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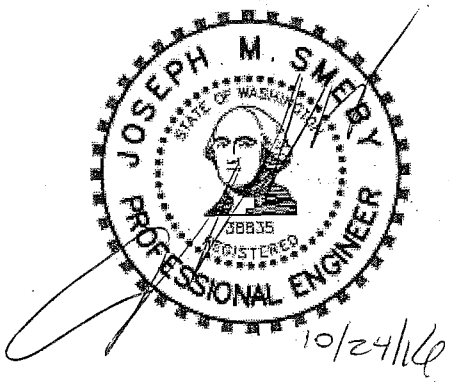
OCT 27 2016
CITY OF MONROE

Drainage Report
Raspberry Hill
PFN: M2016-

for

TK Development, Inc.
712 Kirkland Cir, Unit A104
Kirkland, WA 98033
425.879.5707

SITE LOCATION:
18516 134th St SE
Monroe, WA 98272



Prepared by:
Joseph M. Smeby, P.E.

Job No: 16-0916
Oct. 2016

TABLE OF CONTENTS

LIST OF FIGURES

1. INTRODUCTION

This document is intended to provide engineering information necessary to support the preliminary sub-division application to the City of Monroe for the 28 lot sub-division proposed on this site. The site covers approximately 4.9 acres, of which approximately 4.9 acres will be cleared as a result of this project. Improvements to the south side of 134th St SE along this projects frontage along with new roads and connection to a future extension in the southeast corner of the site are proposed to provide access to the future lots.

This project proposes to construct a new public road within the plat to serve the future lots. In addition, frontage improvements along the south side of 134th St SE including new pavement, curb, planter and sidewalk will be constructed along the north side of the plat. This project will require the construction of driveways for each future lot, stormwater facilities and other utilities. The existing on-site soils are Tokul gravely medial loam, so infiltration will not be viable for this project. The proposed detention system will provide combined detention in a vault and water quality will be provided in a Contech Filter System downstream of the detention vault.

2. DRAINAGE INFORMATION SUMMARY FORM

Project: **Raspberry Hill**
PFN: **M2016-**
Engineer: **Omega Engineering, Inc.**
2707 Wetmore Ave
Everett, WA 98201
Attention: Joseph Smeby, P.E.

Total site area: **4.9 acres**
Offsite area: **0.00 acres**
Disturbed area: **4.9 acres**

Applicant: **Tk Develpoment, Inc.**
712 Kirkland Cir, Unit A104
Kirkland, WA 98033

Number of lots/Bldg: **28**

Drainage Basin Information	Basin
On-site Developed Area	4.9 acres
Off-site Improved Area	0.00 acres
Types of storage proposed	Detention Vault
Approximate total storage volume	67,137 cf per calc
Soil Types	Type C
Basin Data	
Pre-developed run-off rates: 2-year	0.18 cfs
50-year	0.61 cfs
Post-developed run-off rates: 2-year	0.10 cfs
50-year	0.28 cfs

3. EXISTING SITE CHARACTERISTICS and ASSUMPTIONS

The site is located south of 134th St SE and east of the Trombly Hill Subdivision, and in Section 36, Township 28N, Range 6E, Willamette Meridian. See Figure 1 - Vicinity Map. The entire property consists of a multiple lots totaling 19.7 acres.

Land use around the site is single-family residential. This site currently contains some single-family buildings. Frontage improvements will be required along 134th St SE which will include 18' of pavement, curb, gutter, planter and sidewalk.

The existing site is rectangular in shape approximately 327-feet long running east-west and 650-feet running north-south. The grades on the site are moderate. The vegetation found on the existing property is a mixture of landscaping including grasses and shrubs and native vegetation.

Grades on the site generally run from northeast to southwest. The existing soils on this site are Tokul, gravelly medial loam, which is considered Till. A site visit was conducted in September 2016. The weather was clear and sunny with temperatures in the 60's. No surface water was observed on this site.

The soil hydrologic types for this site have been identified as Type C or Till from the Snohomish County Soil Survey Map, see figure 5. The soil type mapped for this site is Tokul gravelly medial loam.

4. NARRATIVE OF DEVELOPED SITE CHARACTERISTICS

This development proposes to create 28 new lots. The detention system will be designed for all the on-site improvements and some of the frontage improvements since they fall within a single "threshold discharge area" and the system has been sized to meet the 2005 DOE stormwater flow control and water quality standards.

The storm drainage system for this project has been designed to collect, treat and detain all of the new landscaping and impervious areas on this site. The off-site new impervious areas within 134th St SE, to the maximum extent practical will be collected as well and conveyed to the vault and filter for treatment and flow control.

The detention and water quality system has been designed using the WWHM2012 software and meet the 2005 State and current City standards.

4A. DOE MINIMUM REQUIREMENTS

MINIMUM REQUIREMENT #1: PREPARATION OF STORMWATER SITE PLANS

This project proposes to construct new impervious surfaces in excess of the minimum threshold so a final stormwater site plan has been prepared with the full engineering plans for this project.

MINIMUM REQUIREMENT #2: CONSTRUCTION STORMWATER POLLUTION PREVENTION (SWPPP)

1: Mark Clearing Limits
One of the first steps in the "Construction Sequence" included on the clearing and grading plan sheets is for a surveyor to stake the limits of clearing and to have construction or silt fencing placed along the limits prior to any other construction activity.

2: Establish Construction Access
The SWPPP calls for the proposed construction entrance to be installed as the second step after the staking of clearing limits. A detail is provided on the plans.

3: Control Flow Rates
This project will construct the detention/water quality vault as a first step. This will be used as a sediment pond during construction and the control structure will be in place to attenuate flows throughout construction.

4: Install Sediment Controls
This site and SWPPP proposes to construct a construction entrance to collect and contain the sediment on this site. In addition, inlet filters will be installed in the existing catch basins adjacent to the site. Interceptor swales with check dams will be used on-site to capture runoff and direct it to the necessary sediment pond/vault. These features are intended to minimize the opportunity for sediment to leave the site via stormwater or on vehicles. The construction of these features is one of the first items required in the "Construction Sequence".

5: Stabilize Soils
The "Construction Sequence" and "TESC Notes" call for the stabilization of soils that remain unworked for certain lengths of time based on the time of year. Stabilization techniques may include but not limited to mulching, plastic sheeting or hydroseeding, notes have been added to the plan regarding protection for the stock pile area if necessary.

6: Protect Slopes
No runoff will be directed toward the existing steep slopes in tract 999, in addition, any stockpile area will be protected as noted above.

7: Protect Drain Inlets
All existing & proposed catch basins and area drains will have inlet filters installed to protect the conveyance system.

8: Stabilize Channels and Outlets
Straw bale check dams will be used in the ditch along the north side of 134th St SE. Also, interceptor swales with check dams. These features will protect the existing and proposed channels from erosion.

9: Control Pollutants
No outside chemicals are expected to be necessary for the construction of this project. All vehicles working on and around the site would need to meet the State requirements for emissions.

10: Control DeWatering
Dewatering runoff will be directed to the detention/water quality pond system. The contractor shall monitor the sediment pond to ensure no erosion or excessive sedimentation occurs in the disposal areas.

11: Maintain BMPs
The construction supervisor will be responsible for maintaining all BMPs during construction and working with the City to relocate or add BMPs as necessary as site conditions change.

12: Manage the Project
It will be the responsibility of the Contractor and Developer to manage this project and coordinate with the City Inspector and Engineer.

Inspection and Monitoring:
Site inspections shall be done by a person who is knowledgeable in the principles and practices of erosion and sediment control. The person must have skills to first assess the site conditions and construction activities that could impact the quality of stormwater, and second assess the effectiveness of erosion and sediment control measures used to control the quality of stormwater discharges.
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, appropriate BMPs or design changes shall be implemented as soon as possible.

Maintaining an Updated Construction SWPPP:
The construction SWPPP shall be retained on-site or within reasonable access to the site.

The SWPPP shall be modified whenever there is a change in the design, construction, operation, or maintenance at the construction site that has, or could have, a significant effect on the discharge of pollutants to waters of the state.

The SWPPP shall be modified if, during inspections or investigations conducted by the owner/operator, or the applicable local or state regulatory authority, it is determined that the SWPPP is ineffective in eliminating or significantly minimizing pollutants in stormwater discharges from the site. The SWPPP shall be modified as necessary to include additional or modified BMPs designed to correct problems identified. Revisions to the SWPPP shall be completed within seven days following inspection.

MINIMUM REQUIREMENT #3: SOURCE CONTROL OF POLLUTANTS

The improvements proposed on this site will create 28-lots and new public roads. Residential sub-divisions do not require additional source control BMPS, but basic water quality is proposed on this site.

MINIMUM REQUIREMENT #4: PRESERVATION OF NATURAL DRAINAGE SYSTEMS AND OUTFALLS

The vault outfall will be connected to the existing conveyance system along the west side of this project within the Trombley Hill subdivision. An existing CB exists along the southwestern corner of this project within a 15' public stormwater easement. The treated and detained runoff from this project will be discharged into the downstream system at this point. This is the natural downstream location since that plat borders this project to the west.

MINIMUM REQUIREMENT #5: ON-SITE STORMWATER MANAGEMENT

Runoff from the new public road and future lots will be collected by CBs and conveyed to a detention/water quality system for this project. Roof runoff from each future SFR will be directed to an individual perforated stubout connection before discharging into the conveyance system within the future road right-of-way. The landscaping will be graded to drain toward the lot yard drains to the maximum extent feasible.

MINIMUM REQUIREMENT #6: RUNOFF TREATMENT

A Contech Storm Filter system is proposed for this project downstream of the vault. This design meets the basic water quality treatment requirement for residential projects.

MINIMUM REQUIREMENT #7: FLOW CONTROL

The design and analysis for this project requires the construction of a vault system which was sized using the WWHM2012 software.

MINIMUM REQUIREMENT #8: WETLAND PROTECTION

No on-site or off-site wetlands have been identified on or near this project.

MINIMUM REQUIREMENT #9: BASIN/WATERSHED PLANNING

The scope of this project is too small to justify a Watershed Plan.

MINIMUM REQUIREMENT #10: OPERATION AND MAINTENANCE

A complete O&M manual has been provided with the full drainage report.

5. DESCRIPTION OF PROPOSED EROSION CONTROL BMP's

Clearing, grading, and temporary erosion and sediment control plans have been prepared for this project. However, since a construction site is dynamic it will be necessary to re-assess the erosion control BMP's during construction and install additional measures when and if necessary.

Proposed temporary measures for this project will include the following BMP's:
-Installation of stabilized rock construction entrance(s).
-Interceptor swales
-Rip-Rap check dams
-Straw mulch, hydroseed or other mulching and planting method to stabilized unworked areas.
-Silt Fencing
-Sediment vault

Permanent measures to reduce or eliminate erosion or water quality degradation will include the following BMP's: (Under Future Phase/Permit)
-Paving all traffic areas
-Drainage collection system, including catch basins and floatable material separators
-Permanent landscaping in pervious areas.
-Limiting cut and fill slopes to 2:1 maximum
-Routine maintenance and inspection of the grounds and response to developing problems.

These proposed erosion control BMP's have been engineered for anticipated conditions in compliance with DOE guidelines. With proper installation, maintenance and inspection the proposed BMP's should result in minimal impact to the surrounding environment. The City retains the authority by code to require additional measures should the existing measures prove insufficient.

A. SITE GRADING/EROSION CONTROL RISK ASSESSMENT

SLOPE: Existing grades onsite slope down from northeast to southwest ranging from 2.0% to approximately 12.0%. The proposed internal road grades will be no greater than 12%.
CRITICAL AREAS: Steep Slopes (Tract 999).
SOILS: In the development area of the site soils are hydrologic group C, (from Web-Soil Survey).
GROUND MOVEMENT POTENTIAL: N/A
SOURCES OF WATER FOR EROSION: Rainfall will be the only significant source of onsite runoff.
MEASURES PROPOSED TO PREVENT/MINIMIZE EROSION:
TEMPORARY MEASURES: Mulch cover, rock construction entrance(s), diversion swales, silt fencing are all proposed to be used to prevent or minimize erosion and siltation during construction.
PERMANENT MEASURES: Future measures will include permanent vegetative cover in pervious areas, limiting permanent cut and fill slopes to 2:1 maximum unless protected with a rockery face, asphalt pavement to stabilize all vehicle traffic areas and a piped conveyance system to control the location of runoff release. Routine maintenance of the grounds and response to developing problems will be a function of the property owner.
CONCLUSION: Proposed erosion control BMP's in compliance with DOE guidelines have been engineered for anticipated conditions. Civil construction plans include a detailed ESC plan that provides details and notes for the proposed BMP's. With proper installation, maintenance and inspection, the proposed BMP's should result in minimal impact to the surrounding environment. Based on the above information the Erosion Risk for this site is Low to Moderate. Reports, studies and designs for this site include:

SEPA Checklist, by Others
Preliminary Engineering Construction Plans, by Omega Engineering, Inc.

B. Minimum Elements

1: Mark Clearing Limits
One of the first steps in the "Construction Sequence" included on the clearing and grading plan sheets is for a surveyor to stake the limits of clearing and to have construction or silt fencing placed along the limits prior to any other construction activity.

2: Establish Construction Access
The SWPPP calls for the proposed construction entrance to be installed as the second step after the staking of clearing limits. A detail is provided on the plans.

3: Control Flow Rates
This project will construct the detention/water quality vault as a first step. This will be used as a sediment pond during construction and the control structure will be in place to attenuate flows throughout construction.

4: Install Sediment Controls
This site and SWPPP proposes to construct a construction entrance to collect and contain the sediment on this site. In addition, inlet filters will be installed in the existing catch basins adjacent to the site. and straw bale check dams will be installed in the ditch along the east side of 191st Ave SE. Interceptor swales with check dams will be used on-site to capture runoff and direct it to the necessary sediment pond/vault. These features are intended to minimize the opportunity for sediment to leave the site via stormwater or on vehicles. The construction of these features is one of the first items required in the 4: Install Sediment Controls
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The SWPPP shall be modified if, during inspections or investigations conducted by the owner/operator, or the applicable local or state regulatory authority, it is determined that the SWPPP is ineffective in eliminating or significantly minimizing pollutants in stormwater discharges from the site. The SWPPP shall be modified as necessary to include additional or modified BMPs designed to correct problems identified. Revisions to the SWPPP shall be completed within seven days following inspection.

6. OFFSITE DRAINAGE ANALYSIS - UPSTREAM

From field observation and review of the available topography, it appears that some small areas to the northeast of this project will drain onto the site along with the existing roadside ditch east of the project within the 134th St SE R/W. The minor areas to the northeast will be allowed to sheet flow onto the site and will be collected by the proposed conveyance system. Runoff from the existing drainage ditch east of this project will be collected and piped within the 134th St SE R/W to the downstream connection point.

7. OFFSITE DRAINAGE ANALYSIS - DOWNSTREAM

The project is bordered to the south by an existing easement and road R/W (Rainier View Rd SE). This road system collects the runoff from the existing site. This conveyance system appears to drain to the southeast and into a drainage pond. However, the actual drainage path could not be confirmed in the field.

It was confirmed and observed in the field however, that that existing runoff from this project is collected by an engineered conveyance system that conveys the site runoff through easements and R/W to the ultimate outfall location to the south. However, the exact location could not be located or observed.

8. DETENTION STORAGE CALCULATIONS

Current City code requires this site be analyzed using the 2005 DOE manual and the WWHM2012 storm water software. Since this site proposes using a detention vault the software will be used to size the system.

The vault has been sized to accommodate the developed conditions for this project and will release the flows to the southwest into the system described in the downstream analysis.

Refer to appendix 'A' for the full output from the WWHM2012 software.

9. WATER QUALITY DESIGN

Water quality for this project will be provided in the form of a Contech Storm Filter system. The Contech design team will help to size the final system at the time of construction plan submittal.

10. CONVEYANCE CALCULATIONS

The majority of the pipes designed for this project will receive up to 5.48 cfs for peak flows from the 100-year storm event. These flows will be concentrated by the inlet to the vault which is designed as a 12" pipe with a slope of spread through multiple inlets to the vault for which the greatest pipe flow rate will be slightly less than 5.8 cfs. These pipes are designed as 12" pipes (S=2.6%, min.) with a peak flowing full capacity of over 8.0 cfs and therefore contain more than adequate capacity to handle the expected flows.

The vault outfall is the conveyance system which will convey the greatest flows from the project. The 100-year flow rate was calculated at 0.33 cfs which can also be conveyed within a 12" pipe. An emergency overflow will be provided for the detention system to accommodate any excessive flows in case of vault failure as part of the construction design/plan set.

Therefore, all pipes designed for this project have more capacity then required based on the expected flow to each leg of the pipe system.

11. OPERATIONS AND MAINTENANCE MANUAL

The Property Owners and HOA will be responsible for maintaining the stormwater and landscaping facilities within this development. Included in this manual are checklists for each feature specific to this project. Copies should be made of the checklists as necessary during routine inspections and required maintenance. Specific problems can be recorded along with the appropriate action taken.

These checklists are a guide for inspections and maintenance. The frequency of the inspections/maintenance is identified in the left hand column with the following abbreviations:

A = Annual (March or April preferred)
M = Monthly
S = After Major Storms (Use 1-inch in 24 hours as a guideline)

Routine inspections and maintenance will improve the long-term performance of the stormwater facilities. If at any time you are unsure if a problem exists or how to address a specific problem contact a Professional Engineer.

Refer to Appendix B for a list of each facility to be maintained and the appropriate maintenance checklist. (To Be Provided with Full Drainage Report)

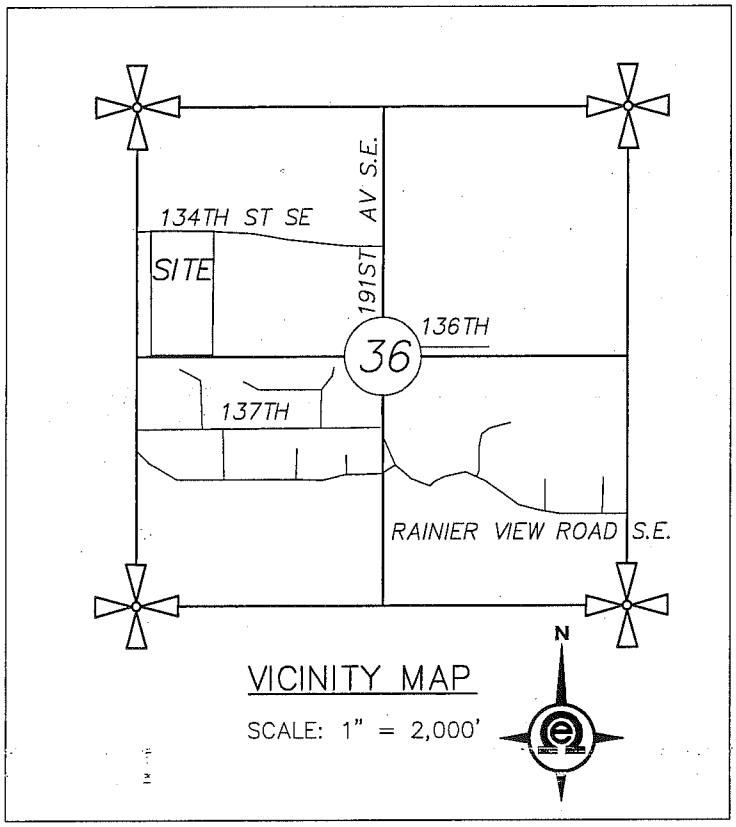


FIG. 1

OMEGA
ENGINEERING, INC.
2707 WETMORE AVE.
Everett, WA 98201
(o)425.387.3820 (f) 425.259.1958

VICINITY MAP
RASPBERRY HILL

DATE	JOB NO.	SCALE	SHEET
10/24/16	16-0916	1" = 2000'	1 OF 1

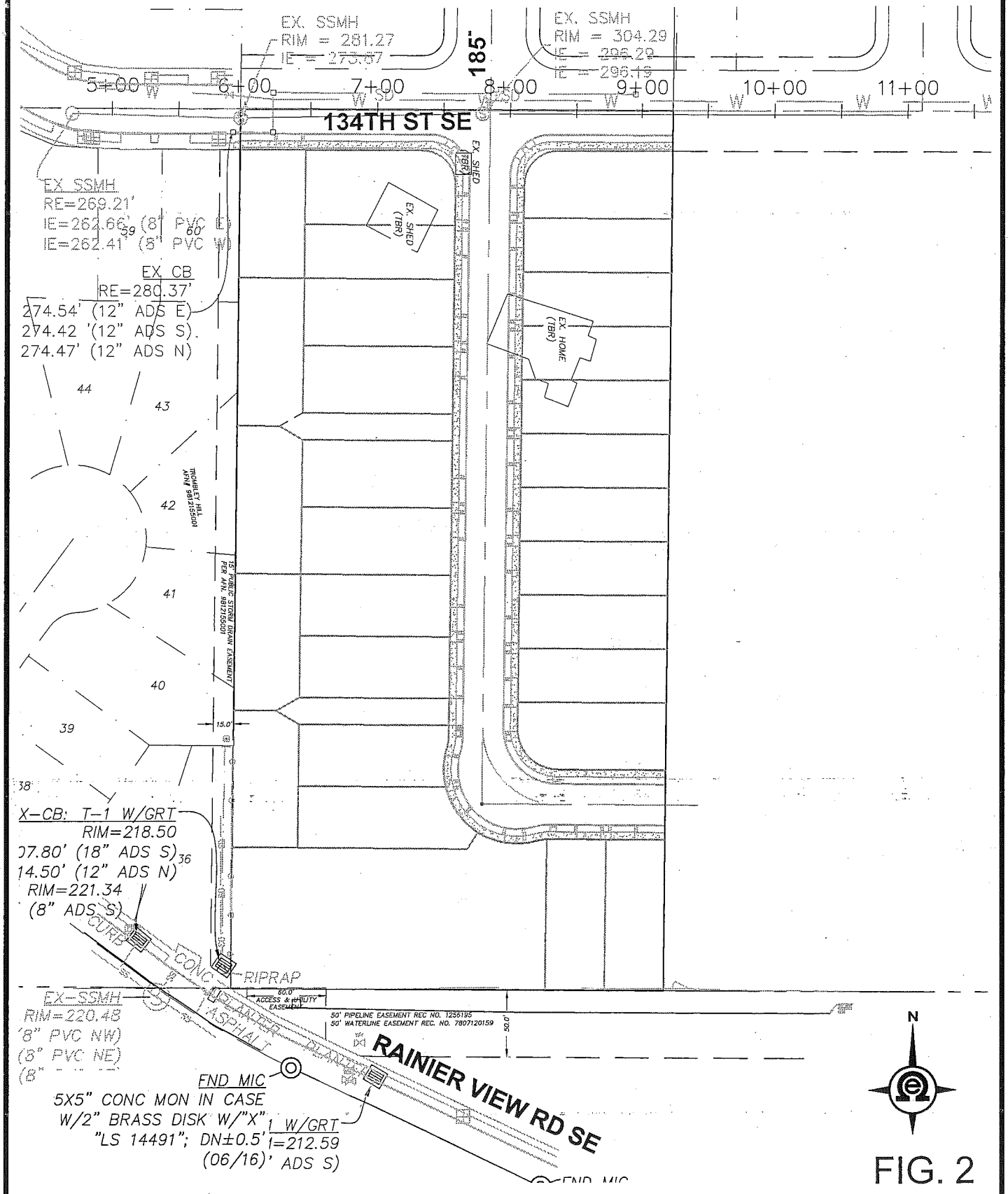


FIG. 2

OMEGA
ENGINEERING, INC.
2707 WETMORE AVE.
Everett, WA 98201
(o)425.387.3820 (f) 425.259.1958

EXISTING BASIN MAP
RASPBERRY HILL

DATE	JOB NO.	SCALE	SHEET
10/24/16	16-0916	1" = 100'	1 OF 1

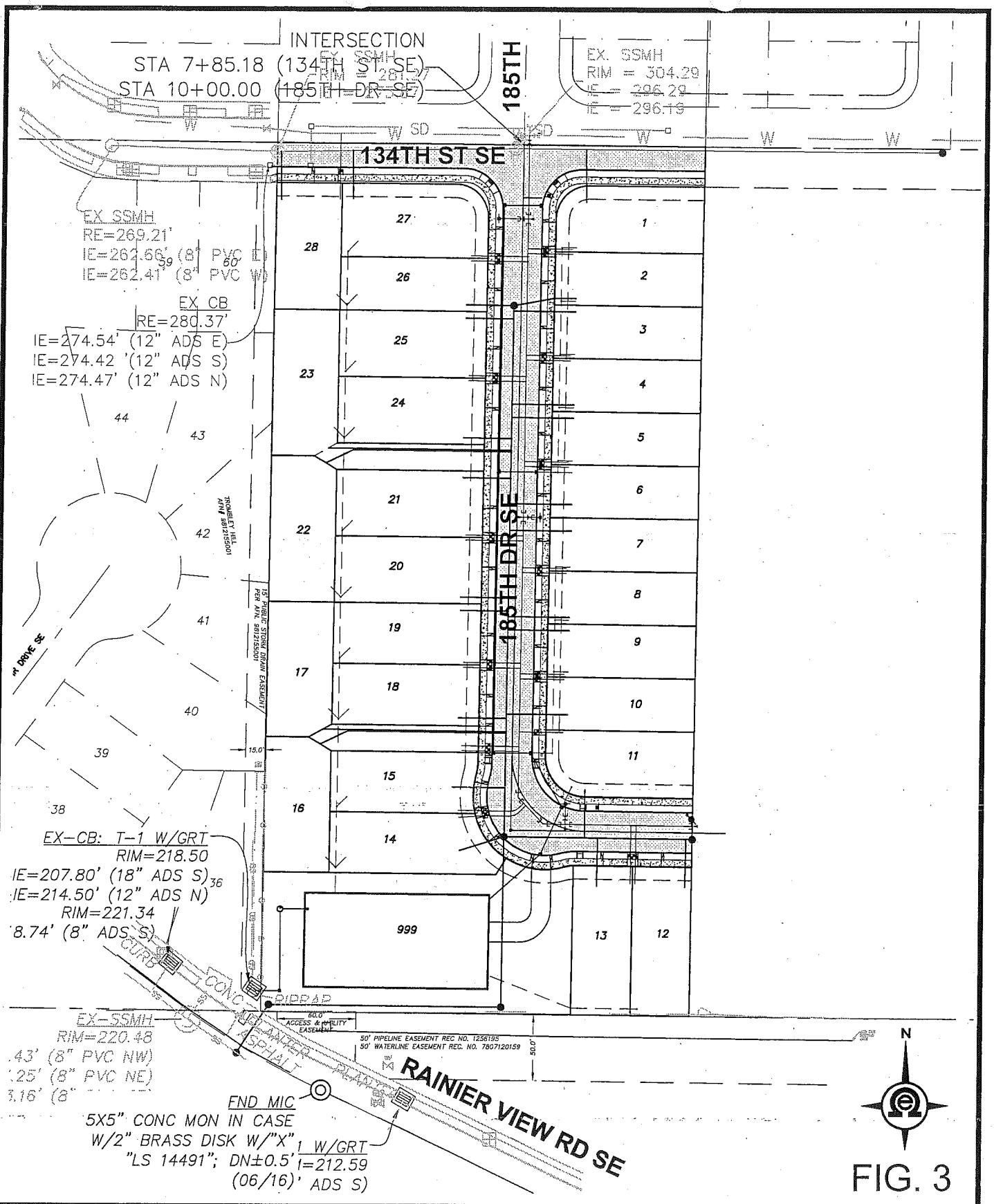


FIG. 3

OMEGA
ENGINEERING, INC.
2707 WETMORE AVE.
Everett, WA 98201
(o)425.387.3820 (f) 425.259.1958

DEVELOPED BASIN MAP
RASPBERRY HILL

DATE	JOB NO.	SCALE	SHEET
10/24/16	16-0916	1" = 100'	1 OF 1

APPENDIX A

STORMWATER CALCULATIONS

WWHM2012

PROJECT REPORT

General Model Information

Project Name:	Vault
Site Name:	Raspberry Hill
Site Address:	
City:	Monroe
Report Date:	10/19/2016
Gage:	Everett
Data Start:	1948/10/01
Data End:	2009/09/30
Timestep:	15 Minute
Precip Scale:	1.20
Version Date:	2016/02/25
Version:	4.2.12

POC Thresholds

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

Landuse Basin Data

Predeveloped Land Use

Basin 1

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
C, Forest, Mod	4.9
Pervious Total	4.9
Impervious Land Use	acre
Impervious Total	0
Basin Total	4.9

Element Flows To:

Surface	Interflow	Groundwater

Mitigated Land Use

Basin 1

Bypass:	No
GroundWater:	No

Pervious Land Use	acre
C, Lawn, Mod	2.46
Pervious Total	2.46

Impervious Land Use	acre
ROADS MOD	0.76
ROOF TOPS FLAT	1.68
Impervious Total	2.44
Basin Total	4.9

Element Flows To:

Surface	Interflow	Groundwater
Vault 1	Vault 1	

Routing Elements
Predeveloped Routing

Mitigated Routing

Vault 1

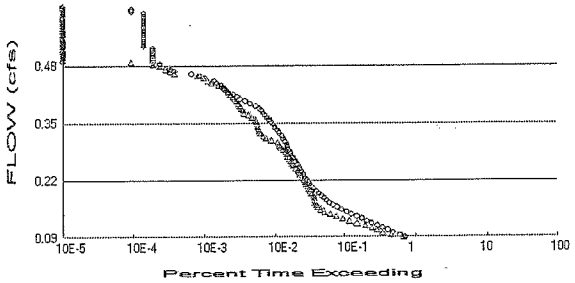
Width: 69.0937290026184 ft.
Length: 138.187458005236 ft.
Depth: 8 ft.
Discharge Structure
Riser Height: 7 ft.
Riser Diameter: 18 in.
Notch Type: Rectangular
Notch Width: 0.012 ft.
Notch Height: 4.018 ft.
Orifice 1 Diameter: 1.4 in. Elevation:0 ft.
Element Flows To:
Outlet 1 Outlet 2

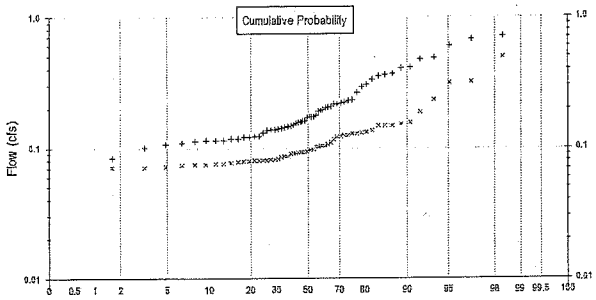
Vault Hydraulic Table

Stage(feet)	Area(ac.)	Volume(ac-ft.)	Discharge(cfs)	Infilt(cfs)
0.0000	0.219	0.000	0.000	0.000
0.0889	0.219	0.019	0.015	0.000
0.1778	0.219	0.039	0.022	0.000
0.2667	0.219	0.058	0.027	0.000
0.3556	0.219	0.077	0.031	0.000
0.4444	0.219	0.097	0.035	0.000
0.5333	0.219	0.116	0.038	0.000
0.6222	0.219	0.136	0.042	0.000
0.7111	0.219	0.155	0.044	0.000
0.8000	0.219	0.175	0.047	0.000
0.8889	0.219	0.194	0.050	0.000
0.9778	0.219	0.214	0.052	0.000
1.0667	0.219	0.233	0.054	0.000
1.1556	0.219	0.253	0.057	0.000
1.2444	0.219	0.272	0.059	0.000
1.3333	0.219	0.292	0.061	0.000
1.4222	0.219	0.311	0.063	0.000
1.5111	0.219	0.331	0.065	0.000
1.6000	0.219	0.350	0.067	0.000
1.6889	0.219	0.370	0.069	0.000
1.7778	0.219	0.389	0.070	0.000
1.8667	0.219	0.409	0.072	0.000
1.9556	0.219	0.428	0.074	0.000
2.0444	0.219	0.448	0.076	0.000
2.1333	0.219	0.467	0.077	0.000
2.2222	0.219	0.487	0.079	0.000
2.3111	0.219	0.506	0.080	0.000
2.4000	0.219	0.526	0.082	0.000
2.4889	0.219	0.545	0.083	0.000
2.5778	0.219	0.565	0.085	0.000
2.6667	0.219	0.584	0.086	0.000
2.7556	0.219	0.604	0.088	0.000
2.8444	0.219	0.623	0.089	0.000
2.9333	0.219	0.643	0.091	0.000
3.0222	0.219	0.662	0.092	0.000
3.1111	0.219	0.681	0.095	0.000
3.2000	0.219	0.701	0.098	0.000

3.2889	0.219	0.720	0.102	0.000
3.3778	0.219	0.740	0.106	0.000
3.4667	0.219	0.759	0.110	0.000
3.5556	0.219	0.779	0.115	0.000
3.6444	0.219	0.798	0.119	0.000
3.7333	0.219	0.818	0.124	0.000
3.8222	0.219	0.837	0.128	0.000
3.9111	0.219	0.857	0.133	0.000
4.0000	0.219	0.876	0.138	0.000
4.0889	0.219	0.896	0.143	0.000
4.1778	0.219	0.915	0.149	0.000
4.2667	0.219	0.935	0.155	0.000
4.3556	0.219	0.954	0.161	0.000
4.4444	0.219	0.974	0.184	0.000
4.5333	0.219	0.993	0.192	0.000
4.6222	0.219	1.013	0.200	0.000
4.7111	0.219	1.032	0.208	0.000
4.8000	0.219	1.052	0.217	0.000
4.8889	0.219	1.071	0.225	0.000
4.9778	0.219	1.091	0.234	0.000
5.0667	0.219	1.110	0.243	0.000
5.1556	0.219	1.130	0.252	0.000
5.2444	0.219	1.149	0.261	0.000
5.3333	0.219	1.169	0.270	0.000
5.4222	0.219	1.188	0.280	0.000
5.5111	0.219	1.208	0.290	0.000
5.6000	0.219	1.227	0.299	0.000
5.6889	0.219	1.246	0.309	0.000
5.7778	0.219	1.266	0.319	0.000
5.8667	0.219	1.285	0.329	0.000
5.9556	0.219	1.305	0.340	0.000
6.0444	0.219	1.324	0.350	0.000
6.1333	0.219	1.344	0.361	0.000
6.2222	0.219	1.363	0.372	0.000
6.3111	0.219	1.383	0.383	0.000
6.4000	0.219	1.402	0.394	0.000
6.4889	0.219	1.422	0.405	0.000
6.5778	0.219	1.441	0.416	0.000
6.6667	0.219	1.461	0.427	0.000
6.7556	0.219	1.480	0.439	0.000
6.8444	0.219	1.500	0.450	0.000
6.9333	0.219	1.519	0.462	0.000
7.0222	0.219	1.539	0.524	0.000
7.1111	0.219	1.558	1.060	0.000
7.2000	0.219	1.578	1.877	0.000
7.2889	0.219	1.597	2.848	0.000
7.3778	0.219	1.617	3.861	0.000
7.4667	0.219	1.636	4.802	0.000
7.5556	0.219	1.656	5.574	0.000
7.6444	0.219	1.675	6.127	0.000
7.7333	0.219	1.695	6.492	0.000
7.8222	0.219	1.714	6.905	0.000
7.9111	0.219	1.734	7.244	0.000
8.0000	0.219	1.753	7.567	0.000
8.0889	0.219	1.773	7.876	0.000
8.1778	0.000	0.000	8.173	0.000

Analysis Results
POC 1





\+ Predeveloped x Mitigated

Predeveloped Landuse Totals for POC #1
Total Pervious Area: 4.9
Total Impervious Area: 0

Mitigated Landuse Totals for POC #1
Total Pervious Area: 2.46
Total Impervious Area: 2.44

Flow Frequency Method: Log Pearson Type III 17B

Flow Frequency Return Periods for Predeveloped. POC #1

Return Period	**Flow(cfs)**
2 year	0.181134
5 year	0.289661
10 year	0.376018
25 year	0.502639
50 year	0.610345
100 year	0.730094

Flow Frequency Return Periods for Mitigated. POC #1

Return Period	**Flow(cfs)**
2 year	0.100478
5 year	0.14358
10 year	0.178531
25 year	0.230866
50 year	0.276404
100 year	0.328106

Annual Peaks

Annual Peaks for Predeveloped and Mitigated. POC #1

Year	**Predeveloped**	**Mitigated**
1949	0.202	0.083
1950	0.205	0.097
1951	0.173	0.081
1952	0.141	0.076
1953	0.114	0.075
1954	0.717	0.093
1955	0.217	0.128
1956	0.190	0.153
1957	0.263	0.129
1958	0.229	0.086

1959	0.179	0.096
1960	0.173	0.106
1961	0.359	0.123
1962	0.174	0.081
1963	0.293	0.080
1964	0.231	0.071
1965	0.143	0.103
1966	0.084	0.079
1967	0.170	0.082
1968	0.207	0.117
1969	0.671	0.085
1970	0.118	0.080
1971	0.223	0.148
1972	0.138	0.092
1973	0.136	0.090
1974	0.366	0.091
1975	0.140	0.075
1976	0.147	0.091
1977	0.106	0.080
1978	0.124	0.075
1979	0.410	0.086
1980	0.192	0.074
1981	0.121	0.078
1982	0.157	0.128
1983	0.333	0.080
1984	0.162	0.188
1985	0.216	0.131
1986	0.485	0.318
1987	0.219	0.232
1988	0.113	0.125
1989	0.146	0.071
1990	0.153	0.122
1991	0.158	0.102
1992	0.120	0.109
1993	0.115	0.071
1994	0.110	0.098
1995	0.161	0.147
1996	0.303	0.136
1997	0.601	0.493
1998	0.100	0.077
1999	0.131	0.103
2000	0.114	0.157
2001	0.039	0.062
2002	0.149	0.104
2003	0.117	0.093
2004	0.197	0.148
2005	0.137	0.093
2006	0.473	0.125
2007	0.349	0.104
2008	0.405	0.315
2009	0.123	0.094

Ranked Annual Peaks

Ranked Annual Peaks for Predeveloped and Mitigated. POC #1

Rank	Predeveloped	Mitigated
1	0.7166	0.4927
2	0.6705	0.3177
3	0.6010	0.3147

4	0.4847	0.2317
5	0.4728	0.1880
6	0.4104	0.1569
7	0.4055	0.1527
8	0.3665	0.1482
9	0.3593	0.1477
10	0.3492	0.1470
11	0.3327	0.1363
12	0.3029	0.1315
13	0.2933	0.1294
14	0.2630	0.1281
15	0.2311	0.1277
16	0.2287	0.1249
17	0.2230	0.1247
18	0.2192	0.1226
19	0.2171	0.1216
20	0.2158	0.1167
21	0.2072	0.1091
22	0.2047	0.1064
23	0.2015	0.1039
24	0.1968	0.1037
25	0.1922	0.1031
26	0.1897	0.1026
27	0.1786	0.1019
28	0.1739	0.0985
29	0.1732	0.0968
30	0.1731	0.0964
31	0.1699	0.0937
32	0.1617	0.0931
33	0.1607	0.0929
34	0.1580	0.0927
35	0.1568	0.0922
36	0.1534	0.0912
37	0.1494	0.0909
38	0.1472	0.0902
39	0.1459	0.0865
40	0.1429	0.0861
41	0.1409	0.0850
42	0.1401	0.0825
43	0.1377	0.0816
44	0.1371	0.0811
45	0.1356	0.0806
46	0.1310	0.0805
47	0.1238	0.0805
48	0.1235	0.0800
49	0.1209	0.0796
50	0.1204	0.0790
51	0.1183	0.0778
52	0.1171	0.0772
53	0.1152	0.0759
54	0.1143	0.0754
55	0.1139	0.0749
56	0.1135	0.0749
57	0.1096	0.0736
58	0.1062	0.0713
59	0.1004	0.0709
60	0.0839	0.0707
61	0.0395	0.0620

Duration Flows
The Facility PASSED

Flow(cfs)	Predev	Mit	Percentage	Pass/Fail
0.0906	15071	14245	94	Pass
0.0958	12696	9597	75	Pass
0.1011	10243	7358	71	Pass
0.1063	8626	6021	69	Pass
0.1116	7281	5084	69	Pass
0.1168	6130	4145	67	Pass
0.1221	5020	3187	63	Pass
0.1273	4297	2509	58	Pass
0.1326	3670	2016	54	Pass
0.1378	3140	1636	52	Pass
0.1431	2635	1352	51	Pass
0.1483	2274	1110	48	Pass
0.1536	1951	981	50	Pass
0.1588	1677	894	53	Pass
0.1641	1468	849	57	Pass
0.1693	1311	833	63	Pass
0.1746	1187	816	68	Pass
0.1798	1091	800	73	Pass
0.1851	1001	778	77	Pass
0.1903	922	724	78	Pass
0.1956	848	696	82	Pass
0.2008	786	670	85	Pass
0.2061	718	636	88	Pass
0.2113	674	608	90	Pass
0.2166	637	583	91	Pass
0.2218	614	557	90	Pass
0.2271	583	527	90	Pass
0.2323	552	486	88	Pass
0.2376	522	469	89	Pass
0.2428	501	453	90	Pass
0.2481	480	423	88	Pass
0.2533	456	395	86	Pass
0.2586	437	378	86	Pass
0.2638	419	362	86	Pass
0.2691	396	341	86	Pass
0.2743	382	326	85	Pass
0.2796	364	312	85	Pass
0.2848	350	297	84	Pass
0.2901	336	280	83	Pass
0.2953	324	258	79	Pass
0.3006	316	244	77	Pass
0.3058	300	229	76	Pass
0.3111	288	188	65	Pass
0.3163	277	158	57	Pass
0.3216	265	145	54	Pass
0.3268	246	132	53	Pass
0.3321	235	128	54	Pass
0.3373	222	126	56	Pass
0.3426	210	122	58	Pass
0.3478	198	119	60	Pass
0.3531	187	116	62	Pass
0.3583	175	112	64	Pass
0.3636	164	101	61	Pass

0.3688	154	90	58	Pass
0.3741	146	79	54	Pass
0.3793	135	75	55	Pass
0.3846	126	71	56	Pass
0.3898	114	69	60	Pass
0.3951	94	65	69	Pass
0.4003	80	61	76	Pass
0.4056	68	57	83	Pass
0.4108	62	54	87	Pass
0.4161	55	50	90	Pass
0.4213	46	47	102	Pass
0.4266	41	44	107	Pass
0.4318	40	39	97	Pass
0.4371	37	34	91	Pass
0.4423	32	27	84	Pass
0.4476	30	24	80	Pass
0.4528	22	21	95	Pass
0.4581	18	17	94	Pass
0.4633	14	8	57	Pass
0.4686	8	7	87	Pass
0.4738	7	6	85	Pass
0.4791	5	5	100	Pass
0.4843	5	4	80	Pass
0.4896	4	2	50	Pass
0.4948	4	0	0	Pass
0.5001	4	0	0	Pass
0.5053	4	0	0	Pass
0.5106	4	0	0	Pass
0.5158	4	0	0	Pass
0.5211	4	0	0	Pass
0.5263	3	0	0	Pass
0.5316	3	0	0	Pass
0.5368	3	0	0	Pass
0.5421	3	0	0	Pass
0.5473	3	0	0	Pass
0.5526	3	0	0	Pass
0.5578	3	0	0	Pass
0.5631	3	0	0	Pass
0.5683	3	0	0	Pass
0.5736	3	0	0	Pass
0.5788	3	0	0	Pass
0.5841	3	0	0	Pass
0.5893	3	0	0	Pass
0.5946	3	0	0	Pass
0.5998	3	0	0	Pass
0.6051	2	0	0	Pass
0.6103	2	0	0	Pass

Water Quality

Water Quality BMP Flow and Volume for POC #1

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

LID Report

LID Technique	Used for Treatment?	Total Volume Needs Treatment (ac-ft)	Volume Through Facility (ac-ft)	Infiltration Volume (ac-ft)	Cumulative Volume Infiltration Credit	Percent Volume Infiltrated	Water Quality	Percent Water Quality Treated	Comment
Vault 1 POC	☐	673.82			☐	0.00			
Total Volume Infiltrated		673.82	0.00	0.00		0.00	0.00	0%	No Treat. Credit
Compliance with LID Standard 8% of 2-yr to 50% of 2-yr									Duration Analysis Result = Passed

Model Default Modifications

Total of 0 changes have been made.

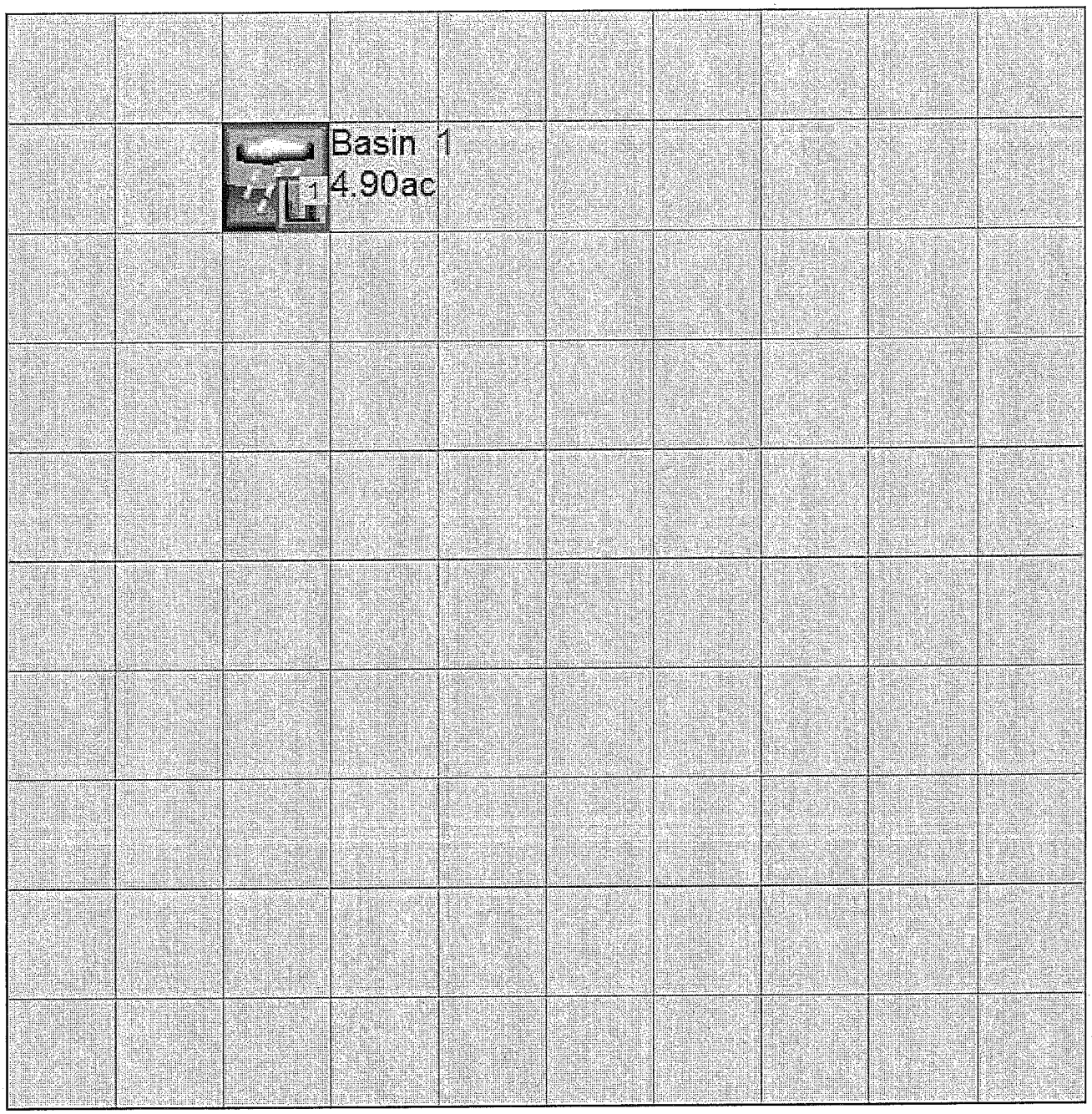
PERLND Changes

No PERLND changes have been made.

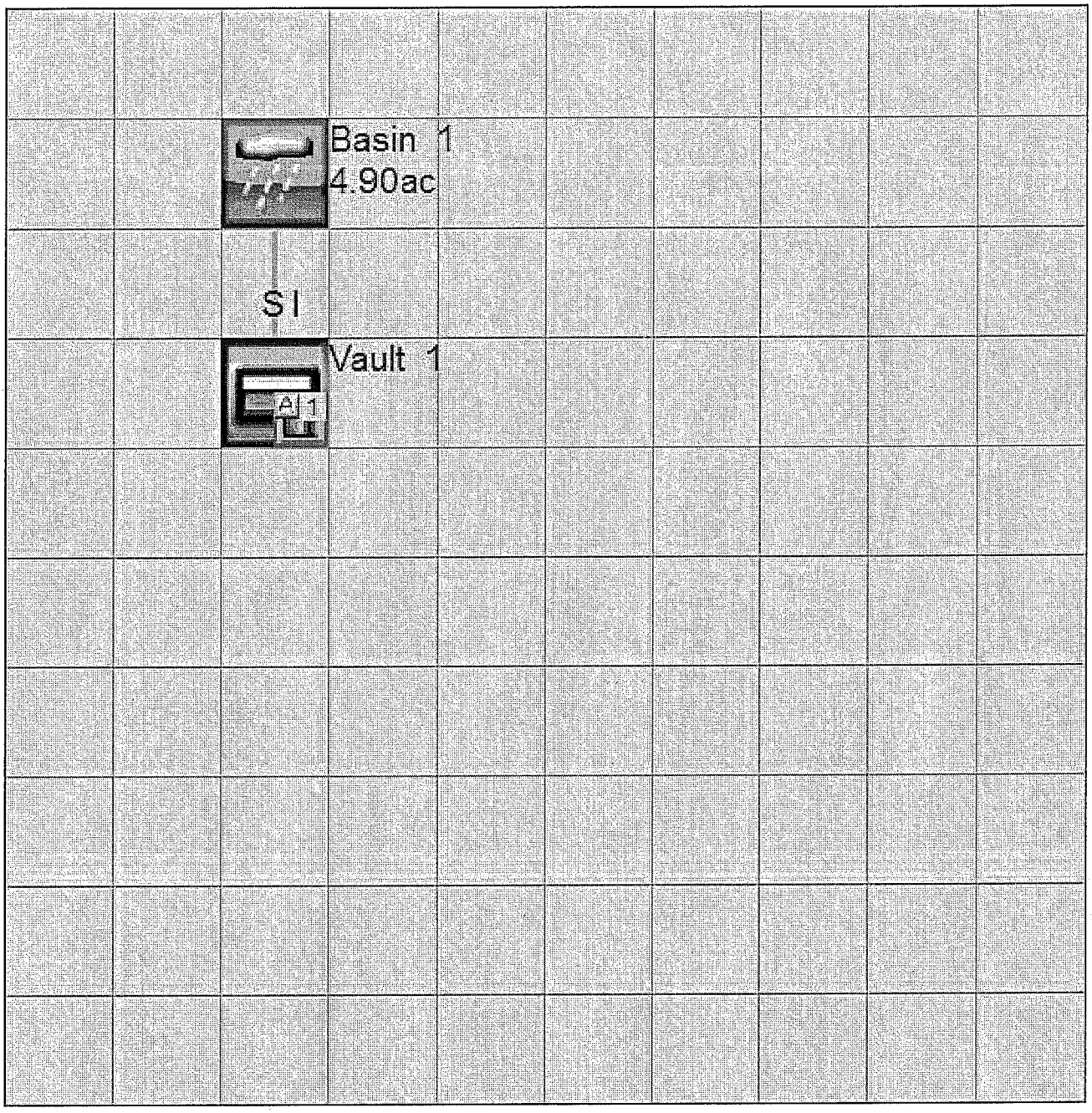
IMPLND Changes

No IMPLND changes have been made.

Appendix
Predeveloped Schematic



Mitigated Schematic



APPENDIX B

MAINTENANCE & OPERATIONS MANUAL
(with construction submittal)

APPENDIX C

GEOTECHNICAL REPORT
(with construction submittal)