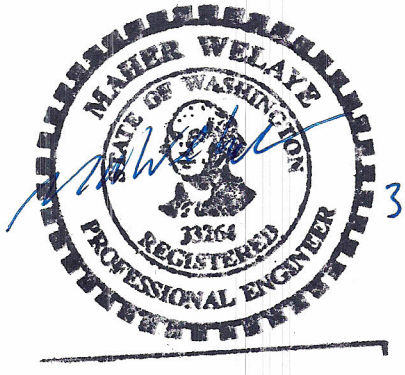
PRELIMINARY
STORMWATER REPORT

FOR

ICOM
ISLAMIC CENTER OF MUKILTEO
HARBOUR POINTE BLVD
Mukilteo, Washington

This report was prepared by Fattah Ghadamsi
under my direct supervision
as defined in WAC 196-23-030.

Maher Welaye P.E.
Project Engineer



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Civil Permit Application Drawings (Reduced Copy Size)

FIGURE 1: Vicinity Map

FIGURE 2: Existing Conditions

FIGURE 3: Proposed Conditions

3 DRAINAGE INFORMATION SUMMARY FORM

Project Name:	Islamic Center Of Mukilteo (ICOM)
Project Engineer:	Maher Welaye
Project Applicant:	Islamic Center Of Mukilteo (ICOM)
Project Total Area:	0.8 Acre.
Project Developed Area:	0.532 Acre.

TABLE 1: SUMMARY TABLE

Drainage Basin Summary Information

On-Site Sub-Basin Area (Acre)	0.8 Acre (total site)
Project Development Area (Acre)	0.532 Acre
Type of Storage Proposed	Detention Vault
Approx. Live Storage Vol. (cu. ft.)	196
Soil Type(s)	C

Pre-Developed Runoff Rates

Q (cfs)*	2 yr	0.007636
	10 yr	0.013812
	50 yr	0.019498
	100 yr	0.021974

Post-Developed Runoff Rates (Mitigated)

Q (cfs)*	2 yr	0.0075
	10 yr	0.0246
	100 yr	0.0884

** Flow rate is found using Western Washington Hydrology Model a computer program (WWHM4) 2012.*

4 EXECUTIVE SUMMARY

4.1 DRAINAGE PLAN DESCREPTION

The drainage plan for this site consists of collection, treatment, and conveyance of stormwater runoff from the proposed parking, driveway, sidewalk and building. The runoff will be collected and conveyed to a proposed Biofiltration system facility via an engineered system of grading, catch basin inlets and drainage pipes. The proposed water quality facilities have been designed to provide treated runoff from pollutant generating impervious surface areas. Peak runoff flow attenuation (detention) is proposed for developed condition runoff will not exceed the 0.15 cfs threshold for the 100 year design storm using (15-minute time steps).

4.2 WATER QUALITY

A multiple of small Bio retention systems is proposed for this project to induce treatment and filtration. A Biofiltration system is proposed to treat the pollutant generating surface area to provide the required enhanced water quality treatment for storm water runoff. This Biofiltration system is approved by department of Ecology State of Washington on November, 2015. It is titled “General Use Level Designation for Basic (TSS), Enhanced, and Phosphorus & Oil Treatment for Americast Filterra”.

4.3 WATER QUANTITY

A detention system (Vault) is proposed to detain the new generating surface runoff for post project construction. The flow control is based on the Stormwater Management Manual for Western Washington 2012 manual (SWMMWW) minimum requirement 7.

4.4 DRAINAGE BASINS

A single 0.8 Acre drainage basin consists of the property area delineated for the pre-development runoff analysis.
The estimated volumes and peak flow rates for the pre- developed condition and post developed condition are summarized in Appendix II.
Hydrologic Analysis is found using Western Washington Hydrology Model a 2012 computer program (WWHM4). The detailed input-output from the "WWHM4" can be found in its entirety in this Appendix II.

4.5 DRAINAGE SYSTEM

The existing and proposed drainage systems are clearly illustrated in the report figures. Additionally, the complete preliminary site plan design drawings are included herein (attached reduce scale drawing set) which includes site grading, clearing areas and erosion and sediment control preliminary design.

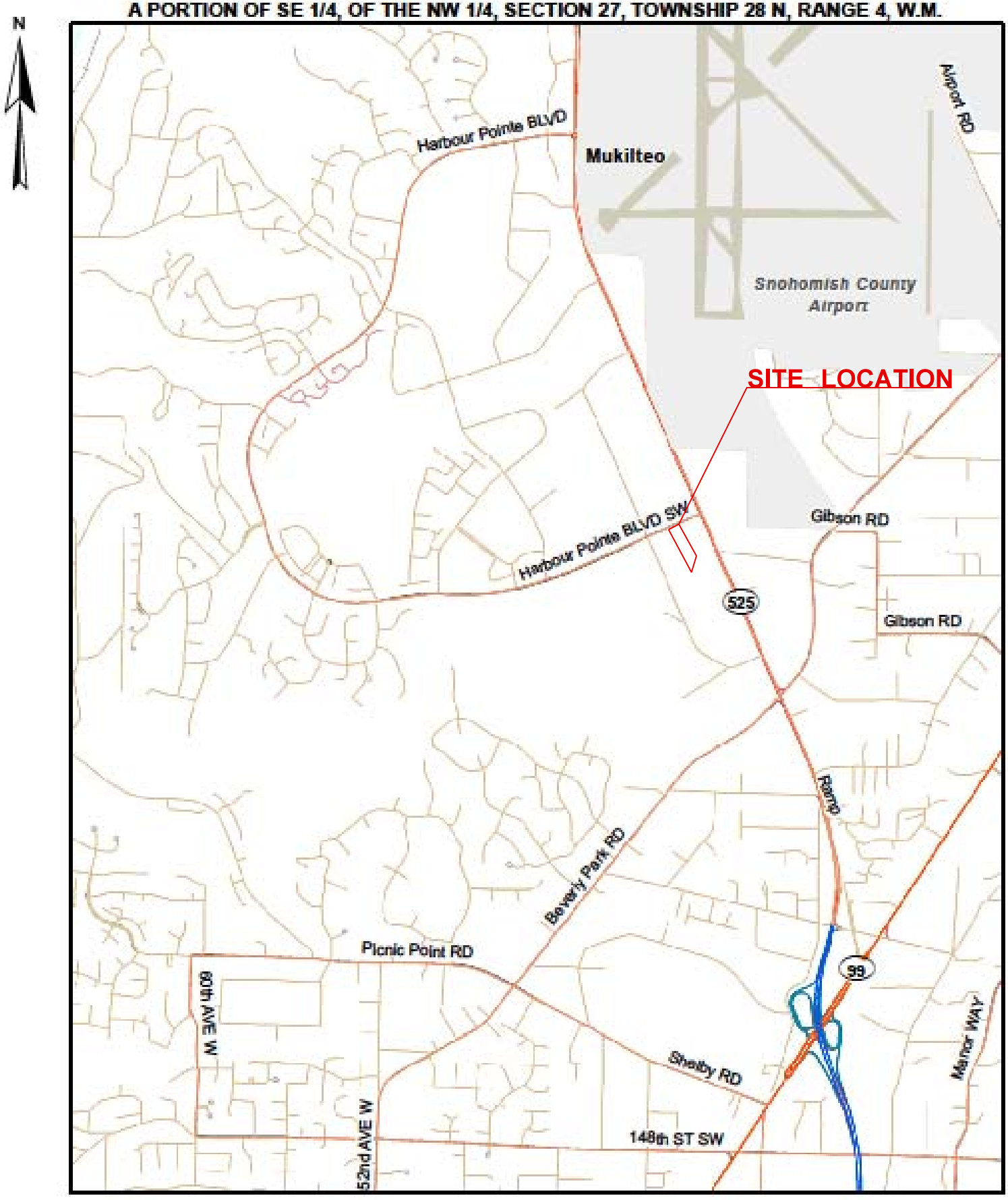
4.6 UPSTREAM ANALYSIS

The site is located at a localized high point therefore there is no upstream runoff from any adjacent properties.

4.7 DOWNSTREAM ANALYSIS

The project point of concentration is the northern property boundary from this point runoff flows north within the Harbour Pointe Blvd right-of-way drainage system. The Harbour Pointe Blvd right-of-way drainage system and has capacity to handle site runoff from the proposed development condition in the unlikely event that all detention systems failed and runoff was release directly without flow attenuation.

A PORTION OF SE 1/4, OF THE NW 1/4, SECTION 27, TOWNSHIP 28 N, RANGE 4, W.M.



VICINITY MAP

5 EXISTING CONDITION

5.1 DESCRIPTION

The subject project area is 0.8 Acre and fronts the south side of Harbour Point Blvd. SW. Located within the SE ¼ of the NW ¼ Section 27, Township 28 N, Range 4, WM in the City of Mukilteo Snohomish County. WA. The property is currently vacant and is fully vegetated with young to mature trees and underbrush. The proposed development plans for the site consist of constructing a new two- story mosque/prayer building. An access road for the site linking to a parking lot located at south side. Figure 1 (Vicinity Map) illustrates the general location of the site and surrounding area.

The site is situated within an urban setting with the subject property currently vacant. 0.8 Acre is contained brush, trees and vegetation, 0.335 Ac is regulated critical area wetlands and wetland buffer. Figure 2 (Existing Conditions) illustrates the subject property with current condition as well as the frontage rights-of-way.

Documents have been prepared to help for the stormwater plan and utilize Low Impact Development (LID) as in minimum requirement (MR) #5 through the preliminary design plan are included in Appendix II:

- A topography map titled “ICOM – 5500 Harbour Pointe Blvd, Unit R104 – Mukilteo, WA. 98275” prepared by ALL Land Surveying, dated March 12, 2014.
- A wetland report titled Critical Area Study and Buffer Mitigation Plan for ICOM – Harbour Point Blvd. – Mukilteo, WA.” Prepared by Wetland Resources, Inc., dated April 15, 2014.
- A Geotechnical Engineering Evaluation “ICOM 3953 Harbour Pointe Boulevard SW – Mukilteo, WA. NGA File No. 905114” prepared by NGA Associates, Inc. dated September 19. 2014.

5.2 VEGETATION

The property vegetation is characterized as areas of brush and mature trees. The existing condition map shows the location of the mature trees on vegetation of the subject property.

5.3 TOPOGRAPHY AND DRAINAGE

The topographic elevation contours on the site ranging from approximately 578 ft at the south limit of the site down to 562 ft at the lowest portion of the site at the north property limit. The majority of the site slopes gently from south to north at slopes less than

approx. 2%. There is an isolated side slope along the western property boundary that approaches approximant 3% gradient.

According to the FEMA Flood Insurance Rate Map No 53061C1309E dated November 8 1999, there are no flood hazard areas on the site.

Figure 2 (Existing Conditions) shows the existing elevation contours, critical area (wetland category class III, and associated buffer) and drainage characteristics within the site.

There is existing stormwater outlet consists of 8-inch concrete pipe installed at elevation 557.1 feet that connects to a catch basin along the south side of Harbour Point Blvd SW. The wetland water depth and annual fluctuation is controlled to this elevation.

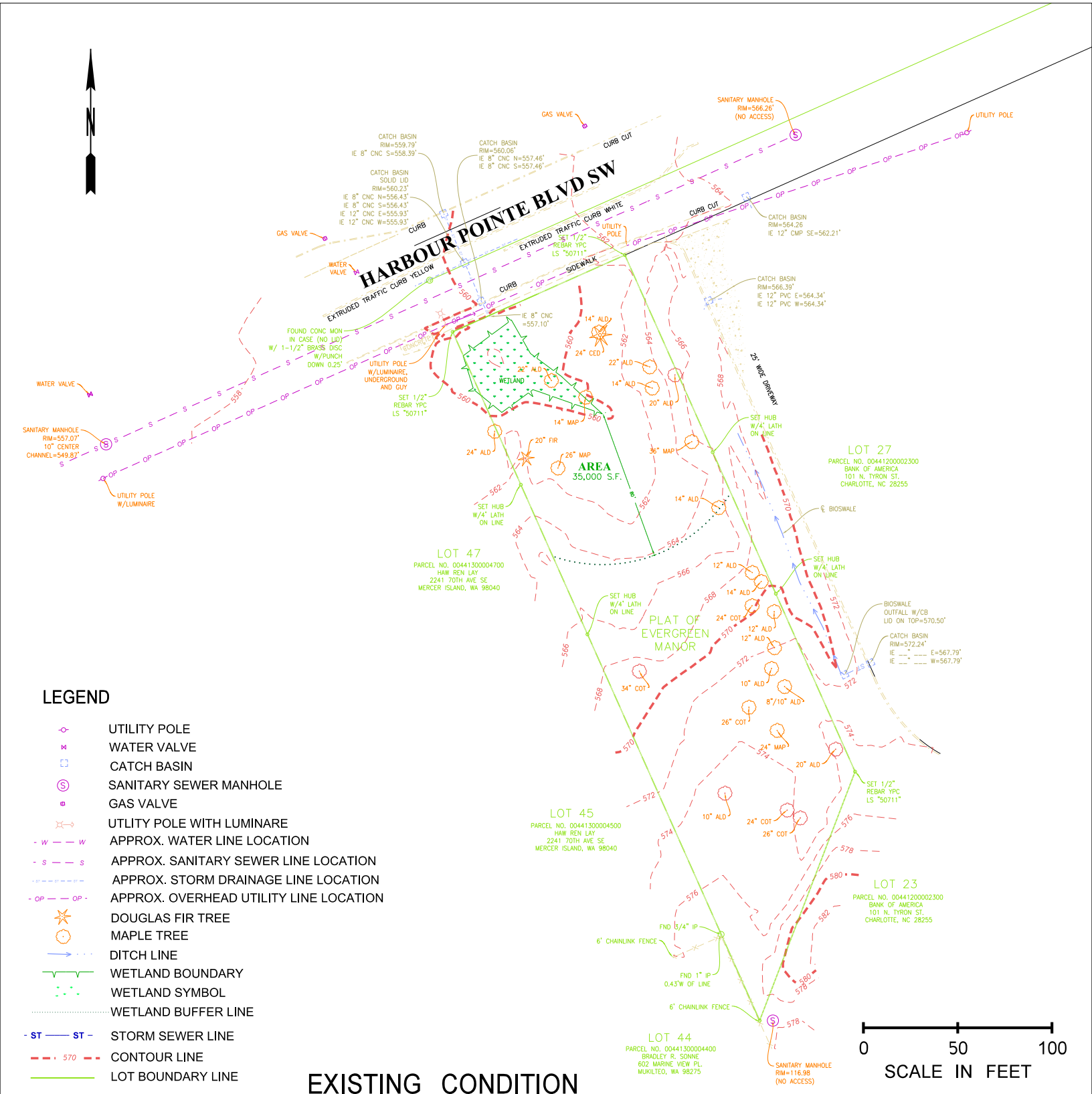
For most storm events, stormwater runoff from the majority of the site area sheet flows to the north where the wetland is and the existing drainage conveyance features. The northern property boundary where the wetland drains into the existing pipe represents the point of compliance “POC” for the site.

5.4 SOILS

According to the Soil Survey of Snohomish County Area, the site soils are Alderwood Urban Land Complex, 2 to 8 percent slopes (Map Unit 5). Alderwood- Urban land complex, 2 to 8 percent slopes: This map unit is on till plains. This unit is about 76 percent Alderwood gravelly sandy loam. Included in this unit are small areas of Everett gravelly sandy loam, 15 to 25 percent slopes and Terric Medisaprist, also included in this unit a small percentage of Urban land. The complete NRCS soil data summary sheet is included in the report Appendix I

5.5 PRE-DEVELOPMENT BASIN ANALYSES

A single drainage basin was delineated for the pre-development runoff analysis. This basin includes the 0.25 Acre which represents the wetland and the wetland buffer, and the 0.55 Acre that will be improved for this project. The basin delineation for the pre-development condition is shown in Figure 2 (Existing Conditions) which illustrates the existing condition topography such as drainage pattern in the form of sheet flow and shallow flow, existing drainage features such conveyance with its associated catch basin and runoff travel paths.
The basin stormwater modeling denotes the runoff flow path point of concentration (designated as POC), for the basin area.
Storm water runoff flows routed to the project point of concentration (POC) in the pre-developed condition represent the maximum runoff rates that will be permitted to flow through POC when the site is in the developed condition. The POC for the project is located at the north limit of the site at Harbor Pointe Blvd S.W.
The estimated volumes and peak flow rates for the pre-developed condition are summarized in Appendix II -Hydrologic Analysis (WWHM4). The detailed input/output from the "WWHM4" computer program can be found in its entirety in this Appendix I.



LEGEND

- UTILITY POLE
- WATER VALVE
- CATCH BASIN
- SANITARY SEWER MANHOLE
- GAS VALVE
- UTLITY POLE WITH LUMINARE
- APPROX. WATER LINE LOCATION
- APPROX. SANITARY SEWER LINE LOCATION
- APPROX. STORM DRAINAGE LINE LOCATION
- APPROX. OVERHEAD UTILITY LINE LOCATION
- DOUGLAS FIR TREE
- MAPLE TREE
- DITCH LINE
- WETLAND BOUNDARY
- WETLAND SYMBOL
- WETLAND BUFFER LINE
- STORM SEWER LINE
- CONTOUR LINE
- LOT BOUNDARY LINE

EXISTING CONDITION

FIGURE 2

6 DEVELOPED SITE CONDITIONS

6.1 DEVELOPED BASIN ANALYSIS

The post-development condition is illustrated in Figure 3 (Proposed Conditions). Using a conservative approach for facility sizing, the impervious surfaces introduced by proposed roofs, paved access, sidewalks, and grass\landscape was quantified from the proposed site plan design per the Washington State Department of Ecology, 2012 Stormwater Management Manual for Western Washington (SWMMWW).
Runoff travel path and resultant time of concentration flow calculations were estimated to the basin project point of concentration.
The proposed drainage system consists of collecting the stormwater in Bio retention facilities and Bio-filtration system/catch basins and transporting runoff through pipes. After treatment, runoff will be conveyed to a detention vault and released to the city storm drain system, however an approximately area along the access road of 200 SY will not be treated and 210 SY will not be detained due to new city of Mukilteo frontage roadway widening project, and sensitive area impacts.
The estimated volumes and peak flow rates for the developed condition are summarized in Appendix-I - Hydrologic Analysis. The detailed input/output from the "WWHM4 computer program can be found in its entirety in this Appendix I.

Minimum Requirements (MR) 1-9 apply for this new development. MR #1 and MR #2 with its 13 elements are illustrated in this report. MR # 3 is to prevent stormwater from coming in contact with pollutants. MR # 4 is satisfied by keeping the same outfall. MR # 5 is on-site stormwater management BMPs by applying infiltration and retention on site to the most extent feasible without causing sensitive area, and erosion impacts. Table 2.5.1 is showing LID performance standard and BMP T5.13.

6.2 MR # 6 RUNOFF TREATMENTS (WATER QUALITY)

Bio retention facilities as Low Impact Development (LID) along with Biofiltration systems are proposed to treat the pollutant generating surface area to provide the required enhanced water quality treatment for storm water runoff. Calculations for the minimum required units are provided in Appendix I. The water quality treatment capacity will be equivalent to the 91% flow for 15 minute step using continues simulation model as WWHM4 software program.

6.3 MR # 7 FLOW CONTROL (DETENTION)

The project post- development site runoff flow rates will not exceed the 0. 15 cfs thresholds for the 100 yr design storm accordance with the (SWMMWW) 2012. The peak flow estimated for the developed condition is 0.1769 cfs compared to the 0.0219

cfs. (Refer to Analysis Results in the WWHM4 report) in Appendix I. Stormwater discharges shall match developed discharge duration to pre-developed durations for the range of pre-developed discharge rates from 50% of the 2-year peak floe up to the full 50-year peak flow.

The estimated volumes and peak flow rates for the developed condition are summarized in (Hydrologic Analysis). The detailed input/output from the "WWHM4" computer program can be found in its entirety in this Appendix I.

6.4 MR # 8 WETLANDS PROTECTION.

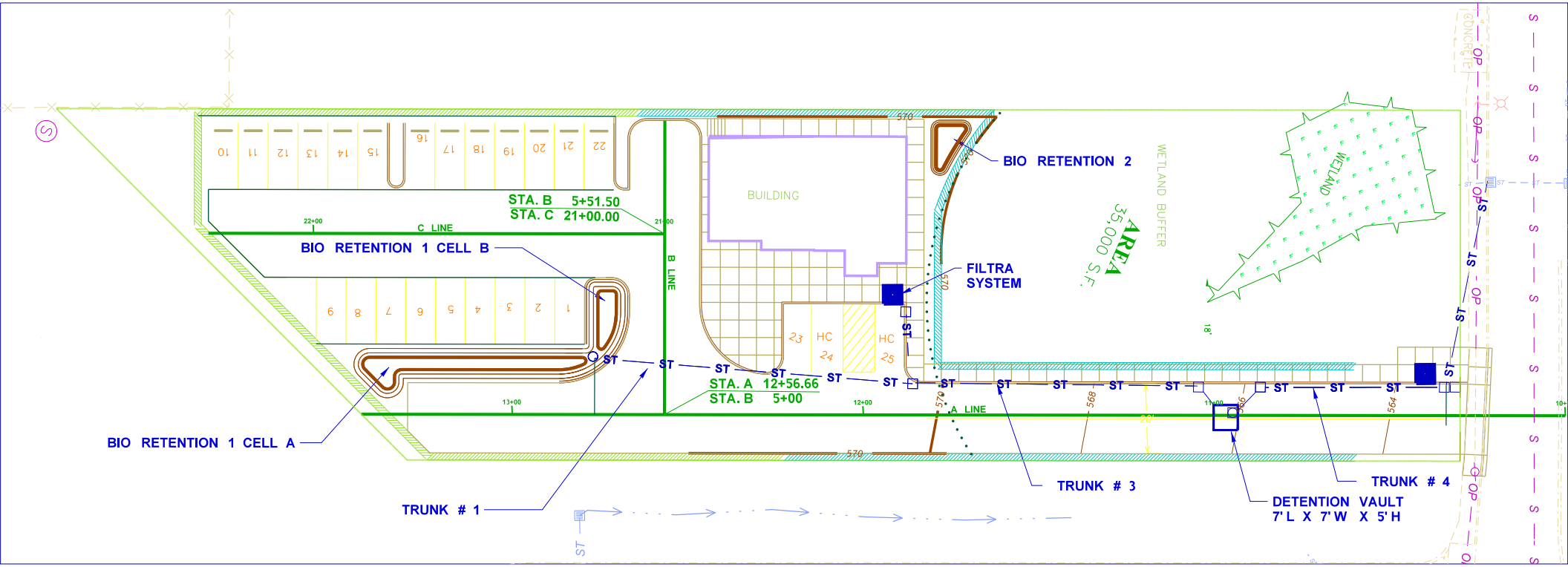
Ensure the wetland receive the same level of protection as any water of the state. Since this wetland is regulated flow by the outfall to the city enclosed drainage system. The building roof top stormwater will pass through bio retention facility before it out falls into the wetland buffer.

6.5 MR # 9 OPERATION AND MAINTENANCE.

Maintenance activity that indicates which action was taken shall be kept available for inspection by the local agency. Other maintenance will be supplied from the manufacture of the BMPs such as Filterra.

6.6 CONVEYANCE

All storm water piping is designed to adequately convey the peak flow for the 25-year post-developed storm event from the basin area served The piping network has also be designed to maintain a minimum cleansing flow velocity. The project site grading design also ensures that the 100 yr design storm event will be safely conveyed overland to suitable drainage features. The Rational Method was used to generate 100-year peak design flow as the basis for the back water calculation to prevent overtopping catch basin inlet on the site. Conveyance calculation is provided in Appendix II


BIO RETENTION 1 CELL B
BIO RETENTION 1 CELL A
BIO RETENTION 2
FILTRA SYSTEM
STA. B 5+51.50
STA. C 21+00.00
STA. A 12+56.66
STA. B 5+00
C LINE
B LINE
A LINE
BUILDING
WETLAND
WETLAND BUFFER
35,000 S.F. AREA
TRUNK # 1
TRUNK # 3
TRUNK # 4
DETENTION VAULT
7' L X 7' W X 5' H

7 EROSION CONTROL RISK ASSESSMENT

A temporary erosion and sedimentation control (TESC) design plan has been prepared to outline control measures necessary to minimize site erosion and sedimentation during construction. The potential erosion control risk issues are identified below.

7.1 SLOPE

A topographic map of the development area of the site shows an elevation range of approximate 15ft over the entire property. The steepest slope on the site approaches 30% adjacent to the Northwest corner of the property where is the sensitive area is situated. This slope should remain undisturbed and protected following any land disturbance. The existing condition plan identifies the areas of highest erosion control risk.

7.2 SOIL TYPE

According to the Soil Survey of Snohomish County Area, the site soils are Alderwood Urban Land Complex. 2% to 8% slopes (Map Unit 5). Permeability of this soil Is moderate in the subsoil land rapid below.

7.3 WINTER EROSION

Disturbed soils during the winter months will increase the threat of erosion. However if winter grading will be required specific measure will be taken based on City of Mukilteo requirements.

7.4 CRITICAL AREAS

Critical area is identified in the Critical Area report included in appendix II.

7.5 FISH BEARING STREAMS

There are no fish bearing stream.

7.6 INSTABILITY & GROUND MOVEMENT

The site appears to be geologically stable with no observed evidence to indicate that the ground is unstable or that any past large scale land movement has occurred.

7.7 SOURCE OF WATER FOR EROSION

Direct rainfall and associated runoff is the source of water that will cause erosion.

7.8 EROSION PREVENTION

There are several measures proposed to minimize erosion and to protect the site and downstream system from the hazards of soil erosion. An erosion control plan was prepared as part of the construction permit plan set detailing appropriate BMP's acceptable for the site development. A detailed list of BMP's identified for this project is outlining in the following section of this report.

7.9 RISK SUMMARY

A temporary erosion and sediment control plan will be prepared as part of the construction drawing approval by the City and when implemented should effectively minimize the risk of erosion. The following section discusses the required elements to be implemented on the site. A detailed Storm Water Pollution Prevention Plan (SWPPP) has also been prepared for the project as part of the National Pollutant Discharge Elimination System (NPDES) application. Moreover, the site erosion control measures will be in accordance with City Code requirements.

8 CONSTRUCTION STORMWATER POLLUTION PREVENTION

All twelve elements of construction Stormwater Pollution Prevention Plan (SWPPP) have been considered and outlined below. The Construction SWPPP shall comply with Elements #1 through #12 as described in Volume 2 Chapter 3 of Washington State Department of Ecology, 2012 Stormwater Management Manual for Western Washington.

8.1 ELEMENT 1: PRESERVE VEGITATION/MARK CLEARING LIMITS

Prior to beginning land disturbing activities, including clearing and grading, all clearing limits, sensitive areas and their buffers, and trees that are to be preserved within the construction area shall be clearly marked, both in the field and on the plans, to prevent damage and offsite impacts. Plastic, metal or stake wire fence may be used to mark the clearing limits. Retain the duff layer, native top soil, and natural vegetation in an undisturbed state to the maximum extent visible.

8.2 ELEMENT 2: ESTABLISH CONSTRUCTION ACCESS

A construction entrance/exit is proposed to be constructed at the only access to the site to Harbor Point Blvd to the north east corner of the site to minimize tracking sediment onto Harbor Point Blvd in accordance with the Construction Entrance detail Appendix II. Any soil tracked onto paved areas shall be swept up and disposed of on a regular basis.

8.3 ELEMENT 3: CONTROL FLOW RATES

A temporary sediment trap (cleared area less than 3 acres) per BMP C240 in the SWMMWW has been sized to prevent soil laden waters from exiting the site. The equations and design criterion for the sediment trap with a safety factor of 2 is as follows.

$$SA = Q_2 \times 2080$$
$$SA = 0.017 \times 2080 = 36 \text{ sf}$$

Where
SA is the surface area of trap
Q_2 is the design peak discharge from the developed 2-year runoff event

Note: A temporary trap may be impractical on the minimal project flows that will discharge to the project POC.

8.4 ELEMENT 4: INSTALL SEDIMENT CONTROLS

The duff layer, native topsoil, and natural vegetation shall be retained in an undisturbed state to the maximum extent practicable. Sediment control BMPs such as Silt fencing shall be installed along the down gradient perimeter of the site prior to project

construction as shown. Temporary sediment traps may also be used if required. Prior to stormwater during construction leaving the construction site or prior to discharge to the infiltration facility, stormwater runoff from disturbed areas shall pass through silt fencing and/or sediment trap for required sediment removal. Sediment traps, vegetated buffer strips, sediment dikes and fencing, and other BMPs intended to trap sediment on-site shall be constructed as one of the first steps in grading.

8.5 ELEMENT 5: STABILIZE SOILS

All exposed and unworked soils shall be stabilized by application of effective BMPs that protect the soil from the erosive forces of raindrop impact and flowing water, and wind erosion From May 1 to September 30 of each year, no soils shall remain exposed and unworked for more than 7 days. This condition applies to all soils on site, whether at final grade or not. Applicable practices include, but are not limited to, temporary and permanent seeding, sodding, mulching, plastic covering, soil application of polyacrylamide (PAM) early application of gravel base on areas to be paved, and dust control. Soil stabilization measures selected should be appropriate for the time of year, site conditions, estimated duration of use, and potential water quality impacts that stabilization agents may have on downstream waters or ground water. Soil stockpiles must be stabilized and protected with sediment trapping measures.
No land disturbing activity, including but not limited to clearing of vegetation, grading, filling, excavating or trenching of soil or earth materials must not remain exposed and un worked for more than the tome periods set forth; during the dry season (may 1 – Sept. 30): for 7 days, and during the wet season (October 1 – April 30): 2 days. Between October 1st and April 30th , all bare soil and earth areas in excess of 500 SF shall be required to be covered with any a minimum of 6'' cover of shredded wood chip/fiber (hog fuel) or crushed rock or gravel, not less than ¾” in aggregate size and 4'' deep. Work on linear construction sites and activities, including right-of-way and easement clearing, roadway development, pipelines, and trenching for utilities, shall not exceed the capability of the individual contractor for his portion of the project to install the bedding materials, roadbeds, structures, pipelines, and/or utilities, and to re-stabilize the disturbed soils, meeting the timing conditions listed above.

8.6 ELEMENT 6: PROTECT SLOPES

Existing vegetation surrounding the project area shall remain undisturbed to protect the existing slopes to the extent feasible. Temporary cut slopes shall be protected with plastic covering per BMP C123

Reduce slope runoff velocities by reducing the continuous length of slope with terracing and diversions, reduce slope steepness, and roughen slope surface. Divert upslope drainage and run-on waters from off-site with interceptor dikes, pipes or swales at top of slope. Off-site stormwater should be handled separately from stormwater generated on the site.

Provide drainage to remove ground water intersecting the slope surface of exposed soil areas. Excavated material shall be placed on the uphill side of trenches, consistent with safety and space considerations. Check dams shall be placed at regular intervals within

trenches that are cut down a slope. Stabilize soils on slopes, as specified in Element #5. BMP combinations are the most effective method of protecting slopes with disturbed soils such as both mulching and straw erosion control blankets.

8.7 ELEMENT 7: PROTECT DRAIN INLETS

All storm drain inlets made operable during construction shall be protected so that stormwater runoff shall not enter the conveyance system without first being filtered or treated to remove sediment. Below grate basin filter inserts shall be installed in catch basins prior to completion of the project. The barriers shall be removed upon completion of construction. All approach roads shall be kept clean, and all sediment and street wash water shall not be allowed to enter storm drains without prior and adequate treatment unless treatment is provided before the storm drain discharges to waters of the State.

8.8 ELEMENT 8: STABILIZE CHANNELS AND OUTLET

Temporary interceptor swale may be installed if required and shall be stabilized with grass vegetation and check dams (rock or triangular silt dikes) as required. Stabilization, including armoring material, adequate to prevent erosion of outlets and adjacent to slopes shall be provided at the outlets of all conveyance systems.

8.9 ELEMENT 9: CONTROL POLLUTANT

All pollutants including waste materials and construction debris, that occur on-site shall be handled and disposed of in a manner that does not cause contamination of stormwater. BMPs shall be utilized to control and protect the site for vehicle maintenance and repair, use of chemicals, pH modifying substances, clan contaminated surfaces immediately following any discharge or spill incident, etc.

8.10 ELEMENT 10: CONTROL DE-WATERING

All foundation, vault, and trench de-watering water, which have similar characteristics to stormwater runoff at the site, shall be discharged into a controlled conveyance system prior to discharge to a sediment trap or sediment pond. Use of a sedimentation bag with outfall to ditch or swale must be stabilized, as specified in Element #8.

8.11 ELEMENT 11: MAINTAIN BMPs

All temporary and permanent erosion and sediment control BMPs shall be maintained by and repaired as needed to assure continued performance of their intended function. Sediment control BMPs shall be inspected weekly or after a runoff-producing storm event during the dry season (no land disturbance allowed during the wet season).

8.12 ELEMENT 12: MANAGE THE PROJECT

Phasing of Construction - The project shall be phased where feasible in order to

prevent, to the maximum extent practicable, the transport of sediment from the development site during construction. Inspect, maintain, and repair all BMPs as needed to assure continued performance of their intended function. Since this site is less than one acre of disturbance an inspector experienced person, who shall be present, on-site or on call at all times. Re-vegetation of exposed areas and maintenance of that vegetation shall be an integral part of the clearing activities for any phase.
Permitted clearing and grading areas and any other areas required to preserve critical or sensitive areas, buffers, native growth protection easements, or tree retention areas, shall be delineated on site per the approved plans.
Whenever inspection and/or monitoring reveals that the BMPs identified in the Construction (SWPPP) are inadequate Due to the actual discharge of or potential to discharge a significant amount of any pollutant the SWPPP shall be modified, as-appropriate to correct problems identified, in a timely manner.
Maintenance of the Construction SWPPP - The Construction SWPPP shall be maintained, updated, and retained on-site. The SWPPP must be modified whenever there is an investigation by the local regulatory authority determination of ineffectiveness in eliminating or minimizing pollutants from the site, or significant change in the design, construction operation or maintenance of any BMP.

8.13 ELEMENT 13: PROTECT LOW IMPACT DEVELOPMENT (LID) BMPs

All Bioretention and Rain Garden BMPs must be protected from sedimentation through installation and maintenance of erosion and sediment control BMPs. Restore the BMPs to its fully functioning condition by removal of any sediment, and Bioretention soil, and replacing with soil meeting the design specification. Keep all heavy equipment off existing soils under LID facilities that have been excavated to final grade to retain the infiltration rate of the soil.
Avoid introducing sediment or sediment laden runoff from surrounding land onto permeable pavements.

9 UPSTREAM ANALYSIS

The site is located at a localized high point, and no off site runoff flow will enter the property.

10 DOWNSTREAM ANALYSIS

The project point of concentration is the southern property boundary from this point runoff flows east within the Harbour Point Blvd SW right-of-way drainage system.
The Harbour Pointe Blvd SW right-of-way drainage system and has capacity to handle site runoff in the proposed development condition (very marginal increase in runoff of less than 0.15 cfs for the 100 yr design storm) as runoff is release directly with flow control).

11 GEOTECHNICAL OR OTHER REPORTS

11.1 CRITICAL AREAS EVALUATION

Critical Area Study and Buffer Mitigation Plan was completed by Wetland Resources Inc. dated April 15, 2014 A copy of the complete report is included in Appendix II.

11.2 GEOTECHNICAL ASSESSMENT

A geotechnical site investigation and report was completed by Nelson Geotechnical Associates, Inc. dated September 19
2014 A copy of the complete report is included in Appendix II.

11.3 HYDROLOGIC BALANCE STUDY

The geotechnical site investigation report completed by Nelson Geotechnical Associates, Inc. includes a sub- surface soil infiltration rate determination and hydrology soil assessment. A copy of the complete report is included in Appendix II.

12 APPENDICES

Appendix I - (A) Hydrologic Analysis (WWHM4)
(B) Pipe Conveyance Calculation
(C) Runoff Treatment (Bio filtration system) BMPs
(D) NRCS Soil Data Map
(E) FEMA Flood Insurance Rate Map

Appendix II - (A) Geotechnical Engineering Evaluation
(B) Critical Area Study and Buffer Mitigation Plan

Appendix III - Plans and Standard Details" Reduced Copy Size"

Appendix I

(A)

Hydrologic Analysis (WWHM4)

WWHM2012

PROJECT REPORT

General Model Information

Project Name:	Detention
Site Name:	ICOM
Site Address:	200 HARBOUR POINTE BLVD SW
City:	MUKILTEO
Report Date:	2/10/2016
Gage:	Everett
Data Start:	1948/10/01
Data End:	2009/09/30
Timestep:	15 Minute
Precip Scale:	1.00
Version Date:	2015/11/13
Version:	4.2.11

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

Combine Bio

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
C, Forest, Flat	0.2138
Pervious Total	0.2138
Impervious Land Use	acre
Impervious Total	0
Basin Total	0.2138

Element Flows To:

Surface	Interflow	Groundwater

Filtera

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
C, Forest, Flat	0.1017
Pervious Total	0.1017
Impervious Land Use	acre
Impervious Total	0
Basin Total	0.1017

Element Flows To:

Surface	Interflow	Groundwater

Detain

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
C, Forest, Flat	0.0407
Pervious Total	0.0407
Impervious Land Use	acre
Impervious Total	0
Basin Total	0.0407

Element Flows To:

Surface	Interflow	Groundwater

Mitigated Land Use

Combine Bio 1

Bypass:	No
GroundWater:	No

Pervious Land Use	acre
A B, Lawn, Flat	0.0954
Pervious Total	0.0954

Impervious Land Use	acre
PARKING FLAT	0.1184
Impervious Total	0.1184
Basin Total	0.2138

Element Flows To:

Surface	Interflow	Groundwater
Surface retention 1	Surface retention 1	

Filtera 1

Bypass:	No
GroundWater:	No

Pervious Land Use	acre
A B, Lawn, Flat	0.0159
Pervious Total	0.0159

Impervious Land Use	acre
DRIVEWAYS FLAT	0.0699
SIDEWALKS FLAT	0.0159
Impervious Total	0.0858
Basin Total	0.1017

Element Flows To:

Surface	Interflow	Groundwater
Sand- Filter 1	Sand- Filter 1	

Detain-1

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
Pervious Total	0
Impervious Land Use	acre
DRIVEWAYS FLAT	0.0407
Impervious Total	0.0407
Basin Total	0.0407

Element Flows To:

Surface	Interflow	Groundwater
Vault 1	Vault 1	

Routing Elements
Predeveloped Routing

Mitigated Routing

Bioretention 1

Bottom Length:	85.50 ft.
Bottom Width:	3.50 ft.
Material thickness of first layer:	1.5
Material type for first layer:	SMMWW 12 in/hr
Material thickness of second layer:	0
Material type for second layer:	Sand
Material thickness of third layer:	0
Material type for third layer:	GRAVEL
Infiltration On	
Infiltration rate:	0.5
Infiltration safety factor:	0.5
Total Volume Infiltrated (ac-ft.):	19.7
Total Volume Through Riser (ac-ft.):	0.128
Total Volume Through Facility (ac-ft.):	19.828
Percent Infiltrated:	99.35
Total Precip Applied to Facility:	2.082
Total Evap From Facility:	0.688
Underdrain not used	
Discharge Structure	
Riser Height:	1 ft.
Riser Diameter:	12 in.
Element Flows To:	
Outlet 1	Outlet 2
Vault 1	

Bioretention Hydraulic Table

Stage(feet)	Area(ac.)	Volume(ac-ft.)	Discharge(cfs)	Infilt(cfs)
0.0000	0.0235	0.0000	0.0000	0.0000
0.0330	0.0233	0.0001	0.0000	0.0000
0.0659	0.0229	0.0001	0.0000	0.0010
0.0989	0.0225	0.0002	0.0000	0.0017
0.1319	0.0221	0.0002	0.0000	0.0017
0.1648	0.0217	0.0003	0.0000	0.0017
0.1978	0.0213	0.0004	0.0000	0.0017
0.2308	0.0210	0.0004	0.0000	0.0017
0.2637	0.0206	0.0005	0.0000	0.0017
0.2967	0.0202	0.0006	0.0000	0.0017
0.3297	0.0198	0.0006	0.0000	0.0017
0.3626	0.0194	0.0007	0.0000	0.0017
0.3956	0.0190	0.0008	0.0000	0.0017
0.4286	0.0187	0.0010	0.0000	0.0017
0.4615	0.0183	0.0011	0.0000	0.0017
0.4945	0.0179	0.0013	0.0000	0.0017
0.5275	0.0175	0.0015	0.0000	0.0017
0.5604	0.0172	0.0017	0.0000	0.0017
0.5934	0.0168	0.0019	0.0000	0.0017
0.6264	0.0164	0.0021	0.0000	0.0017
0.6593	0.0160	0.0023	0.0000	0.0017
0.6923	0.0157	0.0025	0.0000	0.0017
0.7253	0.0153	0.0027	0.0000	0.0017
0.7582	0.0149	0.0030	0.0000	0.0017
0.7912	0.0146	0.0032	0.0000	0.0017
0.8242	0.0142	0.0034	0.0000	0.0017

0.8571	0.0139	0.0037	0.0000	0.0017
0.8901	0.0135	0.0039	0.0000	0.0017
0.9231	0.0131	0.0042	0.0000	0.0017
0.9560	0.0128	0.0044	0.0000	0.0017
0.9890	0.0124	0.0047	0.0000	0.0017
1.0220	0.0121	0.0049	0.0000	0.0017
1.0549	0.0117	0.0052	0.0000	0.0017
1.0879	0.0114	0.0055	0.0000	0.0017
1.1209	0.0110	0.0058	0.0000	0.0017
1.1538	0.0106	0.0061	0.0000	0.0017
1.1868	0.0103	0.0064	0.0000	0.0017
1.2198	0.0100	0.0067	0.0000	0.0017
1.2527	0.0096	0.0070	0.0000	0.0017
1.2857	0.0093	0.0073	0.0000	0.0017
1.3187	0.0089	0.0076	0.0000	0.0017
1.3516	0.0086	0.0079	0.0000	0.0017
1.3846	0.0082	0.0083	0.0000	0.0017
1.4176	0.0079	0.0086	0.0000	0.0017
1.4505	0.0075	0.0089	0.0000	0.0017
1.4835	0.0072	0.0093	0.0000	0.0017
1.5000	0.0069	0.0095	0.0000	0.0017

Bioretention Hydraulic Table

Stage(feet)	Area(ac.)	Volume(ac-ft.)	Discharge(cfs)	To Amended(cfs)	Infilt(cfs)
1.5000	0.0235	0.0095	0.0000	0.0850	0.0000
1.5330	0.0239	0.0102	0.0000	0.0850	0.0000
1.5659	0.0243	0.0110	0.0000	0.0868	0.0000
1.5989	0.0247	0.0118	0.0000	0.0886	0.0000
1.6319	0.0251	0.0127	0.0000	0.0904	0.0000
1.6648	0.0255	0.0135	0.0000	0.0923	0.0000
1.6978	0.0259	0.0143	0.0000	0.0941	0.0000
1.7308	0.0263	0.0152	0.0000	0.0959	0.0000
1.7637	0.0267	0.0161	0.0000	0.0977	0.0000
1.7967	0.0271	0.0170	0.0000	0.0996	0.0000
1.8297	0.0275	0.0179	0.0000	0.1014	0.0000
1.8626	0.0279	0.0188	0.0000	0.1032	0.0000
1.8956	0.0283	0.0197	0.0000	0.1050	0.0000
1.9286	0.0287	0.0206	0.0000	0.1069	0.0000
1.9615	0.0291	0.0216	0.0000	0.1087	0.0000
1.9945	0.0295	0.0226	0.0000	0.1105	0.0000
2.0275	0.0299	0.0235	0.0000	0.1124	0.0000
2.0604	0.0304	0.0245	0.0000	0.1142	0.0000
2.0934	0.0308	0.0255	0.0000	0.1160	0.0000
2.1264	0.0312	0.0266	0.0000	0.1178	0.0000
2.1593	0.0316	0.0276	0.0000	0.1197	0.0000
2.1923	0.0320	0.0286	0.0000	0.1215	0.0000
2.2253	0.0324	0.0297	0.0000	0.1233	0.0000
2.2582	0.0329	0.0308	0.0000	0.1251	0.0000
2.2912	0.0333	0.0319	0.0000	0.1270	0.0000
2.3242	0.0337	0.0330	0.0000	0.1288	0.0000
2.3571	0.0341	0.0341	0.0000	0.1306	0.0000
2.3901	0.0346	0.0352	0.0000	0.1325	0.0000
2.4231	0.0350	0.0364	0.0000	0.1343	0.0000
2.4560	0.0354	0.0375	0.0000	0.1361	0.0000
2.4890	0.0359	0.0387	0.0000	0.1379	0.0000
2.5220	0.0363	0.0399	0.0346	0.1398	0.0000
2.5549	0.0367	0.0411	0.1365	0.1416	0.0000
2.5879	0.0372	0.0423	0.2754	0.1434	0.0000

2.6209	0.0376	0.0435	0.4414	0.1452	0.0000
2.6538	0.0380	0.0448	0.6273	0.1471	0.0000
2.6868	0.0385	0.0461	0.8261	0.1489	0.0000
2.7198	0.0389	0.0473	1.0308	0.1507	0.0000
2.7527	0.0393	0.0486	1.2343	0.1525	0.0000
2.7857	0.0398	0.0499	1.4294	0.1544	0.0000
2.8187	0.0402	0.0512	1.6096	0.1562	0.0000
2.8516	0.0407	0.0526	1.7695	0.1580	0.0000
2.8846	0.0411	0.0539	1.9054	0.1599	0.0000
2.9176	0.0416	0.0553	2.0158	0.1617	0.0000
2.9505	0.0420	0.0567	2.1028	0.1635	0.0000
2.9835	0.0425	0.0581	2.1721	0.1653	0.0000
3.0000	0.0427	0.0588	2.2635	0.1663	0.0000

Surface retention 1

Element Flows To:

Outlet 1	Outlet 2
Vault 1	Bioretention 1

Sand- Filter 1

Bottom Length:	4.00 ft.
Bottom Width:	4.00 ft.
Depth:	0.75 ft.
Side slope 1:	0 To 1
Side slope 2:	0 To 1
Side slope 3:	0 To 1
Side slope 4:	0 To 1
Filtration On	
Hydraulic conductivity:	24.82
Depth of filter medium:	1.8
Total Volume Infiltrated (ac-ft.):	11.911
Total Volume Through Riser (ac-ft.):	0.288
Total Volume Through Facility (ac-ft.):	12.198
Percent Infiltrated:	97.65
Total Precip Applied to Facility:	0
Total Evap From Facility:	0
Discharge Structure	
Riser Height:	0.7 ft.
Riser Diameter:	100 in.
Element Flows To:	
Outlet 1	Outlet 2
Vault 1	

Sand Filter Hydraulic Table

Stage(feet)	Area(ac.)	Volume(ac-ft.)	Discharge(cfs)	Infilt(cfs)
0.0000	0.000	0.000	0.000	0.000
0.0083	0.000	0.000	0.000	0.009
0.0167	0.000	0.000	0.000	0.009
0.0250	0.000	0.000	0.000	0.009
0.0333	0.000	0.000	0.000	0.009
0.0417	0.000	0.000	0.000	0.009
0.0500	0.000	0.000	0.000	0.009
0.0583	0.000	0.000	0.000	0.009
0.0667	0.000	0.000	0.000	0.009
0.0750	0.000	0.000	0.000	0.009
0.0833	0.000	0.000	0.000	0.009
0.0917	0.000	0.000	0.000	0.009
0.1000	0.000	0.000	0.000	0.009
0.1083	0.000	0.000	0.000	0.009
0.1167	0.000	0.000	0.000	0.009
0.1250	0.000	0.000	0.000	0.009
0.1333	0.000	0.000	0.000	0.009
0.1417	0.000	0.000	0.000	0.009
0.1500	0.000	0.000	0.000	0.010
0.1583	0.000	0.000	0.000	0.010
0.1667	0.000	0.000	0.000	0.010
0.1750	0.000	0.000	0.000	0.010
0.1833	0.000	0.000	0.000	0.010
0.1917	0.000	0.000	0.000	0.010
0.2000	0.000	0.000	0.000	0.010
0.2083	0.000	0.000	0.000	0.010
0.2167	0.000	0.000	0.000	0.010
0.2250	0.000	0.000	0.000	0.010
0.2333	0.000	0.000	0.000	0.010
0.2417	0.000	0.000	0.000	0.010

0.2500	0.000	0.000	0.000	0.010
0.2583	0.000	0.000	0.000	0.010
0.2667	0.000	0.000	0.000	0.010
0.2750	0.000	0.000	0.000	0.010
0.2833	0.000	0.000	0.000	0.010
0.2917	0.000	0.000	0.000	0.010
0.3000	0.000	0.000	0.000	0.010
0.3083	0.000	0.000	0.000	0.010
0.3167	0.000	0.000	0.000	0.010
0.3250	0.000	0.000	0.000	0.010
0.3333	0.000	0.000	0.000	0.010
0.3417	0.000	0.000	0.000	0.010
0.3500	0.000	0.000	0.000	0.011
0.3583	0.000	0.000	0.000	0.011
0.3667	0.000	0.000	0.000	0.011
0.3750	0.000	0.000	0.000	0.011
0.3833	0.000	0.000	0.000	0.011
0.3917	0.000	0.000	0.000	0.011
0.4000	0.000	0.000	0.000	0.011
0.4083	0.000	0.000	0.000	0.011
0.4167	0.000	0.000	0.000	0.011
0.4250	0.000	0.000	0.000	0.011
0.4333	0.000	0.000	0.000	0.011
0.4417	0.000	0.000	0.000	0.011
0.4500	0.000	0.000	0.000	0.011
0.4583	0.000	0.000	0.000	0.011
0.4667	0.000	0.000	0.000	0.011
0.4750	0.000	0.000	0.000	0.011
0.4833	0.000	0.000	0.000	0.011
0.4917	0.000	0.000	0.000	0.011
0.5000	0.000	0.000	0.000	0.011
0.5083	0.000	0.000	0.000	0.011
0.5167	0.000	0.000	0.000	0.011
0.5250	0.000	0.000	0.000	0.011
0.5333	0.000	0.000	0.000	0.011
0.5417	0.000	0.000	0.000	0.012
0.5500	0.000	0.000	0.000	0.012
0.5583	0.000	0.000	0.000	0.012
0.5667	0.000	0.000	0.000	0.012
0.5750	0.000	0.000	0.000	0.012
0.5833	0.000	0.000	0.000	0.012
0.5917	0.000	0.000	0.000	0.012
0.6000	0.000	0.000	0.000	0.012
0.6083	0.000	0.000	0.000	0.012
0.6167	0.000	0.000	0.000	0.012
0.6250	0.000	0.000	0.000	0.012
0.6333	0.000	0.000	0.000	0.012
0.6417	0.000	0.000	0.000	0.012
0.6500	0.000	0.000	0.000	0.012
0.6583	0.000	0.000	0.000	0.012
0.6667	0.000	0.000	0.000	0.012
0.6750	0.000	0.000	0.000	0.012
0.6833	0.000	0.000	0.000	0.012
0.6917	0.000	0.000	0.000	0.012
0.7000	0.000	0.000	0.000	0.012
0.7083	0.000	0.000	0.067	0.012
0.7167	0.000	0.000	0.190	0.012
0.7250	0.000	0.000	0.349	0.012

0.7333	0.000	0.000	0.538	0.012
0.7417	0.000	0.000	0.752	0.013
0.7500	0.000	0.000	0.989	0.013
0.7583	0.000	0.000	1.246	0.013

Vault 1

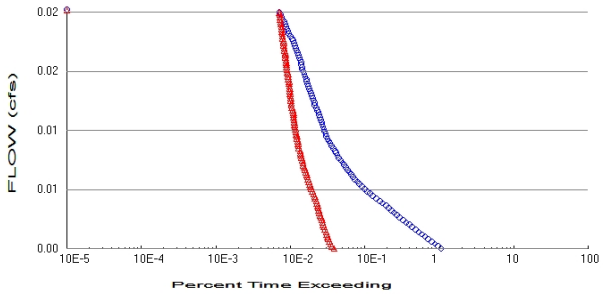
Width: 7 ft.
Length: 7 ft.
Depth: 5 ft.
Discharge Structure
Riser Height: 4 ft.
Riser Diameter: 12 in.
Notch Type: Rectangular
Notch Width: 0.010 ft.
Notch Height: 0.400 ft.
Orifice 1 Diameter: 0.272 in. Elevation:0 ft.
Element Flows To:
Outlet 1 Outlet 2

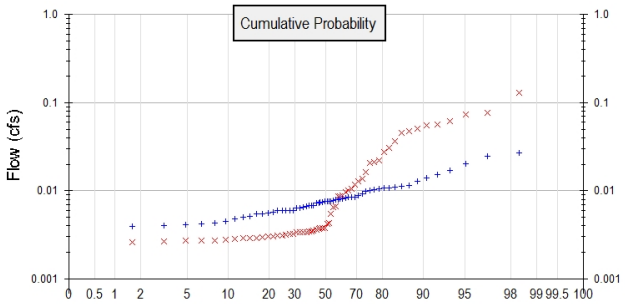
Vault Hydraulic Table

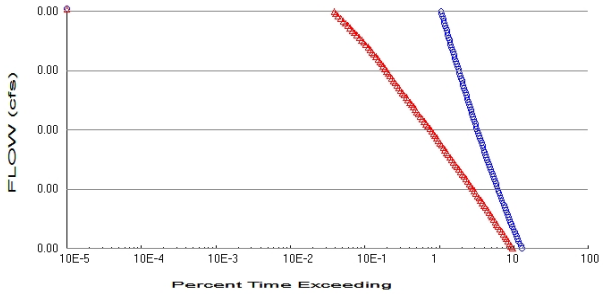
Stage(feet)	Area(ac.)	Volume(ac-ft.)	Discharge(cfs)	Infilt(cfs)
0.0000	0.001	0.000	0.000	0.000
0.0556	0.001	0.000	0.000	0.000
0.1111	0.001	0.000	0.000	0.000
0.1667	0.001	0.000	0.000	0.000
0.2222	0.001	0.000	0.000	0.000
0.2778	0.001	0.000	0.001	0.000
0.3333	0.001	0.000	0.001	0.000
0.3889	0.001	0.000	0.001	0.000
0.4444	0.001	0.000	0.001	0.000
0.5000	0.001	0.000	0.001	0.000
0.5556	0.001	0.000	0.001	0.000
0.6111	0.001	0.000	0.001	0.000
0.6667	0.001	0.000	0.001	0.000
0.7222	0.001	0.000	0.001	0.000
0.7778	0.001	0.000	0.001	0.000
0.8333	0.001	0.000	0.001	0.000
0.8889	0.001	0.001	0.001	0.000
0.9444	0.001	0.001	0.002	0.000
1.0000	0.001	0.001	0.002	0.000
1.0556	0.001	0.001	0.002	0.000
1.1111	0.001	0.001	0.002	0.000
1.1667	0.001	0.001	0.002	0.000
1.2222	0.001	0.001	0.002	0.000
1.2778	0.001	0.001	0.002	0.000
1.3333	0.001	0.001	0.002	0.000
1.3889	0.001	0.001	0.002	0.000
1.4444	0.001	0.001	0.002	0.000
1.5000	0.001	0.001	0.002	0.000
1.5556	0.001	0.001	0.002	0.000
1.6111	0.001	0.001	0.002	0.000
1.6667	0.001	0.001	0.002	0.000
1.7222	0.001	0.001	0.002	0.000
1.7778	0.001	0.002	0.002	0.000
1.8333	0.001	0.002	0.002	0.000
1.8889	0.001	0.002	0.002	0.000
1.9444	0.001	0.002	0.002	0.000
2.0000	0.001	0.002	0.002	0.000
2.0556	0.001	0.002	0.002	0.000
2.1111	0.001	0.002	0.002	0.000

2.1667	0.001	0.002	0.003	0.000
2.2222	0.001	0.002	0.003	0.000
2.2778	0.001	0.002	0.003	0.000
2.3333	0.001	0.002	0.003	0.000
2.3889	0.001	0.002	0.003	0.000
2.4444	0.001	0.002	0.003	0.000
2.5000	0.001	0.002	0.003	0.000
2.5556	0.001	0.002	0.003	0.000
2.6111	0.001	0.002	0.003	0.000
2.6667	0.001	0.003	0.003	0.000
2.7222	0.001	0.003	0.003	0.000
2.7778	0.001	0.003	0.003	0.000
2.8333	0.001	0.003	0.003	0.000
2.8889	0.001	0.003	0.003	0.000
2.9444	0.001	0.003	0.003	0.000
3.0000	0.001	0.003	0.003	0.000
3.0556	0.001	0.003	0.003	0.000
3.1111	0.001	0.003	0.003	0.000
3.1667	0.001	0.003	0.003	0.000
3.2222	0.001	0.003	0.003	0.000
3.2778	0.001	0.003	0.003	0.000
3.3333	0.001	0.003	0.003	0.000
3.3889	0.001	0.003	0.003	0.000
3.4444	0.001	0.003	0.003	0.000
3.5000	0.001	0.003	0.003	0.000
3.5556	0.001	0.004	0.003	0.000
3.6111	0.001	0.004	0.003	0.000
3.6667	0.001	0.004	0.004	0.000
3.7222	0.001	0.004	0.005	0.000
3.7778	0.001	0.004	0.006	0.000
3.8333	0.001	0.004	0.007	0.000
3.8889	0.001	0.004	0.008	0.000
3.9444	0.001	0.004	0.010	0.000
4.0000	0.001	0.004	0.011	0.000
4.0556	0.001	0.004	0.150	0.000
4.1111	0.001	0.004	0.401	0.000
4.1667	0.001	0.004	0.715	0.000
4.2222	0.001	0.004	1.057	0.000
4.2778	0.001	0.004	1.395	0.000
4.3333	0.001	0.004	1.695	0.000
4.3889	0.001	0.004	1.933	0.000
4.4444	0.001	0.005	2.100	0.000
4.5000	0.001	0.005	2.215	0.000
4.5556	0.001	0.005	2.359	0.000
4.6111	0.001	0.005	2.474	0.000
4.6667	0.001	0.005	2.583	0.000
4.7222	0.001	0.005	2.688	0.000
4.7778	0.001	0.005	2.789	0.000
4.8333	0.001	0.005	2.887	0.000
4.8889	0.001	0.005	2.981	0.000
4.9444	0.001	0.005	3.073	0.000
5.0000	0.001	0.005	3.161	0.000
5.0556	0.001	0.005	3.248	0.000
5.1111	0.000	0.000	3.332	0.000

Analysis Results
POC 1







\+ Predeveloped x Mitigated

Predeveloped Landuse Totals for POC #1
Total Pervious Area: 0.3562
Total Impervious Area: 0

Mitigated Landuse Totals for POC #1
Total Pervious Area: 0.1113
Total Impervious Area: 0.2449

Flow Frequency Method: Log Pearson Type III 17B

Flow Frequency Return Periods for Predeveloped. POC #1

Return Period	**Flow(cfs)**
2 year	0.007636
5 year	0.011302
10 year	0.013812
25 year	0.017049
50 year	0.019498
100 year	0.021974

Flow Frequency Return Periods for Mitigated. POC #1

Return Period	**Flow(cfs)**
2 year	0.006848
5 year	0.019067
10 year	0.034833
25 year	0.069822
50 year	0.112706
100 year	0.176916

Annual Peaks

Annual Peaks for Predeveloped and Mitigated. POC #1

Year	Predeveloped	Mitigated
1949	0.004	0.003
1950	0.008	0.010
1951	0.007	0.013
1952	0.005	0.003
1953	0.004	0.003
1954	0.017	0.004
1955	0.011	0.028
1956	0.010	0.031
1957	0.011	0.004
1958	0.008	0.050
1959	0.008	0.003
1960	0.007	0.004
1961	0.008	0.062
1962	0.007	0.005
1963	0.008	0.016
1964	0.007	0.003
1965	0.008	0.002
1966	0.004	0.003
1967	0.009	0.076
1968	0.011	0.010
1969	0.008	0.009
1970	0.006	0.003
1971	0.008	0.011
1972	0.007	0.047
1973	0.006	0.003
1974	0.010	0.007
1975	0.006	0.004
1976	0.006	0.004
1977	0.005	0.003
1978	0.006	0.003
1979	0.011	0.057
1980	0.007	0.003
1981	0.005	0.003
1982	0.007	0.012
1983	0.010	0.004
1984	0.008	0.003
1985	0.010	0.021
1986	0.024	0.074
1987	0.011	0.021
1988	0.006	0.003
1989	0.005	0.003
1990	0.008	0.003
1991	0.008	0.004
1992	0.006	0.003
1993	0.004	0.003
1994	0.004	0.003
1995	0.008	0.003
1996	0.014	0.014
1997	0.027	0.130
1998	0.005	0.022
1999	0.007	0.003
2000	0.004	0.009
2001	0.001	0.003
2002	0.008	0.003
2003	0.006	0.003
2004	0.009	0.055

2005	0.006	0.009
2006	0.015	0.036
2007	0.013	0.006
2008	0.020	0.045
2009	0.006	0.004

Ranked Annual Peaks

Ranked Annual Peaks for Predeveloped and Mitigated. POC #1

Rank	Predeveloped	Mitigated
1	0.0267	0.1296
2	0.0244	0.0762
3	0.0204	0.0740
4	0.0169	0.0622
5	0.0151	0.0566
6	0.0140	0.0552
7	0.0128	0.0503
8	0.0115	0.0475
9	0.0112	0.0455
10	0.0109	0.0362
11	0.0109	0.0309
12	0.0107	0.0276
13	0.0104	0.0221
14	0.0102	0.0211
15	0.0101	0.0207
16	0.0099	0.0164
17	0.0093	0.0136
18	0.0088	0.0129
19	0.0084	0.0118
20	0.0084	0.0106
21	0.0084	0.0100
22	0.0082	0.0096
23	0.0082	0.0088
24	0.0080	0.0087
25	0.0080	0.0087
26	0.0079	0.0067
27	0.0077	0.0065
28	0.0076	0.0055
29	0.0076	0.0043
30	0.0076	0.0042
31	0.0075	0.0038
32	0.0074	0.0037
33	0.0073	0.0037
34	0.0073	0.0037
35	0.0072	0.0036
36	0.0068	0.0035
37	0.0067	0.0035
38	0.0067	0.0034
39	0.0066	0.0034
40	0.0065	0.0034
41	0.0064	0.0034
42	0.0064	0.0033
43	0.0060	0.0033
44	0.0060	0.0033
45	0.0060	0.0032
46	0.0060	0.0031
47	0.0060	0.0031
48	0.0057	0.0030
49	0.0056	0.0030

50	0.0055	0.0030
51	0.0054	0.0029
52	0.0051	0.0029
53	0.0051	0.0029
54	0.0048	0.0028
55	0.0045	0.0028
56	0.0043	0.0027
57	0.0042	0.0027
58	0.0041	0.0027
59	0.0040	0.0027
60	0.0039	0.0026
61	0.0013	0.0024

Duration Flows

The Facility PASSED

Flow(cfs)	Predev	Mit	Percentage	Pass/Fail
0.0006	276343	204049	73	Pass
0.0006	266504	195772	73	Pass
0.0007	257307	187687	72	Pass
0.0007	248538	178768	71	Pass
0.0007	240624	170533	70	Pass
0.0008	232924	162705	69	Pass
0.0008	225438	155090	68	Pass
0.0008	218594	147155	67	Pass
0.0009	211792	138664	65	Pass
0.0009	205375	132140	64	Pass
0.0009	199194	126322	63	Pass
0.0010	193119	120419	62	Pass
0.0010	187302	114879	61	Pass
0.0010	181655	109446	60	Pass
0.0011	176351	104442	59	Pass
0.0011	171217	99330	58	Pass
0.0011	166041	94410	56	Pass
0.0012	161229	89747	55	Pass
0.0012	156652	85234	54	Pass
0.0012	152160	80914	53	Pass
0.0013	147904	76807	51	Pass
0.0013	143754	72914	50	Pass
0.0013	139904	69428	49	Pass
0.0014	136182	66134	48	Pass
0.0014	132461	62862	47	Pass
0.0014	128974	59846	46	Pass
0.0015	125445	56787	45	Pass
0.0015	122151	53921	44	Pass
0.0015	118943	51205	43	Pass
0.0016	115799	48531	41	Pass
0.0016	112869	46050	40	Pass
0.0016	109874	43483	39	Pass
0.0016	107008	41173	38	Pass
0.0017	104270	39035	37	Pass
0.0017	101533	37003	36	Pass
0.0017	98945	35035	35	Pass
0.0018	96378	33131	34	Pass
0.0018	93940	31399	33	Pass
0.0018	91608	29773	32	Pass
0.0019	89320	28148	31	Pass
0.0019	87095	26693	30	Pass
0.0019	84914	25389	29	Pass
0.0020	82839	24169	29	Pass
0.0020	80764	23014	28	Pass
0.0020	78711	21881	27	Pass
0.0021	76743	20762	27	Pass
0.0021	74861	19680	26	Pass
0.0021	73064	18666	25	Pass
0.0022	71332	17781	24	Pass
0.0022	69599	16842	24	Pass
0.0022	67995	15950	23	Pass
0.0023	66369	15045	22	Pass
0.0023	64851	14196	21	Pass

0.0023	63396	13385	21	Pass
0.0024	61878	12628	20	Pass
0.0024	60509	11920	19	Pass
0.0024	59119	11272	19	Pass
0.0025	57728	10692	18	Pass
0.0025	56424	10136	17	Pass
0.0025	55098	9631	17	Pass
0.0026	53814	9090	16	Pass
0.0026	52595	8605	16	Pass
0.0026	51376	8119	15	Pass
0.0027	50242	7689	15	Pass
0.0027	49087	7242	14	Pass
0.0027	47996	6823	14	Pass
0.0027	46970	6449	13	Pass
0.0028	45922	6115	13	Pass
0.0028	44916	5796	12	Pass
0.0028	43911	5473	12	Pass
0.0029	42927	5189	12	Pass
0.0029	42029	4919	11	Pass
0.0029	41045	4654	11	Pass
0.0030	40147	4436	11	Pass
0.0030	39248	4190	10	Pass
0.0030	38372	3965	10	Pass
0.0031	37452	3762	10	Pass
0.0031	36596	3583	9	Pass
0.0031	35762	3407	9	Pass
0.0032	34907	3215	9	Pass
0.0032	34137	3029	8	Pass
0.0032	33345	2838	8	Pass
0.0033	32618	2674	8	Pass
0.0033	31869	2526	7	Pass
0.0033	31142	2372	7	Pass
0.0034	30479	2214	7	Pass
0.0034	29816	2078	6	Pass
0.0034	29174	1935	6	Pass
0.0035	28575	1794	6	Pass
0.0035	27934	1672	5	Pass
0.0035	27335	1554	5	Pass
0.0036	26736	1460	5	Pass
0.0036	26159	1355	5	Pass
0.0036	25624	1270	4	Pass
0.0037	25068	1183	4	Pass
0.0037	24554	1097	4	Pass
0.0037	24062	1018	4	Pass
0.0038	23570	928	3	Pass
0.0038	23121	868	3	Pass
0.0038	22629	834	3	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
Vault 1 POC	☐	6.14			☐	0.00			
retention 1	☐	18.04			☐	99.36			
Sand- Filter 1	☐	12.16			☐	0.00			
Total Volume Infiltrated		36.35	0.00	0.00		49.32	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

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   Detention.wdm
MESSU       25   PreDetention.MES
            27   PreDetention.L61
            28   PreDetention.L62
            30   POCDetention1.dat
END FILES

OPN SEQUENCE
    INGRP              INDELT 00:15
      PERLND      10
      COPY       501
      DISPLY       1
    END INGRP
END OPN SEQUENCE
DISPLY
  DISPLY-INFO1
    # -  #<----------Title----------->***TRAN PIVL DIG1 FIL1  PYR DIG2 FIL2 YRND
    1        Combine Bio                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           ***
   10     C, 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 ***
   10         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  *********
   10         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 ***
   10         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
   10              0       4.5      0.08       400      0.05       0.5     0.996
  END PWAT-PARM2

  PWAT-PARM3
    <PLS >      PWATER input info: Part 3         ***
    # -  # ***PETMAX    PETMIN    INFEXP    INFILD    DEEPFR    BASETP    AGWETP
   10             0         0         2         2         0         0         0
  END PWAT-PARM3
  PWAT-PARM4
    <PLS >     PWATER input info: Part 4                              ***
    # -  #     CEPSC      UZSN      NSUR     INTFW       IRC     LZETP ***
   10           0.2       0.5      0.35         6       0.5       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
   10             0         0         0         0       2.5         1         0
  END PWAT-STATE1

END PERLND

IMPLND
  GEN-INFO
    <PLS ><-------Name------->   Unit-systems   Printer ***
    # -  #                     User  t-series Engl Metr ***
                                     in  out           ***
  END GEN-INFO
  *** Section IWATER***

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

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

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

  IWAT-PARM2
    <PLS >      IWATER input info: Part 2         ***
    # -  # ***  LSUR     SLSUR      NSUR     RETSC
  END IWAT-PARM2

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

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

```
END IMPLND

SCHEMATIC
<-Source->                  <--Area-->     <-Target->   MBLK   ***
<Name>   #                  <-factor->     <Name>   #   Tbl#   ***
Combine Bio***
PERLND  10                      0.2138     COPY   501     12
PERLND  10                      0.2138     COPY   501     13
Filtera***
PERLND  10                      0.1017     COPY   501     12
PERLND  10                      0.1017     COPY   501     13
Detain***
PERLND  10                      0.0407     COPY   501     12
PERLND  10                      0.0407     COPY   501     13

******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


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   Detention.wdm
MESSU       25   MitDetention.MES
            27   MitDetention.L61
            28   MitDetention.L62
            30   POCDetention1.dat
END FILES

OPN SEQUENCE
    INGRP              INDELT 00:15
      PERLND       7
      IMPLND      11
      IMPLND       5
      IMPLND       8
      GENER        2
      RCHRES       1
      RCHRES       2
      RCHRES       3
      RCHRES       4
      COPY         1
      COPY       501
      DISPLY       1
    END INGRP
END OPN SEQUENCE
DISPLY
  DISPLY-INFO1
    # -  #<----------Title----------->***TRAN PIVL DIG1 FIL1  PYR DIG2 FIL2 YRND
    1        Vault  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 ***
    2        24
  END OPCODE
  PARM
    #    #         K ***
    2             0.
  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
  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
  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
  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
  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
  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
  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
  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
  END PWAT-STATE1

END PERLND

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

  ACTIVITY
    <PLS > ************* Active Sections ****************************
    # -  # ATMP SNOW IWAT  SLD  IWG IQAL   ***
   11         0    0    1    0    0    0
    5         0    0    1    0    0    0
    8         0    0    1    0    0    0
  END ACTIVITY

  PRINT-INFO
    <ILS > ******** Print-flags ******** PIVL  PYR
    # -  # ATMP SNOW IWAT  SLD  IWG IQAL    *********
   11         0    0    4    0    0    0    1    9
    5         0    0    4    0    0    0    1    9
    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     ***
   11         0    0    0    0    0
    5         0    0    0    0    0
    8         0    0    0    0    0
  END IWAT-PARM1

  IWAT-PARM2
    <PLS >      IWATER input info: Part 2         ***
    # -  # ***  LSUR     SLSUR      NSUR     RETSC
   11            400      0.01       0.1       0.1
    5            400      0.01       0.1       0.1
    8            400      0.01       0.1       0.1
  END IWAT-PARM2

  IWAT-PARM3
    <PLS >      IWATER input info: Part 3         ***
    # -  # ***PETMAX    PETMIN
   11              0         0
    5              0         0
    8              0         0
  END IWAT-PARM3

  IWAT-STATE1
    <PLS > *** Initial conditions at start of simulation
    # -  # ***  RETS      SURS
   11              0         0
    5              0         0
    8              0         0
  END IWAT-STATE1

END IMPLND

SCHEMATIC
<-Source->                  <--Area-->     <-Target->   MBLK   ***
<Name>   #                  <-factor->     <Name>   #   Tbl#   ***
Combine Bio 1***
PERLND   7                      0.0954     RCHRES   1      2
PERLND   7                      0.0954     RCHRES   1      3
IMPLND  11                      0.1184     RCHRES   1      5
Filtera 1***
PERLND   7                      0.0159     RCHRES   3      2
PERLND   7                      0.0159     RCHRES   3      3
IMPLND   5                      0.0699     RCHRES   3      5
IMPLND   8                      0.0159     RCHRES   3      5
Detain-1***
IMPLND   5                      0.0407     RCHRES   4      5

******Routing******
RCHRES   2                           1     RCHRES   4      7
RCHRES   2                                 COPY     1     17
RCHRES   1                           1     RCHRES   4      7
RCHRES   1                                 COPY     1     17
RCHRES   1                           1     RCHRES   2      8
RCHRES   3                           1     RCHRES   4      7
RCHRES   3                                 COPY     1     17
IMPLND   5                      0.0407     COPY     1     15
RCHRES   4                           1     COPY   501     16
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
GENER    2 OUTPUT TIMSER      .0011111     RCHRES   1     EXTNL  OUTDGT 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                               ***
    1     Surface retentio-006    3    1    1    1   28    0    1
    2     Bioretention  1         2    1    1    1   28    0    1
    3     Sand- Filter  1         2    1    1    1   28    0    1
    4     Vault  1                1    1    1    1   28    0    1
  END GEN-INFO
  *** Section RCHRES***

  ACTIVITY
    <PLS > ************ Active Sections ******************************
    # -  # HYFG ADFG CNFG HTFG SDFG GQFG OXFG NUFG PKFG PHFG ***
    1         1    0    0    0    0    0    0    0    0    0
    2         1    0    0    0    0    0    0    0    0    0
    3         1    0    0    0    0    0    0    0    0    0
    4         1    0    0    0    0    0    0    0    0    0
  END ACTIVITY

  PRINT-INFO
    <PLS > ***************** Print-flags ******************** PIVL  PYR
    # -  # HYDR ADCA CONS HEAT  SED  GQL OXRX NUTR PLNK PHCB PIVL  PYR  *********
    1         4    0    0    0    0    0    0    0    0    0    1    9
    2         4    0    0    0    0    0    0    0    0    0    1    9
    3         4    0    0    0    0    0    0    0    0    0    1    9
    4         4    0    0    0    0    0    0    0    0    0    1    9
  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
             *  *  *  *    *  *  *  *  *       *  *  *  *  *        ***
    1        0  1  0  0    4  5  6  0  0       0  1  0  0  0       2  1  2  2  2
    2        0  1  0  0    4  5  0  0  0       0  0  0  0  0       2  2  2  2  2
    3        0  1  0  0    4  5  0  0  0       0  0  0  0  0       2  2  2  2  2
    4        0  1  0  0    4  0  0  0  0       0  0  0  0  0       2  2  2  2  2
  END HYDR-PARM1

  HYDR-PARM2
    # -  #    FTABNO       LEN      DELTH     STCOR        KS      DB50       ***
  <------><--------><--------><--------><--------><--------><--------><--------> ***
    1              1      0.01       0.0       0.0       0.5       0.0
    2              2      0.02       0.0       0.0       0.5       0.0
    3              3      0.01       0.0       0.0       0.5       0.0
    4              4      0.01       0.0       0.0       0.5       0.0
  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
  <------><-------->     <---><---><---><---><---> *** <---><---><---><---><--->
    1            0         4.0  5.0  6.0  0.0  0.0       0.0  0.0  0.0  0.0  0.0
    2            0         4.0  5.0  0.0  0.0  0.0       0.0  0.0  0.0  0.0  0.0
    3            0         4.0  5.0  0.0  0.0  0.0       0.0  0.0  0.0  0.0  0.0
    4            0         4.0  0.0  0.0  0.0  0.0       0.0  0.0  0.0  0.0  0.0
  END HYDR-INIT
END RCHRES

SPEC-ACTIONS
*** User-Defined Variable Quantity Lines
***                          addr
***                         <------>
*** kwd  varnam optyp  opn  vari  s1 s2 s3 tp multiply  lc ls ac as agfn ***
  <****> <----> <----> <-> <----><-><-><-><-><--------> <><-> <><-> <--> ***
```

```
  UVQUAN vol2   RCHRES   2 VOL              4
  UVQUAN v2m2   GLOBAL     WORKSP  1        3
  UVQUAN vpo2   GLOBAL     WORKSP  2        3
  UVQUAN v2d2   GENER    2 K       1        3
*** User-Defined Target Variable Names
***                  addr or                        addr or
***                 <------>                       <------>
*** kwd   varnam ct  vari  s1 s2 s3  frac oper     vari  s1 s2 s3  frac oper
  <****>  <----><-> <----><-><-><-> <---> <-->    <----><-><-><-> <---> <-->
  UVNAME  v2m2    1 WORKSP  1         1.0 QUAN
  UVNAME  vpo2    1 WORKSP  2         1.0 QUAN
  UVNAME  v2d2    1 K       1         1.0 QUAN
*** opt foplop dcdts  yr mo dy hr mn d t   vnam  s1 s2 s3 ac quantity  tc  ts rp
  <****><-><--><><-><--> <> <> <> <><><>  <----><-><-><-><-><--------> <> <-><->
  GENER   2                               v2m2            =  384.
*** Compute remaining available pore space
  GENER   2                               vpo2            =  v2m2
  GENER   2                               vpo2           -=  vol2
*** Check to see if VPORA goes negative; if so set VPORA = 0.0
IF (vpo2 < 0.0) THEN
  GENER   2                               vpo2            =  0.0
END IF
*** Infiltration volume
  GENER   2                               v2d2            =  vpo2
END SPEC-ACTIONS
FTABLES
  FTABLE      2
   47    5
     Depth      Area    Volume  Outflow1  Outflow2  Velocity  Travel Time***
      (ft)   (acres) (acre-ft)   (cfs)     (cfs)   (ft/sec)    (Minutes)***
  0.000000  0.023485  0.000000  0.000000  0.000000
  0.032967  0.023288  0.000053  0.000000  0.000000
  0.065934  0.022896  0.000109  0.000000  0.001020
  0.098901  0.022505  0.000167  0.000000  0.001732
  0.131868  0.022115  0.000228  0.000000  0.001732
  0.164835  0.021727  0.000291  0.000000  0.001732
  0.197802  0.021339  0.000357  0.000000  0.001732
  0.230769  0.020953  0.000425  0.000000  0.001732
  0.263736  0.020568  0.000496  0.000000  0.001732
  0.296703  0.020185  0.000570  0.000000  0.001732
  0.329670  0.019802  0.000646  0.000000  0.001732
  0.362637  0.019421  0.000725  0.000000  0.001732
  0.395604  0.019042  0.000807  0.000000  0.001732
  0.428571  0.018663  0.000975  0.000000  0.001732
  0.461538  0.018286  0.001149  0.000000  0.001732
  0.494505  0.017910  0.001328  0.000000  0.001732
  0.527473  0.017535  0.001513  0.000000  0.001732
  0.560440  0.017161  0.001703  0.000000  0.001732
  0.593407  0.016789  0.001898  0.000000  0.001732
  0.626374  0.016418  0.002099  0.000000  0.001732
  0.659341  0.016048  0.002305  0.000000  0.001732
  0.692308  0.015679  0.002517  0.000000  0.001732
  0.725275  0.015312  0.002734  0.000000  0.001732
  0.758242  0.014946  0.002956  0.000000  0.001732
  0.791209  0.014581  0.003184  0.000000  0.001732
  0.824176  0.014217  0.003418  0.000000  0.001732
  0.857143  0.013855  0.003657  0.000000  0.001732
  0.890110  0.013494  0.003902  0.000000  0.001732
  0.923077  0.013134  0.004152  0.000000  0.001732
  0.956044  0.012775  0.004408  0.000000  0.001732
  0.989011  0.012418  0.004670  0.000000  0.001732
  1.021978  0.012062  0.004937  0.000000  0.001732
  1.054945  0.011707  0.005210  0.000000  0.001732
  1.087912  0.011353  0.005488  0.000000  0.001732
  1.120879  0.011001  0.005772  0.000000  0.001732
  1.153846  0.010650  0.006062  0.000000  0.001732
  1.186813  0.010300  0.006358  0.000000  0.001732
  1.219780  0.009951  0.006659  0.000000  0.001732
  1.252747  0.009604  0.006967  0.000000  0.001732
  1.285714  0.009258  0.007280  0.000000  0.001732
```

```
  1.318681  0.008913  0.007598  0.000000  0.001732
  1.351648  0.008569  0.007923  0.000000  0.001732
  1.384615  0.008227  0.008253  0.000000  0.001732
  1.417582  0.007886  0.008590  0.000000  0.001732
  1.450549  0.007546  0.008932  0.000000  0.001732
  1.483516  0.007207  0.009280  0.000000  0.001732
  1.500000  0.006870  0.019858  0.000000  0.001732
  END FTABLE  2
  FTABLE      1
   47    6
     Depth      Area    Volume  Outflow1  Outflow2  outflow 3 Velocity  Travel
Time***
      (ft)   (acres) (acre-ft)   (cfs)      (cfs)     (cfs)   (ft/sec)
(Minutes)***
  0.000000  0.006870  0.000000  0.000000  0.000000  0.000000
  0.032967  0.023879  0.000781  0.000000  0.084952  0.000000
  0.065934  0.024274  0.001574  0.000000  0.086779  0.000000
  0.098901  0.024671  0.002381  0.000000  0.088606  0.000000
  0.131868  0.025069  0.003201  0.000000  0.090433  0.000000
  0.164835  0.025468  0.004034  0.000000  0.092260  0.000000
  0.197802  0.025869  0.004880  0.000000  0.094087  0.000000
  0.230769  0.026270  0.005740  0.000000  0.095914  0.000000
  0.263736  0.026673  0.006613  0.000000  0.097740  0.000000
  0.296703  0.027077  0.007499  0.000000  0.099567  0.000000
  0.329670  0.027483  0.008398  0.000000  0.101394  0.000000
  0.362637  0.027889  0.009311  0.000000  0.103221  0.000000
  0.395604  0.028297  0.010237  0.000000  0.105048  0.000000
  0.428571  0.028706  0.011176  0.000000  0.106875  0.000000
  0.461538  0.029117  0.012129  0.000000  0.108702  0.000000
  0.494505  0.029528  0.013096  0.000000  0.110529  0.000000
  0.527473  0.029941  0.014076  0.000000  0.112356  0.000000
  0.560440  0.030355  0.015070  0.000000  0.114183  0.000000
  0.593407  0.030771  0.016078  0.000000  0.116010  0.000000
  0.626374  0.031187  0.017099  0.000000  0.117837  0.000000
  0.659341  0.031605  0.018134  0.000000  0.119664  0.000000
  0.692308  0.032024  0.019183  0.000000  0.121490  0.000000
  0.725275  0.032445  0.020246  0.000000  0.123317  0.000000
  0.758242  0.032866  0.021322  0.000000  0.125144  0.000000
  0.791209  0.033289  0.022413  0.000000  0.126971  0.000000
  0.824176  0.033713  0.023517  0.000000  0.128798  0.000000
  0.857143  0.034139  0.024636  0.000000  0.130625  0.000000
  0.890110  0.034565  0.025768  0.000000  0.132452  0.000000
  0.923077  0.034993  0.026915  0.000000  0.134279  0.000000
  0.956044  0.035422  0.028075  0.000000  0.136106  0.000000
  0.989011  0.035853  0.029250  0.000000  0.137933  0.000000
  1.021978  0.036284  0.030439  0.034569  0.139760  0.000000
  1.054945  0.036717  0.031643  0.136453  0.141587  0.000000
  1.087912  0.037151  0.032860  0.275387  0.143414  0.000000
  1.120879  0.037586  0.034092  0.441409  0.145241  0.000000
  1.153846  0.038023  0.035339  0.627270  0.147067  0.000000
  1.186813  0.038461  0.036599  0.826090  0.148894  0.000000
  1.219780  0.038900  0.037874  1.030827  0.150721  0.000000
  1.252747  0.039340  0.039164  1.234286  0.152548  0.000000
  1.285714  0.039782  0.040468  1.429395  0.154375  0.000000
  1.318681  0.040225  0.041787  1.609623  0.156202  0.000000
  1.351648  0.040669  0.043120  1.769522  0.158029  0.000000
  1.384615  0.041114  0.044469  1.905359  0.159856  0.000000
  1.417582  0.041561  0.045831  2.015818  0.161683  0.000000
  1.450549  0.042008  0.047209  2.102770  0.163510  0.000000
  1.483516  0.042458  0.048601  2.172110  0.165337  0.000000
  1.500000  0.042683  0.049303  2.263538  0.166250  0.000000
  END FTABLE  1
  FTABLE      3
   91    5
     Depth      Area    Volume  Outflow1  Outflow2  Velocity  Travel Time***
      (ft)   (acres) (acre-ft)   (cfs)      (cfs)   (ft/sec)    (Minutes)***
  0.000000  0.000367  0.000000  0.000000  0.000000
  0.008333  0.000367  0.000003  0.000000  0.009235
  0.016667  0.000367  0.000006  0.000000  0.009278
  0.025000  0.000367  0.000009  0.000000  0.009320
```

0.033333	0.000367	0.000012	0.000000	0.009363
0.041667	0.000367	0.000015	0.000000	0.009405
0.050000	0.000367	0.000018	0.000000	0.009448
0.058333	0.000367	0.000021	0.000000	0.009491
0.066667	0.000367	0.000024	0.000000	0.009533
0.075000	0.000367	0.000028	0.000000	0.009576
0.083333	0.000367	0.000031	0.000000	0.009618
0.091667	0.000367	0.000034	0.000000	0.009661
0.100000	0.000367	0.000037	0.000000	0.009703
0.108333	0.000367	0.000040	0.000000	0.009746
0.116667	0.000367	0.000043	0.000000	0.009788
0.125000	0.000367	0.000046	0.000000	0.009831
0.133333	0.000367	0.000049	0.000000	0.009874
0.141667	0.000367	0.000052	0.000000	0.009916
0.150000	0.000367	0.000055	0.000000	0.009959
0.158333	0.000367	0.000058	0.000000	0.010001
0.166667	0.000367	0.000061	0.000000	0.010044
0.175000	0.000367	0.000064	0.000000	0.010086
0.183333	0.000367	0.000067	0.000000	0.010129
0.191667	0.000367	0.000070	0.000000	0.010171
0.200000	0.000367	0.000073	0.000000	0.010214
0.208333	0.000367	0.000077	0.000000	0.010257
0.216667	0.000367	0.000080	0.000000	0.010299
0.225000	0.000367	0.000083	0.000000	0.010342
0.233333	0.000367	0.000086	0.000000	0.010384
0.241667	0.000367	0.000089	0.000000	0.010427
0.250000	0.000367	0.000092	0.000000	0.010469
0.258333	0.000367	0.000095	0.000000	0.010512
0.266667	0.000367	0.000098	0.000000	0.010554
0.275000	0.000367	0.000101	0.000000	0.010597
0.283333	0.000367	0.000104	0.000000	0.010640
0.291667	0.000367	0.000107	0.000000	0.010682
0.300000	0.000367	0.000110	0.000000	0.010725
0.308333	0.000367	0.000113	0.000000	0.010767
0.316667	0.000367	0.000116	0.000000	0.010810
0.325000	0.000367	0.000119	0.000000	0.010852
0.333333	0.000367	0.000122	0.000000	0.010895
0.341667	0.000367	0.000125	0.000000	0.010937
0.350000	0.000367	0.000129	0.000000	0.010980
0.358333	0.000367	0.000132	0.000000	0.011023
0.366667	0.000367	0.000135	0.000000	0.011065
0.375000	0.000367	0.000138	0.000000	0.011108
0.383333	0.000367	0.000141	0.000000	0.011150
0.391667	0.000367	0.000144	0.000000	0.011193
0.400000	0.000367	0.000147	0.000000	0.011235
0.408333	0.000367	0.000150	0.000000	0.011278
0.416667	0.000367	0.000153	0.000000	0.011321
0.425000	0.000367	0.000156	0.000000	0.011363
0.433333	0.000367	0.000159	0.000000	0.011406
0.441667	0.000367	0.000162	0.000000	0.011448
0.450000	0.000367	0.000165	0.000000	0.011491
0.458333	0.000367	0.000168	0.000000	0.011533
0.466667	0.000367	0.000171	0.000000	0.011576
0.475000	0.000367	0.000174	0.000000	0.011618
0.483333	0.000367	0.000178	0.000000	0.011661
0.491667	0.000367	0.000181	0.000000	0.011704
0.500000	0.000367	0.000184	0.000000	0.011746
0.508333	0.000367	0.000187	0.000000	0.011789
0.516667	0.000367	0.000190	0.000000	0.011831
0.525000	0.000367	0.000193	0.000000	0.011874
0.533333	0.000367	0.000196	0.000000	0.011916
0.541667	0.000367	0.000199	0.000000	0.011959
0.550000	0.000367	0.000202	0.000000	0.012001
0.558333	0.000367	0.000205	0.000000	0.012044
0.566667	0.000367	0.000208	0.000000	0.012087
0.575000	0.000367	0.000211	0.000000	0.012129
0.583333	0.000367	0.000214	0.000000	0.012172
0.591667	0.000367	0.000217	0.000000	0.012214
0.600000	0.000367	0.000220	0.000000	0.012257
0.608333	0.000367	0.000223	0.000000	0.012299

```
0.616667  0.000367  0.000227  0.000000  0.012342
0.625000  0.000367  0.000230  0.000000  0.012384
0.633333  0.000367  0.000233  0.000000  0.012427
0.641667  0.000367  0.000236  0.000000  0.012470
0.650000  0.000367  0.000239  0.000000  0.012512
0.658333  0.000367  0.000242  0.000000  0.012555
0.666667  0.000367  0.000245  0.000000  0.012597
0.675000  0.000367  0.000248  0.000000  0.012640
0.683333  0.000367  0.000251  0.000000  0.012682
0.691667  0.000367  0.000254  0.000000  0.012725
0.700000  0.000367  0.000257  0.000000  0.012767
0.708333  0.000367  0.000260  0.067333  0.012810
0.716667  0.000367  0.000263  0.190433  0.012853
0.725000  0.000367  0.000266  0.349825  0.012895
0.733333  0.000367  0.000269  0.538557  0.012938
0.741667  0.000367  0.000272  0.752610  0.012980
0.750000  0.000367  0.000275  0.989273  0.013023
END FTABLE  3
FTABLE      4
 92    4
   Depth      Area    Volume  Outflow1 Velocity  Travel Time***
    (ft)   (acres) (acre-ft)   (cfs)   (ft/sec)    (Minutes)***
0.000000  0.001125  0.000000  0.000000
0.055556  0.001125  0.000062  0.000473
0.111111  0.001125  0.000125  0.000669
0.166667  0.001125  0.000187  0.000820
0.222222  0.001125  0.000250  0.000946
0.277778  0.001125  0.000312  0.001058
0.333333  0.001125  0.000375  0.001159
0.388889  0.001125  0.000437  0.001252
0.444444  0.001125  0.000500  0.001338
0.500000  0.001125  0.000562  0.001420
0.555556  0.001125  0.000625  0.001496
0.611111  0.001125  0.000687  0.001569
0.666667  0.001125  0.000750  0.001639
0.722222  0.001125  0.000812  0.001706
0.777778  0.001125  0.000875  0.001771
0.833333  0.001125  0.000937  0.001833
0.888889  0.001125  0.001000  0.001893
0.944444  0.001125  0.001062  0.001951
1.000000  0.001125  0.001125  0.002008
1.055556  0.001125  0.001187  0.002063
1.111111  0.001125  0.001250  0.002116
1.166667  0.001125  0.001312  0.002169
1.222222  0.001125  0.001375  0.002220
1.277778  0.001125  0.001437  0.002269
1.333333  0.001125  0.001500  0.002318
1.388889  0.001125  0.001562  0.002366
1.444444  0.001125  0.001625  0.002413
1.500000  0.001125  0.001687  0.002459
1.555556  0.001125  0.001750  0.002504
1.611111  0.001125  0.001812  0.002548
1.666667  0.001125  0.001875  0.002592
1.722222  0.001125  0.001937  0.002635
1.777778  0.001125  0.002000  0.002677
1.833333  0.001125  0.002062  0.002718
1.888889  0.001125  0.002125  0.002759
1.944444  0.001125  0.002187  0.002800
2.000000  0.001125  0.002250  0.002839
2.055556  0.001125  0.002312  0.002878
2.111111  0.001125  0.002375  0.002917
2.166667  0.001125  0.002437  0.002955
2.222222  0.001125  0.002500  0.002993
2.277778  0.001125  0.002562  0.003030
2.333333  0.001125  0.002625  0.003067
2.388889  0.001125  0.002687  0.003103
2.444444  0.001125  0.002750  0.003139
2.500000  0.001125  0.002812  0.003174
2.555556  0.001125  0.002875  0.003210
2.611111  0.001125  0.002937  0.003244
```

```
  2.666667  0.001125  0.003000  0.003279
  2.722222  0.001125  0.003062  0.003313
  2.777778  0.001125  0.003125  0.003346
  2.833333  0.001125  0.003187  0.003379
  2.888889  0.001125  0.003250  0.003412
  2.944444  0.001125  0.003312  0.003445
  3.000000  0.001125  0.003375  0.003477
  3.055556  0.001125  0.003437  0.003509
  3.111111  0.001125  0.003500  0.003541
  3.166667  0.001125  0.003562  0.003573
  3.222222  0.001125  0.003625  0.003604
  3.277778  0.001125  0.003687  0.003635
  3.333333  0.001125  0.003750  0.003666
  3.388889  0.001125  0.003812  0.003696
  3.444444  0.001125  0.003875  0.003726
  3.500000  0.001125  0.003937  0.003756
  3.555556  0.001125  0.004000  0.003786
  3.611111  0.001125  0.004062  0.003854
  3.666667  0.001125  0.004125  0.004410
  3.722222  0.001125  0.004187  0.005262
  3.777778  0.001125  0.004250  0.006310
  3.833333  0.001125  0.004312  0.007509
  3.888889  0.001125  0.004375  0.008831
  3.944444  0.001125  0.004437  0.010255
  4.000000  0.001125  0.004500  0.011766
  4.055556  0.001125  0.004562  0.150522
  4.111111  0.001125  0.004625  0.401660
  4.166667  0.001125  0.004687  0.715280
  4.222222  0.001125  0.004750  1.057906
  4.277778  0.001125  0.004812  1.395454
  4.333333  0.001125  0.004875  1.695398
  4.388889  0.001125  0.004937  1.933061
  4.444444  0.001125  0.004999  2.100216
  4.500000  0.001125  0.005062  2.215344
  4.555556  0.001125  0.005124  2.359631
  4.611111  0.001125  0.005187  2.474241
  4.666667  0.001125  0.005249  2.583750
  4.722222  0.001125  0.005312  2.688784
  4.777778  0.001125  0.005374  2.789851
  4.833333  0.001125  0.005437  2.887370
  4.888889  0.001125  0.005499  2.981689
  4.944444  0.001125  0.005562  3.073105
  5.000000  0.001125  0.005624  3.161870
  5.055556  0.001125  0.005687  3.248202
  END FTABLE  4
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
WDM      2 PREC     ENGL    1              RCHRES   1     EXTNL  PREC
WDM      1 EVAP     ENGL    0.5            RCHRES   1     EXTNL  POTEV
WDM      1 EVAP     ENGL    0.76           RCHRES   2     EXTNL  POTEV

END EXT SOURCES

EXT TARGETS
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Volume-> <Member> Tsys Tgap Amd ***
<Name>   #        <Name> # #<-factor->strg <Name>   # <Name>    tem strg strg***
RCHRES   4 HYDR   RO     1 1        1      WDM   1010 FLOW     ENGL      REPL
RCHRES   4 HYDR   STAGE  1 1        1      WDM   1011 STAG     ENGL      REPL
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        2
PERLND     PWATER SURO       0.083333      RCHRES         INFLOW IVOL
  END MASS-LINK    2

  MASS-LINK        3
PERLND     PWATER IFWO       0.083333      RCHRES         INFLOW IVOL
  END MASS-LINK    3

  MASS-LINK        5
IMPLND     IWATER SURO       0.083333      RCHRES         INFLOW IVOL
  END MASS-LINK    5

  MASS-LINK        7
RCHRES     OFLOW  OVOL   1                 RCHRES         INFLOW IVOL
  END MASS-LINK    7

  MASS-LINK        8
RCHRES     OFLOW  OVOL   2                 RCHRES         INFLOW IVOL
  END MASS-LINK    8

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

  MASS-LINK       16
RCHRES     ROFLOW                          COPY           INPUT  MEAN
  END MASS-LINK   16

  MASS-LINK       17
RCHRES     OFLOW  OVOL   1                 COPY           INPUT  MEAN
  END MASS-LINK   17


END MASS-LINK

END RUN
```

Disclaimer

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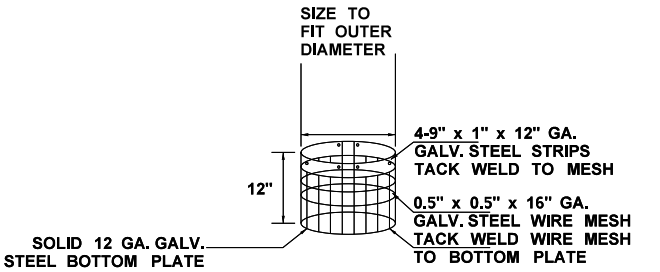
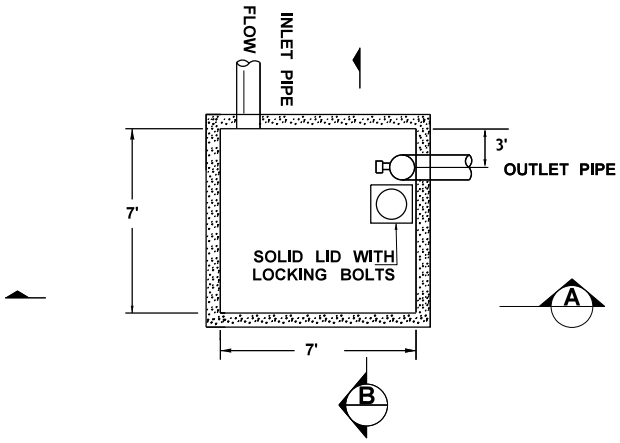


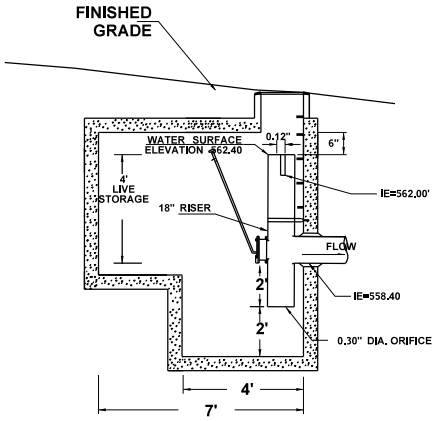
NOTE:

1. INSTALL SCREEN FOR ORIFICE SIZE LESS THAN 0.5-INCH DIAM.
2. ATTACH SCREEN TO FLOW RESTRICTOR WITH 6-1" METAL SCREWS - 2 PER STRAP, OR USE STAINLESS STEEL PIPE CLAMP

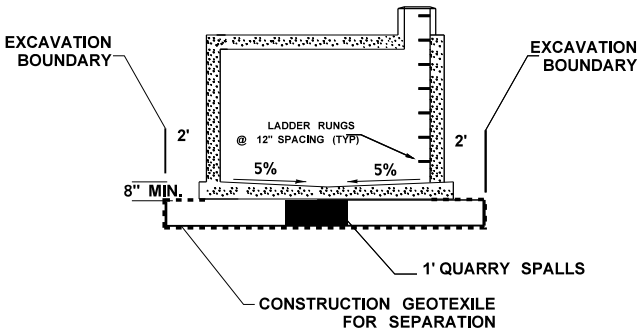
FLOW CONTROL (ORIFICE) SCREEN



PLAN VIEW OF STORMWATER DETENTION VAULT



SECTION A-A



SECTION B-B

DETENTION VAULT DETAILS

Appendix I

(B)

Pipe Conveyance Calculation

Trunk # 1

Storm Sewer Pipe Design

Project: *ICOM Harbour Pointe Blvd SW*
City: *Mukilteo*
County: *Snohomish*

m= 7.83 n= 0.582 Design year 25 Pavement thickness ft= 0.25 Pipe Thickness Inch= 2

													Discharge Drain Design							
		Source of Drainage	Drainage Area A (Acre)	Runoff Coeff. C	CA (acre)	Sum CA (acre)	Tc Across Area (minutes)	Total Tc= Col. 8a+Tc acreoss pipe length (minutes)	Rainfull Intensity (in/hr)	Runoff (cfs)	Contrib. inflow (cfs)	Total Flow (cfs)	Pipe Diamenter (inch)	Manning roughness coefficent "n"	Pipe Slope (ft/ft)	Velocity of Flow (ft/s)	Pipe Capacity (cfs)	Pipe Velocity Check (3ft/s-10ft/s)	Pipe Capacity check (column13vs column17)	Pipe Length (ft)
		4	5	6	7	8	8a	9	10	11	12	13	14	14a	15	16	17	17a	17b	18
0	82	Pavement	0.24	0.95	0.228	0.228	5	5	3.069	0.700	0	0.700	6	0.009	0.008	3.691	0.724	VELOCITY OK	ADEQUATE PIPE CAPACITY	82

Index to Rainfall Coefficents

2-year		**10**-year		**25**-year		**50**-year		**100**-year	
m	n	m	n	m	n	m	n	m	n
3.69	0.556	6.31	0.575	7.83	0.582	8.96	0.585	10.07	0.586

Q=CIA

Q	Flow(cfs)	C for paved=0.90
C	runoff Coefficient	C for grass=0.22
I	rainfall Intencity(in/hr)	
A	drainage area (Acres)	

Tc=L/K(s)^0.5

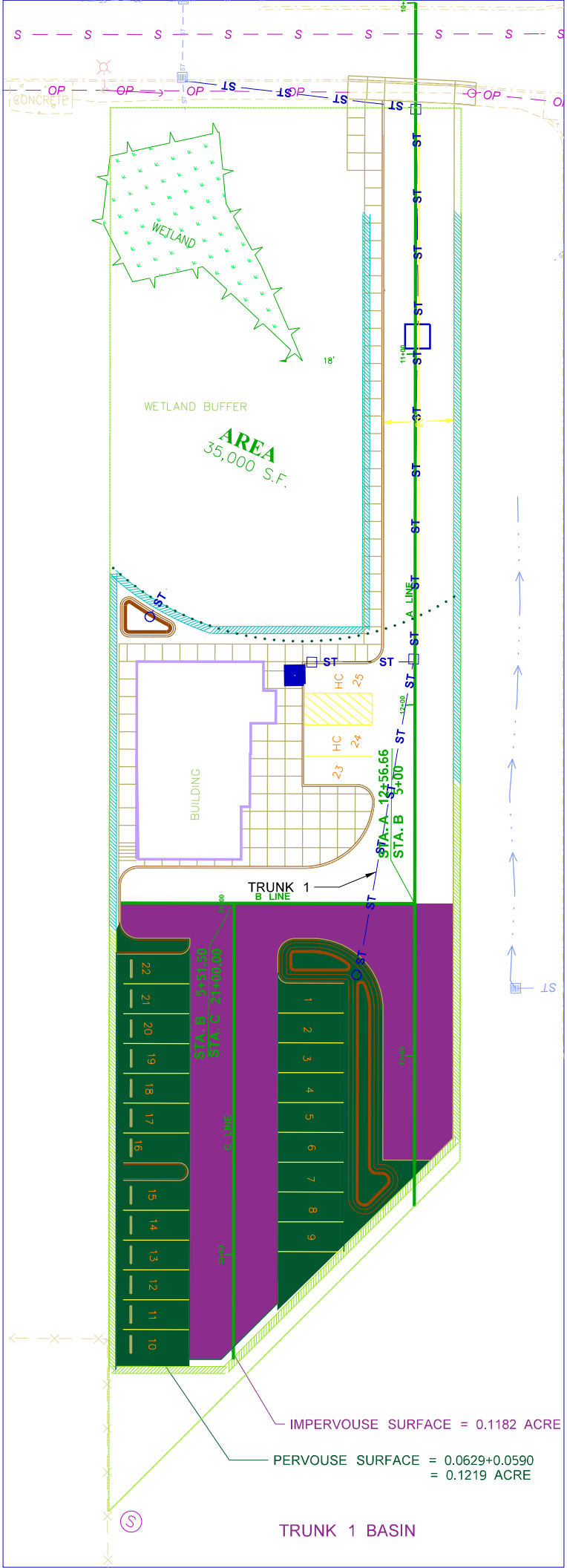
I=m/(Tc)^n
Tc=5 min Minmum

$$V=\frac{1.486}{n}R^{2/3}S^{1/2}$$ Manning's Equation

V	velocity ft/s
D	Pipe Diameter ft
S	Pipe slope ft/ft
n	Manning"s roughness coefficient

$$Q=VA \qquad A=PI\left(\frac{D}{4}\right)^{1/2}$$

Q	Full Flow Capacity cfs
V	Velocity ft/s
A	Cross Section Area of Pipe ft
D	Pipe Diameter ft


WETLAND
WETLAND BUFFER
AREA
35,000 S.F.
BUILDING
TRUNK 1
B LINE
STA. A 12+56.66
STA. B 5+00
STA. B 3+31.80
STA. C 4+00.00
A LINE
B LINE
C LINE
IMPERVOUSE SURFACE = 0.1182 ACRE
PERVOUSE SURFACE = 0.0629+0.0590
= 0.1219 ACRE
TRUNK 1 BASIN

Storm Sewer Pipe Design

Trunk # 2&3

Project: *ICOM Harbour Pointe Blvd SW*
City: *Mukilteo*
County: *Snohomish*

m= 7.83 n= 0.582 Design year 25 Pavement thickness ft= 0.25 Pipe Thickness Inch= 2

													Discharge Drain Design							
		Source of Drainage	Drainage Area A (Acre)	Runoff Coeff. C	CA (acre)	Sum CA (acre)	Tc Across Area (minutes)	Total Tc= Col. 8a+Tc acreoss pipe length (minutes)	Rainfull Intensity (in/hr)	Runoff (cfs)	Contrib. inflow (cfs)	Total Flow (cfs)	Pipe Diamenter (inch)	Manning roughness coefficent "n"	Pipe Slope (ft/ft)	Velocity of Flow (ft/s)	Pipe Capacity (cfs)	Pipe Velocity Check (3ft/s-10ft/s)	Pipe Capacity check (column13vs column17)	Pipe Length (ft)
				6	7	8	8a	9	10	11	12	13	14	14a	15	16	17	17a	17b	18
	21	Pavement	0.105	0.95	0.09975	0.09975	5	5	3.069	0.306	0	0.306	6	0.009	0.008	3.691	0.724	VELOCITY OK	ADEQUATE PIPE CAPACITY	21
	81	Pavement	0.001	0.95	0.00095	0.1007	5	5.095	3.035	0.306	0	0.306	6	0.009	0.008	3.691	0.724	VELOCITY OK	ADEQUATE PIPE CAPACITY	81
	7	Pavement	0.046	0.95	0.0437	0.1444	5	5.461	2.915	0.421		0.421	6	0.009	0.008	3.691	0.724	VELOCITY OK	ADEQUATE PIPE CAPACITY	7

Index to Rainfall Coefficents

2-year		**10**-year		**25**-year		**50**-year		**100**-year	
m	n	m	n	m	n	m	n	m	n
3.69	0.556	6.31	0.575	7.83	0.582	8.96	0.585	10.07	0.586

Q=CIA

Q	Flow(cfs)	C for paved=0.90
C	runoff Coefficient	C for grass=0.22
I	rainfall Intencity(in/hr)	
A	drainage area (Acres)	

Tc=L/K(s)^0.5

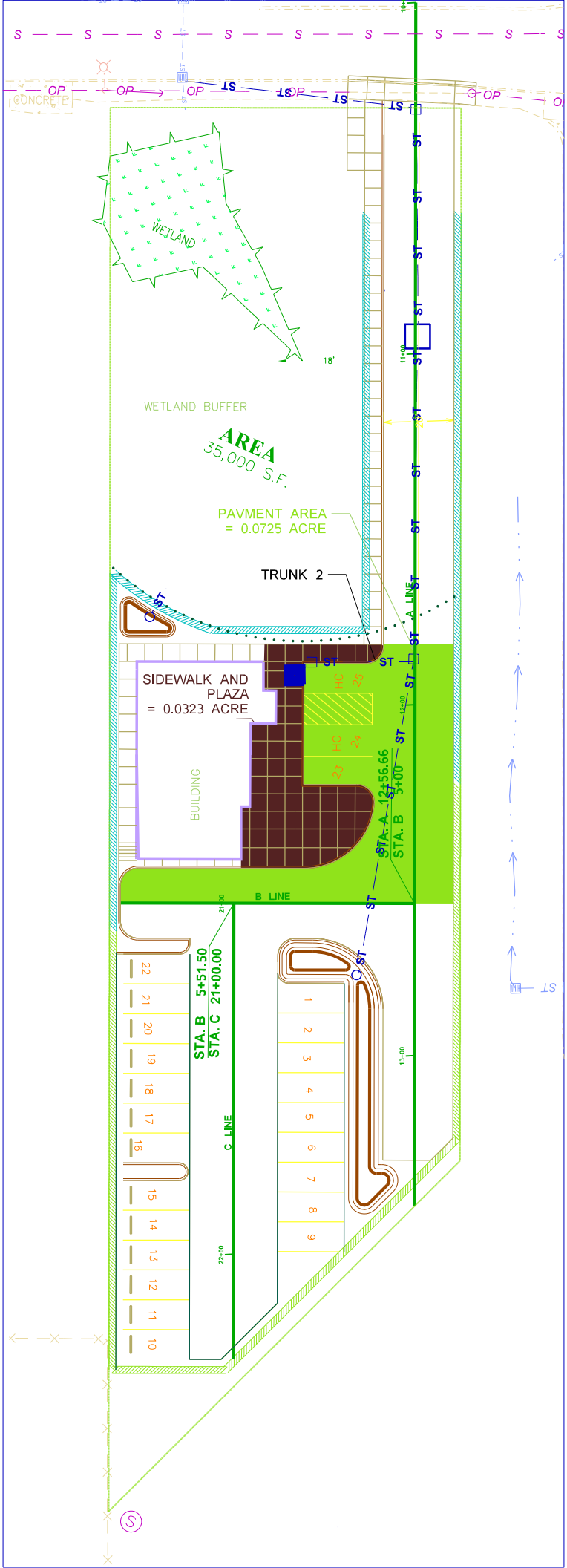
I=m/(Tc)^n
Tc=5 min Minmum

$$V=\frac{1.486}{n} R^{2/3} S^{1/2}$$ Manning's Equation

V	velocity ft/s
D	Pipe Diameter ft
S	Pipe slope ft/ft
n	Manning"s roughness coefficient

$$Q = VA$$
$$A = PI\left(\frac{D}{4}\right)^{1/2}$$

Q	Full Flow Capacity cfs
V	Velocity ft/s
A	Cross Section Area of Pipe ft
D	Pipe Diameter ft


WETLAND
WETLAND BUFFER
AREA
35,000 S.F.
PAVMENT AREA
= 0.0725 ACRE
TRUNK 2
SIDEWALK AND
PLAZA
= 0.0323 ACRE
BUILDING
A LINE
B LINE
C LINE
STA. A 12+56.66
STA. B 5+00
STA. B 5+51.50
STA. C 21+00.00
HC
24'
18'
CONCRETE

Stormsewer Pipe Design

Trunk # 4&5

Project: *ICOM Harbour Pointe Blvd SW*
City: *Mukilteo*
County: *Snohomish*

m= 7.83 n= 0.582 Design year 25 Pavement thickness ft= 0.25 Pipe Thickness Inch= 2

													Discharge Drain Design							
		Source of Drainage	Drainage Area A (Acre)	Runoff Coeff. C	CA (acre)	Sum CA (acre)	Tc Across Area (minutes)	Total Tc= Col. 8a+Tc acreoss pipe length (minutes)	Rainfull Intensity (in/hr)	Runoff (cfs)	Contrib. inflow (cfs)	Total Flow (cfs)	Pipe Diamenter (inch)	Manning roughness coefficent "n"	Pipe Slope (ft/ft)	Velocity of Flow (ft/s)	Pipe Capacity (cfs)	Pipe Velocity Check (3ft/s-10ft/s)	Pipe Capacity check (column13vs column17)	Pipe Length (ft)
2	3	4	5	6	7	8	8a	9	10	11	12	13	14	14a	15	16	17	17a	17b	18
1	53	Vault 100year	0	0	0	0	5	0	3.069	0.000	0.088	0.088	8	0.013	0.008	3.096	1.080	VELOCITY OK	ADEQUATE PIPE CAPACITY	88
2	66	Pavment	0.029	0.95	0.028	0.028	5	5	3.069	0.085	0	0.173	8	0.013	0.008	3.096	1.080	VELOCITY OK	ADEQUATE PIPE CAPACITY	66

Index to Rainfall Coefficents

2-year		**10**-year		**25**-year		**50**-year		**100**-year	
m	n	m	n	m	n	m	n	m	n
3.69	0.556	6.31	0.575	7.83	0.582	8.96	0.585	10.07	0.586

Q=CIA

Q Flow(cfs)
C runoff Coefficient
I rainfall Intencity(in/hr)
A drainage area (Acres)

C for paved=0.90
C for grass=0.22

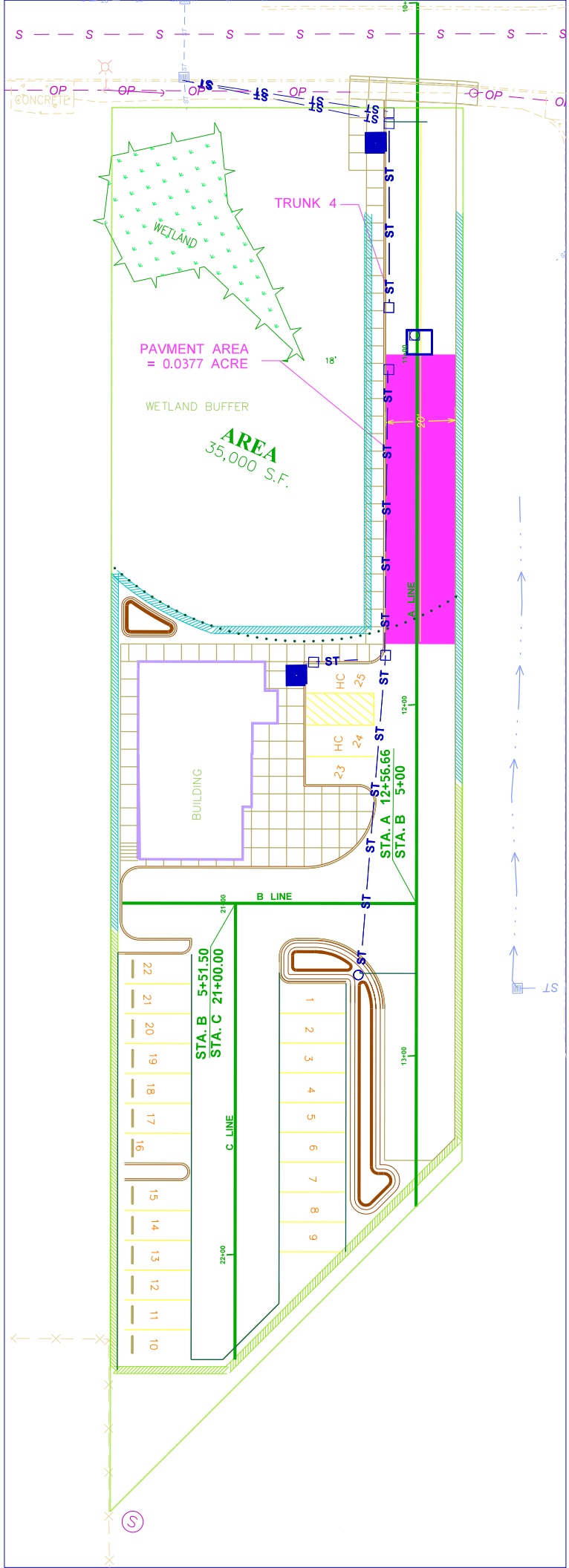
I=m/(Tc)^n
Tc=L/K(s)^0.5 **Tc**=5 min Minmum

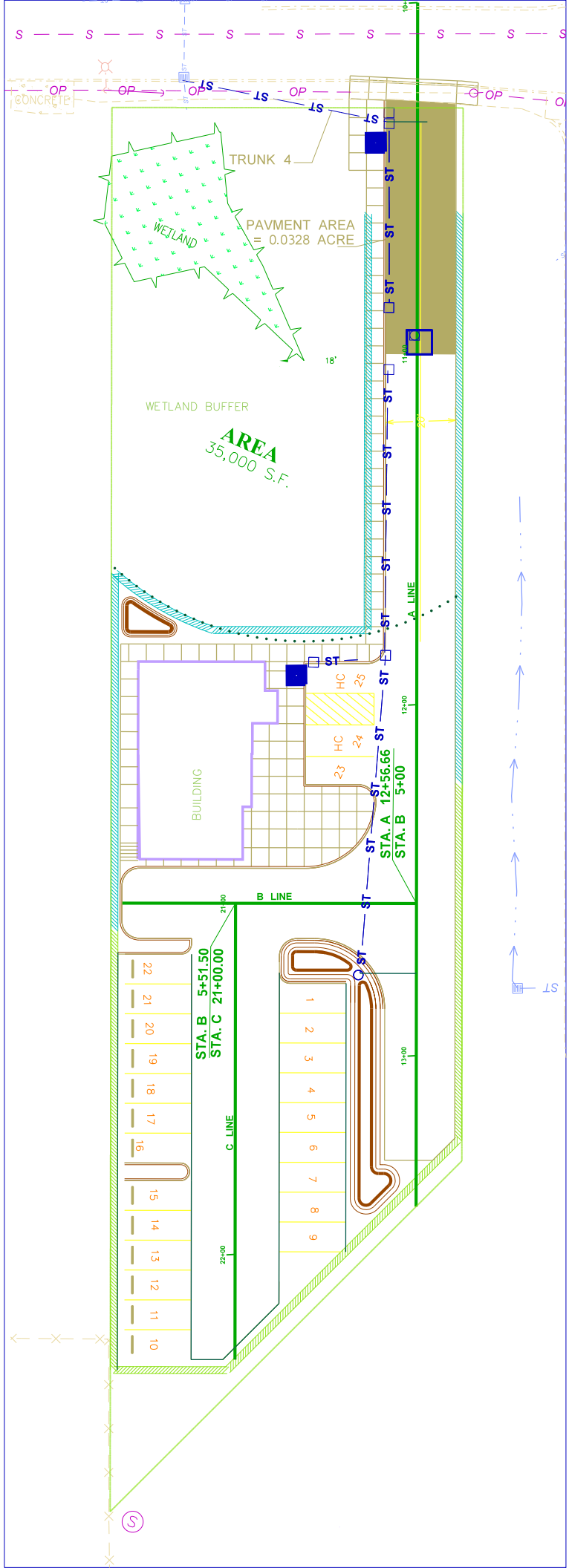
$$V=\frac{1.486}{n} R^{2/3} S^{1/2}$$ Manning's Equation

V velocity ft/s
D Pipe Diameter ft
S Pipe slope ft/ft
n Manning"s roughness coefficient

$$Q=VA \qquad A=\pi\left(\frac{D}{4}\right)^{1/2}$$

Q Full Flow Capacity cfs
V Velocity ft/s
A Cross Section Area of Pipe ft
D Pipe Diameter ft


TRUNK 4
WETLAND
PAVMENT AREA
= 0.0377 ACRE
WETLAND BUFFER
AREA
35,000 S.F.
BUILDING
A LINE
B LINE
C LINE
STA. A 12+56.66
STA. B 5+00
STA. B 5+51.50
STA. C 21+00.00
HC
CONCRETE


TRUNK 4
PAVMENT AREA
= 0.0328 ACRE
WETLAND
WETLAND BUFFER
AREA
35,000 S.F.
BUILDING
A LINE
B LINE
C LINE
STA. A 12+56.66
STA. B 5+00
STA. B 5+51.50
STA. C 21+00.00
HC
ST
OP
S
CONCRETE

Appendix I

(C)

RUNOFF TREATMENT BIO RETENTION AND BIO FILTRATION FACILITEIES

BMPs

WASHINGTON STATE DEPARTMENT OF ECOLOGY

November 2015

GENERAL USE LEVEL DESIGNATION FOR BASIC (TSS), ENHANCED, PHOSPHORUS & OIL TREATMENT

For

Americast Filterra®

Ecology's Decision:

Based on Americast's submissions, including the Final Technical Evaluation Reports, dated March 27, 2014 and December 2009, and additional information provided to Ecology dated October 9, 2009, Ecology hereby issues the following use level designations:

1. A General Use Level Designation for Basic, Enhanced, Phosphorus, and Oil Treatment at the following water quality design hydraulic loading rates:

Treatment	Hydraulic Conductivity* (in/hr) for use in Western Washington Sizing	Infiltration Rate (in/hr) for use in eastern Washington Sizing
Basic	70.92	100
Phosphorus	70.92	100
Oil	35.46	50
Enhanced	24.82	35

*****calculated based on listed infiltration rate and a hydraulic gradient of 1.41 inch/inch.

2. The Filterra® unit is not appropriate for oil spill-control purposes.
3. Ecology approves the Filterra® units for treatment at the hydraulic loading rates listed above, to achieve the maximum water quality design flow rate. Calculate the water quality design flow rates using the following procedures:

- Western Washington: for treatment installed upstream of detention or retention, the water quality design flow rate is the peak 15-minute flow rate as calculated using the sand filter module in the latest version of the Western Washington Hydrology Model or other Ecology-approved continuous runoff model. The model must indicate the unit is capable of processing 91 percent of the influent runoff file.
- Eastern Washington: For treatment installed upstream of detention or retention, the water quality design flow rate is the peak 15-minute flow rate as calculated using one of the three flow rate based methods described in Chapter 2.2.5 of the Stormwater Management Manual for Eastern Washington (SWMMEW) or local manual.
- Entire State: For treatment installed downstream of detention, the water quality design flow rate is the full 2-year release rate of the detention facility.

4. This General Use Level Designation has no expiration date but Ecology may revoke or amend the designation, and is subject to the conditions specified below.

Ecology's Conditions of Use:

Filterra® units shall comply with these conditions shall comply with the following conditions:

1. Design, assemble, install, operate, and maintain the Filterra® units in accordance with applicable Americast Filterra® manuals, document, and the Ecology Decision.
2. Each site plan must undergo Americast Filterra® review before Ecology can approve the unit for site installation. This will ensure that site grading and slope are appropriate for use of a Filterra® unit.
3. Filterra® media shall conform to the specifications submitted to and approved by Ecology.
4. Maintenance includes removing trash, degraded mulch, and accumulated debris from the filter surface and replacing the mulch layer. Use inspections to determine the site-specific maintenance schedules and requirements. Follow maintenance procedures given in the most recent version of the Filterra® Operation and Maintenance Manual.
5. Maintenance: The required maintenance interval for stormwater treatment devices is often dependent upon the degree of pollutant loading from a particular drainage basin. Therefore, Ecology does not endorse or recommend a "one size fits all" maintenance cycle for a particular model/size of manufactured filter treatment device.
    - Filterra® designs their systems for a target maintenance interval of 6 months. Maintenance includes removing accumulated sediment and trash from the surface area of the media, removing the mulch above the media, replacing the mulch, providing plant health evaluation, and pruning the plant if deemed necessary.
    - Conduct maintenance following manufacturer's guidelines.
6. Filterra® units come in standard sizes.
7. The minimum size filter surface-area for use in western Washington is determined by using the sand filter module in the latest version of WWHM or other Ecology approved continuous runoff model for western Washington. Model inputs include
    a) Filter media depth: 1.8 feet
    b) Effective Ponding Depth: 0.75 feet (This is equivalent to the 6-inch clear zone between the top of the mulch and the bottom of the slab plus 3-inches of mulch.)
    c) Side slopes: Vertical
    d) Riser height: 0.70 feet
    e) Filter Hydraulic Conductivity: Use the Hydraulic Conductivity as listed in the table above (use the lowest applicable hydraulic conductivity depending on the level of treatment required) under Ecology's Decision, above.

8. The minimum size filter surface-area for use in eastern Washington is determined by using the design water quality flow rate (as determined in item 3, above) and the Infiltration Rate from the table above (use the lowest applicable Infiltration Rate depending on the level of treatment required). Calculate the required area by dividing the water quality design flow rate (cu-ft/sec) by the Infiltration Rate (converted to ft/sec) to obtain required surface area (sq ft) of the Filterra unit.
9. Discharges from the Filterra® units shall not cause or contribute to water quality standards violations in receiving waters.

Approved Alternate Configurations

Filterra® Internal Bypass - Pipe (FTIB-P)

1. The Filterra® Internal Bypass – Pipe allows for piped-in flow from area drains, grated inlets, trench drains, and/or roof drains. Design capture flows and peak flows enter the structure through an internal slotted pipe. Filterra® inverted the slotted pipe to allow design flows to drop through to a series of splash plates that then disperse the design flows over the top surface of the Filterra® planter area. Higher flows continue to bypass the slotted pipe and convey out the structure.
2. To select a FTIB-P unit, the designer must determine the size of the standard unit using the sizing guidance described above.

Filterra® Internal Bypass – Curb (FTIB-C)

1. The Filterra® Internal Bypass –Curb model (FTIB-C) incorporates a curb inlet, biofiltration treatment chamber, and internal high flow bypass in one single structure. Filterra® designed the FTIB-C model for use in a "Sag" or "Sump" condition and will accept flows from both directions along a gutter line. An internal flume tray weir component directs treatment flows entering the unit through the curb inlet to the biofiltration treatment chamber. Flows in excess of the water quality treatment flow rise above the flume tray weir and discharge through a standpipe orifice; providing bypass of untreated peak flows. Americast manufactures the FTIB-C model in a variety of sizes and configurations and you may use the unit on a continuous grade when a single structure providing both treatment and high flow bypass is preferred. The FTIB-C model can also incorporate a separate junction box chamber to allow larger diameter discharge pipe connections to the structure.
2. To select a FTIB-C unit, the designer must determine the size of the standard unit using the sizing guidance described above.

Filterra® Shallow

1. The Filterra® Shallow provides additional flexibility for design engineers and designers in situations where there is limited depth and various elevation constraints to applying a standard Filterra® configuration. Engineers can design this system up to six inches shallower than any of the previous Filterra unit configurations noted above.

2. Ecology requires that the Filterra® Shallow provide a contact time equivalent to that of the standard unit. This means that with a smaller depth of media, the surface area must increase.
3. To select a Filterra® Shallow System unit, the designer must first identify the size of the standard unit using the modeling guidance described above.
4. Once you establish the size of the standard Filterra® unit using the sizing technique described above, use information from the following table to select the appropriate size Filterra® Shallow System unit.

Shallow Unit Basic, Enhanced, and Oil Treatment Sizing

Standard Depth	Equivalent Shallow Depth
4x4	4x6 or 6x4
4x6 or 6x4	6x6
4x8 or 8x4	6x8 or 8x6
6x6	6x10 or 10x6
6x8 or 8x6	6x12 or 12x6
6x10 or 10x6	13x7

Notes:
1. Shallow Depth Boxes are less than the standard depth of 3.5 feet but no less than 3.0 feet deep (TC to INV).

Applicant: Filterra® Bioretention Systems, division of Contech Engineered Solutions, LLC.

Applicant's Address: 11815 NE Glenn Widing Drive
Portland, OR 97220

Application Documents:

- State of Washington Department of Ecology Application for Conditional Use Designation, Americast (September 2006)
- Quality Assurance Project Plan Filterra® Bioretention Filtration System Performance Monitoring, Americast (April 2008)
- Quality Assurance Project Plan Addendum Filterra® Bioretention Filtration System Performance Monitoring, Americast (June 2008)
- Draft Technical Evaluation Report Filterra® Bioretention Filtration System Performance Monitoring, Americast (August 2009)
- Final Technical Evaluation Report Filterra® Bioretention Filtration System Performance Monitoring, Americast (December 2009)
- Technical Evaluation Report Appendices Filterra® Bioretention Filtration System Performance Monitoring, Americast, August 2009
- Memorandum to Department of Ecology Dated October 9, 2009 from Americast, Inc. and Herrera Environmental Consultants

- Quality Assurance Project Plan Filterra® Bioretention System Phosphorus treatment and Supplemental Basic and Enhanced Treatment Performance Monitoring, Americast (November 2011)
- Filterra® letter August 24, 2012 regarding sizing for the Filterra® Shallow System.
- University of Virginia Engineering Department Memo by Joanna Crowe Curran, Ph. D dated March 16, 2013 concerning capacity analysis of Filterra® internal weir inlet tray.
- Terraphase Engineering letter to Jodi Mills, P.E. dated April 2, 2013 regarding Terraflume Hydraulic Test, Filterra® Bioretention System and attachments.
- Technical Evaluation Report, Filterra® System Phosphorus Treatment and Supplemental Basic Treatment Performance Monitoring. March 27th, 2014.

Applicant's Use Level Request:

General Level Use Designation for Basic, Enhanced, Phosphorus, and Oil Treatment.

Applicant's Performance Claims:

Field-testing and laboratory testing show that the Filterra® unit is promising as a stormwater treatment best management practice and can meet Ecology's performance goals for basic, enhanced, phosphorus, and oil treatment.

Findings of Fact:

Field Testing 2013

1. Filterra® completed field-testing of a 6.5 ft x 4 ft. unit at one site in Bellingham, Washington. Continuous flow and rainfall data collected from January 1, 2013 through July 23, 2013 indicated that 59 storm events occurred. The monitoring obtained water quality data from 22 storm events. Not all the sampled storms produced information that met TAPE criteria for storm and/or water quality data.
2. The system treated 98.9 percent of the total 8-month runoff volume during the testing period. Consequently, the system achieved the goal of treating 91 percent of the volume from the site. Stormwater runoff bypassed during four of the 59 storm events.
3. Of the 22 sampled events, 18 qualified for TSS analysis (influent TSS concentrations ranged from 25 to 138 mg/L). The data were segregated into sample pairs with influent concentration greater than and less than 100 mg/L. The UCL95 mean effluent concentration for the data with influent less than 100 mg/L was 5.2 mg/L, below the 20-mg/L threshold. Although the TAPE guidelines do not require an evaluation of TSS removal efficiency for influent concentrations below 100 mg/L, the mean TSS removal for these samples was 90.1 percent. Average removal of influent TSS concentrations greater than 100 mg/L (three events) was 85 percent. In addition, the system consistently exhibited TSS removal greater than 80 percent at flow rates at a 100 inches per hour [in/hr] infiltration rate and was observed at 150 in/hr.

4. Ten of the 22 sampled events qualified for TP analysis. Americast augmented the dataset using two sample pairs from previous monitoring at the site. Influent TP concentrations ranged from 0.11 to 0.52 mg/L. The mean TP removal for these twelve events was 72.6 percent. The LCL95 mean percent removal was 66.0, well above the TAPE requirement of 50 percent. Treatment above 50 percent was evident at 100 in/hr infiltration rate and as high as 150 in/hr. Consequently, the Filterra® test system met the TAPE Phosphorus Treatment goal at 100 in/hr. Influent ortho-P concentrations ranged from 0.005 to 0.012 mg/L; effluent ortho-P concentrations ranged from 0.005 to 0.013 mg/L. The reporting limit/resolution for the ortho-P test method is 0.01 mg/L, therefore the influent and effluent ortho-P concentrations were both at and near non-detect concentrations.

Field Testing 2008-2009

1. Filterra® completed field-testing at two sites at the Port of Tacoma. Continuous flow and rainfall data collected during the 2008-2009 monitoring period indicated that 89 storm events occurred. The monitoring obtained water quality data from 27 storm events. Not all the sampled storms produced information that met TAPE criteria for storm and/or water quality data.
2. During the testing at the Port of Tacoma, 98.96 to 99.89 percent of the annual influent runoff volume passed through the POT1 and POT2 test systems respectively. Stormwater runoff bypassed the POT1 test system during nine storm events and bypassed the POT2 test system during one storm event. Bypass volumes ranged from 0.13% to 15.3% of the influent storm volume. Both test systems achieved the 91 percent water quality treatment-goal over the 1-year monitoring period.
3. Consultants observed infiltration rates as high as 133 in/hr during the various storms. Filterra® did not provide any paired data that identified percent removal of TSS, metals, oil, or phosphorus at an instantaneous observed flow rate.
4. The maximum storm average hydraulic loading rate associated with water quality data is <40 in/hr, with the majority of flow rates < 25 in/hr. The average instantaneous hydraulic loading rate ranged from 8.6 to 53 inches per hour.
5. The field data showed a removal rate greater than 80% for TSS with an influent concentration greater than 20 mg/l at an average instantaneous hydraulic loading rate up to 53 in/hr (average influent concentration of 28.8 mg/l, average effluent concentration of 4.3 mg/l).
6. The field data showed a removal rate generally greater than 54% for dissolved zinc at an average instantaneous hydraulic loading rate up to 60 in/hr and an average influent concentration of 0.266 mg/l (average effluent concentration of 0.115 mg/l).
7. The field data showed a removal rate generally greater than 40% for dissolved copper at an average instantaneous hydraulic loading rate up to 35 in/hr and an average influent concentration of 0.0070 mg/l (average effluent concentration of 0.0036 mg/l).
8. The field data showed an average removal rate of 93% for total petroleum hydrocarbon (TPH) at an average instantaneous hydraulic loading rate up to 53 in/hr and an average influent concentration of 52 mg/l (average effluent concentration of 2.3 mg/l). The data

also shows achievement of less than 15 mg/l TPH for grab samples. Filterra® provided limited visible sheen data due to access limitations at the outlet monitoring location.

9. The field data showed low percentage removals of total phosphorus at all storm flows at an average influent concentration of 0.189 mg/l (average effluent concentration of 0.171 mg/l). We may relate the relatively poor treatment performance of the Filterra® system at this location to influent characteristics for total phosphorus that are unique to the Port of Tacoma site. It appears that the Filterra® system will not meet the 50 percent removal performance goal when you expect the majority of phosphorus in the runoff to be in the dissolved form.

Laboratory Testing

1. Filterra® performed laboratory testing on a scaled down version of the Filterra® unit. The lab data showed an average removal from 83-91% for TSS with influents ranging from 21 to 320 mg/L, 82-84% for total copper with influents ranging from 0.94 to 2.3 mg/L, and 50-61% for orthophosphate with influents ranging from 2.46 to 14.37 mg/L.
2. Filterra® conducted permeability tests on the soil media.
3. Lab scale testing using Sil-Co-Sil 106 showed percent removals ranging from 70.1% to 95.5% with a median percent removal of 90.7%, for influent concentrations ranging from 8.3 to 260 mg/L. Filterra® ran these laboratory tests at an infiltration rate of 50 in/hr.
4. Supplemental lab testing conducted in September 2009 using Sil-Co-Sil 106 showed an average percent removal of 90.6%. These laboratory tests were run at infiltration rates ranging from 25 to 150 in/hr for influent concentrations ranging from 41.6 to 252.5 mg/l. Regression analysis results indicate that the Filterra® system's TSS removal performance is independent of influent concentration in the concentration rage evaluated at hydraulic loading rates of up to 150 in/hr.

Contact Information:

Applicant:
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darcys@conteches.com

Applicant's Website: http://www.conteches.com

Ecology web link: http://www.ecy.wa.gov/programs/wq/stormwater/newtech/index.html

Ecology:
Douglas C. Howie, P.E.
Department of Ecology
Water Quality Program
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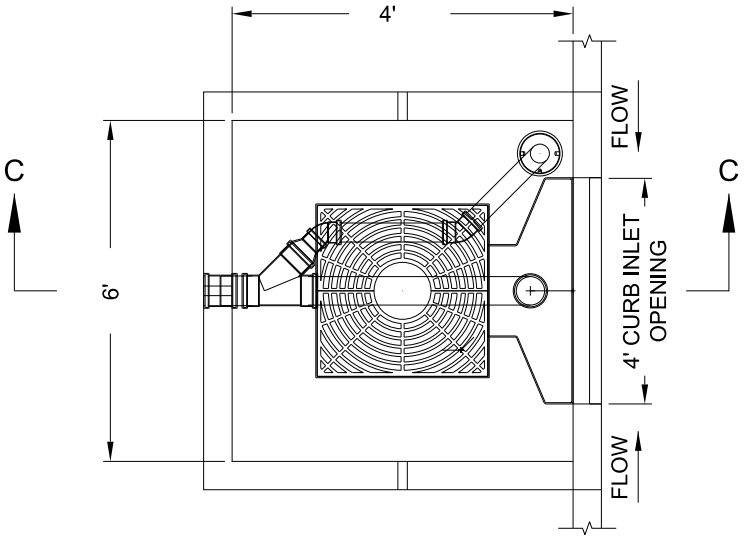
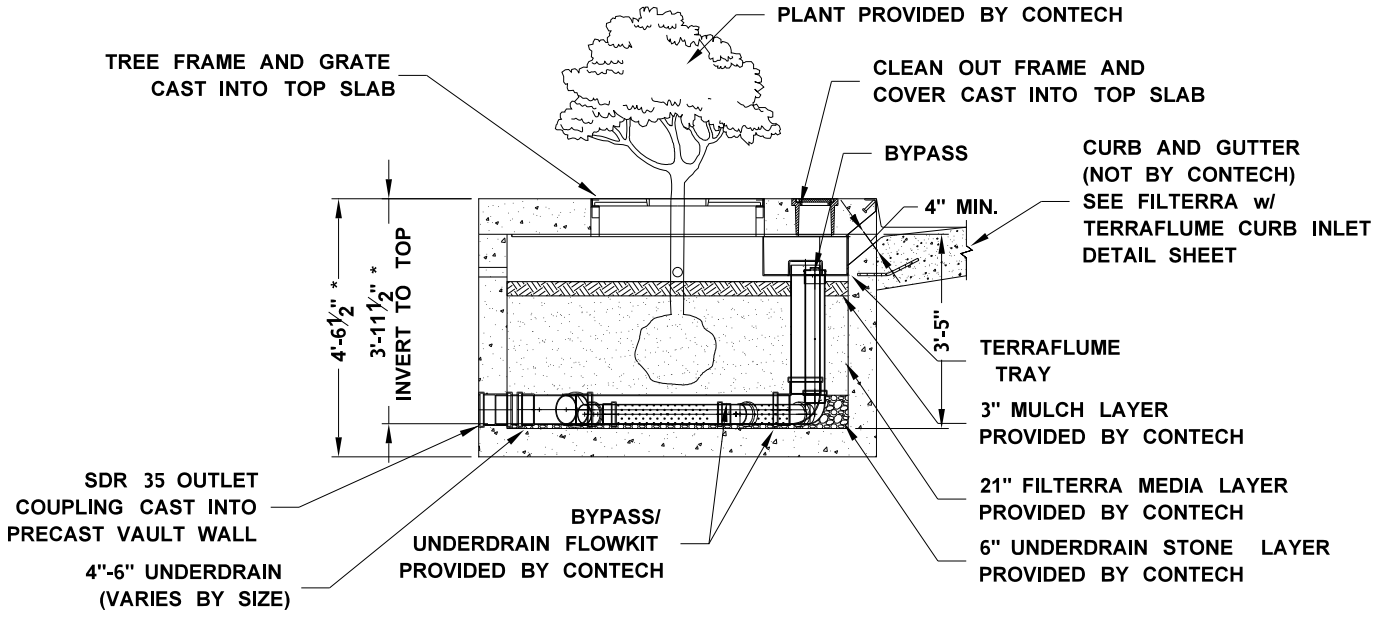
Date	Revision
December 2009	GULD for Basic, Enhanced, and Oil granted, CULD for Phosphorus
September 2011	Extended CULD for Phosphorus Treatment
September 2012	Revised design storm discussion, added Shallow System.
January 2013	Revised format to match Ecology standards, changed Filterra contact information
February 2013	Added FTIB-P system
March 2013	Added FTIB-C system
April 2013	Modified requirements for identifying appropriate size of unit
June 2013	Modified description of FTIB-C alternate configuration
March 2014	GULD awarded for Phosphorus Treatment. GULD updated for a higher flow-rate for Basic Treatment.
June 2014	Revised sizing calculation methods
March 2015	Revised Contact Information
June 2015	CULD for Basic and Enhanced at 100 in/hr infiltration rate
November 2015	Removed information on CULD (created separate CULD document for 100 in/hr infiltration rate)

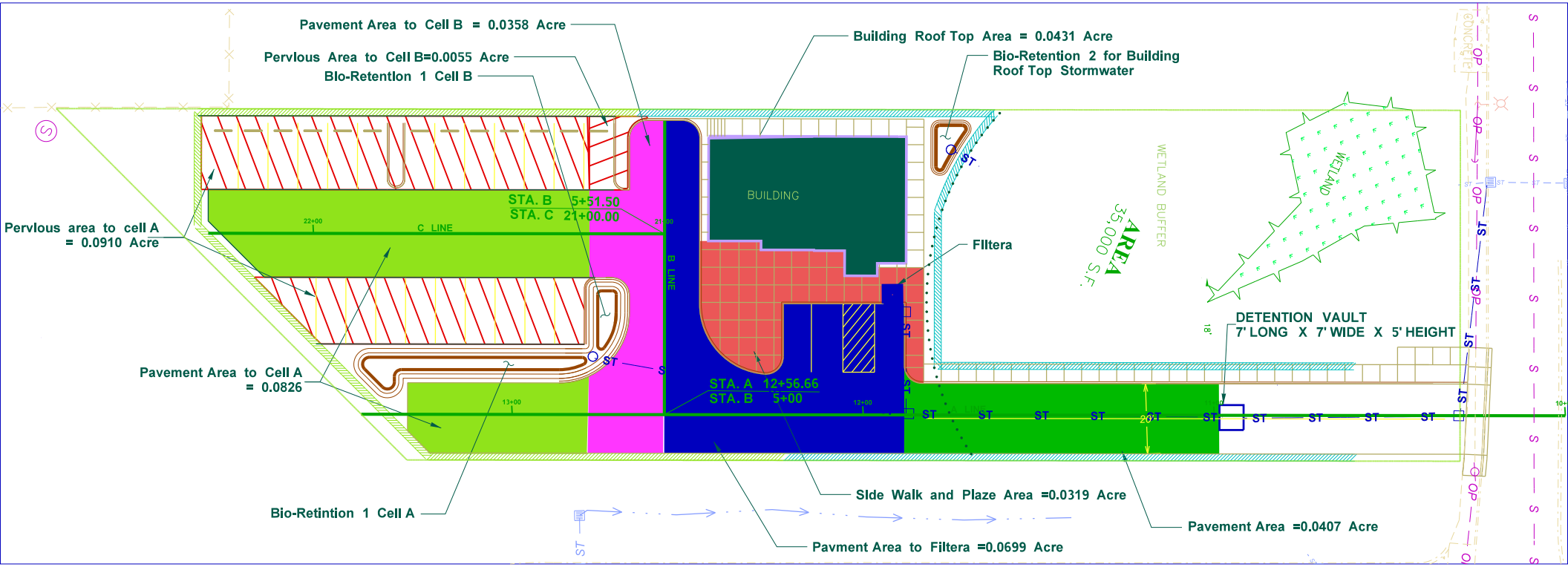


PLAN VIEW



SECTION C-C

FILTERRA INLET CONFIGURATION


Pavement Area to Cell B = 0.0358 Acre
Pervious Area to Cell B=0.0055 Acre
Bio-Retention 1 Cell B
Building Roof Top Area = 0.0431 Acre
Bio-Retention 2 for Building Roof Top Stormwater
Pervious area to cell A = 0.0910 Acre
STA. B 5+51.50
STA. C 21+00.00
C LINE
B LINE
BUILDING
Filtera
WETLAND BUFFER
35,000 S.F. AREA
WETLAND
DETENTION VAULT
7' LONG X 7' WIDE X 5' HEIGHT
Pavement Area to Cell A = 0.0826
STA. A 12+56.66
STA. B 5+00
Bio-Retintion 1 Cell A
Side Walk and Plaze Area =0.0319 Acre
Pavement Area =0.0407 Acre
Pavment Area to Filtera =0.0699 Acre

Existing Condition							
Wetland		**Buffer**		**Forested**		**Total Area**	
SF	**Acres**	SF	**Acres**	SF	**Acres**	SF	**Acres**
1486	0.0341	9283	0.2131	42797	0.5563	35000	0.8035

Proposed Condition							
Pollution Generating Surfaces (PGIS)				**Non Pollution Generating Surfaces (NPGIS)**			
Impervious Area (Pavement)		***Pervious Area (Grass Paver)**		****Building Roof Top**		****Side walk & Plaza Area (Paving Blocks)**	
SF	**Acre**	SF	**Acre**	SF	**Acre**	SF	**Acre**
11329	0.2601	4222	0.0969	1878	0.0431	2127	0.0488

*Grass Paver is modeled as (A/B) Lawn in (WWHM 4) 2012

**Building Roof Top Area is ineffective impervious surface (Infiltration by using Bio-retention facility)

***(Paving Blocks) will be modeled as 50% Grass %50% impervious as Per SWMWW Appendix IIIC

Bio-Retention Area-1 Cell A

Bio-Retention Area-1A		Side Slope	Bottom area	
SF	**Acre**		SF	**Acre**
1092	0.0251	2.5 : 1	250	0.0057

71 Feet long and 3.5 feet wide with bottom slope 0.5%

Contributing Areas				
Pavement		Grass		
SF	**Acres**	SF	**Acres**	Total
3599	0.0826	3939	0.0904	0.1730

Bio-Retention Area-1 Cell B

Bio-Retention Area-1B		Side Slope	Bottom area	
SF	**Acre**		SF	**Acre**
266	0.0061	2.5 : 1	74	0.0017

13.5 Feet long and 5.5 feet wide with bottom slope 0.5%

Contributing Areas				
Pavement		Grass		
SF	**Acres**	SF	**Acres**	Total
1536	0.0353	240	0.0055	0.0408

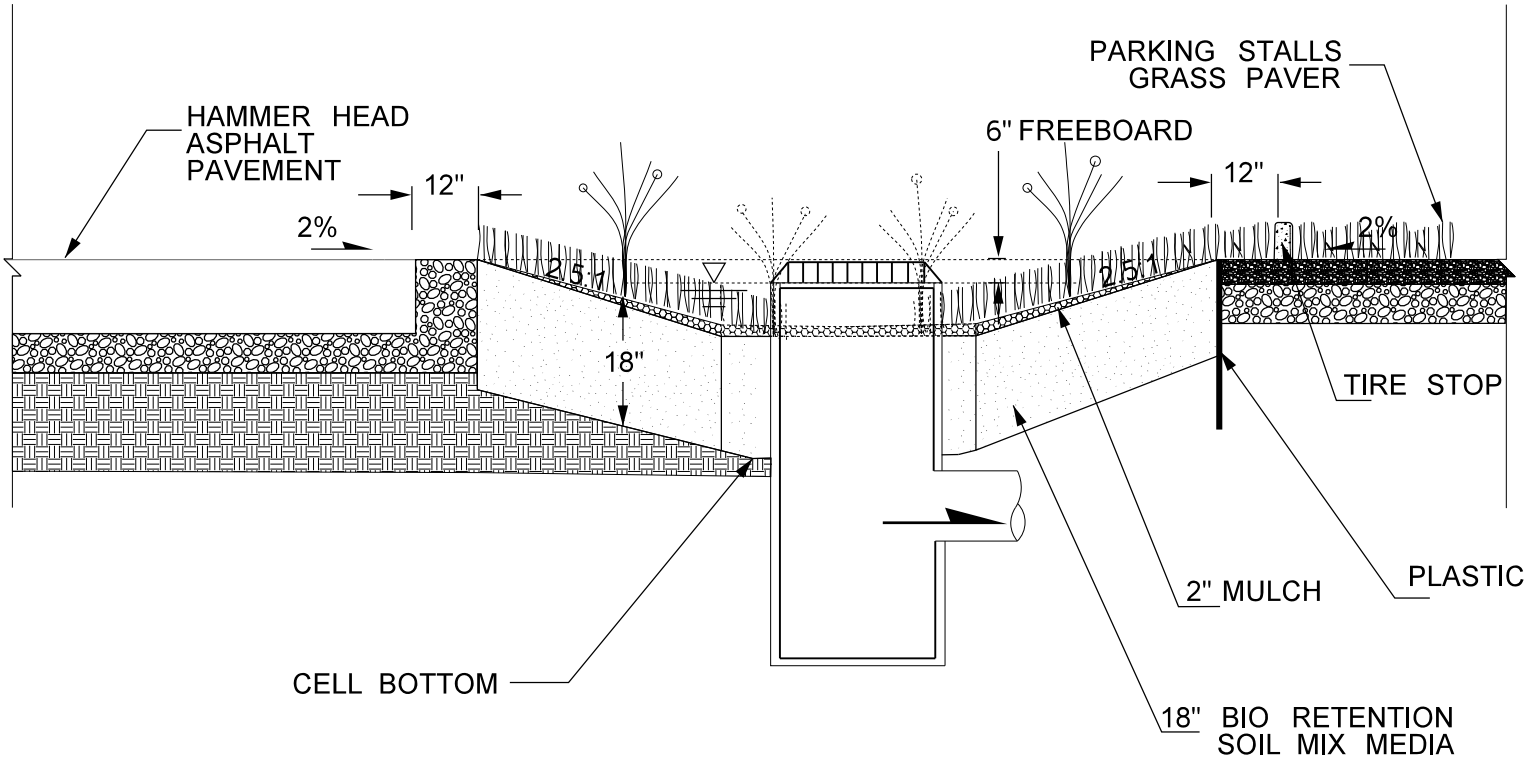
Bio-Retention Area-2

Bio-Retention Area-2		Side Slope	Bottom area	
SF	**Acre**		SF	Acre
126	0.0029	2.5 : 1	65	0.0015

16 Feet long and 4.1 feet wide with bottom slope 0.5%

Contributing Areas Building	
SF	**Acres**
1878	0.0431

Bio-retention Basin Areas



BIORETENTION CELL SECTION (TYP.)

N.T.S.

NOTES:

1- COMPOST TO AGGREGATE RATIO:
60% AGGREGATE AND 40% COMPOST

2- COMPOST MUST BE PRODUCED AT COMPSTING FACILITY PERMITTED BY WA DEPARTMENT OF ECOLOGY

3- ORGANIC MATTER CONTENT 5 TO 8 PERCENT BY WEIGHT

4- SCREEND TO THE SIZE GRADATION FOR FINE COMPOST UNDER TMECC TESTMETHOD 02.02-B

5- BIORETENTION SOIL MIX (BSM) AGGREGATE GRADATION IS LISTED BELOW

SIEVE SIZE	PERCENT PASSING
3/8"	100
#4	95-100
#10	75-90
#40	25-40
#100	4-10
#200	2-5

6- THE FINSHED SUBGRADE MUST BE INSPECTED AND SHALL BE SCRIFED TO A MINUMUM 3" DEEP

7- COMPACT THE BSM TO A RELATIVE COMPACTION OF 85% OF MODIFIED(ASTM D 1557)

WWHM2012

PROJECT REPORT

General Model Information

Project Name:	Bioretention 2
Site Name:	ICOM
Site Address:	200 HARBOUR POINTE BLVD SW
City:	MUKILTEO
Report Date:	2/16/2016
Gage:	Everett
Data Start:	1948/10/01
Data End:	2009/09/30
Timestep:	15 Minute
Precip Scale:	1.00
Version Date:	2015/11/13
Version:	4.2.11

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

Bulidng Roof Top

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
C, Forest, Flat	0.0431
Pervious Total	0.0431
Impervious Land Use	acre
Impervious Total	0
Basin Total	0.0431

Element Flows To:

Surface	Interflow	Groundwater

Mitigated Land Use

Buliding Roof Top

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
Pervious Total	0
Impervious Land Use	acre
ROOF TOPS FLAT	0.0431
Impervious Total	0.0431
Basin Total	0.0431

Element Flows To:

Surface	Interflow	Groundwater
Surface retention 2	Surface retention 2	

Routing Elements
Predeveloped Routing

Mitigated Routing

Bioretention 2

Bottom Length:	16.00 ft.
Bottom Width:	4.10 ft.
Material thickness of first layer:	1.5
Material type for first layer:	SMMWW 12 in/hr
Material thickness of second layer:	0
Material type for second layer:	Sand
Material thickness of third layer:	0
Material type for third layer:	GRAVEL
Infiltration On	
Infiltration rate:	0.5
Infiltration safety factor:	0.5
Total Volume Infiltrated (ac-ft.):	6.94
Total Volume Through Riser (ac-ft.):	0.392
Total Volume Through Facility (ac-ft.):	7.332
Percent Infiltrated:	94.65
Total Precip Applied to Facility:	0.859
Total Evap From Facility:	0.21
Underdrain not used	
Discharge Structure	
Riser Height:	1 ft.
Riser Diameter:	18 in.
Element Flows To:	
Outlet 1	Outlet 2

Bioretention Hydraulic Table

Stage(feet)	Area(ac.)	Volume(ac-ft.)	Discharge(cfs)	Infilt(cfs)
0.0000	0.0063	0.0000	0.0000	0.0000
0.0330	0.0062	0.0000	0.0000	0.0000
0.0659	0.0061	0.0000	0.0000	0.0002
0.0989	0.0059	0.0000	0.0000	0.0004
0.1319	0.0058	0.0001	0.0000	0.0004
0.1648	0.0057	0.0001	0.0000	0.0004
0.1978	0.0055	0.0001	0.0000	0.0004
0.2308	0.0054	0.0002	0.0000	0.0004
0.2637	0.0053	0.0002	0.0000	0.0004
0.2967	0.0052	0.0002	0.0000	0.0004
0.3297	0.0051	0.0003	0.0000	0.0004
0.3626	0.0049	0.0003	0.0000	0.0004
0.3956	0.0048	0.0003	0.0000	0.0004
0.4286	0.0047	0.0004	0.0000	0.0004
0.4615	0.0046	0.0004	0.0000	0.0004
0.4945	0.0045	0.0005	0.0000	0.0004
0.5275	0.0043	0.0005	0.0000	0.0004
0.5604	0.0042	0.0005	0.0000	0.0004
0.5934	0.0041	0.0006	0.0000	0.0004
0.6264	0.0040	0.0006	0.0000	0.0004
0.6593	0.0039	0.0007	0.0000	0.0004
0.6923	0.0038	0.0007	0.0000	0.0004
0.7253	0.0037	0.0008	0.0000	0.0004
0.7582	0.0036	0.0008	0.0000	0.0004
0.7912	0.0035	0.0009	0.0000	0.0004
0.8242	0.0034	0.0010	0.0000	0.0004

0.8571	0.0033	0.0010	0.0000	0.0004
0.8901	0.0032	0.0011	0.0000	0.0004
0.9231	0.0031	0.0011	0.0000	0.0004
0.9560	0.0030	0.0012	0.0000	0.0004
0.9890	0.0029	0.0013	0.0000	0.0004
1.0220	0.0028	0.0013	0.0000	0.0004
1.0549	0.0027	0.0014	0.0000	0.0004
1.0879	0.0026	0.0015	0.0000	0.0004
1.1209	0.0025	0.0015	0.0000	0.0004
1.1538	0.0024	0.0016	0.0000	0.0004
1.1868	0.0023	0.0017	0.0000	0.0004
1.2198	0.0022	0.0018	0.0000	0.0004
1.2527	0.0022	0.0018	0.0000	0.0004
1.2857	0.0021	0.0019	0.0000	0.0004
1.3187	0.0020	0.0020	0.0000	0.0004
1.3516	0.0019	0.0021	0.0000	0.0004
1.3846	0.0018	0.0022	0.0000	0.0004
1.4176	0.0017	0.0023	0.0000	0.0004
1.4505	0.0017	0.0024	0.0000	0.0004
1.4835	0.0016	0.0024	0.0000	0.0004
1.5000	0.0015	0.0025	0.0000	0.0004

Bioretention Hydraulic Table

Stage(feet)	Area(ac.)	Volume(ac-ft.)	Discharge(cfs)	To Amended(cfs)	Infilt(cfs)
1.5000	0.0063	0.0025	0.0000	0.0186	0.0000
1.5330	0.0064	0.0027	0.0000	0.0186	0.0000
1.5659	0.0065	0.0029	0.0000	0.0190	0.0000
1.5989	0.0067	0.0031	0.0000	0.0194	0.0000
1.6319	0.0068	0.0034	0.0000	0.0198	0.0000
1.6648	0.0069	0.0036	0.0000	0.0202	0.0000
1.6978	0.0071	0.0038	0.0000	0.0206	0.0000
1.7308	0.0072	0.0040	0.0000	0.0210	0.0000
1.7637	0.0074	0.0043	0.0000	0.0214	0.0000
1.7967	0.0075	0.0045	0.0000	0.0218	0.0000
1.8297	0.0076	0.0048	0.0000	0.0222	0.0000
1.8626	0.0078	0.0050	0.0000	0.0226	0.0000
1.8956	0.0079	0.0053	0.0000	0.0230	0.0000
1.9286	0.0081	0.0056	0.0000	0.0234	0.0000
1.9615	0.0082	0.0058	0.0000	0.0238	0.0000
1.9945	0.0084	0.0061	0.0000	0.0242	0.0000
2.0275	0.0085	0.0064	0.0000	0.0246	0.0000
2.0604	0.0087	0.0067	0.0000	0.0250	0.0000
2.0934	0.0089	0.0070	0.0000	0.0254	0.0000
2.1264	0.0090	0.0072	0.0000	0.0258	0.0000
2.1593	0.0092	0.0075	0.0000	0.0262	0.0000
2.1923	0.0093	0.0079	0.0000	0.0266	0.0000
2.2253	0.0095	0.0082	0.0000	0.0270	0.0000
2.2582	0.0096	0.0085	0.0000	0.0274	0.0000
2.2912	0.0098	0.0088	0.0000	0.0278	0.0000
2.3242	0.0100	0.0091	0.0000	0.0282	0.0000
2.3571	0.0101	0.0095	0.0000	0.0286	0.0000
2.3901	0.0103	0.0098	0.0000	0.0290	0.0000
2.4231	0.0105	0.0101	0.0000	0.0294	0.0000
2.4560	0.0106	0.0105	0.0000	0.0298	0.0000
2.4890	0.0108	0.0108	0.0000	0.0302	0.0000
2.5220	0.0110	0.0112	0.0519	0.0306	0.0000
2.5549	0.0111	0.0116	0.2049	0.0310	0.0000
2.5879	0.0113	0.0119	0.4142	0.0314	0.0000

2.6209	0.0115	0.0123	0.6666	0.0318	0.0000
2.6538	0.0117	0.0127	0.9542	0.0322	0.0000
2.6868	0.0118	0.0131	1.2709	0.0326	0.0000
2.7198	0.0120	0.0135	1.6110	0.0330	0.0000
2.7527	0.0122	0.0139	1.9688	0.0334	0.0000
2.7857	0.0124	0.0143	2.3387	0.0338	0.0000
2.8187	0.0126	0.0147	2.7149	0.0342	0.0000
2.8516	0.0128	0.0151	3.0914	0.0346	0.0000
2.8846	0.0129	0.0155	3.4625	0.0350	0.0000
2.9176	0.0131	0.0160	3.8224	0.0354	0.0000
2.9505	0.0133	0.0164	4.1657	0.0358	0.0000
2.9835	0.0135	0.0168	4.4876	0.0362	0.0000
3.0000	0.0136	0.0171	4.7838	0.0364	0.0000

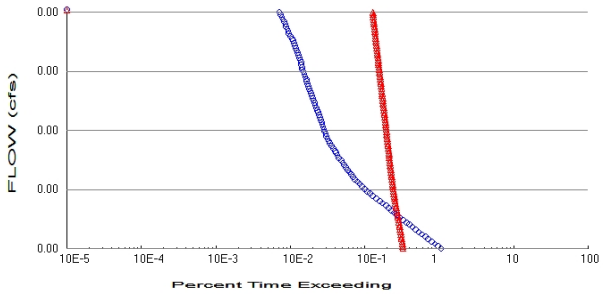
Surface retention 2

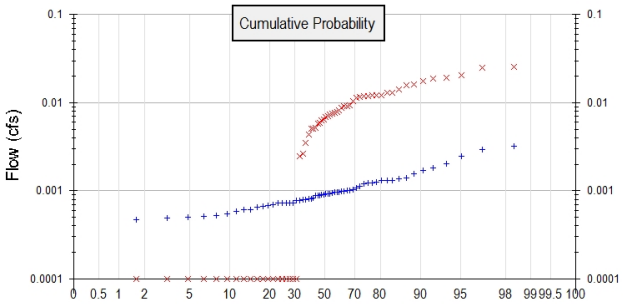
Element Flows To:

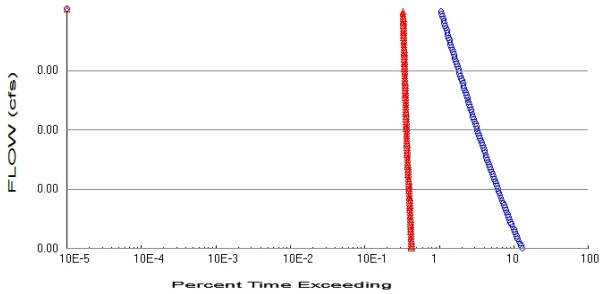
Outlet 1	Outlet 2
	Bioretention 2

Analysis Results

POC 1







\+ Predeveloped x Mitigated

Predeveloped Landuse Totals for POC #1
Total Pervious Area: 0.0431
Total Impervious Area: 0

Mitigated Landuse Totals for POC #1
Total Pervious Area: 0
Total Impervious Area: 0.0431

Flow Frequency Method: Log Pearson Type III 17B

Flow Frequency Return Periods for Predeveloped. POC #1

Return Period	**Flow(cfs)**
2 year	0.000924
5 year	0.001367
10 year	0.001671
25 year	0.002063
50 year	0.002359
100 year	0.002659

Flow Frequency Return Periods for Mitigated. POC #1

Return Period	**Flow(cfs)**
2 year	0.046395
5 year	0.068751
10 year	0.080931
25 year	0.093545
50 year	0.101224
100 year	0.107688

Annual Peaks

Annual Peaks for Predeveloped and Mitigated. POC #1

Year	Predeveloped	Mitigated
1949	0.001	0.000
1950	0.001	0.007
1951	0.001	0.005
1952	0.001	0.000
1953	0.001	0.000
1954	0.002	0.008
1955	0.001	0.019
1956	0.001	0.011
1957	0.001	0.005
1958	0.001	0.007
1959	0.001	0.006
1960	0.001	0.004
1961	0.001	0.014
1962	0.001	0.000
1963	0.001	0.000
1964	0.001	0.000
1965	0.001	0.009
1966	0.000	0.002
1967	0.001	0.006
1968	0.001	0.007
1969	0.001	0.003
1970	0.001	0.000
1971	0.001	0.019
1972	0.001	0.000
1973	0.001	0.009
1974	0.001	0.013
1975	0.001	0.000
1976	0.001	0.010
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	0.012
1983	0.001	0.009
1984	0.001	0.012
1985	0.001	0.021
1986	0.003	0.018
1987	0.001	0.016
1988	0.001	0.007
1989	0.001	0.000
1990	0.001	0.004
1991	0.001	0.012
1992	0.001	0.005
1993	0.001	0.000
1994	0.000	0.012
1995	0.001	0.012
1996	0.002	0.006
1997	0.003	0.025
1998	0.001	0.000
1999	0.001	0.008
2000	0.000	0.006
2001	0.000	0.000
2002	0.001	0.009
2003	0.001	0.000
2004	0.001	0.008

2005	0.001	0.000
2006	0.002	0.025
2007	0.002	0.016
2008	0.002	0.013
2009	0.001	0.012

Ranked Annual Peaks

Ranked Annual Peaks for Predeveloped and Mitigated. POC #1

Rank	Predeveloped	Mitigated
1	0.0032	0.0253
2	0.0030	0.0247
3	0.0025	0.0206
4	0.0020	0.0194
5	0.0018	0.0186
6	0.0017	0.0175
7	0.0016	0.0163
8	0.0014	0.0158
9	0.0014	0.0142
10	0.0013	0.0130
11	0.0013	0.0129
12	0.0013	0.0121
13	0.0013	0.0121
14	0.0012	0.0121
15	0.0012	0.0119
16	0.0012	0.0118
17	0.0011	0.0115
18	0.0011	0.0113
19	0.0010	0.0103
20	0.0010	0.0094
21	0.0010	0.0092
22	0.0010	0.0092
23	0.0010	0.0087
24	0.0010	0.0081
25	0.0010	0.0078
26	0.0010	0.0077
27	0.0009	0.0075
28	0.0009	0.0073
29	0.0009	0.0070
30	0.0009	0.0069
31	0.0009	0.0065
32	0.0009	0.0063
33	0.0009	0.0060
34	0.0009	0.0058
35	0.0009	0.0051
36	0.0008	0.0051
37	0.0008	0.0051
38	0.0008	0.0044
39	0.0008	0.0035
40	0.0008	0.0026
41	0.0008	0.0025
42	0.0008	0.0000
43	0.0007	0.0000
44	0.0007	0.0000
45	0.0007	0.0000
46	0.0007	0.0000
47	0.0007	0.0000
48	0.0007	0.0000
49	0.0007	0.0000

50	0.0007	0.0000
51	0.0007	0.0000
52	0.0006	0.0000
53	0.0006	0.0000
54	0.0006	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	0.0002	0.0000

Duration Flows

The Facility PASSED

Flow(cfs)	Predev	Mit	Percentage	Pass/Fail
0.0001	278482	9054	3	Pass
0.0001	268429	9037	3	Pass
0.0001	258804	9015	3	Pass
0.0001	250035	8994	3	Pass
0.0001	241693	8962	3	Pass
0.0001	233780	8938	3	Pass
0.0001	226294	8915	3	Pass
0.0001	219021	8887	4	Pass
0.0001	212262	8868	4	Pass
0.0001	205611	8846	4	Pass
0.0001	199215	8823	4	Pass
0.0001	193119	8784	4	Pass
0.0001	188606	8763	4	Pass
0.0001	182853	8737	4	Pass
0.0001	177377	8705	4	Pass
0.0001	172052	8682	5	Pass
0.0001	166833	8656	5	Pass
0.0001	161870	8620	5	Pass
0.0001	157079	8588	5	Pass
0.0001	152524	8566	5	Pass
0.0002	148139	8536	5	Pass
0.0002	143968	8508	5	Pass
0.0002	139990	8481	6	Pass
0.0002	136140	8457	6	Pass
0.0002	132418	8427	6	Pass
0.0002	129723	8404	6	Pass
0.0002	126194	8367	6	Pass
0.0002	122772	8333	6	Pass
0.0002	119414	8297	6	Pass
0.0002	116227	8262	7	Pass
0.0002	113190	8226	7	Pass
0.0002	110152	8179	7	Pass
0.0002	107201	8156	7	Pass
0.0002	104399	8126	7	Pass
0.0002	101640	8104	7	Pass
0.0002	98966	8070	8	Pass
0.0002	96378	8042	8	Pass
0.0002	94496	8029	8	Pass
0.0002	92079	7993	8	Pass
0.0002	89747	7965	8	Pass
0.0002	87459	7948	9	Pass
0.0002	85256	7927	9	Pass
0.0002	83095	7899	9	Pass
0.0002	80957	7875	9	Pass
0.0002	78903	7848	9	Pass
0.0003	76850	7828	10	Pass
0.0003	74946	7813	10	Pass
0.0003	73107	7800	10	Pass
0.0003	71310	7781	10	Pass
0.0003	69578	7762	11	Pass
0.0003	68316	7747	11	Pass
0.0003	66690	7728	11	Pass
0.0003	65108	7715	11	Pass

0.0003	63589	7689	12	Pass
0.0003	62092	7679	12	Pass
0.0003	60659	7657	12	Pass
0.0003	59268	7638	12	Pass
0.0003	57835	7627	13	Pass
0.0003	56488	7614	13	Pass
0.0003	55140	7589	13	Pass
0.0003	53836	7572	14	Pass
0.0003	52574	7557	14	Pass
0.0003	51654	7548	14	Pass
0.0003	50456	7522	14	Pass
0.0003	49280	7503	15	Pass
0.0003	48210	7484	15	Pass
0.0003	47098	7469	15	Pass
0.0003	46029	7452	16	Pass
0.0003	45023	7437	16	Pass
0.0003	43997	7415	16	Pass
0.0003	43013	7401	17	Pass
0.0004	42072	7381	17	Pass
0.0004	41066	7366	17	Pass
0.0004	40147	7353	18	Pass
0.0004	39227	7345	18	Pass
0.0004	38543	7336	19	Pass
0.0004	37644	7319	19	Pass
0.0004	36746	7302	19	Pass
0.0004	35890	7285	20	Pass
0.0004	35013	7264	20	Pass
0.0004	34222	7240	21	Pass
0.0004	33409	7232	21	Pass
0.0004	32682	7221	22	Pass
0.0004	31912	7206	22	Pass
0.0004	31163	7191	23	Pass
0.0004	30479	7174	23	Pass
0.0004	29795	7165	24	Pass
0.0004	29324	7159	24	Pass
0.0004	28682	7135	24	Pass
0.0004	28062	7116	25	Pass
0.0004	27420	7103	25	Pass
0.0004	26822	7086	26	Pass
0.0004	26244	7078	26	Pass
0.0004	25688	7063	27	Pass
0.0004	25110	7048	28	Pass
0.0004	24576	7033	28	Pass
0.0005	24062	7013	29	Pass
0.0005	23592	7001	29	Pass
0.0005	23121	6981	30	Pass
0.0005	22629	6968	30	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
retention 2 POC	☐	6.67			☐	94.65			
Total Volume Infiltrated		6.67	0.00	0.00		94.65	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.

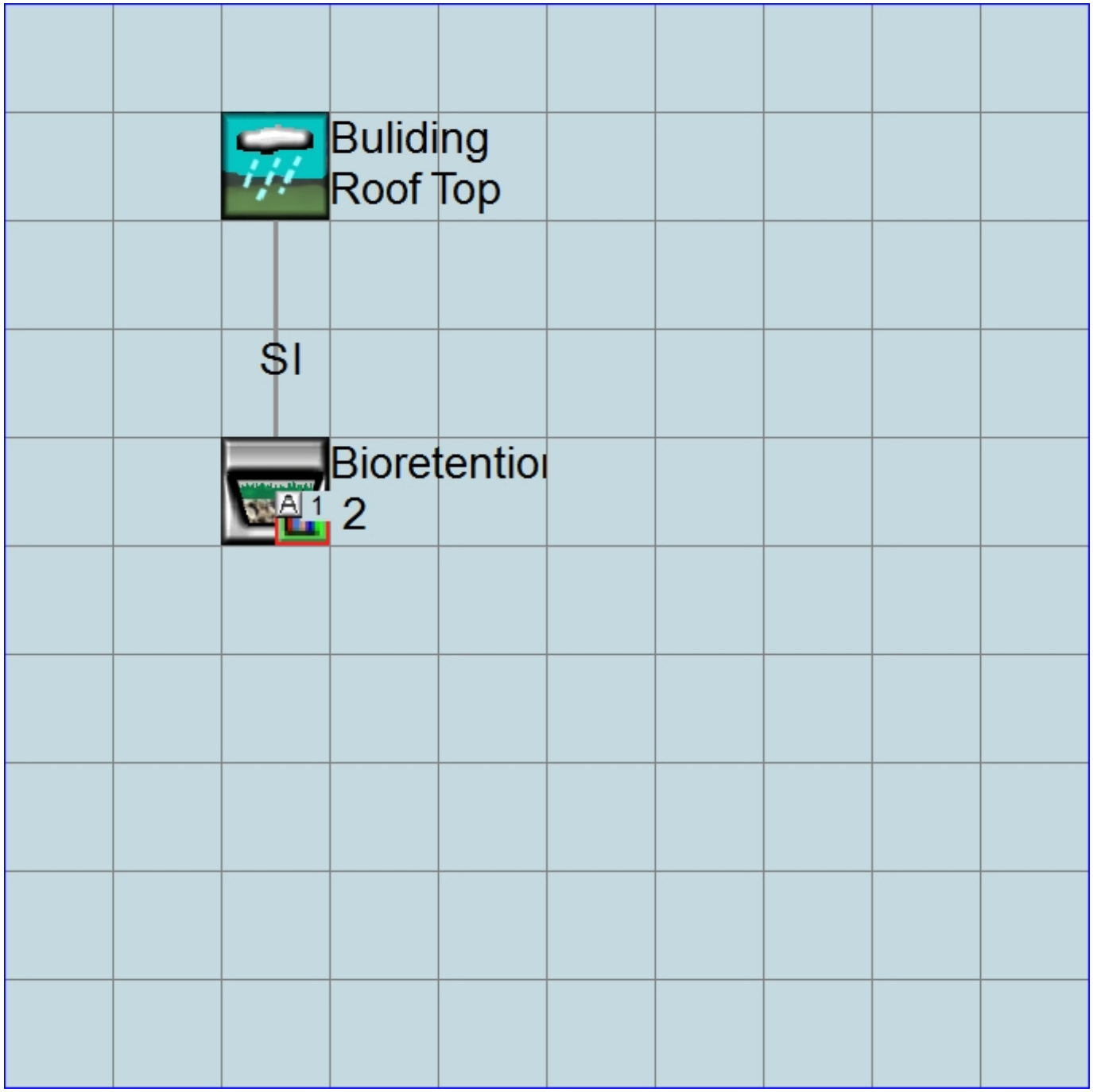
IMPLND Changes

No IMPLND changes have been made.

Appendix

Predeveloped Schematic

Mitigated Schematic



Predeveloped UCI File

Mitigated UCI File

Predeveloped HSPF Message File

Mitigated HSPF Message File

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6200 Capitol Blvd. Ste F
Olympia, WA. 98501
Toll Free 1(866)943-0304
Local (360)943-0304

www.clearcreeksolutions.com

SPECIFICATIONS

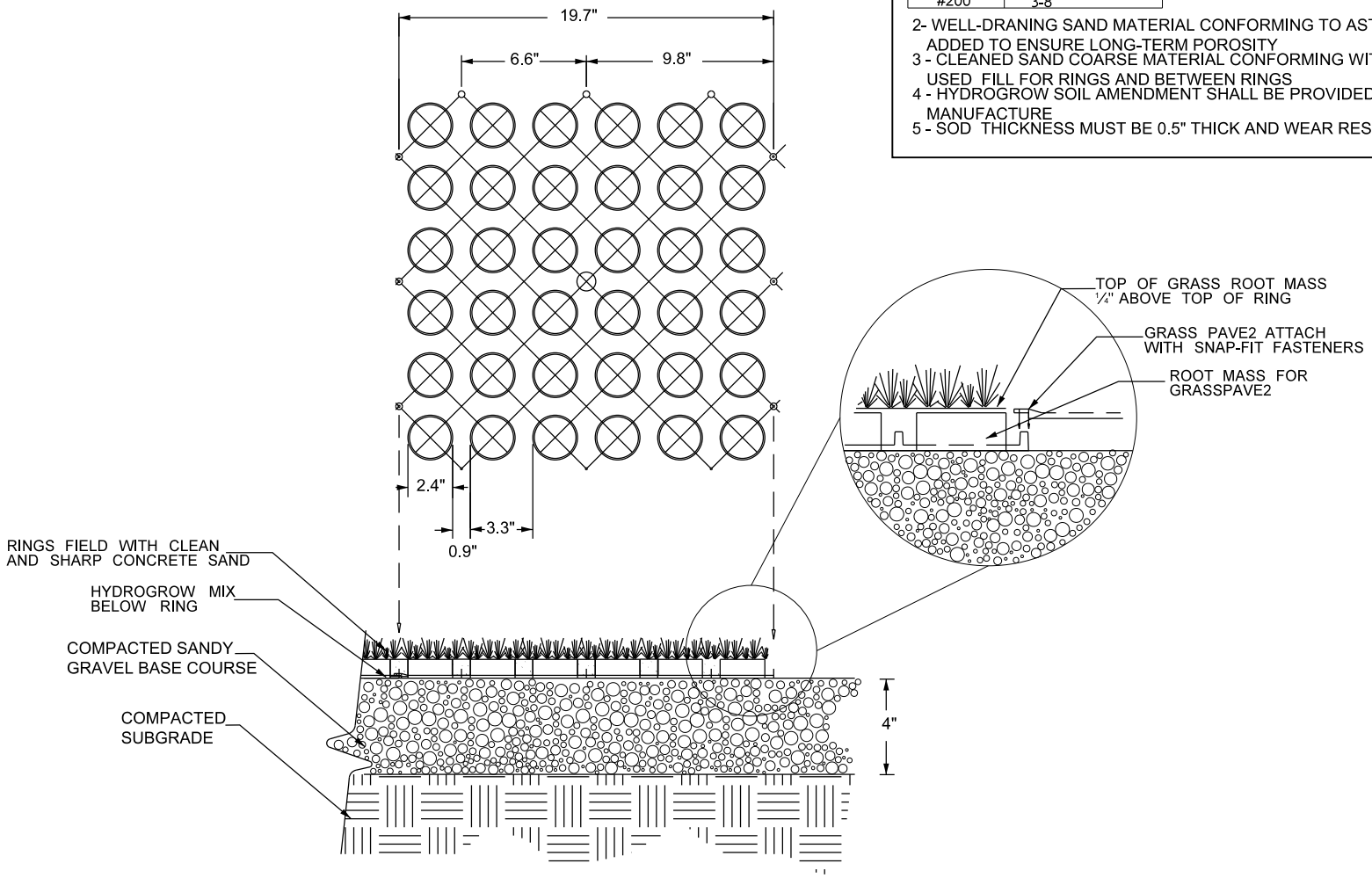
RESIN - HIGH DENSITY POLYETHYLENE (HDPE)
UNIT SIZE - 20" X 20" X 1"
STRENGTH - 5720 POUNDS PER SQUER INCH (PSI)
COLOR - BLACK (STANDARD)
LOADING- MAXIMUM CAPABILITY 15,940 PSI WHEN FILLED WITH SAND

MATERIAL

1- BASE COURSE IS SANDY GRAVEL MUST CONFORM WITH FOLLOWING SIEVE ANALYSIS AND REQUIREMENTS

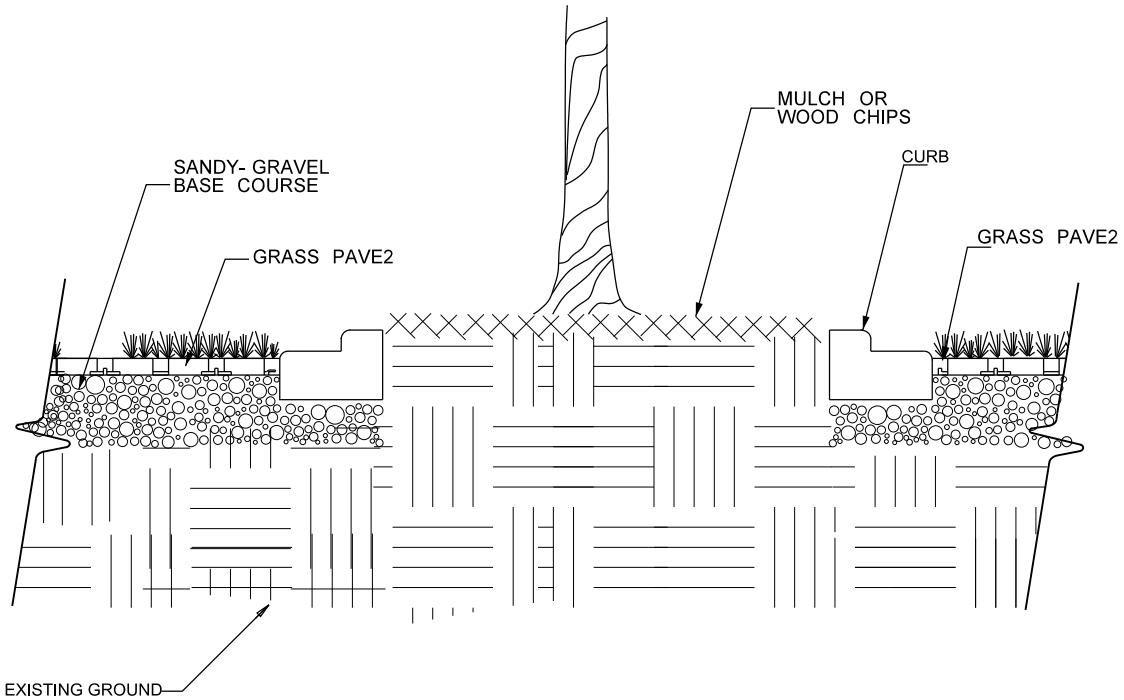
SIEVE SIZE	PERCENT PASSING
1"	100
¾"	90-100
⅜"	70-80
#4	55-70
#10	45-55
#40	25-35
#200	3-8

2- WELL-DRANING SAND MATERIAL CONFORMING TO ASTM C 33 TO BE ADDED TO ENSURE LONG-TERM POROSITY
3 - CLEANED SAND COARSE MATERIAL CONFORMING WITH ASTM C-33 USED FILL FOR RINGS AND BETWEEN RINGS
4 - HYDROGROW SOIL AMENDMENT SHALL BE PROVIDED BY THE MANUFACTURE
5 - SOD THICKNESS MUST BE 0.5" THICK AND WEAR RESISTANT.



GRASSPAVE2 DETAIL (TYP.)

N.T.S.



GRASSPAVE2 PARKING AREA PLANTER DETAIL

SECTION VIEW

Appendix I

(D)

NRCS Soil Data Map

Soil Map—Snohomish County Area, Washington
(ICOM)

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: http://websoilsurvey.nrcs.usda.gov
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 12, Sep 30, 2014

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

Date(s) aerial images were photographed: Jul 7, 2014—Jul 8, 2014

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.

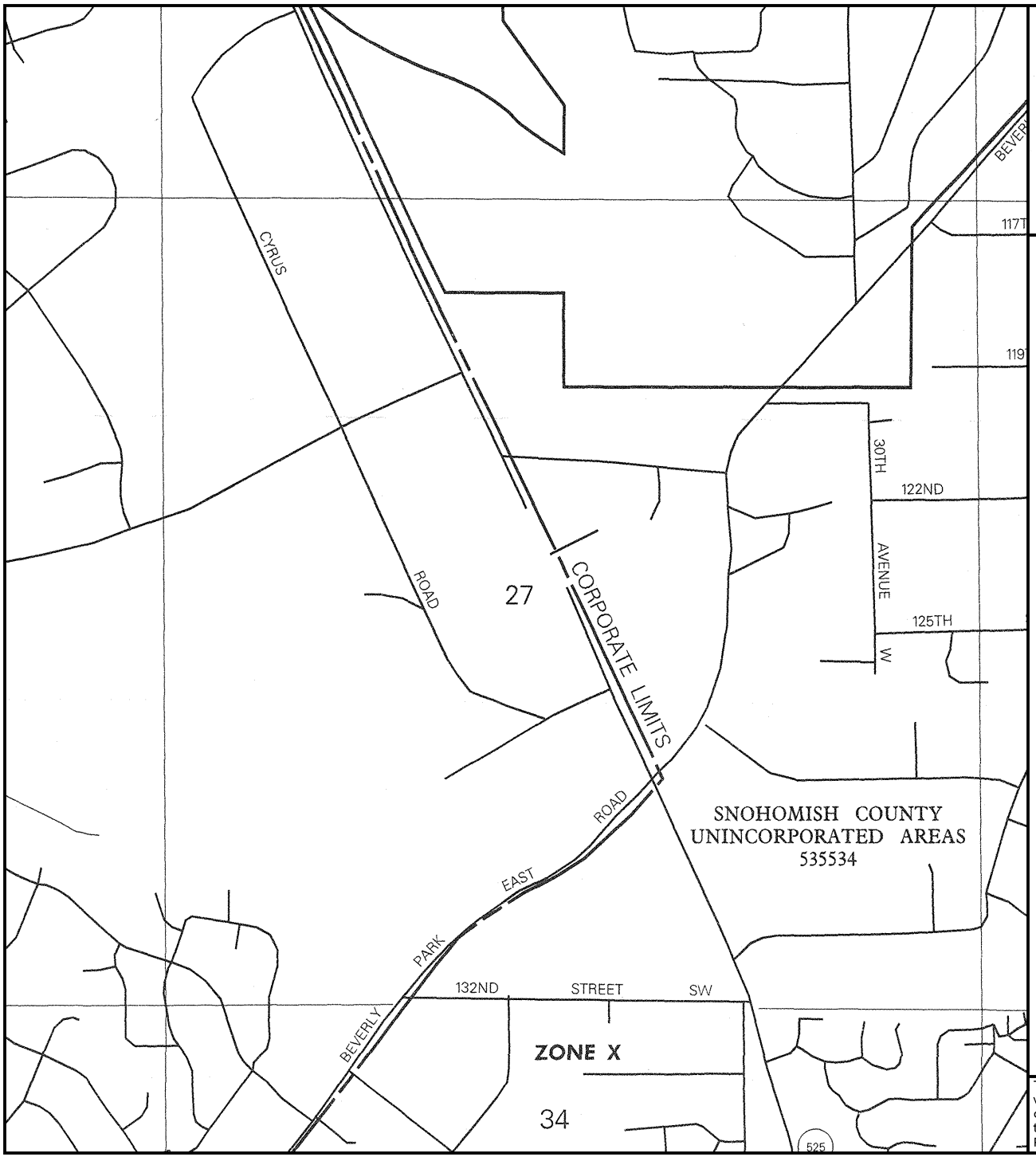
Map Unit Legend

Snohomish County Area, Washington (WA661)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
5	Alderwood-Urban land complex, 2 to 8 percent slopes	54.0	73.1%
19	Everett gravelly sandy loam, 15 to 25 percent slopes	16.6	22.4%
69	Terric Medisaprists, nearly level	2.7	3.6%
78	Urban land	0.6	0.8%
Totals for Area of Interest		**73.8**	**100.0%**

Appendix I

(E)

FEMA Flood Insurance Rate Map



APPROXIMATE SCALE IN FEET

1000 0 1000

NATIONAL FLOOD INSURANCE PROGRAM

FIRM

FLOOD INSURANCE RATE MAP

SNOHOMISH COUNTY, WASHINGTON AND INCORPORATED AREAS

PANEL 1020 OF 1575

(SEE MAP INDEX FOR PANELS NOT PRINTED)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
EVERETT, CITY OF	530164	1020	E
MUKILTEO, CITY OF	530235	1020	E
SNOHOMISH COUNTY, UNINCORPORATED AREAS	535534	1020	E

MAP NUMBER
53061C1020 E

EFFECTIVE DATE:
NOVEMBER 8, 1999

Federal Emergency Management Agency

Appendix II

(A)

Geotechnical Engineering Evaluation

NELSON GEOTECHNICAL ASSOCIATES, INC.
GEOTECHNICAL ENGINEERS & GEOLOGISTS

Main Office
17311 – 135th Ave NE, A-500
Woodinville, WA 98072
(425) 486-1669 · FAX (425) 481-2510

Engineering-Geology Branch
5526 Industry Lane, #2
East Wenatchee, WA 98802
(509) 665-7696 · FAX (509) 665-7692

September 19, 2014

Fattah Ghadamsi
9709 Sharon Drive
Everett, WA 98204

Geotechnical Engineering Evaluation
ICOM
3953 Harbour Pointe Boulevard SW
Mukilteo, Washington
NGA File No. 905114

Dear Mr. Ghadamsi:

We are pleased to submit the attached report titled "Geotechnical Engineering Evaluation – ICOM – Mukilteo, Washington." This report summarizes our observations of the existing surface and subsurface conditions within the site and provides general recommendations for the proposed site development at the address above. Our services were completed in general accordance with our proposal which was signed by you on August 13, 2014.

The property is currently vacant and is fully vegetated with young to mature trees and underbrush. We understand that the proposed development plans for the site consist of constructing a new two-story, mosque/prayer building along with a detached 20- by 40-foot trailer within the southeastern portion of the property. A parking lot will be located within the middle of the property. A wetland and buffer are located within the northern portion of the site. We understand that you desire to infiltrate stormwater runoff within the site.

We explored the site with three trackhoe-excavated test pits. Our explorations indicated that the site is generally underlain by medium dense to very dense glacial till soils with areas of shallow surficial topsoil. We have concluded that the site is generally compatible with the planned development. Foundations should be advanced through any loose soils down to the competent glacial material interpreted to underlie the site, for bearing capacity and settlement considerations. These soils should generally be encountered approximately one to two feet below the existing ground surface, based on our explorations. We should note that deeper areas of unsuitable soils and/or undocumented fill could be encountered in the unexplored areas of the site.

Based on the silty soils encountered in the explorations, it is our opinion that infiltrating stormwater runoff is not feasible for this site. However, pervious pavements could be utilized to infiltrate some of the stormwater runoff generated on this site.

In the attached report, we have also included recommendations for site grading, erosion control, foundation support, structural fill, and drainage.

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EROSION HAZARD 4

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1. Review available soil and geologic maps of the area.
2. Explore the subsurface soil and groundwater conditions within the site with trackhoe-excavated test pits. Trackhoe was contracted by NGA.
3. Perform laboratory analyses on selected samples, as needed.
4. Evaluate the infiltration capacities of the on-site soils.
5. Provide recommendations for earthwork activities.
6. Provide recommendations for temporary and permanent slopes.
7. Provide recommendations for retaining walls.
8. Provide recommendations for slab and subgrade preparation.
9. Provide recommendations for site drainage and erosion control.
10. Document the results of our findings, conclusions, and recommendations in a written geotechnical report.

SITE CONDITIONS

Surface Conditions

The property consists of an irregular-shaped parcel that slopes moderately down to the north. The site is currently vacant and is fully vegetated with young to mature trees and underbrush. The property is bounded to the north by Harbour Pointe Boulevard SW, to the west and south by vacant lots, and to the east by Bank of America property. We did not observe surface water within the site during our site visit.

Subsurface Conditions

Geology: The geologic units for this site are shown on Distribution and Description of Geologic Units in the Mukilteo Quadrangle, Washington by James P. Minard, (1982). The site is mapped as Qvt (Vashon till). The till is described as a non-sorted mixture of clay, silt, sand, pebbles, cobbles, and boulders. Our explorations within the site generally encountered surficial topsoil underlain by till at depth.

Explorations: The subsurface conditions within the site were explored on Thursday, August 25, 2014 by excavating three test pits to depths ranging from 5.5 to 10.4 feet below the existing ground surface. The approximate locations of our explorations are shown on the Site Plan in Figure 2. A geologist from NGA was present during the explorations, examined the soils and geologic conditions encountered, obtained samples of the different soil types, and maintained logs of the test pits.

SENSITIVE AREA EVALUATION

Seismic Hazard

We reviewed the 2012 International Building Code (IBC). Since mostly dense soils are interpreted to underlie the site at depth, the site conditions best fit the IBC description for Soil Class D for native soils.

Hazards associated with seismic activity include liquefaction potential and amplification of ground motion. Liquefaction is caused by a rise in pore pressures in a loose, fine sand deposit beneath the groundwater table. It is our opinion that the dense or better native deposits interpreted to underlie the site have a low potential for liquefaction or amplification of ground motion.

Erosion Hazard

The criteria used for determination of the erosion hazard for affected areas include soil type, slope gradient, vegetation cover, and groundwater conditions. The erosion sensitivity is related to vegetative cover and the specific surface soil types, which are related to the underlying geologic soil units. The Soil Survey of Snohomish County Area, Washington, by the Soil Conservation Service (SCS) was reviewed to determine the erosion hazard of the on-site soils. The surface soils for this site were mapped as Alderwood-Urban land complex, 2 to 8 percent slopes. The erosion hazard for this material is listed as slight. It is our opinion that the erosion hazard for the site soils should be slight in areas where the site is not disturbed.

LABORATORY ANALYSIS

We performed two grain-size analyses on selected soil samples obtained from the site. Laboratory tests were performed on samples taken from Test Pit 3 at 5.5 feet and 6.5 feet. The results of the sieve analyses are presented as Figures 5 and 6.

CONCLUSIONS AND RECOMMENDATIONS

General

It is our opinion from a geotechnical standpoint that the site is compatible with the planned development. Plans include the construction of a two-story structure and a trailer on the property. Our explorations indicated that the site is generally underlain by surficial topsoil with native glacial soil at shallow depths. The native soils should provide adequate support for foundation, slab, and pavement loads. We recommend that the planned structure be designed utilizing shallow foundations. Footings should extend through any undocumented fill or loose soil, and be founded on the underlying medium dense or better native soil, or

anticipate native, medium dense or better soil to be encountered approximately one to two feet across the site, but this depth could be greater in unexplored areas of the site. After site preparation, if the exposed subgrade is deemed loose, it should be compacted to a non-yielding condition and then proof-rolled with a heavy rubber-tired piece of equipment. Areas observed to pump or weave during the proof-roll test should be reworked to structural fill specifications or over-excavated and replaced with properly compacted structural fill or rock spalls. If loose soils are encountered in the pavement areas, the loose soils should be removed and replaced with rock spalls or granular structural fill. If significant surface water flow is encountered during construction, this flow should be diverted around areas to be developed, and the exposed subgrades should be maintained in a semi-dry condition. If deeper areas of unsuitable soils and/or undocumented fill are encountered in the unexplored areas of the site, we recommend that the soil be removed to expose dense native soil and replaced with structural fill or rock spalls.

If wet conditions are encountered, alternative site grading techniques might be necessary. These could include using large excavators equipped with wide tracks and a smooth bucket to complete site grading, and covering exposed subgrade with a layer of crushed rock for protection. If wet conditions are encountered or construction is attempted in wet weather, the subgrade should not be compacted, as this could cause further subgrade disturbance. In wet conditions, it may be necessary to cover the exposed subgrade with a layer of crushed rock as soon as it is exposed to protect the moisture sensitive soils from disturbance by machine or foot traffic during construction. The prepared subgrade should be protected from construction traffic and surface water should be diverted around areas of prepared subgrade.

Temporary and Permanent Slopes

Temporary cut slope stability is a function of many factors, including the type and consistency of soils, depth of the cut, surcharge loads adjacent to the excavation, length of time a cut remains open, and the presence of surface or groundwater. It is exceedingly difficult under these variable conditions to estimate a stable, temporary, cut slope angle. Therefore, it should be the responsibility of the contractor to maintain safe slope configurations since he is continuously at the job site, able to observe the subsurface materials and groundwater conditions encountered and able to monitor the nature and condition of the cut slopes.

The following information is provided solely for the benefit of the owner and other design consultants and should not be construed to imply that Nelson Geotechnical Associates, Inc. assumes responsibility for job site safety. Job site safety is the sole responsibility of the project contractor.

pressures are needed. Current IBC guidelines should be used when considering increased allowable bearing pressure for short-term transitory wind or seismic loads. Potential foundation settlement using the recommended allowable bearing pressure is estimated to be less than one-inch total and ½-inch differential between adjacent footings or across a distance of about 20 feet, based on our experience with similar projects.

Lateral loads may be resisted by friction on the base of the footing and passive resistance against the subsurface portions of the foundation. A coefficient of friction of 0.35 may be used to calculate the base friction and should be applied to the vertical dead load only. Passive resistance may be calculated as a triangular equivalent fluid pressure distribution. An equivalent fluid density of 200 pounds per cubic foot (pcf) should be used for passive resistance design for a level ground surface adjacent to the footing. This level surface should extend a distance equal to at least three times the footing depth. These recommended values incorporate safety factors of 1.5 and 2.0 applied to the estimated ultimate values for frictional and passive resistance, respectively. To achieve this value of passive resistance, the foundations should be poured "neat" against the native medium dense soils or compacted fill should be used as backfill against the front of the footing. We recommend that the upper one foot of soil be neglected when calculating the passive resistance.

Structural Fill

General: Fill placed beneath foundations, pavement, or other settlement-sensitive structures should be placed as structural fill. Structural fill, by definition, is placed in accordance with prescribed methods and standards, and is monitored by an experienced geotechnical professional or soils technician. Field monitoring procedures would include the performance of a representative number of in-place density tests to document the attainment of the desired degree of relative compaction. The area to receive the fill should be suitably prepared as described in the **Site Preparation and Grading** subsection of this report prior to beginning fill placement.

Materials: Structural fill should consist of a good quality, granular soil, free of organics and other deleterious material, and be well graded to a maximum size of about three inches. All-weather structural fill should contain no more than five-percent fines (soil finer than U.S. No. 200 sieve, based on that fraction passing the U.S. 3/4-inch sieve). The use of some of the on-site soils as structural fill may be feasible, but will be highly dependent on moisture and organic contents of the material at the time construction takes place. We should be retained to evaluate proposed structural fill material prior to placement.

These recommended lateral earth pressures are for a drained granular backfill and are based on the assumption of a horizontal ground surface behind the wall for a distance of at least the subsurface height of the wall, and do not account for surcharge loads. Additional lateral earth pressures should be considered for surcharge loads acting adjacent to subsurface walls and within a distance equal to the subsurface height of the wall. This would include the effects of surcharges floor slab loads, slopes, or other surface loads. We could consult with the structural engineer regarding additional loads on retaining walls during final design, if needed.

The lateral pressures on walls may be resisted by friction between the foundation and subgrade soil, and by passive resistance acting on the below-grade portion of the foundation. Recommendations for frictional and passive resistance to lateral loads are presented in the **Foundations** subsection of this report.

All wall backfill should be well compacted as outlined in the **Structural Fill** subsection of this report. Care should be taken to prevent the buildup of excess lateral soil pressures due to over-compaction of the wall backfill. This can be accomplished by placing wall backfill in 8-inch loose lifts and compacting the backfill with small, hand-operated compactors within a distance behind the wall equal to at least one-half the height of the wall. The thickness of the loose lifts should be reduced to accommodate the lower compactive energy of the hand-operated equipment. The recommended level of compaction should still be maintained.

Permanent drainage systems should be installed for retaining walls. Recommendations for these systems are found in the **Subsurface Drainage** subsection of this report. We recommend that we be retained to evaluate the proposed wall drain backfill material and observe installation of the drainage systems.

Pavement Subgrade

Pavement subgrade preparation should be completed as recommended in the **Site Preparation and Grading** and **Structural Fill** subsections of this report. The pavement subgrade should be proof-rolled with a heavy, rubber-tired piece of equipment to identify soft or yielding areas that require repair. We should be retained to observe the proof-rolling and recommend repairs prior to placement of the asphalt or other surfaces.

On-site Infiltration

In our opinion, stormwater infiltration for this site is not feasible using traditional infiltration trenches. In the locations explored, we encountered silty sand material that would provide very limited infiltration based

footings, slabs, or pavements are to be constructed. Final site grades should allow for drainage away from the structures. We suggest that the finished ground be sloped at a minimum gradient of three percent, for a distance of at least 10 feet away from the structures. Surface water should be collected by permanent catch basins and drain lines, and be routed into an appropriate discharge system.

Subsurface Drainage: If groundwater is encountered during construction, we recommend that the contractor slope the bottom of the excavation and collect the water into ditches and small sump pits where the water can be pumped from the excavation and routed to a suitable discharge point.

We recommend the use of footing drains around the structure and behind all retaining walls. Footing drains should be installed at least one foot below planned finished floor elevation. The drains should consist of a minimum 4-inch-diameter, rigid, slotted or perforated, PVC pipe surrounded by free-draining material wrapped in a filter fabric. We recommend that the free-draining material consist of an 18-inch wide zone of clean (less than three-percent fines), granular material placed along the back of walls. Washed rock is an acceptable drain material, or drainage composite may be used instead. The free-draining material or the drainage composite should extend up the wall to one foot below the finished surface. The top foot of backfill should consist of low permeability soil placed over plastic sheeting or building paper to minimize the migration of surface water or silt into the footing drain. Footing drains should discharge into tightlines leading to an appropriate collection and discharge point with convenient cleanouts to prolong the useful life of the drains. Roof drains should not be connected to wall or footing drains.

CONSTRUCTION MONITORING

We recommend that NGA be retained to provide monitoring and consultation services during construction to confirm that the conditions encountered are consistent with those indicated by the explorations, to provide recommendations for design changes should the conditions revealed during the work differ from those anticipated, and to evaluate whether or not earthwork and foundation installation activities comply with contract plans and specifications. We should be contacted a minimum of one week prior to construction activities and could attend pre-construction meetings if requested.

USE OF THIS REPORT

NGA has prepared this report for Fattah Ghadamsi and his agents for use in the planning and design of the development planned on this site only. The scope of our work does not include services related to construction safety precautions and our recommendations are not intended to direct the contractors'

It has been a pleasure to provide service to you on this project. If you have any questions or require further information, please call.

Sincerely,

NELSON GEOTECHNICAL ASSOCIATES, INC.

Bala Dodoye-Alali
Project Geologist

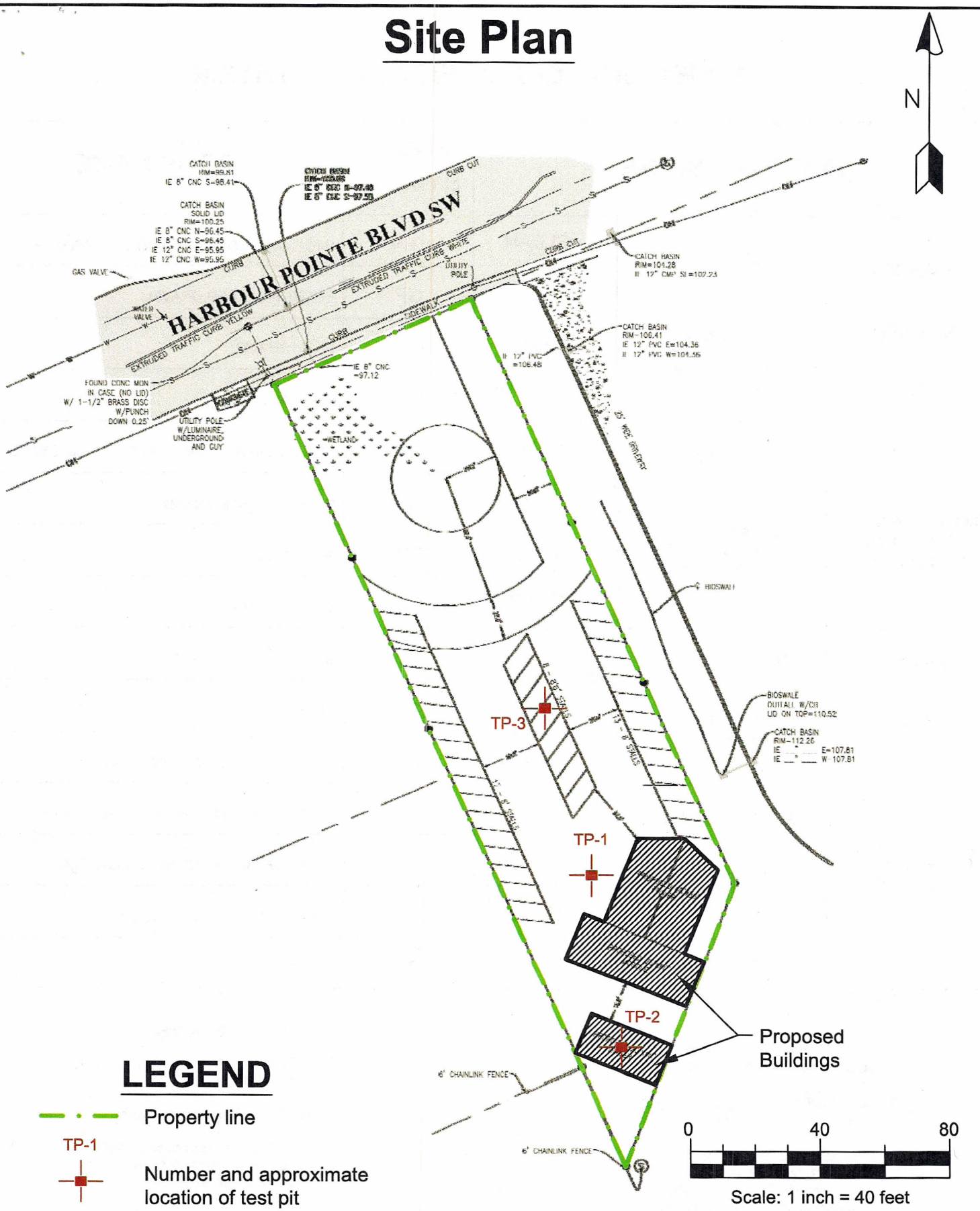
Exp. July 28, 2015

Khaled M. Shawish, PE
Principal

Six Figures Attached

BD:KMS:cja

Site Plan



LEGEND

Property line

TP-1

Number and approximate location of test pit

Reference: Site Plan based on a plan dated March 12, 2014 titled "Boundary and Topographic Survey," prepared by All Land Surveying.

Project Number	Mukilteo Mosque ICOM Site Plan
905114	
Figure 2	

NELSON GEOTECHNICAL ASSOCIATES, INC.
NGA
GEOTECHNICAL ENGINEERS & GEOLOGISTS
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(425) 486-1669 / Fax 481-2510
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No.	Date	Revision	By	CK
1	8/26/14	Original	DPN	BD

2014 NGA Project Folders\905114 Mukilteo Mosque ICOM\Drafting\SP.dwg

LOG OF EXPLORATION

DEPTH (FEET)	USC	SOIL DESCRIPTION
TEST PIT ONE		
0.0 – 1.5		DARK BROWN, SILTY FINE TO MEDIUM SAND WITH GRAVEL AND ROOTS (LOOSE, MOIST) (**TOPSOIL**)
1.5 – 3.6	SM	LIGHT BROWN, SILTY FINE TO MEDIUM SAND WITH GRAVEL, ROOTS, AND IRON OXIDE STAINING (MEDIUM DENSE TO DENSE, MOIST)
3.6 – 6.0	SM	GRAY-BROWN, SILTY FINE TO MEDIUM SAND WITH GRAVEL (DENSE, MOIST)
		SAMPLES WERE COLLECTED AT 2.8 AND 6.0 FEET GROUNDWATER SEEPAGE WAS NOT ENCOUNTERED TEST PIT CAVING WAS NOT ENCOUNTERED TEST PIT WAS COMPLETED AT 6.0 FEET ON 8/25/14
TEST PIT TWO		
0.0 – 1.0		DARK BROWN, SILTY FINE TO MEDIUM SAND WITH GRAVEL AND ROOTS (LOOSE, MOIST) (**TOPSOIL**)
1.0 – 3.0	SM	LIGHT BROWN, SILTY FINE TO MEDIUM SAND WITH GRAVEL (MEDIUM DENSE TO DENSE, DRY-MOIST)
3.0 – 5.5	SM	GRAY-BROWN, SILTY FINE TO MEDIUM SAND WITH GRAVEL (DENSE TO VERY DENSE, MOIST)
		SAMPLES WERE COLLECTED AT 2.7, 5.0, AND 5.5 FEET GROUNDWATER SEEPAGE WAS NOT ENCOUNTERED TEST PIT CAVING WAS NOT ENCOUNTERED TEST PIT WAS COMPLETED AT 5.5 FEET ON 8/25/14
TEST PIT THREE		
0.0 – 1.8		DARK BROWN, SILTY FINE TO MEDIUM SAND WITH GRAVEL AND ORGANICS (LOOSE, MOIST) (**TOPSOIL**)
1.8 – 4.0	SM	GRAY-BROWN, SILTY FINE TO MEDIUM SAND WITH GRAVEL AND IRON OXIDE STAINING (MEDIUM DENSE TO DENSE, MOIST)
4.0 – 6.0	SM	LIGHT GRAY, SILTY FINE TO MEDIUM SAND WITH TRACE GRAVEL AND TRACE IRON OXIDE STAINING (DENSE, MOIST)
6.0 – 10.4	SM	GRAY TO DARK GRAY, SILTY FINE TO MEDIUM SAND WITH GRAVEL (DENSE TO VERY DENSE, MOIST)
		SAMPLES WERE COLLECTED AT 2.5, 5.5, 6.5, 9.0, AND 10.0 FEET GROUNDWATER SEEPAGE WAS NOT ENCOUNTERED TEST PIT CAVING WAS NOT ENCOUNTERED TEST PIT WAS COMPLETED AT 10.4 FEET ON 8/25/14

Project Number
905114

Figure 6

Mukilteo Mosque
ICOM
Sieve Analysis

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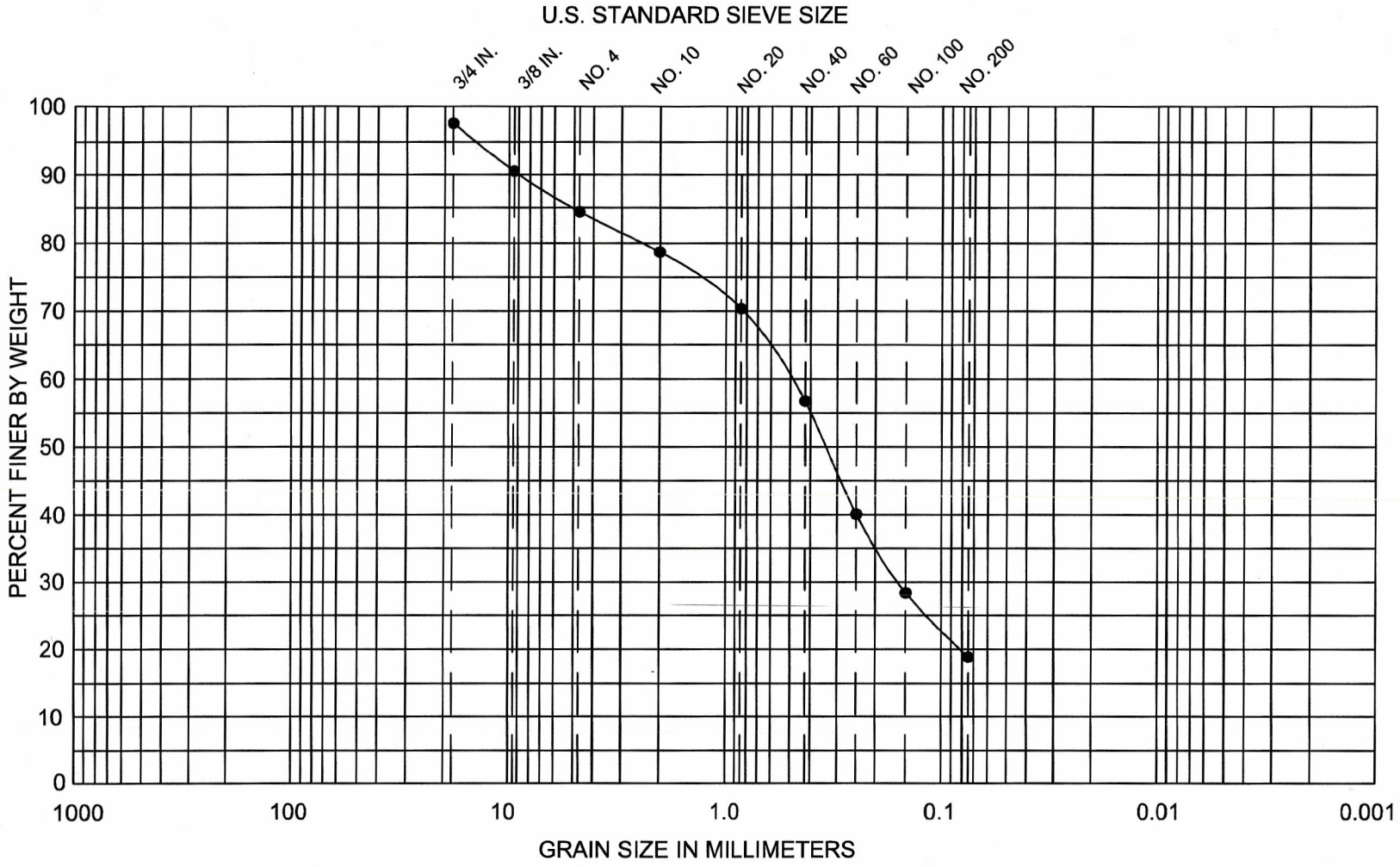
No.	Date	Revision	By	CK
1	8/27/14	Original	DPN	BD



COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	

U.S.C. SYMBOL	EXPLORATION NUMBER	SAMPLE DEPTH	SOIL DESCRIPTION	SOIL DISTRIBUTION
●SM	TP-3	6.5 feet	Gray, silty fine to medium sand with gravel	Gravel = 16% Sand = 65% Silt/Clay = 19%

2014 NGA Project Folders\9051-14 Mukilteo Mosque ICOM\Drafting\Sieve.dwg

Appendix II
(B)

Critical Area Study and Buffer Mitigation Plan

Wetland Resources, Inc.
Delineation / Mitigation / Restoration / Habitat Creation / Permit Assistance

9505 19th Avenue S.E.
Suite 106
Everett, Washington 98208
(425) 337-3174
Fax (425) 337-3045

CRITICAL AREA STUDY AND BUFFER MITIGATION PLAN

FOR

ICOM – HARBOUR POINTE BLVD

MUKILTEO, WA

Wetland Resources, Inc. Project #14060

Prepared By:
Wetland Resources, Inc.
9505 19th Avenue SE, Suite 106
Everett, WA 98208
(425) 337-3174

Prepared For:
Mohammed Khan
5500 Harbour Pointe Blvd., R104
Mukilteo, WA 98275

April 15, 2014

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ATTACHMENTS:

DOE WETLAND RATING FORMS

FIELD DATA FORMS

CRITICAL AREA STUDY MAP & MITIGATION PLAN (SHEET 1/1)

INTRODUCTION

Wetland Resources, Inc. (WRI) conducted a site investigation in July 2012 for the 0.8-acre property located southwest of Harbour Pointe Boulevard SW and Mukilteo Speedway in the city of Mukilteo, WA (portion of Section 27, Township 27N, Range 4E, W.M. The purpose of the investigation was to identify jurisdictional wetlands and/or streams in the vicinity of the subject parcel. The development proposal for this site will include construction of a mosque with associated parking and an access driveway. To do this, the applicant will apply for a variance to reduce a portion of the on-site wetland buffer to a minimum 25-width.

The entire site is forested and relatively level with minor undulations throughout. Access is from the north via Harbour Pointe Boulevard. Surrounding land use consists of commercial to the north, east, and south, and undeveloped and residential use to the west. Dominant plant species found throughout the site consist of red alder and big-leaf maple in the canopy, with salmonberry, Oso-berry, Himalayan blackberry, red elderberry, and sword fern in the understory.

WRI identified one wetland in the northern portion of the site. The wetland is depressional with an intermittent outlet into a pipe that crosses under Harbour Pointe Blvd. The wetland appears to receive hydrology from roadside runoff and a high seasonal groundwater table. It is vegetated with red alder, Scouler's willow, salmonberry, Himalayan blackberry, stinging nettle, and reed canary grass. The wetland receives a total score of 38 points for functions on the DOE Wetland Rating Form, including a habitat score of 10 points. The wetland is therefore classified as a Category III wetland. In the city of Mukilteo, Category III wetlands with fewer than 20 points on high-intensity land use site typically receive maximum 80-foot buffers. No other critical areas were identified within 300 feet of the site.

WETLAND CLASSIFICATION—COWARDIN SYSTEM

According to the Cowardin System, as described in Classification of Wetlands and Deepwater Habitats of the United States, the classifications for the on-site wetland is as follows:

Wetland A: Palustrine, Forested, Broad-leaved Deciduous, Seasonally Flooded.

WETLAND CLASSIFICATION—CITY OF MUKILTEO

Under the Mukilteo Municipal Code (MMC) for Wetland Regulations, Chapter 17B.52B, the on-site wetland is classified using the Washington State Department of Ecology's (DOE) Wetland Rating System for Western Washington (MMC 17B.52B.060; Hruby 2004). Completed rating forms are provided in Appendix B of this report. Wetland buffer widths vary depending upon the intensity of adjacent land use. Buffer widths were determined according to Table I within 17B.52B.070(E).

Wetland A - Category III
Wetland A is a depressional wetland that receives a total score for functions of 38 with a habitat rating of 10. Wetlands attaining a total score for functions of 30 and 50 points are classified as Category III wetlands. Category III wetlands with a habitat score of fewer than 20 points typically receive 80-foot buffers on high intensity land use and 60-foot buffers on medium intensity land use.

In the city of Mukilteo, regulated streams, wetlands and their buffers are designated collectively as Native Growth Protection Areas (NGPAs). All Native Growth Protection Areas shall be shown on the development site plans or final plat maps, and shall be noted as follows, per MMC 17.52.035:

> *There shall be no clearing, excavation, or fill within the native growth protection area shown on the face of this site plan/plat, with the exception of required utility station, removal of dangerous trees, thinning of woodlands for the benefit of the woodlands as determined by a certified landscape architect or arborist, and removal of obstructions on drainage courses, or as allowed under Section 17.52A.070, Vegetation management on steep slopes.*

NATIVE GROWTH PROTECTION AREA SIGNS

Signs designating the presence of the NGPA shall be posted along the NGPA boundary. Signs shall be placed at approximately 50-foot intervals around the perimeter of the NGPA. An example of Type 1 sign language is as follows:

NATIVE GROWTH PROTECTION AREA
THIS WETLAND AND UPLAND BUFFER ARE PROTECTED TO
PROVIDE WILDLIFE HABITAT AND MAINTAIN WATER QUALITY.
PLEASE DO NOT DISTURB THIS VALUABLE RESOURCE.
*SEE RECORDED PLAT FOR RESTRICTIONS

The signs shall be constructed of aluminum or similar durable material. They shall be secured to 4" x 4" x 7' (min.) pressure treated posts buried a minimum of two feet in quick setting concrete.

WETLAND DETERMINATION REPORT

Methodology
Wetland conditions were evaluated using the on-site, routine methodology described in the 2010 Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Western Mountains, Valleys, and Coast Region (Version 2.0), (referred as 2010 Regional Supplement). In general, wetland delineation consisted of two tasks: (1) assessing vegetation, soil, and hydrologic characteristics to identify areas meeting the wetland identification criteria, and (2) mapping wetland boundaries using aerial photography and existing survey information.

The following criteria descriptions were used in the boundary determination:

Vegetation Criteria

Wetland Vegetation Criteria

The 2010 Regional Supplement defines hydrophytic vegetation as "the community of macrophytes that occurs in areas where inundation or soil saturation is either permanent or of sufficient frequency and duration to exert a controlling influence of the plant species present." Field indicators were used to determine whether the vegetation meets the definition for hydrophytic vegetation.

Soils Criteria and Mapped Description

The National Technical Committee for Hydric Soils, as described in the 2010 Regional Supplement, defines hydric soils as "a soil that formed under conditions of saturation, flooding, or ponding long enough during the growing season to develop anaerobic conditions in the upper part." Field indicators were used to determine whether a given soil meets the definition for hydric soils.

According to the Soil Survey of Snohomish County Area Washington, the underlying soils on the subject property consist of Alderwood Urban Land Complex 8 to 15 percent slopes.

Alderwood- Urban land complex, 8 to 15 percent slopes: This map unit is on till plains. This unit is about 60 percent Alderwood gravelly sandy loam and about 25 percent urban land. Included in this unit are small areas of Everett and Indianola soils on terraces and outwash plains, Kitsap soils on terraces and terrace escarpments, and Ragnar soils on outwash plains. Included areas make up about 15 percent of the total acreage.

The Alderwood soil is moderately deep over a hardpan and is moderately well drained. It formed in glacial till. Typically the surface layer is very dark grayish brown gravelly sandy loam about 7 inches thick. The upper part of the subsoil is dark yellowish brown and dark brown very gravelly sandy loam about 23 inches thick. A weakly cemented hardpan is at a depth of about 35 inches. Depth to the hardpan ranges from 20 to 40 inches. Permeability of this soil is moderately rapid above the hardpan and very slow through it. Available water capacity is low. Urban land consists of areas that are covered by streets, buildings, parking lots, and other structures that obscure or alter the soils so that identification is not possible.

Hydrology Criteria

The 2010 Regional Supplement states that criteria for designation as a wetland based on hydrology is met when "areas are seasonally inundated and/or saturated to the surface for a consecutive number of days ≥12.5 percent of the growing season, provided that soil and vegetation parameters are met. Areas inundated or saturated between 5 and 12.5 percent of the growing season in most years may or may not be wetland. Areas saturated to the surface for less than 5 percent of the growing season are non-wetlands." Field indicators are employed in the determination that wetland hydrology parameters are met.

BOUNDARY DETERMINATION FINDINGS

Wetland A

The on-site wetland is located in the northern portion of the property. Dominant vegetation within the wetland is represented by: red alder (*Alnus rubra*, Fac), Scouler's willow (*Salix scouleriana*, FacW), salmonberry (*Rubus spectabilis,* Fac), Himalayan blackberry (*Rubus armeniacus,* Fac), lady fern (*Athyrium felix-femina,* Fac), reed canary grass (*Phalaris arundinacea*, FacW), and stinging nettle (*Urtica dioica*, Fac+).

The underlying soils were very dark gray (10YR 3/1) sandy loam about 18 inches thick. The soils were saturated during our July 2012 site visit.

The dominance of species rated "Facultative" or wetter meets the criteria for hydrophytic vegetation in the areas mapped as wetland. Based on field indicators of hydric soils, it appears that the areas mapped as wetland are saturated to the surface for more than 12.5 percent of the growing season, thereby fulfilling wetland hydrology criteria.

Non-Wetland

Typical vegetation found throughout the non-wetland areas of the site consists of red alder, big-leaf maple (*Acer macrophyllum*, FacU), black cottonwood (*Populus balsamifera*, Fac), salmonberry, Oso-berry (*Oemleria cerasiformis*, FacU), red elderberry (*Sambucus racemosa,* FacU), and western sword fern (*Polystichum munitum,* FacU).

The color of the soils sampled in the non-wetland areas are is very dark grayish brown (10YR 2/2) in the upper four to six inches with a dark yellowish brown (10YR 4/4, 10YR 3/4) in the sublayer. Soil texture throughout the profile is a sandy loam. The soils were slightly moist at the time of the site investigation.

Based on the lack of field indicators, it appears that areas of the site mapped as non-wetland are not saturated to the surface for more than 12.5 percent of the growing season, thereby not fulfilling wetland hydrology criteria.

FUNCTIONS AND VALUES ASSESSMENT

Methodology

The methodology for this functions and values assessment is based on professional opinion developed through past field analyses and interpretation. This assessment pertains specifically to the on-site wetland and stream system, but is typical for assessments of similar systems common to Western Washington.

Value Assessment

The on-site wetland is a depressional wetland with an intermittently flowing outlet. Wetlands with limited outflow retain water longer and allow for higher potential to perform hydrologic functions. This wetland appears to receive its hydrology from stormwater runoff and a seasonal high groundwater table. It appears to have some potential to provide valuable stormwater control functions for the surrounding areas.

The dense vegetation cover within this wetland combined with its highly depressional characteristic in an urban area result in moderately high water quality improvement functions within this wetland.

Habitat functions are limited within this wetland and the surround areas, due to the low connectivity to other diverse habitats. The subject wetland and its vegetated buffer to the south do provide some nesting and foraging opportunities. Based on the existing vegetation structure and plant diversity, it is highly likely that the site is used by a variety of small birds and mammals. However, the on-site wetland is unprotected to the north, and the overall level of habitat functions is relatively low.

PROJECT DESCRIPTION

The applicant is proposing to construct a mosque with associated parking and an access driveway. The majority of the development will occur in the southern part of the site, away from the on-site wetland and buffer area. However, in order to gain access to the development area, the proposed driveway will require permanent wetland buffer impacts. To accomplish this, the applicant will apply for a variance for buffer a reduction that is more than 50 percent of the standard buffer width.

Avoidance Discussion
Complete avoidance of direct wetland impacts will be achieved. Due to the location of the on-site wetland near the entrance to the site, permanent buffer impacts are unavoidable. The total area of permanent buffer impact will amount to 3,765 square feet. The proposed driveway will be 26-feet wide and will parallel the eastern property line. There is no feasible alternative for access into the site that would result in less impact and achieve the same safety requirements. Placing the driveway as far as possible away from the wetland will minimize impacts to the greatest extent. The result is a minimum 19-foot wide buffer between a portion of the on-site wetland and the driveway. The applicant will construct the driveway out of suitable materials that are accepted or preferred by the City. Because the 3,765 square feet of buffer impact will be permanent, the applicant proposes compensation in the form of buffer enhancement and purchase of fee-in-lieu credits, per 17.52.025.C.4.

Impact Analysis
The proposed access driveway will result in 3,765 square feet permanent buffer impacts and a minimum buffer width of 19 feet for the eastern side of the on-site wetland. The vegetation to be impacted will include several red alder trees, a big leaf maple, and salmonberry, Oso berry, and sword fern in the understory. The buffer reduction will result in loss of potential habitat for a variety of small birds and mammals that may use the site. It will also result in reduced shade and protection for the wetland.

No impacts to hydrologic control functions within the on-site wetland are expected since no filling or direct discharge are proposed. Likewise, no long-term effects to water quality functions are expected if the driveway runoff is designed to sheet flow.

Short-term water quality improvement functions will be mitigated through installation of erosion control fencing along the boundaries of the proposed clearing areas.

Proposed Mitigation Measures
Pursuant to MMC 17.52.025.C.4: *In order for the property owner to receive a reduction in the required critical area buffer, administratively or through a variance, the remaining buffer shall be enhanced to reduce significant adverse impacts to the critical area and off-site buffer mitigation shall be required for the area of buffer reduced. Mitigation can be in the form of payment of a fee in-lieu of buffer mitigation through use of the Mukilteo habitat reserve (MHR) as described in the Mukilteo CAMP.*

Therefore, as mitigation for the aforementioned impacts, the applicant is proposing to enhance 3,765 square feet buffer area that remains on the site. Because of the intact understory, enhancement plantings will consist primarily of tree species. Enhancement plantings will be interspersed throughout the existing buffer vegetation to improve habitat complexity and diversity. Following correct installation of the approved mitigation measures, the buffer will have a higher potential for removing excess pollutants and sediments as stormwater sheet flows through the site. Other anticipated benefits would be increased screening and protection around the perimeter of the wetland, which ultimately benefit the habitat functions within the wetland. These assumptions are consistent with the guidelines provided in *Wetlands in Washington State - Volume 2: Guidance for Protecting and Managing Wetlands. (Washington State Department of Ecology, 2005).*

In addition, the applicant will pay into to a fee in-lieu program as part of the requirement for off-site buffer mitigation. The total area of off-site mitigation and purchase of fee in-lieu credits will be equivalent to enhancement of 3,765 square feet of forested buffer area. The City shall advise the applicant is how to complete this payment.

VARIANCE DISCUSSION

Per MMC17.64.040.A, a variance may be granted only if all of the following criteria are met:

1. The variance shall not constitute a grant of special privilege inconsistent with the rules and regulations governing the uses of other properties in the vicinity or zoning district in which the property for which the variance is requested is located.

The variance is intended to relieve the applicant from hardship by allowing the applicant to construct a reasonable access driveway into to the developable portion in the south. No special privileges apply to this application.

2. The variance must be necessary, because of special circumstances relating to the size, shape, topography, location, or surroundings of the subject property, to provide it with use rights and privileges permitted to other properties in the vicinity that are located in the same zoning district in which the subject property is located.

The variance is necessary because of the location of the Category III wetland and its 80-foot regulated buffer at the only entrance point of the site. There is no way to access the site without

impacting the buffer and reducing it to a minimum 19-foot width. Not being able to provide access into the site would deny the applicant a reasonable use of the site that is otherwise allowed on other properties in the vicinity. The proposed 26-foot width of the driveway supports the safest driveway design with two clearly marked lanes. It is the minimum width necessary to achieve safe use of the driveway and site (see engineer's plans for details).

3. The granting of the variance will not be materially detrimental to the public welfare or injurious to the property or improvements in the vicinity or zone in which the subject property is situated.

No harm to the public is expected, since the work will be completely contained within the property. No changes in storm water, utilities, or wastewater are expected to affect surrounding properties.

4. Hardships of a financial nature, hardships which are self-created, and hardships which are personal to the owner and not to the property, shall not be grounds for a variance.

No hardships as mentioned above apply to this application.

5. Variances shall not be granted if the granting of the variance would allow a use not permitted outright or by conditional use permit, or any use prohibited outright or by implications in the zoning district involved.

It is our understanding that the development of a place of worship (a mosque) is allowed on the subject site (zoned as Community Business).

BUFFER ENHANCEMENT PLAN

The applicant proposes to enhance 9,405 square feet of the remaining buffer areas on this site. The designated areas will be enhanced with trees space on approximate 15-foot centers, since most of the understory area is currently vegetated with native species. The plantings will be shade tolerant and will be marked with brightly colored ribbon for easy identification during maintenance and monitoring. The following list of tree plantings is recommended for this site.

Buffer Enhancement Planting Plan (9,405 SF)

Common Name	Latin Name	Size	Spacing	Quantity
Western red cedar	*Thuja plicata*	1 gal	15'	15
Douglas fir	*Pseudotsuga menziesii*	1 gal	15'	14
Big-leaf maple	*Acer macrophyllum*	1 gal	15'	14

PROJECT GOALS AND OBJECTIVES

The goals of this mitigation plan are to offset the new on-site development by replacing and improving the ecological functions on this site. To achieve this, specific goals have been established and are listed below.

Goal 1. Improve wetland buffer functions through vegetation enhancement.

- **Objective 1.** Enhance 9,405 square feet of the on-site buffer.

Goal 2. Permanently protect the enhanced NGPA areas.

- **Objective 1.** Install permanent signs to clearly mark the boundaries of the protected areas.

PLANTING NOTES

Plant in the early spring or late fall and obtain all plants from a reputable nursery. Care and handling of all plant materials is extremely important to the overall success of the project. The origin of all plant materials specified in this plan shall be native plants, nursery grown in the Puget Sound region of Washington. Some limited species substitution may be allowed, only with the agreement of the landscape designer, wetland biologist, and/or City staff.

Handling: Plants shall be handled to avoid all damage, including breaking, bruising, root damage, sunburn, drying, freezing or other injury. Plants must be covered during transport. Plants shall not be bound with wire or rope in a manner that could damage branches. Protect plant roots with shade and wet soil in the time period between delivery and installation. Do not lift container stock by trunks, stems, or tops. Do not remove from containers until ready to plant. Water all plants as necessary to keep moisture levels appropriate to the species' horticultural requirements. Plants shall not be allowed to dry out. All plants shall be watered thoroughly immediately upon installation. Soak all containerized plants thoroughly prior to installation. Bare root plants are subject to the following special requirements, and shall not be used unless planted between November 1 and March 1, and only with the permission of the landscape designer, wetland biologist, and City staff. Bare root plants must have enough fibrous root to insure plant survival. Roots must be covered at all times with mud and/or wet straw, moss, or other suitable packing material until time of installation. Plants whose roots have dried out from exposure will not be accepted at installation inspection.

Weeding: Existing and exotic vegetation in the planting areas will be hand-weeded from around all newly installed plants at the time of installation and on a routine basis throughout the monitoring period. No chemical control of vegetation shall be used on this site.

Planting Pits: Planting pits shall be circular or square with vertical sides, and shall be 6" deeper and 12" larger in diameter than the root ball of the plant. Break up the sides of the pit in compacted soils. Set plants upright in pits. Burlap shall be removed from the planting pit.

Backfill shall be worked back into holes such that air pockets are removed without adversely compacting down soils.

Water: Plants shall be watered midway through backfilling, and again upon completion of backfilling. For spring plantings (if approved), a rim of earth shall be mounded around the base of the tree or shrub no closer than the drip line, or no less than 30 inches in diameter, except on steep slopes or in hollows. Plants shall be watered a second time within 24-48 hours after installation. The earthen rim / dam should be leveled prior to the second growing season.

Plant Location: Three-foot by two-inch by one quarter-inch (3' x 2" x 1/4") lath stakes or suitable flagging material shall be placed next to or on each planting to assist in locating the plants while removing the competing non-native vegetation and to assist in locating the plants during the monitoring period.

Arrangement and Spacing: The plants shall be arranged in a pattern with the appropriate numbers, sizes, species, and distribution that are required in accordance with the approved plans. The actual placement of individual plants shall mimic natural, asymmetric vegetation patterns found on similar undisturbed sites in the area. Spacing of the plantings may be adjusted to maintain existing vegetation with the agreement of the landscape designer, wetland biologist, and/or City staff.

Inspection(s): A wetland biologist shall be present on site to inspect the plants prior to planting. Minor adjustments to the original design may be required prior to and during construction.

Mulch: All landscaped areas denuded of vegetation and soil surface surrounding all planting pit areas shall receive no less than two to four inches of organic compost or certified weed free straw after planting. Compost or certified weed free straw shall be kept well away (at least two inches) from the trunks and stems of woody plants.

Temporary Erosion and Sedimentation Control

Prior to beginning any development or mitigation activities, erosion control fencing shall be installed as described in the grading plan construction drawings. A pre-construction meeting between the City, the consulting wetland professional, contractor and equipment operator(s) will be held prior to any construction activities to inspect the location of siltation fencing.

All sedimentation control facilities shall be kept in place and functioning until vegetation is firmly established. Refer to site engineer's TESC plan for all erosion and sedimentation control details.

PROJECT MONITORING PROGRAM

Purpose for Monitoring

A monitoring program shall be included as a part of the approved mitigation plan. To insure that the performance standards of the approved mitigation plan have been met, the mitigation and/or buffer enhancement site(s) shall be monitored for a minimum of five years. The monitoring period required by the city may be extended an additional two years if the wetland or buffer is not performing as expected by the mitigation or enhancement plan. The monitoring reports shall be submitted on August 1st of each year during the monitoring period.

Monitoring and reports shall be submitted in accordance with the following schedule:
(1) At the time of construction;
(2) Thirty days after planting;
(3) Early in the growing season of the first year;
(4) End of the growing season of the first year;
(5) Twice the second year (at the beginning and end of the growing season); and
(6) Annually thereafter, to cover a total monitoring period of at least five growing seasons.

Performance Standards

Year 1 Monitoring

Success Standard: 100 percent survival of planted species
No greater than 10 percent coverage of invasive species. Zero tolerance of noxious weeds.

Year 2 Monitoring

Success Standard: 90 percent survival of planted species
No greater than 10 percent coverage of invasive species. Zero tolerance of noxious weeds.

Year 3 Monitoring

Success Standard: 80 percent survival of planted species
No greater than 10 percent coverage of invasive species. Zero tolerance of Noxious weeds.

Year 5 Monitoring

Success Standard: 80 percent survival of planted species
No greater than 10 percent coverage of invasive species. Zero tolerance of noxious weeds.

Monitoring Methodologies

Monitoring sample plots and photo points will be established during the as-built inspection and shown on the as-built map. These will be used throughout the 5-year monitoring period. Within these plots, plant survival shall be measured, and invasive vegetation cover will be estimated. These plots shall be fixed, located using stakes, GPS, or other method and used for the duration of the monitoring period. The percentage of plant survival will be derived by subtracting the

number of missing or dead plants from the number of plants that were recorded in the transects during the initial visit to assess plan compliance.

Plant survival within the transects is assumed to be representative of the entire site. In addition to the transects, a visual inspection of the entire mitigation area shall be conducted to assess any high mortality areas not represented by the transects. As a supplement to the visual inspection, a panoramic photo of the entire mitigation site will be taken and included in each monitoring report. If one or more of the planted species exhibit a high rate of mortality and are deemed inappropriate for the site, a substitution may be recommended by the consulting biologist.

Photo points

Permanent photo points will be established within the enhancement areas. Photographs will be taken from these points to visually record condition of the enhancement area. Photos shall be taken annually between May 15 and November 1 (prior to leaf drop), unless otherwise specified.

Monitoring Reports

Monitoring reports shall be submitted by November 1 of each year during the monitoring period. As applicable, monitoring reports must include descriptions / data for:

1) Site plan and vicinity map.
2) Historic description of project, including date of installation, current year of monitoring, restatement of planting / restoration goals, and performance standards.
3) General appearance, health, mortality, colonization rates, percent cover, percent survival, volunteer plant species, invasive weeds, and/or other components deemed appropriate by the Department and a qualified consultant.
4) Slope condition, site stability, any structures or special features.
5) Wetland and buffer conditions, e.g., surrounding land use, use by humans, and/or wild and domestic creatures.
6) Wildlife Monitoring Methods shall include visual sightings, aural observations, nests, scat, tracks, and/or other means deemed appropriate by the Department and a qualified consultant. Wildlife monitoring components shall include species counts, species diversity, breeding activity, habitat type, nesting activity, location, usage, and/or other components deemed appropriate by the Department and a qualified consultant.
7) Assessment of nuisance / exotic biota and recommendations for management.
8) Color photographs (4" x 6" in size) taken from permanent photo-points that shall be depicted on the monitoring report map.

MAINTENANCE

The planting areas will require periodic maintenance to remove undesirable species and replace vegetation mortality. Maintenance may include, but will not be limited to, removal of competing grasses (by hand if necessary), irrigation, fertilization (if necessary), replacement of plant mortality, and the replacement of mulch for each maintenance period. Mulch should be replenished during the maintenance visits, every second year, or as needed.

CONTINGENCY PLAN

If 20 percent of the plants are severely stressed during any of the inspections, or it appears 20 percent may not survive, additional plantings of the same species may be added to the planting area. Elements of a contingency plan may include, but will not be limited to: more aggressive weed control, pest control, mulching, replanting with larger plant material, species substitution, fertilization, soil amendments, and/or irrigation.

PROJECT COSTS

The applicant shall enter into an agreement with the City to complete the mitigation plan approved by the City and shall post a mitigation surety to ensure mitigation is fully functional. The surety shall be in the amount of 150 percent of the estimated cost of the uncompleted actions or the estimated cost of restoring the functions and values of the critical area that are at risk, whichever is greater. The surety shall be based on a cost estimate of installing the project with mitigation plant materials, and any other related costs. Following successful determination of the mitigation plan, the bond shall be released.

Estimated Costs:

*Estimated Cost of Plants (at $10.50/plant)	$451.50
Estimated Bond Amount (150% of Estimated Cost)	**$564.37**

*Estimate includes: cost of plant materials and labor per each one-gallon plant

Estimated In-Lieu-Fee amount **$1,102.50**
(Cost of planting 105 one-gal plants in a 3,765 square foot buffer area)

USE OF THIS REPORT

This Critical Area Study and Buffer Mitigation Plan is supplied to Mohammed Khan as a means of determining on-site critical area conditions. This report is based largely on readily observable conditions and, to a lesser extent, on readily ascertainable conditions. No attempt has been made to determine hidden or concealed conditions.

The laws applicable to critical areas are subject to varying interpretations and may be changed at any time by the courts or legislative bodies. This report is intended to provide information deemed relevant in the applicant's attempt to comply with the laws now in effect. The work for this report has conformed to the standard of care employed by wetland ecologists. No other representation or warranty is made concerning the work or this report and any implied representation or warranty is disclaimed.

Wetland Resources, Inc.

Andrea Bachman
Senior Ecologist

REFERENCES

Castelle, A.J., C. Conolly, M. Emers, E.D. Metz, S. Meyer, M. Witter, S. Mauermann, T. Erickson, and S.S. Cooke. 1992. Wetland Buffers: Use and Effectiveness. Washington. Department of Ecology, Publication No. 92-10. Olympia, WA.

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Corps of Engineers Wetlands Delineation Manual, 1987. Technical Report Y-87-1. Environmental Laboratory. U.S. Army Engineer Waterway Experiment Station. Vicksburg, MS.

Cowardin, L. M., V. Carter, F. C. Golet, and E. T. LaRoe. 1979. Classification of Wetlands and Deepwater Habitats of the United States. FWS/OBS-79/31. U.S. Fish and Wildlife Service, Washington DC. December 1979.

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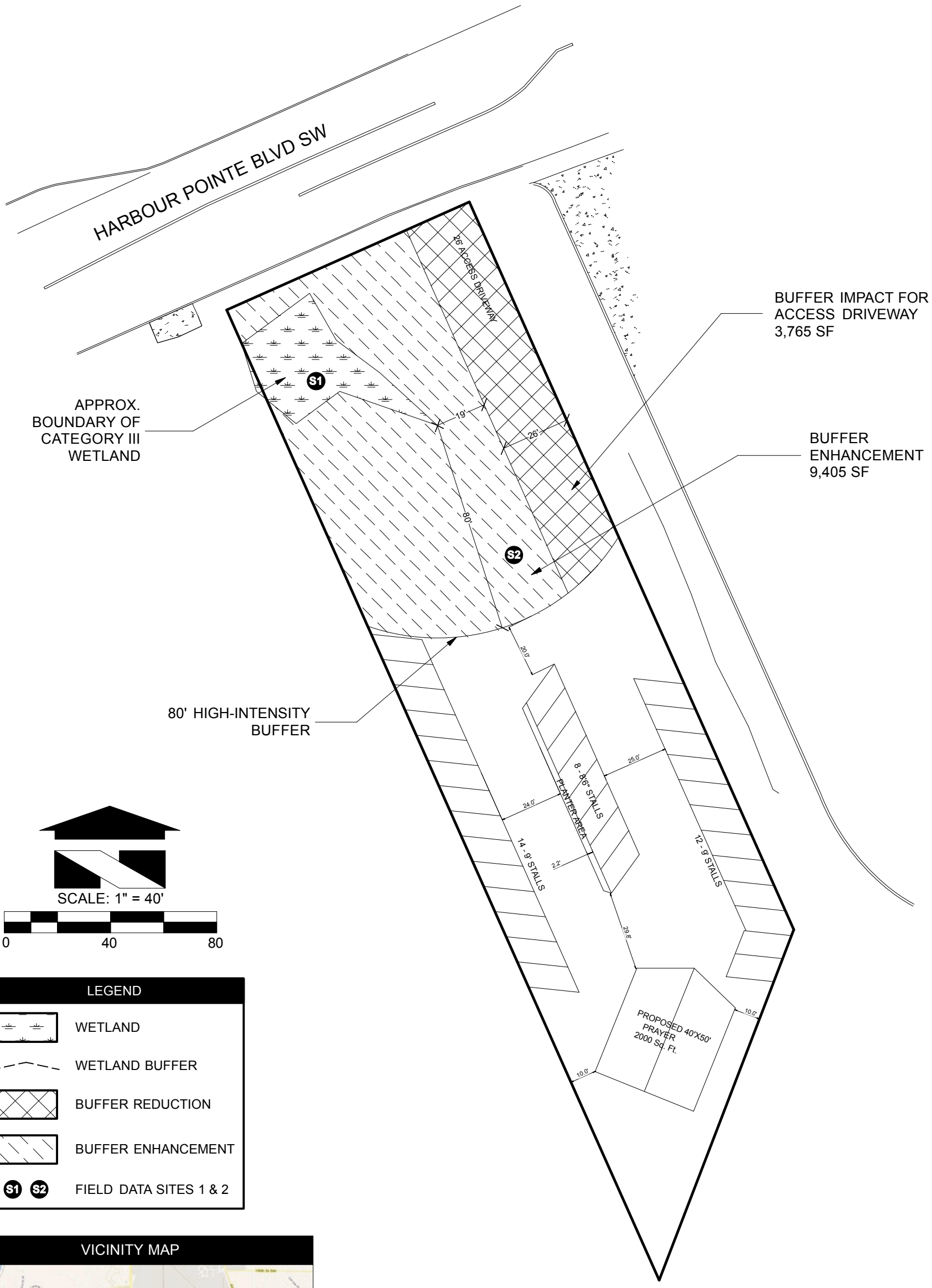
CRITICAL AREA STUDY & MITIGATION MAP

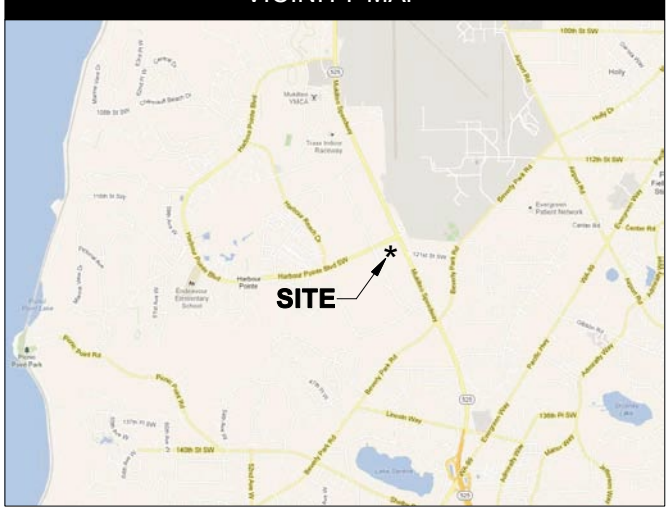
ICOM- HARBOUR POINTE BLVD SW

PORTION OF SECTION 27, TOWNSHIP 28, RANGE 04E, WM



LEGEND	
	WETLAND
	WETLAND BUFFER
	BUFFER REDUCTION
	BUFFER ENHANCEMENT
S1 S2	FIELD DATA SITES 1 & 2

VICINITY MAP



Wetland Resources, Inc.

Delineation / Mitigation / Restoration / Habitat Creation / Permit Assistance

9505 19th Avenue S.E. Suite 106 Everett,Washington 98208
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Fax: (425) 337-3045
Email: mailbox@wetlandresources.com

CRITICAL AREA STUDY MAP & MITIGATION PLAN

ICOM- HARBOUR POINTE BLVD SW

MUKILTEO, WA

Sheet 1/1

Mohammed Khan
5500 Harbour Pointe Blvd., R104
Mukilteo, WA 98275

WRI Job #14060
Drawn by: AB
Date: April 15, 2014

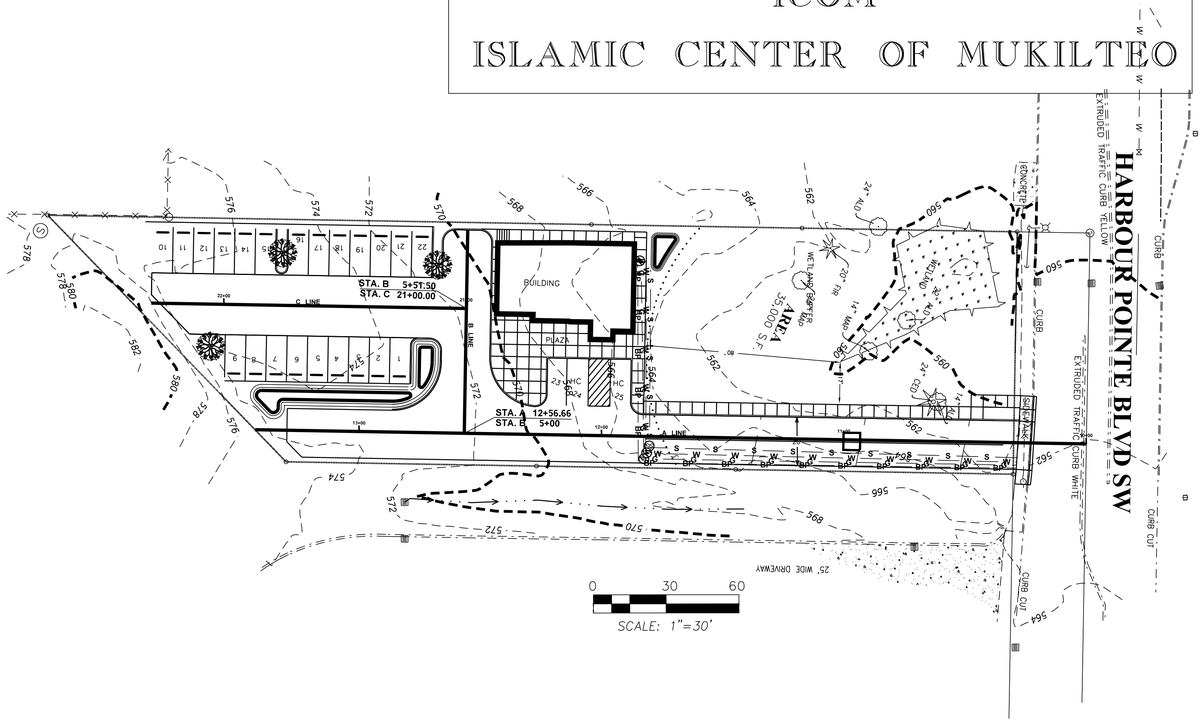
Appendix III

PLANS AND STANDRED DETAILS

"Reduced Copy Size"

A PORTION OF SE 1/4, OF THE NW 1/4, SECTION 27, TOWNSHIP 28 N, RANGE 4, W.M.

ICOM
ISLAMIC CENTER OF MUKILTEO



VICINITY MAP

NTS
STREET ADDRESS: 550 HARBOUR POINT BLVD SW
TAX NUMBER: 00441200002800

UTILITY INFORMATION
SEWER-ALDERWOOD WATER AND SEWER DISTRICT
WATER-ALDERWOOD WATER AND SEWER DISTRICT
ELECTRICITY-PUD
GAS-PSE
FIRE-MUKILTEO FIRE DISTRICT
SCHOOL-MUKILTEO SCHOOL DISTRICT

LAND USE DATA
EXISTING ZONING, CB (S)
PROPOSED ZONING,CB (S)
PROPOSED LAND USE Mosque/Place of Worship

SUMMARY OF DEVELOPMENT AREA
WETLAND BUFFER IMPACTS: -------- SQ FT
IMPERVIOUS AREA: ------ SQ FT
PERVIOUS AREA: ----- SQ FT

SHEET INDEX

1- SITE PLAN
2- EXIS. CONDITION & HORIZONTAL CONTROL
3- TESC & GRADING PLAN
4- ROADWAY SECTION & PROFILES
5- DRAINAGE PLAN & PROFILES
6- PAVING PLAN & WALL PROFILES
7- DRAINAGE DETAILS 1 OF 2
8- DRAINAGE DETAILS 2 OF 2
9- MISCELLANIES DETAILS
10- NOTES

PROJECT TEAM

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Glen Pickus, AICP
Planning Manager
Planning & Community Development
PHONE:425.263-8042
EMAIL: gpickus@mukilteowa.gov

JOB NO. 3935

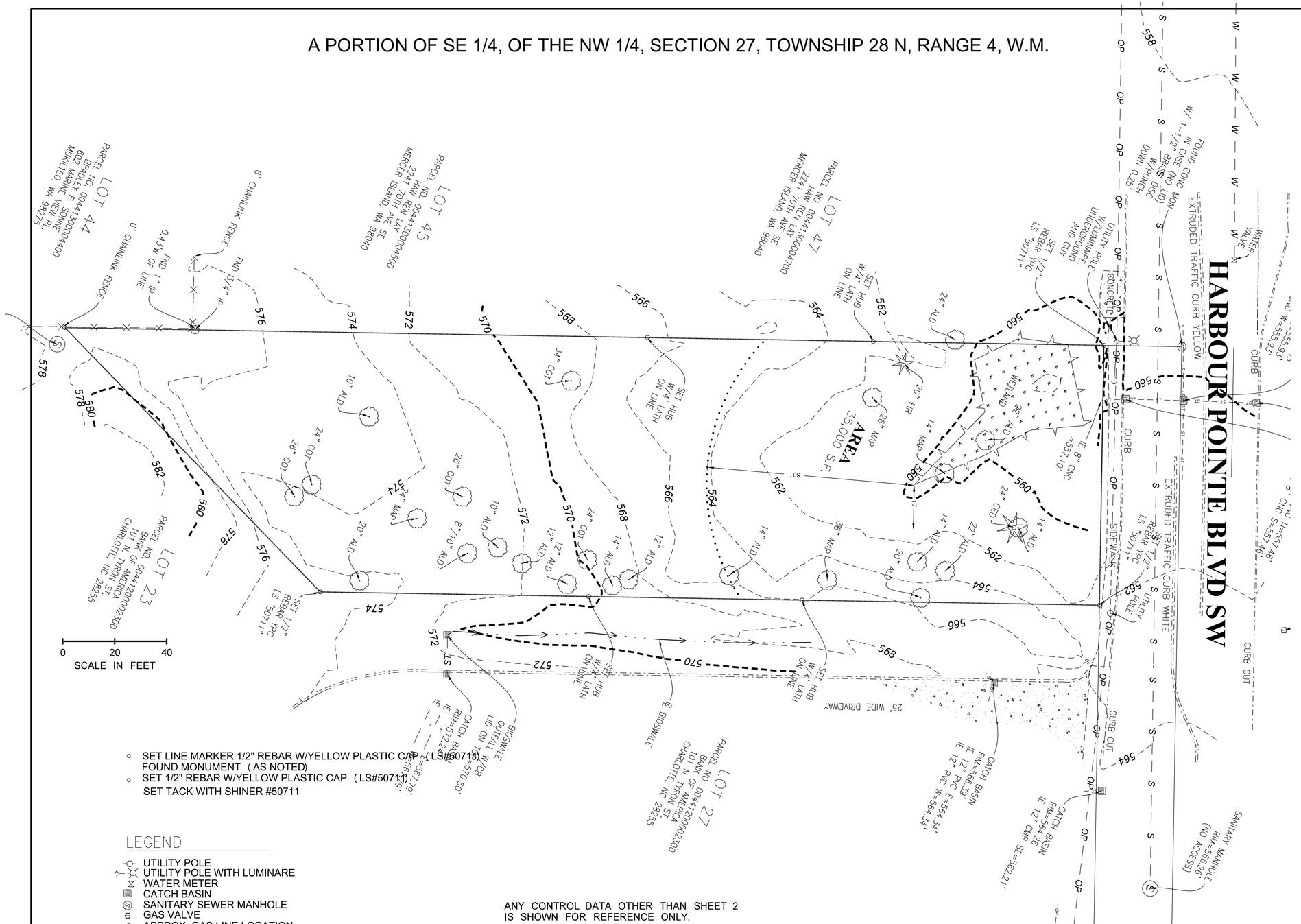
	REVISION	
DESIGN BY: M. WALLAIA	DATE	BY
DRAWN BY: M. WALLAIA		
CHECKED BY: M. WELAYE		
DATE: Feb. 20 2016		
JOB NO. 3935		

ICOM
SITE PLAN
PERMIT #_____
CITY OF MUKILTEO SNOHOMISH COUNTY

SCALE
AS NOTED

SHEET 1 OF 10 SHEETS

A PORTION OF SE 1/4, OF THE NW 1/4, SECTION 27, TOWNSHIP 28 N, RANGE 4, W.M.



- ○ SET LINE MARKER 1/2" REBAR W/YELLOW PLASTIC CAP ~(LS#50711)
  FOUND MONUMENT (AS NOTED)
- ○ SET 1/2" REBAR W/YELLOW PLASTIC CAP (LS#50711)
  SET TACK WITH SHINER #50711

LEGEND

- UTILITY POLE
- UTILITY POLE WITH LUMINARE
- WATER METER
- CATCH BASIN
- SANITARY SEWER MANHOLE
- GAS VALVE
- -G- APPROX. GAS LINE LOCATION
- -W- APPROX. WATER LINE LOCATION
- -S- APPROX. SANITARY SEWER LINE LOCATION
- -SD- APPROX. STORM DRAINAGE LINE LOCATION
- -OH- APPROX. OVERHEAD UTILITY LINE LOCATION
- (M) MEASURED DIMENSION
- (P) PLAT DIMENSION
- (C) CALCULATED DIMENSION

JOB NO. 3935

	REVISION	
DESIGN BY: M. WALLAIA	DATE	BY
DRAWN BY: M. WALLAIA		
CHECKED BY: M. WELAYE		
DATE: Feb. 20 2016		
JOB NO. 3935		

ICOM
EXIS. CONDITION & HORIZONTAL CONTROL
PERMIT # _____
CITY OF MUKILTEO SNOHOMISH COUNTY

SCALE AS NOTED

SHEET 2 OF 10 SHEETS

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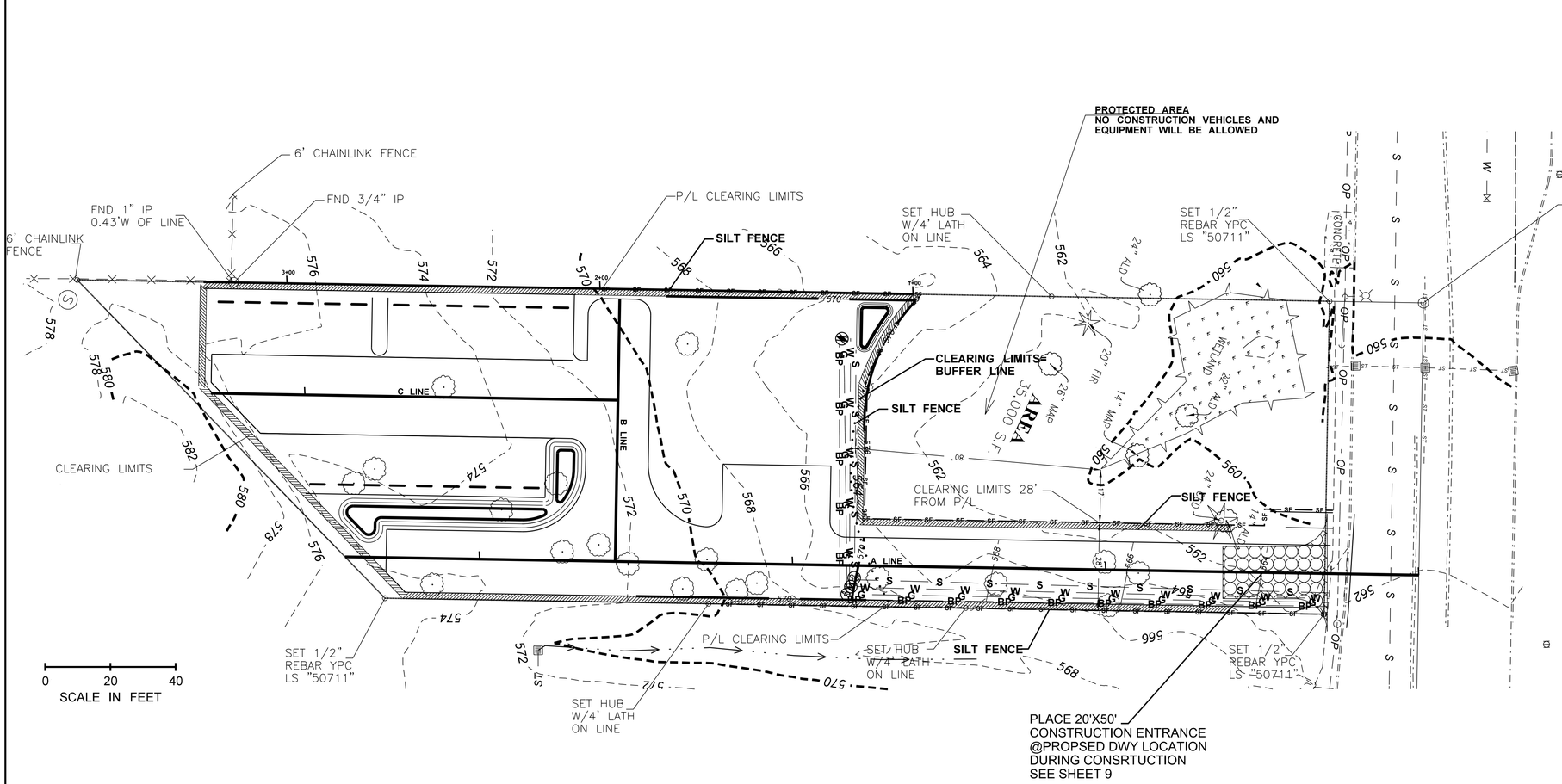
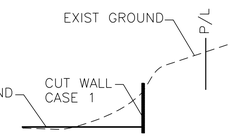
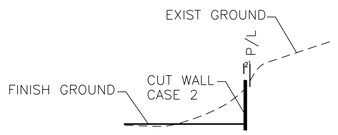


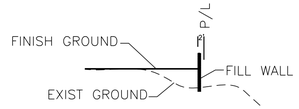
GRADING SETBACK TYP.
NTS



CUT WALL SECTION AT PROPERTY LINE
SEE SHEET 6



CUT WALL SECTION AT PROPERTY LINE
SEE SHEET 6



FILL WALL SECTION AT PROPERTY LINE
SEE SHEET 6

PROPOSED UNDER GROUND UTILITY:

- W —— W — WATER LINE
- G —— G — GAS LINE
- BP —— BP — PWER LINE
- S —— S — SANATER SEWER LINE

CONSTRUCTION SEQUENCE:

EXISTING UTILITY NOTE:

EARTHWORK QUANTITIES:

CUT = 2400 C. Y.
FILL = 0 C. Y.
QUANTITIES WERE CALCULATED USING LOO TIN SUBTRACTION METHODS. CONTRACTOR TO PERFORM WORK AS REQUIRED TO BRING SITE TO FINISHED GRADES AS SHOWN.
NO BORROW OR WASTE SITES ARE REQUIRED FOR THIS PROJECT.

EXISTING TOPOGRAPHY NOTES:

JOB NO. 3935

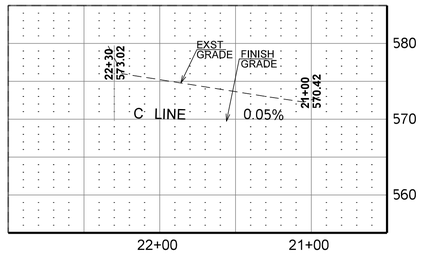
	REVISION	
DESIGN BY: M. WALLAIA	DATE	BY
DRAWN BY: M. WALLAIA		
CHECKED BY: M. WELAYE		
DATE: Feb. 20 2016		
JOB NO. 3935		

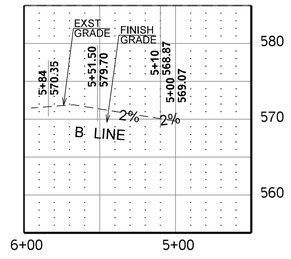
ICOM
TESC & GRADING PLAN
PERMIT #_____
CITY OF MUKILTEO SNOHOMISH COUNTY

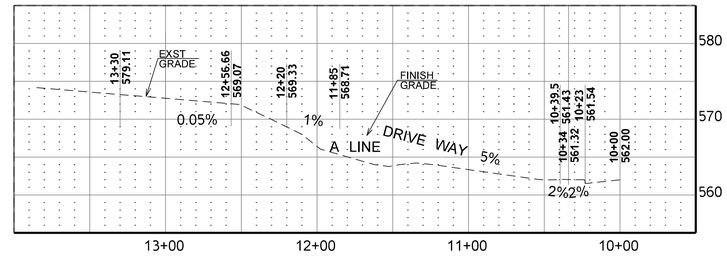
SCALE AS NOTED

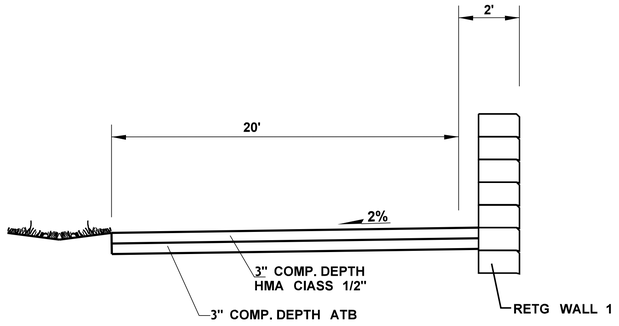
SHEET 3 OF 10 SHEETS

A PORTION OF SE 1/4, OF THE NW 1/4, SECTION 27, TOWNSHIP 28 N, RANGE 4, W.M.

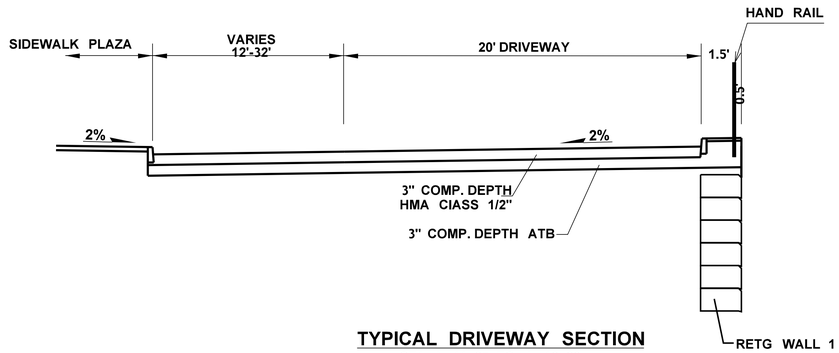




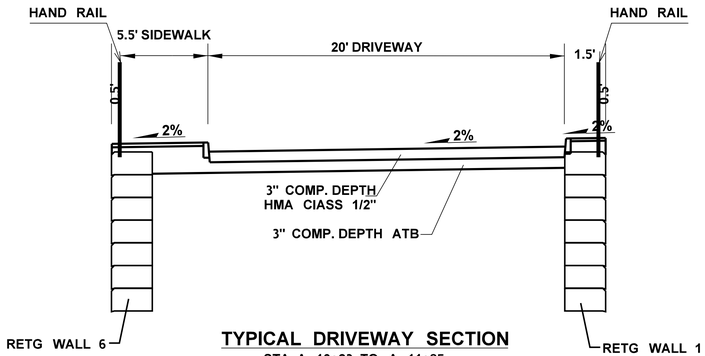




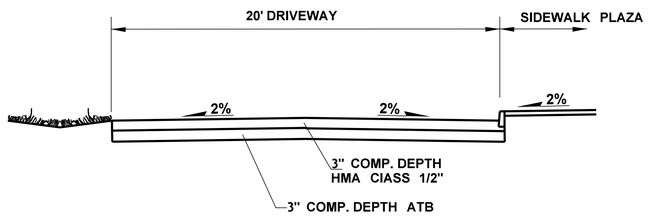
TYPICAL HAMERHEAD SECTION
STA. A 12+20 TO A 13+30
N.T.S.



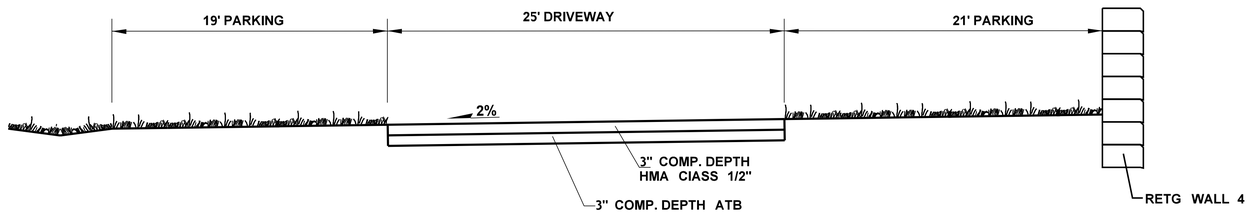
TYPICAL DRIVEWAY SECTION
STA. A 11+85 TO A 12+20
N.T.S.



TYPICAL DRIVEWAY SECTION
STA. A 10+23 TO A 11+85
N.T.S.



TYPICAL DRIVEWAY SECTION
STA. B 5+10 TO B 5+84
N.T.S.



TYPICAL PARKING SECTION
STA. C 21+10 TO C 22+30
N.T.S.

JOB NO. 3935

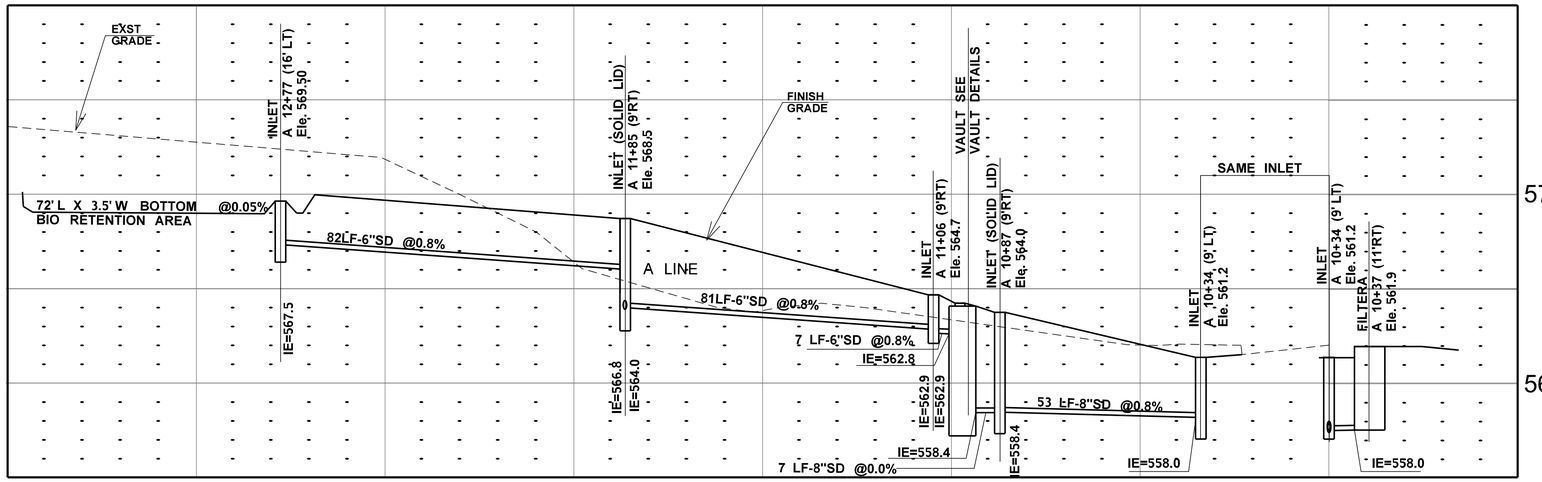
	REVISION	
DESIGN BY: M. WALLAIA	DATE	BY
DRAWN BY: M. WALLAIA		
CHECKED BY: M. WELAYE		
DATE: Feb. 20 2016		
JOB NO. 3935		

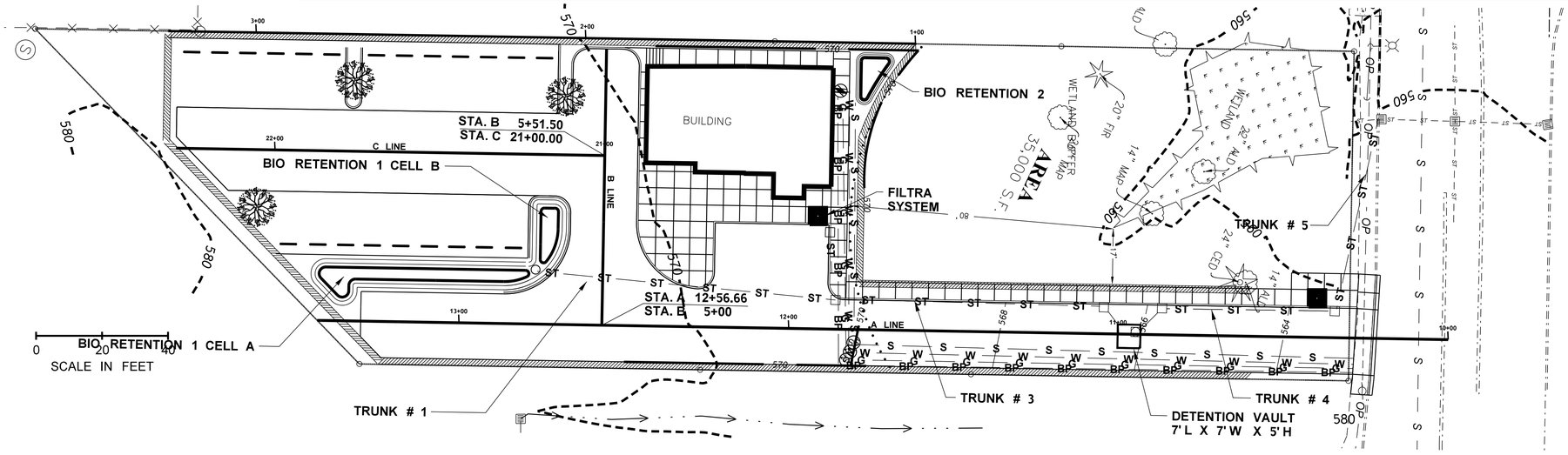
ICOM
ROADWAY SECTION & PROFILES
PERMIT # _____
CITY OF MUKILTEO SNOHOMISH COUNTY

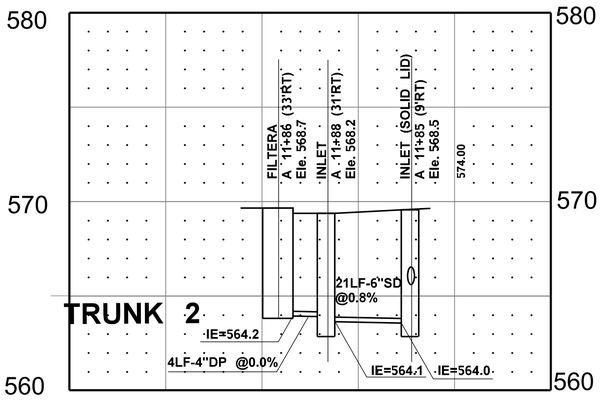
SCALE
AS NOTED

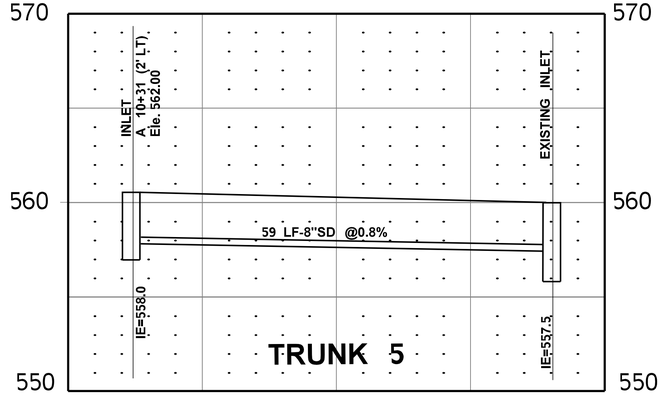
SHEET 4 OF 10 SHEETS

A PORTION OF SE 1/4, OF THE NW 1/4, SECTION 27, TOWNSHIP 28 N, RANGE 4, W.M.









JOB NO. 3935

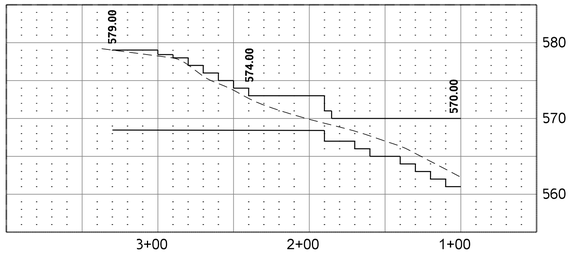
	REVISION	
	DATE	BY
DESIGN BY: M. WALLAIA		
DRAWN BY: M. WALLAIA		
CHECKED BY: M. WELAYE		
DATE: Feb. 20 2016		
JOB NO. 3935		

ICOM
DRAINAGE PLAN & PROFILES
PERMIT #_____
CITY OF MUKILTEO SNOHOMISH COUNTY

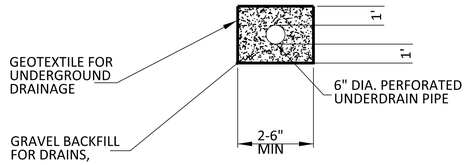
SCALE AS NOTED

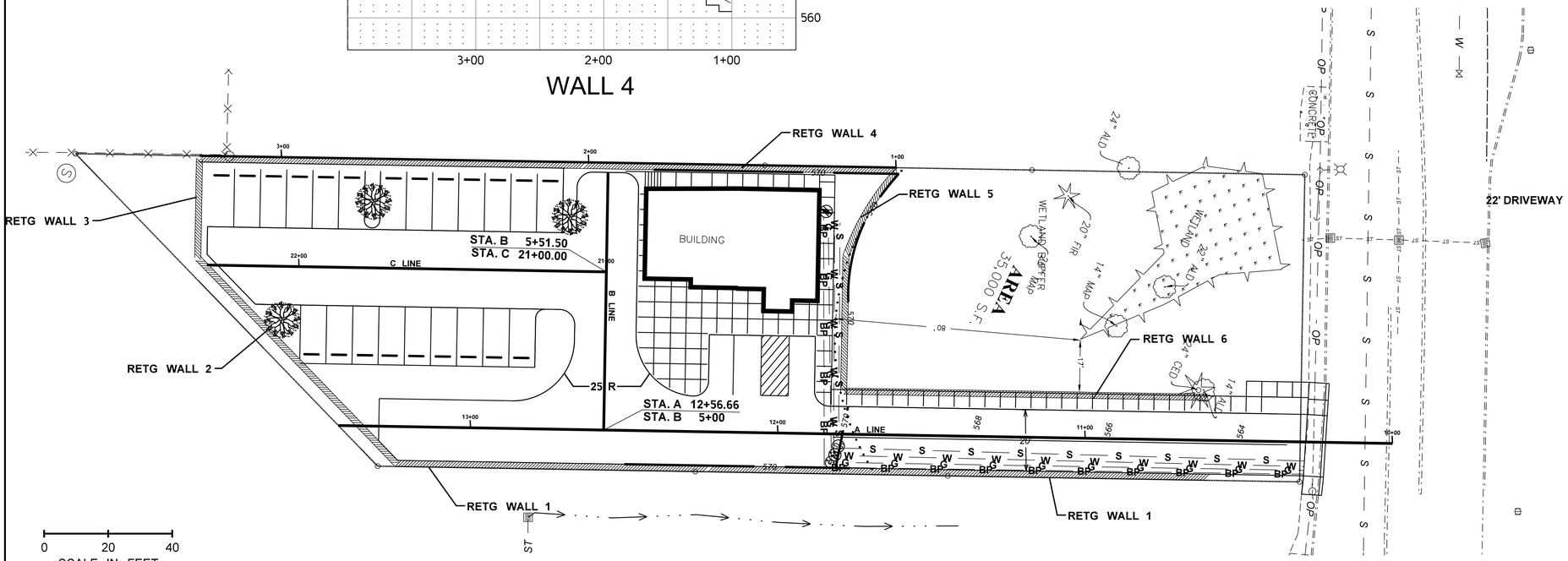
SHEET 5 OF 10 SHEETS

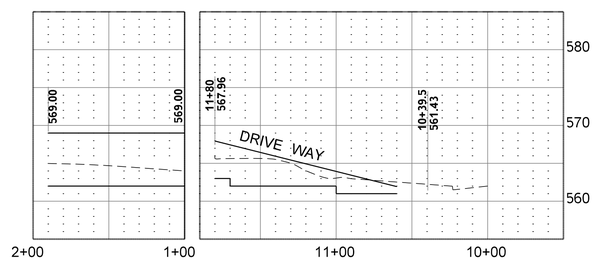
A PORTION OF SE 1/4, OF THE NW 1/4, SECTION 27, TOWNSHIP 28 N, RANGE 4, W.M.



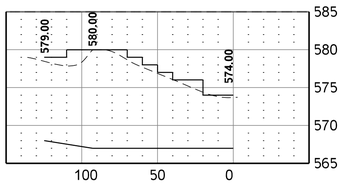
WALL 4



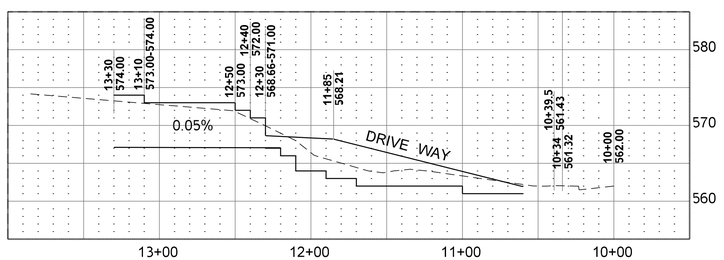




WALL 5 WALL 6



WALL 2-3



WALL 1

0 20 40
HORIZONTAL SCALE IN FEET

5 0
VERTICAL SCALE IN FEET

NOTE:
FINAL WALLS DESIGN AND SHOPDRAWING WILL BE PROVIDED TO THE CITY BY THE CONTRACTOR/SUPPLIER

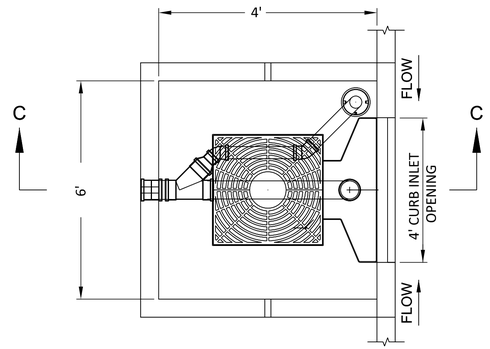
JOB NO. 3935

	REVISION	
DESIGN BY: M. WALLAIA	DATE	BY
DRAWN BY: M. WALLAIA		
CHECKED BY: M. WELAYE		
DATE: Feb. 20 2016		
JOB NO. 3935		

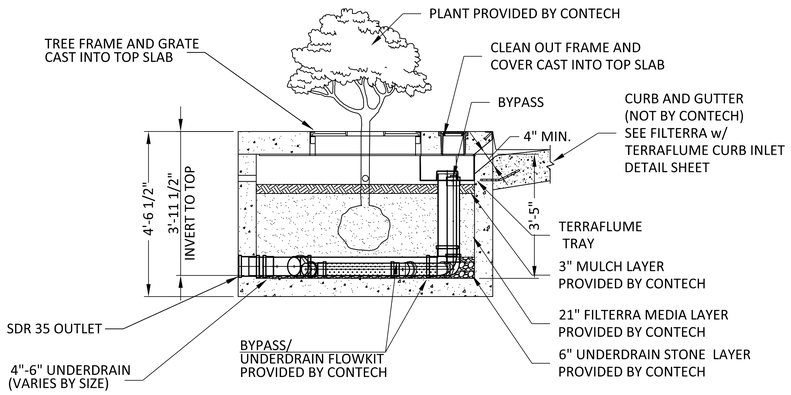
ICOM
PAVING PLAN & WALL PROFILES
PERMIT #_____
CITY OF MUKILTEO SNOHOMISH COUNTY

SCALE AS NOTED

SHEET 6 OF 10 SHEETS

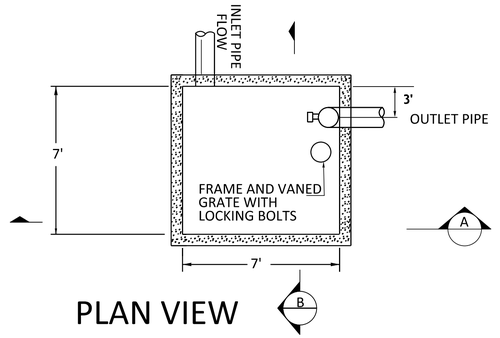


PLAN VIEW

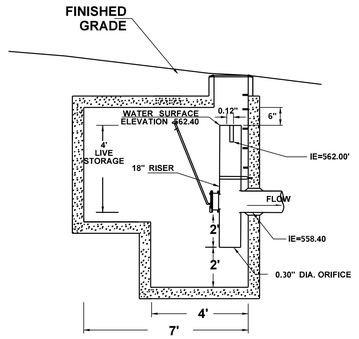


SECTION C-C

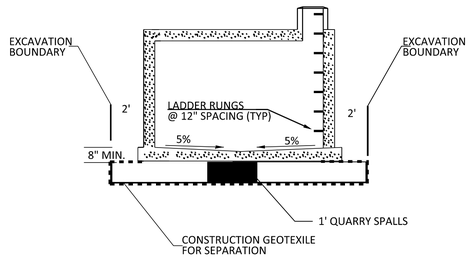
FILTERRA INLET CONFIGURATION



PLAN VIEW

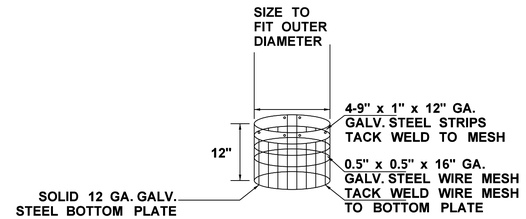


SECTION A-A



SECTION B-B

DETENTION VAULT DETAILS



NOTE:

1. INSTALL SCREEN FOR ORIFICE SIZE LESS THAN 0.5-INCH DIAM.
2. ATTACH SCREEN TO FLOW RESTRICTOR WITH 6-1" METAL SCREWS - 2 PER STRAP, OR USE STAINLESS STEEL PIPE CLAMP

FLOW CONTROL (ORIFICE) SCREEN

JOB NO. 3935

	REVISION	
DESIGN BY: M. WALLAIA	DATE	BY
DRAWN BY: M. WALLAIA		
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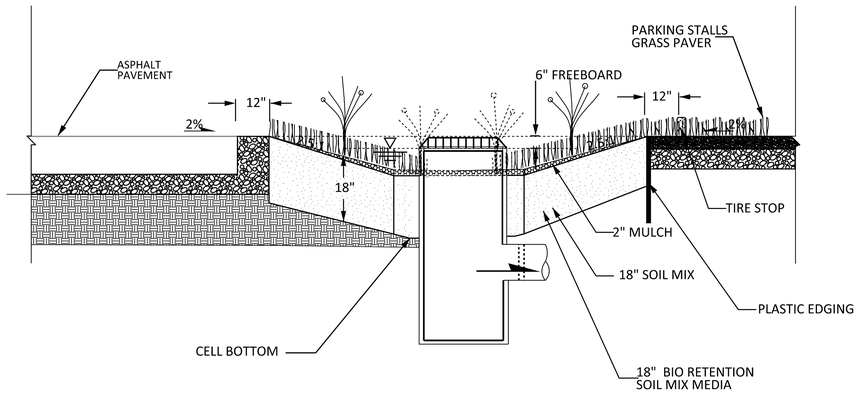
DATE: Feb. 20 2016		
JOB NO. 3935		

ICOM
DRAINAGE DETAILS 1 OF 2
PERMIT #_____
CITY OF MUKILTEO SNOHOMISH COUNTY

SCALE AS NOTED

SHEET 7 OF 10 SHEETS



BIORETENTION CELL SECTION (TYP.)

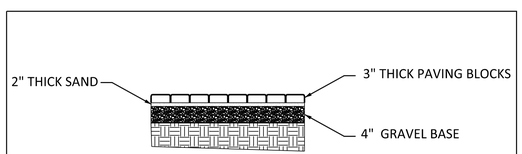
N.T.S.

NOTES:

1- COMPOST TO AGGREGATE RATIO: 60% AGGREGATE AND 40% COMPOST
2- COMPOST MUST BE PRODUCED AT COMPSTING FACILITY PERMITTED BY WA DEPARTMENT OF ECOLOGY
3- ORGANIC MATTER CONTENT 5 TO 8 PERCENT BY WEIGHT
4- SCREEND TO THE SIZE GRADATION FOR FINE COMPOST UNDER TMECC TESTMETHOD 02.02-B
5- BIORETENTION SOIL MIX (BSM) AGGREGATE GRADATION IS LISTED BELOW

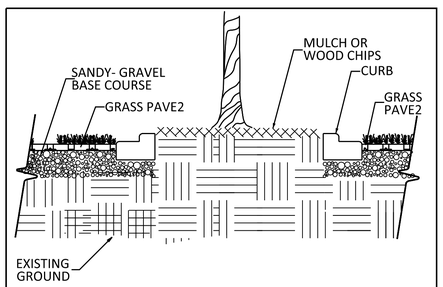
SIEVE SIZE	PERCENT PASSING
⅜"	100
#4	95-100
#10	75-90
#40	25-40
#100	4-10
#200	2-5

6- THE FINSHED SUBGRADE MUST BE INSPECTED AND SHALL BE SCRIFED TO A MINUMUM 3" DEEP
7- COMPACT THE BSM TO A RELATIVE COMPACTION OF 85% OF MODIFIED(ASTM D 1557)



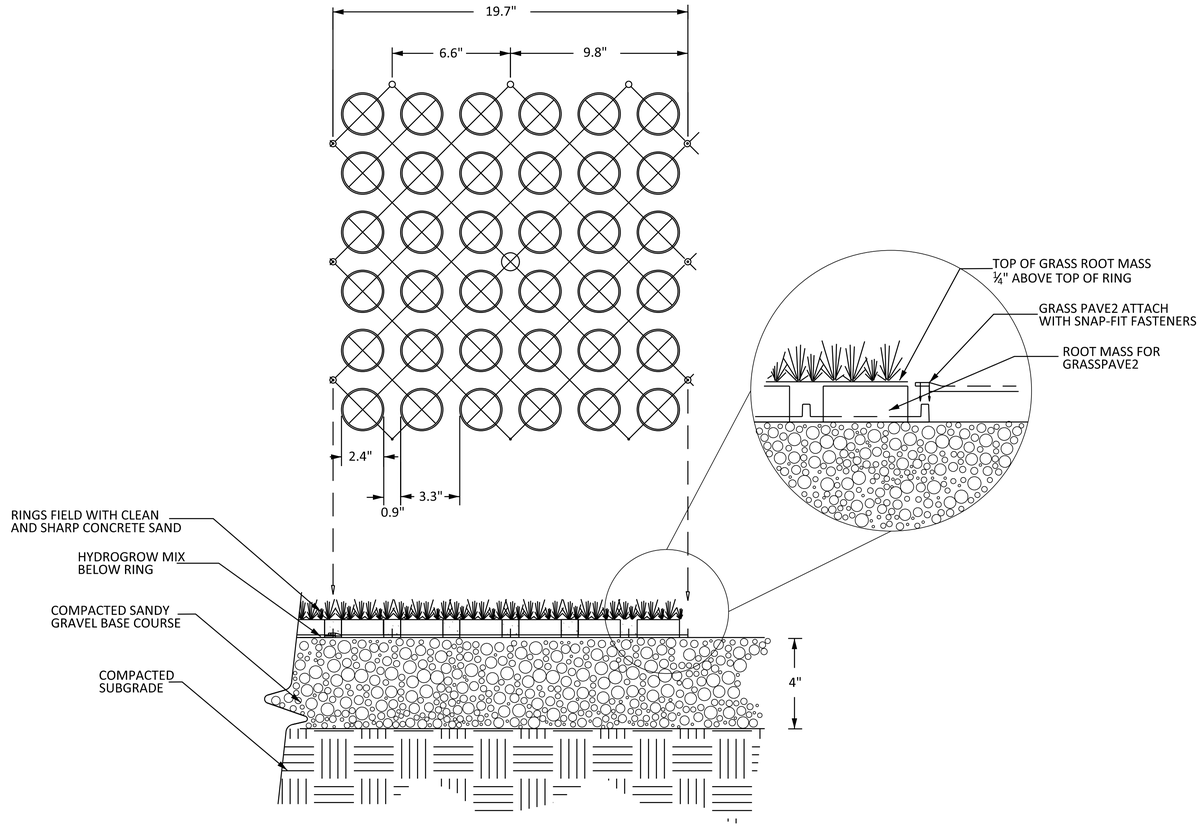
PAVING BLOCKS SECTION (TYP.)

N.T.S.



GRASSPAVE2 PARKING AREA PLANTER DETAIL

N.T.S. SECTION VIEW



GRASSPAVE2 DETAIL (TYP.)

N.T.S.

SPECIFICATIONS

RESIN - HIGH DENSITY POLYETHYLENE (HDPE)
UNIT SIZE - 20" X 20" X 1"
STRENGTH - 5720 POUNDS PER SQUER INCH (PSI)
COLOR - BLACK (STANDARD)
LOADING- MAXIMUM CAPABILITY 15,940 PSI WHEN FILLED WITH SAND

MATERIAL

1- BASE COURSE IS SANDY GRAVEL MUST CONFORM WITH FOLLOWING SIEVE ANALYSIS AND REQUIREMENTS

SIEVE SIZE	PERCENT PASSING
1"	100
¼"	90-100
½"	70-80
#4	55-70
#10	45-55
#40	25-35
#200	3-8

2- WELL-DRANING SAND MATERIAL CONFORMING TO ASTM C 33 TO BE ADDED TO ENSURE LONG-TERM POROSITY
3 - CLEANED SAND COARSE MATERIAL CONFORMING WITH ASTM C-33 USED FILL FOR RINGS AND BETWEEN RINGS
4 - HYDROGROW SOIL AMENDMENT SHALL BE PROVIDED BY THE MANUFACTURE
5 - SOD THICKNESS MUST BE 0.5" THICK AND WEAR RESISTANT.

JOB NO. 3935

	REVISION	
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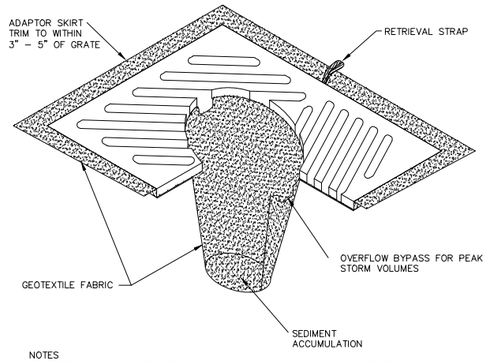
DATE: Feb. 20 2016		
JOB NO. 3935		

ICOM
DRAINAGE DETAILS 2 OF 2
PERMIT # _____
CITY OF MUKILTEO SNOHOMISH COUNTY

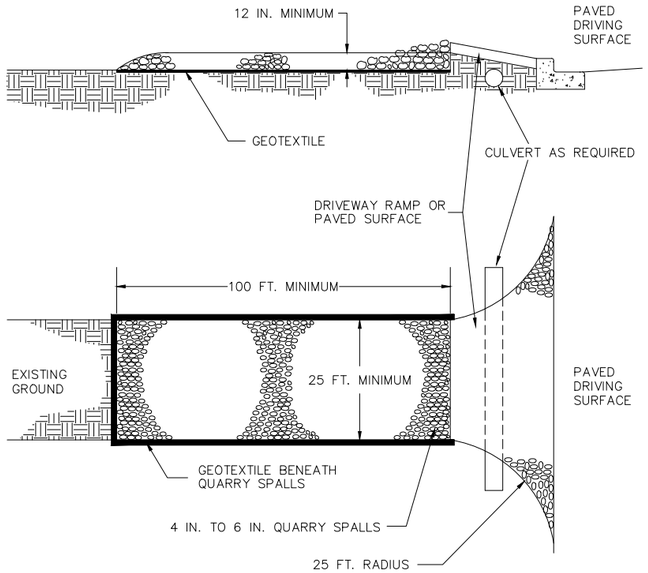
SCALE AS NOTED

SHEET 8 OF 10 SHEETS



NOTES
1. INSERT SHALL BE INSTALLED PRIOR TO CLEARING AND GRADING ACTIVITY, OR UPON PLACEMENT OF A NEW CATCH BASIN.
2. SEDIMENT SHALL BE REMOVED FROM THE UNIT WHEN IT BECOMES HALF FULL .
3. SEDIMENT REMOVAL SHALL BE ACCOMPLISHED BY REMOVING THE INSERT, EMPTYING, AND RE–INSERTING IT INTO THE CATCH BASIN.

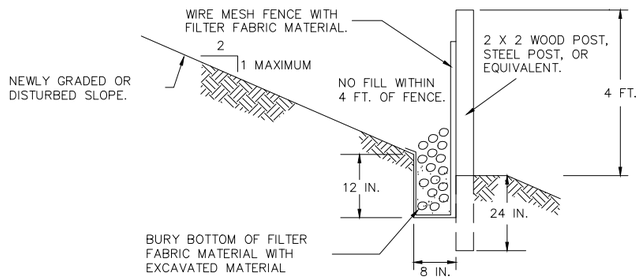
1 CATCH BASIN PROTECTION
SCALE: NTS



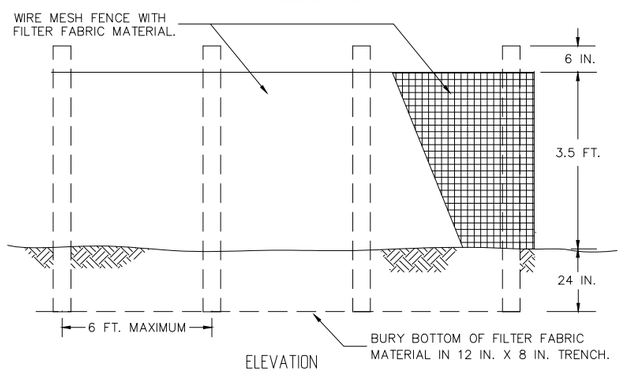
PLAN

NOTES:
1. PAD SHALL BE REMOVED AND REPLACED WHEN SOIL IS EVIDENT ON THE SURFACE OF THE PAD OR AS DIRECTED BY THE CITY CLEARING AND GRADING INSPECTOR.
2. PAD SHALL BE INSTALLED IN PLANTING STRIP AS APPROPRIATE.
3. PAD THICKNESS SHALL BE INCREASED IF SOIL CONDITIONS DICTATE OR PER THE DIRECTION OF THE CITY CLEARING AND GRADING INSPECTOR.
4. MINIMUM DIMENSIONS MAY BE MODIFIED AS REQUIRED BY SITE CONDITIONS UPON APPROVAL OF THE CITY CLEARING AND GRADING INSPECTOR.

2 TEMPORARY CONSTRUCTION ENTRANCE
SCALE: NTS



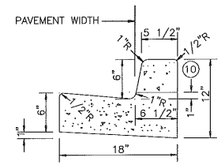
TYPICAL CROSS SECTION



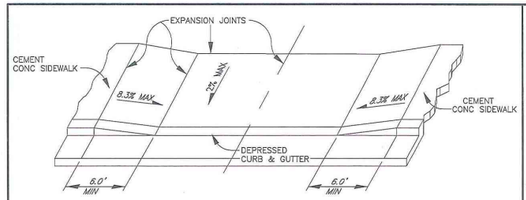
ELEVATION

NOTES:
1. FENCE SHALL NOT BE INSTALLED ON SLOPES STEEPER THAN 2 : 1.
2. JOINTS IN FILTER FABRIC SHALL BE OVERLAPPED 6 INCHES AT POST.
3. USE STAPLES, WIRE RINGS, OR EQUIVALENT TO ATTACH FABRIC TO WIRE FENCE.
4. REMOVE SEDIMENT WHEN IT REACHES 1/3 FENCE HEIGHT.

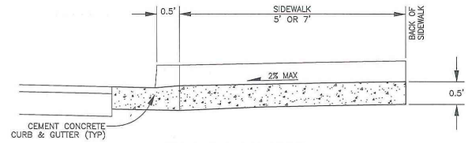
3 SILT FENCE
SCALE: NTS



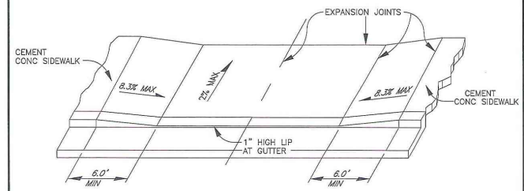
CEMENT CONCRETE VERTICAL CURB AND GUTTER



DROP CURB DRIVEWAY APPROACH – TYPE 3
(WITHOUT PLANTER)
NTS



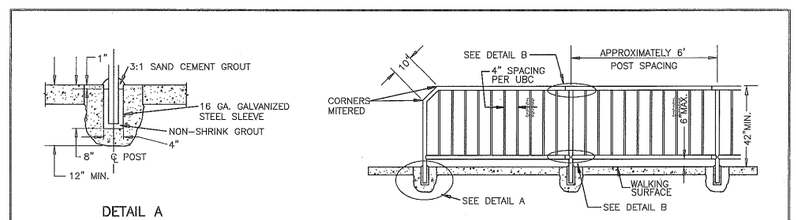
TYPE 3 APPROACH SECTION



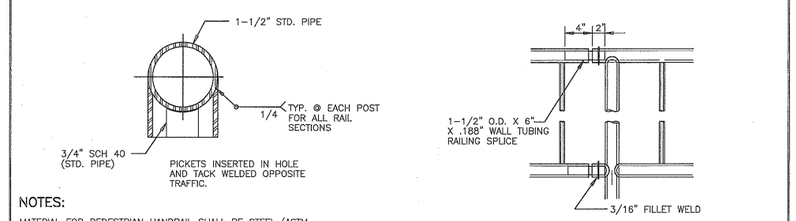
DROP CURB DRIVEWAY APPROACH – TYPE 3R (REVERSE SLOPE)
(WITHOUT PLANTER)
NTS

NOTES:
1. RECOMMEND SIDEWALK CROSS SLOPES AND RAMPS BE DESIGNED AT A MAXIMUM OF 1.5% AND 7.5%, RESPECTIVELY, TO ENSURE ADA COMPLIANCE. SEE EDDS 4–05 FOR DETAILS.
2. SEE STD DWG 2–028 FOR NOTES

SNOHOMISH COUNTY PUBLIC WORKS	APPROVED BY:	DATE
2–024 DROP CURB DRIVEWAY – TYPES 3 & 3R	COUNTY ROAD ENGINEER	11/7/15



DETAIL A



DETAIL B

NOTES:
MATERIAL FOR PEDESTRIAN HANDRAIL SHALL BE STEEL (ASTM A120) OR ALUMINUM (ASTM B241 OR B429 ALLOY 6061–T6. MANUFACTURING OF THE HANDRAIL SHALL CONFORM TO STANDARD DRAWING 4–202.

SEE TEXT SECTION 4–16

S:\TES\COMMON\EDDS\EDDS DRAWINGS\Ch4\4200.dwg

SNOHOMISH COUNTY PUBLIC WORKS	APPROVED BY:	DATE
4–200 PEDESTRIAN HANDRAIL DETAILS	COUNTY ROAD ENGINEER	2-25-03

JOB NO. 3935

DESIGN BY: M. WALLAIA	REVISION DATE	BY
DRAWN BY: M. WALLAIA		
CHECKED BY: M. WELAYE		
DATE: Feb. 20 2016		
JOB NO. 3935		

ICOM
MISCELLANIES DETAILS
PERMIT #_____
CITY OF MUKILTEO SNOHOMISH COUNTY

SCALE AS NOTED

SHEET 9 OF 10 SHEETS

A PORTION OF SE 1/4, OF THE NW 1/4, SECTION 27, TOWNSHIP 28 N, RANGE 4, W.M.

GENERAL NOTES:

1. All work and materials shall be in accordance with the City of Mukiteo Development Standards and the Washington State Department of Transportation/American Public Works Association Standard Specifications for Road, Bridge, and Municipal Construction, and the current Stormwater Management Manual for Westren Washington from the Department of Ecology .
2. All work pertaining to this project shall be subject to inspection by the City Inspector or his designated representative. Prior to any site work, the contractor shall contact the City Inspector at (425) - to schedule a pre-construction conference. See Supplementary General Note 8.
3. Before performing any grading or clearing, the limits of all proposed clearing and grading, sensitive and critical areas and their butters, trees to be retained, and drainage courses shall be marked in the field and verified by the City Inspector [SCC 17.05.220(1)] and (SCC 24.30.020(1)(h). The person responsible for accurately locating these features and telephone number is: Name: Phone:
4. The developer and project engineer are responsible for water quality. A monitoring program shall be established by the project engineer. The project engineer's name and phone number are:
   Name: Phone:
5. Engineered as-built meeting Policy POL-3010 shall be required prior to final approval of the drainage system. Final approval is required for temporary or permanent occupancy.
6. All Native Growth Protection Areas (NGPA) shall be left in a substantially natural state. No clearing, grading, tilling, building construction or placement, or road construction of any kind shall occur within these areas. Removal of vegetation by the property owner shall be limited to that which is hazardous. NO adjustment to the boundary of any such area shall occur without further Environmental Review and amendment of the CASP recorded with Snohomish County.
7. Prior to initiation of site work, highly visible markers such as bright orange barrier fencing or flagging shall be used to Identify NGPA boundaries. Prior to recording, all NGPA's shall be clearly and permanently marked on the project site. Signs shall be placed no greater than 100 feet apart around the perimeter of the NGPA. Neither clearing of any vegetation nor grading is allowed within the NGPA areas.
8. Not Used
9. It shall be the contractor's responsibility to apply for and obtain grading permits required for any non-approved dump sites.
10. Approval is required for all changes to the construction plans by the design engineer and City of Mukilteo before construction occurs. Noncompliance with the construction plans, erosion control requirements, water quality requirements and/or clearing limits may result in revocation of project permits, plan approval and bond foreclosures.
11. Monuments and property corners shall be protected from disturbance during construction. A licensed surveyor shall obtain a permit for the removal or replacement of any R/W monuments, survey monuments, or property corners in accordance with State Low and WAC 332-120 prior to any disturbance to the corner. The points to be protected or replaced shall be located by the project surveyor or engineer and shown on the construction plans.

GRADING AND TESC NOTES:

12. Not used.
13. All grading shall comply to chapter 33 of the Uniform Building Code. 30-635 & 3063A of the Snohomish County Code. (current edition)
14. Temporary Erosion/Siltation Control (TESC) Measures shall be installed prior to any site work (see attached detailed drainage plan).
15 All persons engaging in development activities shall prevent or minimize erosion and sedimentation on-site, and shall protect properties and water courses downstream from the site.
16. All streets are to be kept clear of dirt and debris. Streets shall be swept immediately when dirt has been tracked onto the paved surfaces.
17. Noncompliance with the erosion control requirements, water quality requirements and/or clearing limits may result in revocation of project permits, plan approval and bond foreclosures.
18. Not used.
19. From April 1 to September 30, soil shall be exposed for a maximum of 7 days. Ground cover BMPs shall be used to stabilize the soil
20. Soil stockpiles shall be stabilized within 24 hours. When actively working with the soil stockpile, stabilization shall occur at the end of each work day.
21. Siltation Barriers and all other TESC measures shall be inspected immediately after each rainfall event greater than 0.1" rainfall, and at least daily during prolonged rainfall events.
22. Maintenance and repair of TESC facilities and structures shall be conducted immediately upon recognition of a problem or when the TESC measures become damaged.
23. Sediment deposits shall be removed from all temporary drainage facilities and structures upon reaching a depth of 6 Inches.
24. Sufficient TESC BMP materials and supplies to protect the entire site shall be stockpiled on-site.
25. Inlets of the permanent drainage system shall be protected from sediment influx by use of filter fabric, micropore bags, or similar filtering materials end methods.
26. Construction acceptance will be subject to a well established ground cover that fulfills the requirement of the approved construction plans and Title 25 Snohomish County Drainage Ordinance.
27. All disturbed areas such as roadway back-slopes, etc. shall be seeded with a perennial ground cover gross to minimize erosion. Grass seeding wilt be done using an approved HYDROSEEDER or as otherwise approved by the City of Mukilteo.
28. All areas to be seeded shall be cultivated to the satisfaction of the city inspector. This may be accomplished by disking; raking, harrowing or other acceptable means. Perform all cultural operations across or at right angles to the slope. If necessary, surface runoff control measures such as gradient terraces, interceptor dike/swales, level spreaders, and sediment basins shall be installed prior to seeding.
29. Immediately following finish grading, permanent vegetation (consisting of rapid, persistent and legume) will be applied at a minimum 80# per acre. This is to include the following: 20% Annual, perennial or hybrid rye grass, 40% Creeping Red Fescue, 40% White Clover, or as otherwise approved by the City. HYDROSEED required.

GRADING AND TESC NOTES (CONT.):

30. Fertilizer shall be applied at 400# per acre of 10-20-20 (10 pounds per 1100 square feet) or equivalent. Developments adjacent to water bodies shall use non-phosphorus fertilizer.

30A. Excess excavation shall be disposed of at a permitted site or commercial topsoil company.

31. These plans indicate cut and fill slopes which exceed a maximum of two feet horizontal to one foot vertical (2: 1). A rock or concrete retaining wall may be required. All rock retaining walls greater than four (4) feet In height are to follow city specifications and to be designed and certified by a civil engineer experienced in Soils mechanics. All other cut and fill slopes shall be maximum of 2: 1.
32. The embankment of the temporary sedimentation basin should be checked regularly to ensure that it is structurally sound and has not been damaged by erosion or construction equipment. The emergency spillway should be checked regularly to insure that Its lining is well established end erosion-resistant. The siltation basin should be checked after each runoff-producing rainfall for sediment clean out. When the sediment reaches the clean out level, it shall be immediately removed and property disposed.

TEMPORARY GRAVEL CONSTRUCTION ENTRANCE:

33. Not used.
34. INSTALLATION: The area of the entrance should be vleared of all vegetation roots ,and other objetionable material. The gravel shall be placed to the specified dimention. Any drainge facilities required because of washing should be constructed according to specifications in the plan. If wash racks are used, they should be installed according to manufacture's spcifications.
35. Aggregate: 4" - 6" Crushed Ballast Rock.
36. Filter Fabric (Geotextile Fabric) shall be inserted beneath the entire construction entrance .
37. Entrance Dimensions: The aggregate layer must be at least 12 Inches thick. It must extend the full width of the vehicular ingress and egress area. The length of the entrance must be at least 60 feet.
38. WASHING: If conditions on the site are such that most of the mud Le not removed from vehicle tires by content with the gravel, then the tires must be washed before vehicles enter public road. Wash water must be carried away from the entrance to a settling area to remove sediment. A wash rack may also be used to make washing more convenient and effective.
39. Maintenance: The entrance shall be maintained in a condition which will prevent tracking or flow of mud onto public right-of-way. This may require periodic top dressing with 2-inch stone, as conditions demand, and repair and/or clean out any structures used to trap sediment. All materials spilled, dropped, washed or tracked from vehicles onto roadway or into storm drains must be removed immediately.

STORM DRAINAGE NOTES:

40. Pipes: (The engineer shell place a note stating the minimum pipe specifications allowed per the design. Don't write this out on General Notes; apply It)
    a. All storm sewer pipe Shall conform with City of Mukiltieo Design and Development Standards and Division 7 of the WSDOT / APWA Specification.
    b. All pipe shall be placed on stable earth, or if in the opinion of the city Inspector, the exiting foundation is unsatisfactory, then It shall be excavated below grade end back filed with compacted gravel material to support the pipe.
    c. The backfill shall be placed equally on both sides of the pipe or pipe-arch in layers with a loose average depth of 8" maximum depth 8", thoroughly tamping each layer. These compacted layers must extend for one diameter on each side of the pipe or to the side of the trench. Materials to complete the fill over pipe shall be the same as described (Refer to WSDOT standard specification 7-04.313) and standard specification 2-03.3(14)C, method B & C.
    d. Galvanized steel CMP shall meet the requirements of AASHTO designation M-36. type 1 & type 2. Pipe shall have asphalt treatment 1 or better.
    e. Corrugated aluminum pipe and coupling bands Shall meet the requirements of AASHTO M198 and M197
    f. Double walled (smooth interior) corrugated polyethylene pipe, meeting the requirements of AASHTO M 252 in 8 inch size and AASHTO M 294s in sizes 12' through 36" is an acceptable alternative to schedule A culvert pipe as shown on WSDOT/APWA Standard Plan B-17 and for Storm sewers in accordance with Snohomish County standards.
    g. Band size shall be 12" far pipe less than 42" diameter and 49" x 33" arch pipe. Refer to item "K Charts" for larger size pipes.
    h. Backfill around pipe must be compacted to a specified AASHTO T-99 density of 90%. Use reasonable care in handling and installation. Alt non-perforated metal pipe shall have neoprene gaskets at the joints. 0-ring gaskets may be used for Type F Coupling band.
    i. A note specifying the gage and bend size for all pipes used in the design shall be placed on the plans. and manholes exceeding 5 feet in depth
41. Catch Basins end manholes:
    All catch basins shall be type 1 unless otherwise noted
    All catch bastes with a depth over 5.0 feet to the flow line shall be a type II CB or larger (manhole).
    The Contractor shall be responsible for adjusting all manhole, inlet, and catch basin frames end grates just prior to pouring of curbs end paving.
    d. All grates shall be depressed 0.1 feet below pavement level.
    Catch basin frame and grates shall be Olympic Foundry Model 5435, 5436A, or 80503A, locking type or equal. Model 5435A is referred to as a 'through curb inlet' on the plan, Model 50503A is referred to as a "rotted grate Inlet" In \he plan.
    All type II catch basin manholes, inlet, and catch basins shall have locking lids. Rolled Greta not approved for outside of City right-of-way or for use with type II Manhole.
    g. Standard ladder steps shall be provided in all catch basins and manholes exceeding 5 feet in depth

WET SEASON GRADING NOTES (OCTOBER 1-MARCH 31):

1. The construction sequence shell be modified to minimize the area of unstabilized soil. A maximum of 1,000 square feet of dirt will be exposed at any time.
2. Earthen areas that are subject to contributing sediments during storm events and where earth movement is not anticipated for 48-hours shall be stabilized using the following BMPs:
3. Cover disturbed areas with 4" deep straw mulch. Cover stock piles with plastic sheeting.
4. Wet season TESC measures will be expanded to include
   (1) Prevent all groundwater flows and offsite surface flows from running over bare earth (convey with pipe and/or lined channels through the site).
   (2) Deliveries shall be made to staging site adjacent to construction entrance. Place quarry spalls in all areas subject to travel by vehicles making deliveries.
5. Solis shall not be disturbed except for actual construction activities. Parking is allowed only on paved end/or gravel surfaces.
6. Slopes 8% end greater without established groundcover will be stabilized with plastic sheeting, 6-mil (minimum). The sheeting shell be anchored with sand bags located 5-feet apart on the perimeter end 10-feet on center an the remainder of the sheeting. A minimum of 2-feet overlap is required for overlapping sheets.
7. Water discharged from the site will be monitored for turbidity. Maximum allowable turbidity of discharged water will be 5 NTU over background. provide the monitoring frequency and methodology .
8. When rainfall is heavy (defined as rainfall hard enough to produce sediment run-off from exposed dirt), all exposed earthwork shell be covered. No other construction activity shall occur on perviaus surfaces during these periods of heavy rain.
10. Stormwater will be monitored daily during periods of rainfall. If turbidity exceeds the maximum allowable, all site runoff will be pumped to indicated area and dispersed using sprinklers or perforated piping. See grading and TESC Plan.

SUPPLEMENTARY GENERAL NOTES:

1. Not used.
2. Remove abandoned pipes in the right-of-way.
3. All pipes shall have a minimum of 12" cover at the top of the bell, or shall have minimum cover per the manufacturer's specifications, whichever is greater.
4. Prior to placing any surface materials on the roadway, it shall be the responsibility of the developer or utility to provide density test reports (as specified in EDDS) certified by a professional engineer licensed to practice in the State of Washington.

CHANNELIZATION AND SIGNING

1. Approved permanent traffic control signs and markings within the public Right-of-Way (ROW) shall be installed by the city of Mukilteo forces. The developer shall pay for installation of all devices. The inspector shall notify the Deportment of Public Works (DPW) Traffic Operations when the project is ready for channelization and signing. If City forces are unavailable to perform the striping installation within an appropriate time frame, the permit holder shall contract for the striping installation. DPW Traffic Operations shall be contacted at least 2 days in advance of installation to verify channelization layout.
2. During project construction, the contractor shall provide and maintain all temporary construction signs, traffic control signs, delineators and temporary markings as required. All signs. traffic control signs, delineators and temporary markings shall be according to the Current Manual of Uniform Traffic Control Devices (MUTCD).
3. Access by emergency vehicles shall be maintained at all times during construction.
4. After work within the traveled roadway is completed at the end of each day, the road shall be cleared of debris and equipment, and completely open ta traffic (unless otherwise approved by the Deportment of Public Works of the City). Lighted barricades or barrels shall delineate all areas within the roadway affected by construction (i.e. edge of pavement, new curb edges not illuminated by street lights).
5. A ROW use permit Is required from DPW for any lane/road closures within the City o Mukilteo right-of-way, Contact DPW at least 15 days prior to construction activity within the public ROW. City of Mukilteo does not have jurisdiction on state routes or private roads or private property. For any activity encroaching on such property the applicant shall obtain permission from the appropriate authority.
6. Prior to placing any surface material on the roadway, it shall be the responsibilty of the developer or utility to provid density test reports (As specified in EDDS) certified by a professional engineer licensed to practice in the State of Washington (EDDS 8-05).
7. The developer/contractor shall be responsible for interim traffic control during construction on or along traveled city roadway. The developer/contractor must submit a traffic control plan to publix works (Permit Counter) and recive approval prior to commencement of any construction.
8. Survey Monuments shall be found and set in accordance with Snohomish County Engineering Design and Development Standards (EEDS, Chapter 4-03, Detail 4-130. Monuments and property corners shall be protected from disturbance during construction. A licensed Surveyor shall obtain a permit for removal or replacement of any ROW monuments, Survey Monuments, or Property corners in accordance with state law and WAC 332-120 prior to any disturbance to the corner. The points to be protected or replaced shall be relocated by the project surveyor or engineer and shown on the construction plans.
9. Prior to any site work, the contractor shall contact the City Inspector for land development division at (425)
   to schedule a preconstruction conference. Field changes requiring redesign Shall be submitted and approved prior to construction. Engineered as-builts shall be required prior to site approval.
10. For all underground utility installations within the City right-of-way, the workmanship and material shall be in accordance with (EEDS) sections 8-02,8-04, 8-05, 8-05, and most recent copy of the State of Wadhington Standard Specification for Road, Bridge, and Municipal Construction (WSDOT/APWA).
11. Consistent with EDDS Chapter 8-05,Utilities, or other intending to trench in the existing or proposed City right-of -way shall notify Planning and Development Services Inspection Section not less than 3 working days prioe to performing the work. Must apply for EDDS deviation, if the design is not consistent with EDDS Chapter 8. The notification shall include; A. Location of the work (Site Location and Location of trench work relative to existing/proposed roads).
    B. Permit Number.
    C. Method of compaction to be used.
    D. Day and hour when compaction is to be done.
    E. Day and hour when testing is to be done.
12. Neat Cut Line, clean Heat and Tack Edges with sealer CSS-1 and seal with AR4000, and sand. Saw cut shall be 1-foot minimum inside the existing edge of pavement, and 4- feet minimum paved section required.

JOB NO. 3935

	REVISION	
DESIGN BY: M. WALLAIA	DATE	BY
DRAWN BY: M. WALLAIA		
CHECKED BY: M. WELAYE		
DATE: Feb. 20 2016		
JOB NO. 3935		

ICOM
NOTES
PERMIT #_____
CITY OF MUKILTEO SNOHOMISH COUNTY

SCALE
AS NOTED

SHEET 10 OF 10 SHEETS