface	Interflow	Groundwater

Mitigated Land Use

Basin 1

Bypass:	No
GroundWater:	No

Pervious Land Use	acre
A B, Lawn, Flat	0.237
A B, Forest, Flat	0.61
Pervious Total	0.847

Impervious Land Use	acre
SIDEWALKS FLAT	0.038
Impervious Total	0.038
Basin Total	0.885

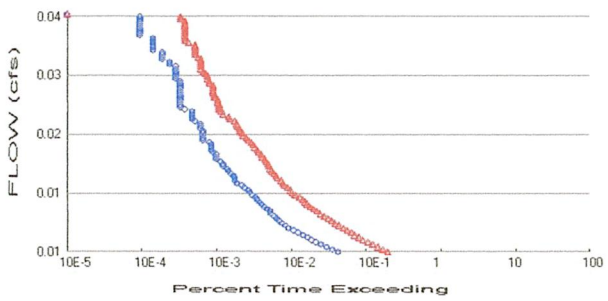
Element Flows To:

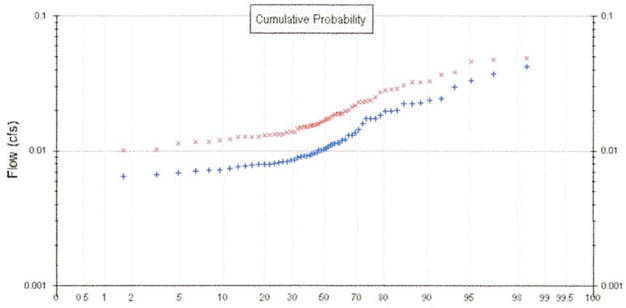
Surface	Interflow	Groundwater

Routing Elements
Predeveloped Routing

Mitigated Routing

Analysis Results
POC 1





\+ Predeveloped x Mitigated

Predeveloped Landuse Totals for POC #1
Total Pervious Area: 0.862
Total Impervious Area: 0.023

Mitigated Landuse Totals for POC #1
Total Pervious Area: 0.847
Total Impervious Area: 0.038

Flow Frequency Method: Log Pearson Type III 17B

Flow Frequency Return Periods for Predeveloped. POC #1

Return Period	Flow(cfs)
2 year	0.011243
5 year	0.017202
10 year	0.022094
25 year	0.029491
50 year	0.035979
100 year	0.043388

Flow Frequency Return Periods for Mitigated. POC #1

Return Period	Flow(cfs)
2 year	0.017667
5 year	0.025376
10 year	0.031279
25 year	0.039705
50 year	0.046723
100 year	0.054409

Annual Peaks

Annual Peaks for Predeveloped and Mitigated. POC #1

Year	Predeveloped	Mitigated
1949	0.010	0.017
1950	0.012	0.020
1951	0.011	0.019
1952	0.010	0.016
1953	0.012	0.020
1954	0.037	0.046
1955	0.024	0.030
1956	0.007	0.009
1957	0.010	0.016
1958	0.022	0.037

1959	0.009	0.015
1960	0.009	0.014
1961	0.030	0.049
1962	0.011	0.018
1963	0.014	0.022
1964	0.013	0.017
1965	0.008	0.013
1966	0.008	0.014
1967	0.020	0.032
1968	0.011	0.017
1969	0.020	0.033
1970	0.008	0.013
1971	0.018	0.023
1972	0.014	0.023
1973	0.011	0.019
1974	0.016	0.023
1975	0.011	0.018
1976	0.008	0.013
1977	0.008	0.013
1978	0.006	0.010
1979	0.017	0.025
1980	0.008	0.013
1981	0.008	0.013
1982	0.008	0.013
1983	0.010	0.017
1984	0.010	0.016
1985	0.017	0.023
1986	0.024	0.028
1987	0.011	0.019
1988	0.009	0.015
1989	0.010	0.016
1990	0.007	0.012
1991	0.009	0.016
1992	0.009	0.015
1993	0.007	0.012
1994	0.008	0.013
1995	0.007	0.012
1996	0.023	0.027
1997	0.042	0.047
1998	0.013	0.021
1999	0.007	0.010
2000	0.020	0.032
2001	0.007	0.012
2002	0.007	0.011
2003	0.009	0.015
2004	0.017	0.029
2005	0.008	0.014
2006	0.033	0.038
2007	0.022	0.028
2008	0.008	0.013
2009	0.008	0.014

Ranked Annual Peaks

Ranked Annual Peaks for Predeveloped and Mitigated. POC #1

Rank	Predeveloped	Mitigated
1	0.0421	0.0485
2	0.0373	0.0475
3	0.0332	0.0457

4	0.0298	0.0380
5	0.0243	0.0368
6	0.0237	0.0326
7	0.0226	0.0325
8	0.0225	0.0324
9	0.0223	0.0305
10	0.0199	0.0286
11	0.0197	0.0285
12	0.0197	0.0278
13	0.0183	0.0272
14	0.0174	0.0248
15	0.0172	0.0235
16	0.0172	0.0234
17	0.0159	0.0231
18	0.0143	0.0230
19	0.0136	0.0218
20	0.0131	0.0211
21	0.0130	0.0199
22	0.0121	0.0195
23	0.0119	0.0189
24	0.0115	0.0189
25	0.0114	0.0188
26	0.0114	0.0184
27	0.0112	0.0180
28	0.0109	0.0175
29	0.0107	0.0172
30	0.0104	0.0171
31	0.0102	0.0165
32	0.0101	0.0163
33	0.0100	0.0159
34	0.0096	0.0157
35	0.0095	0.0155
36	0.0094	0.0155
37	0.0092	0.0152
38	0.0092	0.0151
39	0.0091	0.0151
40	0.0090	0.0148
41	0.0089	0.0145
42	0.0085	0.0138
43	0.0085	0.0137
44	0.0083	0.0136
45	0.0082	0.0133
46	0.0081	0.0132
47	0.0080	0.0131
48	0.0079	0.0130
49	0.0079	0.0129
50	0.0079	0.0127
51	0.0078	0.0127
52	0.0077	0.0127
53	0.0076	0.0126
54	0.0074	0.0121
55	0.0072	0.0119
56	0.0072	0.0117
57	0.0071	0.0117
58	0.0069	0.0113
59	0.0067	0.0103
60	0.0065	0.0101
61	0.0064	0.0095

Duration Flows

Flow(cfs)	Predev	Mit	Percentage	Pass/Fail
0.0056	889	4100	461	Fail
0.0059	750	3533	471	Fail
0.0062	631	3046	482	Fail
0.0065	533	2612	490	Fail
0.0068	453	2257	498	Fail
0.0072	397	1939	488	Fail
0.0075	349	1702	487	Fail
0.0078	305	1501	492	Fail
0.0081	260	1345	517	Fail
0.0084	230	1193	518	Fail
0.0087	195	1042	534	Fail
0.0090	177	909	513	Fail
0.0093	161	813	504	Fail
0.0096	146	733	502	Fail
0.0099	137	658	480	Fail
0.0102	127	582	458	Fail
0.0105	115	519	451	Fail
0.0108	112	470	419	Fail
0.0111	101	424	419	Fail
0.0114	93	382	410	Fail
0.0118	87	350	402	Fail
0.0121	80	322	402	Fail
0.0124	74	301	406	Fail
0.0127	70	274	391	Fail
0.0130	64	240	375	Fail
0.0133	59	220	372	Fail
0.0136	57	208	364	Fail
0.0139	50	191	382	Fail
0.0142	47	171	363	Fail
0.0145	40	166	415	Fail
0.0148	37	156	421	Fail
0.0151	37	139	375	Fail
0.0154	36	135	375	Fail
0.0157	33	126	381	Fail
0.0160	31	118	380	Fail
0.0164	30	112	373	Fail
0.0167	26	109	419	Fail
0.0170	26	105	403	Fail
0.0173	24	99	412	Fail
0.0176	21	96	457	Fail
0.0179	21	88	419	Fail
0.0182	21	84	400	Fail
0.0185	19	78	410	Fail
0.0188	18	75	416	Fail
0.0191	18	69	383	Fail
0.0194	18	65	361	Fail
0.0197	17	62	364	Fail
0.0200	14	57	407	Fail
0.0203	14	53	378	Fail
0.0206	14	48	342	Fail
0.0210	14	47	335	Fail
0.0213	14	44	314	Fail
0.0216	13	43	330	Fail
0.0219	13	41	315	Fail

0.0222	13	40	307	Fail
0.0225	11	37	336	Fail
0.0228	10	32	320	Fail
0.0231	10	31	310	Fail
0.0234	10	26	260	Fail
0.0237	10	24	240	Fail
0.0240	8	23	287	Fail
0.0243	7	23	328	Fail
0.0246	7	23	328	Fail
0.0249	7	22	314	Fail
0.0252	7	22	314	Fail
0.0256	7	20	285	Fail
0.0259	7	20	285	Fail
0.0262	7	19	271	Fail
0.0265	7	19	271	Fail
0.0268	7	19	271	Fail
0.0271	7	19	271	Fail
0.0274	7	17	242	Fail
0.0277	7	17	242	Fail
0.0280	6	16	266	Fail
0.0283	6	16	266	Fail
0.0286	6	15	250	Fail
0.0289	6	14	233	Fail
0.0292	6	13	216	Fail
0.0295	6	13	216	Fail
0.0298	5	13	260	Fail
0.0302	5	13	260	Fail
0.0305	4	13	325	Fail
0.0308	4	12	300	Fail
0.0311	4	11	275	Fail
0.0314	4	11	275	Fail
0.0317	3	11	366	Fail
0.0320	3	11	366	Fail
0.0323	3	11	366	Fail
0.0326	3	9	300	Fail
0.0329	3	8	266	Fail
0.0332	3	8	266	Fail
0.0335	2	8	400	Fail
0.0338	2	8	400	Fail
0.0341	2	8	400	Fail
0.0344	2	8	400	Fail
0.0348	2	8	400	Fail
0.0351	2	8	400	Fail
0.0354	2	8	400	Fail
0.0357	2	7	350	Fail
0.0360	2	7	350	Fail

The development has an increase in flow durations from 1/2 Predeveloped 2 year flow to the 2 year flow or more than a 10% increase from the 2 year to the 50 year flow.
The development has an increase in flow durations for more than 50% of the flows for the range of the duration analysis.

Water Quality

Water Quality BMP Flow and Volume for POC #1

On-line facility volume:	0 acre-feet
On-line facility target flow:	0 cfs.
Adjusted for 15 min:	0 cfs.
Off-line facility target flow:	0 cfs.
Adjusted for 15 min:	0 cfs.

LID Report

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

Model Default Modifications

Total of 0 changes have been made.

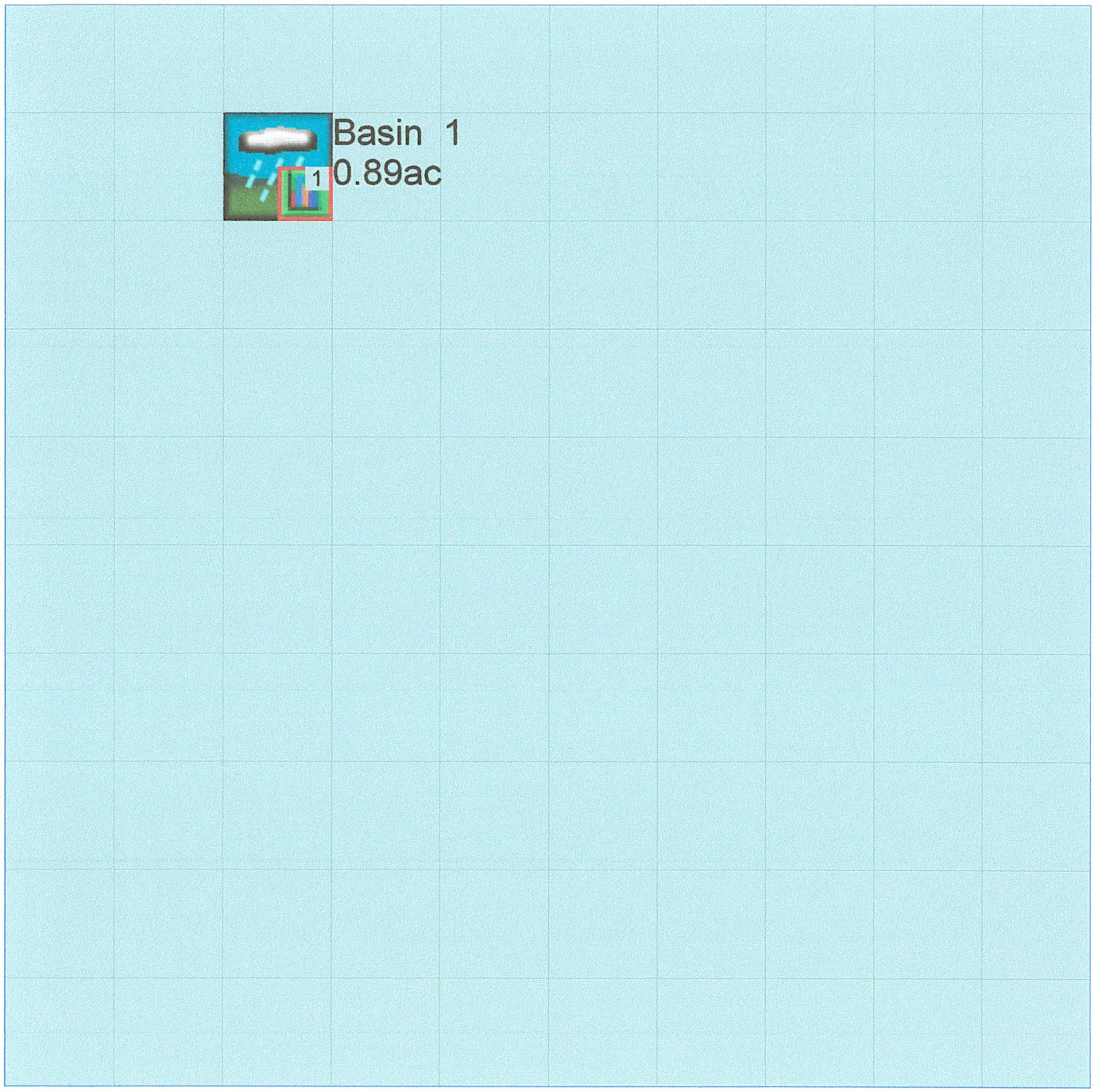
PERLND Changes

No PERLND changes have been made.

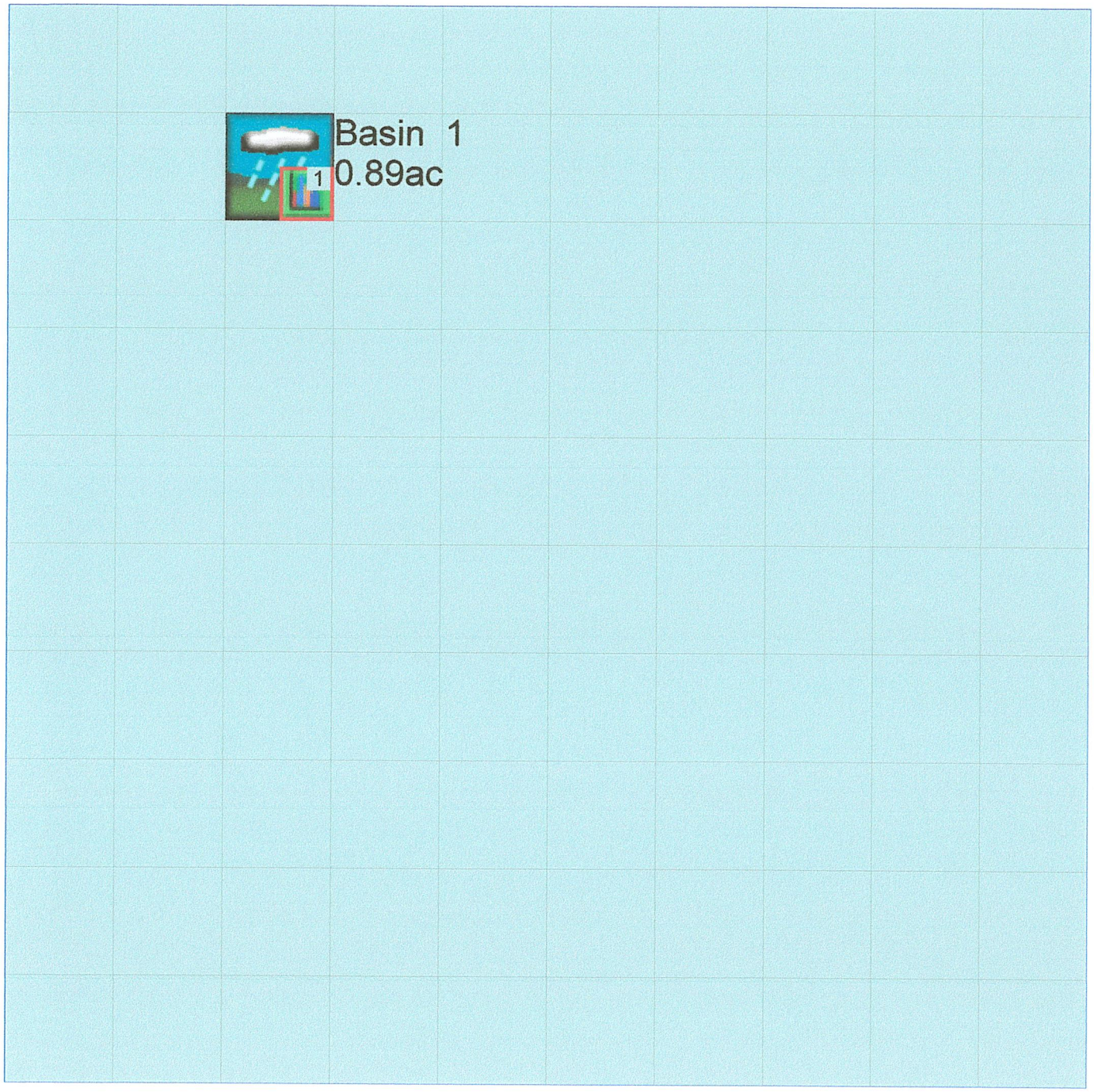
IMPLND Changes

No IMPLND changes have been made.

Appendix
Predeveloped Schematic



Mitigated Schematic



Predeveloped UCI File

```
RUN

GLOBAL
  WWHM4 model simulation
  START       1948 10 01         END    2009 09 30
  RUN INTERP OUTPUT LEVEL    3    0
  RESUME     0 RUN     1                     UNIT SYSTEM     1
END GLOBAL

FILES
<File>  <Un#>   <-----------File Name------------------------------>***
<-ID->                                                              ***
WDM         26   22-08-30-SITE CALCS-220638.wdm
MESSU       25   Pre22-08-30-SITE CALCS-220638.MES
            27   Pre22-08-30-SITE CALCS-220638.L61
            28   Pre22-08-30-SITE CALCS-220638.L62
            30   POC22-08-30-SITE CALCS-2206381.dat
END FILES

OPN SEQUENCE
    INGRP               INDELT 00:15
      PERLND        1
      PERLND        7
      IMPLND        1
      COPY        501
      DISPLY        1
    END INGRP
END OPN SEQUENCE
DISPLY
  DISPLY-INFO1
    # -  #<----------Title----------->***TRAN PIVL DIG1 FIL1  PYR DIG2 FIL2 YRND
    1        Basin  1                   MAX                   1    2   30    9
  END DISPLY-INFO1
END DISPLY
COPY
  TIMESERIES
    # -  #  NPT  NMN ***
    1         1    1
  501         1    1
  END TIMESERIES
END COPY
GENER
  OPCODE
    #    # OPCD ***
  END OPCODE
  PARM
    #    #         K ***
  END PARM
END GENER
PERLND
  GEN-INFO
    <PLS ><-------Name------->NBLKS   Unit-systems   Printer ***
    # -  #                          User  t-series Engl Metr ***
                                          in  out           ***
    1     A/B, Forest, Flat       1    1    1    1   27    0
    7     A/B, Lawn, Flat         1    1    1    1   27    0
  END GEN-INFO
  *** Section PWATER***

  ACTIVITY
    <PLS > ************ Active Sections ******************************
    # -  # ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC ***
    1         0    0    1    0    0    0    0    0    0    0    0    0
    7         0    0    1    0    0    0    0    0    0    0    0    0
  END ACTIVITY

  PRINT-INFO
    <PLS > ***************** Print-flags **************************** PIVL  PYR
```

```
    # -  # ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC  *********
    1         0    0    4    0    0    0    0    0    0    0    0    0    1    9
    7         0    0    4    0    0    0    0    0    0    0    0    0    1    9
  END PRINT-INFO

  PWAT-PARM1
    <PLS >  PWATER variable monthly parameter value flags  ***
    # -  # CSNO RTOP UZFG  VCS  VUZ  VNN VIFW VIRC  VLE INFC  HWT ***
    1         0    0    0    0    0    0    0    0    0    0    0
    7         0    0    0    0    0    0    0    0    0    0    0
  END PWAT-PARM1

  PWAT-PARM2
    <PLS >      PWATER input info: Part 2         ***
    # -  # ***FOREST      LZSN    INFILT      LSUR     SLSUR      KVARY      AGWRC
    1              0         5         2       400      0.05        0.3      0.996
    7              0         5       0.8       400      0.05        0.3      0.996
  END PWAT-PARM2

  PWAT-PARM3
    <PLS >      PWATER input info: Part 3         ***
    # -  # ***PETMAX    PETMIN    INFEXP    INFILD    DEEPFR    BASETP    AGWETP
    1              0         0         2         2         0         0         0
    7              0         0         2         2         0         0         0
  END PWAT-PARM3
  PWAT-PARM4
    <PLS >     PWATER input info: Part 4                              ***
    # -  #     CEPSC      UZSN      NSUR     INTFW       IRC     LZETP ***
    1          0.2       0.5      0.35         0       0.7       0.7
    7          0.1       0.5      0.25         0       0.7      0.25
  END PWAT-PARM4

  PWAT-STATE1
    <PLS > *** Initial conditions at start of simulation
               ran from 1990 to end of 1992 (pat 1-11-95) RUN 21 ***
    # -  # ***  CEPS      SURS       UZS      IFWS       LZS      AGWS      GWVS
    1              0         0         0         0         3         1         0
    7              0         0         0         0         3         1         0
  END PWAT-STATE1

END PERLND

IMPLND
  GEN-INFO
    <PLS ><-------Name------->   Unit-systems   Printer ***
    # -  #                     User  t-series Engl Metr ***
                                     in  out           ***
    1      ROADS/FLAT              1    1    1   27    0
  END GEN-INFO
  *** Section IWATER***

  ACTIVITY
    <PLS > ************ Active Sections ******************************
    # -  # ATMP SNOW IWAT  SLD  IWG IQAL   ***
    1         0    0    1    0    0    0
  END ACTIVITY

  PRINT-INFO
    <ILS > ******** Print-flags ******** PIVL  PYR
    # -  # ATMP SNOW IWAT  SLD  IWG IQAL    *********
    1         0    0    4    0    0    0    1    9
  END PRINT-INFO

  IWAT-PARM1
    <PLS >  IWATER variable monthly parameter value flags  ***
    # -  # CSNO RTOP  VRS  VNN RTLI     ***
    1         0    0    0    0    0
  END IWAT-PARM1

  IWAT-PARM2
```

```
    <PLS >       IWATER input info: Part 2         ***
    # -  # ***  LSUR     SLSUR      NSUR     RETSC
    1            400      0.01       0.1       0.1
  END IWAT-PARM2

  IWAT-PARM3
    <PLS >       IWATER input info: Part 3         ***
    # -  # ***PETMAX    PETMIN
    1              0         0
  END IWAT-PARM3

  IWAT-STATE1
    <PLS > *** Initial conditions at start of simulation
    # -  # ***  RETS      SURS
    1              0         0
  END IWAT-STATE1

END IMPLND

SCHEMATIC
<-Source->                  <--Area-->     <-Target->   MBLK   ***
<Name>   #                  <-factor->     <Name>   #   Tbl#   ***
Basin  1***
PERLND   1                       0.61     COPY   501     12
PERLND   1                       0.61     COPY   501     13
PERLND   7                      0.252     COPY   501     12
PERLND   7                      0.252     COPY   501     13
IMPLND   1                      0.023     COPY   501     15

******Routing******
END SCHEMATIC

NETWORK
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   #        <Name> # #<-factor->strg <Name>   #   #        <Name> # #  ***
COPY   501 OUTPUT MEAN   1 1   48.4        DISPLY   1     INPUT  TIMSER 1



<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   #        <Name> # #<-factor->strg <Name>   #   #        <Name> # #  ***
END NETWORK

RCHRES
  GEN-INFO
    RCHRES       Name        Nexits   Unit Systems   Printer                ***
    # -  #<------------------><---> User T-series  Engl Metr LKFG           ***
                                      in  out                               ***
  END GEN-INFO
  *** Section RCHRES***

  ACTIVITY
    <PLS > ************ Active Sections ****************************
    # -  # HYFG ADFG CNFG HTFG SDFG GQFG OXFG NUFG PKFG PHFG ***
  END ACTIVITY

  PRINT-INFO
    <PLS > ***************** Print-flags ****************** PIVL  PYR
    # -  # HYDR ADCA CONS HEAT  SED  GQL OXRX NUTR PLNK PHCB PIVL  PYR  *********
  END PRINT-INFO

  HYDR-PARM1
    RCHRES  Flags for each HYDR Section                                  ***
    # -  #  VC A1 A2 A3  ODFVFG for each *** ODGTFG for each     FUNCT  for each
            FG FG FG FG  possible  exit  *** possible  exit      possible  exit
             *  *  *  *    *  *  *  *  *       *  *  *  *  *         ***
  END HYDR-PARM1

  HYDR-PARM2
    # -  #    FTABNO       LEN     DELTH     STCOR        KS      DB50       ***
```

```
  <------><--------><--------><--------><--------><--------><-------->       ***
  END HYDR-PARM2
  HYDR-INIT
    RCHRES  Initial conditions for each HYDR section                          ***
    # -  # ***   VOL     Initial  value  of COLIND     Initial  value  of OUTDGT
         *** ac-ft     for each possible exit        for each possible exit
  <------><-------->     <---><---><---><---><---> *** <---><---><---><---><--->
  END HYDR-INIT
END RCHRES

SPEC-ACTIONS
END SPEC-ACTIONS
FTABLES
END FTABLES

EXT SOURCES
<-Volume-> <Member> SsysSgap<--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   # <Name> # tem strg<-factor->strg <Name>   #   #        <Name> # #  ***
WDM      2 PREC     ENGL    1              PERLND   1 999 EXTNL  PREC
WDM      2 PREC     ENGL    1              IMPLND   1 999 EXTNL  PREC
WDM      1 EVAP     ENGL    0.76           PERLND   1 999 EXTNL  PETINP
WDM      1 EVAP     ENGL    0.76           IMPLND   1 999 EXTNL  PETINP

END EXT SOURCES

EXT TARGETS
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Volume-> <Member> Tsys Tgap Amd ***
<Name>   #        <Name> # #<-factor->strg <Name>   # <Name>    tem strg strg***
COPY   501 OUTPUT MEAN   1 1     48.4      WDM    501 FLOW     ENGL      REPL
END EXT TARGETS

MASS-LINK
<Volume>   <-Grp> <-Member-><--Mult-->     <Target>       <-Grp> <-Member->***
<Name>            <Name> # #<-factor->     <Name>                <Name> # #***
  MASS-LINK       12
PERLND     PWATER SURO       0.083333      COPY           INPUT  MEAN
  END MASS-LINK   12

  MASS-LINK       13
PERLND     PWATER IFWO       0.083333      COPY           INPUT  MEAN
  END MASS-LINK   13

  MASS-LINK       15
IMPLND     IWATER SURO       0.083333      COPY           INPUT  MEAN
  END MASS-LINK   15


END MASS-LINK

END RUN
```

Mitigated UCI File

```
RUN

GLOBAL
  WWHM4 model simulation
  START       1948 10 01         END    2009 09 30
  RUN INTERP OUTPUT LEVEL    3    0
  RESUME     0 RUN     1                    UNIT SYSTEM     1
END GLOBAL

FILES
<File>  <Un#>   <-----------File Name------------------------------>***
<-ID->                                                              ***
WDM         26   22-08-30-SITE CALCS-220638.wdm
MESSU       25   Mit22-08-30-SITE CALCS-220638.MES
            27   Mit22-08-30-SITE CALCS-220638.L61
            28   Mit22-08-30-SITE CALCS-220638.L62
            30   POC22-08-30-SITE CALCS-2206381.dat
END FILES

OPN SEQUENCE
    INGRP               INDELT 00:15
      PERLND        7
      PERLND        1
      IMPLND        8
      COPY        501
      DISPLY        1
    END INGRP
END OPN SEQUENCE
DISPLY
  DISPLY-INFO1
    # -  #<----------Title----------->***TRAN PIVL DIG1 FIL1  PYR DIG2 FIL2 YRND
    1        Basin  1                   MAX                    1    2   30    9
  END DISPLY-INFO1
END DISPLY
COPY
  TIMESERIES
    # -  #  NPT  NMN ***
    1         1    1
  501         1    1
  END TIMESERIES
END COPY
GENER
  OPCODE
    #    # OPCD ***
  END OPCODE
  PARM
    #    #         K ***
  END PARM
END GENER
PERLND
  GEN-INFO
    <PLS ><-------Name------->NBLKS   Unit-systems   Printer ***
    # -  #                          User  t-series Engl Metr ***
                                          in  out           ***
    7     A/B, Lawn, Flat          1    1    1    1   27    0
    1     A/B, Forest, Flat        1    1    1    1   27    0
  END GEN-INFO
  *** Section PWATER***

  ACTIVITY
    <PLS > ************ Active Sections ******************************
    # -  # ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC ***
    7         0    0    1    0    0    0    0    0    0    0    0    0
    1         0    0    1    0    0    0    0    0    0    0    0    0
  END ACTIVITY

  PRINT-INFO
    <PLS > ***************** Print-flags **************************** PIVL  PYR
```

```
    # -  # ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC  *********
    7         0    0    4    0    0    0    0    0    0    0    0    0    1    9
    1         0    0    4    0    0    0    0    0    0    0    0    0    1    9
  END PRINT-INFO

  PWAT-PARM1
    <PLS >  PWATER variable monthly parameter value flags  ***
    # -  # CSNO RTOP UZFG  VCS  VUZ  VNN VIFW VIRC  VLE INFC  HWT ***
    7         0    0    0    0    0    0    0    0    0    0    0
    1         0    0    0    0    0    0    0    0    0    0    0
  END PWAT-PARM1

  PWAT-PARM2
    <PLS >      PWATER input info: Part 2         ***
    # -  # ***FOREST      LZSN    INFILT      LSUR     SLSUR     KVARY     AGWRC
    7              0         5       0.8       400      0.05       0.3     0.996
    1              0         5         2       400      0.05       0.3     0.996
  END PWAT-PARM2

  PWAT-PARM3
    <PLS >      PWATER input info: Part 3         ***
    # -  # ***PETMAX    PETMIN    INFEXP    INFILD    DEEPFR    BASETP    AGWETP
    7              0         0         2         2         0         0         0
    1              0         0         2         2         0         0         0
  END PWAT-PARM3
  PWAT-PARM4
    <PLS >     PWATER input info: Part 4                              ***
    # -  #     CEPSC      UZSN      NSUR     INTFW       IRC     LZETP ***
    7          0.1       0.5      0.25         0       0.7      0.25
    1          0.2       0.5      0.35         0       0.7       0.7
  END PWAT-PARM4

  PWAT-STATE1
    <PLS > *** Initial conditions at start of simulation
               ran from 1990 to end of 1992 (pat 1-11-95) RUN 21 ***
    # -  # ***  CEPS      SURS       UZS      IFWS       LZS      AGWS      GWVS
    7              0         0         0         0         3         1         0
    1              0         0         0         0         3         1         0
  END PWAT-STATE1

END PERLND

IMPLND
  GEN-INFO
    <PLS ><-------Name------->   Unit-systems   Printer ***
    # -  #                     User  t-series Engl Metr ***
                                     in  out           ***
    8      SIDEWALKS/FLAT         1    1    1   27    0
  END GEN-INFO
  *** Section IWATER***

  ACTIVITY
    <PLS > ************* Active Sections ******************************
    # -  # ATMP SNOW IWAT  SLD  IWG IQAL   ***
    8         0    0    1    0    0    0
  END ACTIVITY

  PRINT-INFO
    <ILS > ******** Print-flags ******** PIVL  PYR
    # -  # ATMP SNOW IWAT  SLD  IWG IQAL    *********
    8         0    0    4    0    0    0    1    9
  END PRINT-INFO

  IWAT-PARM1
    <PLS >  IWATER variable monthly parameter value flags  ***
    # -  # CSNO RTOP  VRS  VNN RTLI     ***
    8         0    0    0    0    0
  END IWAT-PARM1

  IWAT-PARM2
```

```
    <PLS >       IWATER input info: Part 2         ***
    # -  # ***  LSUR     SLSUR      NSUR     RETSC
    8            400      0.01       0.1       0.1
  END IWAT-PARM2

  IWAT-PARM3
    <PLS >       IWATER input info: Part 3         ***
    # -  # ***PETMAX    PETMIN
    8              0         0
  END IWAT-PARM3

  IWAT-STATE1
    <PLS > *** Initial conditions at start of simulation
    # -  # ***  RETS      SURS
    8              0         0
  END IWAT-STATE1

END IMPLND

SCHEMATIC
<-Source->                  <--Area-->     <-Target->   MBLK   ***
<Name>   #                  <-factor->     <Name>   #   Tbl#   ***
Basin  1***
PERLND   7                       0.237     COPY   501     12
PERLND   7                       0.237     COPY   501     13
PERLND   1                        0.61     COPY   501     12
PERLND   1                        0.61     COPY   501     13
IMPLND   8                       0.038     COPY   501     15

******Routing******
END SCHEMATIC

NETWORK
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   #        <Name> # #<-factor->strg <Name>   #   #        <Name> # #  ***
COPY   501 OUTPUT MEAN   1 1   48.4        DISPLY   1     INPUT  TIMSER 1



<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   #        <Name> # #<-factor->strg <Name>   #   #        <Name> # #  ***
END NETWORK

RCHRES
  GEN-INFO
    RCHRES       Name        Nexits   Unit Systems   Printer                ***
    # -  #<------------------><---> User T-series  Engl Metr LKFG           ***
                                      in  out                               ***
  END GEN-INFO
  *** Section RCHRES***

  ACTIVITY
    <PLS > ************ Active Sections ****************************
    # -  # HYFG ADFG CNFG HTFG SDFG GQFG OXFG NUFG PKFG PHFG ***
  END ACTIVITY

  PRINT-INFO
    <PLS > ***************** Print-flags ****************** PIVL  PYR
    # -  # HYDR ADCA CONS HEAT  SED  GQL OXRX NUTR PLNK PHCB PIVL  PYR  *********
  END PRINT-INFO

  HYDR-PARM1
    RCHRES  Flags for each HYDR Section                                  ***
    # -  #  VC A1 A2 A3  ODFVFG for each *** ODGTFG for each     FUNCT  for each
            FG FG FG FG  possible  exit  *** possible  exit      possible  exit
             *  *  *  *    *  *  *  *  *       *  *  *  *  *         ***
  END HYDR-PARM1

  HYDR-PARM2
    # -  #    FTABNO       LEN     DELTH     STCOR        KS      DB50       ***
```

```
  <------><--------><--------><--------><--------><--------><-------->       ***
  END HYDR-PARM2
  HYDR-INIT
    RCHRES  Initial conditions for each HYDR section                          ***
    # -  # ***   VOL     Initial  value  of COLIND     Initial  value  of OUTDGT
         *** ac-ft     for each possible exit        for each possible exit
  <------><-------->     <---><---><---><---><---> *** <---><---><---><---><---->
  END HYDR-INIT
END RCHRES

SPEC-ACTIONS
END SPEC-ACTIONS
FTABLES
END FTABLES

EXT SOURCES
<-Volume-> <Member> SsysSgap<--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   # <Name> # tem strg<-factor->strg <Name>   #   #        <Name> # #  ***
WDM      2 PREC     ENGL    1              PERLND   1 999 EXTNL  PREC
WDM      2 PREC     ENGL    1              IMPLND   1 999 EXTNL  PREC
WDM      1 EVAP     ENGL    0.76           PERLND   1 999 EXTNL  PETINP
WDM      1 EVAP     ENGL    0.76           IMPLND   1 999 EXTNL  PETINP

END EXT SOURCES

EXT TARGETS
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Volume-> <Member> Tsys Tgap Amd ***
<Name>   #        <Name> # #<-factor->strg <Name>   # <Name>    tem strg strg***
COPY     1 OUTPUT MEAN   1 1     48.4      WDM    701 FLOW     ENGL      REPL
COPY   501 OUTPUT MEAN   1 1     48.4      WDM    801 FLOW     ENGL      REPL
END EXT TARGETS

MASS-LINK
<Volume>    <-Grp> <-Member-><--Mult-->     <Target>       <-Grp> <-Member->***
<Name>             <Name> # #<-factor->     <Name>                <Name> # #***
  MASS-LINK       12
PERLND     PWATER SURO       0.083333      COPY           INPUT  MEAN
  END MASS-LINK   12

  MASS-LINK       13
PERLND     PWATER IFWO       0.083333      COPY           INPUT  MEAN
  END MASS-LINK   13

  MASS-LINK       15
IMPLND     IWATER SURO       0.083333      COPY           INPUT  MEAN
  END MASS-LINK   15


END MASS-LINK

END RUN
```

Predeveloped HSPF Message File

Mitigated HSPF Message File

Disclaimer

Legal Notice

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SECTION IV

OPERATION AND MAINTENANCE STANDARDS

Maintenance and operation of storm water facilities is the responsibility of the property owner in compliance with the maintenance standards. A copy of the Maintenance and Operation Manual, submitted as part of the permit application, shall be retained on-site and shall be transferred with the property to the new property owners.

Maintenance of stormwater facilities is the single most important factor in ensuring satisfactory long term performance of the system. It follows that the lack of proper maintenance is the single most important factor which causes unsatisfactory performance and in some cases system failure. It is therefore essential that regular maintenance and cleaning of the system be an integral part of site operations. The following maintenance tables are provided as a guide to the person in charge of maintenance as to how often maintenance is required, what to look for, expected results, etc. A good maintenance program will prolong the useful life of the system and reduce the likelihood of problems occurring as the system ages.

MAINTENANCE TABLES

#	SUBJECT
2	Infiltration
5	Catch Basins

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

Maintenance Component	Defect	Conditions When Maintenance is Needed	Results Expected When Maintenance is performed
General	Trash & Debris	Trash or debris which is located immediately in front of the catch basin opening or is blocking inletting capacity of the basin by more than 10%. Trash or debris (in the basin) that exceeds 60 percent of the sump depth as measured from the bottom of basin to invert of the lowest pipe into or out of the basin, but in no case less than a minimum of six inches clearance from the debris surface to the invert of the lowest pipe. Trash or debris in any inlet or outlet pipe blocking more than 1/3 of its height. Dead animals or vegetation that could generate odors that could cause complaints or dangerous gases (e.g., methane).	No Trash or debris located immediately in front of catch basin or on grate opening. No trash or debris in the catch basin. Inlet and outlet pipes free of trash or debris. No dead animals or vegetation present within the catch basin.
	Sediment	Sediment (in the basin) that exceeds 60 percent of the sump depth as measured from the bottom of basin to invert of the lowest pipe into or out of the basin, but in no case less than a minimum of 6 inches clearance from the sediment surface to the invert of the lowest pipe.	No sediment in the catch basin
	Structure Damage to Frame and/or Top Slab	Top slab has holes larger than 2 square inches or cracks wider than 1/4 inch. (Intent is to make sure no material is running into basin). Frame not sitting flush on top slab, i.e., separation of more than 3/4 inch of the frame from the top slab. Frame not securely attached	Top slab is free of holes and cracks. Frame is sitting flush on the riser rings or top slab and firmly attached.
	Fractures or Cracks in Basin Walls/ Bottom	Maintenance person judges that structure is unsound. Grout fillet has separated or cracked wider than 1/2 inch and longer than 1 foot at the joint of any inlet/outlet pipe or any evidence of soil particles entering catch basin through cracks.	Basin replaced or repaired to design standards. Pipe is regrouted and secure at basin wall.
	Settlement/ Misalignment	If failure of basin has created a safety, function, or design problem.	Basin replaced or repaired to design standards.

Maintenance Component	Defect	Conditions When Maintenance is Needed	Results Expected When Maintenance is performed
	Vegetation	Vegetation growing across and blocking more than 10% of the basin opening. Vegetation growing in inlet/outlet pipe joints that is more than six inches tall and less than six inches apart.	No vegetation blocking opening to basin. No vegetation or root growth present.
	Contamination and Pollution	See Table V-A.1: Maintenance Standards - Detention Ponds	No pollution present.
Catch Basin Cover	Cover Not in Place	Cover is missing or only partially in place. Any open catch basin requires maintenance.	Cover/grate is in place, meets design standards, and is secured
	Locking Mechanism Not Working	Mechanism cannot be opened by one maintenance person with proper tools. Bolts into frame have less than 1/2 inch of thread.	Mechanism opens with proper tools.
	Cover Difficult to Remove	One maintenance person cannot remove lid after applying normal lifting pressure. (Intent is keep cover from sealing off access to maintenance.)	Cover can be removed by one maintenance person.
Ladder	Ladder Rungs Unsafe	Ladder is unsafe due to missing rungs, not securely attached to basin wall, misalignment, rust, cracks, or sharp edges.	Ladder meets design standards and allows maintenance person safe access.
Metal Grates (If Applicable)	Grate opening Unsafe	Grate with opening wider than 7/8 inch.	Grate opening meets design standards.
	Trash and Debris	Trash and debris that is blocking more than 20% of grate surface inletting capacity.	Grate free of trash and debris.
	Damaged or Missing.	Grate missing or broken member(s) of the grate.	Grate is in place, meets the design standards, and is installed and aligned with the flow path.

Table V-A.2: Maintenance Standards - Infiltration

Maintenance Component	Defect	Conditions When Maintenance Is Needed	Results Expected When Maintenance Is Performed
General	Trash & Debris	See Table V-A.1: Maintenance Standards - Detention Ponds	See Table V-A.1: Maintenance Standards - Detention Ponds
	Poisonous/Noxious Vegetation	See Table V-A.1: Maintenance Standards - Detention Ponds	See Table V-A.1: Maintenance Standards - Detention Ponds
	Contaminants and Pollution	See Table V-A.1: Maintenance Standards - Detention Ponds	See Table V-A.1: Maintenance Standards - Detention Ponds
	Rodent Holes	See Table V-A.1: Maintenance Standards - Detention Ponds	See Table V-A.1: Maintenance Standards - Detention Ponds
Storage Area	Sediment	Water ponding in infiltration pond after rainfall ceases and appropriate time allowed for infiltration. Treatment basins should infiltrate Water Quality Design Storm Volume within 48 hours, and empty within 24 hours after cessation of most rain events. (A percolation test pit or test of facility indicates facility is only working at 90% of its designed capabilities. Test every 2 to 5 years. If two inches or more sediment is present, remove).	Sediment is removed and/or facility is cleaned so that infiltration system works according to design.
Filter Bags (if applicable)	Filled with Sediment and Debris	Sediment and debris fill bag more than 1/2 full.	Filter bag is replaced or system is redesigned.
Rock Filters	Sediment and Debris	By visual inspection, little or no water flows through filter during heavy rain storms.	Gravel in rock filter is replaced.
Side Slopes of Pond	Erosion	See Table V-A.1: Maintenance Standards - Detention Ponds	See Table V-A.1: Maintenance Standards - Detention Ponds
Emergency Overflow Spillway and Berms over 4 feet in height.	Tree Growth	See Table V-A.1: Maintenance Standards - Detention Ponds	See Table V-A.1: Maintenance Standards - Detention Ponds
	Piping	See Table V-A.1: Maintenance Standards - Detention Ponds	See Table V-A.1: Maintenance Standards - Detention Ponds

Maintenance Component	Defect	Conditions When Maintenance Is Needed	Results Expected When Maintenance Is Performed
Emergency Overflow Spillway	Rock Missing	See Table V-A.1: Maintenance Standards - Detention Ponds	See Table V-A.1: Maintenance Standards - Detention Ponds
	Erosion	See Table V-A.1: Maintenance Standards - Detention Ponds	See Table V-A.1: Maintenance Standards - Detention Ponds
Pre-settling Ponds and Vaults	Facility or sump filled with Sediment and/or debris	6" or designed sediment trap depth of sediment.	Sediment is removed.

SECTION V

United States Department of Agriculture

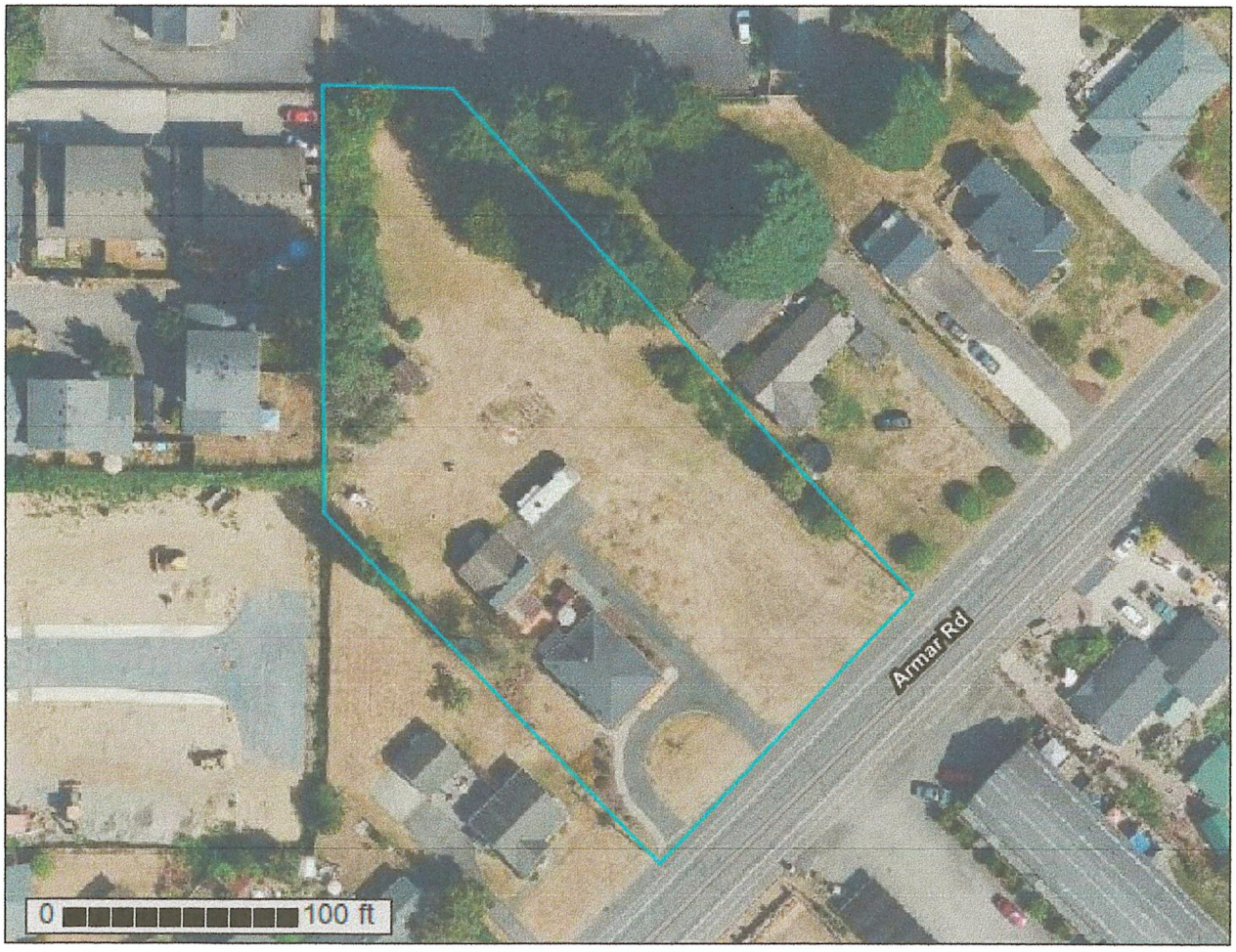
NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for Snohomish County Area, Washington

6506 ARMAR RD, MARYSVILLE



July 22, 2022

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (https://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

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Contents

How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil

scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

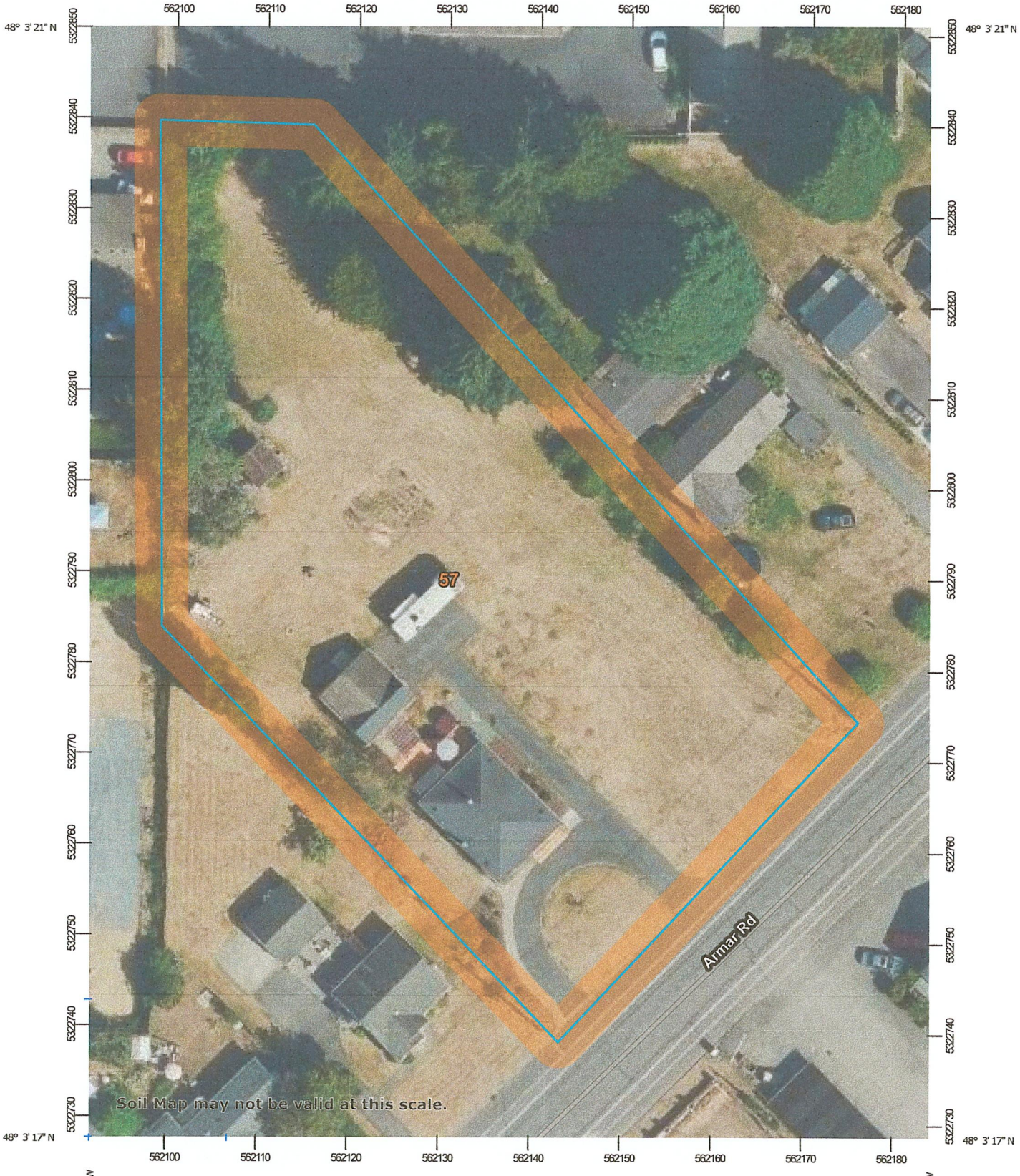
After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and

identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Custom Soil Resource Report
Soil Map



Map Scale: 1:596 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0 5 10 20 30

Feet: 0 25 50 100 150

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

MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features

- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features

- Streams and Canals

Transportation

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

Background

- Aerial Photography

MAP INFORMATION

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

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

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

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

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

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

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

Soil Survey Area: Snohomish County Area, Washington
Survey Area Data: Version 23, Aug 31, 2021

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

Date(s) aerial images were photographed: Aug 16, 2020—Aug 19, 2020

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

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
57	Ragnar fine sandy loam, 0 to 8 percent slopes	1.0	100.0%
Totals for Area of Interest		**1.0**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series.* Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases.* Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas.* Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Snohomish County Area, Washington

57—Ragnar fine sandy loam, 0 to 8 percent slopes

Map Unit Setting

National map unit symbol: 2hzk
Elevation: 300 to 1,000 feet
Mean annual precipitation: 35 to 65 inches
Mean annual air temperature: 50 to 54 degrees F
Frost-free period: 150 to 210 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Ragnar and similar soils: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Ragnar

Setting

Landform: Outwash plains
Parent material: Glacial outwash

Typical profile

H1 - 0 to 2 inches: ashy fine sandy loam
H2 - 2 to 24 inches: ashy sandy loam
H3 - 24 to 60 inches: loamy sand

Properties and qualities

Slope: 0 to 8 percent
Depth to restrictive feature: 20 to 40 inches to strongly contrasting textural stratification
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): High (1.98 to 5.95 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Low (about 3.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: A
Ecological site: F002XA004WA - Puget Lowlands Forest
Forage suitability group: Droughty Soils (G002XN402WA)
Other vegetative classification: Droughty Soils (G002XN402WA)
Hydric soil rating: No

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SOIL FIELD LOG

MAC JOB #: 6HAG-220638 WEATHER: 70°F, CLOUDY

SITE ADDRESS: 6506 ARMAR RD, MARYSVILLE DATE: 8/10/22

DEPTH	SOIL DESCRIPTION
	TOPSOIL (SAMPLE TAKEN)
6"	DARK BROWN, DRY TO MOIST, SILTY SAND, F-M SAND, TRACE GRAVEL, F-M GRAVEL
18"	(SAMPLE TAKEN)
20"	DRYER, SAND, F-M SAND, ORANGEISH BROWN, TRACE FINE GRAVEL.
26"	(SAMPLE TAKEN)
31"	HOLE TERMINATED DUE TO LACK OF COHESION (UNABLE TO OBTAIN SAMPLE) NO GROUNDWATER OBSERVED.

SOIL FIELD LOG

MAC JOB #: GHAG-220638 WEATHER: CLOUDY, 70°F

SITE ADDRESS: 6506 ARMAR ROAD, MARYSVILLE DATE: 8/10/22

DEPTH	SOIL DESCRIPTION
	TOPSOIL (SAMPLE TAKEN)
6"	LIGHT BROWN, DRYISH MOIST, SILTY/LOAMY SAND, F-M SAND, TRACE GRAVEL, HARD.
12"	TAN, DRY, LOOSE, FINE SAND (SAMPLE TAKEN)
24"	(SAMPLE TAKEN)
29"	HOLE TERMINATED DUE TO LACK OF COHESION. (UNABLE TO OBTAIN SAMPLES)
	NO GROUNDWATER OBSERVED.

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PAP-Accredited
NAPT

Mac Engineering
PO Box 177
Silvana, WA 98287

Report: 60221-1-1
Date: August 15, 2022
Project No: 220638
Project Name: GHAG

Sample ID	Organic Matter	Cation Exchange Capacity
TP-1 @ 6"	10.42%	20.0 meq/100g
TP-2 @ 6"	5.76%	10.6 meq/100g
Method	**ASTM D2974**	**EPA 9081**

APPENDIX

GRAPHIC SCALE

40 0 20 40

(IN FEET)
1 INCH = 40 FT

30052800000703

35.16'

EX TREELINE (TYP)

EX FLOW (TYP)

38.00

EX BLDG

30052800411000

±10'

N00° 31' 07"W 191.15'

30052800409200

EX BLDG

EX TREE (TYP)

EX SHED

TP-1

EX WELL
(TO BE DECOMMISSIONED PER WSDOE REQUIREMENTS)

±15'

EX GARAGE

S45° 24' 31"E 308.13'

EX SFR

100' WELL R

RAGNAR FINE SANDY LOAM

TP-2

30052800402600

EX 20' R/W

EX 20' R/W

EX GARAGE

EX CONC DECK

EX FENCE

N45° 24' 31"W 197.91'

EX SFR

EX CONC DECK

EX ASPHALT

THE ARBORS
(A CONDO)

30052800402800

EX GARAGE

±10'

EX SFR

EX CURB

N44° 35' 29"E 159.42' (C)(R1)

ARMAR ROAD

EX ASPHALT ROAD

EX PP (TYP)

EX CB (TYP)

EX EDGE LINE (TYP)

EX MH

EX FH

GHAG-ARMAR RD
EXISTING SITE PLAN
FIG 1

MAC ENGINEERING, LLC
PO Box 177
Silvana, WA 98287
Tel: 360-652-5820
E-Mail: macengineering@frontier.com

Looking northeast along Armar Road

Looking southwest along Armar Road

FIGURE 2: SITE PHOTOGRAPHS

Looking northwest along northeastern property line

Looking southwest along southeastern property line

FIGURE 2: SITE PHOTOGRAPHS

Looking northwest along southwestern property line

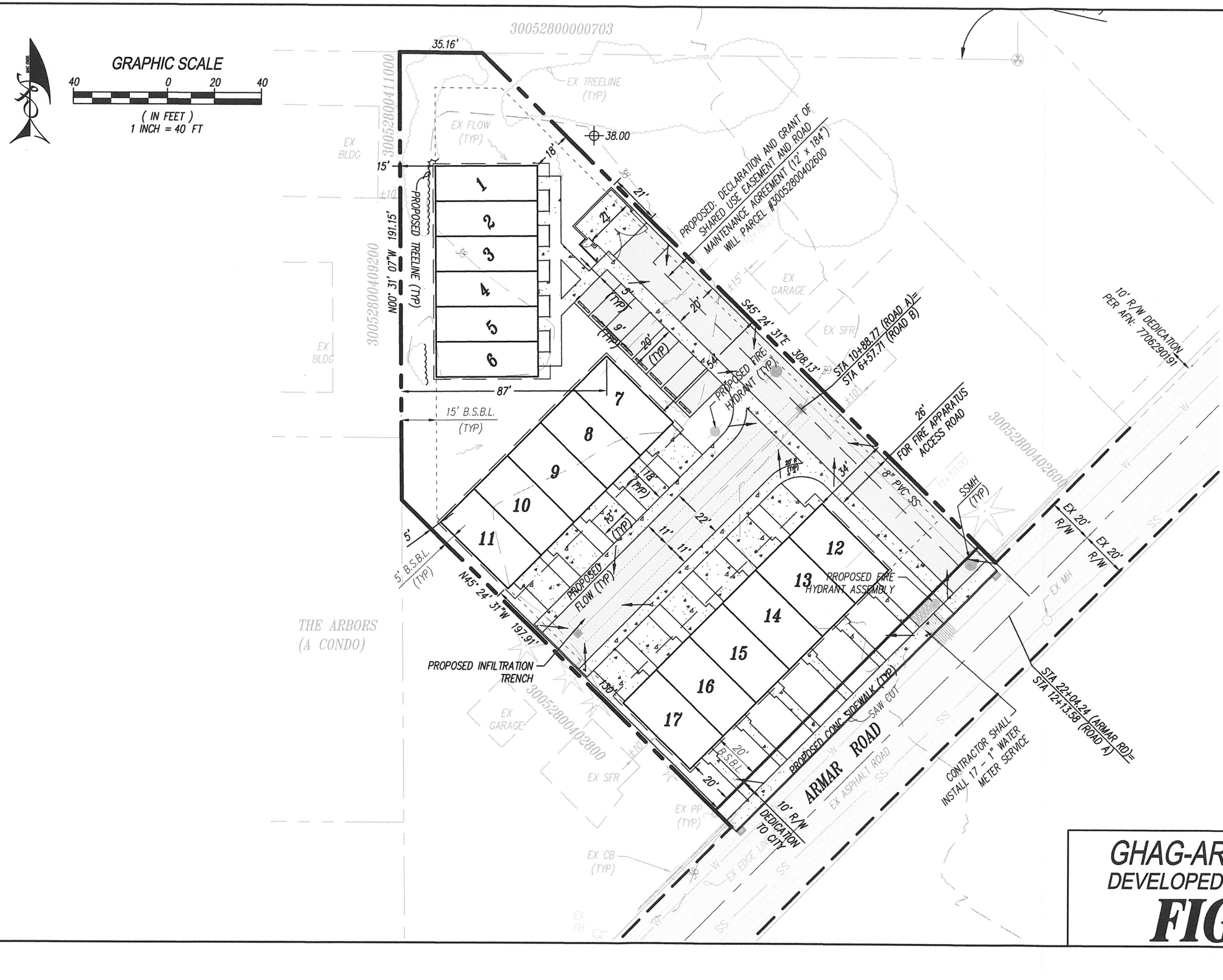
Looking southeast from northwestern portion of property

FIGURE 2: SITE PHOTOGRAPHS

GRAPHIC SCALE

40 0 20 40

(IN FEET)
1 INCH = 40 FT

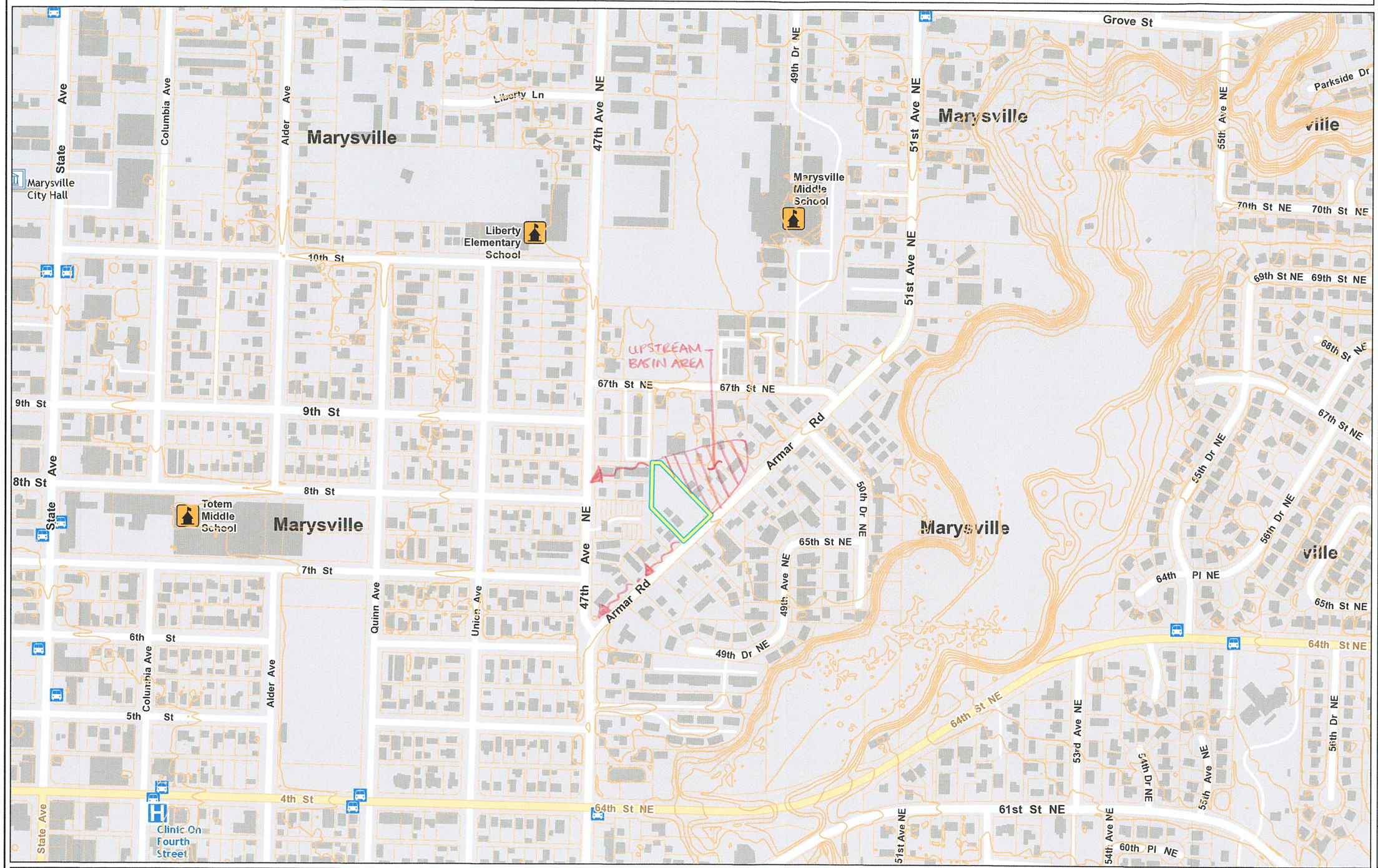


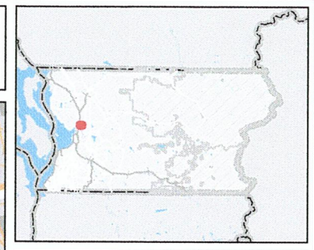
GHAG-ARMAR RD
DEVELOPED SITE PLAN
FIG 3

PDS Map Portal
Snohomish County Planning & Development Services

OFF-SITE BASIN MAP

8/18/2022





Legend

- Snohomish County Tax Parcels

1:4,800

800.0 0 400.00 800.0 Feet

Projection: NAD_1983_StatePlane_Washington_North_FIPS_4601_Feet
Planning and Development Services, Snohomish County

Notes

GHAG - 220638

Fig 4

PRAINAGE INVENTORY MAP

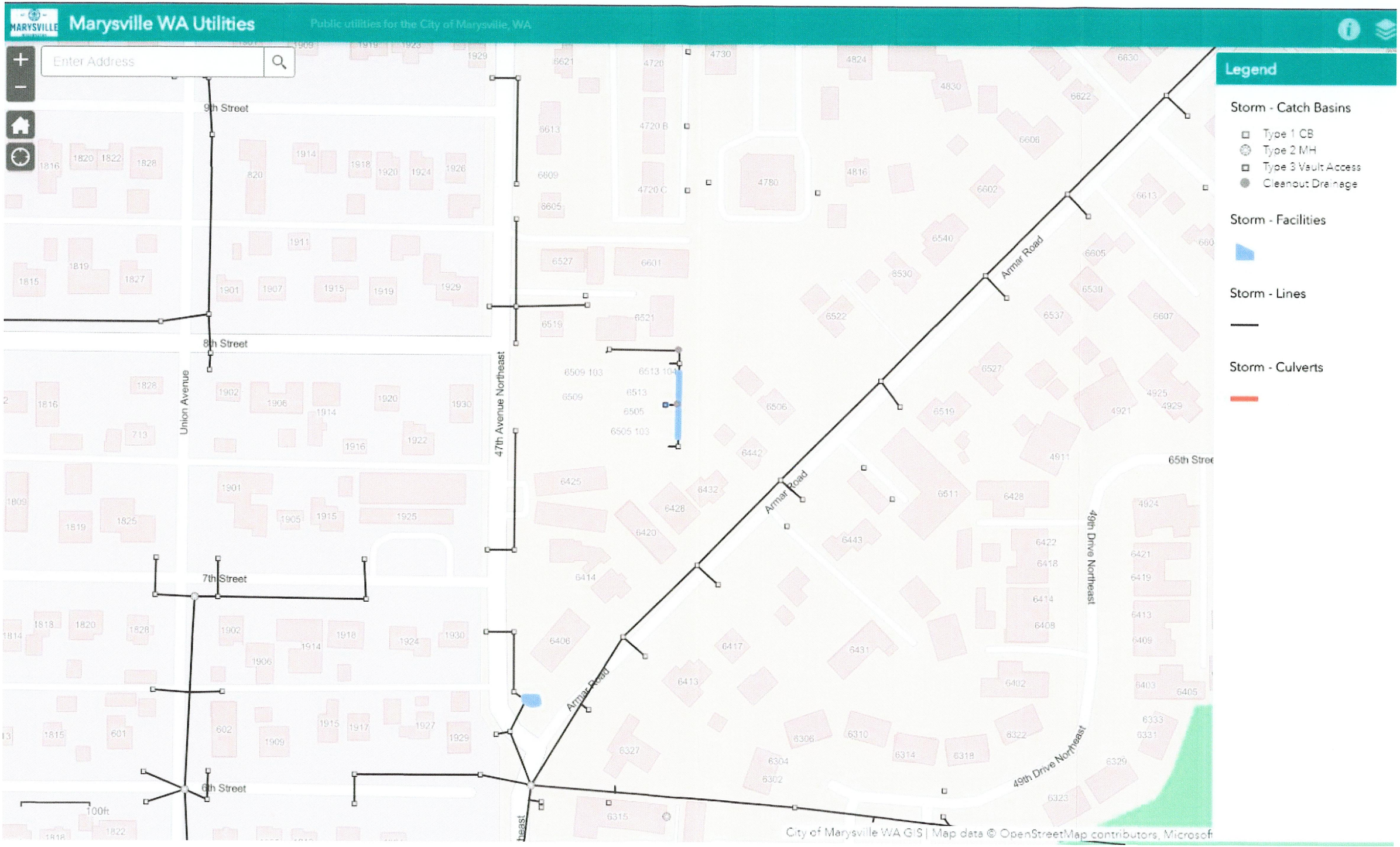
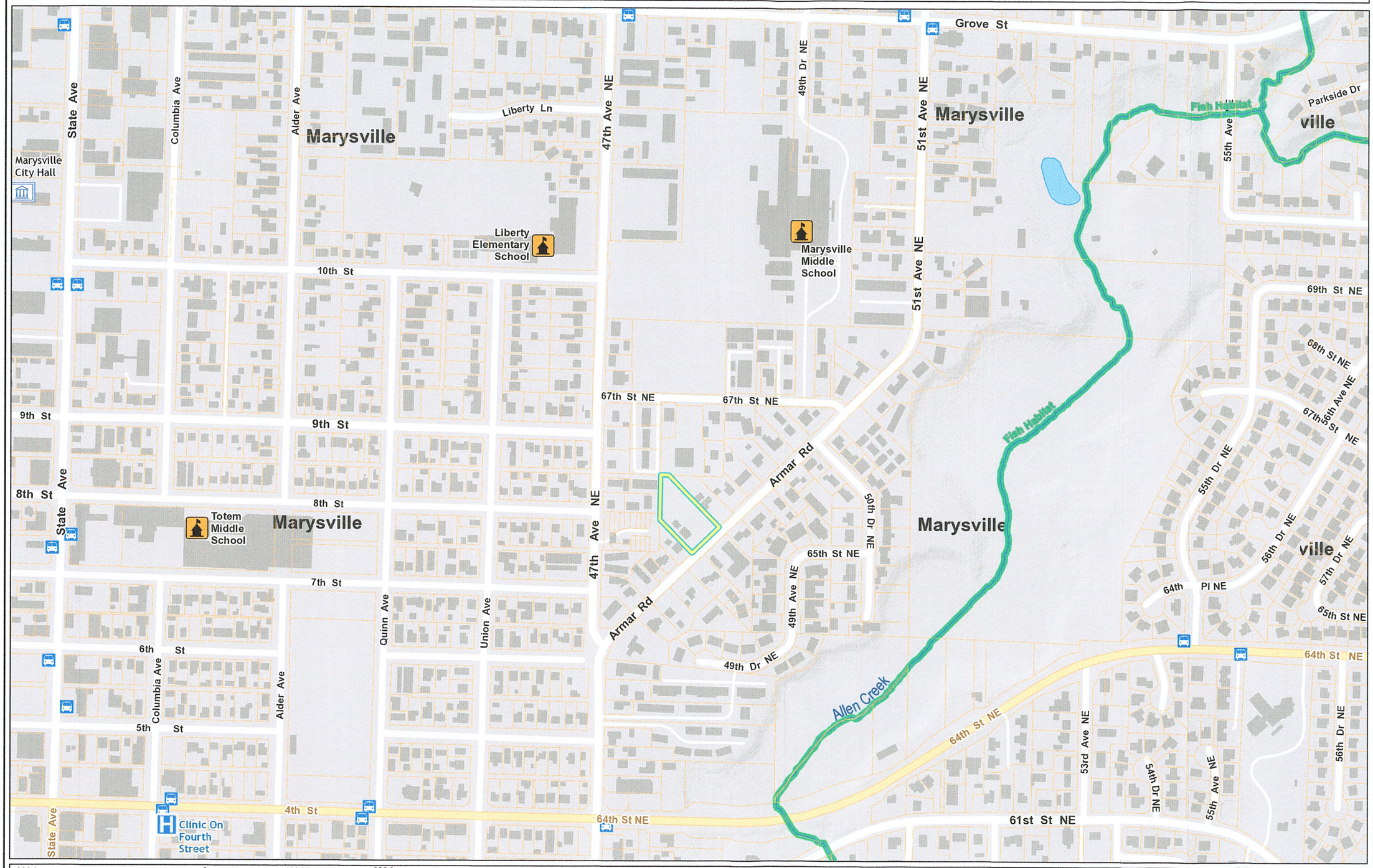


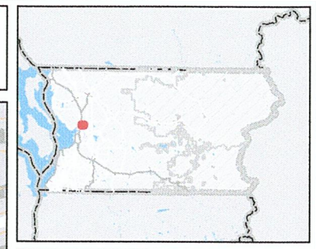
FIG 5

PDS Map Portal
Snohomish County Planning & Development Services

STREAM INVENTORY MAP

8/18/2022





Legend

- Snohomish County Tax Parcels
- Snohomish County Streams
  - Shoreline of Statewide Significance
  - Fish Habitat
  - Non-fish Habitat Perennial
  - Non-fish Habitat Seasonal
  - Unknown, Untyped
- Snohomish County Water Bodies
  - Shoreline of Statewide Significance
  - Fish Habitat
  - Non-fish Habitat Perennial
  - Non-fish Habitat Seasonal
  - Unknown, Untyped

1:4,800

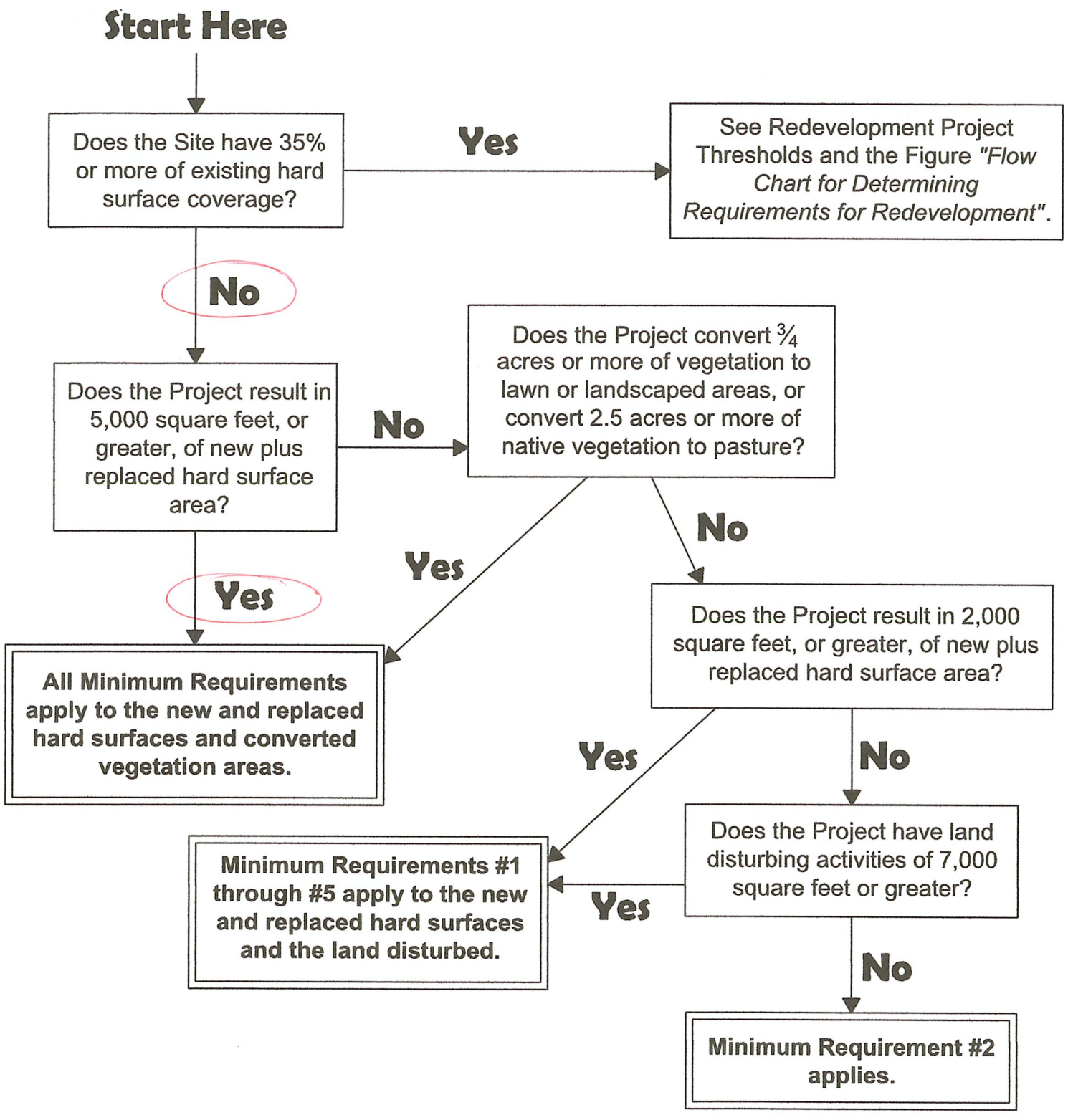
800.0 0 400.00 800.0 Feet

Projection: NAD_1983_StatePlane_Washington_North_FIPS_4601_Feet
Planning and Development Services, Snohomish County

Notes

GHAG - 220638

FIG 6



DEPARTMENT OF ECOLOGY
State of Washington

Flow Chart for Determining Requirements for New Development

Revised March 2019

Fig 7