ATTACHMENT 18

Duke's Landing

Preliminary Stormwater Site Plan Report

March 13, 2015
Revised May 5, 2015
Revised: June 18, 2015
Revised: July 1, 2015

Prepared for

Kellie Caffey
227 Bellevue Way NE Suite #174
Bellevue, WA 98004

Submitted by

ESM Consulting Engineers, LLC
33400 8th Avenue S, Suite 205
Federal Way, WA 98003

253.838.6113 tel
253.838.7104 fax

ESM

www.esmcivil.com

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PRELIMINARY
Stormwater Site Plan
FOR
Duke's Landing

Prepared for:
Kellie Caffie
227 Bellevue Way NE, Suite 174
Bellevue, WA 98004

Prepared by:
ESM Consulting Engineers
33400 8th Avenue S, Suite 205
Federal Way, WA 98003

BRIANNE NICHOLE GASTFIELD
STATE OF WASHINGTON
43175
REGISTERED
PROFESSIONAL ENGINEER
8/3/15

July 1, 2015 | Job No. 1787-001-013

Approved By:

City of Redmond | Date

TABLE OF CONTENTS

LIST OF FIGURES

APPENDIX

1. PROJECT OVERVIEW

The proposed Duke's Landing is a 18-lot plat located at the Ermines of NE 47th Street & 164th Court NE in the City of Redmond, WA. The project is 4.27 acres in size and incorporates three parcels numbered 555630-0067, 555630-0068 and 555630-0069, all of which are zoned R-4. The property also includes right of way which will be as part of Duke's Landing. See Figure 1.1 for the Vicinity Map and Figure 1.3 for further detail.

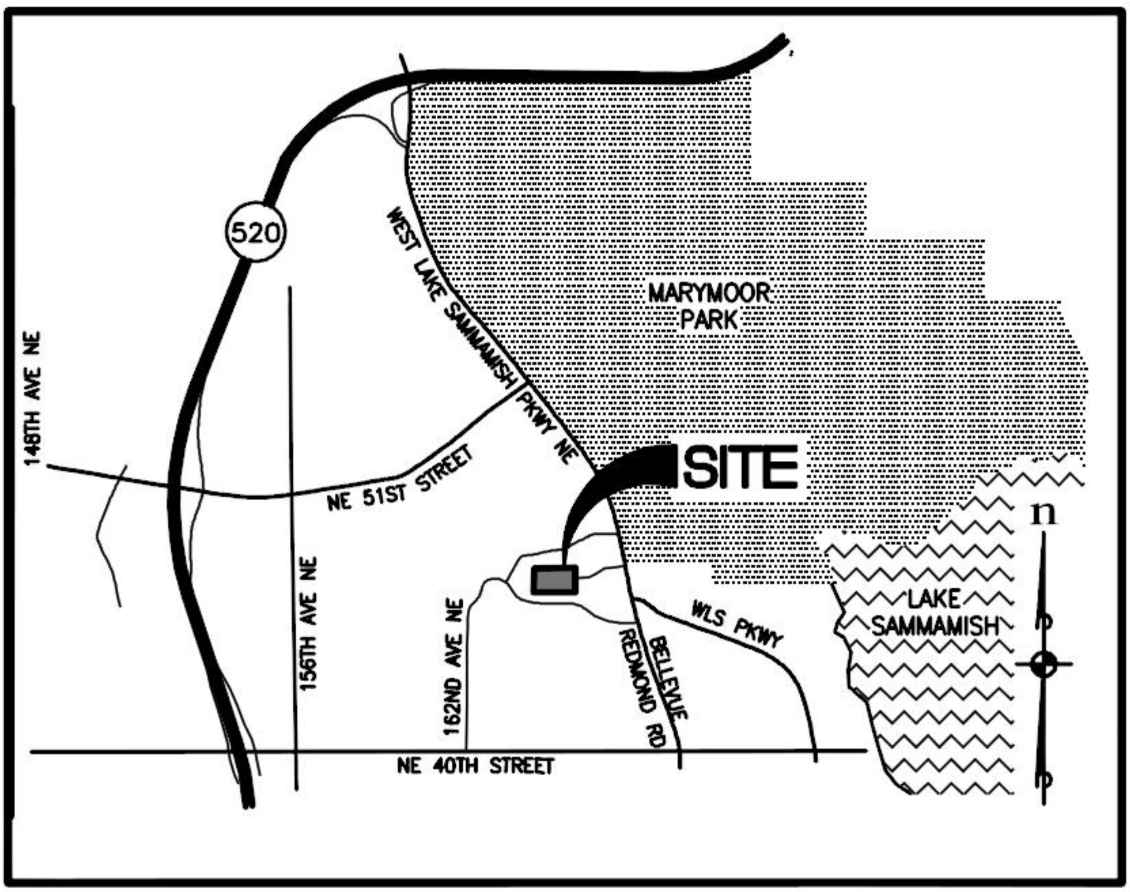
The existing site consists of a single-family dwelling with paved driveways and a few small structures. All structures on site will be demolished. The existing site is generally sloped from west to east with natural discharge point at northeast corner of the property. The site is generally lawn except the west edge of the site, which is lightly forested. Upstream offsite flows are captured via ditch along the south boundary line routed to the northeast corner of the site through a 6" pipe. See Figure 1.2 for the Existing Site Conditions. The soils are Alderwood gravely loam. See Figure 1.4 for soils map. The flows then conveyed to the conveyance system within NE 48th Street.

The proposed development consists of 19 residential units and the associated roadways and landscaped areas. Furthermore, this project is classified as a "Large Project" where the project is required to meet the Minimum Requirements #1-9 in Chapter 2 of the Stormwater Notebook and comply with requirements on Chapter 6 of the 2012 City of Redmond Stormwater Management Technical Notebook (SWMTN). See the attached Figure 1.1 – Vicinity Map for the specific location and Figure 1.3 – Drainage Basin, Sub-basins and site characteristics.

The project was also evaluated for Low Impact Development (LID), however based on the Geotechnical Engineering Report, infiltration through the existing soils was not considered feasible. Furthermore, due to the proposed development type and density a well as the surrounding developments, LID features such as dispersion, rain gardens, and retention of native growth area also not practical. In summary, the proposed LID feature is to use compost amended soils in the landscaping.

Stormwater runoff will be collected via catch basins and conveyed in a piped conveyance system to a stormwater combined detention and wetvault. The vault will discharge to the existing conveyance system along NE 47th Street where it ultimately enters the flow along West Lake Sammamish Parkway NE. The upstream offsite runoff will be collected via a combination ditch and interceptor drain which will flow into a conveyance system along the east part of this site. From there runoff will enter into the existing system within NE 47th Street. Runoff continues towards the City of Redmond Stormwater Regional Facility (354R) which ultimately flows into the Sammamish River a few miles downstream. See Section 4 for the downstream analysis details.

Figure 1.1
Vicinity Map



VICINITY MAP

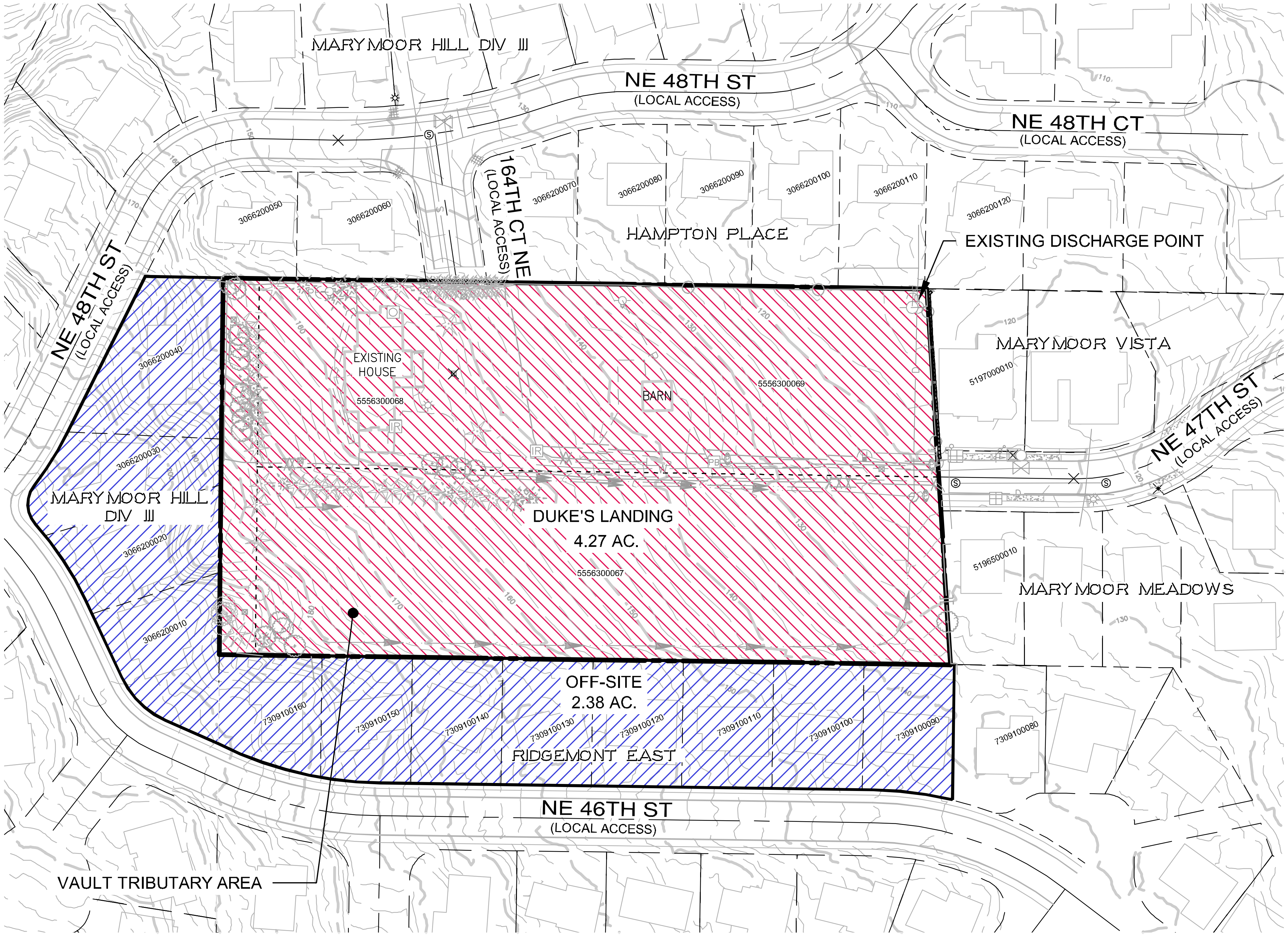
NTS

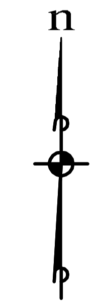
Figure 1.2
Existing Drainage Basin Map

ATTACHMENT 18

DUKE'S LANDING PRELIMINARY PLAT

CITY OF REDMOND, KING COUNTY WASHINGTON





SCALE: 1" = 100'

0 50 100

CONTOUR INTERVAL: 2'

LEGEND

D	EXISTING STORM DRAIN
	EXISTING TREE
	EXISTING EDGE OF PAVEMENT
100	EXISTING CONTOUR
	PROPERTY BOUNDARY
	EXISTING DITCH
	EXISTING DRAINAGE BASIN
	EXISTING BASIN
	OFF-SITE BASIN

DUKE'S LANDING, LLC

DUKE'S LANDING

PREDEVELOPED BASIN MAP

FIG. 1.2

DRAWING: BS-01

ESM CONSULTING ENGINEERS LLC

33400 8th Ave S, Suite 205
Federal Way, WA 98003

FEDERAL WAY (253) 838-6113
EVERETT (425) 297-9900

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JOB NO. 1787-001-013 | DATE: 2015-03-13
DRAWN: ER | SHEET 1 OF 2

File: \\esm8\engr\ESM-JOBS\1787\001\013\exhibits\BS-01.dwg
Plotted: 3/13/2015 3:03 PM Plotted By: Erin Rusted

Figure 1.3
Proposed Drainage Basin Map

DUKE'S LANDING PRELIMINARY PLAT

CITY OF REDMOND, KING COUNTY WASHINGTON

n

SCALE: 1" = 100'

0 50 100

CONTOUR INTERVAL: 2'

LEGEND

- PROPOSED 12"ø STORM DRAIN
- EXISTING STORM DRAIN
- EXISTING TREE
- EXISTING CONTOUR
- PROPOSED CONTOUR
- PROPOSED DRAINAGE BASIN
- TRACTS – (0.51 AC.)
- LOTS – (3.00 AC.)
- R/W – (0.76 AC.)
- OFF-SITE – (2.38 AC.)

DUKE'S LANDING, LLC

DUKE'S LANDING

FIG. 1.3 DRAINAGE BASIN, SUB-BASINS, AND SITE CHARACTERISTICS

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33400 8th Ave S, Suite 205
Federal Way, WA 98003

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EVERETT (425) 297-9900

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DATE: 2015-06-18
SHEET 2 OF 2

DRAWING: BS-02

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Figure 1.4
Soils Map

Soil Map—King County Area, Washington
(Duke's Landing)

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: King County Area, Washington
Survey Area Data: Version 10, 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: Aug 31, 2013—Oct 6, 2013

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

King County Area, Washington (WA633)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
AgC	Alderwood gravelly sandy loam, 8 to 15 percent slopes	6.4	100.0%
Totals for Area of Interest		**6.4**	**100.0%**

2. CONDITIONS AND REQUIREMENTS SUMMARY

The proposed project will address the minimum requirements #1 through #9 as documented below.

Minimum Requirement #1: Preparation of a Stormwater Site Plans
This report meets this minimum requirement.

Minimum Requirement #2: Construction Stormwater Pollution Prevention Plan (SWPPP)
The Construction Stormwater Pollution Prevention Plan (CSWPPP) report has been competed under separate cover.

Minimum Requirement #3: Source Control of Pollution
The Temporary Erosion and Sedimentation Control (TESC) Design will be shown on the final construction plans and additional information will be provided with the final Stormwater Site Plan.

The proposed project will include clearing and grading for the 18 lots, associated roadways, and vault area. The existing house, barn, associated driveways and accessory structures will be demolished. Erosion and sediment controls will be provided to prevent, to the maximum extent possible, the transport of sediment from the project site to downstream drainage facilities, water resources, and adjacent properties. The Temporary Erosion and Sedimentation Control (TESC) Plans will be shown on the final construction plans and additional information will be provided with the final Stormwater Site Plan.

Minimum Requirement #4: Preservation of Natural Drainage Systems and Outfalls
The City of Redmond informed ESM that the storm system within NE 48th Street is over capacity. Due to this, Duke's Landing storm water and its upstream offsite area will be routed to NE 47th Street, which has sufficient capacity for the project's discharge. The system within NE 48th Street and NE 47th Street combine within a 1/4 mile downstream and they are considered part of the same basin.

Minimum Requirement #5: On-Site Stormwater Management
On-Site stormwater management is described in Chapter 5.0.

Minimum Requirement #6: Runoff Treatment
Runoff treatment will be provided in a combined detention and wetvault located on site. For more information, see Chapter 5.0.

Minimum Requirement #7: Flow Control
Flow control will be provided in a proposed stormwater combined detention and wetvault located on site. For more information, see Chapter 5.0.

Minimum Requirement #8: Wetlands Protection
Wetlands will not be impacted by the proposed project improvements.

Minimum Requirement #9: Operation and Maintenance
The Operations and Maintenance Manual will be provided with the final Stormwater Site Plan.

3. EXISTING CONDITIONS SUMMARY

The existing site consists of two single-family dwellings with associated gravel driveways, along with a few small detached structures. All structures on site will be demolished. The existing site is relatively flat (mean slope of about 7%, less than 10% max slopes on site) and slopes down generally from the southwest corner of the property towards the northeast. The pervious portions of the parcels are generally lawn except the west edge of the site is lightly forested.

Approximately 2.38 acres of upstream area drains onto the site from the west (18 existing lots) and south (4 existing lots) edges of the project site. Using the City of Redmond zoning code of R-4, these lots were modeled as 80% of the maximum impervious area allowed by zoning (80% of 60% of the lot area).

TABLE 4.1 Pre-Developed Tributary Area

SUBBASIN	TOTAL AREA (Ac.)	TILL FOREST (Ac.)	TILL GRASS (Ac.)	IMPERVIOUS (AC.)
Duke’s Landing	4.27	4.27	0	0
Off-site	2.38	0	1.24	1.14
TOTAL	**6.65**	**4.27**	**1.24**	**1.14**

According to the Geotechnical Engineering Report dated December 8, 2014 by Terra Associates, the site is covered with native glacial deposits comprised predominantly of silty fine sand to fine sandy silt with varying amounts of gravel. A copy of the Geotechnical Engineering Report can be found in Appendix B.

There are no known historical drainage problems such as flooding, erosion, etc. There are also no known difficult site conditions, sensitive areas, critical areas, fuel tanks, or septic systems located on the property. The project site is not located in an aquifer recharge area, a Superfund area or a 100-year flood hazard zone, however the project is located in Wellhead Protection Zone 4.

4. OFF-SITE ANALYSIS REPORT

An offsite analysis for the property has been completed as part of the Preliminary Stormwater Site Plan for the project.

The following Level 1 downstream analysis reviews the four tasks (outlined in the 2005 Western Washington DOE Stormwater Design Manual). These tasks were completed in an effort to avoid any negative downstream impacts to the existing drainage system.

The four tasks outlined under this review are:

- Task 1 – Define and map the study area
- Task 2 – Review all available information on the study area
- Task 3 – Field inspect the study area
- Task 4 – Describe the drainage system, and its existing and predicted problems

Task 1 – Define and map the study area

The site is located in the Sammamish River Basin and found within the Sammamish River Sub-Basin boundary. The project site is not located in a landslide hazard area, flood plains, geologic sensitive area, critical drainage area, or erosion hazard area.

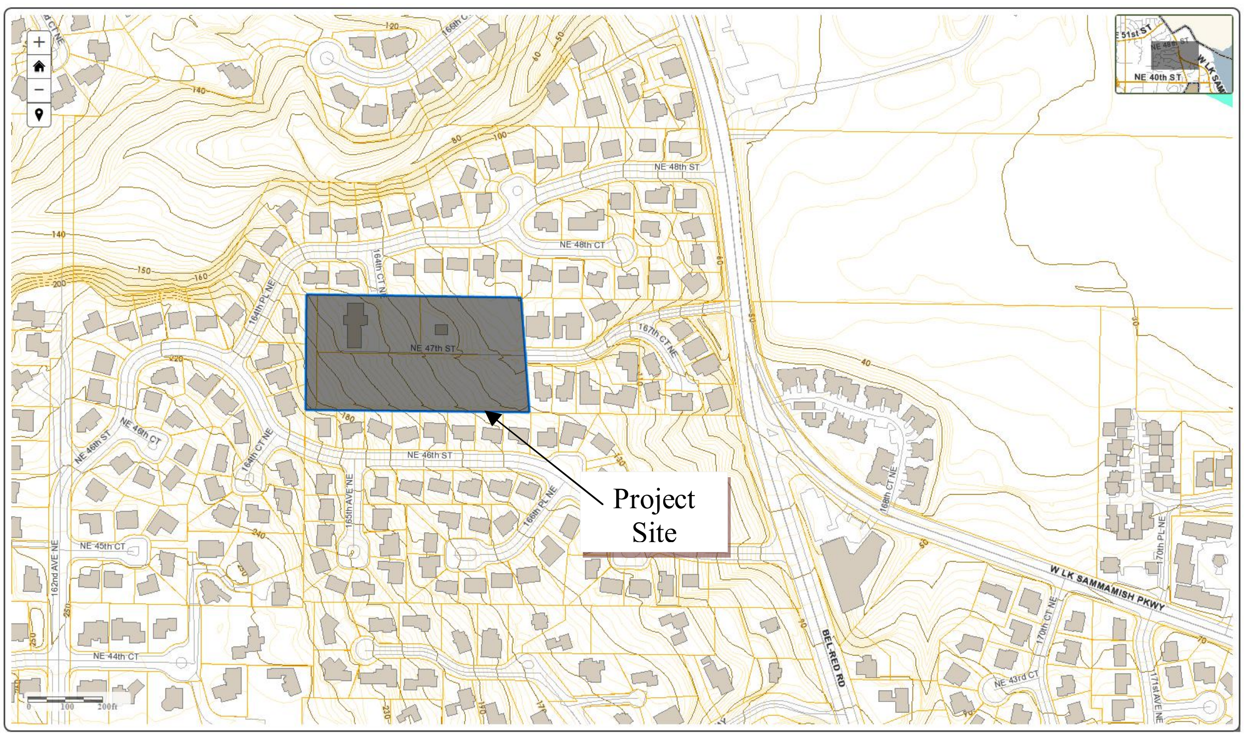


Figure 4.1 Offsite Analysis Overview

Task 2 – Review all available information on the study area

The following resources from the King County iMAP website were used in conjunction with the Level 1 analysis for the project site:

Adopted basin plans

- The site is located in the Sammamish River Basin and found within the Sammamish River Sub-Basin boundary.

Sensitive Areas Folio

- Wetlands – None mapped on the project site.
- Streams and 100-Year Floodplains – None mapped on the project site.
- Erosion Hazard Areas – None mapped on the project site.
- Seismic Hazard Areas – None mapped on the project site.
- Coal Mine Hazard Areas – None mapped.

For more information, see the attached maps following this section.

Drainage Complaints

- The drainage complaint list has been attached following this section. The drainage complaints have been obtained and none were applicable for the project site.

U. S. Department of Agriculture, King County Soils Survey

- The soils on the project site is Alderwood gravelly sandy loam, 8 to 15 percent slopes, with a Hydrologic Soil Group C. Furthermore, the Geotechnical Engineering Report by Terra Associates advises that the site is native glacial deposits comprised predominantly of silty fine sand to fine sandy silt with varying amounts of gravel.

Flow Control Facility

- Flow control device is required for proposed project and stormwater discharges shall match developed discharge durations to pre-developed durations for the range of pre-developed discharge rates from 50% of the 2-year peak flow up to the full 50-year peak flow. The pre-developed condition to be matched shall be a forested land cover.

Water Quality Facility

- The project site is shown in the Water Quality Treatment Area as Basic Water Quality.

Task 3 – Field Inspection

A site reconnaissance was completed by ESM Consulting Engineers on February 6, 2015, for the purpose of analyzing the proposed project site and its upstream and downstream corridors. The weather conditions was moderately raining, 55 degrees Fahrenheit and cloudy.

Upstream Analysis – The upstream off-site basin includes runoff from existing lots along west and south edge of the project site. The right-of-ways along the off-site lots have been excluded from the upstream off-site basin due to visible conveyance system along NE 46th Street from west to east.

Downstream Analysis – The existing stormwater runoff from the site gradually sheet flows from southwest to northeast through roughly mowed pasture at the boundary of the site. The runoff from the offsite are collected along the southern edges of the property and are collected by a existing ditch that flows from west to east towards the existing discharge point at the northeast corner of the site. From there runoff continues to flow through network of pipes along NE 48th Street and crosses the West Lake Sammamish Parkway NE to the City of Redmond Regional Stormwater Facility located northeast from Duke's Landing. Ultimately the flow from the site is conveyed into Sammamish River located directly east from project site, approximately quarter mile downstream. The conveyance systems along NE 47th Street have also been verified as part of natural discharge point.

ESM was informed by the City of Redmond that the storm drainage system along NE 48th Street was over capacity and experiences frequent overflows. Due to this, the project proposes to route the discharge from the proposed combined stormwater detention and wetvault to the existing system within NE 47th Street (shown in Figure 1.3). The system within NE 47th Street is routed to a downstream biofiltration swale and detention facility which discharges to the West Lake Sammamish Parkway NE. Runoff is conveyed north and combines with the stormwater from NE 48th Street and the downstream described above.

Figure 4.2 Downstream Analysis Map

Onsite Drainage Analysis

Photo 1 Current Site Condition
(Existing ditch, looking from the southeast corner of the site towards southwest corner)

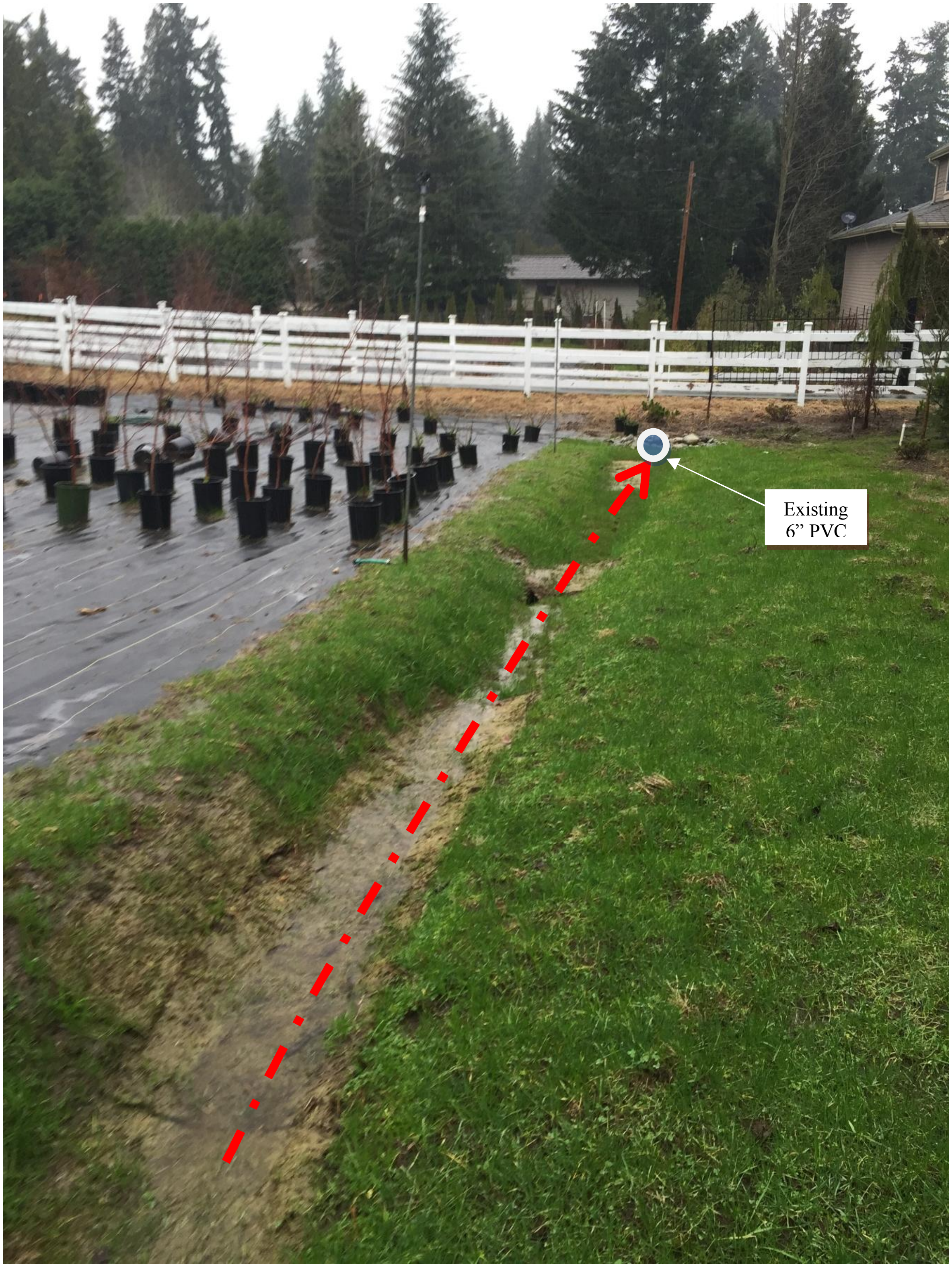


Photo 2 Current Site Condition
(Existing ditch enters the 6" pipe and continues flowing toward northwest corner of the site, looking from the southeast corner of the site towards northwest corner)

Natural Downstream Analysis (NE 48th Street)

Reach 1 (Natural Discharge location)

Runoff from the existing site leaves through an existing 6" pipe by catch basin at the northeast corner of the site. From there the runoff continues to flow north towards existing conveyance system along NE 48th Street. A small amount of flow was visible at the time of visit.

Photo 3 Current Site Condition
(looking from the northeast corner of the site towards north existing discharge point)

Reach 2 (0' to 170'+)

Runoff from the site currently is routed to this catch basin and continues east along NE 48th Street. Unable to verify pipe sizes as the catch basin lid was locked. From there the runoff continues to flow east in the existing conveyance system along NE 48th Street. A large amount of flow was visible at the time of visit.

Photo 4 Current Site Condition
(looking west from the intersection of the NE 48th St & NE 48th Ct.)

Reach 3 (170'+ to 230'+)
Combined runoff flows across the NE 48th Street and continue east along NE 48th Street. A large amount of flow was visible at the time of visit.

Photo 5 Current Site Condition
(looking south from the intersection of the NE 48th St & NE 48th Ct.)

Reach 4 (230'+ to 700'+)
Further east along NE 48th Street the road the runoff from the site is combined with runoff from lots along NE 48th Street and the surface flow from the roadway. A large amount of flow was visible at the time of visit.

Photo 6 Current Site Condition
(looking west from the approximately 500' from the intersection of the NE 48th St & NE 48th Ct.)

Reach 5 (700'+ to 850'+)

Further east along NE 48th Street the runoff from the site is combined with runoff from lots along NE 48th Street and the surface flow from the roadway. A large amount of flow was visible at the time of visit.

Photo 7 Current Site Condition
(looking north from the sidewalk front of 16658 NE 48th St.)

Reach 6 (850' to 1,000'+)
NE 48th Street system connects into West Lake Sammamish Parkway NE system which flows south to north where it is across the parkway.

Photo 8 Current Site Condition
(looking west from the intersection of the NE 48th St & West Lake Sammamish Parkway NE)

Reach 7 (1,000'+ to Regional Stormwater Facility)
Combined runoff flows east within existing conveyance system towards City of Redmond Regional Stormwater Facility. Runoff ultimately flows to Sammamish River.

Photo 9 Current Site Condition
(looking east from the intersection of the NE 48th St & West Lake Sammamish Parkway NE)

<u>Proposed Discharge Downstream (NE 47th Street)</u>

Reach 1 (at Duke's Landing)

The runoff at the east portion of the site sheet flows into the existing catch basin along NE 47th Street and continues east.

Photo 10 Duke's Landing Proposed Downstream
(looking west from existing end of NE 47th Street)

Reach 2 (0' to 200'+)
Runoff continue to flow east along NE 47th Street via tight line system and along the curb and gutter

Photo 11 Duke's Landing Proposed Downstream
(looking east along the NE 47th Street)

Reach 3 (200' to 500'+)
Existing runoff continues to flow east along NE 47th Street toward the intersection of NE 47th Street & West Lake Sammamish Parkway NE. The flow along roadway is then routed to an existing diversion manhole then directed towards the existing biofiltration swale and detention pond located at the intersection. According to City of Redmond GIS the pond discharges along West Lake Sammamish Parkway NE.

The project proposes to install a pipe in the existing diversion manhole that will route flows downstream to two new Type 2 Catch Basins installed on the existing storm water pipe in West Lake Sammamish Parkway. A portion of flows will be diverted by the existing diversion manhle to the existing biofiltration swale and detention pond located near the intersection, the remainder will be routed to a new catch basin located in West Lake Sammamish Parkway with the new pipe. The existing diversion manhole will remain unchanged.

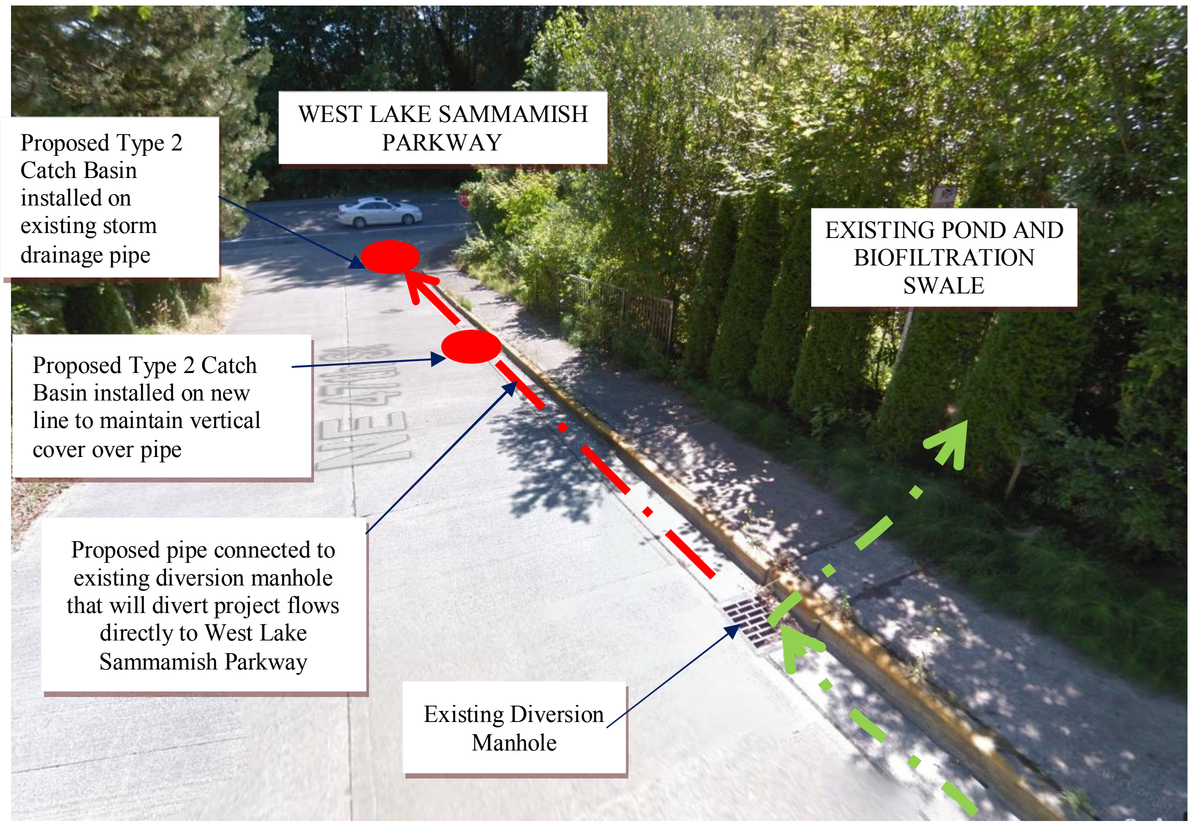


Photo 12 Duke's Landing Proposed Downstream
(looking east along the NE 47th Street)

Reach 4 (500' to 600'+)
The flow from the existing pond flows into the existing conveyance system along West Lake Sammamish Parkway NE and continues flowing north.

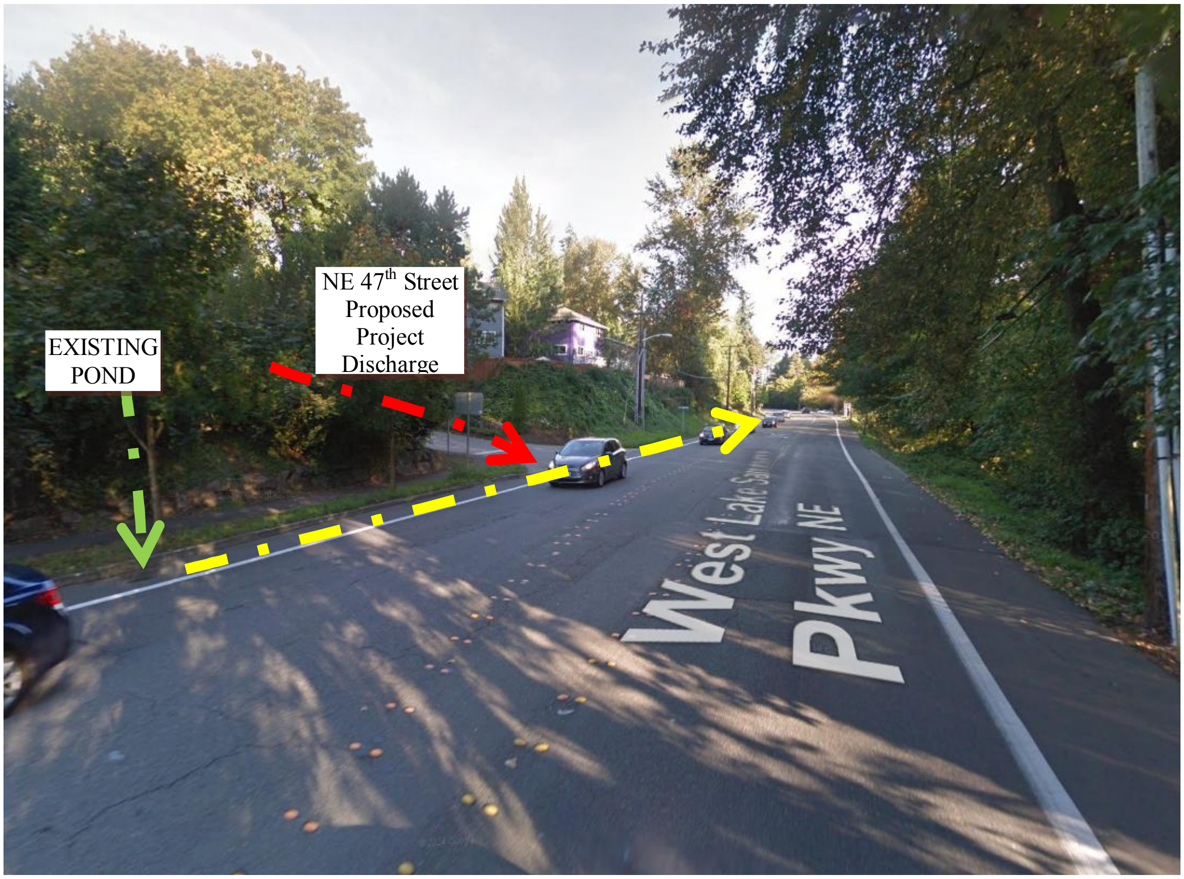


Photo 13 Duke's Landing Proposed Downstream
(looking north along the West Lake Sammamish Parkway NE)

Reach 5 (600'+ to Regional Stormwater Facility)
The remaining runoff along NE 47th Street will flow east to the intersection of NE 47th Street & West Lake Sammamish Parkway NE. Then it will flow north where it connects with the NE 48th Street flows and continues towards City of Redmond Regional Detention facility.

Photo 14 Duke's Landing Proposed Downstream
(looking west at the intersection of NE 47th Street and West Lake Sammamish Parkway NE)

Task 4 – Describe the drainage system, and its existing and predicted problems

According to the City of Redmond the existing conveyance system along NE 48th Street to regional detention facility is over capacity. Therefore, the Duke's Landing storm water and its upstream offsite area will be directed to the storm system within NE 47th Street to convey its flows to the downstream corridor.

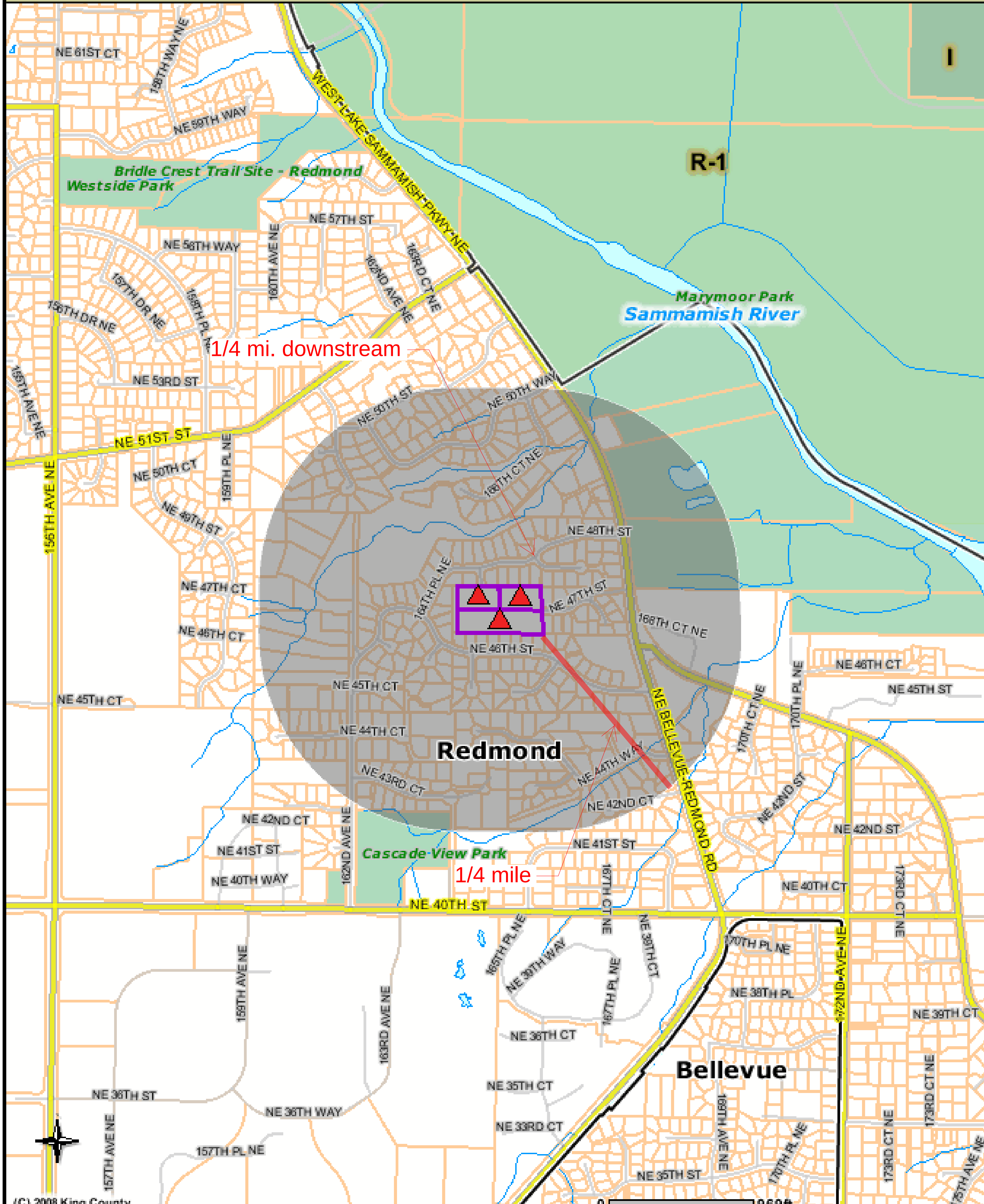
During the site visit, there was no sign of stormwater disturbances of the offsite drainage system or any backwater.

The drainage complaint list has been attached following this section. The drainage complaints have been obtained and none were applicable for the project site.

Figure 4.2
KCGIS Parcel Report/Environmental Hazards

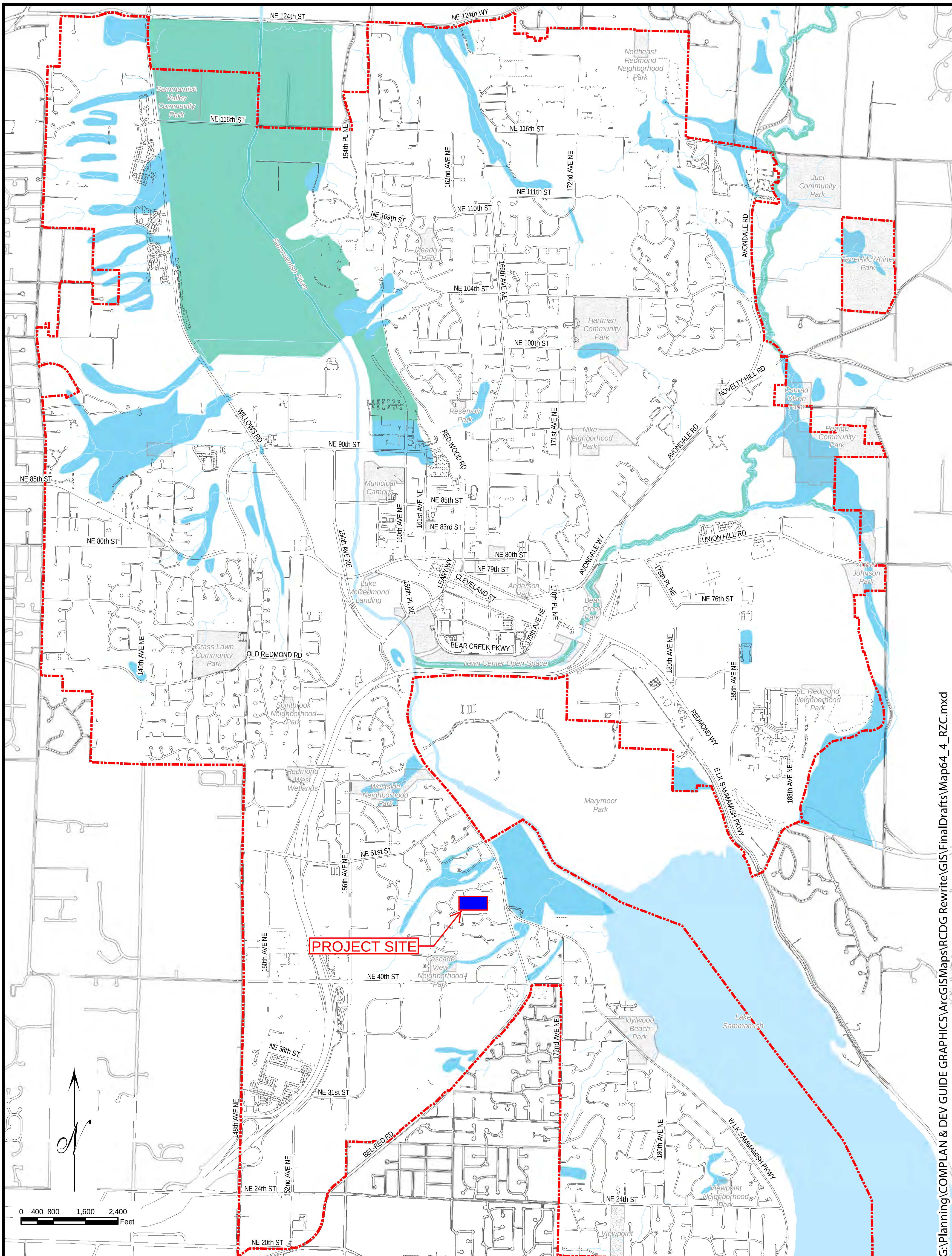
Duke's Landing

ATTACHMENT 18



Date: 3/16/2015 Source: King County iMAP - Property Information (http://www.metrokc.gov/GIS/iMAP)

King County



City of Redmond

Critical Areas Map

Effective: April 16, 2011

Map 64.4 Wetlands

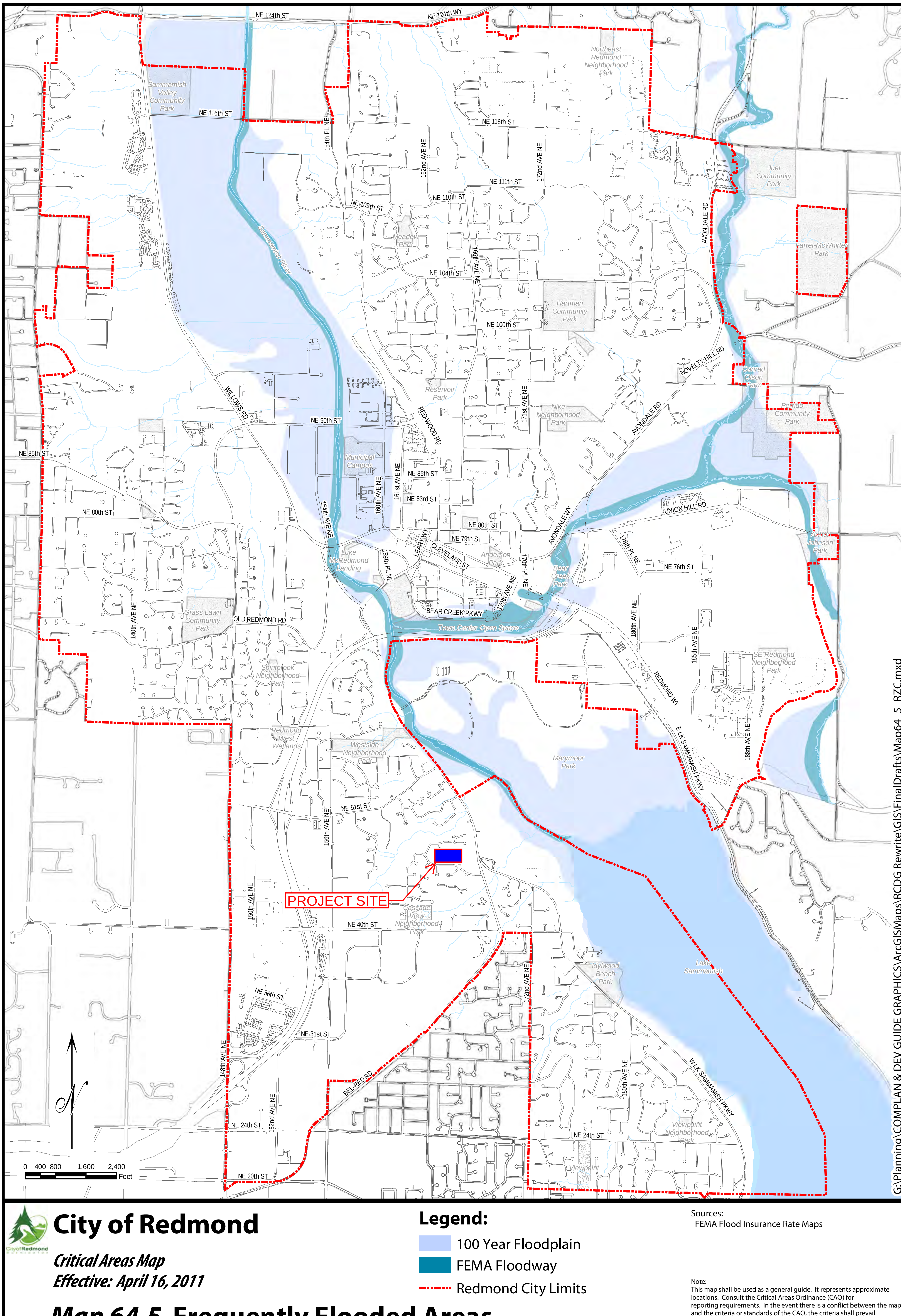
Legend:

- Mixed Wetland/Upland
- Wetland
- Redmond City Limits

Sources:
- USGS National Wetland Inventory
- Aerial Photo Interpretation
- SCS Soil Survey
- City of Redmond

Note:
This map shall be used as a general guide. It represents approximate locations. Consult the Critical Areas Ordinance (CAO) for reporting requirements. In the event there is a conflict between the map and the criteria or standards of the CAO, the criteria shall prevail.

ATTACHMENT 18



City of Redmond

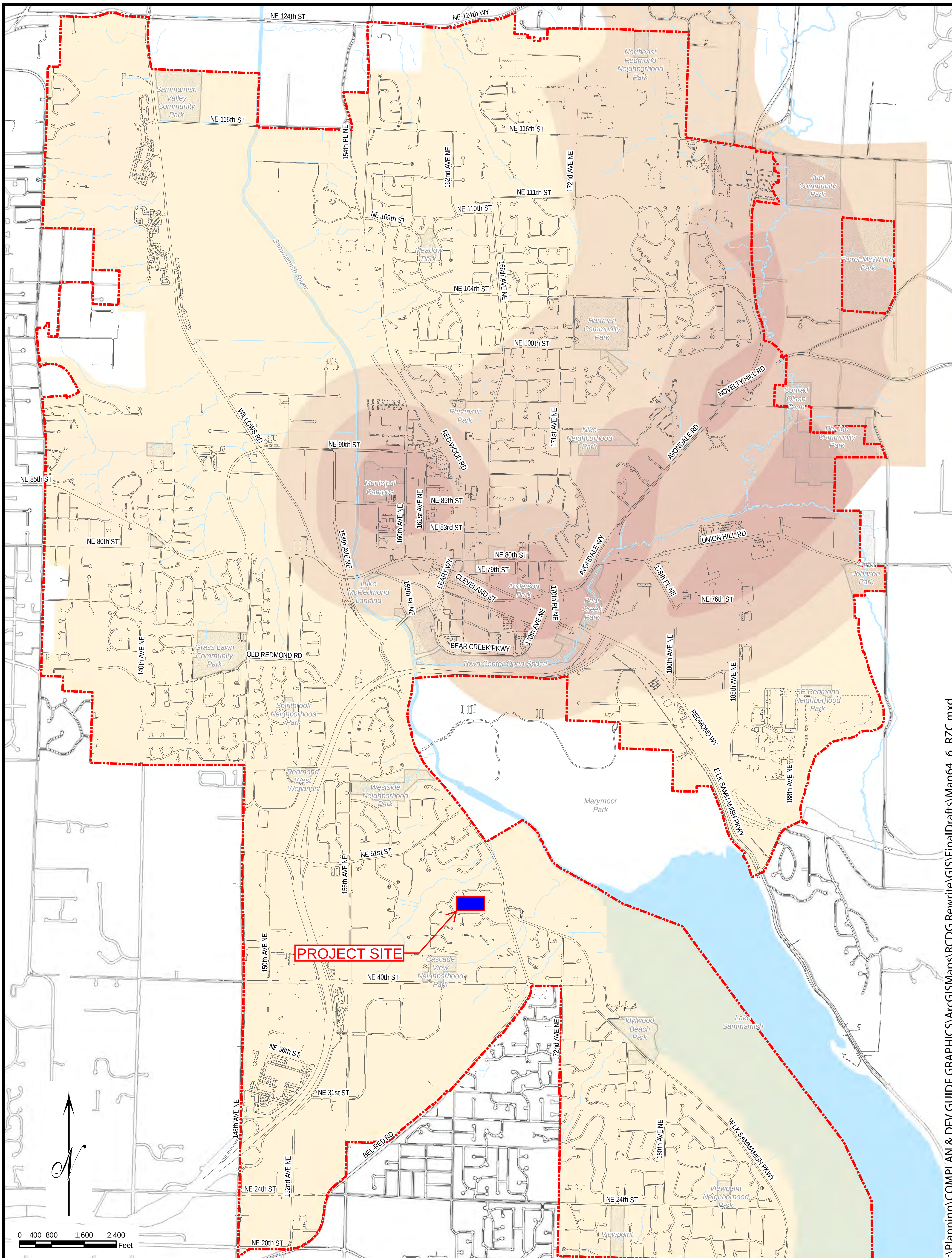
Critical Areas Map
Effective: April 16, 2011

Map 64.5 Frequently Flooded Areas

Legend:
- 100 Year Floodplain
- FEMA Floodway
- Redmond City Limits

Sources:
FEMA Flood Insurance Rate Maps

Note:
This map shall be used as a general guide. It represents approximate locations. Consult the Critical Areas Ordinance (CAO) for reporting requirements. In the event there is a conflict between the map and the criteria or standards of the CAO, the criteria shall prevail.



City of Redmond

Critical Areas Map

Effective: April 16, 2011

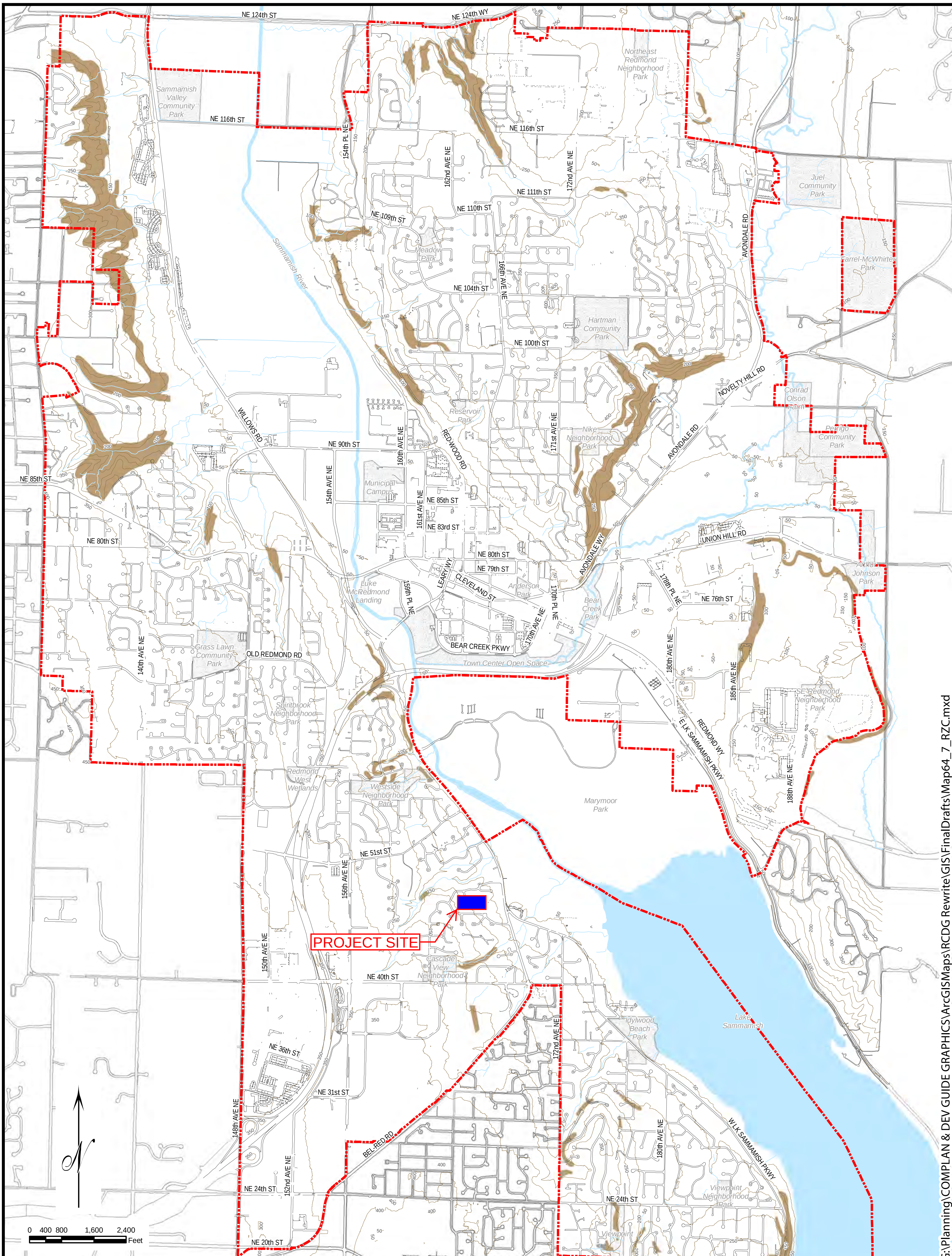
Map 64.6 Wellhead Protection Zones

Legend:

- Wellhead Protection Zone 1
- Wellhead Protection Zone 2
- Wellhead Protection Zone 3
- Wellhead Protection Zone 4
- Redmond City Limits

Sources:
City of Redmond Public Works Department

Note:
This map shall be used as a general guide. It represents approximate locations. Consult the Critical Areas Ordinance (CAO) for reporting requirements. In the event there is a conflict between the map and the criteria or standards of the CAO, the criteria shall prevail.



City of Redmond

Critical Areas Map

Effective: April 16, 2011

Map 64.7 Landslide Hazard Areas

Legend:

- Landslide Hazard Areas
- Contours
- Redmond City Limits

Sources:
USGS Topographic Maps
USGS Geologic Maps

Note:
This map shall be used as a general guide. It represents approximate locations. Consult the Critical Areas Ordinance (CAO) for reporting requirements. In the event there is a conflict between the map and the criterial or standards of the CAO, the criteria shall prevail.

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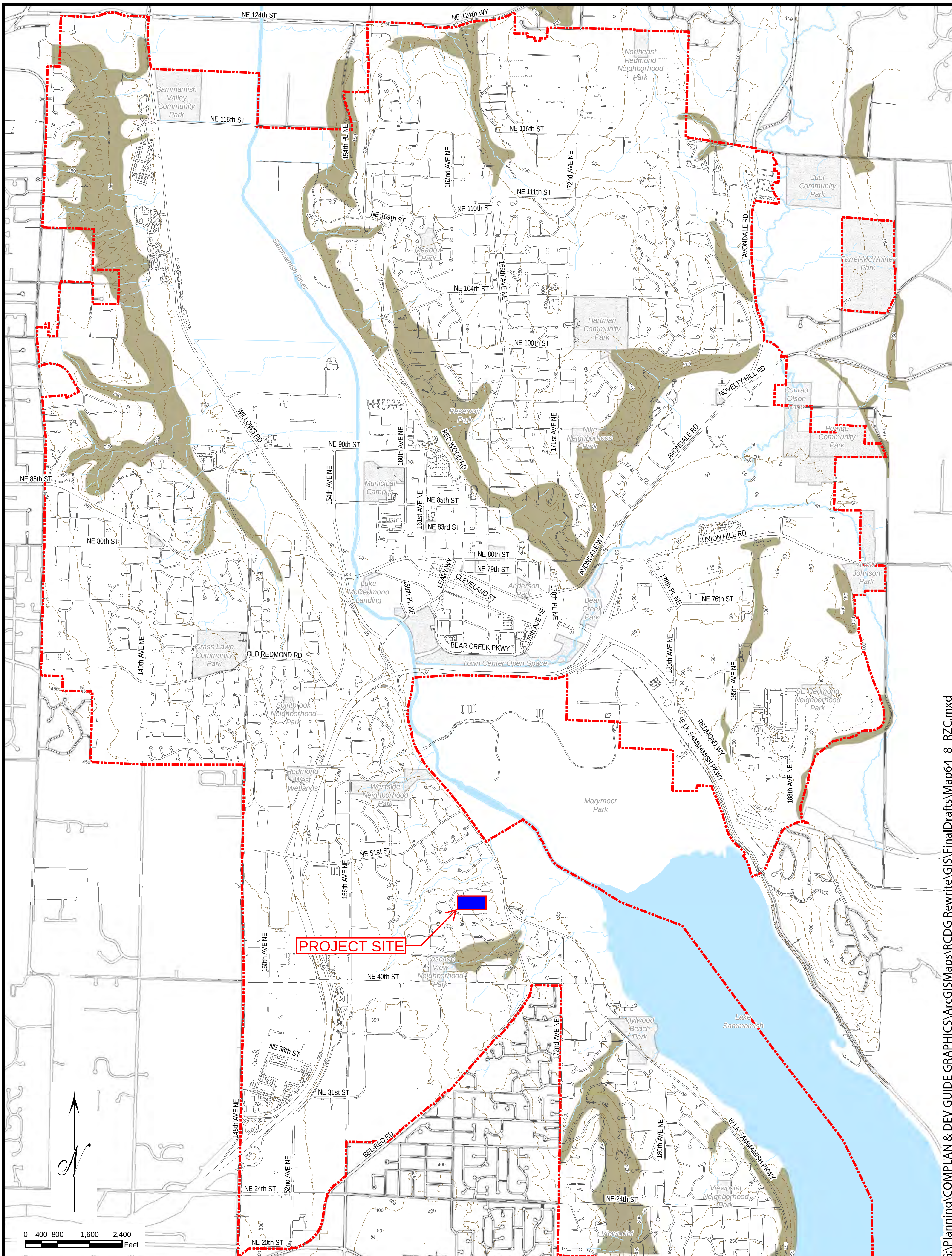


City of Redmond

Critical Areas Map

Effective: April 16, 2011

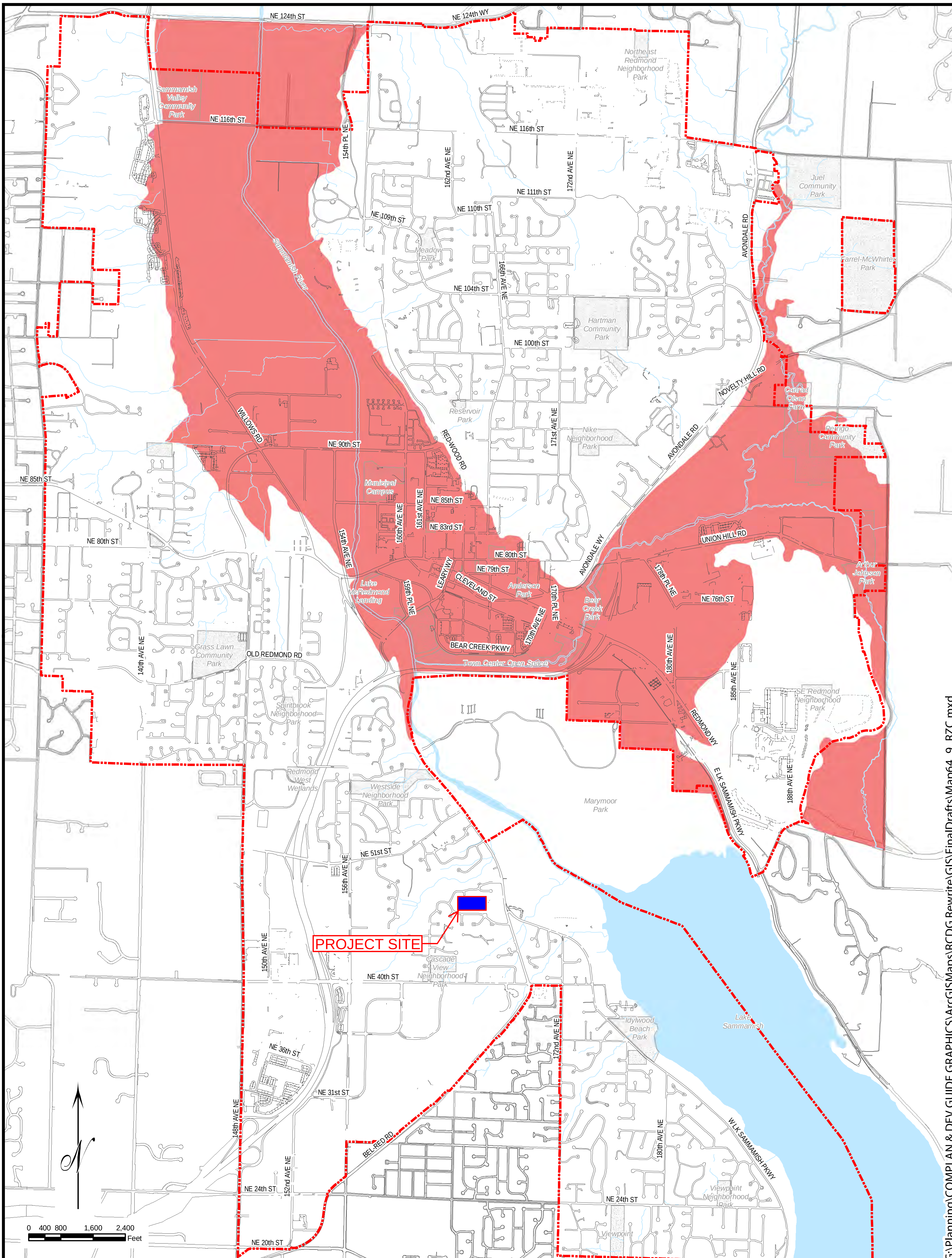
Map 64.8 Erosion Hazard Areas

Legend:

- Erosion Hazard Areas
- Contours
- Redmond City Limits

Sources:
SCS Soil Survey

Note:
This map shall be used as a general guide. It represents approximate locations. Consult the Critical Areas Ordinance (CAO) for reporting requirements. In the event there is a conflict between the map and the criteria or standards of the CAO, the criteria shall prevail.



City of Redmond

Critical Areas Map
Effective: April 16, 2011

Map 64.9 Seismic Hazard Areas

Legend:

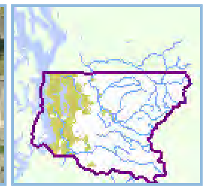
Seismic Hazard Areas
Redmond City Limits

Sources:
USGS Geologic Maps

Note:
This map shall be used as a general guide. It represents approximate locations. Consult the Critical Areas Ordinance (CAO) for reporting requirements. In the event there is a conflict between the map and the criteria or standards of the CAO, the criteria shall prevail.

King County Districts and Development Conditions for parcel 5556300069

Parcel number	**5556300069**	Drainage Basin	**Sammamish River**
Address	**Not Available**	Watershed	**Sammamish River**
Jurisdiction	**Redmond**	WRIA	**Cedar-Sammamish (8)**
Zipcode	**98052**	PLSS	**SW - 13 - 25 - 5**
Kroll Map page	**529**	Latitude	**47.65199**
Thomas Guide page	**537**	Longitude	**-122.1202**



Electoral Districts

Voting district	**RED 48-2636**	Fire district	**does not apply**
King County Council district	**District 6, Jane Hague (206) 477-1006**	Water district	**does not apply**
		Sewer district	**does not apply**
Congressional district	**1**	Water & Sewer district	**does not apply**
Legislative district	**48**	Parks & Recreation district	**does not apply**
School district	**Lake Washington #414**	Hospital district	**Public Hospital District No. 2**
Seattle school board district	**does not apply (not in Seattle)**	Rural library district	**Rural King County Library System**
District Court electoral district	**Northeast**	Tribal Lands?	**No**

King County planning and critical areas designations

King County zoning	**NA, check with jurisdiction**	Potential annexation area	**does not apply**
Development conditions	**None**	Rural town?	**No**
Comprehensive Plan	**does not apply**	Water service planning area	**does not apply**
Urban Growth Area	**Urban**	Roads MPS zone	**98**
Community Service Area	**does not apply**	Transportation Concurrency Management	**does not apply**
Community Planning Area	**Eastside**	Forest Production district?	**No**
Coal mine hazards?	**None mapped**	Agricultural Production district?	**No**
Erosion hazards?	**None mapped**	Critical aquifer recharge area?	**None mapped**
Landslide hazards?	**None mapped**	100-year flood plain?	**None mapped**
Seismic hazards?	**None mapped**	Wetlands at this parcel?	**None mapped**
		Within the Tacoma Smelter Plume?	**Non-Detect to 20.0 ppm** Estimated Arsenic Concentration in Soil

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King County Districts and Development Conditions for parcel 5556300068

Parcel number	**5556300068**	Drainage Basin	**Sammamish River**
Address	**16410 NE 47TH ST 98052**	Watershed	**Sammamish River**
Jurisdiction	**Redmond**	WRIA	**Cedar-Sammamish (8)**
Zipcode	**98052**	PLSS	**SW - 13 - 25 - 5**
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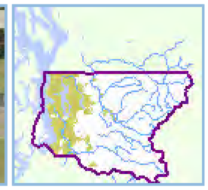
Thomas Guide page	**537**	Longitude	**-122.12144**



Electoral Districts

Voting district	**RED 48-2636**	Fire district	**does not apply**
King County Council district	**District 6, Jane Hague (206) 477-1006**	Water district	**does not apply**
Congressional district	**1**	Sewer district	**does not apply**
Legislative district	**48**	Water & Sewer district	**does not apply**
School district	**Lake Washington #414**	Parks & Recreation district	**does not apply**
Seattle school board district	**does not apply (not in Seattle)**	Hospital district	**Public Hospital District No. 2**
District Court electoral district	**Northeast**	Rural library district	**Rural King County Library System**
		Tribal Lands?	**No**

King County planning and critical areas designations

King County zoning	**NA, check with jurisdiction**	Potential annexation area	**does not apply**
Development conditions	**None**	Rural town?	**No**
Comprehensive Plan	**does not apply**	Water service planning area	**does not apply**
Urban Growth Area	**Urban**	Roads MPS zone	**98**
Community Service Area	**does not apply**	Transportation Concurrency Management	**does not apply**
Community Planning Area	**Eastside**	Forest Production district?	**No**
Coal mine hazards?	**None mapped**	Agricultural Production district?	**No**
Erosion hazards?	**None mapped**	Critical aquifer recharge area?	**None mapped**
Landslide hazards?	**None mapped**	100-year flood plain?	**None mapped**
Seismic hazards?	**None mapped**	Wetlands at this parcel?	**None mapped**
		Within the Tacoma Smelter Plume?	**Non-Detect to 20.0 ppm** Estimated Arsenic Concentration in Soil

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King County Districts and Development Conditions for parcel 5556300067

Parcel number	**5556300067**	Drainage Basin	**Sammamish River**
Address	**Not Available**	Watershed	**Sammamish River**
Jurisdiction	**Redmond**	WRIA	**Cedar-Sammamish (8)**
Zipcode	**98052**	PLSS	**SW - 13 - 25 - 5**
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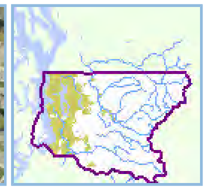

Electoral Districts

Voting district	**RED 48-2636**	Fire district	**does not apply**
King County Council district	**District 6, Jane Hague (206) 477-1006**	Water district	**does not apply**
Congressional district	**1**	Sewer district	**does not apply**
Legislative district	**48**	Water & Sewer district	**does not apply**
School district	**Lake Washington #414**	Parks & Recreation district	**does not apply**
Seattle school board district	**does not apply (not in Seattle)**	Hospital district	**Public Hospital District No. 2**
District Court electoral district	**Northeast**	Rural library district	**Rural King County Library System**
		Tribal Lands?	**No**

King County planning and critical areas designations

King County zoning	**NA, check with jurisdiction**	Potential annexation area	**does not apply**
Development conditions	**None**	Rural town?	**No**
Comprehensive Plan	**does not apply**	Water service planning area	**does not apply**
Urban Growth Area	**Urban**	Roads MPS zone	**98**
Community Service Area	**does not apply**	Transportation Concurrency Management	**does not apply**
Community Planning Area	**Eastside**	Forest Production district?	**No**
Coal mine hazards?	**None mapped**	Agricultural Production district?	**No**
Erosion hazards?	**None mapped**	Critical aquifer recharge area?	**None mapped**
Landslide hazards?	**None mapped**	100-year flood plain?	**None mapped**
Seismic hazards?	**None mapped**	Wetlands at this parcel?	**None mapped**
		Within the Tacoma Smelter Plume?	**Non-Detect to 20.0 ppm** Estimated Arsenic Concentration in Soil

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5. PERMANENT STORMWATER CONTROL PLAN

EXISTING SITE HYDROLOGY

The following are the assumptions and site parameters for the pre-developed conditions:

The site is currently developed with single resident with a barn and surrounding covered in native trees with paved driveways accessing off NE 47th Street. The overall existing drainage basin is 4.27 acres from the site and an additional 2.38 acres off-site upstream with natural drainage discharge point located northeast corner of the site. The overall basin was modeled as hydrologic group C, moderate forested condition in WWHM2012, matching the original condition of the overall site. From the existing discharge point the flows will flow north then east, towards City of Redmond regional stormwater facility and ultimately drains to the Sammamish River. See Table 3.1 Existing Land Use in Section 3 of this report for area breakdown.

The associated stormwater existing land use condition and flows are shown in Tables 5.1 and 5.2 below.

Table 5.1 Existing Land Use Table

SUBBASIN	TOTAL AREA (Ac.)	TILL FOREST (Ac.)	TILL GRASS (Ac.)	IMPERVIOUS (AC.)
Duke's Landing	4.27	4.27	0	0
Off-site	2.38	0	0.48	1.90
TOTAL	**6.65**	**4.27**	**0.48**	**1.90**

Table 5.2 – Existing Conditions WWHM Flows	**2-year 24-hour** (cfs)	**5-year 24-hour** (cfs)	**10-year 24-hour** (cfs)	**25-year 24-hour** (cfs)	**50-year 24-hour** (cfs)	**100-year 24-hour** (cfs)
Predeveloped Basin	0.1271	0.2083	0.2605	0.3226	0.3656	0.4058
Offsite Basin	0.5181	0.6928	0.8168	0.9834	1.1148	1.2526
Overall Basin (cfs)	0.6452	0.9011	1.0773	1.306	1.4804	1.6584

DEVELOPED SITE HYDROLOGY

The project will create 18 residential lots with associated roadway, sidewalk, driveways, roof areas, landscaped yards, and a combined detention and wetvault. There will be one drainage area within the project.

Building rooftops and impervious areas (driveway, porch) were estimated at 80% of the maximum impervious area allowed by the City of Redmond Zoning Code for R-4 zoned lots, which is 60%.

The combined detention and wetvault is located in the northeast corner of the site. The detained the runoff then discharges to the proposed roadway and existing system within NE 47th Street. A pipe will be added to the existing diversion manhole located prior to the downstream detention pond and biofiltration swale. The pipe will direct Duke's Landing flows directly into the West Lake Sammamish Parkway NE storm drainage system.

TABLE 5.3
Developed Pond Detained Area

SUBBASIN	TOTAL AREA (Ac)	IMPERV. AREA (Ac)	TILL GRASS (Ac)
Duke's Landing	4.27	2.35	1.92
Offsite Area	2.38	1.14	1.24
TOTAL	**6.65**	**3.49**	**3.16**

The proposed stormwater drainage basins were defined based on the existing topography of the site, the proposed site grading, and the proposed drainage system. Figure 1.3 – Drainage Basin, Sub-basins and site characteristics shows the overall drainage basin and the sub basins.

The impervious areas in the right-of-way consist of roadway and sidewalk. The impervious areas on the lots consist of building roof, driveway, walkway, and deck areas, estimated at the 80% of the maximum impervious area per lot. Tract A is estimated as 100 percent pervious, Tract B is estimated as 50 percent pervious, and the lots are estimated as 52 percent per lot (80% of 60% of the lot area).

Table 5.4 below summarizes the proposed basin areas.

Table 5.4 – Basin Area	Pervious, C (acres)	Impervious (acres)	Total (acres)
Lots	1.57	1.44	3.01
Right-of-ways	0	0.76	0.76
Tract A	0.19	0	0.19
Tract B	0.16	0.15	0.31
Total Vault	**0.95**	**3.32**	**4.27**

The associated overall basin stormwater flows are shown in Table 5.5 below.

Table 5.5 – Proposed Conditions WWHM Flows (cfs)	2-year 24-hour (cfs)	5-year 24-hour (cfs)	10-year 24-hour (cfs)	25-year 24-hour (cfs)	50-year 24-hour (cfs)	100-year 24-hour (cfs)
Duke's Landing	0.0776	0.1246	0.1646	0.2269	0.2831	0.3487
Off-site Upstream	0.5181	0.6928	0.8168	0.9834	1.1148	1.2526
Overall Basin	0.5957	0.8174	0.9814	1.2103	1.3979	1.6013

Due to the natural topography of the site off-site upstream basin will routed directly into NE 47th Street storm drainage system. The off-site upstream basin is modeled as 48% impervious area and 52% as grassy landscape for individual homes based on City of Redmond R-4 zoning code.

The total stormwater runoff from the Duke's Landing is proposed to flow along NE 47th Street storm drainage system along with the off-site upstream basin. The existing conveyance system has been verified for storm pipe capacity of 50 year storm using Rational Method with StormShed3G. A copy of the result can be found in Appendix C of this report.

The downstream storm water system connects into the Marymoor Short Plat storm drainage system. Prior to the existing facility the stormwater is diverted to either an existing biofiltration facility or an existing storm water detention pond. In order to ensure that both of these facilities continue to perform as they current do, the Duke's Landing project proposes to add an additional pipe outlet to the existing diversion manhole that will divert the Duke's Landing and its upstream offsite flows directly to the West Lake Sammamish Parkway.

PERFORMANCE GOALS AND STANDARDS

The stormwater design standards for the proposed Duke's Landing project are based on the SWMTN. The stormwater combined detention and wetvault is designed to meet the SWMTN.

FLOW CONTROL SYSTEM

A flow control facility is required for this project. The detained discharges duration shall match 50% of the 2-year pre-developed peak flow up to the full 50-year pre-developed peak flow. The pre-developed condition was modeled as forested land cover.

The detention portion of the facility requires a minimum volume of 53,970 cubic feet; a 57,057 cubic feet is provided. The detention portion of the vault is 91 feet in length, 66 feet in width and 9.5 feet in depth.

WATER QUALITY SYSTEM

A water quality facility meeting basic water quality as described in the SWMTN is required for this project. The SWMTN requires that all water quality treatment facilities exceed the minimum volume runoff predicted for a 24-hour, 6-month storm return frequency or 91 percent of the runoff volume estimated by an approved continuous runoff model.

The water quality portion from the Duke's Landing will be combined with the onsite storm water detention vault. The required minimum water quality volume within the vault is 15,020 cubic feet. A volume of 24,024 cubic feet is provided. The water quality portion of the vault size is 91 feet in length, 66 feet in width and 4 feet in depth.

CONVEYANCE SYSTEM ANALYSIS AND DESIGN

The proposed stormwater conveyance system will consist of curb/gutter, catch basins, and underground pipes that convey stormwater to the combined stormwater detention and wetvault. The stormwater drainage conveyance system will be sized to convey the 10 year design storm event and to contain the 50 year design storm event. A detailed Conveyance System Analysis and Design will be provided with the final Stormwater Site Plan.

TEMPORARY EROSION AND SEDIMENT CONTROL (TESC) DESIGN

The Temporary Erosion and Sedimentation Control (TESC) Design will be shown on the final construction plans and additional information will be provided with the final Stormwater Site Plan.

6. CONSTRUCTION STORMWATER POLLUTION PREVENTION PLAN

The CSWPPP Report has been completed and is included as Appendix D.

7. SPECIAL REPORTS AND STUDIES

- Geotechnical Report, by Terra Associated, Inc dated December 8, 2014 (see Appendix B)

8. OTHER PERMITS

The National Pollutant Discharge Elimination System (NPDES) permit will be prepared with the final construction plans.

This project also requires the following permits:

Building Permits
Clearing & Grading Permits

9. OPERATION AND MAINTENANCE MANUAL

The Operation and Maintenance Manual will be provided with the final Stormwater Site Plan.

10. BOND QUANTITIES WORKSHEET

The Bond Quantities Worksheet will be provided with the final Stormwater Site Plan.

APPENDIX A

WWHM2012 Vault Sizing Output

WWHM2012

PROJECT REPORT

General Model Information

Project Name:	DukesLanding2
Site Name:	
Site Address:	
City:	
Report Date:	6/18/2015
Gage:	Seatac
Data Start:	1948/10/01
Data End:	2009/09/30
Timestep:	15 Minute
Precip Scale:	1.00
Version:	2015/06/05

POC Thresholds

Low Flow Threshold for POC1:	50 Percent of the 2 Year
High Flow Threshold for POC1:	50 Year
Low Flow Threshold for POC2:	50 Percent of the 2 Year
High Flow Threshold for POC2:	50 Year

Landuse Basin Data
Predeveloped Land Use

Predev-Site

Bypass:	No
GroundWater:	No
Pervious Land Use	Acres
C, Forest, Mod	4.27
Pervious Total	4.27
Impervious Land Use	Acres
Impervious Total	0
Basin Total	4.27

Element Flows To:

Surface	Interflow	Groundwater

Predev-Offsite

Bypass:	No
GroundWater:	No
Pervious Land Use	Acres
C, Lawn, Flat	1.24
Pervious Total	1.24
Impervious Land Use	Acres
ROOF TOPS FLAT	1.14
Impervious Total	1.14
Basin Total	2.38

Element Flows To:

Surface	Interflow	Groundwater

Mitigated Land Use

Dev-Site

Bypass:	No
GroundWater:	No
Pervious Land Use	Acres
C, Lawn, Flat	1.92
Pervious Total	1.92
Impervious Land Use	Acres
ROADS MOD	0.91
ROOF TOPS FLAT	1.44
Impervious Total	2.35
Basin Total	4.27

Element Flows To:

Surface	Interflow	Groundwater
Vault 1	Vault 1	

Dev-Offsite

Bypass:	No
GroundWater:	No
Pervious Land Use	Acres
C, Lawn, Flat	1.24
Pervious Total	1.24
Impervious Land Use	Acres
ROOF TOPS FLAT	1.14
Impervious Total	1.14
Basin Total	2.38

Element Flows To:

Surface	Interflow	Groundwater

Routing Elements

Predeveloped Routing

Mitigated Routing

Vault 1

Width:	62 ft.	
Length:	91 ft.	
Depth:	10.5 ft.	
Discharge Structure		
Riser Height:	9.5 ft.	
Riser Diameter:	18 in.	
Orifice 1 Diameter:	1.01 in.	Elevation:0 ft.
Orifice 2 Diameter:	1.625 in.	Elevation:6.1 ft.
Orifice 3 Diameter:	1.375 in.	Elevation:8.1 ft.
Element Flows To:		

Control Structure to be placed in CB#18 shown on the southeast side of combined detention and wetvault.

Outlet 1 Outlet 2

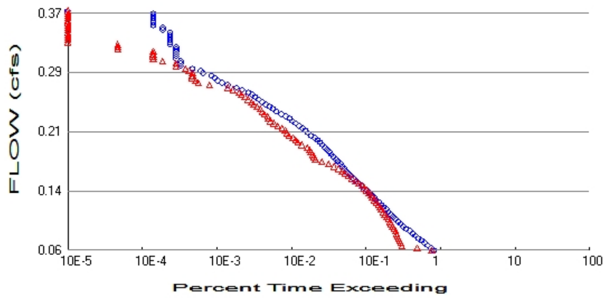
Vault Hydraulic Table

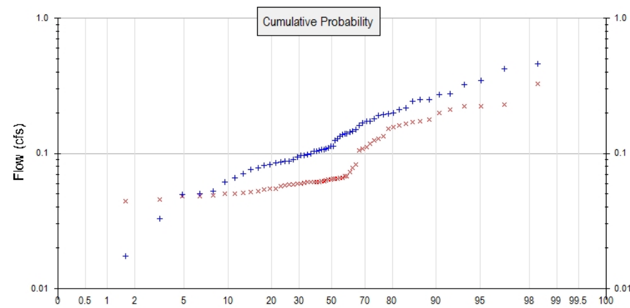
Stage(ft)	**Area(ac)**	**Volume(ac-ft)**	**Discharge(cfs)**	**Infilt(cfs)**
0.0000	0.129	0.000	0.000	0.000
0.1167	0.129	0.015	0.009	0.000
0.2333	0.129	0.030	0.013	0.000
0.3500	0.129	0.045	0.016	0.000
0.4667	0.129	0.060	0.018	0.000
0.5833	0.129	0.075	0.021	0.000
0.7000	0.129	0.090	0.023	0.000
0.8167	0.129	0.105	0.025	0.000
0.9333	0.129	0.120	0.026	0.000
1.0500	0.129	0.136	0.028	0.000
1.1667	0.129	0.151	0.029	0.000
1.2833	0.129	0.166	0.031	0.000
1.4000	0.129	0.181	0.032	0.000
1.5167	0.129	0.196	0.034	0.000
1.6333	0.129	0.211	0.035	0.000
1.7500	0.129	0.226	0.036	0.000
1.8667	0.129	0.241	0.037	0.000
1.9833	0.129	0.256	0.039	0.000
2.1000	0.129	0.272	0.040	0.000
2.2167	0.129	0.287	0.041	0.000
2.3333	0.129	0.302	0.042	0.000
2.4500	0.129	0.317	0.043	0.000
2.5667	0.129	0.332	0.044	0.000
2.6833	0.129	0.347	0.045	0.000
2.8000	0.129	0.362	0.046	0.000
2.9167	0.129	0.377	0.047	0.000
3.0333	0.129	0.392	0.048	0.000
3.1500	0.129	0.408	0.049	0.000
3.2667	0.129	0.423	0.050	0.000
3.3833	0.129	0.438	0.050	0.000
3.5000	0.129	0.453	0.051	0.000
3.6167	0.129	0.468	0.052	0.000
3.7333	0.129	0.483	0.053	0.000
3.8500	0.129	0.498	0.054	0.000
3.9667	0.129	0.513	0.055	0.000
4.0833	0.129	0.528	0.055	0.000
4.2000	0.129	0.544	0.056	0.000
4.3167	0.129	0.559	0.057	0.000

4.4333	0.129	0.574	0.058	0.000
4.5500	0.129	0.589	0.059	0.000
4.6667	0.129	0.604	0.059	0.000
4.7833	0.129	0.619	0.060	0.000
4.9000	0.129	0.634	0.061	0.000
5.0167	0.129	0.649	0.062	0.000
5.1333	0.129	0.664	0.062	0.000
5.2500	0.129	0.680	0.063	0.000
5.3667	0.129	0.695	0.064	0.000
5.4833	0.129	0.710	0.064	0.000
5.6000	0.129	0.725	0.065	0.000
5.7167	0.129	0.740	0.066	0.000
5.8333	0.129	0.755	0.066	0.000
5.9500	0.129	0.770	0.067	0.000
6.0667	0.129	0.785	0.068	0.000
6.1833	0.129	0.800	0.089	0.000
6.3000	0.129	0.816	0.101	0.000
6.4167	0.129	0.831	0.110	0.000
6.5333	0.129	0.846	0.117	0.000
6.6500	0.129	0.861	0.124	0.000
6.7667	0.129	0.876	0.130	0.000
6.8833	0.129	0.891	0.136	0.000
7.0000	0.129	0.906	0.141	0.000
7.1167	0.129	0.921	0.146	0.000
7.2333	0.129	0.936	0.150	0.000
7.3500	0.129	0.952	0.155	0.000
7.4667	0.129	0.967	0.159	0.000
7.5833	0.129	0.982	0.163	0.000
7.7000	0.129	0.997	0.167	0.000
7.8167	0.129	1.012	0.171	0.000
7.9333	0.129	1.027	0.175	0.000
8.0500	0.129	1.042	0.178	0.000
8.1667	0.129	1.057	0.195	0.000
8.2833	0.129	1.072	0.207	0.000
8.4000	0.129	1.088	0.217	0.000
8.5167	0.129	1.103	0.225	0.000
8.6333	0.129	1.118	0.232	0.000
8.7500	0.129	1.133	0.239	0.000
8.8667	0.129	1.148	0.246	0.000
8.9833	0.129	1.163	0.252	0.000
9.1000	0.129	1.178	0.258	0.000
9.2167	0.129	1.193	0.264	0.000
9.3333	0.129	1.208	0.270	0.000
9.4500	0.129	1.224	0.275	0.000
9.5667	0.129	1.239	0.554	0.000
9.6833	0.129	1.254	1.522	0.000
9.8000	0.129	1.269	2.792	0.000
9.9167	0.129	1.284	4.108	0.000
10.033	0.129	1.299	5.225	0.000
10.150	0.129	1.314	5.982	0.000
10.267	0.129	1.329	6.515	0.000
10.383	0.129	1.344	6.975	0.000
10.500	0.129	1.360	7.406	0.000
10.617	0.129	1.375	7.812	0.000
10.733	0.000	0.000	8.198	0.000

Analysis Results

POC 1





+ Predeveloped x Mitigated

Predeveloped Landuse Totals for POC #1
Total Pervious Area: 4.27
Total Impervious Area: 0

Mitigated Landuse Totals for POC #1
Total Pervious Area: 1.92
Total Impervious Area: 2.35

Flow Frequency Method: Log Pearson Type III 17B

Flow Frequency Return Periods for Predeveloped. POC #1

Return Period	**Flow(cfs)**
2 year	0.12714
5 year	0.20833
10 year	0.260534
25 year	0.322633
50 year	0.365646
100 year	0.405823

Flow Frequency Return Periods for Mitigated. POC #1

Return Period	**Flow(cfs)**
2 year	0.077621
5 year	0.124578
10 year	0.164569
25 year	0.22692
50 year	0.283105
100 year	0.348672

Annual Peaks

Annual Peaks for Predeveloped and Mitigated. POC #1

Year	**Predeveloped**	**Mitigated**
1949	0.146	0.055
1950	0.174	0.067
1951	0.278	0.229
1952	0.087	0.049
1953	0.070	0.061
1954	0.108	0.061
1955	0.173	0.059
1956	0.139	0.128
1957	0.112	0.061
1958	0.125	0.065

1959	0.107	0.054
1960	0.192	0.171
1961	0.105	0.078
1962	0.066	0.048
1963	0.090	0.063
1964	0.128	0.065
1965	0.085	0.118
1966	0.082	0.059
1967	0.195	0.066
1968	0.110	0.060
1969	0.107	0.058
1970	0.086	0.062
1971	0.097	0.063
1972	0.211	0.167
1973	0.093	0.109
1974	0.104	0.064
1975	0.144	0.057
1976	0.103	0.061
1977	0.015	0.048
1978	0.087	0.066
1979	0.053	0.046
1980	0.248	0.173
1981	0.078	0.061
1982	0.161	0.135
1983	0.138	0.064
1984	0.083	0.051
1985	0.049	0.053
1986	0.218	0.082
1987	0.192	0.152
1988	0.076	0.054
1989	0.050	0.052
1990	0.460	0.178
1991	0.244	0.157
1992	0.100	0.068
1993	0.097	0.050
1994	0.033	0.044
1995	0.139	0.073
1996	0.322	0.224
1997	0.249	0.222
1998	0.061	0.050
1999	0.273	0.160
2000	0.097	0.065
2001	0.017	0.041
2002	0.112	0.105
2003	0.168	0.058
2004	0.179	0.200
2005	0.133	0.062
2006	0.150	0.124
2007	0.348	0.325
2008	0.424	0.209
2009	0.198	0.111

Ranked Annual Peaks

Ranked Annual Peaks for Predeveloped and Mitigated. POC #1

Rank	Predeveloped	Mitigated
1	0.4604	0.3253
2	0.4242	0.2285
3	0.3480	0.2241

4	0.3224	0.2218
5	0.2778	0.2094
6	0.2728	0.2000
7	0.2488	0.1783
8	0.2483	0.1734
9	0.2442	0.1706
10	0.2179	0.1667
11	0.2109	0.1604
12	0.1978	0.1569
13	0.1952	0.1523
14	0.1923	0.1347
15	0.1917	0.1276
16	0.1793	0.1240
17	0.1737	0.1180
18	0.1728	0.1108
19	0.1678	0.1089
20	0.1610	0.1050
21	0.1496	0.0822
22	0.1463	0.0784
23	0.1442	0.0730
24	0.1395	0.0677
25	0.1392	0.0675
26	0.1377	0.0662
27	0.1330	0.0656
28	0.1277	0.0653
29	0.1248	0.0651
30	0.1124	0.0646
31	0.1123	0.0639
32	0.1099	0.0638
33	0.1082	0.0633
34	0.1070	0.0626
35	0.1070	0.0622
36	0.1054	0.0615
37	0.1036	0.0614
38	0.1031	0.0614
39	0.0997	0.0612
40	0.0973	0.0610
41	0.0969	0.0607
42	0.0969	0.0598
43	0.0935	0.0592
44	0.0900	0.0587
45	0.0872	0.0584
46	0.0871	0.0581
47	0.0858	0.0568
48	0.0849	0.0547
49	0.0830	0.0545
50	0.0816	0.0537
51	0.0779	0.0527
52	0.0759	0.0516
53	0.0704	0.0507
54	0.0656	0.0503
55	0.0609	0.0503
56	0.0527	0.0492
57	0.0503	0.0483
58	0.0492	0.0482
59	0.0327	0.0457
60	0.0174	0.0443
61	0.0151	0.0405

ATTACHMENT 18

Duration Flows
The Facility PASSED

Flow(cfs)	Predev	Mit	Percentage	Pass/Fail
0.0636	17430	16176	92	Pass
0.0666	15772	10299	65	Pass
0.0697	14354	6470	45	Pass
0.0727	13073	6258	47	Pass
0.0758	11867	6047	50	Pass
0.0788	10765	5835	54	Pass
0.0819	9824	5653	57	Pass
0.0849	8985	5486	61	Pass
0.0880	8271	5328	64	Pass
0.0910	7349	5073	69	Pass
0.0941	6750	4857	71	Pass
0.0971	6207	4667	75	Pass
0.1002	5756	4455	77	Pass
0.1032	5337	4256	79	Pass
0.1063	4958	4028	81	Pass
0.1093	4609	3811	82	Pass
0.1124	4280	3625	84	Pass
0.1154	3983	3444	86	Pass
0.1185	3690	3281	88	Pass
0.1215	3433	3112	90	Pass
0.1246	3185	2941	92	Pass
0.1276	2960	2759	93	Pass
0.1307	2751	2612	94	Pass
0.1337	2532	2470	97	Pass
0.1368	2359	2321	98	Pass
0.1399	2182	2192	100	Pass
0.1429	2020	2016	99	Pass
0.1460	1864	1885	101	Pass
0.1490	1702	1706	100	Pass
0.1521	1578	1546	97	Pass
0.1551	1445	1397	96	Pass
0.1582	1330	1237	93	Pass
0.1612	1238	1108	89	Pass
0.1643	1155	1017	88	Pass
0.1673	1091	920	84	Pass
0.1704	1024	798	77	Pass
0.1734	961	669	69	Pass
0.1765	895	546	61	Pass
0.1795	838	449	53	Pass
0.1826	777	427	54	Pass
0.1856	731	409	55	Pass
0.1887	684	388	56	Pass
0.1917	636	373	58	Pass
0.1948	600	345	57	Pass
0.1978	564	294	52	Pass
0.2009	516	260	50	Pass
0.2039	480	244	50	Pass
0.2070	438	225	51	Pass
0.2100	388	198	51	Pass
0.2131	356	185	51	Pass
0.2161	329	175	53	Pass
0.2192	298	160	53	Pass
0.2222	272	139	51	Pass

0.2253	242	124	51	Pass
0.2283	220	112	50	Pass
0.2314	202	105	51	Pass
0.2344	179	102	56	Pass
0.2375	155	92	59	Pass
0.2405	133	86	64	Pass
0.2436	120	81	67	Pass
0.2466	108	73	67	Pass
0.2497	97	66	68	Pass
0.2527	86	62	72	Pass
0.2558	78	56	71	Pass
0.2589	69	51	73	Pass
0.2619	64	45	70	Pass
0.2650	56	42	75	Pass
0.2680	46	35	76	Pass
0.2711	39	30	76	Pass
0.2741	30	17	56	Pass
0.2772	25	12	48	Pass
0.2802	22	11	50	Pass
0.2833	20	10	50	Pass
0.2863	18	10	55	Pass
0.2894	14	10	71	Pass
0.2924	13	9	69	Pass
0.2955	10	8	80	Pass
0.2985	7	6	85	Pass
0.3016	7	6	85	Pass
0.3046	7	4	57	Pass
0.3077	6	3	50	Pass
0.3107	6	3	50	Pass
0.3138	6	3	50	Pass
0.3168	6	3	50	Pass
0.3199	6	1	16	Pass
0.3229	6	1	16	Pass
0.3260	5	1	20	Pass
0.3290	5	0	0	Pass
0.3321	5	0	0	Pass
0.3351	5	0	0	Pass
0.3382	5	0	0	Pass
0.3412	5	0	0	Pass
0.3443	4	0	0	Pass
0.3473	4	0	0	Pass
0.3504	3	0	0	Pass
0.3534	3	0	0	Pass
0.3565	3	0	0	Pass
0.3595	3	0	0	Pass
0.3626	3	0	0	Pass
0.3656	3	0	0	Pass

Water Quality

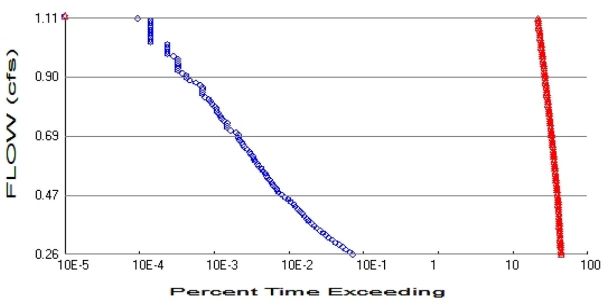
Water Quality BMP Flow and Volume for POC #1

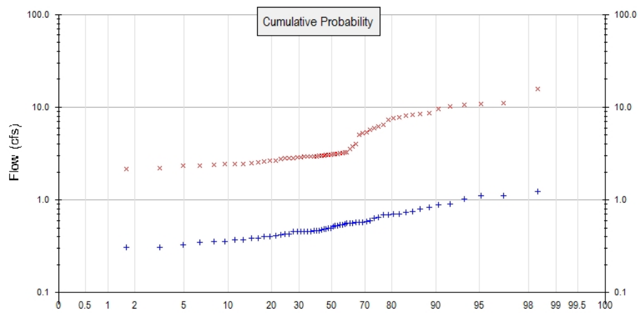
On-line facility volume:	0.3448 acre-feet
On-line facility target flow:	0.3879 cfs.
Adjusted for 15 min:	0.3879 cfs.
Off-line facility target flow:	0.2158 cfs.
Adjusted for 15 min:	0.2158 cfs.

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	☐	476.74			☐	0.00			
Total Volume Infiltrated		476.74	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

POC 2





+ Predeveloped x Mitigated

Predeveloped Landuse Totals for POC #2
Total Pervious Area: 1.24
Total Impervious Area: 1.14

Mitigated Landuse Totals for POC #2
Total Pervious Area: 1.24
Total Impervious Area: 1.14

Flow Frequency Method: Log Pearson Type III 17B

Flow Frequency Return Periods for Predeveloped. POC #2

Return Period	**Flow(cfs)**
2 year	0.518081
5 year	0.692809
10 year	0.816845
25 year	0.983381
50 year	1.114756
100 year	1.252551

Flow Frequency Return Periods for Mitigated. POC #2

Return Period	**Flow(cfs)**
2 year	3.757189
5 year	6.031352
10 year	7.968461
25 year	10.989065
50 year	13.711245
100 year	16.888318

Annual Peaks

Annual Peaks for Predeveloped and Mitigated. POC #2

Year	**Predeveloped**	**Mitigated**
1949	0.743	2.649
1950	0.696	3.266
1951	0.460	11.061
1952	0.327	2.381
1953	0.353	2.954
1954	0.420	2.962
1955	0.458	2.866
1956	0.455	6.176
1957	0.566	2.937
1958	0.405	3.127
1959	0.369	2.637

1960	0.482	8.259
1961	0.469	3.796
1962	0.359	2.338
1963	0.454	3.028
1964	0.415	3.150
1965	0.596	5.714
1966	0.352	2.843
1967	0.702	3.174
1968	0.711	2.896
1969	0.540	2.827
1970	0.482	3.011
1971	0.576	3.066
1972	0.697	8.069
1973	0.309	5.273
1974	0.551	3.091
1975	0.576	2.748
1976	0.425	2.972
1977	0.402	2.334
1978	0.497	3.203
1979	0.642	2.210
1980	0.804	8.394
1981	0.526	2.973
1982	0.829	6.521
1983	0.566	3.086
1984	0.387	2.456
1985	0.530	2.550
1986	0.464	3.978
1987	0.646	7.369
1988	0.368	2.601
1989	0.460	2.499
1990	1.241	8.629
1991	0.910	7.593
1992	0.384	3.275
1993	0.309	2.434
1994	0.307	2.145
1995	0.458	3.532
1996	0.579	10.851
1997	0.537	10.739
1998	0.462	2.437
1999	1.110	7.761
2000	0.520	3.161
2001	0.496	1.962
2002	0.737	5.082
2003	0.573	2.810
2004	1.020	9.679
2005	0.471	2.977
2006	0.433	6.003
2007	1.118	15.820
2008	0.893	10.137
2009	0.565	5.362

Ranked Annual Peaks

Ranked Annual Peaks for Predeveloped and Mitigated. POC #2

Rank	Predeveloped	Mitigated
1	1.2407	15.8196
2	1.1180	11.0607
3	1.1098	10.8509
4	1.0197	10.7389

5	0.9100	10.1373
6	0.8925	9.6794
7	0.8289	8.6289
8	0.8035	8.3940
9	0.7429	8.2588
10	0.7372	8.0688
11	0.7113	7.7614
12	0.7023	7.5927
13	0.6970	7.3690
14	0.6960	6.5209
15	0.6458	6.1762
16	0.6418	6.0029
17	0.5956	5.7138
18	0.5795	5.3616
19	0.5761	5.2734
20	0.5760	5.0821
21	0.5733	3.9775
22	0.5659	3.7962
23	0.5658	3.5320
24	0.5652	3.2750
25	0.5511	3.2662
26	0.5398	3.2035
27	0.5365	3.1745
28	0.5304	3.1606
29	0.5257	3.1497
30	0.5202	3.1271
31	0.4973	3.0906
32	0.4958	3.0863
33	0.4821	3.0658
34	0.4816	3.0282
35	0.4709	3.0112
36	0.4688	2.9769
37	0.4635	2.9733
38	0.4623	2.9720
39	0.4603	2.9619
40	0.4601	2.9540
41	0.4585	2.9366
42	0.4576	2.8957
43	0.4554	2.8663
44	0.4541	2.8426
45	0.4327	2.8265
46	0.4253	2.8102
47	0.4202	2.7478
48	0.4149	2.6489
49	0.4049	2.6369
50	0.4021	2.6013
51	0.3871	2.5497
52	0.3838	2.4995
53	0.3690	2.4560
54	0.3679	2.4366
55	0.3593	2.4338
56	0.3534	2.3809
57	0.3520	2.3380
58	0.3266	2.3336
59	0.3091	2.2097
60	0.3090	2.1453
61	0.3070	1.9623

Duration Flows

Flow(cfs)	Predev	Mit	Percentage	Pass/Fail
0.2590	1530	946027	61831	Fail
0.2677	1394	941535	67541	Fail
0.2763	1234	936402	75883	Fail
0.2850	1108	932124	84126	Fail
0.2936	998	927632	92949	Fail
0.3023	893	922927	103351	Fail
0.3109	811	919077	113326	Fail
0.3195	728	914799	125659	Fail
0.3282	667	910521	136509	Fail
0.3368	607	906671	149369	Fail
0.3455	557	902607	162047	Fail
0.3541	502	898543	178992	Fail
0.3628	467	895121	191674	Fail
0.3714	425	891485	209761	Fail
0.3801	391	887849	227071	Fail
0.3887	371	884641	238447	Fail
0.3973	345	881219	255425	Fail
0.4060	319	878010	275238	Fail
0.4146	301	874802	290631	Fail
0.4233	280	871380	311207	Fail
0.4319	261	868599	332796	Fail
0.4406	247	865391	350360	Fail
0.4492	224	862183	384903	Fail
0.4578	209	859402	411197	Fail
0.4665	188	852130	453260	Fail
0.4751	169	845285	500168	Fail
0.4838	156	839083	537873	Fail
0.4924	148	832452	562467	Fail
0.5011	139	825608	593962	Fail
0.5097	132	819833	621085	Fail
0.5183	127	813416	640485	Fail
0.5270	118	807855	684622	Fail
0.5356	111	801652	722209	Fail
0.5443	107	795663	743610	Fail
0.5529	104	790316	759919	Fail
0.5616	97	784541	808805	Fail
0.5702	91	778766	855786	Fail
0.5789	84	773847	921246	Fail
0.5875	80	768286	960357	Fail
0.5961	75	762938	1017250	Fail
0.6048	73	758019	1038382	Fail
0.6134	71	752458	1059800	Fail
0.6221	65	747111	1149401	Fail
0.6307	63	742619	1178760	Fail
0.6394	59	737486	1249976	Fail
0.6480	54	732353	1356209	Fail
0.6566	52	726578	1397265	Fail
0.6653	50	720375	1440750	Fail
0.6739	47	715028	1521336	Fail
0.6826	45	709039	1575642	Fail
0.6912	45	703050	1562333	Fail
0.6999	42	697917	1661707	Fail
0.7085	35	691928	1976937	Fail
0.7172	32	686153	2144228	Fail

0.7258	32	681019	2128184	Fail
0.7344	32	675672	2111475	Fail
0.7431	29	670111	2310727	Fail
0.7517	27	665192	2463674	Fail
0.7604	26	659844	2537861	Fail
0.7690	24	654497	2727070	Fail
0.7777	23	650006	2826113	Fail
0.7863	23	645086	2804721	Fail
0.7949	22	640381	2910822	Fail
0.8036	20	634820	3174100	Fail
0.8122	19	629045	3310763	Fail
0.8209	18	624125	3467361	Fail
0.8295	16	618564	3866025	Fail
0.8382	15	613003	4086686	Fail
0.8468	15	608084	4053893	Fail
0.8554	15	602736	4018239	Fail
0.8641	15	597389	3982593	Fail
0.8727	14	592898	4234985	Fail
0.8814	12	587764	4898033	Fail
0.8900	10	582631	5826310	Fail
0.8987	9	578139	6423766	Fail
0.9073	9	573220	6369111	Fail
0.9160	8	568942	7111775	Fail
0.9246	7	563809	8054414	Fail
0.9332	7	558462	7978028	Fail
0.9419	7	553970	7913857	Fail
0.9505	7	548623	7837471	Fail
0.9592	7	543489	7764128	Fail
0.9678	7	538998	7699971	Fail
0.9765	6	533864	8897733	Fail
0.9851	5	529159	10583180	Fail
0.9937	5	524881	10497620	Fail
1.0024	5	520176	10403520	Fail
1.0110	5	515684	10313680	Fail
1.0197	5	511620	10232400	Fail
1.0283	3	506915	16897166	Fail
1.0370	3	502423	16747433	Fail
1.0456	3	497717	16590566	Fail
1.0543	3	492798	16426600	Fail
1.0629	3	488520	16284000	Fail
1.0715	3	483815	16127166	Fail
1.0802	3	478895	15963166	Fail
1.0888	3	474831	15827700	Fail
1.0975	3	470126	15670866	Fail
1.1061	3	465634	15521133	Fail
1.1148	2	461784	23089200	Fail

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

Water Quality

Water Quality BMP Flow and Volume for POC #2

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

LID Report

LID Technique	Used for Treatment ?	Total Volume Needs Treatment (ac-ft)	Volume Through Facility (ac-ft)	Infiltration Volume (ac-ft)	Cumulative Volume Infiltration Credit	Percent Volume Infiltrated	Water Quality	Percent Water Quality Treated	Comment
Total Volume Infiltrated		0.00	0.00	0.00		0.00	0.00	0%	No Treat. Credit
Compliance with LID Standard 8% of 2-yr to 50% of 2-yr									Duration Analysis Result = 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   DukesLanding2.wdm
MESSU      25   PreDukesLanding2.MES
           27   PreDukesLanding2.L61
           28   PreDukesLanding2.L62
           30   POCDukesLanding21.dat
           31   POCDukesLanding22.dat
END FILES

OPN SEQUENCE
    INGRP              INDELT 00:15
      PERLND      11
      PERLND      16
      IMPLND       4
      COPY       501
      COPY       502
      DISPLY       1
      DISPLY       2
    END INGRP
END OPN SEQUENCE
DISPLY
  DISPLY-INFO1
    # -  #<----------Title----------->***TRAN PIVL DIG1 FIL1  PYR DIG2 FIL2 YRND
    1        Predev-Site                 MAX                     1    2   30    9
    2        Predev-Offsite              MAX                     1    2   31    9
  END DISPLY-INFO1
END DISPLY
COPY
  TIMESERIES
    # -  #  NPT  NMN ***
    1         1    1
  501         1    1
  502         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            ***
   11     C, Forest, Mod          1    1    1    1   27    0
   16     C, 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 ***
   11         0    0    1    0    0    0    0    0    0    0    0    0
```

```
   16         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  *********
   11         0    0    4    0    0    0    0    0    0    0    0    0    1    9
   16         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 ***
   11         0    0    0    0    0    0    0    0    0    0    0
   16         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
   11             0       4.5      0.08       400       0.1       0.5     0.996
   16             0       4.5      0.03       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
   11             0         0         2         2         0         0         0
   16             0         0         2         2         0         0         0
  END PWAT-PARM3
  PWAT-PARM4
    <PLS >     PWATER input info: Part 4                               ***
    # -  #     CEPSC      UZSN      NSUR     INTFW       IRC     LZETP ***
   11           0.2       0.5      0.35         6       0.5       0.7
   16           0.1      0.25      0.25         6       0.5      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
   11             0         0         0         0       2.5         1         0
   16             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           ***
    4      ROOF TOPS/FLAT         1    1    1   27    0
  END GEN-INFO
  *** Section IWATER***

  ACTIVITY
    <PLS > ************* Active Sections *****************************
    # -  # ATMP SNOW IWAT  SLD  IWG IQAL   ***
    4         0    0    1    0    0    0
  END ACTIVITY

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

  IWAT-PARM2
    <PLS >      IWATER input info: Part 2         ***
    # -  # ***  LSUR     SLSUR      NSUR     RETSC
    4            400      0.01       0.1       0.1
  END IWAT-PARM2

  IWAT-PARM3
    <PLS >      IWATER input info: Part 3         ***
    # -  # ***PETMAX    PETMIN
    4              0         0
  END IWAT-PARM3

  IWAT-STATE1
    <PLS > *** Initial conditions at start of simulation
    # -  # ***  RETS      SURS
    4              0         0
  END IWAT-STATE1

END IMPLND

SCHEMATIC
<-Source->                  <--Area-->     <-Target->   MBLK   ***
<Name>   #                  <-factor->     <Name>   #   Tbl#   ***
Predev-Site***
PERLND  11                        4.27     COPY   501     12
PERLND  11                        4.27     COPY   501     13
Predev-Offsite***
PERLND  16                        1.24     COPY   502     12
PERLND  16                        1.24     COPY   502     13
IMPLND   4                        1.14     COPY   502     15

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

NETWORK
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   #        <Name> # #<-factor->strg <Name>   #   #        <Name> # #  ***
COPY   501 OUTPUT MEAN   1 1   48.4        DISPLY   1     INPUT  TIMSER 1
COPY   502 OUTPUT MEAN   1 1   48.4        DISPLY   2     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
COPY   502 OUTPUT MEAN   1 1     48.4      WDM    502 FLOW     ENGL      REPL
END EXT TARGETS

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

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

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


END MASS-LINK

END RUN
```

Mitigated UCI File

```
RUN

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

FILES
<File>  <Un#>   <-----------File Name------------------------------>***
<-ID->                                                              ***
WDM        26   DukesLanding2.wdm
MESSU      25   MitDukesLanding2.MES
           27   MitDukesLanding2.L61
           28   MitDukesLanding2.L62
           31   POCDukesLanding22.dat
           30   POCDukesLanding21.dat
END FILES

OPN SEQUENCE
    INGRP              INDELT 00:15
      PERLND      16
      IMPLND       2
      IMPLND       4
      RCHRES       1
      COPY       502
      COPY         1
      COPY       501
      DISPLY       2
      DISPLY       1
    END INGRP
END OPN SEQUENCE
DISPLY
  DISPLY-INFO1
    # -  #<----------Title----------->***TRAN PIVL DIG1 FIL1  PYR DIG2 FIL2 YRND
    2        Dev-Offsite                 MAX                    1    2   31    9
    1        Vault  1                    MAX                    1    2   30    9
  END DISPLY-INFO1
END DISPLY
COPY
  TIMESERIES
    # -  #  NPT  NMN ***
    1        1    1
  502        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          ***
   16      C, 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 ***
```

```
  16         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  *********
  16         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 ***
  16         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
  16              0       4.5      0.03       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
  16              0         0         2         2         0         0         0
  END PWAT-PARM3
  PWAT-PARM4
    <PLS >     PWATER input info: Part 4                                     ***
    # -  #     CEPSC      UZSN      NSUR     INTFW       IRC     LZETP ***
  16             0.1      0.25      0.25         6       0.5      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
  16              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          ***
    2      ROADS/MOD              1    1    1   27    0
    4      ROOF TOPS/FLAT         1    1    1   27    0
  END GEN-INFO
  *** Section IWATER***

  ACTIVITY
    <PLS > ************* Active Sections *****************************
    # -  # ATMP SNOW IWAT  SLD  IWG IQAL   ***
    2         0    0    1    0    0    0
    4         0    0    1    0    0    0
  END ACTIVITY

  PRINT-INFO
    <ILS > ******** Print-flags ******** PIVL  PYR
    # -  # ATMP SNOW IWAT  SLD  IWG IQAL    *********
    2         0    0    4    0    0    0    1    9
    4         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     ***
    2         0    0    0    0    0
    4         0    0    0    0    0
```

```
  END IWAT-PARM1

  IWAT-PARM2
    <PLS >      IWATER input info: Part 2         ***
    # -  # ***  LSUR     SLSUR      NSUR     RETSC
    2            400      0.05       0.1      0.08
    4            400      0.01       0.1       0.1
  END IWAT-PARM2

  IWAT-PARM3
    <PLS >      IWATER input info: Part 3         ***
    # -  # ***PETMAX    PETMIN
    2              0         0
    4              0         0
  END IWAT-PARM3

  IWAT-STATE1
    <PLS > *** Initial conditions at start of simulation
    # -  # ***  RETS      SURS
    2              0         0
    4              0         0
  END IWAT-STATE1

END IMPLND

SCHEMATIC
<-Source->                  <--Area-->     <-Target->   MBLK   ***
<Name>   #                  <-factor->     <Name>   #   Tbl#   ***
Dev-Site***
PERLND  16                        1.92     RCHRES   1      2
PERLND  16                        1.92     RCHRES   1      3
IMPLND   2                        0.91     RCHRES   1      5
IMPLND   4                        1.44     RCHRES   1      5

******Routing******
PERLND  16                        1.92     COPY     1     12
IMPLND   2                        0.91     COPY     1     15
IMPLND   4                        1.44     COPY     1     15
PERLND  16                        1.92     COPY     1     13
RCHRES   1                           1     COPY   501     16
END SCHEMATIC

NETWORK
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   #        <Name> # #<-factor->strg <Name>   #   #        <Name> # #  ***
COPY   502 OUTPUT MEAN   1 1   48.4        DISPLY   2     INPUT  TIMSER 1
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                           ***
    1     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
  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
  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  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      0.02       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  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
END SPEC-ACTIONS
FTABLES
  FTABLE      1
   92    4
     Depth      Area    Volume  Outflow1 Velocity  Travel Time***
      (ft)   (acres) (acre-ft)   (cfs)   (ft/sec)    (Minutes)***
  0.000000  0.129522  0.000000  0.000000
  0.116667  0.129522  0.015111  0.009455
  0.233333  0.129522  0.030222  0.013372
  0.350000  0.129522  0.045333  0.016377
  0.466667  0.129522  0.060444  0.018911
  0.583333  0.129522  0.075555  0.021143
  0.700000  0.129522  0.090666  0.023161
  0.816667  0.129522  0.105777  0.025016
  0.933333  0.129522  0.120888  0.026744
  1.050000  0.129522  0.135999  0.028366
  1.166667  0.129522  0.151110  0.029900
  1.283333  0.129522  0.166221  0.031360
  1.400000  0.129522  0.181331  0.032754
  1.516667  0.129522  0.196442  0.034092
  1.633333  0.129522  0.211553  0.035378
  1.750000  0.129522  0.226664  0.036620
  1.866667  0.129522  0.241775  0.037821
  1.983333  0.129522  0.256886  0.038985
  2.100000  0.129522  0.271997  0.040115
  2.216667  0.129522  0.287108  0.041215
  2.333333  0.129522  0.302219  0.042285
  2.450000  0.129522  0.317330  0.043330
  2.566667  0.129522  0.332441  0.044349
  2.683333  0.129522  0.347552  0.045346
  2.800000  0.129522  0.362663  0.046321
  2.916667  0.129522  0.377774  0.047276
  3.033333  0.129522  0.392885  0.048213
  3.150000  0.129522  0.407996  0.049131
  3.266667  0.129522  0.423107  0.050033
  3.383333  0.129522  0.438218  0.050918
  3.500000  0.129522  0.453329  0.051789
  3.616667  0.129522  0.468440  0.052645
  3.733333  0.129522  0.483551  0.053487
  3.850000  0.129522  0.498662  0.054317
  3.966667  0.129522  0.513773  0.055133
  4.083333  0.129522  0.528884  0.055938
```

```
  4.200000  0.129522  0.543994  0.056732
  4.316667  0.129522  0.559105  0.057514
  4.433333  0.129522  0.574216  0.058286
  4.550000  0.129522  0.589327  0.059048
  4.666667  0.129522  0.604438  0.059801
  4.783333  0.129522  0.619549  0.060543
  4.900000  0.129522  0.634660  0.061277
  5.016667  0.129522  0.649771  0.062002
  5.133333  0.129522  0.664882  0.062719
  5.250000  0.129522  0.679993  0.063428
  5.366667  0.129522  0.695104  0.064129
  5.483333  0.129522  0.710215  0.064822
  5.600000  0.129522  0.725326  0.065508
  5.716667  0.129522  0.740437  0.066187
  5.833333  0.129522  0.755548  0.066859
  5.950000  0.129522  0.770659  0.067524
  6.066667  0.129522  0.785770  0.068183
  6.183333  0.129522  0.800881  0.089521
  6.300000  0.129522  0.815992  0.101528
  6.416667  0.129522  0.831103  0.110447
  6.533333  0.129522  0.846214  0.117928
  6.650000  0.129522  0.861325  0.124529
  6.766667  0.129522  0.876436  0.130518
  6.883333  0.129522  0.891547  0.136049
  7.000000  0.129522  0.906657  0.141221
  7.116667  0.129522  0.921768  0.146101
  7.233333  0.129522  0.936879  0.150737
  7.350000  0.129522  0.951990  0.155165
  7.466667  0.129522  0.967101  0.159414
  7.583333  0.129522  0.982212  0.163505
  7.700000  0.129522  0.997323  0.167456
  7.816667  0.129522  1.012434  0.171283
  7.933333  0.129522  1.027545  0.174996
  8.050000  0.129522  1.042656  0.178607
  8.166667  0.129522  1.057767  0.195371
  8.283333  0.129522  1.072878  0.207522
  8.400000  0.129522  1.087989  0.217007
  8.516667  0.129522  1.103100  0.225301
  8.633333  0.129522  1.118211  0.232860
  8.750000  0.129522  1.133322  0.239900
  8.866667  0.129522  1.148433  0.246543
  8.983333  0.129522  1.163544  0.252868
  9.100000  0.129522  1.178655  0.258928
  9.216667  0.129522  1.193766  0.264762
  9.333333  0.129522  1.208877  0.270400
  9.450000  0.129522  1.223988  0.275865
  9.566667  0.129522  1.239099  0.554871
  9.683333  0.129522  1.254210  1.522654
  9.800000  0.129522  1.269320  2.792652
  9.916667  0.129522  1.284431  4.108938
  10.03333  0.129522  1.299542  5.225336
  10.15000  0.129522  1.314653  5.982653
  10.26667  0.129522  1.329764  6.515541
  10.38333  0.129522  1.344875  6.975495
  10.50000  0.129522  1.359986  7.406162
  10.61667  0.129522  1.375097  7.812535
  END FTABLE  1
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
```

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<Name>   #        <Name> # #<-factor->strg <Name>   # <Name>    tem strg strg***
RCHRES   1 HYDR   RO     1 1        1      WDM   1000 FLOW     ENGL      REPL
RCHRES   1 HYDR   STAGE  1 1        1      WDM   1001 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
COPY     2 OUTPUT MEAN   1 1     48.4      WDM    702 FLOW     ENGL      REPL
COPY   502 OUTPUT MEAN   1 1     48.4      WDM    802 FLOW     ENGL      REPL
END EXT TARGETS

MASS-LINK
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<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       12
PERLND     PWATER SURO       0.083333      COPY           INPUT  MEAN
  END MASS-LINK   12

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

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

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


END MASS-LINK

END RUN
```

Predeveloped HSPF Message File

Mitigated HSPF Message File

APPENDIX B

Geotechnical Report
Terra Associates, Inc.

ATTACHMENT 18

GEOTECHNICAL REPORT

Duke's Landing
Redmond, Washington

Project No. T-6930

Terra Associates, Inc.

Prepared for:

Kellie and Terry Caffey
Bellevue, Washington

December 8, 2014

ATTACHMENT 18

TERRA ASSOCIATES, Inc.

Consultants in Geotechnical Engineering, Geology
and
Environmental Earth Sciences

December 8, 2014
Project No. T-6930

Kellie and Terry Caffey
227 Bellevue Way NE, #174
Bellevue, Washington 98004

Subject: Geotechnical Report
Duke's Landing
NE 47th Street
Redmond, Washington

Dear Kellie and Terry:

As requested, we conducted a geotechnical engineering study for the subject project. The attached report presents our findings and recommendations for the geotechnical aspects of project design and construction.

Our study indicates the site soils generally consist of about 7 to 12 inches of topsoil overlying glacial deposits comprised predominantly of silty fine sand to fine sandy silt with varying amounts of gravel. We observed light to moderate seepage of perched groundwater between depths of about 3 and 3.5 feet in 2 test pits.

In our opinion, there are no geotechnical conditions that would preclude the planned residential development. Residences can be supported on conventional spread footings bearing on competent native soils underlying the organic surface soils or on structural fill placed on competent native soils. Floor slabs and pavements can be similarly supported.

Detailed recommendations addressing these issues and other geotechnical design considerations are presented in the attached report. We trust the information presented is sufficient for your current needs. If you have any questions or require additional information, please call.

Sincerely yours,
TERRA ASSOCIATES, INC.

John C. Sadler, L.E.G., L.H.G.
Project Manager

12-8-14

Theodore J. Schepper, P.E.
President

cc: Eric LaBrie, ESM Consulting Engineers, LLC

TABLE OF CONTENTS

Page No.

Figures

Appendices

Geotechnical Report
Duke's Landing
NE 47th Street
Redmond, Washington

1.0 PROJECT DESCRIPTION

The proposed project is a residential development. A conceptual site plan prepared by ESM dated November 5, 2014 indicates that the project will consist of 18 single-family lots with associated infrastructure. Site grading and building plans are currently not available; however, we expect that the residences would be two-story, wood-frame structures, with their main floors constructed at grade or framed over daylight basements or crawl spaces. Foundation loads should be relatively light, in the range of 2 to 3 kips per foot for bearing walls and 25 to 50 kips for isolated columns.

Stormwater runoff from the development will be conveyed to a buried detention vault located in the southeastern portion of the site. Vault dimensions and elevations are currently not available.

The recommendations contained in the following sections of this report are preliminary and based on our understanding of the above design features. We should review design drawings as they become available to verify that our recommendations have been properly interpreted and incorporated into project design and to amend or supplement our recommendations, if required.

2.0 SCOPE OF WORK

We explored subsurface conditions at the site by observing soil and groundwater conditions in six test pits excavated to maximum depths of about 5 to 6.5 feet below existing surface grades using a small track-mounted excavator. Using the results of our field study and laboratory testing, analyses were undertaken to develop geotechnical recommendations for project design and construction. Specifically, this report addresses the following:

- Soil and groundwater conditions.
- Geologic Hazards per the Redmond Municipal Code
- Seismic design parameters per the current International Building Code (IBC).
- Site preparation and grading for development.
- Excavations
- Foundations
- Slab-on-grade floors
- Infiltration feasibility
- Stormwater detention vault
- Subsurface drainage
- Utilities
- Pavements

It should be noted that recommendations outlined in this report regarding drainage are associated with soil strength, design earth pressures, erosion, and stability. Design and performance issues with respect to moisture as it relates to the structure environment (i.e., humidity, mildew, mold) is beyond Terra Associates' purview. A building envelope specialist or contactor should be consulted to address these issues, as needed.

3.0 SITE CONDITIONS

3.1 Surface

The site is a 4.17-acre assemblage of 3 parcels located in the 16500 block of NE 47th Street in Redmond, Washington. The approximate location of the site is shown on Figure 1.

Existing site improvements include a single-family residence and a barn located in the northwestern and north-central portions of the site, respectively, and an asphalt-paved driveway that runs east to west into the property off of NE 47th Street. Existing surface gradients generally slope down to east-northeast at gentle to moderate inclinations. Topographic information shown on a site plan titled Existing Conditions and Tree Survey by ESM Consulting Engineers, LLC, dated January 17, 2014, indicates that slope gradients at the site are generally about 12 to 14 percent, with localized slope areas of about 28 percent and about 20 percent in the southwestern corner of the site and on the east side of the barn, respectively. Site vegetation consists primarily of pasture grasses, with grass lawn, scattered mature coniferous trees, and landscape trees and shrubs growing around the residence.

We observed shallow drainage swales along the southern site margin and adjacent to the south side of the driveway. The swales appear to have been dug by the property owner to collect and convey surface water from the upper southern portion of the site to an off-site discharge point near the northeastern corner of the site. We did not observe any water flowing in the swales at the time of our fieldwork.

3.2 Soils

The soils observed in the test pits consist of about 7 to 12 inches of sod and/or topsoil overlying native glacial deposits comprised predominantly of silty fine sand to fine sandy silt with varying amounts of gravel. The upper approximately 3 to 4.5 feet of soil is typically medium dense, moist, and mottled. These upper weathered soils generally overlie soils that are similar in texture, but are in a dense to very dense and moist condition. The dense to very dense soils observed in Test Pits TP-1, TP-2, and TP-4 are interpreted to be till. We observed dense to very dense fine sandy silt in Test Pits TP-5 and TP-6. The silt has been glacially consolidated, but is not interpreted as till, as there is stratification of the soil unit.

The *Geologic map of the Redmond quadrangle, King County Washington*, by J.P. Minard and Derek B. Booth (1988) shows site geology mapped as Vashon till (Qvt). The dense to very dense silty sand to sandy silt with gravel observed in the test pits is consistent with this geologic map unit. The upper medium dense soils are a weathered zone of the till deposit. The stratified silt unit observed in Test Pits TP-5 and TP-6 are interpreted to be transitional beds, which are mapped in contact with till immediately north of the subject site.

Detailed descriptions of the subsurface conditions we observed in the test pits are presented on the Test Pit Logs in Appendix A. The approximate locations of the test pits are shown on Figure 2.

3.3 Groundwater

We observed light seepage and light to moderate seepage of perched groundwater between depths of about 3 and 3.5 feet in Test Pits TP-1 and TP-3, respectively. The occurrence of shallow perched groundwater is typical for sites underlain by till and till-like soils. We expect that perched groundwater levels and flow rates will fluctuate seasonally and will typically reach their highest levels during and shortly following the wet winter months (October through May).

3.4 Geologic Hazards

We evaluated site conditions for the presence of geologic hazards. Section 21.64.060 (Geologically Hazardous Areas) of the City of Redmond Zoning Code (RZC) defines geologically hazardous areas as erosion hazard areas, landslide hazard areas, and seismic hazard areas.

3.4.1 Erosion Hazard Areas

Section 21.64.060A.1.a of the RZC defines erosion hazard areas as "...lands or areas underlain by soils identified by the U.S. Department of Agriculture Soil Conservation Service (SCS) as having "severe" or "very severe" rill and inter-rill erosion hazards. This includes, but is not limited to, the following group of soils when they occur on slopes of 15 percent or greater: Alderwood-Kitsap (AkF), Alderwood gravelly sandy loam (AgD), Kitsap silt loam (KpD), Everett (EvD), and Indianola (InD)."

The Soil Conservation Service (SCS) has classified the soils underlying the west and east portions of the site as *Alderwood gravelly sandy loam, 6 to 15 percent slopes (AgC)*. Alderwood soils are described as formed over till, which is generally consistent with the soils observed in the test pits. The SCS describes the erosion hazard of AgC soils as moderate, which does not meet the criteria for an erosion hazard area. However, as discussed, localized slope areas with inclinations of about 20 to 28 percent exist at the site. In the areas where these slope inclinations exist, the site soils would be better classified as *Alderwood gravelly sandy loam, 15 to 30 percent slopes (AgD)*, which meets the above criteria for an erosion hazard area.

In our opinion, the erosion hazard at the site would be adequately mitigated with proper implementation and maintenance of Best Management Practices (BMPs) for erosion prevention and sedimentation control. All BMPs for erosion protection and sedimentation control should conform to City of Redmond requirements, and should be in place prior to and during any grading activity at the site.

3.4.2 Landslide Hazard Areas

Section 21.64.060A.1.b of the RZC defines landslide hazard areas as "...areas potentially subject to significant or severe risk of landslides based on a combination of geologic, topographic, and hydrogeologic factors.

They include areas susceptible because of any combination of bedrock, soil, slope, slope aspect, structure, hydrology, or other factors. They are areas of the landscape that are at a high risk of failure or that presently exhibit downslope movement of soil and/or rocks and that are separated from the underlying stationary part of the slope by a definite plane of separation. The plane of separation may be thick or thin and may be composed of multiple failure zones depending on local conditions, including soil type, slope gradient, and groundwater regime." Landslide hazard areas include the following:

i. Areas of historic failures, such as:

   a. Areas designated as quaternary slumps or landslides on maps published by the United States Geologic Survey (USGS).

   b. Those areas designated by the United States Department of Agriculture (USDA) Soil Conservation Service (SCS) as having a "severe" limitation for building site development.

ii. Areas containing a combination of slopes steeper than 15 percent, springs or groundwater seepage, and hillsides intersecting geologic contacts with a relatively permeable sediment overlying a relatively impermeable sediment or bedrock.

iii. Areas that have shown movement during the Holocene epoch (from 10,000 years ago to the present) or which are underlain or covered by mass wastage debris of that epoch.

iv. Slopes that are parallel or subparallel to planes of weakness in subsurface materials.

v. Slopes having gradients steeper than 80 percent subject to rockfall during seismic shaking.

vi. Areas potentially unstable as a result of rapid stream incision, stream bank erosion, and undercutting by wave action.

vii. Any area with a slope 40 percent or steeper with a vertical relief of 10 feet or more.

Conditions meeting the above criteria do not exist at the site.

3.4.3 Seismic Hazard Areas

Section 21.64.060A.1.c of the RZC defines seismic hazard areas as "…lands subject to severe risk of damage as a result of earthquake-induced ground shaking, slope failure, settlement, soil liquefaction, or surface faulting."

Based on the soil and groundwater conditions we observed at the site, it is our opinion that the risk for damage resulting from earthquake induced slope failure, ground settlement, surface faulting, or soil liquefaction is negligible. Therefore, in our opinion, unusual seismic hazard areas do not exist at the site, and design in accordance with local building codes for determining seismic forces would adequately mitigate impacts associated with ground shaking.

3.5 Seismic Design Parameters

Based on the site soil conditions and our knowledge of the area geology, per the 2012 International Building Code (IBC), site class "C" should be used in structural design. Based on this site class, in accordance with the 2012 IBC, the following parameters should be used in computing seismic forces:

Seismic Design Parameters (IBC 2012)

Spectral response acceleration (Short Period), S_{Ms}	1.256 g
Spectral response acceleration (1 – Second Period), S_{M1}	0.634 g
Five percent damped .2 second period, S_{Ds}	0.837 g
Five percent damped 1.0 second period, S_{D1}	0.423 g

Values determined using the United States Geological Survey (USGS) Ground Motion Parameter Calculator accessed on December 2, 2014 at the web site http://earthquake.usgs.gov/designmaps/us/application.php.

4.0 DISCUSSION AND RECOMMENDATIONS

4.1 General

Based on our study, there are no geotechnical conditions that would preclude the planned development. Residences can be supported on conventional spread footings bearing on competent native soils underlying the organic topsoil or on structural fill placed on the competent native soils. Floor slabs and pavements can be similarly supported.

The site soils contain a sufficient amount of fines (silt- and clay-sized particles) such that they will be difficult to compact as structural fill when too wet or too dry. If grading activities will take place during the winter season, the owner should be prepared to import free-draining granular material for use as structural fill and backfill.

Detailed recommendations regarding these issues and other geotechnical design considerations are provided in the following sections of this report. These recommendations should be incorporated into the final design drawings and construction specifications.

4.2 Site Preparation and Grading

To prepare the site for construction, all vegetation, organic surface soils, and other deleterious materials should be stripped and removed from the site. We expect surface stripping depths of about 7 to 12 inches will be required to remove the organic surficial soils. Stripped vegetation debris should be removed from the site. Organic soils will not be suitable for use as structural fill, but may be used for limited depths in nonstructural areas or for landscaping purposes. Demolition of existing structures should include removal of existing foundations and abandonment of underground septic systems and other buried utilities. Abandoned utility pipes that fall outside of new building areas can be left in place provided they are sealed to prevent intrusion of groundwater seepage and soil. Once clearing and grubbing operations are complete, cut and fill operations to establish desired building grades can be initiated.

A representative of Terra Associates, Inc. should examine all bearing surfaces to verify that conditions encountered are as anticipated and are suitable for placement of structural fill or direct support of building and pavement elements. Our representative may request proofrolling exposed surfaces with a heavy rubber tired vehicle to determine if any isolated soft and yielding areas are present. If unstable yielding areas are observed, they should be cut to firm bearing soil and filled to grade with structural fill. If the depth of excavation to remove unstable soils is excessive, use of geotextile fabric such as Mirafi 500X or equivalent in conjunction with structural fill can be considered in order to limit the depth of removal. In general, our experience has shown that a minimum of 18 inches of clean, granular structural fill over the geotextile fabric should establish a stable bearing surface.

The native soils observed at the site contain a sufficient amount of fines (silt and clay size particles) that will make them difficult to compact as structural fill if they are too wet or too dry. Accordingly, the ability to use these soils from site excavations as structural fill will depend on their moisture content and the prevailing weather conditions when site grading activities take place. Soils that are too wet to properly compact could be dried by aeration during dry weather conditions, or mixed with an additive such as cement or lime to stabilize the soil and facilitate compaction. If an additive is used, additional Best Management Practices (BMPs) for its use will need to be incorporated into the Temporary Erosion and Sedimentation Control (TESC) plan for the project. Soils that are dry of optimum should be moisture conditioned by controlled addition of water and blending prior to material placement.

If grading activities are planned during the wet winter months, or if they are initiated during the summer and extend into fall and winter, the owner should be prepared to import wet weather structural fill. For this purpose, we recommend importing a granular soil that meets the following grading requirements:

U.S. Sieve Size	Percent Passing
6 inches	100
No. 4	75 maximum
No. 200	5 maximum*

*Based on the 3/4-inch fraction.

Prior to use, Terra Associates, Inc. should examine and test all materials imported to the site for use as structural fill.

Structural fill should be placed in uniform loose layers not exceeding 12 inches and compacted to a minimum of 95 percent of the soil's maximum dry density, as determined by American Society for Testing and Materials (ASTM) Test Designation D-698 (Standard Proctor). The moisture content of the soil at the time of compaction should be within two percent of its optimum, as determined by this ASTM standard. In nonstructural areas, the degree of compaction can be reduced to 90 percent.

4.3 Excavations

All excavations at the site associated with confined spaces, such as lower building level retaining walls, must be completed in accordance with local, state, and federal requirements. Based on the Washington State Safety and Health Administration (WSHA) regulations, the medium dense to dense native soils would typically be classified as Type C soils. Unweathered, dense to very dense till and till-like soils would typically be classified as Type A soils.

Accordingly, for temporary excavations of more than 4 feet and less than 20 feet in depth, the side slopes in Type C soils should be laid back at a slope inclination of 1.5:1 (Horizontal:Vertical) or flatter. Temporary excavations in Type A soils can be laid back at inclinations of 0.75:1 or flatter. For temporary excavation slopes less than 8 feet in height in Type A soils, the lower 3.5 feet can be cut to a vertical condition with a 0.75:1 slope graded above. For temporary excavation slopes greater than 8 feet in height up to a maximum height of 12 feet, the slope above the 3.5-foot high vertical portion should be laid back to an inclination of 1:1 or flatter. No vertical cut with a backslope immediately above is allowed for excavation depths that exceed 12 feet. In this case, a 4-foot high vertical cut with an equivalent horizontal bench to the cut slope toe is required. If there is insufficient room to complete the excavations in the manners discussed above, or if excavations greater than 20 feet deep are planned, you may need to use temporary shoring to support the excavations.

Seepage of perched groundwater should be anticipated within excavations extending to the dense to very dense till and till-like soils. In our opinion, the volume of water and rate of flow into the excavation should be relatively minor and would not be expected to impact the stability of the excavations when completed as described above. Conventional sump pumping procedures along with a system of collection trenches, if necessary, should be capable of maintaining a relatively dry excavation for construction purposes in these soils.

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

4.4 Foundations

Residential structures may be supported on conventional spread footing foundations bearing on competent native soils or on structural fill placed above the native soils. Foundation subgrades should be prepared, as recommended in Section 4.2 of this report.

Perimeter foundations exposed to the weather should bear at a minimum depth of 1.5 feet below final exterior grades for frost protection. Interior foundations can be constructed at any convenient depth below the floor slab. We recommend designing foundations for a net allowable bearing capacity of 2,500 pounds per square foot (psf). For short-term loads, such as wind and seismic, a one-third increase in this allowable capacity can be used in design. With the anticipated loads and this bearing stress applied, building settlements should be less than one-half inch total and one-fourth inch differential.

For designing foundations to resist lateral loads, a base friction coefficient of 0.35 can be used. Passive earth pressure acting on the sides of the footings may also be considered. We recommend calculating this lateral resistance using an equivalent fluid weight of 300 pounds per cubic foot (pcf). We recommend not including the upper 12 inches of soil in this computation because they can be affected by weather or disturbed by future grading activity. This value assumes the foundations will be constructed neat against competent native soil or the excavations are backfilled with structural fill, as described in Section 4.2 of this report. The recommended passive and friction values include a safety factor of 1.5.

4.5 Slab-on-Grade Floors

Slab-on-grade floors may be supported on a subgrade prepared as recommended in Section 4.2 of this report. Immediately below the floor slab, we recommend placing a four-inch thick capillary break layer composed of clean, coarse sand or fine gravel that has less than three percent passing the No. 200 sieve. This material will reduce the potential for upward capillary movement of water through the underlying soil and subsequent wetting of the floor slab.

The capillary break layer will not prevent moisture intrusion through the slab caused by water vapor transmission. Where moisture by vapor transmission is undesirable, such as covered floor areas, a common practice is to place a durable plastic membrane on the capillary break layer and then cover the membrane with a layer of clean sand or fine gravel to protect it from damage during construction, and aid in uniform curing of the concrete slab. It should be noted that if the sand or gravel layer overlying the membrane is saturated prior to pouring the slab, it will be ineffective in assisting uniform curing of the slab and can actually serve as a water supply for moisture seeping through the slab and affecting floor coverings. Therefore, in our opinion, covering the membrane with a layer of sand or gravel should be avoided if floor slab construction occurs during the wet winter months and the layer cannot be effectively drained.

4.6 Infiltration Feasibility

Based on the conditions observed in our test pits, it is our opinion that on-site infiltration is not a viable option for management of site stormwater. Based on the presence of mottling in the vast majority of soils observed at the site, it is also our opinion that the site conditions would generally not be suitable for applying other natural drainage practices (NDPs).

4.7 Stormwater Detention Vault

As discussed, stormwater runoff from the development will be conveyed to a buried detention vault located in the southeastern portion of the site. Vault dimensions and elevations are currently not available. Because of equipment limitations, the depth of our test pit in the area of the vault was limited to six feet in the dense to very dense till. We anticipate that the excavation for the vault will expose similar dense to very dense glacial deposits; however, this should be verified prior to construction.

Vault foundations supported by dense to very dense native soils at a depth greater than 6 feet may be designed for an allowable bearing capacity of 5,000 psf. For short-term loads, such as seismic, a one-third increase in this allowable capacity can be used. Friction at the base of foundations and passive earth pressure will provide resistance to these lateral loads. For designing foundations to resist lateral loads, a base friction coefficient of 0.35 can be used. Passive earth pressure acting on the sides of the vault footings may also be considered. We recommend calculating this lateral resistance using an equivalent fluid weight of 300 pounds per cubic foot (pcf).

The magnitude of earth pressures developing on the vault walls will depend in part on the quality and compaction of the wall backfill. We recommend placing and compacting wall backfill as structural fill as recommended in Section 4.2.

To prevent development of hydrostatic pressure and uplift on the vault, wall drainage must be installed. A typical recommended wall drainage detail is shown on Figure 3. If it is not possible to discharge collected water at the footing invert elevation, we recommend setting the invert elevation of the wall drainpipe equivalent to the outfall invert and connecting the drain to the outfall pipe for discharge.

With the recommended wall backfill and drainage, we recommend designing the restrained vault walls for an earth pressure imposed by an equivalent fluid weighing 50 pcf. For any portion of the wall that falls below the invert elevation of the wall drain, an earth pressure equivalent to a fluid weighing 85 pcf should be used. For evaluating walls under seismic loading, an additional uniform earth pressure equivalent to 8H psf, where H is the height of the below-grade wall in feet, can be used. These values assume a horizontal backfill condition. If necessary, for H20 traffic surcharge loading, a uniform horizontal traffic surcharge value of 75 psf should be included in design of vault walls.

The vault will be subject to uplift pressures if wall drainage is not provided. The weight of the structure and the weight of the backfill soil above its foundation will provide resistance to uplift. A soil unit weight of 125 pcf can be used for the vault backfill provided the backfill is placed and compacted as structural fill as recommended in Section 4.2.

4.8 Drainage

Surface

Final exterior grades should promote free and positive drainage away from the building areas. We recommend providing a positive drainage gradient away from the building perimeter. If a positive gradient cannot be provided, provisions for collection and disposal of surface water adjacent to the structure should be provided.

Subsurface

We recommend installing a continuous drain along the outside lower edge of the perimeter building foundations. The drains can be laid to grade at an invert elevation equivalent to the bottom of footing grade. The drains can consist of four-inch diameter perforated PVC pipe that is enveloped in washed ½- to ¾-inch gravel-sized drainage aggregate. The aggregate should extend six inches above and to the sides of the pipe. The foundation drains and roof downspouts should be tightlined separately to an approved point of controlled discharge. All drains should be provided with cleanouts at easily accessible locations. These cleanouts should be serviced at least once each year.

4.9 Utilities

Utility pipes should be bedded and backfilled in accordance with American Public Works Association (APWA) or local jurisdictional requirements. At minimum, trench backfill should be placed and compacted as structural fill as described in Section 4.2 of this report. As noted, soils excavated on-site should generally be suitable for use as backfill material. However, the vast majority of the site soils are fine grained and moisture sensitive; therefore, moisture conditioning may be necessary to facilitate proper compaction. If utility construction takes place during the winter, it may be necessary to import suitable wet weather fill for utility trench backfilling.

4.10 Pavements

Pavement subgrade should be prepared as described in the Section 4.2 of this report. Regardless of the degree of relative compaction achieved, the subgrade must be firm and relatively unyielding before paving. The subgrade should be proofrolled with heavy rubber-tire construction equipment such as a loaded 10-yard dump truck to verify this condition.

The pavement design section is dependent upon the supporting capability of the subgrade soils and the traffic conditions to which it will be subjected. For residential access, with traffic consisting mainly of light passenger vehicles with only occasional heavy traffic, and with a stable subgrade prepared as recommended, we recommend the following pavement sections:

- Two inches of hot mix asphalt (HMA) over four inches of crushed rock base (CRB)
- 3 ½ inches full depth HMA over prepared subgrade

The paving materials used should conform to the Washington State Department of Transportation (WSDOT) specifications for ½-inch class HMA and CRB.

Long-term pavement performance will depend on surface drainage. A poorly-drained pavement section will be subject to premature failure as a result of surface water infiltrating into the subgrade soils and reducing their supporting capability. For optimum pavement performance, we recommend surface drainage gradients of at least two percent. Some degree of longitudinal and transverse cracking of the pavement surface should be expected over time. Regular maintenance should be planned to seal cracks when they occur.

5.0 ADDITIONAL SERVICES

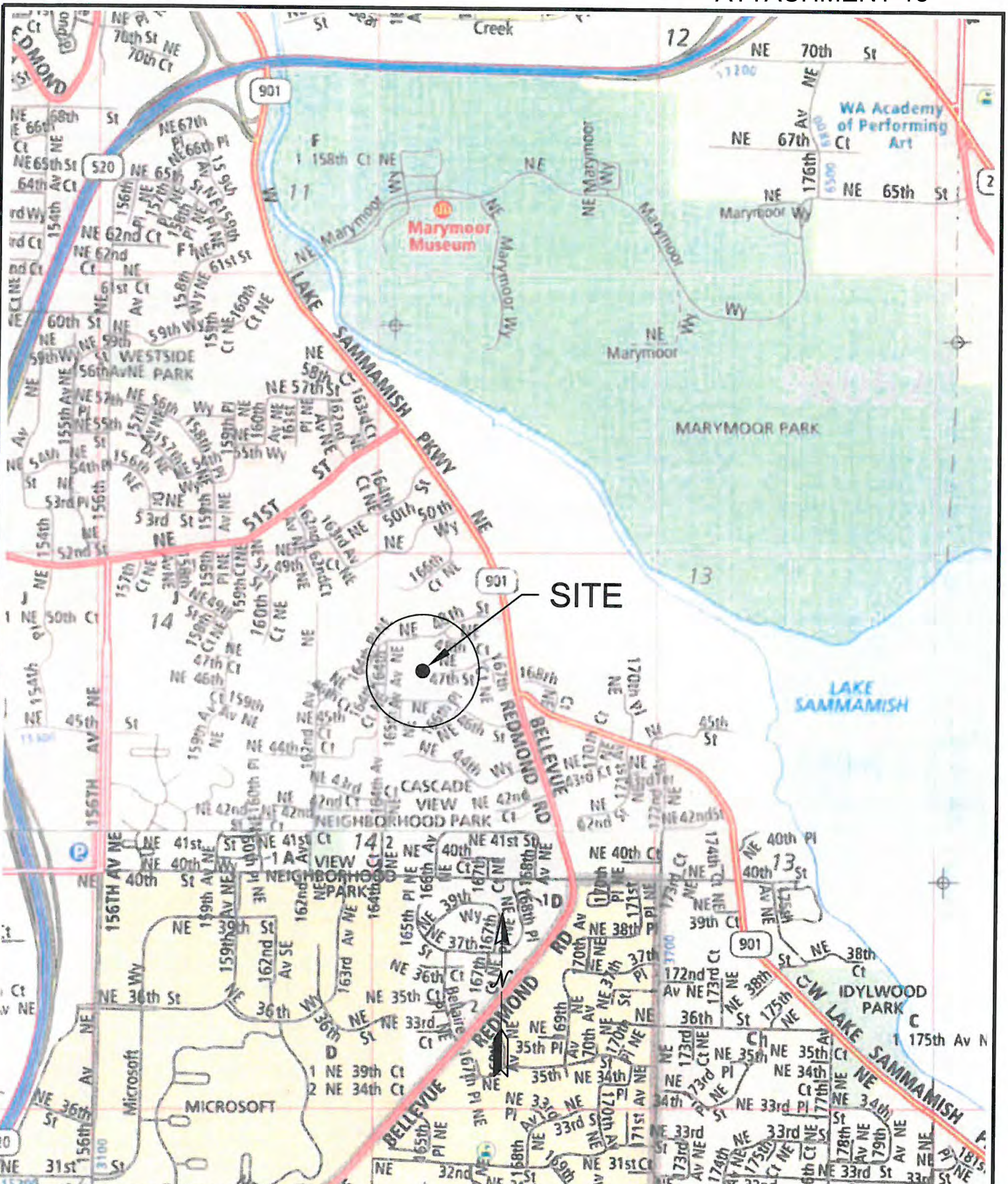
Terra Associates, Inc. should review the final designs and specifications in order to verify that earthwork and foundation recommendations have been properly interpreted and implemented in project design. We should also provide geotechnical services during construction in order to observe compliance with our design concepts, specifications, and recommendations. This will allow for design changes if subsurface conditions differ from those anticipated prior to the start of construction.

6.0 LIMITATIONS

We prepared this report in accordance with generally accepted geotechnical engineering practices. This report is the copyrighted property of Terra Associates, Inc. and is intended for specific application to the Duke's Landing project. This report is for the exclusive use of Kellie and Terry Caffey and their authorized representatives. No other warranty, expressed or implied, is made.

The analyses and recommendations presented in this report are based on data obtained from our on-site test pits. Variations in soil conditions can occur, the nature and extent of which may not become evident until construction. If variations appear evident, Terra Associates, Inc. should be requested to reevaluate the recommendations in this report prior to proceeding with construction.

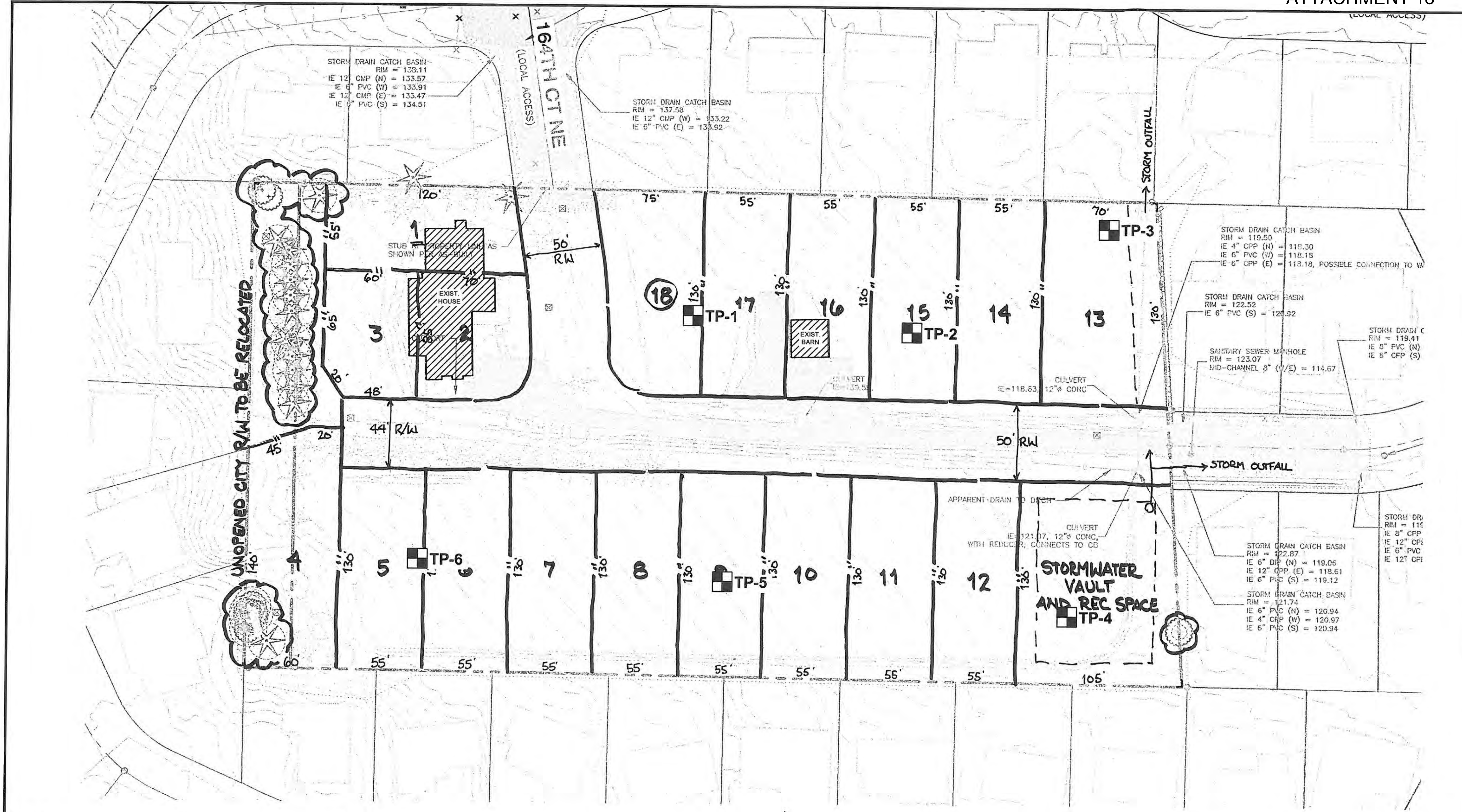
ATTACHMENT 18



REFERENCE: THOMAS GUIDE (2008)

NOT TO SCALE

Terra Associates, Inc. Consultants in Geotechnical Engineering Geology and Environmental Earth Sciences	VICINITY MAP DUKE'S LANDING REDMOND, WASHINGTON	
Proj. No.T-6930	Date DEC 2014	Figure 1



NOTE:

THIS SITE PLAN IS SCHEMATIC. ALL LOCATIONS AND DIMENSIONS ARE APPROXIMATE. IT IS INTENDED FOR REFERENCE ONLY AND SHOULD NOT BE USED FOR DESIGN OR CONSTRUCTION PURPOSES.

REFERENCE:

SITE PLAN BY ESM CONSULTING ENGINEERS, LLC (11-5-14)

LEGEND:

APPROXIMATE TEST PIT LOCATION

0 60 120

APPROXIMATE SCALE IN FEET

N

Terra Associates, Inc.
Consultants in Geotechnical Engineering
Geology and
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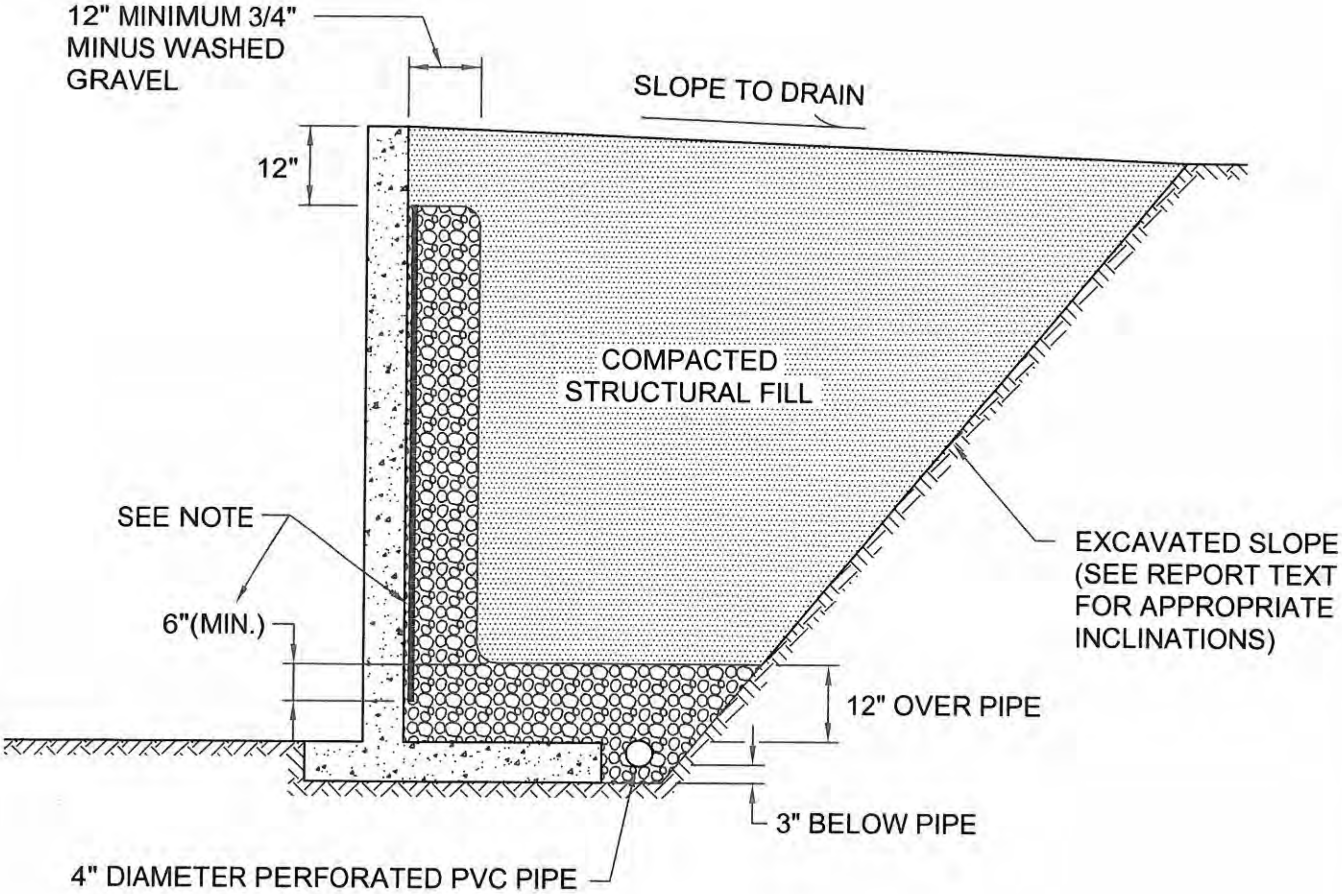
EXPLORATION LOCATION PLAN
DUKE'S LANDING
REDMOND, WASHINGTON

Proj. No.T-6930	Date DEC 2014	Figure 2

ATTACHMENT 18



NOT TO SCALE

NOTE:

MIRADRAIN G100N PREFABRICATED DRAINAGE PANELS OR SIMILAR PRODUCT CAN BE SUBSTITUTED FOR THE 12-INCH WIDE GRAVEL DRAIN BEHIND WALL. DRAINAGE PANELS SHOULD EXTEND A MINIMUM OF SIX INCHES INTO 12-INCH THICK DRAINAGE GRAVEL LAYER OVER PERFORATED DRAIN PIPE.

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TYPICAL WALL DRAINAGE DETAIL
DUKE'S LANDING
REDMOND, WASHINGTON

Proj. No.T-6930	Date DEC 2014	Figure 3

APPENDIX A
FIELD EXPLORATION AND LABORATORY TESTING

Duke's Landing
Redmond, Washington

On November 11, 2014, we investigated subsurface conditions at the site by excavating 6 test pits to maximum depths of about 5 to 6.5 feet below existing surface grades using a small track-mounted excavator. The test pit locations are shown on Figure 2. The test pit locations were approximately determined in the field by sighting and pacing from existing surface features. The Test Pit Logs are presented on Figures A-2 through A-7.

An engineering geologist from our office maintained a log of each test pit as it was excavated, classified the soil conditions encountered, and obtained representative soil samples. All soil samples were visually classified in the field in accordance with the Unified Soil Classification System. A copy of this classification is presented as Figure A-1.

Representative soil samples obtained from the test pits were placed in sealed plastic bags and taken to our laboratory for further examination and testing. The moisture content of each sample was measured and is reported on the Test Pit Logs. Grain size analyses were performed on three of the soil samples. The results are shown on Figure A-8.

MAJOR DIVISIONS			LETTER SYMBOL	TYPICAL DESCRIPTION
COARSE GRAINED SOILS More than 50% material larger than No. 200 sieve size	**GRAVELS** More than 50% of coarse fraction is larger than No. 4 sieve	Clean Gravels (less than 5% fines)	GW	Well-graded gravels, gravel-sand mixtures, little or no fines.
			GP	Poorly-graded gravels, gravel-sand mixtures, little or no fines.
		Gravels with fines	GM	Silty gravels, gravel-sand-silt mixtures, non-plastic fines.
			GC	Clayey gravels, gravel-sand-clay mixtures, plastic fines.
	SANDS More than 50% of coarse fraction is smaller than No. 4 sieve	Clean Sands (less than 5% fines)	SW	Well-graded sands, sands with gravel, little or no fines.
			SP	Poorly-graded sands, sands with gravel, little or no fines.
		Sands with fines	SM	Silty sands, sand-silt mixtures, non-plastic fines.
			SC	Clayey sands, sand-clay mixtures, plastic fines.
FINE GRAINED SOILS More than 50% material smaller than No. 200 sieve size	**SILTS AND CLAYS** Liquid Limit is less than 50%		ML	Inorganic silts, rock flour, clayey silts with slight plasticity.
			CL	Inorganic clays of low to medium plasticity. (Lean clay)
			OL	Organic silts and organic clays of low plasticity.
	SILTS AND CLAYS Liquid Limit is greater than 50%		MH	Inorganic silts, elastic.
			CH	Inorganic clays of high plasticity. (Fat clay)
			OH	Organic clays of high plasticity.
HIGHLY ORGANIC SOILS			PT	Peat.

DEFINITION OF TERMS AND SYMBOLS

COHESIONLESS

Density	Standard Penetration Resistance in Blows/Foot
Very Loose	0-4
Loose	4-10
Medium Dense	10-30
Dense	30-50
Very Dense	>50

COHESIVE

Consistancy	Standard Penetration Resistance in Blows/Foot
Very Soft	0-2
Soft	2-4
Medium Stiff	4-8
Stiff	8-16
Very Stiff	16-32
Hard	>32

Symbol	Definition
I	2" OUTSIDE DIAMETER SPILT SPOON SAMPLER
II	2.4" INSIDE DIAMETER RING SAMPLER OR SHELBY TUBE SAMPLER
▼	WATER LEVEL (Date)
Tr	TORVANE READINGS, tsf
Pp	PENETROMETER READING, tsf
DD	DRY DENSITY, pounds per cubic foot
LL	LIQUID LIMIT, percent
PI	PLASTIC INDEX
N	STANDARD PENETRATION, blows per foot

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UNIFIED SOIL CLASSIFICATION SYSTEM
DUKE'S LANDING
REDMOND, WASHINGTON

Proj. No.T-6930	Date DEC 2014	Figure A-1

LOG OF TEST PIT NO. 1

FIGURE A-2

PROJECT NAME: Duke's Landing **PROJ. NO:** T-6930 **LOGGED BY:** JCS

LOCATION: Redmond, Washington **SURFACE CONDS:** Pasture Grass **APPROX. ELEV:** 143 Feet

DATE LOGGED: November 11, 2014 **DEPTH TO GROUNDWATER:** 3.5 Feet **DEPTH TO CAVING:** N/A

DEPTH (FT.)	SAMPLE NO.	DESCRIPTION	CONSISTENCY/ RELATIVE DENSITY	W (%)	POCKET PEN. (TSF)	REMARKS
		(7 inches SOD and TOPSOIL) Gray silty SAND with gravel, moist to wet, mottled. (SM)				
1						
2			Medium Dense			
3						
4		Gray, trace to slightly clayey, silty fine SAND with gravel, moist, scattered mottling. (SM) (Till)	Dense to Very Dense			
5				11.3		
6		Test pit terminated at 5.5 feet. Light groundwater seepage at 3.5 feet.				
7						
8						

NOTE: This subsurface information pertains only to this test pit location and should not be interpreted as being indicative of other locations at the site.

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LOG OF TEST PIT NO. 2

FIGURE A-3

PROJECT NAME: Duke's Landing **PROJ. NO:** T-6930 **LOGGED BY:** JCS

LOCATION: Redmond, Washington **SURFACE CONDS:** Pasture Grass **APPROX. ELEV:** 132 Feet

DATE LOGGED: November 11., 2014 **DEPTH TO GROUNDWATER:** N/A **DEPTH TO CAVING:** N/A

DEPTH (FT.)	SAMPLE NO.	DESCRIPTION	CONSISTENCY/ RELATIVE DENSITY	W (%)	POCKET PEN. (TSF)	REMARKS
0–3		(7 inches SOD and TOPSOIL) Gray silty SAND with gravel, moist, mottled. (SM) (Weathered till)	Medium Dense	18.8		
3–6		Gray-brown to gray silty fine SAND with gravel to fine sandy SILT with gravel, moist, scattered mottling. (SM/ML) (Till)	Dense to Very Dense			
6–8		Test pit terminated at 6 feet. No groundwater seepage.				

NOTE: This subsurface information pertains only to this test pit location and should not be interpreted as being indicative of other locations at the site.

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LOG OF TEST PIT NO. 3

FIGURE A-4

PROJECT NAME: Duke's Landing **PROJ. NO:** T-6930 **LOGGED BY:** JCS

LOCATION: Redmond, Washington **SURFACE CONDS:** Pasture Grass **APPROX. ELEV:** 116 Feet

DATE LOGGED: November 11, 2014 **DEPTH TO GROUNDWATER:** 3 Feet **DEPTH TO CAVING:** N/A

DEPTH (FT.)	SAMPLE NO.	DESCRIPTION	CONSISTENCY/ RELATIVE DENSITY	W (%)	POCKET PEN. (TSF)	REMARKS
0–2		(12 inches SOD and TOPSOIL) Gray-brown silty fine SAND with gravel, moist, mottled. (SM)	Medium Dense			
2–3.5		Gray-brown to brown SAND to SAND with silt, moist to wet, mottled. (SP/SP-SM)		25.3 (at 3)		
3.5–6.5		Gray-brown to brown silty SAND with gravel to SAND with silt and gravel, moist to wet, mottled. (SM/SP-SM)	Medium Dense to Dense			
6.5–8		Test pit terminated at 6.5 feet. Light to moderate groundwater seepage between 3 and 3.5 feet.				

NOTE: This subsurface information pertains only to this test pit location and should not be interpreted as being indicative of other locations at the site.

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LOG OF TEST PIT NO. 4

FIGURE A-5

PROJECT NAME: Duke's Landing **PROJ. NO:** T-6930 **LOGGED BY:** JCS

LOCATION: Redmond, Washington **SURFACE CONDS:** Grass **APPROX. ELEV:** 132 Feet

DATE LOGGED: November 11, 2014 **DEPTH TO GROUNDWATER:** N/A **DEPTH TO CAVING:** N/A

DEPTH (FT.)	SAMPLE NO.	DESCRIPTION	CONSISTENCY/ RELATIVE DENSITY	W (%)	POCKET PEN. (TSF)	REMARKS
0–3		(7 inches SOD and TOPSOIL) Gray-brown silty fine SAND with gravel, moist, mottled. (SM)	Medium Dense			
3–6		Gray-brown silty fine SAND with gravel, dense, moist, scattered mottling. (SM) (Till-like)	Dense			
6–8		Test pit terminated at 6 feet due to equipment limitations. No groundwater seepage.				

NOTE: This subsurface information pertains only to this test pit location and should not be interpreted as being indicative of other locations at the site.

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ATTACHMENT 18

LOG OF TEST PIT NO. 5

FIGURE A-6

PROJECT NAME: Duke's Landing **PROJ. NO:** T-6930 **LOGGED BY:** JCS

LOCATION: Redmond, Washington **SURFACE CONDS:** Grass **APPROX. ELEV:** 150 Feet

DATE LOGGED: November 11, 2014 **DEPTH TO GROUNDWATER:** N/A **DEPTH TO CAVING:** N/A

DEPTH (FT.)	SAMPLE NO.	DESCRIPTION	CONSISTENCY/ RELATIVE DENSITY	W (%)	POCKET PEN. (TSF)	REMARKS
0–4.5		(7 inches TOPSOIL) Gray fine sandy SILT, moist, mottled. (ML)	Medium Dense Very Dense	23.6		
4.5–5		Gray fine sandy SILT, moist. (ML)	Very Dense			
5–8		Test pit terminated at 5 feet due to equipment limitations. No groundwater seepage.				

NOTE: This subsurface information pertains only to this test pit location and should not be interpreted as being indicative of other locations at the site.

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LOG OF TEST PIT NO. 6

FIGURE A-7

PROJECT NAME: Duke's Landing **PROJ. NO:** T-6930 **LOGGED BY:** JCS

LOCATION: Redmond, Washington **SURFACE CONDS:** Grass **APPROX. ELEV:** 171 Feet

DATE LOGGED: November 11, 2014 **DEPTH TO GROUNDWATER:** N/A **DEPTH TO CAVING:** N/A

DEPTH (FT.)	SAMPLE NO.	DESCRIPTION	CONSISTENCY/ RELATIVE DENSITY	W (%)	POCKET PEN. (TSF)	REMARKS
1, 2, 3, 4		(12 inches TOPSOIL) Gray-brown silty fine SAND to fine sandy SILT, trace of gravel, moist, mottled. (SM/ML)	Medium Dense			
5, 6		Gray fine sandy SILT, moist, stratified. (ML)	Dense	25.5		
7, 8		Test pit terminated at 6 feet. No groundwater seepage.				

NOTE: This subsurface information pertains only to this test pit location and should not be interpreted as being indicative of other locations at the site.

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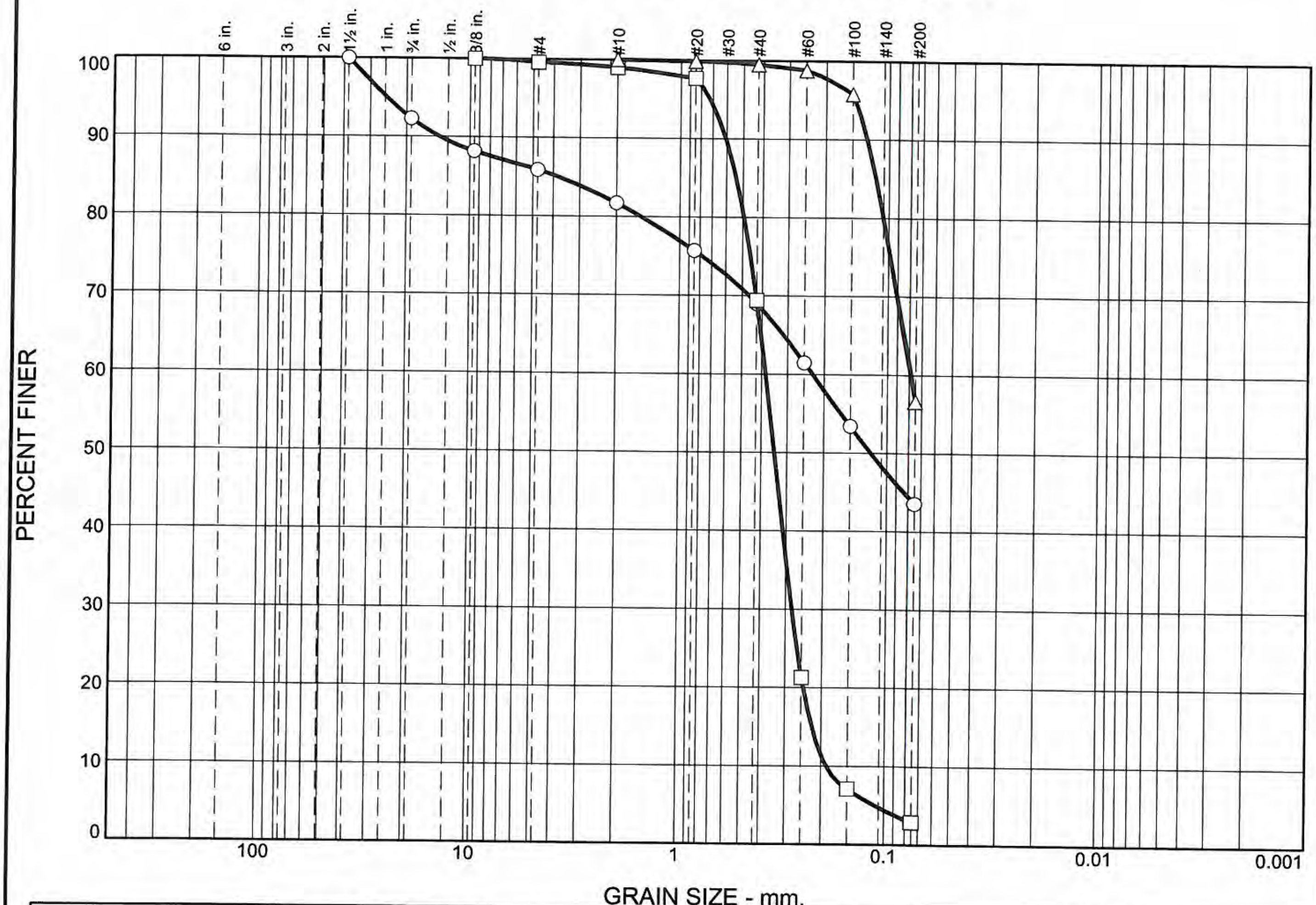
Particle Size Distribution Report



	% +3"	% Gravel Coarse	% Gravel Fine	% Sand Coarse	% Sand Medium	% Sand Fine	% Fines Silt	% Fines Clay
○	0.0	7.7	6.4	4.2	12.7	25.4	43.6	
□	0.0	0.0	0.4	0.6	29.6	66.5	2.9	
△	0.0	0.0	0.0	0.0	0.5	42.9	56.6	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			3.7822	0.2274	0.1192					
□			0.5405	0.3825	0.3453	0.2800	0.2224	0.1893	1.08	2.02
△			0.1155	0.0786						

Material Description	USCS	AASHTO
○ silty SAND	SM	
□ SAND	SP	
△ sandy SILT	ML	

Project No. T-6930 **Client:** Kellie and Terry Caffey

Project: Duke's Landing

○ **Location:** TP-1 **Depth:** 5.5'

□ **Location:** TP-3 **Depth:** 3'

△ **Location:** TP-6 **Depth:** 5'

Terra Associates, Inc.

Kirkland, WA

Remarks:

○ Tested 12-1-14

□ Tested 12-1-14

△ Tested 12-1-14

Figure A-8

Tested By: FQ

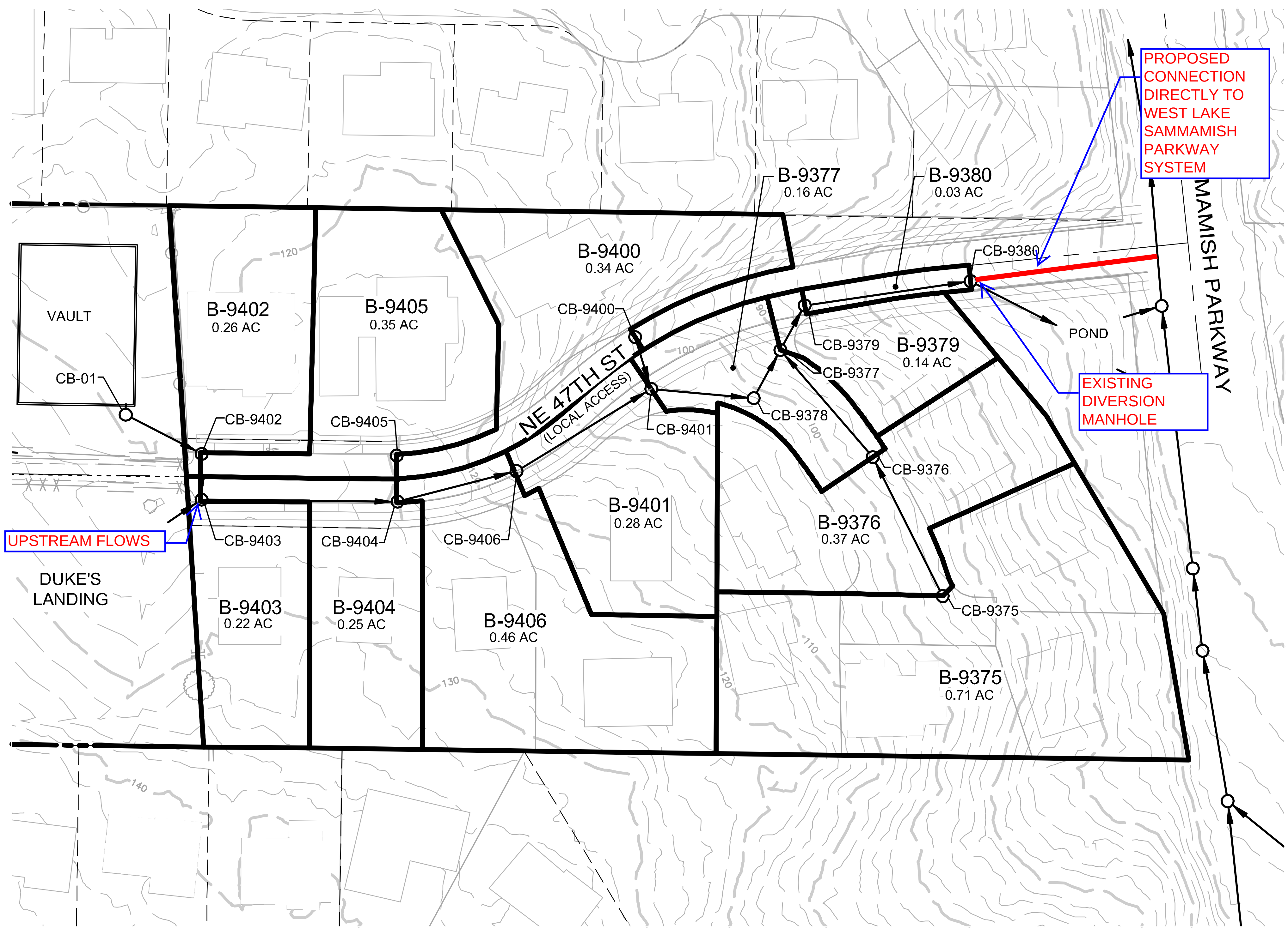
APPENDIX C

StormShed3G Outputs

ATTACHMENT 18

DUKE'S LANDING PRELIMINARY PLAT

CITY OF REDMOND, KING COUNTY WASHINGTON



n

SCALE: 1" = 70'

0 35 70

CONTOUR INTERVAL: 2'

LEGEND

EXISTING STORM DRAIN

EXISTING TREE

EXISTING EDGE OF PAVEMENT

100 EXISTING CONTOUR

PROPERTY BOUNDARY

EXISTING DRAINAGE BASIN

NOTE:

EXISTING STORM DRAINAGE STRUCTURES AND CONTOUR LABELS ARE BASED ON CITY OF REDMOND GIS.

DUKE'S LANDING, LLC

DUKE'S LANDING

OFFSITE EXISTING BASIN MAP

FIG. C.1

ESM CONSULTING ENGINEERS LLC
33400 8th Ave S, Suite 205
Federal Way, WA 98003
FEDERAL WAY (253) 838-6113
EVERETT (425) 297-9900
www.esmcivil.com
Civil Engineering
Public Works
Land Surveying
Project Management
Land Planning
Landscape Architecture

JOB NO. 1787-001-013
DRAWN: ER
DATE: 2015-06-18
SHEET 1 OF 2
DRAWING: BS-03

File: \\esm8\engr\ESM-JOBS\1787\001\013\exhibits\BS-03.dwg
Plotted: 6/18/2015 2:21 PM
Plotted By: Brianne Gastfield

Duke's Landing Offsite Analysis

Figure C.2 – Offsite Conveyance System

Figure C.3 – Offsite Conveyance Drainage Basins

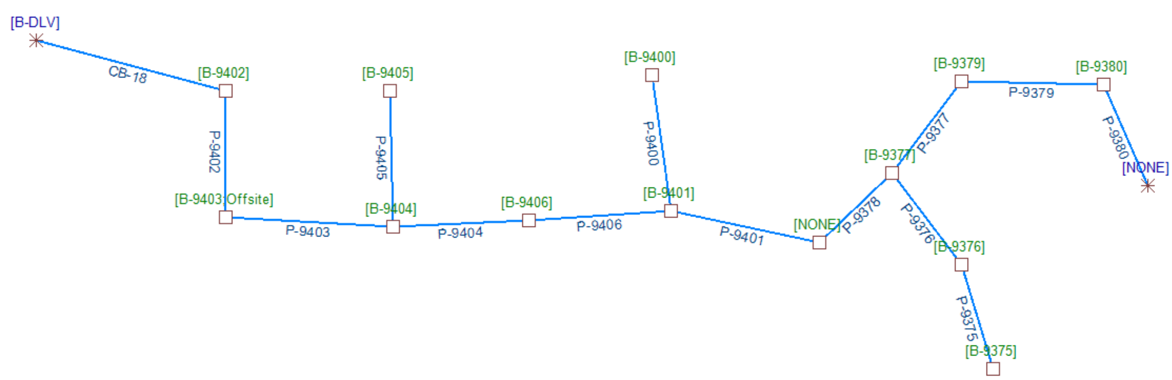


Figure C.4 – Offsite Conveyance Structure Rim Elevations

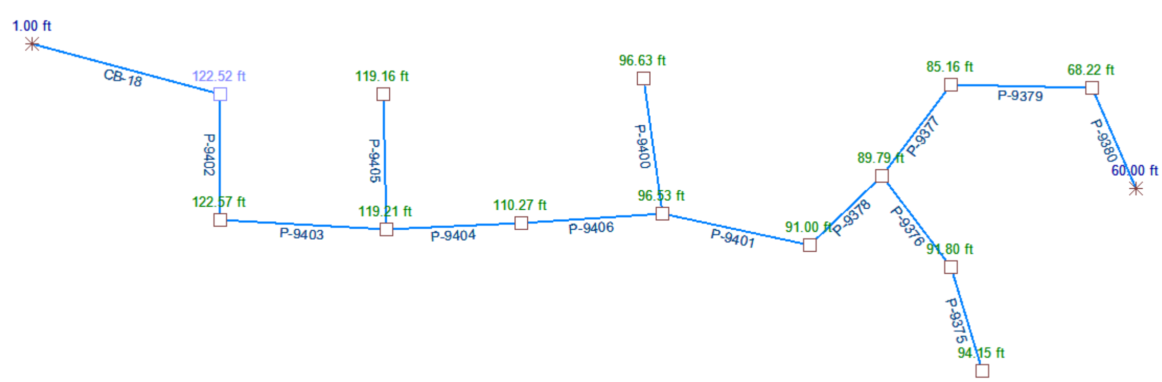
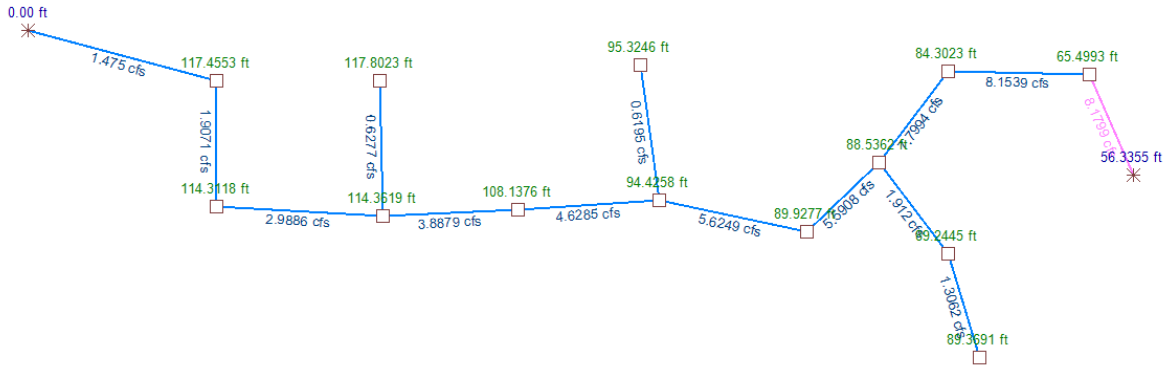
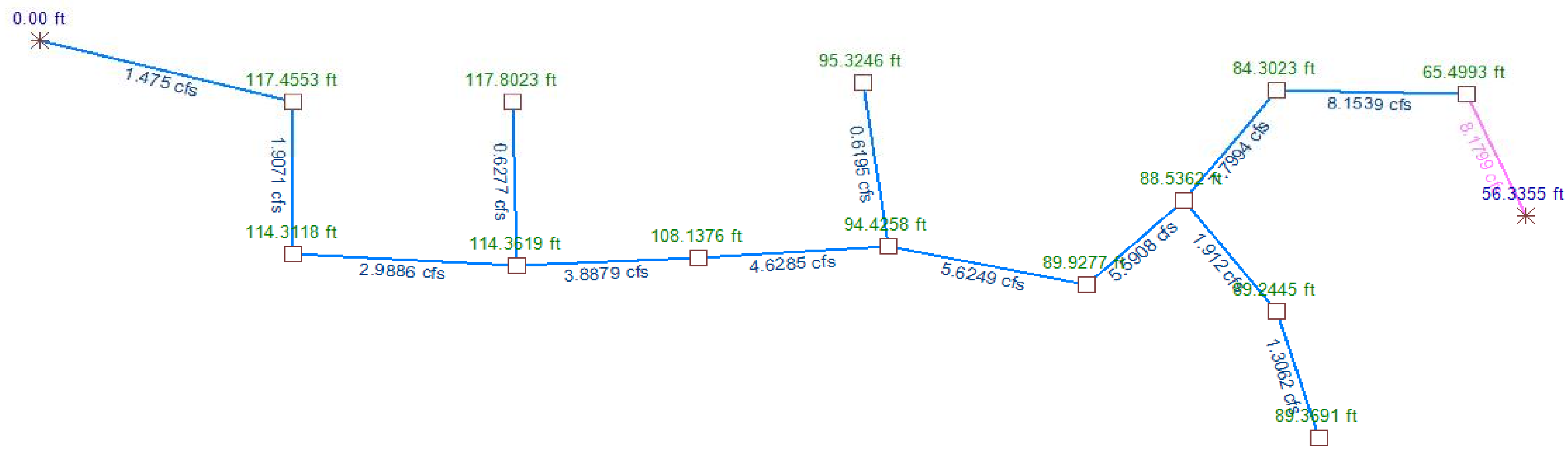


Figure C.5 – Offsite Conveyance Water Surface Elevations



Catch Basin	Area (sf)	Area (ac)	IMP	PER
9375	30960.45	0.71	0.34	0.37
9376	15951.28	0.37	0.17	0.20
9377	6968.12	0.16	0.16	0.00
9379	6203.05	0.14	0.14	0.00
9380	1383.93	0.03	0.03	0.00
9400	14873.76	0.34	0.16	0.18
9401	12262.46	0.28	0.13	0.15
9402	11288.9	0.26	0.12	0.14
9403	9442.3	0.22	0.10	0.12
9404	10808.22	0.25	0.11	0.14
9405	15285.11	0.35	0.16	0.19
9406	20229.2	0.46	0.22	0.24
	155656.8	3.57		

	Area (ac)	IMP	PER	50yr dev flow
Offsite	2.38	1.14	1.24	0.7416
Duke's Landing	4.27	2.35	1.92	1.4490



ATTACHMENT 18

Layout Report: Dukes Landing

Event	Precip (in)
2 yr 24 hr	1.85
10 year	2.83
25 year	3.27
100 year	3.79

Reach Records

Record Id: CB-01

Section Shape:		Circular		
Uniform Flow Method:		Manning's	**Coefficient:**	0.012
Routing Method:		Travel Time Shift	**Contributing Hyd**	
DnNode		9402	**UpNode**	CB-01
Material		unspecified	**Size**	12 in Diam
Ent Losses		Groove End w/Headwall		
Length		49.00 ft	**Slope**	1.00%
Up Invert		111.45 ft	**Dn Invert**	110.96 ft
Conduit Constraints				
Min Vel	**Max Vel**	**Min Slope**	**Max Slope**	**Min Cover**
2.00 ft/s	15.00 ft/s	0.50%	2.00%	3.00 ft
Drop across MH		0.00 ft	**Ex/Infil Rate**	0.00 in/hr

Record Id: P-9375

Section Shape:		Circular		
Uniform Flow Method:		Manning's	**Coefficient:**	0.012
Routing Method:		Travel Time Shift	**Contributing Hyd**	
DnNode		9376	**UpNode**	9375
Material		unspecified	**Size**	12 in Diam
Ent Losses		Groove End w/Headwall		
Length		90.00 ft	**Slope**	1.52%
Up Invert		86.57 ft	**Dn Invert**	85.20 ft
Conduit Constraints				
Min Vel	**Max Vel**	**Min Slope**	**Max Slope**	**Min Cover**
2.00 ft/s	15.00 ft/s	0.50%	2.00%	3.00 ft
Drop across MH		0.00 ft	**Ex/Infil Rate**	0.00 in/hr

Record Id: P-9376

Section Shape:		Circular		
Uniform Flow Method:		Manning's	**Coefficient:**	0.012
Routing Method:		Travel Time Shift	**Contributing Hyd**	
DnNode		9377	**UpNode**	9376
Material		unspecified	**Size**	12 in Diam
Ent Losses		Groove End w/Headwall		
Length		81.00 ft	**Slope**	1.49%
Up Invert		85.20 ft	**Dn Invert**	83.99 ft
Conduit Constraints				
Min Vel	**Max Vel**	**Min Slope**	**Max Slope**	**Min Cover**
2.00 ft/s	15.00 ft/s	0.50%	2.00%	3.00 ft
Drop across MH		0.00 ft	**Ex/Infil Rate**	0.00 in/hr

Record Id: P-9377

Section Shape:		Circular		
Uniform Flow Method:		Manning's	**Coefficient:**	0.012
Routing Method:		Travel Time Shift	**Contributing Hyd**	
DnNode		9379	**UpNode**	9377
Material		unspecified	**Size**	12 in Diam
Ent Losses		Groove End w/Headwall		
Length		29.40 ft	**Slope**	10.31%
Up Invert		83.99 ft	**Dn Invert**	80.96 ft
Conduit Constraints				
Min Vel	**Max Vel**	**Min Slope**	**Max Slope**	**Min Cover**
2.00 ft/s	15.00 ft/s	0.50%	2.00%	3.00 ft
Drop across MH		0.00 ft	**Ex/Infil Rate**	0.00 in/hr

Record Id: P-9378

Section Shape:		Circular		
Uniform Flow Method:		Manning's	**Coefficient:**	0.012
Routing Method:		Travel Time Shift	**Contributing Hyd**	
DnNode		9377	**UpNode**	9378
Material		unspecified	**Size**	12 in Diam
Ent Losses		Groove End w/Headwall		
Length		32.00 ft	**Slope**	9.09%
Up Invert		86.90 ft	**Dn Invert**	83.99 ft
Conduit Constraints				
Min Vel	**Max Vel**	**Min Slope**	**Max Slope**	**Min Cover**
2.00 ft/s	15.00 ft/s	0.50%	2.00%	3.00 ft
Drop across MH		0.00 ft	**Ex/Infil Rate**	0.00 in/hr

Record Id: P-9379

Section Shape:		Circular		
Uniform Flow Method:		Manning's	**Coefficient:**	0.012
Routing Method:		Travel Time Shift	**Contributing Hyd**	
DnNode		9380	**UpNode**	9379
Material		unspecified	**Size**	15 in Diam
Ent Losses		Groove End w/Headwall		
Length		97.00 ft	**Slope**	21.80%
Up Invert		80.96 ft	**Dn Invert**	59.81 ft
Conduit Constraints				
Min Vel	**Max Vel**	**Min Slope**	**Max Slope**	**Min Cover**
2.00 ft/s	15.00 ft/s	0.50%	2.00%	3.00 ft
Drop across MH		0.00 ft	**Ex/Infil Rate**	0.00 in/hr

Record Id: P-9380

Section Shape:		Circular		
Uniform Flow Method:		Manning's	**Coefficient:**	0.012
Routing Method:		Travel Time Shift	**Contributing Hyd**	
DnNode		POND	**UpNode**	9380
Material		unspecified	**Size**	12 in Diam
Ent Losses		Groove End Projecting		
Length		55.00 ft	**Slope**	8.11%
Up Invert		59.81 ft	**Dn Invert**	55.35 ft
Conduit Constraints				
Min Vel	**Max Vel**	**Min Slope**	**Max Slope**	**Min Cover**
2.00 ft/s	15.00 ft/s	0.50%	2.00%	3.00 ft
Drop across MH		0.00 ft	**Ex/Infil Rate**	0.00 in/hr

Record Id: P-9400

Section Shape:		Circular		
Uniform Flow Method:		Manning's	**Coefficient:**	0.012
Routing Method:		Travel Time Shift	**Contributing Hyd**	
DnNode		9401	**UpNode**	9400
Material		unspecified	**Size**	12 in Diam
Ent Losses		Groove End w/Headwall		
Length		31.00 ft	**Slope**	4.68%
Up Invert		94.33 ft	**Dn Invert**	92.88 ft
Conduit Constraints				
Min Vel	**Max Vel**	**Min Slope**	**Max Slope**	**Min Cover**
2.00 ft/s	15.00 ft/s	0.50%	2.00%	3.00 ft
Drop across MH		0.00 ft	**Ex/Infil Rate**	0.00 in/hr

Record Id: P-9401

Section Shape:		Circular		
Uniform Flow Method:		Manning's	**Coefficient:**	0.012
Routing Method:		Travel Time Shift	**Contributing Hyd**	
DnNode		9378	**UpNode**	9401
Material		unspecified	**Size**	12 in Diam
Ent Losses		Groove End w/Headwall		
Length		60.00 ft	**Slope**	10.08%
Up Invert		92.95 ft	**Dn Invert**	86.90 ft
Conduit Constraints				
Min Vel	**Max Vel**	**Min Slope**	**Max Slope**	**Min Cover**
2.00 ft/s	15.00 ft/s	0.50%	2.00%	3.00 ft
Drop across MH		0.00 ft	**Ex/Infil Rate**	0.00 in/hr

Record Id: P-9402

Section Shape:		Circular		
Uniform Flow Method:		Manning's	**Coefficient:**	0.012
Routing Method:		Travel Time Shift	**Contributing Hyd**	
DnNode		9403	**UpNode**	9402
Material		unspecified	**Size**	12 in Diam
Ent Losses		Groove End w/Headwall		
Length		26.30 ft	**Slope**	1.00%
Up Invert		110.96 ft	**Dn Invert**	110.697 ft
Conduit Constraints				
Min Vel	**Max Vel**	**Min Slope**	**Max Slope**	**Min Cover**
2.00 ft/s	15.00 ft/s	0.50%	2.00%	3.00 ft
Drop across MH		0.00 ft	**Ex/Infil Rate**	0.00 in/hr

Record Id: P-9403

Section Shape:		Circular		
Uniform Flow Method:		Manning's	**Coefficient:**	0.012
Routing Method:		Travel Time Shift	**Contributing Hyd**	
DnNode		9404	**UpNode**	9403
Material		unspecified	**Size**	12 in Diam
Ent Losses		Groove End w/Headwall		
Length		112.00 ft	**Slope**	0.97%
Up Invert		110.70 ft	**Dn Invert**	109.61 ft
Conduit Constraints				
Min Vel	**Max Vel**	**Min Slope**	**Max Slope**	**Min Cover**
2.00 ft/s	15.00 ft/s	0.50%	2.00%	3.00 ft
Drop across MH		0.00 ft	**Ex/Infil Rate**	0.00 in/hr

Record Id: P-9404

Section Shape:		Circular		
Uniform Flow Method:		Manning's	**Coefficient:**	0.012
Routing Method:		Travel Time Shift	**Contributing Hyd**	
DnNode		9406	**UpNode**	9404
Material		unspecified	**Size**	12 in Diam
Ent Losses		Groove End w/Headwall		

Length		71.00 ft	**Slope**	4.07%
Up Invert		109.61 ft	**Dn Invert**	106.72 ft
Conduit Constraints				
Min Vel	**Max Vel**	**Min Slope**	**Max Slope**	**Min Cover**
2.00 ft/s	15.00 ft/s	0.50%	2.00%	3.00 ft
Drop across MH		0.00 ft	**Ex/Infil Rate**	0.00 in/hr

Record Id: P-9405

Section Shape:		Circular		
Uniform Flow Method:		Manning's	**Coefficient:**	0.012
Routing Method:		Travel Time Shift	**Contributing Hyd**	
DnNode		9404	**UpNode**	9405
Material		unspecified	**Size**	12 in Diam
Ent Losses		Groove End w/Headwall		
Length		26.00 ft	**Slope**	17.58%
Up Invert		116.36 ft	**Dn Invert**	111.79 ft
Conduit Constraints				
Min Vel	**Max Vel**	**Min Slope**	**Max Slope**	**Min Cover**
2.00 ft/s	15.00 ft/s	0.50%	2.00%	3.00 ft
Drop across MH		0.00 ft	**Ex/Infil Rate**	0.00 in/hr

Record Id: P-9406

Section Shape:		Circular		
Uniform Flow Method:		Manning's	**Coefficient:**	0.012
Routing Method:		Travel Time Shift	**Contributing Hyd**	
DnNode		9401	**UpNode**	9406
Material		unspecified	**Size**	12 in Diam
Ent Losses		Groove End w/Headwall		
Length		92.00 ft	**Slope**	14.93%
Up Invert		106.62 ft	**Dn Invert**	92.88 ft
Conduit Constraints				
Min Vel	**Max Vel**	**Min Slope**	**Max Slope**	**Min Cover**
2.00 ft/s	15.00 ft/s	0.50%	2.00%	3.00 ft
Drop across MH		0.00 ft	**Ex/Infil Rate**	0.00 in/hr

Node Records

Record Id: 9375

Descrip:	Prototype Record	Increment	0.10 ft	
Start El.	85.20 ft	Max El.	94.15 ft	
Void Ratio	100			
Condition	Existing	Structure Type	CB-TYPE 1-48	
		Channelization	No Special Shape	
Catch	0.00 ft	Bottom Area	12.5664 sf	
MH/CB Type Node				

Record Id: 9376

Descrip:	Prototype Record	Increment	0.10 ft	
Start El.	83.99 ft	Max El.	91.80 ft	
Void Ratio	100			
Condition	Existing	Structure Type	CB-TYPE 1-48	
		Channelization	No Special Shape	
Catch	0.00 ft	Bottom Area	12.5664 sf	
MH/CB Type Node				

Record Id: 9377

Descrip:	Prototype Record	Increment	0.10 ft	
Start El.	83.99 ft	Max El.	89.79 ft	
Void Ratio	100			
Condition	Existing	Structure Type	CB-TYPE 1-48	
		Channelization	No Special Shape	
Catch	0.00 ft	Bottom Area	12.5664 sf	
MH/CB Type Node				

Record Id: 9378

Descrip:	Prototype Record	Increment	0.10 ft	
Start El.	86.90 ft	Max El.	91.00 ft	
Void Ratio	100			
Condition	Proposed	Structure Type	CB-TYPE 1-48	
		Channelization	No Special Shape	
Catch	0.00 ft	Bottom Area	12.5664 sf	
MH/CB Type Node				

Record Id: 9379

Descrip:	Prototype Record	Increment	0.10 ft	
Start El.	80.96 ft	Max El.	85.16 ft	
Void Ratio	100			
Condition	Proposed	Structure Type	CB-TYPE 2-48	
		Channelization	No Special Shape	
Catch	0.00 ft	Bottom Area	12.5664 sf	
MH/CB Type Node				

Record Id: 9380

Descrip:	Prototype Record	Increment	0.10 ft	
Start El.	59.81 ft	Max El.	68.22 ft	
Void Ratio	100			
Condition	Proposed	Structure Type	CB-TYPE 2-48	
		Channelization	No Special Shape	
Catch	0.00 ft	Bottom Area	12.5664 sf	
MH/CB Type Node				

Record Id: 9400

Descrip:	Prototype Record	Increment	0.10 ft	
Start El.	94.33 ft	Max El.	96.63 ft	
Void Ratio	100			
Condition	Existing	Structure Type	CB-TYPE 1-48	
		Channelization	No Special Shape	
Catch	0.00 ft	Bottom Area	12.5664 sf	
MH/CB Type Node				

Record Id: 9401

Descrip:	Prototype Record	Increment	0.10 ft	
Start El.	92.88 ft	Max El.	96.53 ft	
Void Ratio	100			
Condition	Existing	Structure Type	CB-TYPE 1-48	
		Channelization	No Special Shape	
Catch	0.00 ft	Bottom Area	12.5664 sf	
MH/CB Type Node				

Record Id: 9402

Descrip:	Prototype Record	Increment	0.10 ft	
Start El.	113.72 ft	Max El.	122.52 ft	
Void Ratio	100			
Condition	Proposed	Structure Type	CB-TYPE 2-48	
		Channelization	No Special Shape	
Catch	0.00 ft	Bottom Area	12.5664 sf	
MH/CB Type Node				

Record Id: 9403

Descrip:	Prototype Record	Increment	0.10 ft	
Start El.	112.91 ft	Max El.	122.57 ft	
Void Ratio	100			
Condition	Proposed	Structure Type	CB-TYPE 2-48	
		Channelization	No Special Shape	
Catch	0.00 ft	Bottom Area	12.5664 sf	
MH/CB Type Node				

Record Id: 9404

Descrip:	Prototype Record	Increment	0.10 ft	
Start El.	111.79 ft	Max El.	119.21 ft	
Void Ratio	100			
Condition	Proposed	Structure Type	CB-TYPE 2-48	
		Channelization	No Special Shape	
Catch	0.00 ft	Bottom Area	12.5664 sf	
MH/CB Type Node				

Record Id: 9405

Descrip:	Prototype Record	Increment	0.10 ft	
Start El.	116.36 ft	Max El.	119.16 ft	
Void Ratio	100			
Condition	Existing	Structure Type	CB-TYPE 1-48	
		Channelization	No Special Shape	
Catch	0.00 ft	Bottom Area	12.5664 sf	
MH/CB Type Node				

Record Id: 9406

Descrip:	Prototype Record	Increment	0.10 ft	
Start El.	106.72 ft	Max El.	110.27 ft	
Void Ratio	100			
Condition	Existing	Structure Type	CB-TYPE 1-48	
		Channelization	No Special Shape	
Catch	0.00 ft	Bottom Area	12.5664 sf	
MH/CB Type Node				

Record Id: CB-01

Descrip:		Increment	0.00 ft	
Start El.	0.00 ft	Max El.	1.00 ft	
Void Ratio	0			

Record Id: POND

Descrip:	Prototype	Increment	0.10 ft	
Start El.	50.00 ft	Max El.	60.00 ft	
Void Ratio	100			
Dummy Type Node				
Descrip:	Prototype Record	Increment	0.10 ft	
Start El.	50.00 ft	Max El.	60.00 ft	
Void Ratio	100			
Dummy Type Node				

Contributing Drainage Areas

Record Id: B-9375

Design Method				Rational	**IDF Table:**	Seattle
Composite C Calc						
Description				SubArea	Sub c	
Pavement and roofs (n=0.90)				0.34 ac	0.9	
Landscaping, lawns (n=0.25)				0.37 ac	0.25	
Directly Connected TC Calc						
Type	**Description**	**Length**	**Slope**	**Coeff**	**Misc**	**TT**
Fixed	City of Redmond					5.00 min
Directly Connected TC						5.00 min

Record Id: B-9376

Design Method				Rational	**IDF Table:**	Seattle
Composite C Calc						
Description				SubArea	Sub c	
Pavement and roofs (n=0.90)				0.17 ac	0.9	
Landscaping, lawns (n=0.25)				0.20 ac	0.25	
Directly Connected TC Calc						
Type	**Description**	**Length**	**Slope**	**Coeff**	**Misc**	**TT**
Fixed	City of Redmond					5.00 min
Directly Connected TC						5.00 min

Record Id: B-9377

Design Method				Rational	**IDF Table:**	Seattle
Composite C Calc						
Description				SubArea	Sub c	
Pavement and roofs (n=0.90)				0.16 ac	0.9	
Directly Connected TC Calc						
Type	**Description**	**Length**	**Slope**	**Coeff**	**Misc**	**TT**
Fixed	City of Redmond					5.00 min
Directly Connected TC						5.00 min

Record Id: B-9379

Design Method				Rational	**IDF Table:**	Seattle
Composite C Calc						
Description				SubArea	Sub c	
Pavement and roofs (n=0.90)				0.14 ac	0.9	
Directly Connected TC Calc						
Type	**Description**	**Length**	**Slope**	**Coeff**	**Misc**	**TT**
Fixed	City of Redmond					5.00 min
Directly Connected TC						5.00 min

Record Id: B-9380

Design Method				Rational	IDF Table:	Seattle
Composite C Calc						
Description				SubArea	Sub c	
Pavement and roofs (n=0.90)				0.03 ac	0.9	
Directly Connected TC Calc						
Type	**Description**	**Length**	**Slope**	**Coeff**	**Misc**	**TT**
Fixed	City of Redmond					5.00 min
Directly Connected TC						5.00 min

Record Id: B-9400

Design Method				Rational	IDF Table:	Seattle
Composite C Calc						
Description				SubArea	Sub c	
Pavement and roofs (n=0.90)				0.34 ac	0.9	
Directly Connected TC Calc						
Type	**Description**	**Length**	**Slope**	**Coeff**	**Misc**	**TT**
Fixed	City of Redmond					5.00 min
Directly Connected TC						5.00 min

Record Id: B-9401

Design Method				Rational	IDF Table:	Seattle
Composite C Calc						
Description				SubArea	Sub c	
Pavement and roofs (n=0.90)				0.13 ac	0.9	
Landscaping, lawns (n=0.25)				0.15 ac	0.25	
Directly Connected TC Calc						
Type	**Description**	**Length**	**Slope**	**Coeff**	**Misc**	**TT**
Fixed	City of Redmond					5.00 min
Directly Connected TC						5.00 min

Record Id: B-9402

Design Method				Rational	IDF Table:	Seattle
Composite C Calc						
Description				SubArea	Sub c	
Pavement and roofs (n=0.90)				0.12 ac	0.9	
Landscaping, lawns (n=0.25)				0.14 ac	0.25	
Directly Connected TC Calc						
Type	**Description**	**Length**	**Slope**	**Coeff**	**Misc**	**TT**
Fixed	City of Redmond					5.00 min
Directly Connected TC						5.00 min

Record Id: B-9403

Design Method				Rational	IDF Table:	Seattle
Composite C Calc						
Description				SubArea	Sub c	
Pavement and roofs (n=0.90)				0.10 ac	0.9	
Landscaping, lawns (n=0.25)				0.12 ac	0.25	
Directly Connected TC Calc						
Type	**Description**	**Length**	**Slope**	**Coeff**	**Misc**	**TT**
Fixed	City of Redmond					5.00 min
Directly Connected TC						5.00 min

Record Id: B-9404

Design Method				Rational	IDF Table:	Seattle
Composite C Calc						
Description				SubArea	Sub c	
Pavement and roofs (n=0.90)				0.11 ac	0.9	
Landscaping, lawns (n=0.25)				0.14 ac	0.25	
Directly Connected TC Calc						
Type	**Description**	**Length**	**Slope**	**Coeff**	**Misc**	**TT**
Fixed	City of Redmond					5.00 min
Directly Connected TC						5.00 min

Record Id: B-9405

Design Method				Rational	IDF Table:	Seattle
Composite C Calc						
Description				SubArea	Sub c	
Pavement and roofs (n=0.90)				0.16 ac	0.9	
Landscaping, lawns (n=0.25)				0.19 ac	0.25	
Directly Connected TC Calc						
Type	**Description**	**Length**	**Slope**	**Coeff**	**Misc**	**TT**
Fixed	City of Redmond					5.00 min
Directly Connected TC						5.00 min

Record Id: B-9406

Design Method				Rational	IDF Table:	Seattle
Composite C Calc						
Description				SubArea	Sub c	
Pavement and roofs (n=0.90)				0.22 ac	0.9	
Landscaping, lawns (n=0.25)				0.24 ac	0.25	
Directly Connected TC Calc						
Type	**Description**	**Length**	**Slope**	**Coeff**	**Misc**	**TT**
Fixed	City of Redmond					5.00 min
Directly Connected TC						5.00 min

Record Id: B-DLV*

Design Method				Rational	**IDF Table:**	Seattle
Composite C Calc						
Description				SubArea	Sub c	
Light Forest (n=0.15)				3.00 ac	0.15	
Directly Connected TC Calc						
Type	**Description**	**Length**	**Slope**	**Coeff**	**Misc**	**TT**
Fixed	City of Redmond					5.00 min
Directly Connected TC						5.00 min

*3.00 acres of SubArea have been added to represent 50yr developed flow from the Duke's Landing 50 yrs storm event is roughly 1.4490 cfs

```
Flow Frequency
Flow(cfs)         0701
2 Year    =     0.7153
5 Year    =     0.9304
10 Year   =     1.0829
25 Year   =     1.2875
50 Year   =     1.4490
100 Year  =     1.6183
```

Record Id: Offsite*

Design Method				Rational	**IDF Table:**	Seattle
Composite C Calc						
Description				SubArea	Sub c	
Light Forest (n=0.15)				0.75 ac	0.15	
Directly Connected TC Calc						
Type	**Description**	**Length**	**Slope**	**Coeff**	**Misc**	**TT**
Fixed	City of Redmond					5.00 min
Directly Connected TC						5.00 min

*0.75 acres of SubArea have been added to represent 50yr developed flow from the offsite area of 50 yrs storm event is roughly 0.7416 cfs

```
Flow Frequency
Flow(cfs)         0503
2 Year    =     0.3537
5 Year    =     0.4659
10 Year   =     0.5464
25 Year   =     0.6552
50 Year   =     0.7416
100 Year  =     0.8328
```

ROUTEHYD [] THRU [Dukes Landing] USING [10 yr] AND [Seattle] NOTZERO RELATIVE RATIONAL

Rational Method analysis

Reach ID	Area (ac)	TC (min)	i (in/hr)	Flow (cfs)	Full Q (cfs)	Full ratio	nDepth (ft)	Size	nVel (ft/s)	fVel (ft/s)	CArea
P-9375	0.71	5	2.3949	0.9544	4.7714	0.2	0.3034	12 in Diam	4.7422	6.0751	B-9375
P-9376	1.08	5.3163	2.3183	1.3944	4.7241	0.2952	0.3724	12 in Diam	5.2325	6.0148	B-9376
P-9400	0.34	5	2.3949	0.4526	8.3723	0.0541	0.1579	12 in Diam	5.6901	10.6599	B-9400
P-9405	0.35	5	2.3949	0.4586	16.2253	0.0283	0.1157	12 in Diam	9.0628	20.6587	B-9405
CB-01	3	5	2.3949	1.0777	3.8701	0.2785	0.3609	12 in Diam	4.2198	4.9276	B-DLV
P-9402	3.26	5.1935	2.3472	1.3919	3.8701	0.3596	0.4145	12 in Diam	4.5252	4.9276	B-9402
P-9403	4.98	5.2904	2.3243	2.1802	3.8116	0.572	0.542	12 in Diam	5.0155	4.8531	B-9403;Offsite
P-9404	5.58	5.6626	2.242	2.8328	7.808	0.3628	0.4166	12 in Diam	9.1485	9.9415	B-9404
P-9406	6.04	5.7919	2.2153	3.3706	14.9562	0.2254	0.3227	12 in Diam	15.3776	19.0428	B-9406
P-9401	6.66	5.8916	2.1954	4.0944	12.2872	0.3332	0.3962	12 in Diam	14.1354	15.6445	B-9401
P-9378	6.66	5.9624	2.1815	4.0686	11.6682	0.3487	0.4074	12 in Diam	13.5351	14.8564	
P-9377	7.9	6.0018	2.1739	5.6751	12.4266	0.4567	0.4744	12 in Diam	15.4588	15.822	B-9377
P-9379	8.04	6.0335	2.1679	5.9324	32.7625	0.1811	0.3601	15 in Diam	20.2674	26.6972	B-9379
P-9380	8.07	6.1132	2.1528	5.9494	11.0213	0.5398	0.5236	12 in Diam	14.2904	14.0327	B-9380

ROUTEHYD [] THRU [Dukes Landing] USING [10 yr] AND [Seattle] NOTZERO RELATIVE RATIONAL

HGL Analysis

From Node	To Node	HG El (ft)	App (ft)	Bend (ft)	Junct Loss (ft)	Adjusted HG El (ft)	Max El (ft)
							56.3038
9380	POND	62.3757	------	0.2657	------	62.6414	68.22
9379	9380	82.7581	------	0.4276	------	83.1857	85.16
9377	9379	86.3267	------	0.0164	0.1023	86.4455	89.79
9376	9377	86.6124	0.0229	0.0026	------	86.5921	91.8
9375	9376	87.1378	------	------	------	87.1378	94.15
9378	9377	88.4872	------	0.2346	------	88.7218	91
9401	9378	94.5541	------	0.0226	0.0304	94.6071	96.53
9400	9401	94.6873	------	------	------	94.6873	96.63
9406	9401	108.0024	------	0.0014	------	108.0037	110.27
9404	9406	110.7547	------	0.0029	0.0192	110.7768	119.21
9405	9404	116.6556	------	------	------	116.6556	119.16
9403	9404	111.6569	------	0.3949	------	112.0518	122.57
9402	9403	112.1444	0.0292	0.0277	------	112.1429	122.52
CB-01	9402	112.2159	--na--	--na--	--na--	1.1000	1

ROUTEHYD [] THRU [Dukes Landing] USING [10 yr] AND [Seattle] NOTZERO RELATIVE RATIONAL

Conduit Notes

Reach	HW Depth	HW/D	Q (cfs)	TW Depth	Dc (ft)	Dn (ft)	Comment
P-9380	2.5657	2.5657	5.95	0.9538	0.9538	0.5236	SuperCrit
P-9379	1.7981	1.4385	5.93	2.8314	0.9854	0.3601	SuperCrit
P-9377	2.3367	2.3367	5.68	2.2257	0.9453	0.4744	SuperCrit
P-9376	2.6193	2.6193	1.39	2.4555	0.4998	0.3724	Outlet
P-9375	0.5678	0.5678	0.95	1.3921	0.41	0.3034	SuperCrit
P-9378	1.5872	1.5872	4.07	2.4555	0.8534	0.4074	SuperCrit
P-9401	1.6041	1.6041	4.09	1.8218	0.8556	0.3962	SuperCrit
P-9400	0.3573	0.3573	0.45	1.7271	0.2786	0.1579	SuperCrit
P-9406	1.3824	1.3824	3.37	1.7271	0.7856	0.3227	SuperCrit
P-9404	1.1447	1.1447	2.83	1.2837	0.7221	0.4166	SuperCrit
P-9405	0.2956	0.2956	0.46	0.2806	0.2806	0.1157	SuperCrit
P-9403	0.9569	0.9569	2.18	1.1668	0.631	0.542	SuperCrit
P-9402	1.4474	1.4474	1.39	1.3548	0.4993	0.4145	Outlet
CB-01	1.2559	1.2559	1.08	1.1829	0.4366	0.3609	Outlet

ROUTEHYD [] THRU [Dukes Landing] USING [25 yr] AND [Seattle] NOTZERO RELATIVE RATIONAL

Rational Method analysis

Reach ID	Area (ac)	TC (min)	i (in/hr)	Flow (cfs)	Full Q (cfs)	Full ratio	nDepth	Size	nVel (ft/s)	fVel (ft/s)	CArea
P-9375	0.71	5	2.8938	1.1532	4.7714	0.2417	0.3343	12 in Diam	5.0115	6.0751	B-9375
P-9376	1.08	5.2993	2.8046	1.6869	4.7241	0.3571	0.4128	12 in Diam	5.5144	6.0148	B-9376
P-9400	0.34	5	2.8938	0.5469	8.3723	0.0653	0.1732	12 in Diam	6.0151	10.6599	B-9400
P-9405	0.35	5	2.8938	0.5542	16.2253	0.0342	0.1264	12 in Diam	9.6263	20.6587	B-9405
CB-01	3	5	2.8938	1.3022	3.8701	0.3365	0.3996	12 in Diam	4.4449	4.9276	B-DLV
P-9402	3.26	5.1837	2.8381	1.683	3.8701	0.4349	0.4614	12 in Diam	4.7523	4.9276	B-9402
P-9403	4.98	5.276	2.8112	2.6369	3.8116	0.6918	0.6119	12 in Diam	5.2351	4.8531	B-9403;Offsite
P-9404	5.58	5.6325	2.7139	3.429	7.808	0.4392	0.4639	12 in Diam	9.6143	9.9415	B-9404
P-9406	6.04	5.7556	2.6824	4.0813	14.9562	0.2729	0.3569	12 in Diam	16.2204	19.0428	B-9406
P-9401	6.66	5.8501	2.659	4.959	12.2872	0.4036	0.4424	12 in Diam	14.7912	15.6445	B-9401
P-9378	6.66	5.9178	2.6426	4.9284	11.6682	0.4224	0.4537	12 in Diam	14.2248	14.8564	
P-9377	7.9	5.9552	2.6336	6.875	12.4266	0.5532	0.5316	12 in Diam	16.2021	15.822	B-9377
P-9379	8.04	5.9855	2.6264	7.1872	32.7625	0.2194	0.398	15 in Diam	21.3735	26.6972	B-9379
P-9380	8.07	6.0611	2.6087	7.2091	11.0213	0.6541	0.5896	12 in Diam	14.9628	14.0327	B-9380

ROUTEHYD [] THRU [Dukes Landing] USING [25 yr] AND [Seattle] NOTZERO RELATIVE RATIONAL

HGL Analysis

From Node	To Node	HG El (ft)	App (ft)	Bend (ft)	Junct Loss (ft)	Adjusted HG El (ft)	Max El (ft)
							56.3273
9380	POND	63.2276	------	0.3899	------	63.6175	68.22
9379	9380	83.0773	------	0.6276	------	83.7049	85.16
9377	9379	87.0396	------	0.0241	0.15	87.2136	89.79
9376	9377	87.4566	0.0335	0.0037	------	87.4268	91.8
9375	9376	87.5489	------	------	------	87.5489	94.15
9378	9377	88.8534	------	0.3441	------	89.1975	91
9401	9378	94.9247	------	0.0331	0.0444	95.0022	96.53
9400	9401	95.0167	------	------	------	95.0167	96.63
9406	9401	108.2531	------	0.002	------	108.2551	110.27
9404	9406	110.9351	------	0.0043	0.028	110.9674	119.21
9405	9404	116.6969	------	------	------	116.6969	119.16
9403	9404	111.7961	------	0.0886	------	111.8847	122.57
9402	9403	112.02	0.0427	0.0405	------	112.0178	122.52
CB-01	9402	112.1245	--na--	--na--	--na--	1.1000	1

ROUTEHYD [] THRU [Dukes Landing] USING [25 yr] AND [Seattle] NOTZERO RELATIVE RATIONAL

Conduit Notes

Reach	HW Depth	HW/D	Q (cfs)	TW Depth	Dc (ft)	Dn (ft)	Comment
P-9380	3.4176	3.4176	7.21	0.9773	0.9773	0.5896	SuperCrit
P-9379	2.1173	1.6939	7.19	3.8075	1.0716	0.398	SuperCrit
P-9377	3.0496	3.0496	6.87	2.7449	0.9728	0.5316	SuperCrit
P-9376	3.4635	3.4635	1.69	3.2236	0.5523	0.4128	Outlet
P-9375	2.3469	2.3469	1.15	2.2268	0.4524	0.3343	Outlet
P-9378	1.9534	1.9534	4.93	3.2236	0.913	0.4537	SuperCrit
P-9401	1.9747	1.9747	4.96	2.2975	0.9146	0.4424	SuperCrit
P-9400	2.1375	2.1375	0.55	2.1222	0.3071	0.1732	Outlet
P-9406	1.6331	1.6331	4.08	2.1222	0.8545	0.3569	SuperCrit
P-9404	1.3251	1.3251	3.43	1.5351	0.7919	0.4639	SuperCrit
P-9405	0.3369	0.3369	0.55	0.3093	0.3093	0.1264	SuperCrit
P-9403	1.0961	1.0961	2.64	1.3574	0.6963	0.6119	SuperCrit
P-9402	1.323	1.323	1.68	1.1877	0.5517	0.4614	Outlet
CB-01	1.1645	1.1645	1.3	1.0578	0.4822	0.3996	Outlet

ATTACHMENT 18

ROUTEHYD [] THRU [Dukes Landing] USING [50 yr] AND [Seattle] NOTZERO RELATIVE RATIONAL

Rational Method analysis

Reach ID	Area (ac)	TC (min)	i (in/hr)	Flow (cfs)	Full Q (cfs)	Full ratio	nDepth (ft)	Size	nVel (ft/s)	fVel (ft/s)	CArea
P-9375	0.71	5	3.2778	1.3062	4.7714	0.2738	0.3576	12 in Diam	5.179	6.0751	B-9375
P-9376	1.08	5.2896	3.1788	1.912	4.7241	0.4047	0.4431	12 in Diam	5.6916	6.0148	B-9376
P-9400	0.34	5	3.2778	0.6195	8.3723	0.074	0.1839	12 in Diam	6.2468	10.6599	B-9400
P-9405	0.35	5	3.2778	0.6277	16.2253	0.0387	0.1342	12 in Diam	9.9871	20.6587	B-9405
CB-12	4.5	5	3.2778	2.2125	2.7366	0.8085	0.682	12 in Diam	3.8776	3.4843	B-DLV;Offsite
P-9402	4.76	5.2149	3.2035	2.6205	6.7032	0.3909	0.4346	12 in Diam	8.0021	8.5348	B-9402
P-9403	4.98	5.2711	3.1848	2.9874	3.8701	0.7719	0.6598	12 in Diam	5.4344	4.9276	B-9403
P-9404	5.58	5.6146	3.0771	3.888	10.3418	0.3759	0.4251	12 in Diam	12.2249	13.1675	B-9404
P-9406	6.04	5.7114	3.0486	4.6384	14.9562	0.3101	0.3818	12 in Diam	16.8303	19.0428	B-9406
P-9401	6.66	5.8025	3.0224	5.6368	12.2872	0.4588	0.4757	12 in Diam	15.302	15.6445	B-9401
P-9378	6.66	5.8679	3.004	5.6025	11.6682	0.4802	0.4884	12 in Diam	14.7006	14.8564	
P-9377	7.9	5.9042	2.994	7.8157	12.4266	0.629	0.5751	12 in Diam	16.7188	15.822	B-9377
P-9379	8.04	5.9335	2.9859	8.1709	32.7625	0.2494	0.4254	15 in Diam	22.1808	26.6972	B-9379
P-9380	8.07	6.0064	2.9661	8.1968	11.0213	0.7437	0.6429	12 in Diam	15.3612	14.0327	B-9380

ROUTEHYD [] THRU [Dukes Landing] USING [50 yr] AND [Seattle] NOTZERO RELATIVE RATIONAL

HGL Analysis

From Node	To Node	HG El (ft)	App (ft)	Bend (ft)	Junct Loss (ft)	Adjusted HG El (ft)	Max El (ft)
							56.3356
9380	POND	64.0095	------	0.5039	------	64.5135	68.22
9379	9380	83.3702	------	0.811	------	84.1813	85.16
9377	9379	87.6938	------	0.0311	0.1933	87.9182	89.79
9376	9377	88.2294	0.043	0.0048	------	88.1912	91.8
9375	9376	88.3473	------	------	------	88.3473	94.15
9378	9377	89.538	0.7998	0.4446	------	89.1828	91
9401	9378	95.2646	------	0.0428	0.0572	95.3646	96.53
9400	9401	95.3834	------	------	------	95.3834	96.63
9406	9401	108.483	------	0.0026	------	108.4856	110.27
9404	9406	113.2955	------	0.0055	0.036	113.337	119.21
9405	9404	116.7268	------	------	------	116.7268	119.16
9403	9404	114.0971	------	0.2147	------	114.3118	122.57
9402	9403	114.8009	------	0.1169	------	114.9178	122.52
CB-12	9402	115.2291	------	------	------	115.2291	123.38

ROUTEHYD [] THRU [Dukes Landing] USING [50 yr] AND [Seattle] NOTZERO RELATIVE RATIONAL

Conduit Notes

Reach	HW Depth	HW/D	Q (cfs)	TW Depth	Dc (ft)	Dn (ft)	Comment
P-9380	4.1995	4.1995	8.2	0.9856	0.9856	0.6429	SuperCrit
P-9379	2.4102	1.9282	8.17	4.7035	1.123	0.4254	SuperCrit
P-9377	3.7038	3.7038	7.82	3.2213	0.9829	0.5751	SuperCrit
P-9376	4.2363	4.2363	1.91	3.9282	0.5897	0.4431	Outlet
P-9375	3.1453	3.1453	1.31	2.9912	0.483	0.3576	Outlet
P-9378	5.5468	5.5468	5.6	3.9282	0.9429	0.4884	Outlet
P-9401	2.3146	2.3146	5.64	2.2828	0.944	0.4757	SuperCrit
P-9400	2.5042	2.5042	0.62	2.4846	0.3276	0.1839	Outlet
P-9406	1.863	1.863	4.64	2.4846	0.8959	0.3818	SuperCrit
P-9404	1.5055	1.5055	3.89	1.7656	0.8376	0.4251	SuperCrit
P-9405	0.3668	0.3668	0.63	1.547	0.3299	0.1342	SuperCrit
P-9403	1.1871	1.1871	2.99	1.547	0.7412	0.6598	SuperCrit
P-9402	1.0809	1.0809	2.62	1.4018	0.6941	0.4346	SuperCrit
CB-12	1.5091	1.5091	2.21	1.1978	0.636	0.682	Outlet

Duke's Landing Offsite Analysis
Existing Diversion Manhole (9380) to West Lake Sammamish Parkway (WLSP)

Figure C.6 – Offsite Conveyance System – 9380 to WLSP

Figure C.7 – Offsite Conveyance Drainage Basins – 9380 to WLSP

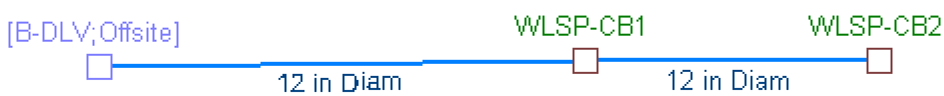
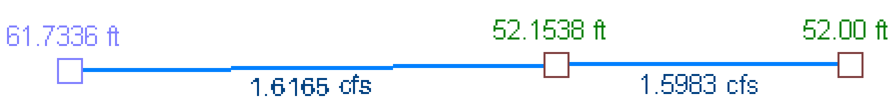


Figure C.8 – Offsite Conveyance Structure Rim Elevations – 9380 to WLSP

Figure C.9 – Offsite Conveyance Water Surface Elevations – 9380 to WLSP



Layout Report: Dukes Landing-WLSP

Event	Precip (in)
2 yr 24 hr	1.85
10 year	2.83
25 year	3.27
100 year	3.79

Reach Records

Record Id: 9380-WLSP

Section Shape:		Circular		
Uniform Flow Method:		Manning's	**Coefficient:**	0.012
Routing Method:		Travel Time Shift	**Contributing Hyd**	
DnNode		WLSP-CB1	**UpNode**	9380-WLSP
Material		unspecified	**Size**	12 in Diam
Ent Losses		Groove End w/Headwall		
Length		77.00 ft	**Slope**	13.25%
Up Invert		61.01 ft	**Dn Invert**	50.81 ft
Conduit Constraints				
Min Vel	**Max Vel**	**Min Slope**	**Max Slope**	**Min Cover**
2.00 ft/s	15.00 ft/s	0.50%	2.00%	3.00 ft
Drop across MH		0.00 ft	**Ex/Infil Rate**	0.00 in/hr

Record Id: WLSP-CB1

Section Shape:		Circular		
Uniform Flow Method:		Manning's	**Coefficient:**	0.012
Routing Method:		Travel Time Shift	**Contributing Hyd**	
DnNode		WLSP-CB2	**UpNode**	WLSP-CB1
Material		unspecified	**Size**	12 in Diam
Ent Losses		Groove End w/Headwall		
Length		32.00 ft	**Slope**	2.53%
Up Invert		50.81 ft	**Dn Invert**	50.00 ft
Conduit Constraints				
Min Vel	**Max Vel**	**Min Slope**	**Max Slope**	**Min Cover**
2.00 ft/s	15.00 ft/s	0.50%	2.00%	3.00 ft
Drop across MH		0.00 ft	**Ex/Infil Rate**	0.00 in/hr

Node Records

Record Id: 9380-WLSP

Descrip:	Flow Splitter	Increment	0.10 ft	
Start El.	61.01 ft	Max El.	64.61 ft	
Void Ratio	100			
Condition	Proposed	Structure Type	CB-TYPE 2-48	
		Channelization	No Special Shape	
Catch	0.00 ft	Bottom Area	12.5664 sf	
MH/CB Type Node				

Record Id: WLSP-CB1

Descrip:	Prototype	Increment	0.10 ft	
Start El.	50.81 ft	Max El.	53.06 ft	
Void Ratio	100			
Condition	Existing	Structure Type	CB-TYPE 1	
		Channelization	No Special Shape	
Catch	0.00 ft	Bottom Area	3.97 sf	
MH/CB Type Node				

Record Id: WLSP-CB2

Descrip:	Prototype	Increment	0.10 ft	
Start El.	50.00 ft	Max El.	52.15 ft	
Void Ratio	100			
Condition	Existing	Structure Type	CB-TYPE 2-48	
		Channelization	No Special Shape	
Catch	0.00 ft	Bottom Area	12.5664 sf	
MH/CB Type Node				

Contributing Drainage Areas

Record Id: B-DLV*

Design Method				Rational	**IDF Table:**	Seattle
Composite C Calc						
Description				SubArea	Sub c	
Light Forest (n=0.15)				3.00 ac	0.15	
Directly Connected TC Calc						
Type	**Description**	**Length**	**Slope**	**Coeff**	**Misc**	**TT**
Fixed	City of Redmond					5.00 min
Directly Connected TC						5.00 min

*3.00 acres of SubArea have been added to represent 50yr developed flow from the Duke's Landing 50 yrs storm event is roughly 1.4490 cfs

Flow Frequency	
Flow(cfs)	0701
2 Year =	0.7153
5 Year =	0.9304
10 Year =	1.0829
25 Year =	1.2875
50 Year =	1.4490
100 Year =	1.6183

Record Id: Offsite*

Design Method				Rational	**IDF Table:**	Seattle
Composite C Calc						
Description				SubArea	Sub c	
Light Forest (n=0.15)				0.75 ac	0.15	
Directly Connected TC Calc						
Type	**Description**	**Length**	**Slope**	**Coeff**	**Misc**	**TT**
Fixed	City of Redmond					5.00 min
Directly Connected TC						5.00 min

*0.75 acres of SubArea have been added to represent 50yr developed flow from the offsite area of 50 yrs storm event is roughly 0.7416 cfs

Flow Frequency	
Flow(cfs)	0503
2 Year =	0.3537
5 Year =	0.4659
10 Year =	0.5464
25 Year =	0.6552
50 Year =	0.7416
100 Year =	0.8328

ROUTEHYD [] THRU [Dukes Landing-WLSP] USING [10 yr] AND [Seattle] NOTZERO RELATIVE RATIONAL

Rational Method analysis

Reach ID	Area (ac)	TC (min)	i (in/hr)	Flow (cfs)	Full Q (cfs)	Full ratio	nDepth (ft)	Size	nVel (ft/s)	fVel (ft/s)	CArea
9380-WLSP	4.5	5	2.3949	1.6165	14.0857	0.1148	0.2295	12 in Diam	11.8823	17.9344	B-DLV;Offsite
WLSP-CB1	4.5	5.108	2.3679	1.5983	6.1558	0.2596	0.3476	12 in Diam	6.5867	7.8378	

HGL Analysis

From Node	To Node	HG El (ft)	App (ft)	Bend (ft)	Junct Loss	Adjusted	Max El (ft)
							52
WLSP-CB1	WLSP-CB2	52.1321	0.0658	0.0004	------	52.0667	53.06
9380-WLSP	WLSP-CB1	61.7336	------	------	------	61.7336	64.61

Conduit Notes

Reach	HW Depth (ft)	HW/D ratio	Q (cfs)	TW Depth (ft)	Dc (ft)	Dn (ft)	Comment
WLSP-CB1	2.1317	2.1317	1.6	2	0.5369	0.3476	Outlet Control
9380-WLSP	0.7236	0.7236	1.62	1.2567	0.5401	0.2295	SuperCrit flow, Inlet end controls

ROUTEHYD [] THRU [Dukes Landing-WLSP] USING [25 yr] AND [Seattle] NOTZERO RELATIVE RATIONAL

Rational Method analysis

Reach ID	Area (ac)	TC (min)	i (in/hr)	Flow (cfs)	Full Q	Full ratio	nDepth	Size	nVel (ft/s)	fVel (ft/s)	CArea
9380-WLSP	4.5	5	2.8938	1.9533	14.0857	0.1387	0.2514	12 in Diam	12.6208	17.9344	B-DLV;Offsite
WLSP-CB1	4.5	5.1017	2.8626	1.9323	6.1558	0.3139	0.3836	12 in Diam	6.9668	7.8378	

HGL Analysis

From Node	To Node	HG El (ft)	App (ft)	Bend (ft)	Junct Loss	Adjusted	Max El (ft)
							52
WLSP-CB1	WLSP-CB2	52.1929	0.096	0.0005	------	52.0974	53.06
9380-WLSP	WLSP-CB1	61.8367	------	------	------	61.8367	64.61

Conduit Notes

Reach	HW Depth (ft)	HW/D ratio	Q (cfs)	TW Depth (ft)	Dc (ft)	Dn (ft)	Comment
WLSP-CB1	2.1925	2.1925	1.93	2	0.5929	0.3836	Outlet Control
9380-WLSP	0.8267	0.8267	1.95	1.2874	0.5962	0.2514	SuperCrit flow, Inlet end controls

ROUTEHYD [] THRU [Dukes Landing-WLSP] USING [50 yr] AND [Seattle] NOTZERO RELATIVE RATIONAL

Rational Method analysis

Reach ID	Area (ac)	TC (min)	i (in/hr)	Flow (cfs)	Full Q (cfs)	Full ratio	nDepth (ft)	Size	nVel (ft/s)	fVel (ft/s)	CArea
9380-WLSP	4.5	5	3.2778	2.2125	14.0857	0.1571	0.2678	12 in Diam	13.0844	17.9344	B-DLV;Offsite
WLSP-CB1	4.5	5.0981	3.2433	2.1892	6.1558	0.3556	0.4118	12 in Diam	7.1787	7.8378	

HGL Analysis

From Node	To Node	HG El (ft)	App (ft)	Bend (ft)	Junct Loss	Adjusted	Max El (ft)
							52
WLSP-CB1	WLSP-CB2	52.2475	0.1232	0.0007	------	52.125	53.06
9380-WLSP	WLSP-CB1	61.9154	------	------	------	61.9154	64.61

Conduit Notes

Reach	HW Depth	HW/D	Q (cfs)	TW Depth	Dc (ft)	Dn (ft)	Comment
WLSP-CB1	2.2471	2.2471	2.19	2	0.6324	0.4118	Outlet Control
9380-WLSP	0.9054	0.9054	2.21	1.315	0.636	0.2678	SuperCrit flow, Inlet end controls

STREET, STORM DRAIN, WATER (PRESSURE ZONE 350) AND SEWER (METRO SEWER MANHOLE #R19D-35) IMPROVEMENT PLANS TO SERVE

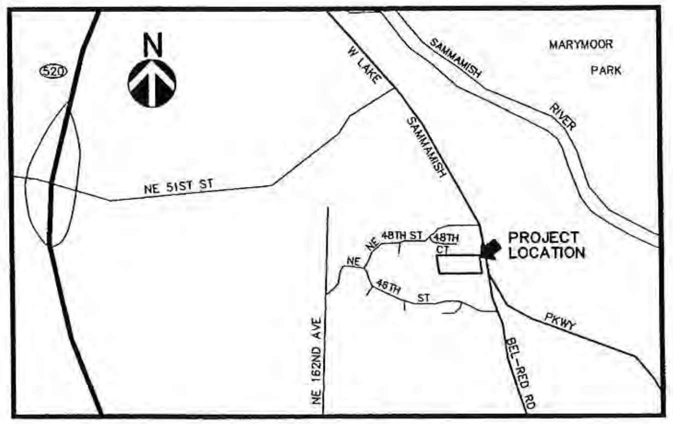
MARYMOOR HILL SHORT PLAT

CITY OF REDMOND

PORTION OF N.W. 1/4, SECTION 13, TWP. 25 N. RGE. 5 E., W.M., KING COUNTY, WA

FILE# SPL-99-003

RECORD DRAWINGS



VICINITY MAP

SCALE: NTS

GENERAL NOTES

1) THE EXISTING ZONE CLASSIFICATION IS "R4" AND NO CHANGES TO ZONING ARE PROPOSED.

2) SITE BENCH MARK – TOP OF SW ANCHOR BOLT FOR TRAFFIC LIGHT POLE ON WEST SIDE OF BELL-RED ROAD 160 FEET SOUTH OF PROJECT SITE. LABELED "BM 331" ELEV. = 67.11'.

3) THE SOURCE FOR BOTH THE WATER AND SEWER IS THE CITY OF REDMOND.

4) THERE ARE NOT ANY SIGNIFICANT EXISTING GRADES OF 40% OR GREATER ON THIS SITE. AS SITE IS DEVELOPED SMALL AREAS WILL HAVE GREATER THAN 40% BUT WILL BE APPROPRIATELY STABILIZED, I.E. ROCKERYS ETC..

5) SURVEYOR AND ENGINEER: DAVID EVANS AND ASSOCIATES, INC.
RICHARD DICKMAN, P.L.S., J.M. TED EVERAGE, P.E.
415 118TH AVE SE
BELLEVUE WA, 98005-3518
(425)519-6500

BUILDER AND DEVELOPER: LAKEVILLE CONSTRUCTION
SUSAN HO
12501 BEL-RED ROAD SUITE 102
BELLEVUE WA, 98005
(425)453-8388

ARCHITECT: FREIHEIT AND HO ARCHITECTS, INC.
LARRY HO
10940 NE 33RD PL SUITE 202
BELLEVUE WA, 98004
(425)828-6899

6) VERTICAL DATUM – CITY OF REDMOND BENCH MARKS RED 77 1989 AND RD 5.

7) ALL EXISTING STRUCTURES SHOWN ARE TO REMAIN.

8) EXISTING UNDERGROUND UTILITIES SHOWN ARE PER CITY OF REDMOND AS-BUILTS.

9) LOT COVERAGE CALCULATIONS:
16 LOTS MAXIMUM
80% = MINIMUM = 12.8 LOTS => 13 LOTS
13 LOTS SHOWN (INCLUDING SHADOW PLAT LOTS)
LOT AVERAGE = 9803 SQ. FT.

10) BOUNDARY IS PER THE RECORD OF SURVEY AS PREPARED BY C&C SURVEYING INC. AS FILED IN VOL. 127 OF SURVEYS, PAGE 214.

11) ALL LOTS WILL PROVIDE STRUCTURES WITH AUTOMATIC FIRE SPRINKLERS DESIGNED TO NFPA 13D AND REDMOND FIRE DEPARTMENT STANDARDS. BACK FLOW PREVENTION WILL BE REQUIRED WITHIN EACH STRUCTURE AND THE EXISTING STRUCTURES WILL ALSO HAVE AN AUTOMATIC FIRE SPRINKLERS DESIGNED TO NFPA 13D AND REDMOND FIRE DEPARTMENT STANDARDS. THE DESIGN OF THOSE SYSTEMS WILL BE REVIEWED UNDER A REMODEL PERMIT. THE EXISTING STRUCTURES SHALL HAVE THE FIRE SPRINKLERS INSTALLED AND ACCEPTANCE TESTED PRIOR TO THE ISSUANCE OF ANY CERTIFICATES OF OCCUPANCY FOR ANY NEW HOMES ON THE PLAT.

12) ROAD 'B' WILL BE DESIGNATED AS FIRE LANE, WITH CURB MARKINGS TO CITY OF REDMOND STANDARDS.

13) NO LOTS SHALL BE PERMITTED DIRECT ACCESS TO WEST LAKE SAMMAMISH PARKWAY OR BEL-RED ROAD.

14) THE LOCATION OF THE NEAREST FIRE HYDRANT TO THE NORTH IS 300' ± FEET FROM THE NORTH PROPERTY LINE. THE NEAREST FIRE HYDRANT SOUTH IS 290' ± FEET FROM OF THE SOUTH PROPERTY LINE.

15) ALL EXISTING ON SITE OVERHEAD UTILITIES SHALL BE RELOCATED UNDERGROUND, INCLUDING FRONTAGE UTILITIES ALONG WEST LAKE SAMMAMISH PARKWAY.

16) FIRE HYDRANTS SHALL BE IN PLACE WITH 5" LOCKING STORZ ADAPTER AND SERVICEABLE PRIOR TO COMBUSTIBLE CONSTRUCTION.

17. CHICAGO TITLE INSURANCE COMPANY, TITLE ORDER NO. 542523, DATED MARCH 31, 1999, USED FOR DELINEATION OF EASEMENTS OF RECORD. NO FURTHER SEARCH INTO THE RECORD WAS REQUESTED OR PERFORMED.

THE FOLLOWING NOTES PERTAIN TO SCHEDULE 'B', EXCEPTION, AS DISCLOSED WITHIN SAID REPORT.

18. PARAGRAPHS 1 AND 5. PARAGRAPH 1 PERTAINS TO A 20-FOOT WIDE INGRESS, EGRESS AND UTILITY EASEMENT BEING THE DRIVEWAY AS LOCATED DECEMBER 6, 1967 AND MAY 3, 1968, AS DISCLOSED BY INSTRUMENT FILED UNDER AUDITOR'S FILE NO. 6283500 AND RECORDING NOS. 7301050191 AND 7708020790. THE DECLARATION OF EASEMENT AS DISCLOSED BY INSTRUMENT UNDER RECORDING NO. 9709191047 (PARAGRAPH 5) FOR INGRESS, EGRESS AND UTILITIES DOES 1) SUPERSEDE THOSE EASEMENTS DISCLOSED BY PARAGRAPH NO. 1 AND 2) LOCATE THE EASEMENT AS DEFINED BY EXHIBIT 'B' WHICH IS THE LOCATION OF THE DRIVEWAY AS NOW EXISTING. (IT IS THE SURVEYOR'S OPINION THAT THE DRIVE IS IN THE SAME LOCATION). THIS EASEMENT WILL BE VACATED CONCURRENTLY WITH THE RECORDING OF THE FINAL SHORT PLAT MYLAR.

BASIS OF BEARING

NAD-83(91) – CITY OF REDMOND HORIZONTAL CONTROL COORDINATES "A" MONUMENTS:

CITY OF REDMOND: A-129 – AT MAJOR JUNCTION OF W. LAKE SAMMAMISH PARKWAY AT BELLEVUE-REDMOND RD, CAP IN EDGE OF CONCRETE WALKWAY AT WEST END OF SOUTH CROSSWALK 10 FT FROM SIGNAL LITE BASE.
N: 240016.14 E: 1324114.89

CITY OF REDMOND: A-130 – BEL-RED ROAD AT NE 44TH WAY, ENTRANCE TO "COUNTY CREEK", SW SIDE OF ROAD, CAP IN CONCRETE CURB RETURN AT SW EDGE OF WALKWAY SE RETURN.
N: 239318.32 E: 1324331.02

BENCHMARK AND DATUM

CITY OF REDMOND BENCH MARK 77, 1989
0.25 FOOT DIA. BRASS CAP SET IN CONCRETE BASE FOR CROSSWALK LIGHT AT NORTHWEST CORNER OF INTERSECTION OF NE 51st ST AND W. LAKE SAMMAMISH PARKWAY.
STAMPED – BM77 C.O.R.
ELEV. = 48.219 FEET

SITE BENCH MARK :
TOP OF SW ANCHOR BOLT FOR TRAFFIC LIGHT POLE ON WEST SIDE OF BEL-RED ROAD 160 FEET SOUTH OF PROJECT SITE. LABELED "BM 331" ELEVATION = 67.11

VERTICAL DATUM – CITY OF REDMOND.

CITY OF REDMOND BENCH MARK RD5, 1989
BRASS DISK SET IN NORTH EDGE OF CONCRETE FOOTING FOR CHIMNEY ON WEST SIDE OF HOUSE AT 5050 W. LK. SAMMAMISH PARKWAY N.E.
STAMPED – RD5 RESET 1965 U.S.C. & G.S.
ELEV. = 50.729 FEET

LEGAL DESCRIPTION

LAND DESCRIPTION OF RECORD

PARCEL A: PARCEL No. 5556300065

THAT PORTION OF LOT 1, BLOCK 2, MIRAVISTA, ACCORDING TO THE PLAT THEREOF, RECORDED IN VOLUME 28 OF PLATS, PAGE(S) 35, IN KING COUNTY, WASHINGTON, DESCRIBED AS FOLLOWS:

BEGINNING AT THE MOST EASTERLY CORNER OF SAID LOT 1;
THENCE SOUTH 88°57'25" WEST ALONG THE SOUTH LINE THEREOF 576.89 FEET;
THENCE NORTH 5°19'43" WEST 156.11 FEET TO THE SOUTHWEST CORNER OF THAT TRACT OF LAND CONVEYED BY STATUTORY WARRANTY DEED RECORDED UNDER RECORDING NUMBER 6283500;

THENCE NORTH 88°59'12" EAST ALONG SAID SOUTH LINE OF SAID CONVEYED TRACT TO THE EAST LINE OF SAID LOT 1;
THENCE SOUTHERLY ALONG THE EAST LINE OF SAID LOT 1 TO THE POINT OF BEGINNING.

PARCEL B: PARCEL No. 5556300066

THAT PORTION OF LOT 1, BLOCK 2, MIRAVISTA, ACCORDING TO THE PLAT THEREOF, RECORDED IN VOLUME 28 OF PLATS, PAGE (S) 35, IN KING COUNTY WASHINGTON, DESCRIBED AS FOLLOWS:

BEGINNING AT THE MOST EASTERLY CORNER OF SAID LOT 1;
THENCE SOUTH 88°57'25" WEST ALONG THE SOUTH LINE THEREOF 576.89 FEET;
THENCE NORTH 5°19'43" WEST 156.11 FEET TO THE SOUTHWEST CORNER OF THAT TRACT OF LAND CONVEYED BY STATUTORY WARRANTY DEED RECORDED UNDER RECORDING NUMBER 6283500; AND THE TRUE POINT OF BEGINNING;
THENCE NORTH 05°19'43" WEST A DISTANCE OF 126.03 FEET, MORE OR LESS, TO THE NORTH LINE OF SAID LOT 1;
THENCE NORTH 89°01'00" EAST A DISTANCE OF 556.76 FEET TO THE NORTHEAST CORNER OF SAID LOT 1;
THENCE SOUTHERLY ALONG THE EAST LINE OF SAID LOT 1 TO A POINT WHICH BEARS NORTH 88°59'12" EAST FROM THE TRUE POINT OF BEGINNING;
THENCE SOUTH 88°59'12" WEST TO THE TRUE POINT OF BEGINNING;

TOGETHER WITH THAT PORTION OF THE VACATED 30 FOOT STRIP ADJOINING SAID LOT 1 ON THE NORTH LYING EASTERLY OF THE NORTHERLY PROLONGATION OF THE WEST LINE OF THE ABOVE DESCRIBED TRACT TO THE NORTH LINE OF SAID 30 FOOT STRIP;

CALL BEFORE YOU DIG
Call: TOLL FREE
1-800-424-5555

NOTE:

1) THIS DEVELOPMENT SHALL BE CONSTRUCTED WITH THE YEAR 2000 STANDARD SPECIFICATIONS AND DETAILS.

2) THE SOIL ENGINEER EMPLOYED BY THE DEVELOPER SHALL VERIFY AND SUBSEQUENTLY ADVISE THE CITY OF REDMOND THAT THE INSTALLATION OF THE PAVING SECTION(S) CONFIRMS TO HIS DESIGN. THE PROJECT WILL NOT BE ACCEPTED UNTIL THE SOILS ENGINEER PROVIDES THE CITY OF REDMOND WITH WRITTEN DOCUMENTATION OF THIS INFORMATION.

TYPICAL LEGEND

EXISTING / PROPOSED

- PC OR PT MONUMENT
- ROAD R.O.W. CENTERLINE
- LOT LINES
- MINOR CONTOUR LINES (680)
- MAJOR CONTOUR LINES (680)
- TYPE I 48" SAN. SEWER MANHOLE W/FLOW DIRECTION
- PVC SEWER PIPE (SS)
- SANITARY SEWER STUBOUT (S.S.S.O.) (SSSO)
- D.I.P. WATER LINE (W)
- CONCRETE THRUST BLOCK
- WATERLINE GATE VALVE
- 5/8" X 3/4" WATER METER ASSEMBLY PER CITY STANDARDS WITH 2" SUPPLY FROM MAIN.
- 1 1/2" FIRE SPRINKLER METER
- FIRE HYDRANT
- WATERLINE TEE
- STORM DRAIN LINE (SD)
- TYPE I CATCHBASIN W/FLOW DIRECTION
- TYPE II CATCHBASIN
- UTILITY EASEMENT
- WHEEL CHAIR RAMP
- SILT FENCE
- CATCH BASIN PROTECTION
- INTERCEPTOR DITCH
- CONCRETE PAVEMENT
- ASPHALT PAVEMENT
- PAVEMENT RECONSTRUCTION

SHEET INDEX

AS-BUILT CERTIFICATE

I HEREBY CERTIFY THAT THIS AS-BUILT SURVEY CORRECTLY REPRESENTS A SURVEY MADE UNDER MY DIRECTION AND REPRESENTS THE ACTUAL SITE CONDITIONS ON JANUARY 27, 2003.

RICHARD A. DICKMAN PLS 26252 — DATE 7/10/04

RICHARD A. DICKMAN — STATE OF WASHINGTON — REGISTERED PROFESSIONAL LAND SURVEYOR — EXPIRES 5/21/06

FILE# SPL-99-003

02-1000

APPROVED FOR CONSTRUCTION

FOR: DAVE RHODES
DIRECTOR OF PUBLIC WORKS
CITY OF REDMOND

DATE: ______
PLAN CHECK ENGINEER: ______
STORM: ______
UTILITY: ______
FIRE: ______
TRANSPORTATION: ______
PLANNING: ______

THIS APPROVAL IS FOR DESIGN CONCEPT ONLY. THESE PLANS APPEAR TO BE IN CONFORMANCE WITH CITY OF REDMOND DESIGN STANDARDS FOR CONSTRUCTION. THIS APPROVAL SHALL NOT BE CONSTRUED AS AUTHORIZING CONSTRUCTION NOT IN ACCORDANCE WITH APPLICABLE CITY STANDARDS. THE CITY PRESERVES THE RIGHT TO REQUIRE REVISIONS TO THE APPROVED PLANS TO ASSURE CONFORMANCE WITH CITY OF REDMOND DESIGN STANDARDS FOR CONSTRUCTION AT ANY TIME THAT IS DISCOVERED THAT THE PROPOSED CONSTRUCTION DOES NOT OTHERWISE MEET THE APPLICABLE CONSTRUCTION STANDARDS. THE OWNER IS REQUIRED TO PROVIDE DESIGNS AND PLANS IN ACCORDANCE WITH APPLICABLE CITY STANDARDS AND ASSURE THAT CONSTRUCTION IS ACCOMPLISHED IN ACCORDANCE WITH THOSE STANDARDS. THE OWNER AND/OR DESIGN ENGINEER AND/OR DEVELOPER MAY BE REQUIRED TO MAKE NECESSARY APPROVED FIELD REVISIONS TO CORRECT ANY ERRORS OR OMISSIONS FOUND TO EXIST ON APPROVED PLAN.

LAKEVILLE CONSTRUCTION
Marymoor Hill Short Plat
COVER SHEET
City of Redmond
CONSTRUCTION PLANS

DAVID EVANS AND ASSOCIATES, INC.
415 - 118TH AVENUE S.E.
BELLEVUE, WA. 98005-3518 (425) 519-6500

REVISIONS	
REVISED PER CITY COMMENTS	07-02-04
PREPARED RECORD DRAWINGS	01-09-03

1 OF 16 SHEETS

SCALE: 1" = 20' DESIGN: RABR
DATE: 5/15/01 DRAWN: RABR
FILE: LKVL0003 CHECKED: JTE

07/03/04 4:21pm

CONSTRUCTION SEQUENCE

1. PRE-CONSTRUCTION MEETING
2. INSTALL FENCED CLEARING LIMITS
3. INSTALL CATCH BASIN PROTECTION.
4. GRADE AND INSTALL CONSTRUCTION ENTRANCES.
5. INSTALL PERIMETER PROTECTION (SILT FENCE, BRUSH BARRIER, ETC.)
6. CLEAR AND GRUB.
7. CONSTRUCT SEDIMENT POND (CONVERTED DETENTION POND.)
8. GRADE AND STABILIZE CONSTRUCTION ROADS.
9. CONSTRUCT SURFACE WATER CONTROLS (INTERCEPTOR DIKES, PIPE SLOPE DRAINS, ETC.) SIMULTANEOUSLY WITH CLEARING AND GRADING FOR PROJECT DEVELOPMENT.
10. CONSTRUCT THE STORM DRAIN CONVEYANCE SYSTEM AND OTHER UTILITIES AS SHOWN ON THE PLAN. INSTALL AND MAINTAIN CATCH BASIN SEDIMENT TRAPS/INSERTS PER DETAIL ON ALL CATCH BASINS LOCATED WITHIN THE LIMITS OF THE CONSTRUCTION ARE, WHETHER NEW OR EXISTING FACILITIES.
11. INSTALL CURBS, SIDEWALKS AND PAVEMENT.
12. MAINTAIN EROSION CONTROL MEASURES IN ACCORDANCE WITH C.O.R. STANDARDS AND MANUFACTURER'S RECOMMENDATIONS.
13. RELOCATE EROSION CONTROL MEASURES OR INSTALL NEW MEASURES SO THAT AS SITE CONDITIONS CHANGE THE EROSION AND SEDIMENT CONTROL IS ALWAYS IN ACCORDANCE WITH THE C.O.R. TESC MINIMUM REQUIREMENTS.
14. COVER ALL AREAS THAT WILL BE UNWORKED FOR MORE THAN SEVEN DAYS DURING THE DRY SEASON OR TWO DAYS DURING THE WET SEASON WITH STRAW, WOOD FIBER MULCH, COMPOST, AND PLASTIC SHEETING OR EQUIVALENT.
15. STABILIZE ALL AREAS THAT REACH FINAL GRADE WITHIN SEVEN DAYS.
16. SEED OR SOD ANY AREAS TO REMAIN UNWORKED FOR MORE THAN 30 DAYS.
17. TEST ALL IMPROVEMENTS AS REQUIRED BY THE PLANS AND THE AGENCY'S SPECIFICATIONS.
18. PRE-FINAL THE SITE WITH CITY OF REDMOND.
19. ONCE ALL POSSIBILITY OF EROSION HAS PASSED AND SITE IS APPROVED BY C.O.R. INSPECTOR, BMP'S MAY BE REMOVED.
20. CORRECT ALL PUNCH LIST ITEMS IDENTIFIED.
21. FINAL INSPECTION.

NOTES

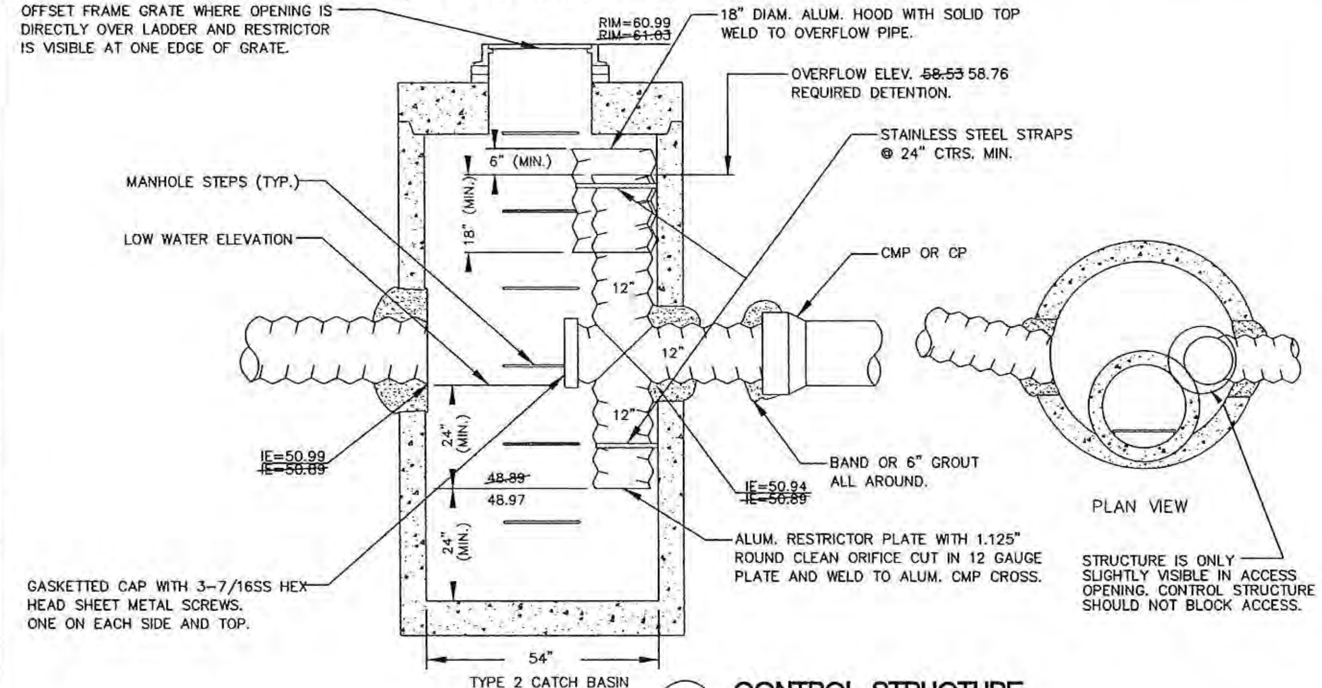
THESE INSTRUCTIONS AND DIRECTIONS ARE THE MINIMUM NECESSARY. MORE STRINGENT MEASURES MAY BE NECESSARY AS SEASONAL CONDITIONS, THE CONTRACTOR'S METHODS AND THE STATE OF CONSTRUCTION MAY DICTATE. THE CONTRACTOR SHALL ADDRESS THESE CONDITIONS AND PROVIDE ADDITIONAL EROSION CONTROL MEASURES AT NO ADDITIONAL COST TO THE OWNER.

CLEARING, GRADING, TEMPORARY EROSION CONTROL

1. ALL CLEARING AND GRADING WORK SHALL MEET THE REQUIREMENTS AS SET FORTH IN SECTION 20E.90.10 OF THE REDMOND COMMUNITY DEVELOPMENT GUIDE OR MORE SPECIFICALLY THE STORMWATER AND EROSION CONTROL TECHNICAL NOTEBOOK, ISSUE NO. 3 OR LATEST EDITION.
2. A PRECONSTRUCTION MEETING SHALL BE HELD WITH THE CONSTRUCTION DIVISION, AND ALL REQUIRED PERMITS MUST BE APPROVED PRIOR TO START OF CONSTRUCTION.
3. TEMPORARY EROSION/SEDIMENT CONTROLS SHALL BE INSTALLED AND OPERATION PRIOR TO ANY GRADING OR EXTENSIVE LAND CLEARING. THESE CONTROLS MUST BE SATISFACTORILY MAINTAINED UNTIL CONSTRUCTION AND LANDSCAPING ARE COMPLETE.
4. ADDITIONAL EROSION CONTROL MEASURES MAY BE REQUIRED BY THE CITY OF REDMOND CONSTRUCTION INSPECTOR DEPENDING ON SITE AND WEATHER CONDITIONS. WORK PERFORMED DURING THE RAINY SEASON, OCTOBER 1ST THROUGH APRIL 30TH, SHALL REQUIRE A PHASING PLAN TO LIMIT THE EXTENT OF SOIL EXPOSURE.
5. AT THE DISCRETION OF THE PUBLICS WORKS DIRECTOR, WORK MAY BE SUSPENDED DURING PERIODS OF INCLEMENT WEATHER TO REDUCE ACTUAL OR POTENTIAL EROSION AND/OR SEDIMENTATION.
6. WHEN WORK IS STOPPED OR COMPLETED IN AN AREA, THE CITY CONSTRUCTION INSPECTOR MAY REQUIRE ADDITIONAL EROSION CONTROL, INCLUDING SEEDING OR OTHER MEASURES.
7. ALL WATER RUNOFF FROM ANY CONSTRUCTION SITE BEING DISCHARGED TO A CITY STORMWATER SYSTEM SHALL NOT EXCEED TURBIDITY VALUES OF 50 NTU'S AND IN ADDITION SHALL MEET THE REQUIREMENTS OF THE CLEAN WATERS ACT 1972, WASHINGTON ADMINISTRATIVE CODE 173, AND RCW 90.48.
8. LOCATIONS SHOWN OF EXISTING UTILITIES ARE APPROXIMATE. IT SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR TO VERIFY THE CORRECT LOCATIONS SO AS TO AVOID DAMAGE OR DISTURBANCE.
9. KEEP OFF-SITE STREETS CLEAN AT ALL TIMES. FLUSHING STREETS SHALL NOT BE ALLOWED. ALL STREETS SHALL BE SWEPT.
10. ALL GROUND COVER IS TO REMAIN UNDISTURBED OUTSIDE OF CLEARING AREAS.
11. FLOW FROM IMPERVIOUS SURFACES (ROOF, STREETS, DRIVEWAYS, ETC.) SHALL BE CONNECTED TO A DRAINAGE SYSTEM AS SOON AS POSSIBLE.
12. CLEARING LIMITS SHALL BE FIELD LOCATED BY A LICENSED LAND SURVEYOR AND FENCED WITH A MINIMUM 42-INCH HIGH ORANGE SAFETY FENCE SUPPORTED BY WOOD OR METAL POSTS.
13. TREES TO REMAIN SHALL BE MARKED WITH FLAGGING, AND FENCED AT 5 FEET OUTSIDE OF THE DRIP LINE WHEN ADJACENT TO AREAS TO BE CLEARED.
14. TRUCK AND VEHICULAR WHEEL WASHES SHALL BE REQUIRED IF DEEMED NECESSARY BY THE CITY.

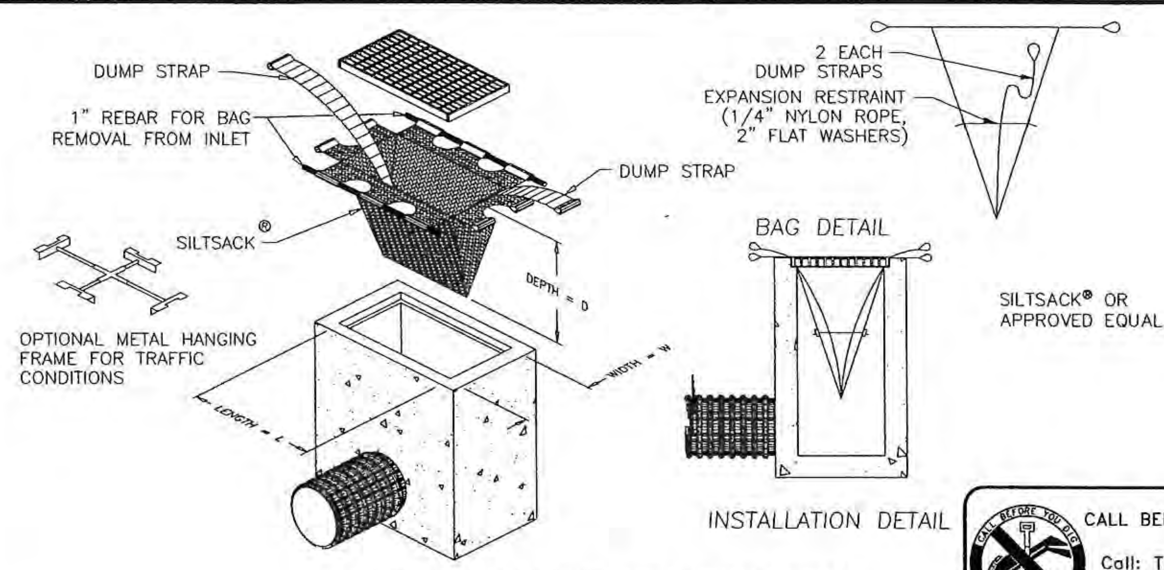
STORMWATER SYSTEM PLANS

1. A PRE-CONSTRUCTION MEETING IS REQUIRED BEFORE ANY WORK COMMENCES ON THIS SITE.
2. ALL SURVEYING OF CLEARING LIMITS AND CONSTRUCTION STAKING SHALL BE DONE BY A LICENSED CIVIL ENGINEER OR LICENSED LAND SURVEYOR.
3. BEFORE MASS CLEARING OF THE SITE CLEARING LIMITS AND INITIAL EROSION CONTROL MEASURES SHALL BE INSPECTED BY THE CITY.
4. ANY WORK WITHIN AN EXISTING STREET SHALL NOT COMMENCE UNTIL THE CONTRACTOR PREPARES A TRAFFIC CONTROL PLAN AND RECEIVES APPROVAL OF THE PLAN FROM THE CITY TRANSPORTATION DIVISION AND CITY CONSTRUCTION INSPECTOR.
5. AT ALL TIMES DURING CONSTRUCTION, THE APPROVED CONSTRUCTION DRAWINGS AND THE CITY OF REDMOND STANDARD SPECIFICATIONS AND DESIGN DETAILS SHALL BE ON SITE.
6. CITY OF REDMOND SURVEY MONUMENTS THAT ARE DISTURBED DURING CONSTRUCTION SHALL BE REPLACED AS DIRECTED BY THE CITY CONSTRUCTION INSPECTIONS.
7. STENCIL ALL ON SITE STORM INLETS WITH "DUMP NO WASTE DRAINS TO STREAM, GROUND WATER OR LAKE".
8. PIPE BEDDING REQUIREMENTS SHALL CONFORM TO COR STANDARD DETAIL 201.
9. THE SOIL ENGINEER EMPLOYED BY THE DEVELOPER SHALL VERIFY AND SUBSEQUENTLY ADVISE THE CITY THAT THE INSTALLATION OF THE PAVING SECTION(S) CONFORMS TO HIS DESIGN. THE PROJECT WILL NOT BE ACCEPTED UNTIL THE SOILS ENGINEER PROVIDES THE CITY WITH WRITTEN DOCUMENTATION OF THIS INFORMATION.
10. CONTRACTOR IS RESPONSIBLE FOR INSTALLING ALL SIGNS AND CHANNELIZATION PER CITY OF REDMOND STANDARDS. CONTRACTOR SHALL LAY OUT ALL SIGNS AND CHANNELIZATION, AND THEN CONTACT THE TRANSPORTATION DIVISION AT 556-2854 48 HOURS IN ADVANCE OF INSTALLATION TO VERIFY LAYOUT.
11. ALL NECESSARY SIGNS AND MARKINGS ON-SITE, ALONG PROPERTY FRONTAGE, AND AT SPECIFICALLY DESIGNATED OFF-SITE LOCATIONS SHALL BE PROVIDED BY THE APPLICANT AS REQUIRED BY THE TRANSPORTATION DIVISION WHETHER OR NOT THESE ARE INDICATED ON THE CONSTRUCTION DRAWINGS.



1/3 CONTROL STRUCTURE

(COR DETAIL #610) NTS



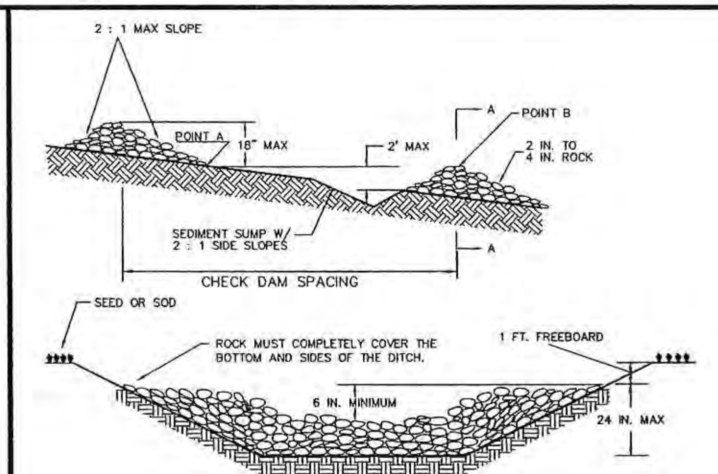
2/3 CATCH BASIN PROTECTION DETAIL

NTS

CALL BEFORE YOU DIG

Call: TOLL FREE

1-800-424-5555

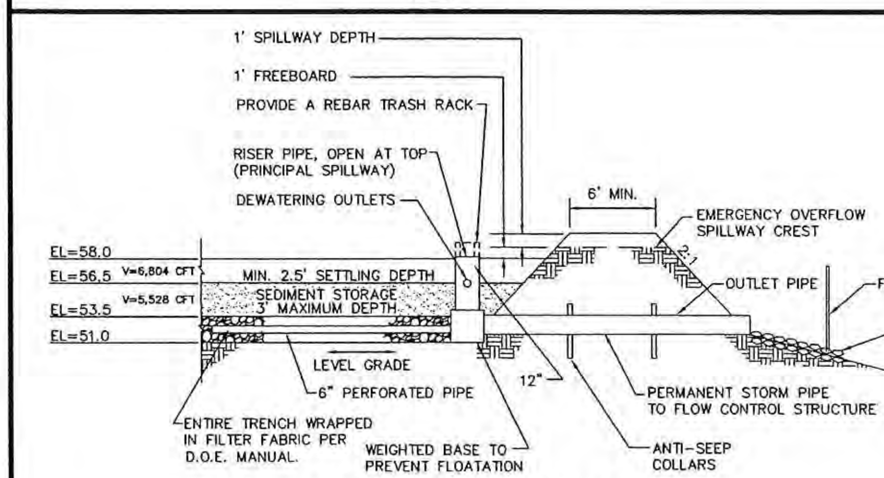


NOTES :

1. 50 FT MAXIMUM SPACING BETWEEN CHECK DAMS.
2. ANY SEDIMENT DEPOSITION OF MORE THAN 0.5 FT. IN DEPTH SHALL BE REMOVED SO THAT THE CHANNEL IS RESTORED TO ITS ORIGINAL DESIGN CAPACITY.
3. THE CHANNEL SHALL BE EXAMINED FOR SIGNS OF SCOURING AND EROSION OF THE BED AND BANKS. IF SCOURING OR EROSION HAS OCCURRED, AFFECTED AREAS SHALL BE PROTECTED BY RIP-RAP, AN EROSION CONTROL BLANKET, OR A NET.
4. A 6-INCH SUMP SHALL BE PROVIDED IMMEDIATELY UPSTREAM OF CHECK DAM.
5. CHECK DAMS SHALL BE CONSTRUCTED SO THAT POINTS A AND B ARE OF EQUAL ELEVATION.
6. SANDBAG CHECK DAMS MAY BE SUBSTITUTED FOR ROCK CHECK DAMS AS APPROVED BY THE CLEARING AND GRADING INSPECTOR.

3/3 CHECK DAM DETAIL

NTS



4/3 RISER AND PERFORATED PIPE DETAIL

NTS

AS-BUILT CERTIFICATE

I HEREBY CERTIFY THAT THIS AS-BUILT SURVEY CORRECTLY REPRESENTS A SURVEY MADE UNDER MY DIRECTION AND REPRESENTS THE ACTUAL SITE CONDITIONS ON JANUARY 27, 2003.

RICHARD A. DICKMAN PLS 26252 — DATE 7/1/04

RICHARD A. DICKMAN · STATE OF WASHINGTON · 26252 · REGISTERED · PROFESSIONAL LAND SURVEYOR · EXPIRES 5/21/06

NOTE:

1. THIS DEVELOPMENT SHALL BE CONSTRUCTED WITH THE YEAR 2000 STANDARD SPECIFICATIONS AND DETAILS.
2. MAXIMUM OPEN TRENCH LENGTH IS 300'.

FILE# SPL-99-003

02-1001

APPROVED FOR CONSTRUCTION

FOR: DAVE RHODES
DIRECTOR OF PUBLIC WORKS
CITY OF REDMOND

DATE: ____
PLAN CHECK ENGINEER: ____
STORM: ____
UTILITY: ____
FIRE: ____
TRANSPORTATION: ____
PLANNING: ____

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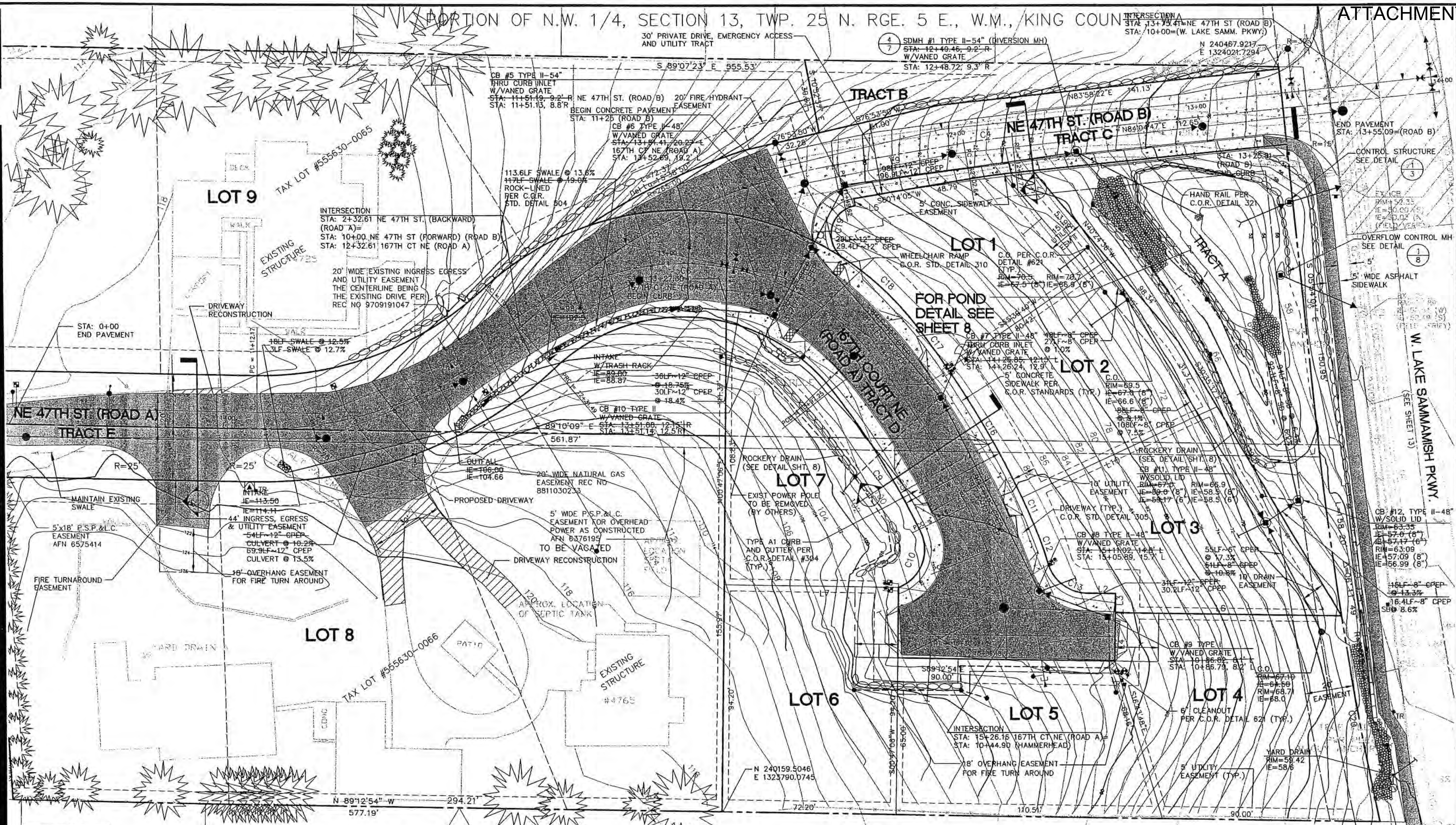
LAKEVILLE CONSTRUCTION
Marymoor Hill Short Plat
TESC NOTES AND DETAILS
City of Redmond
CONSTRUCTION PLANS

DEA INC.
DAVID EVANS AND ASSOCIATES, INC.
415 - 118TH AVENUE S.E.
BELLEVUE, WA. 98005-3518 519-6500

REVISED PER CITY'S COMMENTS 7-3-04
PREPARED RECORD DRAWINGS 01-09-03
REVISIONS

3 OF 16 SHEETS

SCALE: 1" = 20' — DESIGN: NDV
DATE: 5/15/01 — DRAWN: RABR
FILE: LKVL0003 — CKED: JTE



LINE TABLE		
No.	Bearing	Distance
L1	N00°47'06"E	5.21'
L2	S89°12'54"E	11.82'
L3	N00°47'06"E	8.00'
L4	N00°47'06"E	20.00'
L5	N09°45'55"W	3.00'
L6	S89°12'54"E	93.62'
L7	S89°12'54"E	72.20'
L8	N80°14'05"E	48.79'
L9	N80°14'05"E	53.01'
L10	N65°04'14"E	89.26'
L11	N00°47'06"E	44.67'
L12	N84°26'02"E	3.59'

CURVE TABLE							
No.	Radius	Delta	Length	No.	Radius	Delta	Length
C1	NOT USED			C12	122.00'	06°46'38"	14.43'
C2	NOT USED			C13	17.00'	73°21'50"	21.77'
C3	NOT USED			C14	350.00'	15°11'59"	92.85'
C4	300.00'	03°50'42"	20.13'	C15	100.00'	16°16'24"	40.86'
C5	250.00'	34°17'28"	149.62'	C16	372.00'	09°24'34"	61.09'
C6	100.00'	94°58'29"	165.76'	C17	372.00'	03°29'21"	22.65'
C7	156.67'	43°38'00"	119.31'	C18	122.00'	18°52'12"	40.18'
C8	78.00'	38°53'56"	52.96'	C19	12.00'	136°55'58"	28.68'
C9	328.00'	12°02'15"	68.91'	C20	1472.69'	03°22'20"	86.68'
C10	17.00'	94°55'00"	28.16'	C21	NOT USED		
C11	372.00'	02°18'04"	14.94'	C22	29.00'	34°51'44"	17.65'

LEGEND

EXISTING		PROPOSED
	ROAD R.O.W. CENTERLINE	
	LOT LINES	
	MINOR CONTOUR LINES	
680	MAJOR CONTOUR LINES	680
SD	STORM DRAIN LINE	
	TYPE I CATCHBASIN W/ FLOW DIRECTION	
	TYPE II CATCHBASIN	
	UTILITY EASEMENT	
	WHEEL CHAIR RAMP	
	STREET LIGHT	

NOTES:

1. SEE SHEET 7 FOR INTERSECTION DETAIL DESIGN.
2. DRIVEWAYS AND ACCESS SHALL BE LIMITED TO ONE PER LOT PER STREET FRONTAGE.
3. OFFSETS TO CATCH BASINS ARE FROM CENTERLINE OF ROAD TO CENTER OF CATCH BASINS.
4. ALL ROOF DRAINS SHALL HAVE TRACER WIRE FOR LOCATION
5. ALL UTILITIES SHALL BE UNDERGROUND INCLUDING EXISTING OVERHEAD ALONG THE WEST SIDE OF WEST LAKE SAMMAMISH PARKWAY
6. THIS DEVELOPMENT SHALL BE CONSTRUCTED WITH THE YEAR 2000 STANDARD SPECIFICATIONS AND DETAILS

MERIDIAN – CITY OF REDMOND HORIZONTAL CONTROL GLO MONUMENTS AND GPS MONUMENTS BEARINGS ARE BASED ON STATIONS A-130 AND A-129

0 10 20 40

RICHARD A. DICKMAN
STATE OF WASHINGTON
26252
REGISTERED PROFESSIONAL LAND SURVEYOR
EXPIRES 5/21/06

AS-BUILT CERTIFICATE

I HEREBY CERTIFY THAT THIS AS-BUILT SURVEY CORRECTLY REPRESENTS A SURVEY MADE UNDER MY DIRECTION AND REPRESENTS THE ACTUAL SITE CONDITIONS ON JULY 3, 2004.

RICHARD A. DICKMAN PLS 26252 — 7/10/04 DATE

CALL BEFORE YOU DIG
Call: TOLL FREE
1-800-424-5555

FILE# SPL-99-003

02-1002

APPROVED FOR CONSTRUCTION

FOR: DAVE RHODES
DIRECTOR OF PUBLIC WORKS
CITY OF REDMOND

DATE: ______
PLAN CHECK ENGINEER: ______
STORM: ______
UTILITY: ______
FIRE: ______
TRANSPORTATION: ______
PLANNING: ______

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LAKEVILLE CONSTRUCTION
Marymoor Hill Short Plat
ROAD AND STORM PLAN
City of Redmond
CONSTRUCTION PLANS

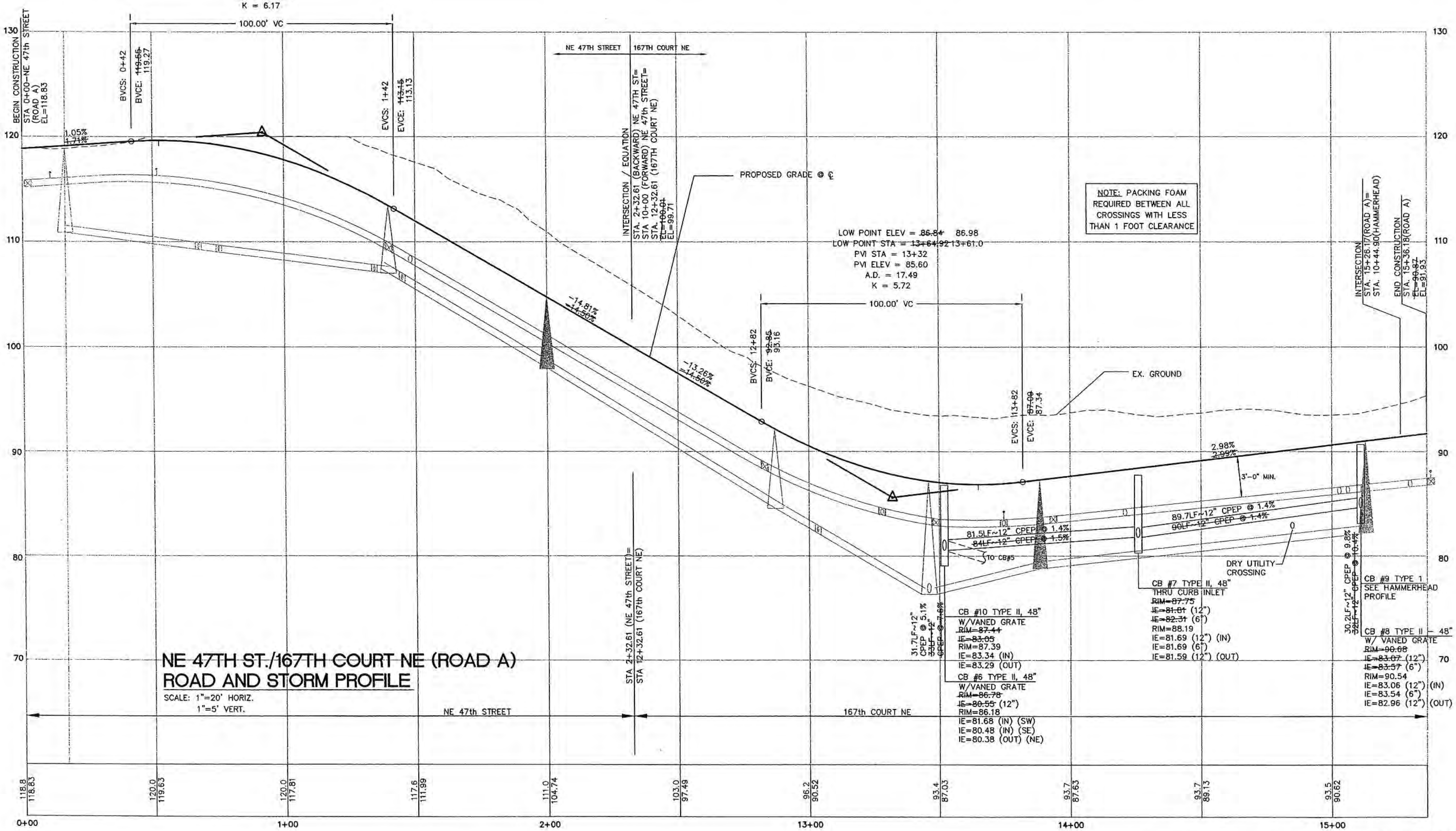
DAVID EVANS AND ASSOCIATES, INC.
415 - 118TH AVENUE S.E. BELLEVUE, WA. 98005-5518 (425) 519-6500

ADD SIDEWALK, ROCKERY AND BLOCK WALL ON W. LK. SAMMAMISH PKWY 7-3-04
PREPARED RECORD DRAWINGS 01-09-03
REVISIONS

4 OF 16 SHEETS
SCALE: 1" = 20'
DATE: 5/15/01
FILE: LKVL0003
DESIGN:
DRAWN: RABR
CHECKED: JTE

pct 07/03/04 4:01pm Lkvl0003-0003\0300cadd\310\ddwg\maryhill_as_built\MRH-rs1.dwg

PORTION OF N.W. 1/4, SECTION 13, TWP. 25 N. RGE. 5 E., W.M., KING COUNTY, WA



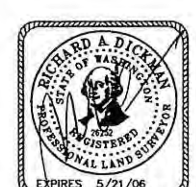
NE 47TH ST./167TH COURT NE (ROAD A) ROAD AND STORM PROFILE

SCALE: 1"=20' HORIZ.
1"=5' VERT.

FILE# SPL-99-003

02-1003

CALL BEFORE YOU DIG
Call: TOLL FREE
1-800-424-5555



AS-BUILT CERTIFICATE

I HEREBY CERTIFY THAT THIS AS-BUILT SURVEY CORRECTLY REPRESENTS A SURVEY MADE UNDER MY DIRECTION AND REPRESENTS THE ACTUAL SITE CONDITIONS ON JANUARY 27, 2003.

RICHARD A. DICKMAN PLS 26252 — DATE 7/10/04

NOTE:

THIS DEVELOPMENT CONSTRUCTED WITH THE YEAR 2000 STANDARD SPECIFICATIONS AND DETAILS.

APPROVED FOR CONSTRUCTION

FOR: DAVE RHODES
DIRECTOR OF PUBLIC WORKS
CITY OF REDMOND

DATE: ____
PLAN CHECK ENGINEER: ____
STORM: ____
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LAKEVILLE CONSTRUCTION
Marymoor Hill Short Plat
ROAD AND STORM PROFILE
City of Redmond
CONSTRUCTION PLANS

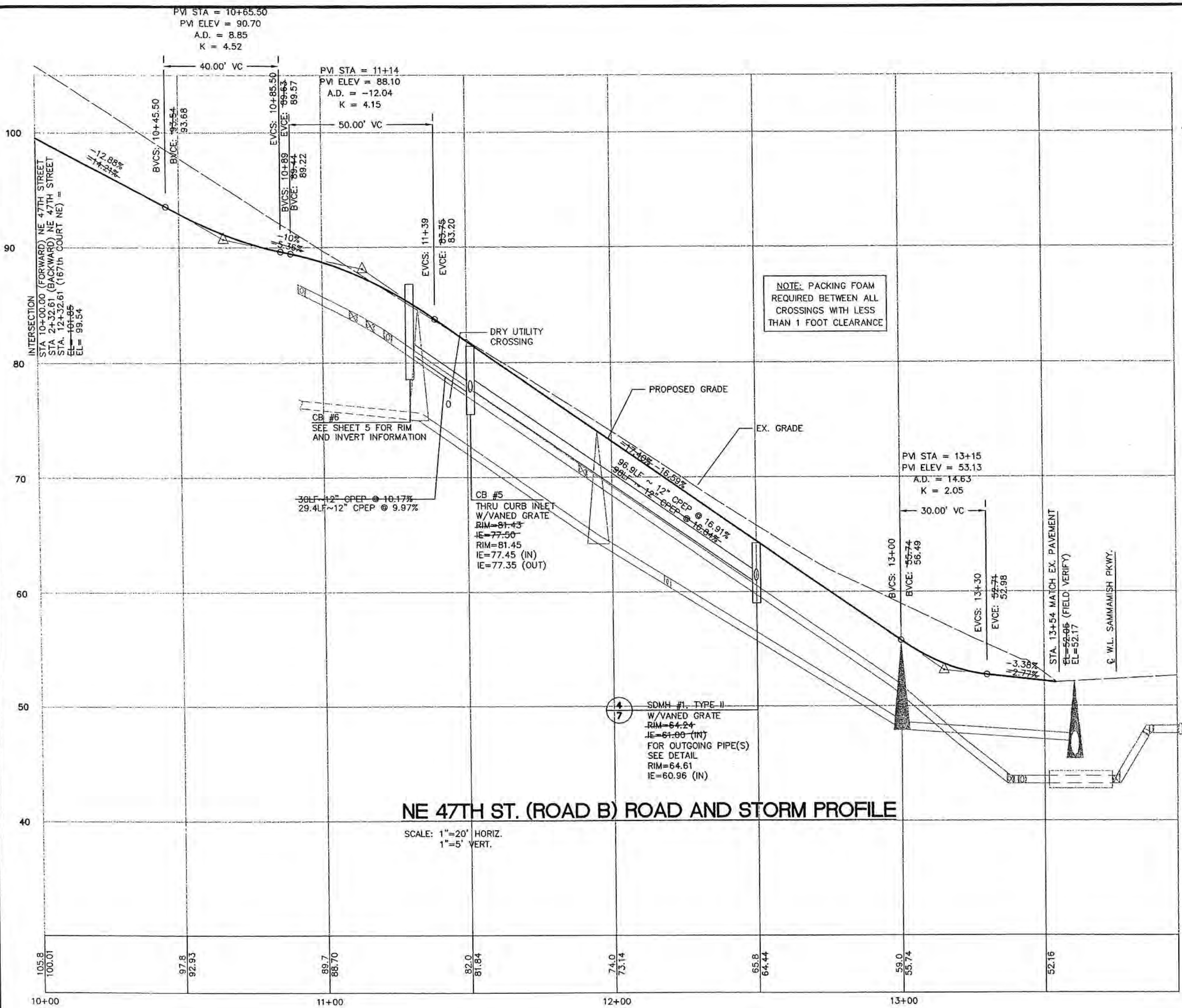
DAVID EVANS AND ASSOCIATES, INC.
415 - 118TH AVENUE S.E.
BELLEVUE, WA. 98005-3518 (425) 519-6500

REVISED PER CITY'S COMMENTS	7-3-04
PREPARED RECORD DRAWINGS	01-09-03
REVISIONS	

5 of 16 SHEETS

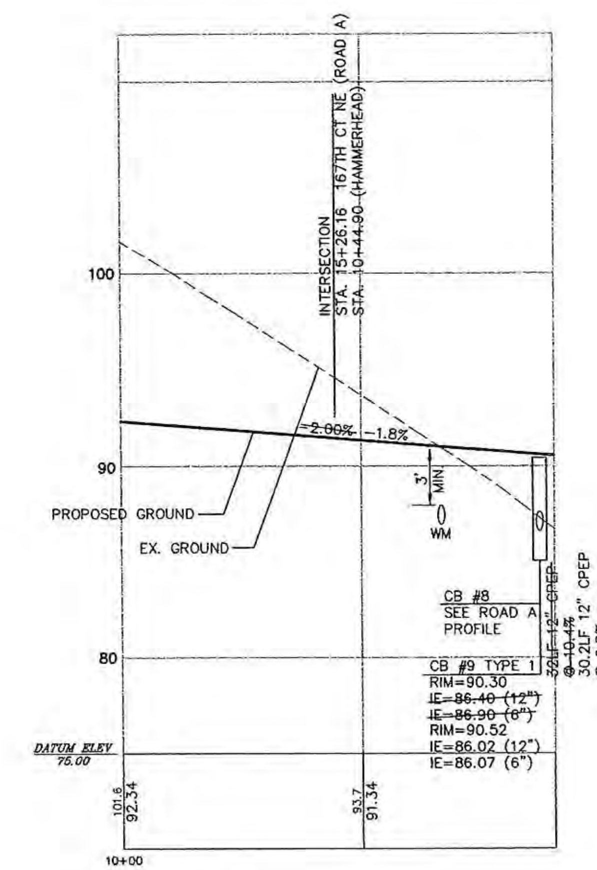
SCALE: 1" = 20' — DESIGN: RABR
DATE: 5/15/01 — DRAWN: RABR
FILE: LKV.0003 — CHECKED: JTE

pct 07/03/04 4:44pr _Lkv\0003-0003\0300cadd\310\dwg\maryhill_as_built\MRH-PM1.dwg



NE 47TH ST. (ROAD B) ROAD AND STORM PROFILE

SCALE: 1"=20' HORIZ.
1"=5' VERT.



HAMMERHEAD TURNAROUND

SCALE: 1"=20' HORIZ.
1"=5' VERT.

RICHARD A. DICKMAN
STATE OF WASHINGTON
26252
REGISTERED PROFESSIONAL LAND SURVEYOR
EXPIRES 5/21/06

AS-BUILT CERTIFICATE

I HEREBY CERTIFY THAT THIS AS-BUILT SURVEY CORRECTLY REPRESENTS A SURVEY MADE UNDER MY DIRECTION AND REPRESENTS THE ACTUAL SITE CONDITIONS ON JANUARY 27, 2003.

RICHARD A. DICKMAN PLS 26252

7/10/04
DATE

CALL BEFORE YOU DIG
Call: TOLL FREE
1-800-424-5555

NOTE:

THIS DEVELOPMENT CONSTRUCTED WITH THE YEAR 2000 STANDARD SPECIFICATIONS AND DETAILS.

FILE# SPL-99-003

02-1004

APPROVED FOR CONSTRUCTION

FOR: DAVE RHODES
DIRECTOR OF PUBLIC WORKS
CITY OF REDMOND

DATE:

PLAN CHECK ENGINEER:

STORM:

UTILITY:

FIRE:

TRANSPORTATION:

PLANNING:

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LAKEVILLE CONSTRUCTION
Marymoor Hill Short Plat
ROAD AND STORM PROFILE
City of Redmond
CONSTRUCTION PLANS

DAVID EVANS AND ASSOCIATES, INC.
415 - 118TH AVENUE S.E.
BELLEVUE, WA. 98005-3518 (425) 519-6500

REVISED PER CITY'S COMMENTS 7-3-04
PREPARED RECORD DRAWINGS 01-09-03
REVISIONS

6 OF 16 SHEETS

SCALE: 1" = 20' DESIGN: RABR
DATE: 5/15/01 DRAWN: RABR
FILE: LKVL0003 CHECKED: JTE

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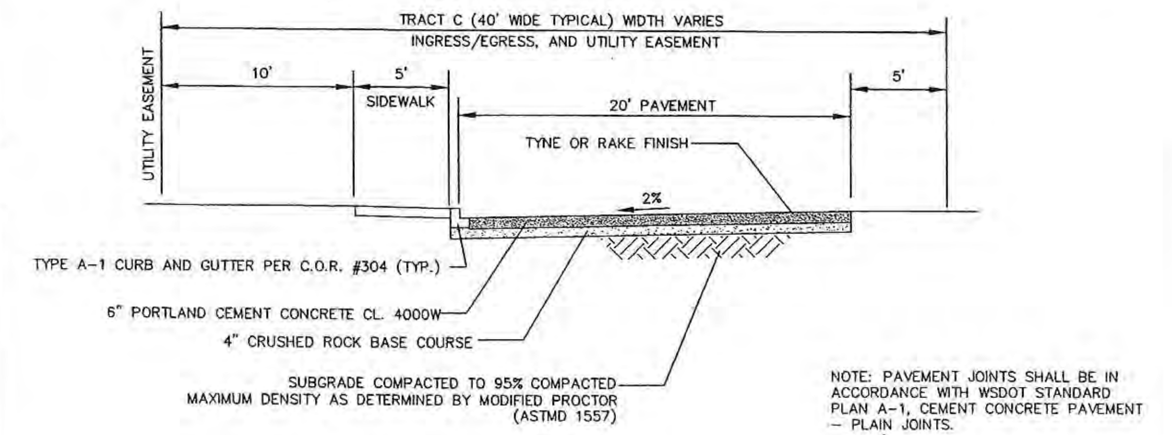
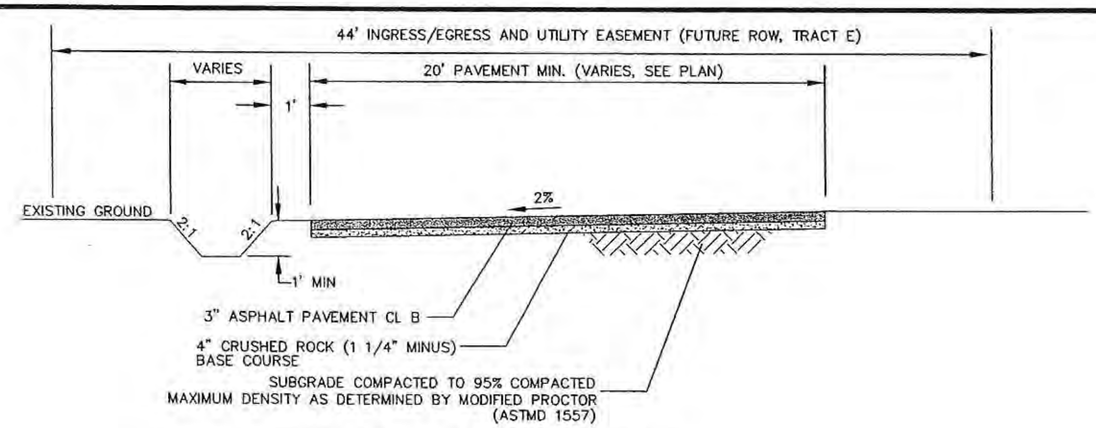
pct 07/03/04 4:46pm

ATTACHMENT 18

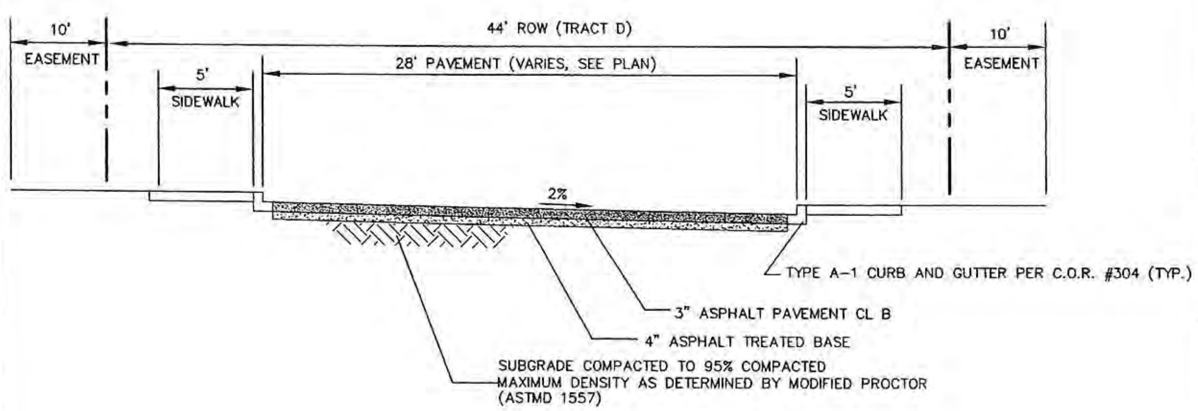
PORTION OF N.W. 1/4, SECTION 13
TWP. 25 N. RGE. 5 E., W.M., KING COUNTY, WA



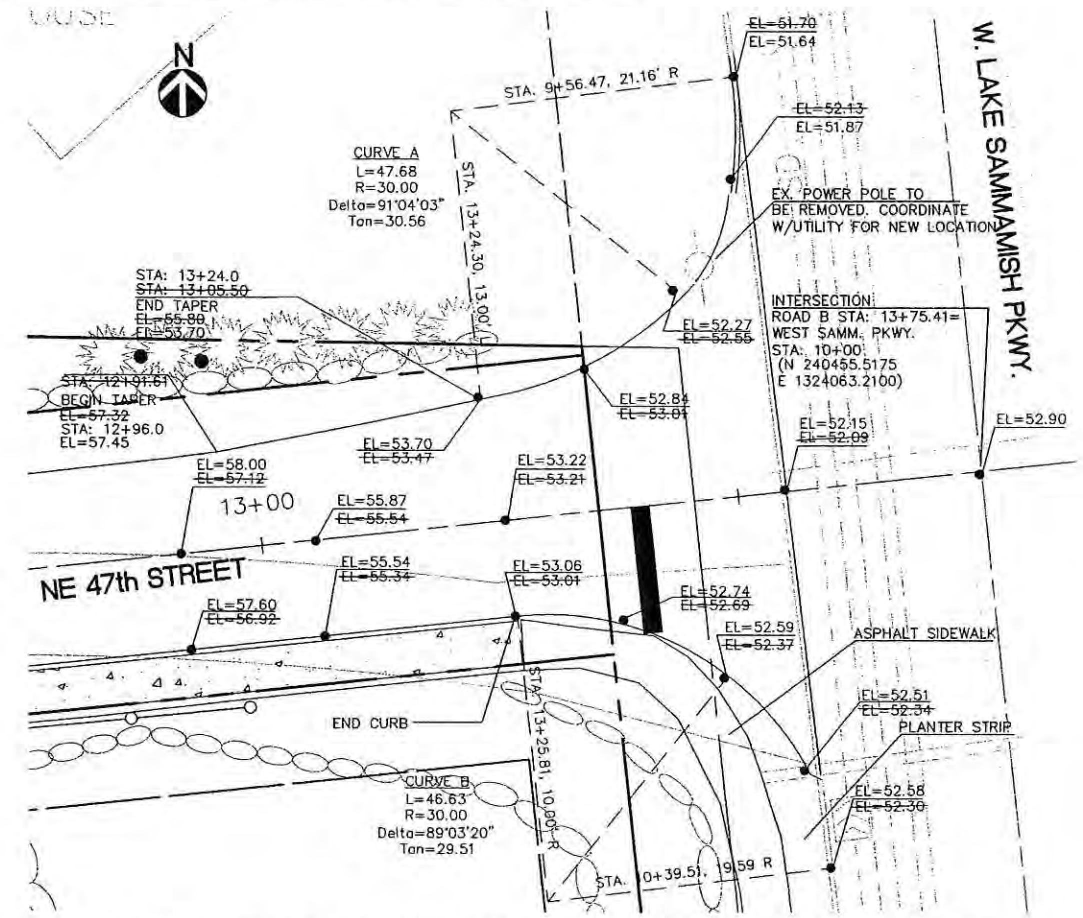
1/7 NE 47th STREET (ROAD B) SECTION COR #326
FROM STA: 11+25.00 TO STA: 13+55.09



2/7 N.E. 47th ST./167TH CT. NE (ROAD A) SECTION
FROM STA: 0+00 TO STA: 2+36.61, 10+00 TO 11+25 (NE 47TH ST.)
FROM STA: 12+36.61 TO STA: 13+64 (167TH CT NE.)

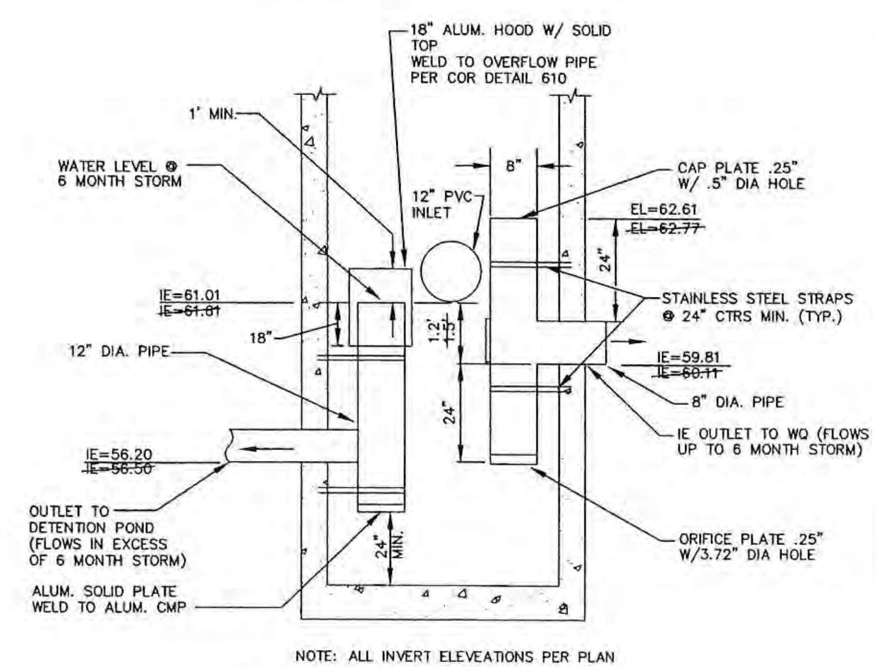


3/7 167th COURT N.E. (ROAD A) SECTION COR #301
FROM STA: 13+64.00 TO STA: 15+36.18



NE 47th STREET(ROAD B) AND W. LAKE SAMMAMISH INTERSECTION
SCALE: 1"=10'

CALL BEFORE YOU DIG
Call: TOLL FREE
1-800-424-5555



4/7 DIVERSION MANHOLE - 54"
NTS

AS-BUILT CERTIFICATE

I HEREBY CERTIFY THAT THIS AS-BUILT SURVEY CORRECTLY REPRESENTS A SURVEY MADE UNDER MY DIRECTION AND REPRESENTS THE ACTUAL SITE CONDITIONS ON JULY 3, 2004.

RICHARD A. DICKMAN PLS 26252 — 7/10/04 DATE

RICHARD A. DICKMAN, STATE OF WASHINGTON, 26252, REGISTERED PROFESSIONAL LAND SURVEYOR, EXPIRES 5/21/06

NOTE:

THIS DEVELOPMENT SHALL BE CONSTRUCTED WITH THE YEAR 2000 STANDARD SPECIFICATIONS AND DETAILS.

FILE# SPL-99-003 02-1005

APPROVED FOR CONSTRUCTION

FOR: DAVE RHODES
DIRECTOR OF PUBLIC WORKS
CITY OF REDMOND

DATE:
PLAN CHECK ENGINEER:
STORM:
UTILITY:
FIRE:
TRANSPORTATION:
PLANNING:

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LAKEVILLE CONSTRUCTION
Marymoor Hill Short Plat
ROAD AND STORM DETAILS
City of Redmond
CONSTRUCTION PLANS

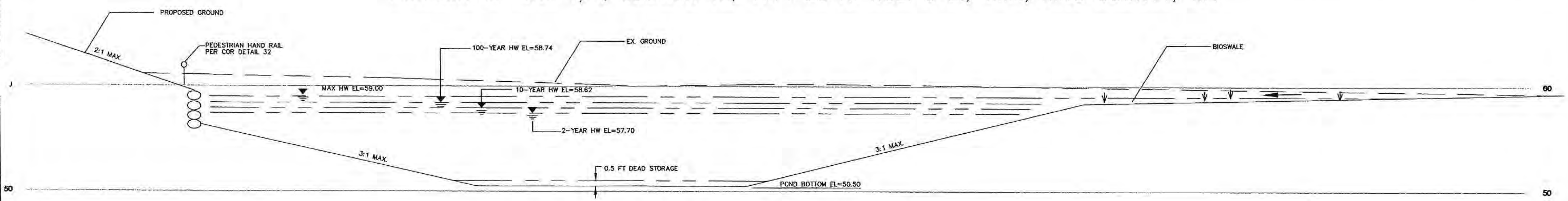
DEA
DAVID EVANS AND ASSOCIATES, INC.
415 - 118TH AVENUE S.E.
BELLEVUE, WA. 98005-3518 (425) 519-6500

ADD SIDEWALK, ROCKERY AND BLOCK WALL ON W. LK. SAMMAMISH PKWY 7-3-04
PREPARED RECORD DRAWINGS 01-09-03
REVISIONS

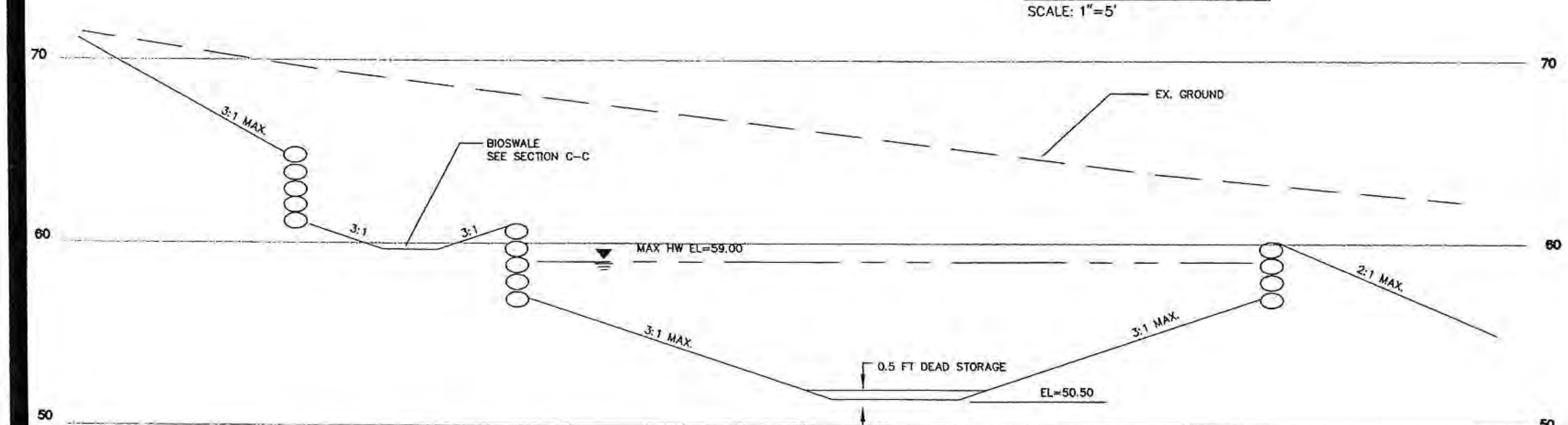
7 OF 16 SHEETS
SCALE: 1" = 20' | DESIGN: JTE
DATE: 5/15/01 | DRAWN: RABR
FILE: LKVL0003 | CHECKED: JTE

pct 07/03/04 3:32p Lkvl0003-0003\0300cadd\310ldwg\maryhill_as_built\MRH-D2.dwg

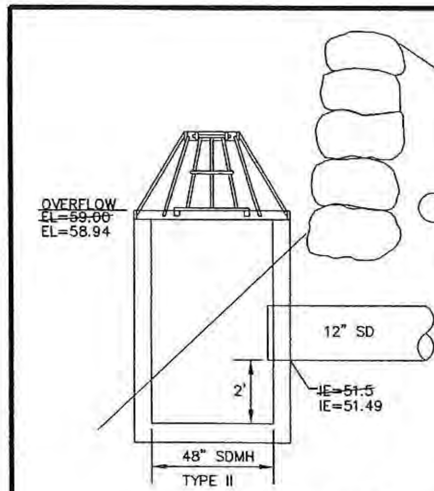
PORTION OF N.W. 1/4, SECTION 13, TWP. 25 N. RGE. 5 E., W.M., KING COUNTY, WA



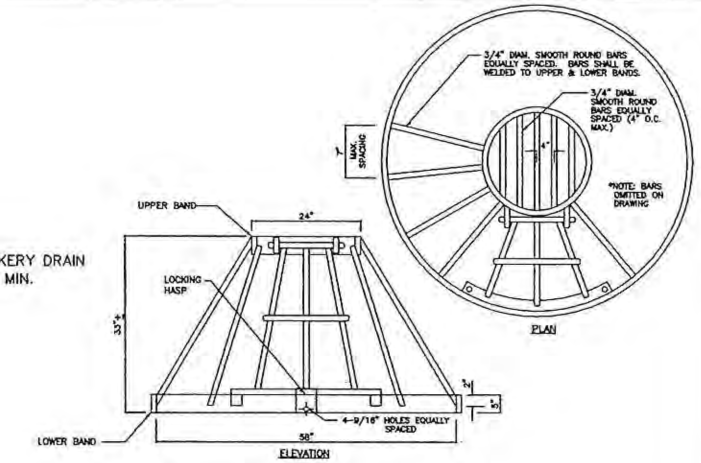
POND SECTION A-A
SCALE: 1"=5'



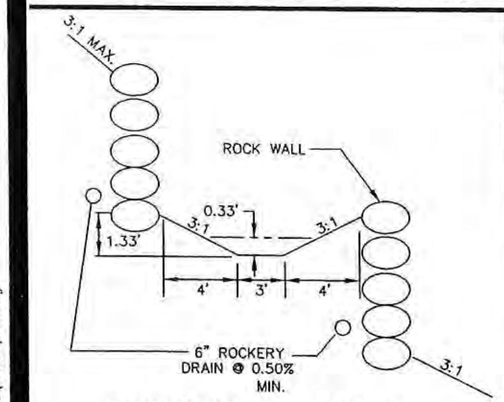
POND SECTION B-B
SCALE: 1"=5' HORIZ. 1"=5' VERT.



1/8 OVERFLOW STRUCTURE
NTS



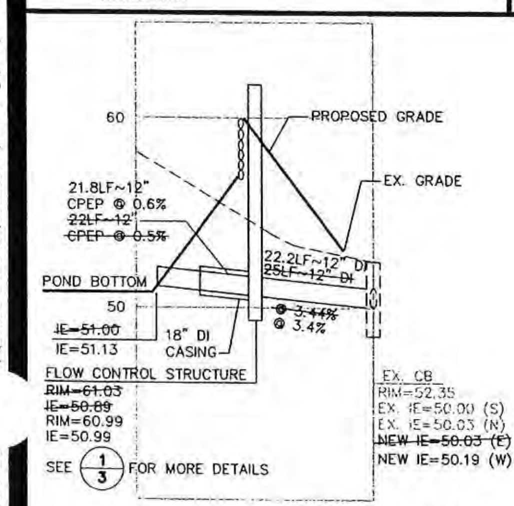
DEBRIS CAGE DETAIL
NTS



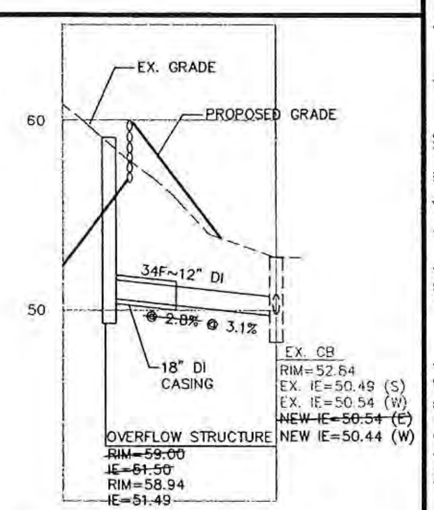
BIOSWALE SECTION C-C
SCALE: NTS

DETENTION POND SEED W/STANDARD BIOSWALE MIX

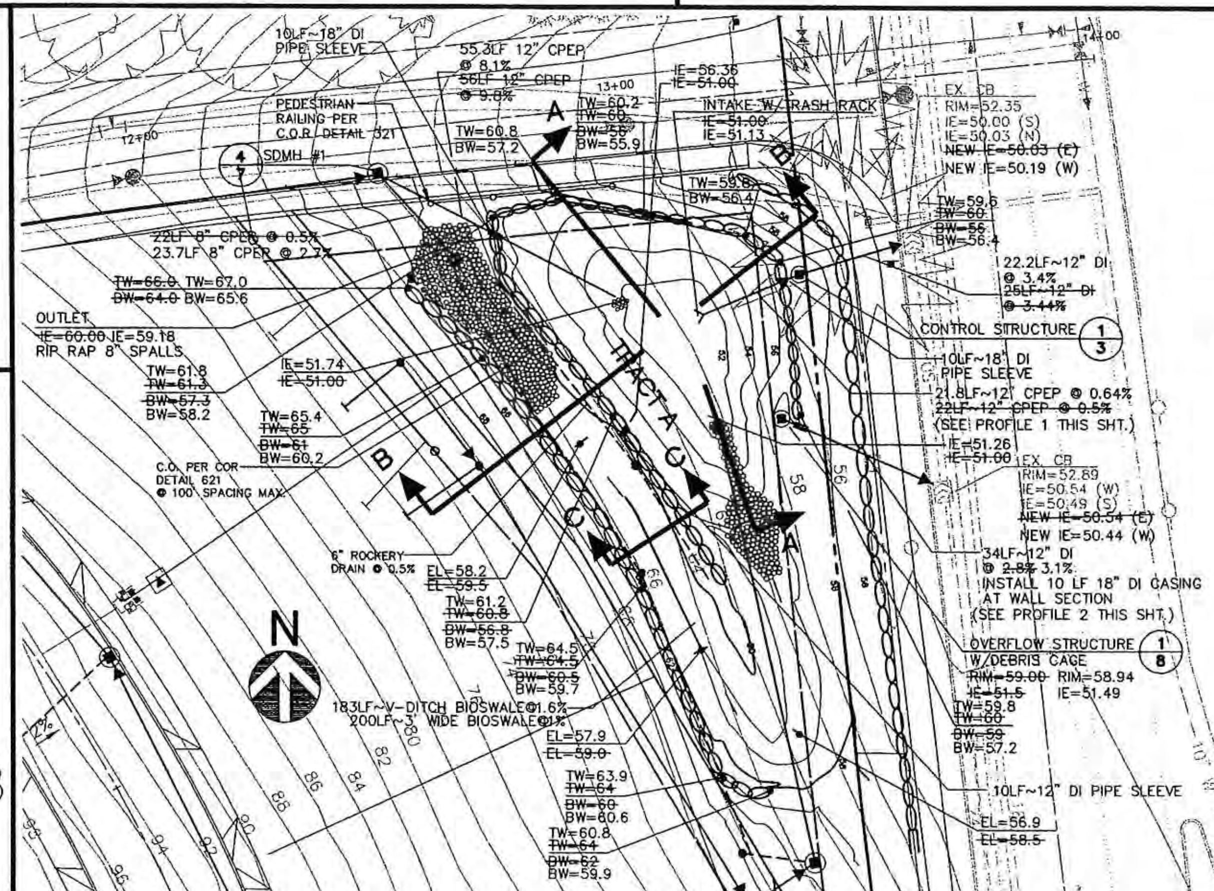
40% DW TALL FESCUE
30% BARCLAY PERENIAL RYEGRASS
25% CREEPING RED FESCUE
5% HIGHLAND COLONIAL BENTGRASS



POND STORM PROFILE 1
SCALE: 1"=20' HORIZ. 1"=5' VERT.



POND STORM PROFILE 2
SCALE: 1"=20' HORIZ. 1"=5' VERT.



POND PLAN (TRACT A)
SCALE: 1"=20'

DETENTION POND VOLUME	
REQUIRED=	13,200 CF
PROVIDED=	13,950 CF

CALL BEFORE YOU DIG
Call: TOLL FREE
1-800-424-5555

POND AND BIOSWALE LINERS:

1. THE LINER MATERIAL MUST BE EITHER A COMMERCIAL HEAVY PLASTIC POND LINER (MIN. 40 MIL) OR A BENTONITE CLAY (MIN. 12" THICK)
2. A LAYER OF COMPACTED TOP SOIL (MIN. 18" THICK SHALL BE PLACED OVER THE LINER PRIOR TO SEEDING WITH THE APPROPRIATE SEED MIX.

AS-BUILT CERTIFICATE

I HEREBY CERTIFY THAT THIS AS-BUILT SURVEY CORRECTLY REPRESENTS A SURVEY MADE UNDER MY DIRECTION AND REPRESENTS THE ACTUAL SITE CONDITIONS ON JULY 3, 2004.

RICHARD A. DICKMAN STATE OF WASHINGTON REGISTERED 26252 PROFESSIONAL LAND SURVEYOR
EXPIRES 5/21/06

RICHARD A. DICKMAN PLS 26252 — 7/10/04 DATE

NOTE:
THIS DEVELOPMENT CONSTRUCTED WITH THE YEAR 2000 STANDARD SPECIFICATIONS AND DETAILS.

FILE# SPL-99-003

02-1006

APPROVED FOR CONSTRUCTION

FOR: DAVE RHODES
DIRECTOR OF PUBLIC WORKS
CITY OF REDMOND

DATE: ____
PLAN CHECK ENGINEER: ____
STORM: ____
UTILITY: ____
FIRE: ____
TRANSPORTATION: ____
PLANNING: ____

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LAKEVILLE CONSTRUCTION
Marymoor Hill Short Plat
POND PLAN AND DETAILS
City of Redmond
CONSTRUCTION PLANS

DAVID EVANS AND ASSOCIATES, INC.
415 - 118TH AVENUE S.E.
BELLEVUE, WA. 98005-3518 (425) 519-6500

ADD SIDEWALK, ROCKERY AND BLOCK WALL ON W. LK. SAMMAMISH PKWY 7-3-04
PREPARED RECORD DRAWINGS 01-09-03
REVISIONS

8 OF 16 SHEETS
SCALE: 1" = 20' | DESIGN: NDV
DATE: 5/15/01 | DRAWN: RABR
FILE: LKVL0003 | CHECKED: JTE

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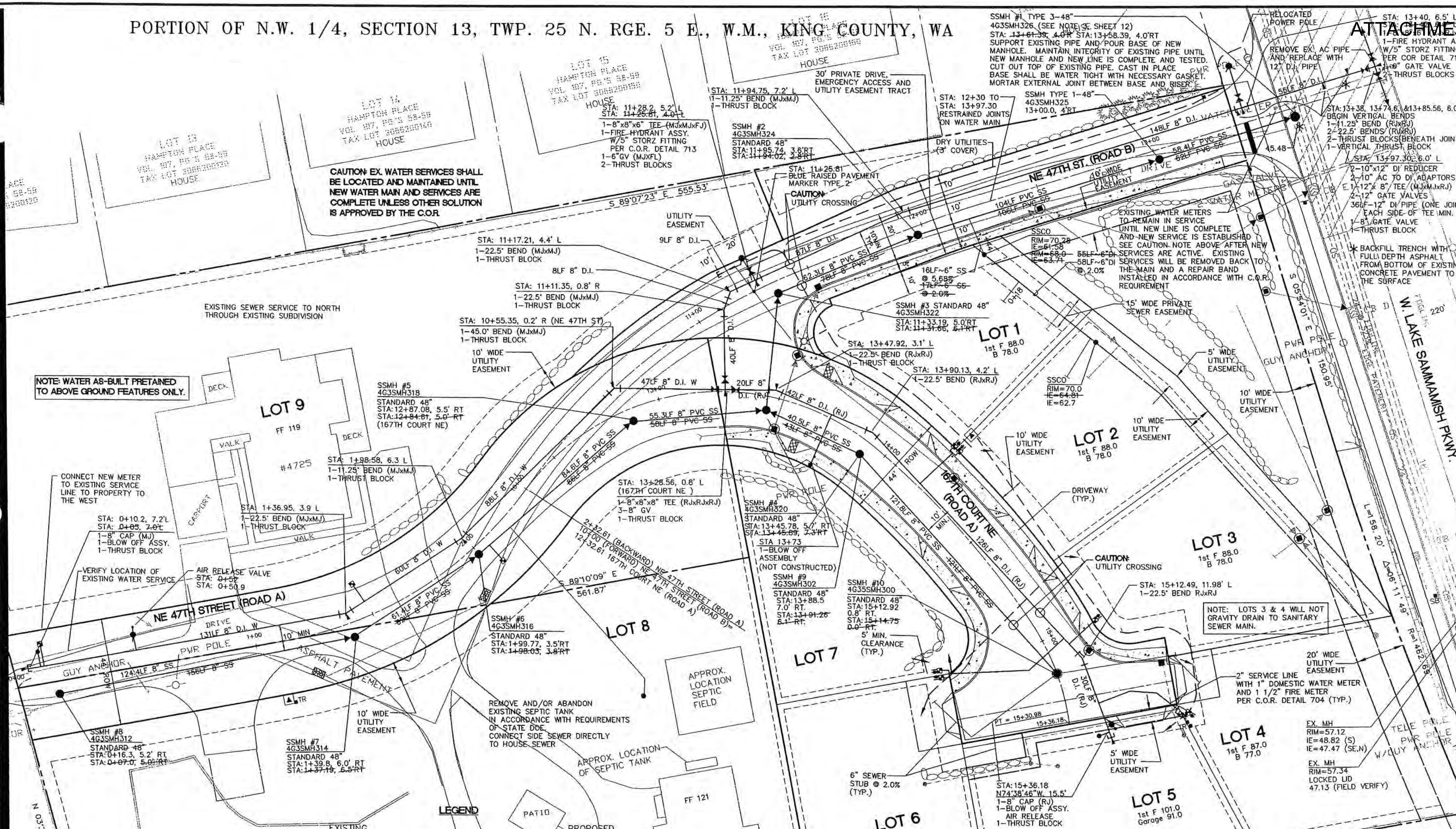
PORTION OF N.W. 1/4, SECTION 13, TWP. 25 N. RGE. 5 E., W.M., KING COUNTY, WA

ATTACHMENT 18



LEGEND

EXISTING		PROPOSED
●	TYPE I 48" SAN. SEWER MANHOLE W/FLOW DIRECTION	●←
— —SS— —	PVC SEWER PIPE	———
— —SSSO— —●	SANITARY SEWER STUBOUT (S.S.S.O.)	———●
— —W— —	D.I.P. WATER LINE	———
◄	CONCRETE THRUST BLOCK	◄
⋈	WATERLINE GATE VALVE	⋈
⊠	WATER METER	⊠
●	FIRE HYDRANT	●
⊢	WATERLINE TEE	⊢
	STREET LIGHT	☼

NOTES:
1. WATER PRESSURE ZONE 350
2. ALL LOTS INCLUDING 2 EXISTING STRUCTURES REQUIRE INDIVIDUAL PRV'S.
3. WATER MAIN SHALL BE RESTRAINED JOINT PIPE FROM STA: 12+90 TO STA: 15+36.18.

MERIDIAN – CITY OF REDMOND HORIZONTAL CONTROL GLO MONUMENTS AND GPS MONUMENTS BEARINGS ARE BASED ON STATIONS A-130 AND A-129

0 10 20 40

NOTE:
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RICHARD A. DICKMAN — STATE OF WASHINGTON — 26252 — REGISTERED PROFESSIONAL LAND SURVEYOR — EXPIRES 5/21/06

CERTIFICATE

I HEREBY CERTIFY THAT THIS SURVEY CORRECTLY REPRESENTS A SURVEY MADE UNDER MY DIRECTION AND REPRESENTS THE ACTUAL SITE CONDITIONS ON JULY 3, 2004.

RICHARD A. DICKMAN PLS 26252 — 7/10/04 DATE

CALL BEFORE YOU DIG
Call: TOLL FREE
1-800-424-5555

FILE# SPL-99-003

02-1007

APPROVED FOR CONSTRUCTION

FOR: DAVE RHODES
DIRECTOR OF PUBLIC WORKS
CITY OF REDMOND

DATE: ____
PLAN CHECK ENGINEER: ____
STORM: ____
UTILITY: ____
FIRE: ____
TRANSPORTATION: ____
PLANNING: ____

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LAKEVILLE CONSTRUCTION
Marymoor Hill Short Plat
SEWER AND WATER PLAN
City of Redmond
CONSTRUCTION PLANS

DAVID EVANS AND ASSOCIATES, INC.
415 - 118TH AVENUE S.E.
BELLEVUE, WA. 98005-3518 (425) 519-6500

REVISIONS	
ADD SIDEWALK, ROCKERY AND BLOCK WALL ON W. LK. SAMMAMISH PKWY	7-3-04
REVISED PER CITY'S COMMENTS	04-04-03
PREPARED RECORD DRAWINGS	01-09-03

9 OF 16 SHEETS

SCALE: 1" = 20' DESIGN:
DATE: 5/15/01 DRAWN: RABR
FILE: LKVL0003 CHECKED: JTE

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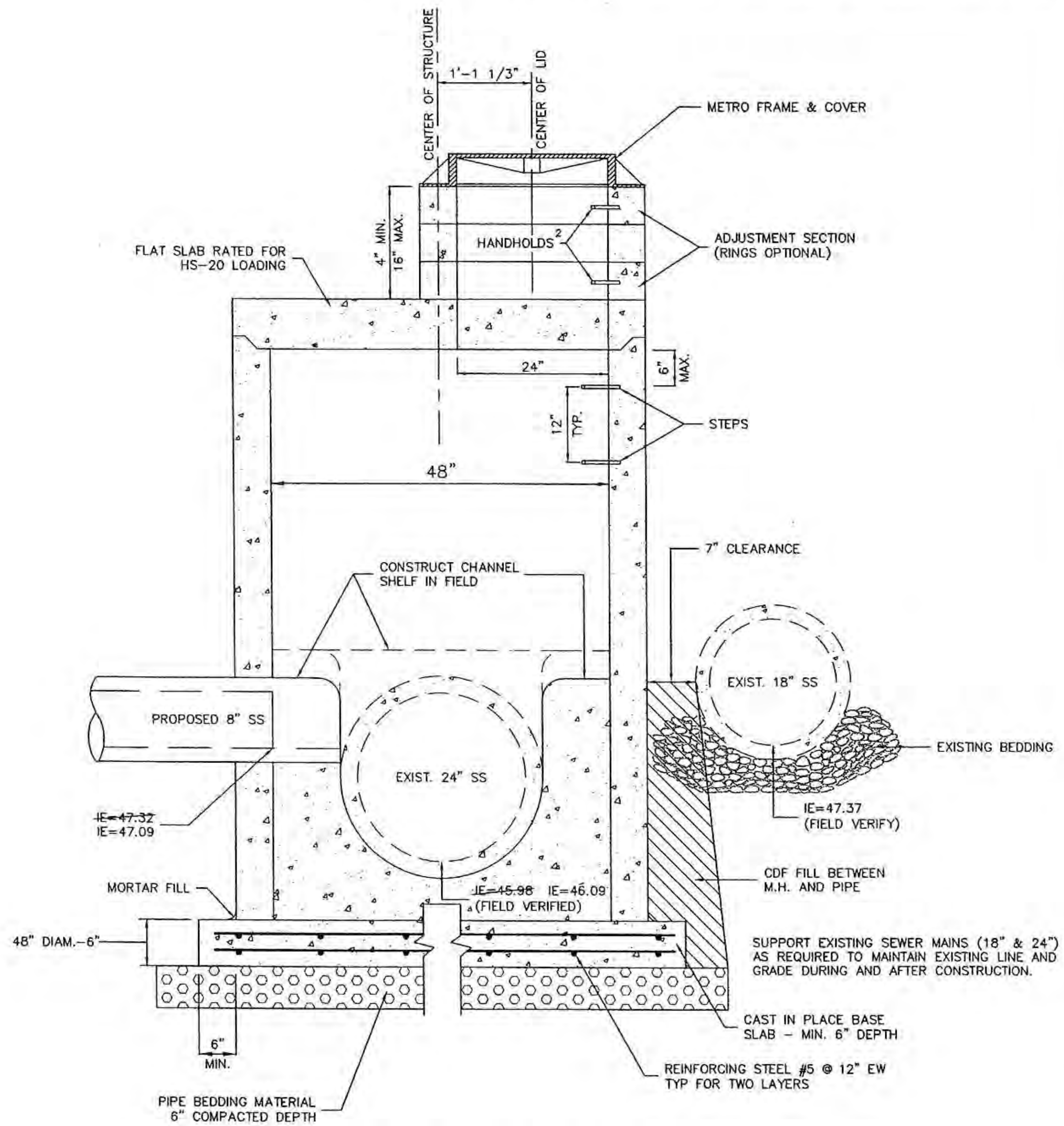
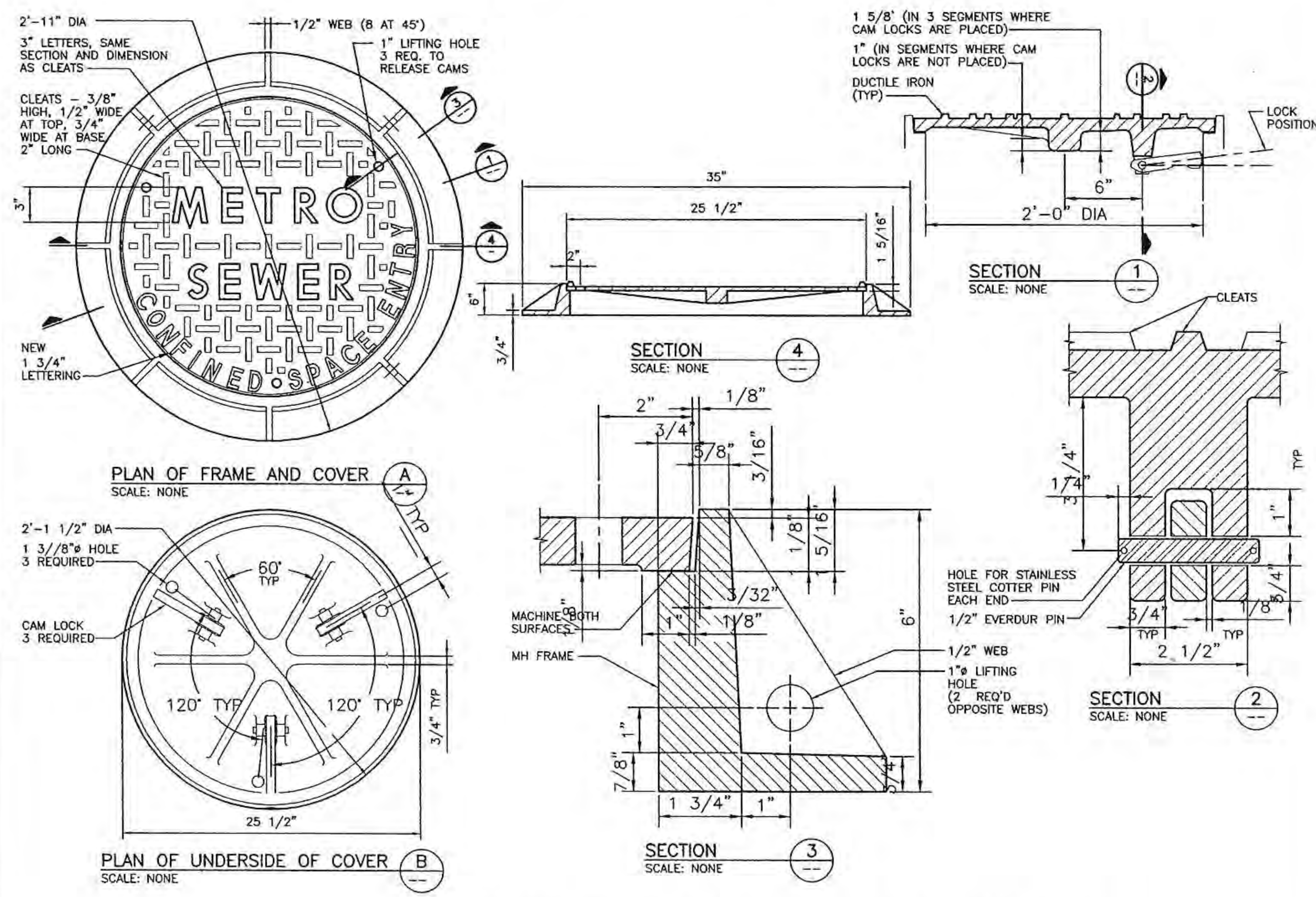
pct 07/03/04



STANDARD TYPE 3 MANHOLE – 48"

NOTES:

1. MANHOLES SHALL BE CONSTRUCTED IN ACCORDANCE WITH AASHTO M199 UNLESS OTHERWISE SHOWN ON PLANS OR NOTED IN THE WSDOT/APWA STANDARD SPECIFICATIONS.
2. HANDHOLDS IN ADJUSTMENT SECTION SHALL HAVE 3" MIN. CLEARANCE. STEPS IN MANHOLE SHALL HAVE 6" MIN. CLEARANCE. SEE DWG. NO. 2-011, "MANHOLE DETAILS." HANDHOLDS SHALL BE PLACED IN ALTERNATING GRADE RINGS OR LEVELING BRICK COURSE WITH A MIN. OF ONE HANDHOLD BETWEEN THE LAST STEP AND THE TOP OF THE MANHOLE.
3. ALL REINFORCED CAST-IN-PLACE CONCRETE SHALL BE CLASS 4000. NON-REINFORCED CONCRETE IN CHANNEL AND SHELF SHALL BE CLASS 3000. ALL PRECAST CONCRETE SHALL BE CLASS 4000.
4. KNOCKOUTS SHALL HAVE WALL THICKNESS OF 2" MIN. UNUSED KNOCKOUTS NEED NOT BE GROUTED IF WALL IS LEFT INTACT. PIPES SHALL BE INSTALLED ONLY IN FACTORY KNOCKOUTS UNLESS OTHERWISE APPROVED BY THE ENGINEER.
5. KNOCKOUT OR CUTOUT HOLE SIZE SHALL EQUAL PIPE OUTER DIAM. PLUS MANHOLE WALL THICKNESS. MAX. HOLE SIZE SHALL BE 36" FOR 48" M.H. MIN. DISTANCE BETWEEN HOLES SHALL BE 8" FOR 48" M.H.
6. MANHOLE RINGS AND COVERS SHALL BE IN ACCORDANCE WITH SEC. 7.05 AND MEET THE STRENGTH REQUIREMENTS OF FEDERAL SPECIFICATION RR-F-621D. MATING SURFACES SHALL BE FINISHED TO ASSURE NON-ROCKING FIT WITH ANY COVER POSITION.
7. ALL BASE REINFORCING STEEL SHALL HAVE A MIN. YIELD STRENGTH OF 60,000 PSI AND BE PLACED IN THE UPPER HALF OF THE BASE WITH 1" MIN. CLEARANCE.
8. FOR HEIGHTS OF 12' OR LESS, MIN. SOIL BEARING VALUE SHALL EQUAL 3,300 POUNDS PER SQUARE FOOT. FOR HEIGHTS OVER 12', MIN. SOIL BEARING VALUE SHALL EQUAL 3,800 POUNDS PER SQUARE FOOT.
9. FOR DETAILS SHOWING GRADE RING, LADDER, STEPS, HANDHOLDS, AND TOP SLABS, SEE DWG. NO. 2-011, "MANHOLE DETAILS."
10. SEE THE WSDOT/APWA STANDARD SPECIFICATIONS SEC. 7-05.3 FOR JOINT REQUIREMENTS.



STANDARD 24" DIAMETER LOCKING FRAME AND COVER

NOTES:

1. MR. ERIC DAVISON (206/684-1707) SHALL BE NOTIFIED AT LEAST TWO (2) WORKING DAYS PRIOR TO CONSTRUCTION IN THE VICINITY OF KING COUNTY'S 24-INCH, LAKE HILLS TRUNK.
2. KING COUNTY DOES NOT GUARANTEE PIPE LOCATION, DIAMETER OR INVERT ELEVATION; THEREFORE, FIELD VERIFICATION IS RECOMMENDED PRIOR TO CONSTRUCTION.
3. PLANS FOR DEWATERING ADJACENT TO KING COUNTY FACILITIES SHALL BE SUBMITTED TO MR. ERIC DAVISON FOR KING COUNTY REVIEW AND APPROVAL AT LEAST FIVE DAYS PRIOR TO CONSTRUCTION.
4. DURING CONSTRUCTION, NO DEBRIS SHALL BE ALLOWED TO ENTER KING COUNTY'S 24-INCH, LAKE HILLS TRUNK.
5. CONNECTION TO THE 24-INCH, LAKE HILLS TRUNK SHALL NOT BE BACKFILLED UNTIL IT HAS BEEN INSPECTED AND APPROVED BY A KING COUNTY REPRESENTATIVE.
6. THE 8-INCH CONNECTION SHALL ENTER THE NEWLY CONSTRUCTED MANHOLE MATCHING ITS CROWN WITH THE CROWN OF THE 24-INCH, LAKE HILLS TRUNK.
7. PROPOSED 8-INCH CONNECTION TO THE LAKE HILLS TRUNK SHALL BE MADE BY CORE DRILLING AND USE OF A KOR-N-SEAL BOOT AS DISTRIBUTED BY P.I.P.E., INC., 4601 SHOUTH ORCHARD, TACOMA, WASHINGTON 98409, (253) 475-8888.
8. THE CONNECTION SHALL BE PLUGGED AND NOT BE PUT INTO SERVICE UNTIL THE TRIBUATRY SYSTEM HAS BEEN CLEANED, INSPECTED, TESTED, AND APPROVED BY THE CITY OF REDMOND.

RICHARD A. DICKMAN
STATE OF WASHINGTON
26252
REGISTERED PROFESSIONAL LAND SURVEYOR
EXPIRES 5/21/06

AS-BUILT CERTIFICATE

I HEREBY CERTIFY THAT THIS AS-BUILT SURVEY CORRECTLY REPRESENTS A SURVEY MADE UNDER MY DIRECTION AND REPRESENTS THE ACTUAL SITE CONDITIONS ON JANUARY 27, 2003.

RICHARD A. DICKMAN PLS 26252 — DATE 7/10/04

CALL BEFORE YOU DIG
Call: TOLL FREE
1-800-424-5555

FILE# SPL-99-003

02-1008

APPROVED FOR CONSTRUCTION	
FOR: DAVE RHODES DIRECTOR OF PUBLIC WORKS CITY OF REDMOND	THIS APPROVAL IS FOR DESIGN CONCEPT ONLY. THESE PLANS APPEAR TO BE IN CONFORMANCE WITH CITY OF REDMOND DESIGN STANDARDS FOR CONSTRUCTION. THIS APPROVAL SHALL NOT BE CONSTRUED AS AUTHORIZING CONSTRUCTION NOT IN ACCORDANCE WITH APPLICABLE CITY STANDARDS. THE CITY PRESERVES THE RIGHT TO REQUIRE REVISIONS TO THE APPROVED PLANS TO ASSURE CONFORMANCE WITH CITY OF REDMOND DESIGN STANDARDS FOR CONSTRUCTION AT ANY TIME THAT IS DISCOVERED THAT THE PROPOSED CONSTRUCTION DOES NOT OTHERWISE MEET THE APPLICABLE CONSTRUCTION STANDARDS. THE OWNER IS REQUIRED TO PROVIDE DESIGNS AND PLANS IN ACCORDANCE WITH APPLICABLE CITY STANDARDS AND ASSURE THAT CONSTRUCTION IS ACCOMPLISHED IN ACCORDANCE WITH THOSE STANDARDS. THE OWNER AND/OR DESIGN ENGINEER AND/OR DEVELOPER MAY BE REQUIRED TO MAKE NECESSARY APPROVED FIELD REVISIONS TO CORRECT ANY ERRORS OR OMISSIONS FOUND TO EXIST ON APPROVED PLAN.
DATE:	
PLAN CHECK ENGINEER:	
STORM:	
UTILITY:	
FIRE:	
TRANSPORTATION:	
PLANNING:	

LAKEVILLE CONSTRUCTION
Marymoor Hill Short Plat
SEWER MANHOLE DETAIL
City of Redmond
CONSTRUCTION PLANS

DAVID EVANS AND ASSOCIATES, INC.
415 - 118TH AVENUE S.E.
BELLEVUE, WA. 98005-3518 (425) 519-6500

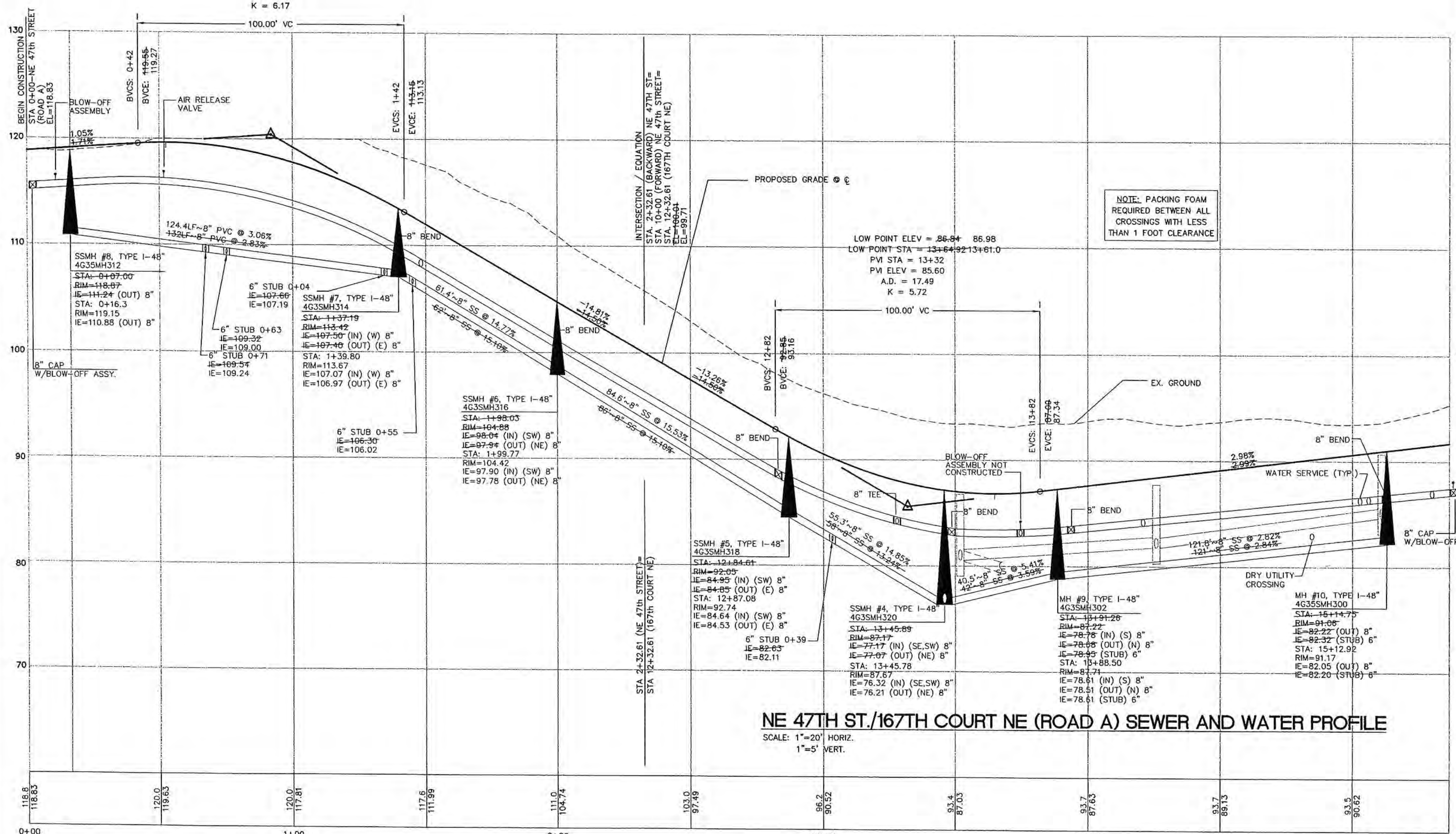
REVISED PER CITY'S COMMENTS 7-3-04
PREPARED RECORD DRAWINGS 01-09-03
REVISIONS

10 OF 16 SHEETS

SCALE: 1" = 20' DESIGN: NDV
DATE: 5/15/01 DRAWN: RABR
FILE: LKVL0003 CHECKED: JTE

ATTACHMENT 18

PORTION OF N.W. 1/4, SECTION 13, TWP. 25 N. RGE. 5 E., W.M., KING COUNTY, WA



NE 47TH ST./167TH COURT NE (ROAD A) SEWER AND WATER PROFILE

SCALE: 1"=20' HORIZ.
1"=5' VERT.

NOTE:
THIS DEVELOPMENT CONSTRUCTED WITH THE YEAR 2000 STANDARD SPECIFICATIONS AND DETAILS.

FILE# SPL-99-003

02-1009

RICHARD A. DICKMAN STATE OF WASHINGTON REGISTERED PROFESSIONAL LAND SURVEYOR 26252 EXPIRES 5/21/06

AS-BUILT CERTIFICATE

I HEREBY CERTIFY THAT THIS AS-BUILT SURVEY CORRECTLY REPRESENTS A SURVEY MADE UNDER MY DIRECTION AND REPRESENTS THE ACTUAL SITE CONDITIONS ON JANUARY 27, 2003.

RICHARD A. DICKMAN PLS 26252 — 7/1/04 DATE

NOTE:
IF GROUND WATER ENCOUNTERED AT THE BOTTOM OF SEWER TRENCH LINE, CDF DAMS SHALL BE USED. SEE DETAIL ON SHEET 11.

APPROVED FOR CONSTRUCTION

FOR: DAVE RHODES
DIRECTOR OF PUBLIC WORKS
CITY OF REDMOND

DATE:
PLAN CHECK ENGINEER:
STORM:
UTILITY:
FIRE:
TRANSPORTATION:
PLANNING:

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LAKEVILLE CONSTRUCTION
Marymoor Hill Short Plat
SEWER AND WATER PROFILE
City of Redmond
CONSTRUCTION PLANS

DAVID EVANS AND ASSOCIATES, INC.
415 - 118TH AVENUE S.E.
BELLEVUE, WA. 98005-3518 (425) 519-6500

REVISIONS	
REVISED PER CITY'S COMMENTS	7-3-04
PREPARED RECORD DRAWINGS	01-09-03

11 OF 16 SHEETS

SCALE: 1" = 20'
DATE: 5/15/01
FILE: LKVL0003
DESIGN:
DRAWN: RABR
CHECKED: JTE

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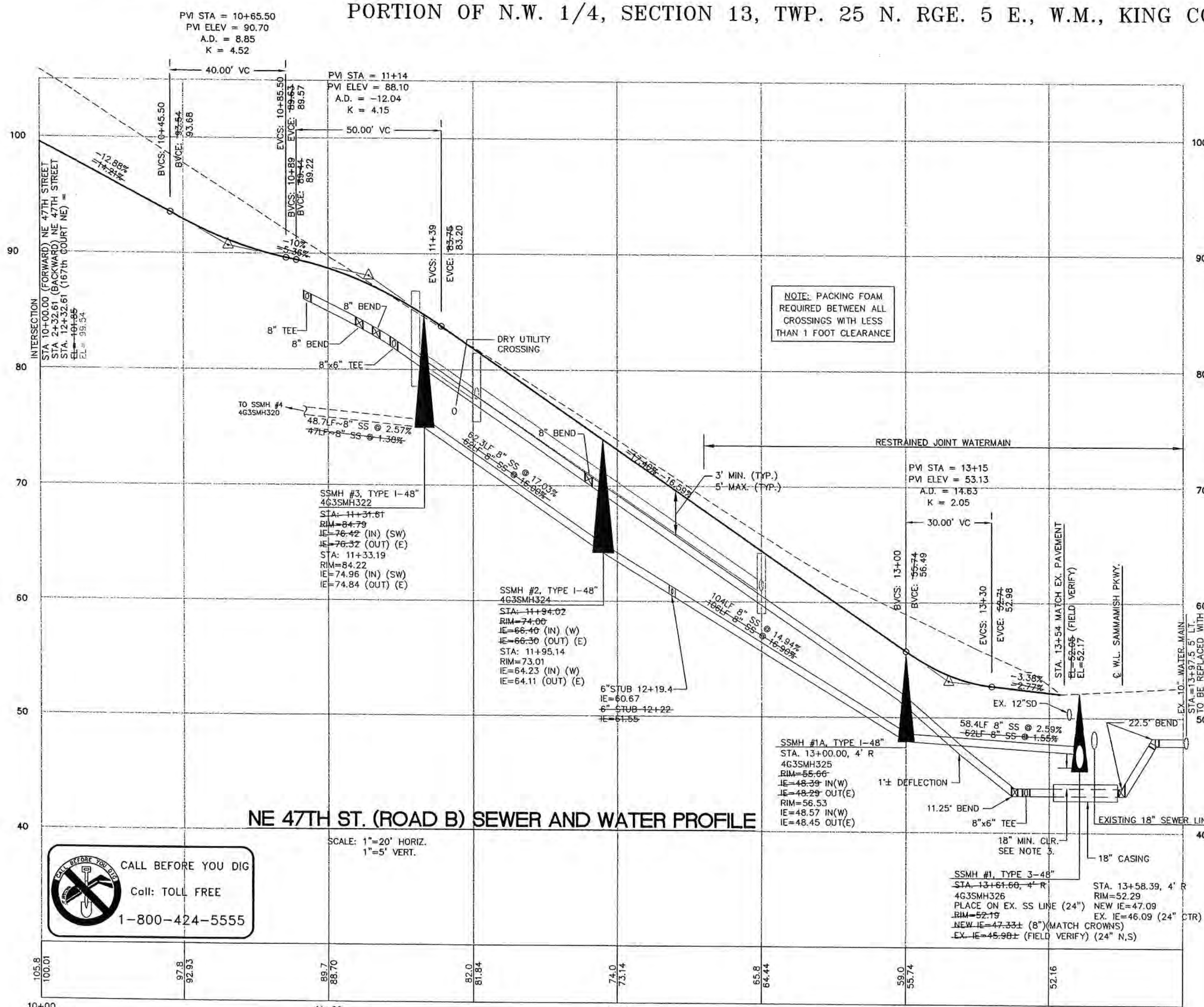
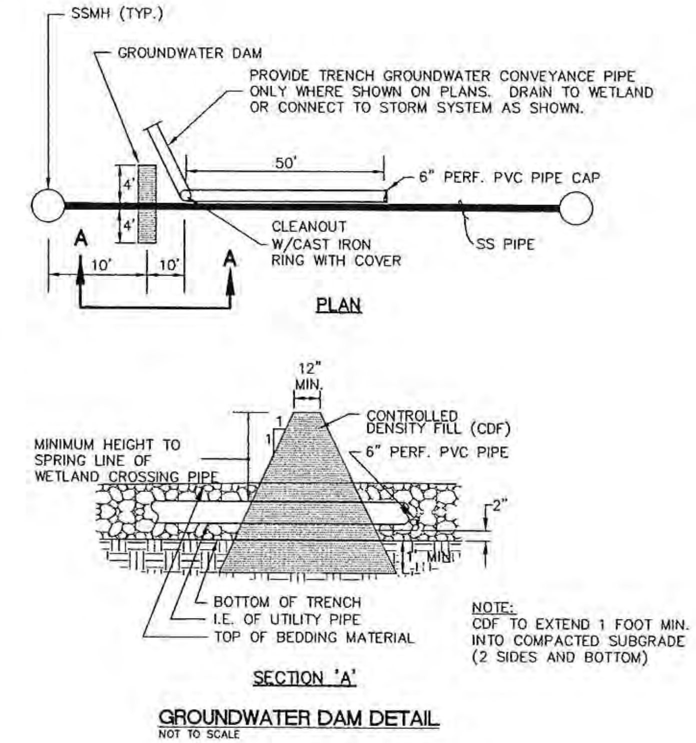
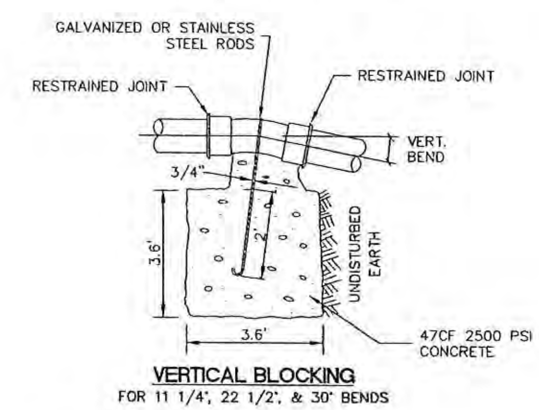
pct 07/03/04 4

PORTION OF N.W. 1/4, SECTION 13, TWP. 25 N. RGE. 5 E., W.M., KING COUNTY, WA

ATTACHMENT 18







AS-BUILT CERTIFICATE

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RICHARD A. DICKMAN PLS 26252 — EXPIRES 5/21/06

7/1/04
DATE

NOTE:

THIS DEVELOPMENT CONSTRUCTED WITH THE YEAR 2000 STANDARD SPECIFICATIONS AND DETAILS.

FILE# SPL-99-003

1009A
02-~~1010~~

APPROVED FOR CONSTRUCTION

FOR: DAVE RHODES
DIRECTOR OF PUBLIC WORKS
CITY OF REDMOND

DATE:
PLAN CHECK ENGINEER:
STORM:
UTILITY:
FIRE:
TRANSPORTATION:
PLANNING:

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GENERAL NOTES:

1. IF GROUND WATER ENCOUNTERED AT THE BOTTOM OF SEWER TRENCH LINE, CDF DAMS SHALL BE USED. SEE DETAIL THIS SHEET.
2. SUPPORT EXISTING PIPE AND POUR BASE OF NEW MANHOLE. MAINTAIN INTEGRITY OF EXISTING PIPE UNTIL NEW MANHOLE AND NEW LINE IS COMPLETE AND TESTED. CUT OUT TOP OF EXISTING PIPE
3. CONTRACTOR SHALL PROVIDE ADEQUATE STRUCTURAL SUPPORT FOR THE EXISTING SEWER MAINS (18" & 24") TO PREVENT DEFLECTION OF JOINTS. WATER MAIN SHALL BE CONSTRUCTED TO INSURE JOINTS ARE EQUAL DISTANCE FROM EXISTING 24" SEWER LINE. WATER MAIN SHALL BE ENCASED IN A 18" MINIMUM DUCTILE IRON PIPE OR APPROVED EQUAL AS SPECIFIED D.O.E. CRITERIA FOR SEWAGE WORKS DESIGN, C1-9.1.4A. ALL VOIDS SHALL BE PRESSURE-GROUTED WITH SAND-CEMENT GROUT OR BENTONITE. COMMERCIALLY AVAILABLE PIPE SKIDS AND END SEALS ARE ACCEPTABLE. ALL UTILITY WORK WITHIN W. LAKE SAMMAMISH PARKWAY SHALL BE BACKFILLED W/CDF.

WATERMAIN NOTES:

1. CONCRETE BLOCKING SIZES BASED ON:
   - 36 FEET OF PIPE RESTRAINED EACH SIDE OF BEND.
   - THRUST BLOCK AREAS BASED ON SAFE BEARING LOAD OF 1,000 PSF.
   - 2,500 PSI CONCRETE.
   - MINIMUM 3 FEET OF COVER.
   - PIPE THRUST BASED ON 200 PSI PRESSURE.
   - PIPE ENCASED IN POLYETHYLENE.
   - VERTICAL BLOCK SIZE BASED ON CONCRETE WEIGHT OF 150 POUNDS PER CUBIC FOOT.
   - TRENCH CONDITIONS BASED ON TYPE 2, FLAT BOTTOM TRENCH WITH LIGHTLY CONSOLIDATED BACKFILL, PER ANSI/AWWA C150/A21.50.
   - FACTOR OF SAFETY IS 1.5.
   - SOIL FRICTIONAL RESISTANCE BASED ON COHESIVE GRANULAR SOIL TYPE (GC+SC). SAND, GRAVEL, CLAY MIXTURE.
2. LINE SHALL NOT BE PRESSURIZED UNTIL ALL TRENCHING WITHIN 100 FEET OF VERTICAL BEND IS BACKFILLED AND COMPACTED TO MINIMUM COVER OF 3 FEET OVER PIPE.

LAKEVILLE CONSTRUCTION
Marymoor Hill Short Plat
SEWER AND WATER PROFILE
City of Redmond
CONSTRUCTION PLANS

DAVID EVANS AND ASSOCIATES, INC.
415 - 118TH AVENUE S.E.
BELLEVUE, WA. 98005-3518 (425) 519-6500

REVISED PER CITY'S COMMENTS	7-3-04	
PREPARED RECORD DRAWINGS	01-09-03	
		REVISIONS

12 OF 16 SHEETS

SCALE: 1" = 20' DATE: 5/15/01 FILE: LKVL0003 DESIGN: DRAWN: RABR CHECKED: JTE

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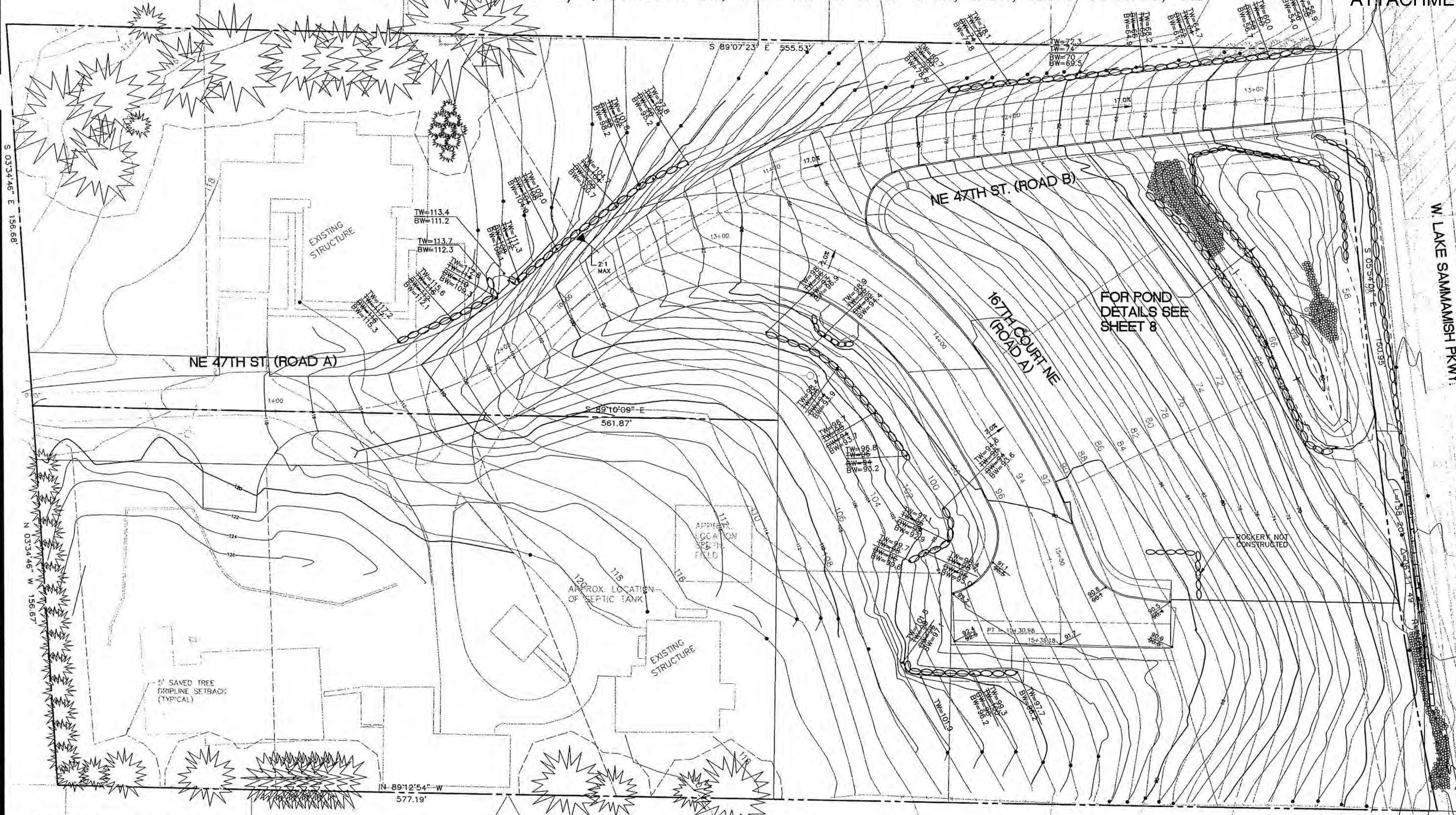
pct 07/03/04

PORTION OF N.W. 1/4, SECTION 13, TWP. 25 N. RGE. 5 E., W.M., KING COUNTY, WA

ATTACHMENT 18



EARTHWORK QUANTITIES

TOTAL STRIPPING= 2,624 CY*

AFTER STRIPPING
TOTAL CUT= 2,560 CY
TOTAL FILL= 763 CY

TOTAL NET= 1,797 CY (CUT)

* ASSUMES 1.5 FEET

EARTHWORK QUANTITIES SHOWN ARE FOR PERMITTING PURPOSES ONLY. CONTRACTOR'S ARE RESPONSIBLE FOR THEIR OWN TAKEOFF.

TOTAL DISTURBED AREA=1.1 AC

N

MERIDIAN – CITY OF REDMOND HORIZONTAL CONTROL GLO MONUMENTS AND GPS MONUMENTS BEARINGS ARE BASED ON STATIONS A-130 AND A-129

0 10 20 40

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RICHARD A. DICKMAN · STATE OF WASHINGTON · REGISTERED PROFESSIONAL LAND SURVEYOR · EXPIRES 5/21/06

AS-BUILT CERTIFICATE

I HEREBY CERTIFY THAT THIS AS-BUILT SURVEY CORRECTLY REPRESENTS A SURVEY MADE UNDER MY DIRECTION AND REPRESENTS THE ACTUAL SITE CONDITIONS ON JULY 3, 2004.

RICHARD A. DICKMAN PLS 26252 — DATE 7/10/04

NOTE:

THIS DEVELOPMENT CONSTRUCTED WITH THE YEAR 2000 STANDARD SPECIFICATIONS AND DETAILS.

FILE# SPL-99-003

~~02-1012~~ 10013

APPROVED FOR CONSTRUCTION

FOR: DAVE RHODES
DIRECTOR OF PUBLIC WORKS
CITY OF REDMOND

DATE:
PLAN CHECK ENGINEER:
STORM:
UTILITY:
FIRE:
TRANSPORTATION:
PLANNING:

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LAKEVILLE CONSTRUCTION
Marymoor Hill Short Plat
GRADING PLAN
City of Redmond
CONSTRUCTION PLANS

DAVID EVANS AND ASSOCIATES, INC.
415 - 118TH AVENUE S.E.
BELLEVUE, WA. 98005-3518 (425) 519-6500

ADD SIDEWALK, ROCKERY AND BLOCK WALL ON W. LK. SAMMAMISH PKWY 7-3-04
PREPARED RECORD DRAWINGS 01-09-03
REVISIONS

14 OF 16 SHEETS

SCALE: 1" = 20' DESIGN: JTE
DATE: 5/15/01 DRAWN: RABR
FILE: LKVL0003 CHECKED: JTE

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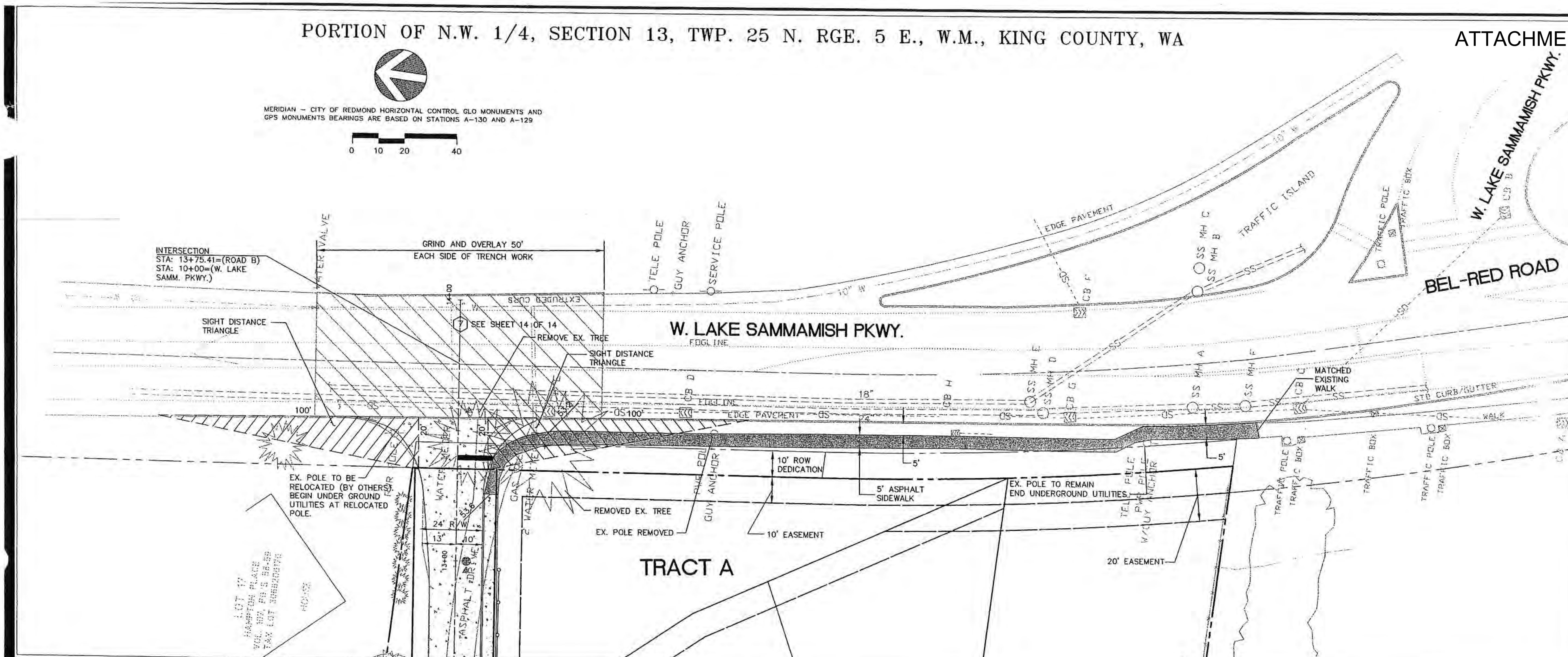
ATTACHMENT 18

PORTION OF N.W. 1/4, SECTION 13, TWP. 25 N. RGE. 5 E., W.M., KING COUNTY, WA



FOR PAVEMENT MARKING AND SIGNS
SEE STRIPING AND SIGNING PLAN (SHEET 14 OF 14)

EXISTING STORM DRAIN STRUCTURE DATA					
STRUCTURE	RIM	INVERT	STRUCTURE	RIM	INVERT
CB A	65.53	18" N – 59.98	CB F	55.66	8" NNE – 53.21
CB B	59.45	12" N – 56.11	CB G	57.48	18" S – 53.85
CB C	60.68	12" SE – 54.93			18" N – 53.76
		18" N – 55.13			8" SSW – 54.48
		18" S – 55.03	CB H	55.69	12" W – 53.47
CB D	52.89	12" W – 50.54			12" N – 53.42
		12" S – 50.49			12" S – 53.37
CB E	52.35	12" S – 50.00			
		12" N – 50.03			

EX. SANITARY SEWER STRUCTURE DATA		
SS MH A	59.17	24" N/S – 51.24
SS MH B	57.21	18" N/S – 47.81
		12" E – 48.26
SS MH C	56.67	UNDER CONST
SS MH D(METRO)	57.34	LOCKED LID
SS MH E	57.12	18" S – 48.82
		24" SE/N – 47.47
SS MH F	60.02	14" N/S – 51.90

RICHARD A. DICKMAN STATE OF WASHINGTON 26252 REGISTERED PROFESSIONAL LAND SURVEYOR EXPIRES 5/21/06

AS-BUILT CERTIFICATE

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RICHARD A. DICKMAN PLS 26252 — 7/10/04 DATE

NOTE:

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FILE# SPL-99-003

02-~~1013~~ 1009C

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APPROVED FOR CONSTRUCTION

FOR: DAVE RHODES
DIRECTOR OF PUBLIC WORKS
CITY OF REDMOND

DATE:
PLAN CHECK ENGINEER:
STORM:
UTILITY:
FIRE:
TRANSPORTATION:
PLANNING:

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LAKEVILLE CONSTRUCTION
Marymoor Hill Short Plat
RD. IMPROVEMENT/CHAN. PLAN
City of Redmond
CONSTRUCTION PLANS

DAVID EVANS AND ASSOCIATES, INC.
415 - 118TH AVENUE S.E.
BELLEVUE, WA. 98005-3518 (425) 519-6500

ADD SIDEWALK, ROCKERY AND BLOCK WALL ON W. LK. SAMMAMISH PKWY 7-3-04
PREPARED RECORD DRAWINGS 01-09-03
REVISIONS

15 OF 16 SHEETS

SCALE: 1" = 20'
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FILE: LKVL0003
DESIGN:
DRAWN: RABR
CHECKED: JTE

LKVL0003 ... XREFS: CC_TOPO.DWG

ATTACHMENT 18

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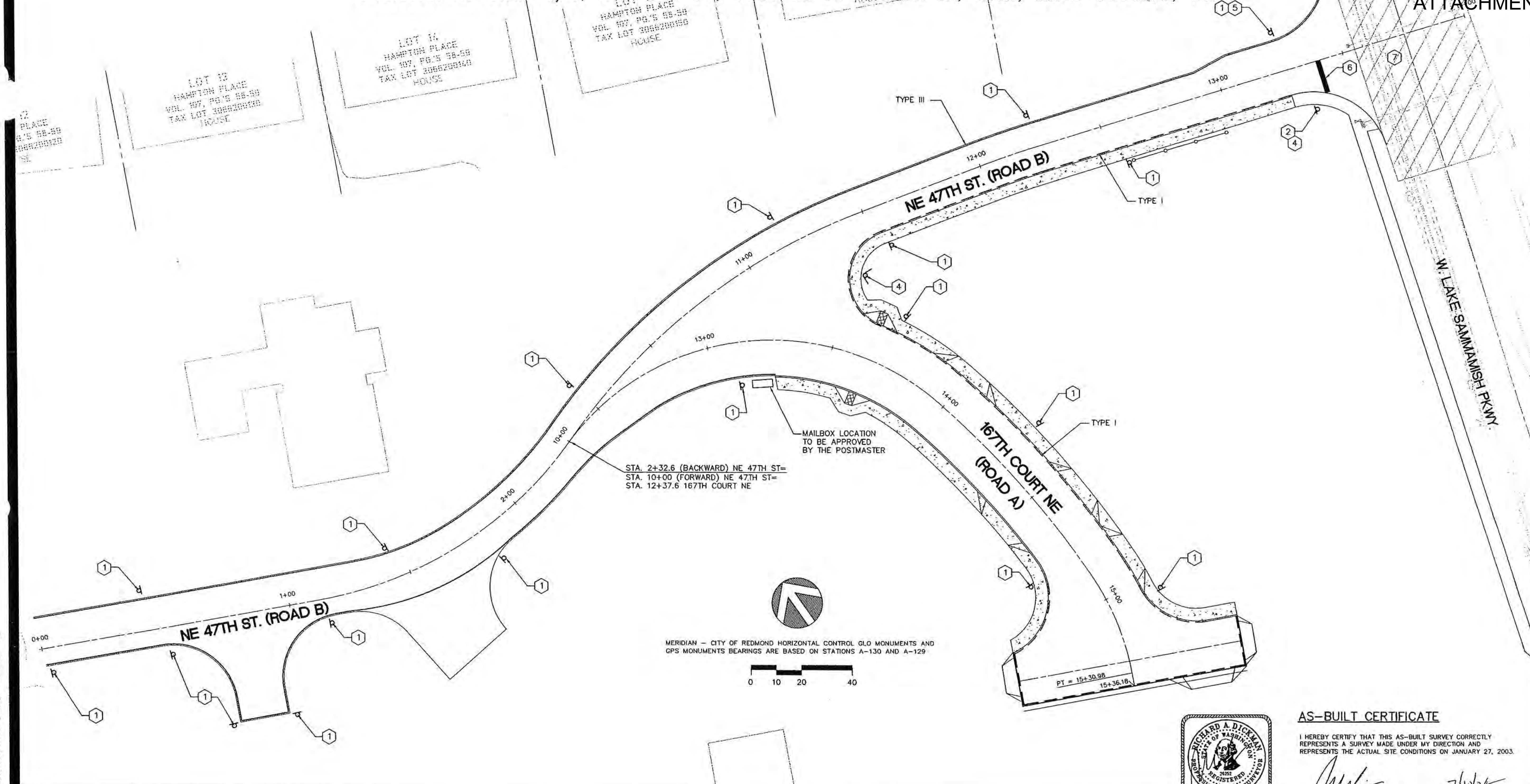

TYPE I
CURB PAINTED YELLOW

TYPE III
6" YELLOW STRIPE ON PAVEMENT

1. INSTALL TYPE II "NO PARKING FIRE LANE" SIGN AND POST
2. INSTALL STOP SIGN AND POST PER C.O.R. STD 426
3. NOT USED
4. INSTALL STREET NAME SIGN AND POST PER C.O.R. DETAIL 426
5. INSTALL "NO OUTLET" SIGN AND POST PER COR STD. 426
6. INSTALL 24" STOP BAR PER COR STD. 311
7. REPLACE EXISTING STRIPING IN W. LAKE SAMMAMISH PARKWAY AFTER COMPLETION OF OVERLAY

CALL BEFORE YOU DIG
Call: TOLL FREE
1-800-424-5555

AS-BUILT CERTIFICATE

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RICHARD A. DICKMAN PLS 26252 — DATE 7/10/04

RICHARD A. DICKMAN, STATE OF WASHINGTON, 26252, REGISTERED PROFESSIONAL LAND SURVEYOR, EXPIRES 5/21/06

FILE# SPL-99-003

1009'D
02-~~1014~~

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LAKEVILLE CONSTRUCTION
Marymoor Hill Short Plat
STRIPING AND SIGNING PLAN
City of Redmond
CONSTRUCTION PLANS

DAVID EVANS AND ASSOCIATES, INC.
415 - 118TH AVENUE S.E.
BELLEVUE, WA. 98005-3518 (425) 519-6500

PREPARED RECORD DRAWINGS 01-09-03
REVISIONS

16 OF 16 SHEETS

SCALE: 1" = 20' DESIGN:
DATE: 5/15/01 DRAWN: RABR
FILE LKV.0003 CHECKED: JTE

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APPENDIX D

Construction Storm Water Pollution Prevention Plan

Stormwater Pollution Prevention Plan

For
Duke's Landing

Prepared For
Northwest Regional Office
3190 - 160th Avenue SE
Bellevue, WA 98008-5452
425-649-7000

Owner	Developer	Operator/Contractor
Duke's Landing, LLC	Duke's Landing, LLC	Duke's Landing, LLC
227 Bellevue Way NE Suite #174	227 Bellevue Way NE Suite #174	227 Bellevue Way NE Suite #174
Bellevue, WA 98004	Bellevue, WA 98004	Bellevue, WA 98004

Project Site Location
16410 NE 47th Street
Redmond, WA 98052

Certified Erosion and Sediment Control Lead
To be determined

SWPPP Prepared By
ESM Consulting Engineers, LLC
33400 8th Avenue South, Suite 205
Federal Way, WA 98003
(253) 838-6113
Brianne Gastfield, P.E.

SWPPP Preparation Date
April 8th 2015

Approximate Project Construction Dates
To be determined

Contents

Appendix A Site plans

- Vicinity map (with all discharge points)
- Site plan with TESC measures

Appendix B Construction BMPs

- Possibly reference in BMPs, but likely it will be a consolidated list so that the applicant can photocopy from the list from the SWMM.

Appendix C Alternative Construction BMP list

- List of BMPs not selected, but can be referenced if needed in each of the 12 elements

Appendix D General Permit

Appendix E Site Log and Inspection Forms

Appendix F Engineering Calculations (if necessary)

- Flows, ponds, etc…

1.0 Introduction

This Stormwater Pollution Prevention Plan (SWPPP) has been prepared as part of the NPDES stormwater permit requirements for the Duke's Landing construction project in *Redmond, Washington. The site is located at 16410 NE 47th Street, Redmond WA 98052.* **The existing site** *is 4.27 acres in size and incorporates three parcels numbered 555630-0067, 555630-0068 and 555630-0069. The existing site consists of a single-family dwelling with paved driveways and a few small barn structures.* **The proposed development consists of** *grading, roadway and utility construction phase and a home construction phase on the finished lots with an estimated total/disturbed area of 4.00 acres.*

Construction activities will include demolition of existing buildings onsite, clearing & grading, roadwork, storm water quality & detention vault construction, utilities installation, foundation excavation, home construction and landscaping. **The purpose of this SWPPP is to describe the proposed construction activities and all temporary and permanent erosion and sediment control (TESC) measures, pollution prevention measures, inspection/monitoring activities, and recordkeeping that will be implemented during the proposed construction project. The objectives of the SWPPP are to:**

1. **Implement Best Management Practices (BMPs) to prevent erosion and sedimentation, and to identify, reduce, eliminate or prevent stormwater contamination and water pollution from construction activity.**

2. **Prevent violations of surface water quality, ground water quality, or sediment management standards.**

3. **Prevent, during the construction phase, adverse water quality impacts including impacts on beneficial uses of the receiving water by controlling peak flow rates and volumes of stormwater runoff at the Permittee's outfalls and downstream of the outfalls.**

This SWPPP was prepared using the Ecology SWPPP Template downloaded from the Ecology website on April 8, 2015. T**his SWPPP was prepared based on the requirements set forth in the Construction Stormwater General Permit, *Stormwater Management Manual for Western Washington* (SWMMWW 2005) and City of Redmond Stormwater Management Technical Notebook (SWMTN 2012)**. The report is divided into seven main sections with several appendices that include stormwater related reference materials. The topics presented in the each of the main sections are:

- Section 1 – INTRODUCTION. This section provides a summary description of the project, and the organization of the SWPPP document.

- Section 2 – SITE DESCRIPTION. This section provides a detailed description of the existing site conditions, proposed construction activities, and calculated stormwater flow rates for existing conditions and post–construction conditions.

- Section 3 – CONSTRUCTION BMPs. This section provides a detailed description of the BMPs to be implemented based on the 12 required elements of the SWPPP (SWMMEWW 2004).

- Section 4 – CONSTRUCTION PHASING AND BMP IMPLEMENTATION. This section provides a description of the timing of the BMP implementation in relation to the project schedule.

- Section 5 – POLLUTION PREVENTION TEAM. This section identifies the appropriate contact names (emergency and non-emergency), monitoring personnel, and the onsite temporary erosion and sedimentation control inspector

- Section 6 – INSPECTION AND MONITORING. This section provides a description of the inspection and monitoring requirements such as the parameters of concern to be monitored, sample locations, sample frequencies, and sampling methods for all stormwater discharge locations from the site.

- Section 7 – RECORDKEEPING. This section describes the requirements for documentation of the BMP implementation, site inspections, monitoring results, and changes to the implementation of certain BMPs due to site factors experienced during construction.

Supporting documentation and standard forms are provided in the following Appendices:

Appendix A – Site plans
Appendix B – Construction BMPs
Appendix C – Alternative Construction BMP list
Appendix D – General Permit
Appendix E – Site Log and Inspection Forms
Appendix F – Engineering Calculations

2.0 Site Description

2.1 Existing Conditions

The proposed site is located at 16410 NE 47th Street, Redmond Washington. A site vicinity map is provided in Appendix A. The site is 4.27 acres in size and includes a single-family house with associated gravel driveways, along with few detached structures. All structures on site will be demolished. The topography of the site and surrounding properties gently slopes from west to east along NE 47th Street. The site consist of Alderwood gravelly sandy loam, 8 to 15 percent slopes.

Runoff from the site generally drains from west to east to a ditch along the driveways and recently dug ditch along south boundary of the site. The natural drainage point from the site is located at northwest corner of the site and continues to flow along series of catch basins and ultimately discharges to Sammamish River. At the point of discharge, Sammamish River is not listed as a Category 5 polluted water of the state under the State's Clean Water Act Section 303(d) list.

There are not critical areas on the site such as high erosion risk areas, wetlands, streams, or steep slopes (potential landslide area).

2.2 Proposed Construction Activities

The proposed development includes the construction of a 18 single-family residences. A combined stormwater detention and treatment vault will be constructed in the northwest corner (low drainage spot) of the site. New sanitary, electrical, gas, and storm drain utilities will also be constructed.

Construction activities will include site preparation, TESC installation, demolition of the existing structure, clearing, site-wide grading for each lots, excavation for the building foundations and pre-cast concrete stormwater vault and asphalt paving. The schedule and phasing of BMPs during construction is provided in Section 4.0.

Stormwater runoff volumes were calculated using the Western Washington Hydrology Model (WWHM). The temporary sedimentation pond that will be used during construction was designed using the 2-year storm event since construction will not occur over a long time-frame (approximately one year).

After the building is constructed and all new utilities are installed, the site will be graded and paved. A landscape buffer area will be constructed on the northwest corner of the site at Tract B.

The following summarizes details regarding site areas:

- Total site area: 4.27 acres
- Percent impervious area before construction: 15 %
- Percent impervious area after construction: 80 %
- Disturbed area during construction: 4.00 acres
- Disturbed area that is characterized as impervious (i.e., access roads, staging, parking): 3.32 acres
- 2-year stormwater runoff peak flow prior to construction (existing): 0.13 cfs
- 10-year stormwater runoff peak flow prior to construction (existing): 0.26 cfs
- 2-year stormwater runoff peak flow during construction: 1.37 cfs
- 10-year stormwater runoff peak flow during construction: 2.01 cfs
- 2-year stormwater runoff peak flow after construction: 0.12 cfs
- 10-year stormwater runoff peak flow <u>after</u> construction: 0.26 cfs

All stormwater flow calculations are provided in Appendix F.

3.0 Construction Stormwater BMPs

3.1 The 12 BMP Elements

3.1.1 Element #1 – Mark Clearing Limits

To protect adjacent properties and to reduce the area of soil exposed to construction, the limits of construction will be clearly marked before land-disturbing activities begin. Trees that are to be preserved, as well as all sensitive areas and their buffers, shall be clearly delineated, both in the field and on the plans. In general, natural vegetation and native topsoil shall be retained in an undisturbed state to the maximum extent possible. The BMPs relevant to marking the clearing limits that will be applied for this project include:

- Silt Fence (City of Redmond Standard Detail 502)

  Silt fencing is used for sediment control and marking clearing limits for this project.

- Stake and Wire Fence (BMP C104)

  Install Stake and Wire Fence around trees to be retained west of the property.

Alternate BMPs for marking clearing limits are included in Appendix C as a quick reference tool for the onsite inspector in the event the BMP(s) listed above are deemed ineffective or inappropriate during construction to satisfy the requirements set forth in the General NPDES Permit (Appendix D). To avoid potential erosion and sediment control issues that may cause a violation(s) of the NPDES Construction Stormwater permit (as provided in Appendix D), the Certified Erosion and Sediment Control Lead will promptly initiate the implementation of one or more of the alternative BMPs listed in Appendix C after the first sign that existing BMPs are ineffective or failing.

3.1.2 Element #2 – Establish Construction Access

Construction access or activities occurring on unpaved areas shall be minimized, yet where necessary, access points shall be stabilized to minimize the tracking of sediment onto public roads, and wheel washing, street sweeping, and street cleaning shall be employed to prevent sediment from entering state waters. All wash wastewater shall be controlled on site. The specific BMPs related to establishing construction access that will be used on this project include:

- Stabilized Construction Entrance (City of Redmond Standard Detail 503)

  Stabilized construction entrance will be placed at the access routes onto the site from existing roadway at the start of the site development phase.

Alternate construction access BMPs are included in Appendix C as a quick reference tool for the onsite inspector in the event the BMP(s) listed above are deemed ineffective or inappropriate during construction to satisfy the requirements set forth in the General NPDES Permit (Appendix D). To avoid potential erosion and sediment control issues that may cause a violation(s) of the NPDES Construction Stormwater permit (as provided in Appendix D), the Certified Erosion and Sediment Control Lead will promptly initiate the implementation of one or more of the alternative BMPs listed in Appendix C after the first sign that existing BMPs are ineffective or failing.

3.1.3 Element #3 – Control Flow Rates

In order to protect the properties and waterways downstream of the project site, stormwater discharges from the site will be controlled. The specific BMPs for flow control that shall be used on this project include:

- Temporary Sediment Pond (BMP C241)

  Proposed temporary sediment ponds at low point to remove sediments from leaving the project site.

Alternate flow control BMPs are included in Appendix C as a quick reference tool for the onsite inspector in the event the BMP(s) listed above are deemed ineffective or inappropriate during construction to satisfy the requirements set forth in the General NPDES Permit (Appendix D). To avoid potential erosion and sediment control issues that may cause a violation(s) of the NPDES Construction Stormwater permit (as provided in Appendix D), the Certified Erosion and Sediment Control Lead will promptly initiate the implementation of one or more of the alternative BMPs listed in Appendix C after the first sign that existing BMPs are ineffective or failing.

The project site is located west of the Cascade Mountain Crest. As such, the project must comply with Minimum Requirement 7 (Ecology 2005).

In general, discharge rates of stormwater from the site will be controlled where increases in impervious area or soil compaction during construction could lead to downstream erosion, or where necessary to meet local agency stormwater discharge requirements (e.g. discharge to combined sewer systems).

3.1.4 Element #4 – Install Sediment Controls

All stormwater runoff from disturbed areas shall pass through an appropriate sediment removal BMP before leaving the construction site or prior to being discharged to an infiltration facility. The specific BMPs to be used for controlling sediment on this project include:

- Silt Fence (City of Redmond Standard Detail 502)

- Storm Drain Inlet Protection (City of Redmond Standard Detail I-40.20-00)

  Inlet protection will be used for nearby catch basins to capture any sediment leaving the project site.

Alternate sediment control BMPs are included in Appendix C as a quick reference tool for the onsite inspector in the event the BMP(s) listed above are deemed ineffective or inappropriate during construction to satisfy the requirements set forth in the General NPDES Permit (Appendix D). To avoid potential erosion and sediment control issues that may cause a violation(s) of the NPDES Construction Stormwater permit (as provided in Appendix D), the Certified Erosion and Sediment Control Lead will promptly initiate the implementation of one or more of the alternative BMPs listed in Appendix C after the first sign that existing BMPs are ineffective or failing.

In addition, sediment will be removed from paved areas in and adjacent to construction work areas manually or using mechanical sweepers, as needed, to minimize tracking of sediments on vehicle tires away from the site and to minimize washoff of sediments from adjacent streets in runoff.

Whenever possible, sediment laden water shall be discharged into onsite, relatively level, vegetated areas (BMP C240 paragraph 5, page 4-102).

In some cases, sediment discharge in concentrated runoff can be controlled using permanent stormwater BMPs (e.g., infiltration swales, ponds, trenches). Sediment loads can limit the effectiveness of some permanent stormwater BMPs, such as those used for infiltration or biofiltration; however, those BMPs designed to remove solids by settling (wet ponds or detention ponds) can be used during the construction phase. When permanent stormwater BMPs will be used to control sediment discharge during construction, the structure will be protected from excessive sedimentation with adequate erosion and sediment control BMPs. Any accumulated sediment shall be removed after construction is complete and the permanent stormwater BMP will be restabilized with vegetation per applicable design requirements once the remainder of the site has been stabilized.

The following BMPs will be implemented as end-of-pipe sediment controls as required to meet permitted turbidity limits in the site discharge(s). Prior to the implementation of these technologies, sediment sources and erosion control and soil stabilization BMP efforts will be maximized to reduce the need for end-of-pipe sedimentation controls.

- Temporary Sediment Pond (BMP C241)
- Construction Stormwater Filtration (BMP C251)

3.1.5 Element #5 – Stabilize Soils

Exposed and unworked soils shall be stabilized with the application of effective BMPs to prevent erosion throughout the life of the project. The specific BMPs for soil stabilization that shall be used on this project include:

- Temporary and Permanent Seeding (BMP C120)
- Mulching (BMP C121)
- Sodding (BMP C124)
- Dust Control (BMP C140)

Alternate soil stabilization BMPs are included in Appendix C as a quick reference tool for the onsite inspector in the event the BMP(s) listed above are deemed ineffective or inappropriate during construction to satisfy the requirements set forth in the General NPDES Permit (Appendix D). To avoid potential erosion and sediment control issues that may cause a violation(s) of the NPDES Construction Stormwater permit (as provided in Appendix D), the Certified Erosion and Sediment Control Lead will promptly initiate the implementation of one or more of the alternative BMPs listed in Appendix C after the first sign that existing BMPs are ineffective or failing.

In general, cut and fill slopes will be stabilized as soon as possible and soil stockpiles will be temporarily covered with plastic sheeting. All stockpiled soils shall be stabilized from erosion, protected with sediment trapping measures, and where possible, be located away from storm drain inlets, waterways, and drainage channels.

3.1.6 Element #6 – Protect Slopes

All cut and fill slopes will be designed, constructed, and protected in a manner than minimizes erosion. The following specific BMPs will be used to protect slopes for this project:

- Temporary and Permanent Seeding (BMP C120)

Alternate slope protection BMPs are included in Appendix C as a quick reference tool for the onsite inspector in the event the BMP(s) listed above are deemed ineffective or inappropriate during construction to satisfy the requirements set forth in the General NPDES Permit (Appendix D). To avoid potential erosion and sediment control issues that may cause a violation(s) of the NPDES Construction Stormwater permit (as provided in Appendix D), the Certified Erosion and Sediment Control Lead will promptly initiate the implementation of one or more of the alternative BMPs listed in Appendix C after the first sign that existing BMPs are ineffective or failing.

3.1.7 Element #7 – Protect Drain Inlets

All storm drain inlets and culverts made operable during construction shall be protected to prevent unfiltered or untreated water from entering the drainage conveyance system. However, the first priority is to keep all access roads clean of sediment and keep street wash water separate from entering storm drains until treatment can be provided. Storm Drain Inlet Protection (BMP C220) will be implemented for all drainage inlets and culverts that could potentially be impacted by sediment-laden runoff on and near the project site. The following inlet protection measures will be applied on this project:

- Storm Drain Inlet Protection (City of Redmond Standard Detail I-40.20-00)

If the BMP options listed above are deemed ineffective or inappropriate during construction to satisfy the requirements set forth in the General NPDES Permit (Appendix D), or if no BMPs are listed above but deemed necessary during construction, the Certified Erosion and Sediment Control Lead shall implement one or more of the alternative BMP inlet protection options listed in Appendix C.

3.1.8 Element #8 – Stabilize Channels and Outlets

Where site runoff is to be conveyed in channels, or discharged to a stream or some other natural drainage point, efforts will be taken to prevent downstream erosion. The specific BMPs for channel and outlet stabilization that shall be used on this project include:

- Interceptor Dike and Swale (BMP C200)Alternate channel and outlet stabilization BMPs are included in Appendix C as a quick reference tool for the onsite inspector in the event the BMP(s) listed above are deemed ineffective or inappropriate during construction to satisfy the requirements set forth in the General NPDES Permit (Appendix D). To avoid potential erosion and sediment control issues that may cause a violation(s) of the NPDES Construction Stormwater permit (as provided in Appendix D), the Certified Erosion and Sediment Control Lead will promptly initiate the implementation of one or more of the alternative BMPs listed in Appendix C after the first sign that existing BMPs are ineffective or failing.

3.1.9 Element #9 – Control Pollutants

All pollutants, including waste materials and demolition debris, that occur onsite shall be handled and disposed of in a manner that does not cause contamination of stormwater. Good housekeeping and preventative measures will be taken to ensure that the site will be kept clean, well organized, and free of debris. If required, BMPs to be implemented to control specific sources of pollutants are discussed below.

Vehicles, construction equipment, and/or petroleum product storage/dispensing:

- All vehicles, equipment, and petroleum product storage/dispensing areas will be inspected regularly to detect any leaks or spills, and to identify maintenance needs to prevent leaks or spills.

- On-site fueling tanks and petroleum product storage containers shall include secondary containment.

- Spill prevention measures, such as drip pans, will be used when conducting maintenance and repair of vehicles or equipment.

- In order to perform emergency repairs on site, temporary plastic will be placed beneath and, if raining, over the vehicle.

- Contaminated surfaces shall be cleaned immediately following any discharge or spill incident.

Chemical storage:

- Any chemicals stored in the construction areas will conform to the appropriate source control BMPs listed in Volume IV of the Ecology stormwater manual. In Western WA, all chemicals shall have cover, containment, and protection provided on site, per BMP C153 for Material Delivery, Storage and Containment in SWMMWW 2005

- Application of agricultural chemicals, including fertilizers and pesticides, shall be conducted in a manner and at application rates that will not result in loss of chemical to stormwater runoff. Manufacturers' recommendations for application procedures and rates shall be followed.

Excavation and tunneling spoils dewatering waste:

- Dewatering BMPs and BMPs specific to the excavation and tunneling (including handling of contaminated soils) are discussed under Element 10.

Demolition:

- Dust released from demolished sidewalks, buildings, or structures will be controlled using Dust Control measures (BMP C140).

- Storm drain inlets vulnerable to stormwater discharge carrying dust, soil, or debris will be protected using Storm Drain Inlet Protection (BMP C220 as described above for Element 7).

- Process water and slurry resulting from sawcutting and surfacing operations will be prevented from entering the waters of the State by implementing Sawcutting and Surfacing Pollution Prevention measures (BMP C152).

Concrete and grout:

- Process water and slurry resulting from concrete work will be prevented from entering the waters of the State by implementing Concrete Handling measures (BMP C151).

Sanitary wastewater:

- Portable sanitation facilities will be firmly secured, regularly maintained, and emptied when necessary.

- Wheel wash or tire bath wastewater shall be discharged to a separate on-site treatment system or to the sanitary sewer as part of Wheel Wash implementation (BMP C106).

Solid Waste:

- Solid waste will be stored in secure, clearly marked containers.

Other:

- Other BMPs will be administered as necessary to address any additional pollutant sources on site.

As per the Federal regulations of the Clean Water Act (CWA) and according to Final Rule 40 CFR Part 112, as stated in the National Register, a Spill Prevention, Control, and Countermeasure (SPCC) Plan is required for construction activities. A SPCC Plan has been prepared to address an approach to prevent, respond to, and report spills or releases to the environment that could result from construction activities. This Plan must:

- Be well thought out in accordance with good engineering;

- Achieve three objectives - prevent spills, contain a spill that occurs, and clean up the spill;

- Identify the name, location, owner, and type of facility;

- Include the date of initial operation and oil spill history;

- Name the designated person responsible;

- Show evidence of approval and certification by the person in authority; and

- Contain a facility analysis.

The facility does not require a Spill Prevention, Control, and Countermeasure (SPCC) Plan under the Federal regulations of the Clean Water Act (CWA).

3.1.10 Element #10 – Control Dewatering

There will be no dewatering as part of this construction project.

3.1.11 Element #11 – Maintain BMPs

All temporary and permanent erosion and sediment control BMPs shall be maintained and repaired as needed to assure continued performance of their intended function. Maintenance and repair shall be conducted in accordance with each particular BMPs specifications (attached). Visual monitoring of the BMPs will be conducted at least once every calendar week and within 24 hours of any stormwater or non-stormwater discharge from the site. If the site becomes inactive, and is temporarily stabilized, the inspection frequency will be reduced to once every month.

All temporary erosion and sediment control BMPs shall be removed within 30 days after the final site stabilization is achieved or after the temporary BMPs are no longer needed. Trapped sediment shall be removed or stabilized on site. Disturbed soil resulting from removal of BMPs or vegetation shall be permanently stabilized.

3.1.12 Element #12 – Manage the Project

Erosion and sediment control BMPs for this project have been designed based on the following principles:

- Design the project to fit the existing topography, soils, and drainage patterns.
- Emphasize erosion control rather than sediment control.
- Minimize the extent and duration of the area exposed.
- Keep runoff velocities low.
- Retain sediment on site.
- Thoroughly monitor site and maintain all ESC measures.
- Schedule major earthwork during the dry season.

In addition, project management will incorporate the key components listed below:

As this project site is located west of the Cascade Mountain Crest, the project will be managed according to the following key project components:

Phasing of Construction

- The construction project is being phased to the extent practicable in order to prevent soil erosion, and, to the maximum extent possible, the transport of sediment from the site during construction.

- Revegetation of exposed areas and maintenance of that vegetation shall be an integral part of the clearing activities during each phase of construction, per the Scheduling BMP (C 162).

Seasonal Work Limitations

- From October 1 through April 30, clearing, grading, and other soil disturbing activities shall only be permitted if shown to the satisfaction of the local permitting authority that silt-laden runoff will be prevented from leaving the site through a combination of the following:

    - ☐ Site conditions including existing vegetative coverage, slope, soil type, and proximity to receiving waters; and

    - ☐ Limitations on activities and the extent of disturbed areas; and

    - ☐ Proposed erosion and sediment control measures.

- Based on the information provided and/or local weather conditions, the local permitting authority may expand or restrict the seasonal limitation on site disturbance.

- The following activities are exempt from the seasonal clearing and grading limitations:

    - ☐ Routine maintenance and necessary repair of erosion and sediment control BMPs;

    - ☐ Routine maintenance of public facilities or existing utility structures that do not expose the soil or result in the removal of the vegetative cover to soil; and

    - ☐ Activities where there is 100 percent infiltration of surface water runoff within the site in approved and installed erosion and sediment control facilities.

Coordination with Utilities and Other Jurisdictions

- Care has been taken to coordinate with utilities, other construction projects, and the local jurisdiction in preparing this SWPPP and scheduling the construction work.

Inspection and Monitoring

- All BMPs shall be inspected, maintained, and repaired as needed to assure continued performance of their intended function. Site inspections shall be conducted by a person who is knowledgeable in the principles and practices of erosion and sediment control. This person has the necessary skills to:

  - Assess the site conditions and construction activities that could impact the quality of stormwater, and

  - Assess the effectiveness of erosion and sediment control measures used to control the quality of stormwater discharges.

- A Certified Erosion and Sediment Control Lead shall be on-site or on-call at all times.

- Whenever inspection and/or monitoring reveals that the BMPs identified in this 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

- This 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 (7) days following the inspection.

4.0 Construction Phasing and BMP Implementation

The BMP implementation schedule will be driven by the construction schedule. The following provides a sequential list of the proposed construction schedule milestones and the corresponding BMP implementation schedule. The list contains key milestones such as wet season construction.

The BMP implementation schedule listed below is keyed to proposed phases of the construction project, and reflects differences in BMP installations and inspections that relate to wet season construction. The project site is located west of the Cascade Mountain Crest. As such, the dry season is considered to be from May 1 to September 30 and the wet season is considered to be from October 1 to April 30.

- Estimate of Construction start date: ~
- Estimate of Construction finish date: ~
- Mobilize equipment on site: ~
- Mobilize and store all ESC and soil stabilization products: ~
- Install ESC measures: ~
- Install stabilized construction entrance: ~
- Begin clearing and grubbing:

5.0 Pollution Prevention Team

5.1 Roles and Responsibilities

The pollution prevention team consists of personnel responsible for implementation of the SWPPP, including the following:

- Certified Erosion and Sediment Control Lead (CESCL) – primary contractor contact, responsible for site inspections (BMPs, visual monitoring, sampling, etc.); to be called upon in case of failure of any ESC measures.
- Project's Civil Engineer – For projects with engineered structures only (sediment ponds/traps, sand filters, etc.): site representative for the owner that is the project's supervising engineer responsible for inspections and issuing instructions and drawings to the contractor's site supervisor or representative
- Emergency Ecology Contact – individual to be contacted at Ecology in case of emergency. Go to the following website to get the name and number for the Ecology contact information: http://www.ecy.wa.gov/org.html.
- Emergency Owner Contact – individual that is the site owner or representative of the site owner to be contacted in the case of an emergency.
- Non-Emergency Ecology Contact – individual that is the site owner or representative of the site owner than can be contacted if required.
- Monitoring Personnel – personnel responsible for conducting water quality monitoring; for most sites this person is also the Certified Erosion and Sediment Control Lead.

5.2 Team Members

Names and contact information for those identified as members of the pollution prevention team are provided in the following table.

Title	Name(s)	Phone Number
Certified Erosion and Sediment Control Lead (CESCL)	To be determined	~
Project's Civil Engineer	Brianne Gastfield, P.E.	(253) 838-6113
Project's lead SWPPP specialist	To be determined	~
Applicant's Project Manager	Eric LaBrie	(253) 838-6113
General Contractor	To be determined	~
Grading Contractor	To be determined	~
Emergency Ecology Contact	Kevin Fitzpatrick	(425) 649-7033
Emergency Owner Contact	Terry Caffey	(425) 941-1059
Non-Emergency Ecology Contact	Shawn Hopkins	(360) 407-6442
Monitoring Personnel	To be determined	~

6.0 Site Inspections and Monitoring

Monitoring includes visual inspection, monitoring for water quality parameters of concern, and documentation of the inspection and monitoring findings in a site log book. A site log book will be maintained for all on-site construction activities and will include:

- A record of the implementation of the SWPPP and other permit requirements
- Site inspections
- Stormwater quality monitoring

For convenience, the inspection form and water quality monitoring forms included in this SWPPP include the required information for the site log book. This SWPPP may function as the site log book if desired, or the forms may be separated and included in a separate site log book. However, if separated, the site log book but must be maintained on-site or within reasonable access to the site and be made available upon request to Ecology or the local jurisdiction.

6.1 Site Inspection

All BMPs will be inspected, maintained, and repaired as needed to assure continued performance of their intended function. The inspector will be a Certified Erosion and Sediment Control Lead (CESCL) per BMP C160. The name and contact information for the CESCL is provided in Section 5 of this SWPPP.

Site inspection will occur in all areas disturbed by construction activities and at all stormwater discharge points. Stormwater will be examined for the presence of suspended sediment, turbidity, discoloration, and oily sheen. The site inspector will evaluate and document the effectiveness of the installed BMPs and determine if it is necessary to repair or replace any of the BMPs to improve the quality of stormwater discharges. All maintenance and repairs will be documented in the site log book or forms provided in this document. All new BMPs or design changes will be documented in the SWPPP as soon as possible.

6.1.1 Site Inspection Frequency

Site inspections will be conducted at least once a week and within 24 hours following any discharge from the site. For sites with temporary stabilization measures, the site inspection frequency can be reduced to once every month.

6.1.2 Site Inspection Documentation

The site inspector will record each site inspection using the site log inspection forms provided in Appendix E. The site inspection log forms may be separated from this SWPPP document, but will be maintained on-site or within reasonable access to the site and be made available upon request to Ecology or the local jurisdiction.

6.2 Stormwater Quality Monitoring

6.2.1 Turbidity

Turbidity sampling and monitoring will be conducted during the entire construction phase of the project. Samples will be collected daily at the catch basin in the northwest corner of the site (CB5). If there is no flow in this catch basin, the attempt to sample will be recorded in the site log book and reported to Ecology in the monthly Discharge Monitoring Report (DMR) as "No Discharge". Samples will be analyzed for turbidity using the EPA 180.1 analytical method.

The key benchmark turbidity value is 25 nephelometric turbidity units (NTU) for the downstream receiving water body. If the 25 NTU benchmark is exceeded in any sample collected from CB5, the following steps will be conducted:

1. Ensure all BMPs specified in this SWPPP are installed and functioning as intended.

2. Assess whether additional BMPs should be implemented, and document modified BMPs in the SWPPP as necessary.

3. Sample discharge daily until the discharge is 25 NTU or lower.

If the turbidity exceeds 250 NTU at any time, the following steps will be conducted:

1. Notify Ecology by phone within 24 hours of analysis (see Section 5.0 of this SWPPP for contact information).

2. Continue sampling daily until the discharge is 25 NTU or lower Initiate additional treatment BMPs such as off-site treatment, infiltration, filtration and chemical treatment within 24 hours, and implement those additional treatment BMPs as soon as possible, but within a minimum of 7 days.

3. Describe inspection results and remedial actions taken in the site log book and in monthly discharge monitoring reports as described in Section 7.0 of this SWPPP.

6.2.2 pH

Sampling and monitoring for pH will occur during the phase of construction when concrete pouring will be conducted until fully cured (3 weeks from last pour) and discharges are documented to be below pH 8.5. Samples will be collected weekly at the sedimentation pond prior to discharge to surface water. Samples will be analyzed for pH using a calibrated pH meter and recorded in the site log book.

The key benchmark pH value for stormwater is a maximum of 8.5. If a pH greater than 8.5 is measured in the sedimentation trap/pond(s) that has the potential to discharge to surface water, the following steps will be conducted:

1. Prevent (detain) all discharges from leaving the site and entering surface waters or storm drains if the pH is greater than 8.5

2. Implement CO_2 sparging or dry ice treatment in accordance with Ecology BMP C252.

3. Describe inspection results and remedial actions that are taken in the site log book and in monthly discharge monitoring reports as described in Section 7.0 of this SWPPP.

6.2.3 City of Redmond Standards

Water quality standards include the State Standards and the City Standards. City Standards include the following:

a. At the outflow point(s) from the treatment system(s), the turbidity standard is 25 NTU, Maximum. NTU = Nephelometric Turbidity Unit.

b. At downstream points of discharge to surface waters, the standard is as follows: runoff from the site is not to cause the turbidity level in receiving water(s) to increase more than 5 NTU.

c. At the outflow point(s) from the site, the standard for pH is 6.5, minimum, and 8.5, maximum.

d. All available measures can include, but are not necessarily limited to, project phasing, advanced erosion and sediment control measures, and delaying all or part of any project work that has not commenced to avoid working during the rainy season.

e. Unless larger design storm is specified for a specific or pollution control method, the minimum design storm for construction phase measures is the 10-year return frequency storm.

7.0 Reporting and Recordkeeping

7.1 Recordkeeping

7.1.1 Site Log Book

A site log book will be maintained for all on-site construction activities and will include:

- A record of the implementation of the SWPPP and other permit requirements;
- Site inspections; and,
- Stormwater quality monitoring.

For convenience, the inspection form and water quality monitoring forms included in this SWPPP include the required information for the site log book.

7.1.2 Records Retention

Records of all monitoring information (site log book, inspection reports/checklists, etc.), this Stormwater Pollution Prevention Plan, and any other documentation of compliance with permit requirements will be retained during the life of the construction project and for a minimum of three years following the termination of permit coverage in accordance with permit condition S5.C.

7.1.3 Access to Plans and Records

The SWPPP, General Permit, Notice of Authorization letter, and Site Log Book will be retained on site or within reasonable access to the site and will be made immediately available upon request to Ecology or the local jurisdiction. A copy of this SWPPP will be provided to Ecology within 14 days of receipt of a written request for the SWPPP from Ecology. Any other information requested by Ecology will be submitted within a reasonable time. A copy of the SWPPP or access to the SWPPP will be provided to the public when requested in writing in accordance with permit condition S5.G.

7.1.4 Updating the SWPPP

In accordance with Conditions S3, S4.B, and S9.B.3 of the General Permit, this SWPPP will be modified if the SWPPP is ineffective in eliminating or significantly minimizing pollutants in stormwater discharges from the site or there has been a change in design, construction, operation, or maintenance at the site that has a significant effect on the discharge, or potential for discharge, of pollutants to the waters of the State. The SWPPP will be modified within seven days of determination based on inspection(s) that additional or modified BMPs are necessary to correct problems identified, and an updated timeline for BMP implementation will be prepared.

7.2 Reporting

7.2.1 Discharge Monitoring Reports

If cumulative soil disturbance is smaller than 5 acres: Discharge Monitoring Report (DMR) forms will not be submitted to Ecology because water quality sampling is not being conducted at the site.

If cumulative soil disturbance is 5 acres or larger: Discharge Monitoring Reports (DMRs) will be submitted to Ecology monthly. Of there was no discharge during a given monitoring period, the Permittee shall submit the form as required, with the words "No discharge" entered in the place of monitoring results. The DMR due date is 15 days following the end of each month.

Water quality sampling results will be submitted to Ecology monthly on Discharge Monitoring Report (DMR) forms in accordance with permit condition S5.B. If there was no discharge during a given monitoring period, the form will be submitted with the words "no discharge" entered in place of the monitoring results. If a benchmark was exceeded, a brief summary of inspection results and remedial actions taken will be included. If sampling could not be performed during a monitoring period, a DMR will be submitted with an explanation of why sampling could not be performed.

7.2.2 Notification of Noncompliance

If any of the terms and conditions of the permit are not met, and it causes a threat to human health or the environment, the following steps will be taken in accordance with permit section S5.F:

1. Ecology will be immediately notified of the failure to comply.

2. Immediate action will be taken to control the noncompliance issue and to correct the problem. If applicable, sampling and analysis of any noncompliance will be repeated immediately and the results submitted to Ecology within five (5) days of becoming aware of the violation.

3. A detailed written report describing the noncompliance will be submitted to Ecology within five (5) days, unless requested earlier by Ecology.

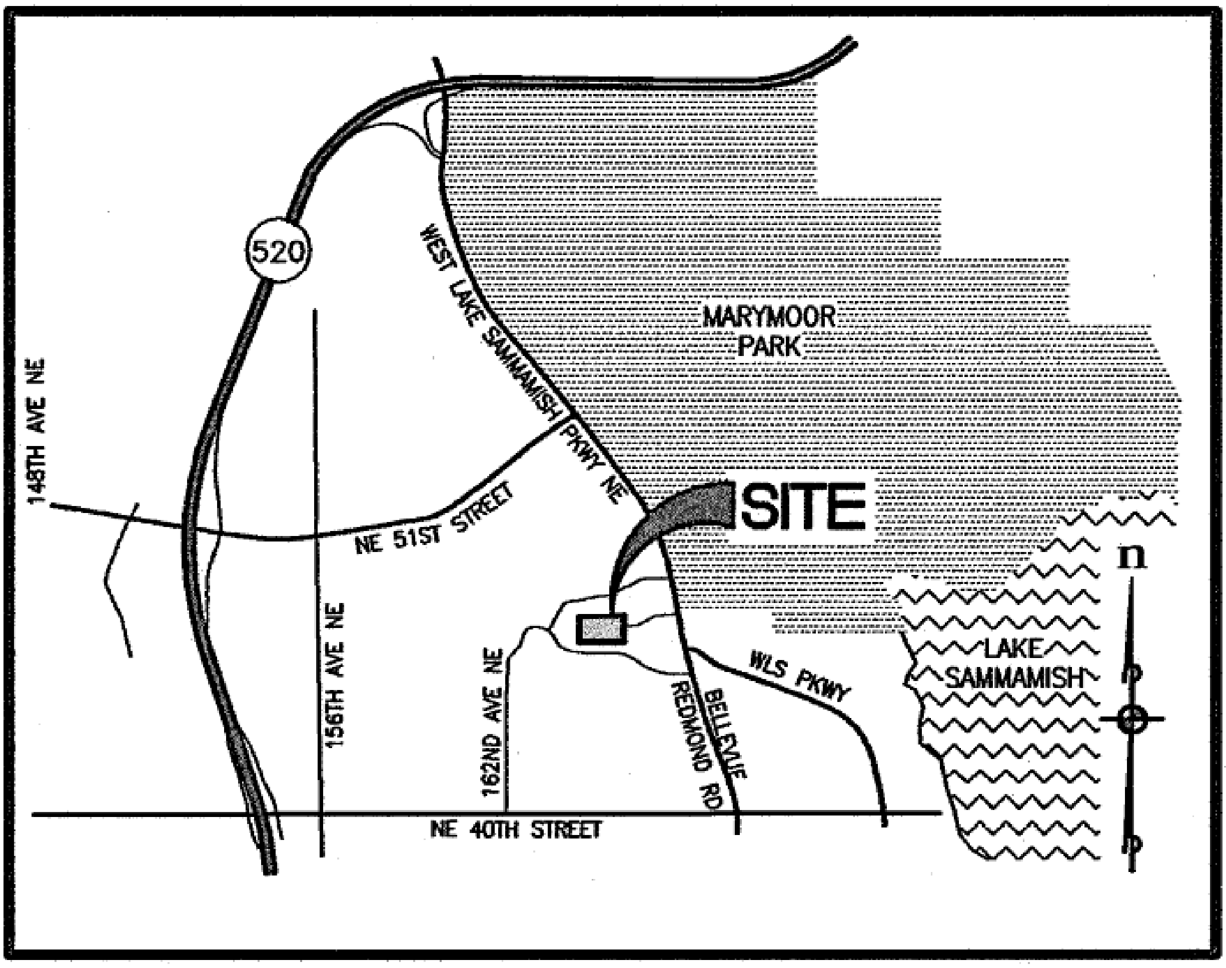
Any time turbidity sampling indicates turbidity is 250 nephelometric turbidity units (NTU) or greater or water transparency is 6 centimeters or less, the Ecology regional office will be notified by phone within 24 hours of analysis as required by permit condition S5.A (see Section 5.0 of this SWPPP for contact information).

In accordance with permit condition S4.F.6.b, the Ecology regional office will be notified if chemical treatment other than CO_2 sparging is planned for adjustment of high pH water (see Section 5.0 of this SWPPP for contact information).

7.2.3 Permit Application and Changes

In accordance with permit condition S2.A, a complete application form will be submitted to Ecology and the appropriate local jurisdiction (if applicable) to be covered by the General Permit.

Appendix A – Site Plans



VICINITY MAP

NTS

A PORTION OF NW 1/4 OF THE SW 1/4 OF SEC. 13, TWP. 25 N., RGE. 5E, KING CO. WA

Appendix B – Construction BMPs

Stake and Wire Fence (BMP C104)

Stabilized Construction Entrance (City of Redmond Standard Detail 503)

Temporary and Permanent Seeding (BMP C120)

Mulching (BMP C121)

Sodding (BMP C124)

Dust Control (BMP C140)

Concrete Handling (BMP C151)

Material Delivery, Storage and Containment (BMP C153)

Concrete Washout Area (BMP C154)

Certified Erosion and Sediment Control Lead (BMP C160)

Interceptor Dike and Swale (BMP C200)

Outlet Protection (BMP C209)

Storm Drain Inlet Protection (City of Redmond Standard Detail I-40,20-00)

Silt Fence (City of Redmond Standard Detail 502)

Temporary Sediment Pond (BMP C241)

BMP C104: Stake and Wire Fence

Purpose

Fencing is intended to: (1) restrict clearing to approved limits; (2) prevent disturbance of sensitive areas, their buffers, and other areas required to be left undisturbed; (3) limit construction traffic to designated construction entrances or roads; and, (4) protect any areas where marking with survey tape may not provide adequate protection.

Conditions of Use

To establish clearing limits, stake or wire fence may be used:

- At the boundary of sensitive areas, their buffers, and other areas required to be left uncleared.
- As necessary, to control vehicle access to and on the site.

Design and Installation Specifications

- See Figure 4.1 for details.
- More substantial fencing shall be used if the fence does not prevent encroachment into those areas that are not to be disturbed.

Maintenance Standards

- If the fence has been damaged or visibility reduced, it shall be repaired or replaced immediately and visibility restored.

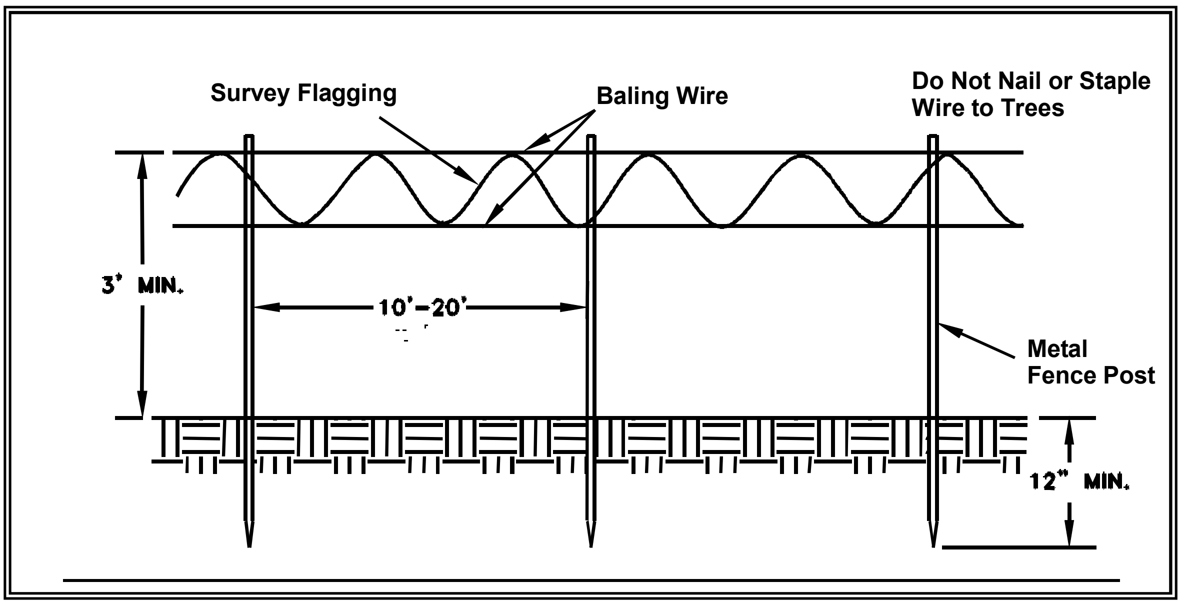
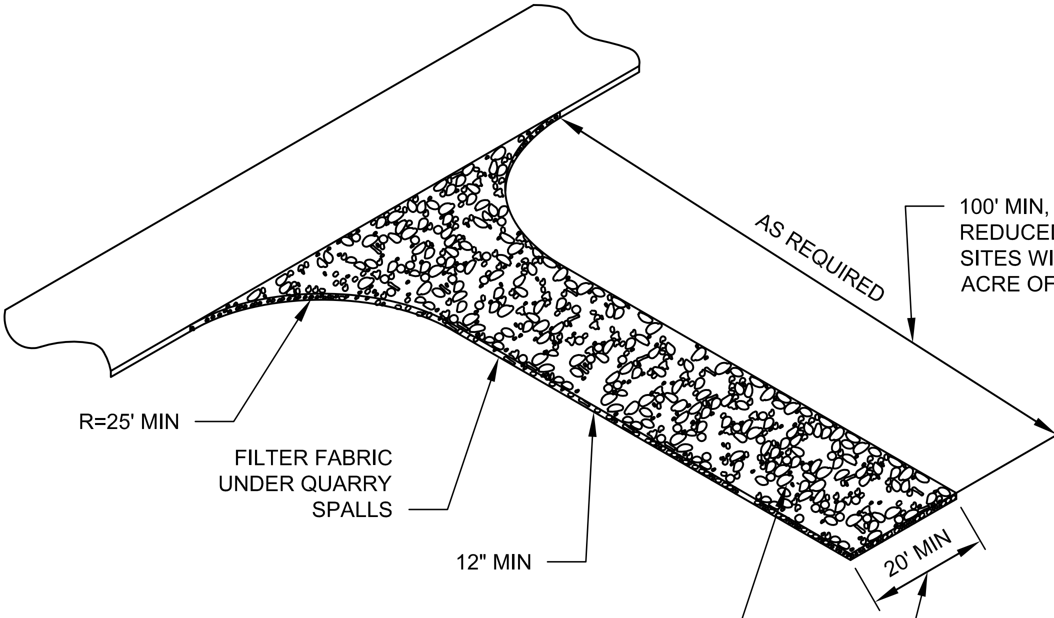


Figure 4.1 – Stake and Wire Fence



STABILIZED CONSTRUCTION ENTRANCE

NTS

NOTES:

1. STONE SIZE- USE 4" STONE OR RECLAIMED OR RECYCLED CONCRETE EQUIVALENT.
2. LENGTH - AS REQUIRED BUT NOT LESS THAN 50' (EXCEPT ON SINGLE RESIDENCE LOT WHERE A 30' MINIMUM LEGTH WOULD APPLY).
3. THICKNESS - NOT LESS THAN 12"
4. WIDTH - 20' MINIMUM BUT NOT LESS THAN THE FULL WIDTH AT POINTS WHERE INGRESS OR EGRESS OCCURS.
5. "FILTER FABRIC SHALL BE WOVEN STABILIZATION FABRIC WITH A MINIMUM PERMITIVITY OF 0.9(SEC-1). PLACE FILTER FABRIC OVER THE ENTIRE AREA PRIOR TO PLACING OF STONE. FILTER FABRIC IS NOT REQUIRED FOR A SINGLE FAMILY RESIDENCE LOT"
6. MAINTENANCE - THE ENTRANCE SHALL BE MAINTAINED IN A CONDITION WHICH WILL PREVENT TRACKING OR FLOWING OF SEDIMENT ONTO PUBLIC RIGHT-OF-WAY. THIS MAY REQUIRE PERIODIC TIP DRESSING WITH ADDITIONAL STONE AS CONDITIONS DEMAND AND REPAIR AND/OR CLEAN OUT OF ANY MEASURES USED TO TRAP SEDIMENT. ALL SEDIMENT SPILLED, DROPPED, WASHED OR TRACKED ONTO PUBLIC RIGHT-OF-WAY MUST BE REMOVED IMMEDIATELY.
7. WASHING - WHEELS SHALL BE CLEANED TO REMOVE SEDIMENT PRIOR TO ENTRANCE ONTO PUBLIC RIGHT-OF-WAY. WHEN WASHING IS REQUIRED, IT SHALL BE DONE ON AN AREA STABILIZED WITH STONE AND WHICH DRAINS INTO AN APPROVED SEDIMENT TRAPPING DEVICE.
8. PERIODIC INSPECTION AND NEEDED MAINTENANCE SHALL BE PROVIDED AFTER EACH RAIN.

CITY OF REDMOND, WASHINGTON	STANDARD DETAILS	
APPROVED BY: RON GRANT CITY ENGINEER	**STABILIZED CONSTRUCTION ENTRANCE**	
REVISION DATE: MARCH 01, 2012	FILE NAME: SD503.DWG	DETAIL NUMBER: **503**

RONALD D. GRANT · STATE OF WASHINGTON · 22521 · REGISTERED PROFESSIONAL ENGINEER

City of Redmond WASHINGTON

BMP C120: Temporary and Permanent Seeding

Purpose

Seeding is intended to reduce erosion by stabilizing exposed soils. A well-established vegetative cover is one of the most effective methods of reducing erosion.

Conditions of Use

- Seeding may be used throughout the project on disturbed areas that have reached final grade or that will remain unworked for more than 30 days.
- Channels that will be vegetated should be installed before major earthwork and hydroseeded with a Bonded Fiber Matrix. The vegetation should be well established (i.e., 75 percent cover) before water is allowed to flow in the ditch. With channels that will have high flows, erosion control blankets should be installed over the hydroseed. If vegetation cannot be established from seed before water is allowed in the ditch, sod should be installed in the bottom of the ditch over hydromulch and blankets.
- Retention/detention ponds should be seeded as required.
- Mulch is required at all times because it protects seeds from heat, moisture loss, and transport due to runoff.
- All disturbed areas shall be reviewed in late August to early September and all seeding should be completed by the end of September. Otherwise, vegetation will not establish itself enough to provide more than average protection.
- At final site stabilization, all disturbed areas not otherwise vegetated or stabilized shall be seeded and mulched. Final stabilization means the completion of all soil disturbing activities at the site and the establishment of a permanent vegetative cover, or equivalent permanent stabilization measures (such as pavement, riprap, gabions or geotextiles) which will prevent erosion.

Design and Installation Specifications

- Seeding should be done during those seasons most conducive to growth and will vary with the climate conditions of the region. Local experience should be used to determine the appropriate seeding periods.
- The optimum seeding windows for western Washington are April 1 through June 30 and September 1 through October 1. Seeding that occurs between July 1 and August 30 will require irrigation until 75 percent grass cover is established. Seeding that occurs between October 1 and March 30 will require a mulch or plastic cover until 75 percent grass cover is established.
- To prevent seed from being washed away, confirm that all required surface water control measures have been installed.

- The seedbed should be firm and rough. All soil should be roughened no matter what the slope. If compaction is required for engineering purposes, slopes must be track walked before seeding. Backblading or smoothing of slopes greater than 4:1 is not allowed if they are to be seeded.
- New and more effective restoration-based landscape practices rely on deeper incorporation than that provided by a simple single-pass rototilling treatment. Wherever practical the subgrade should be initially ripped to improve long-term permeability, infiltration, and water inflow qualities. At a minimum, permanent areas shall use soil amendments to achieve organic matter and permeability performance defined in engineered soil/landscape systems. For systems that are deeper than 8 inches the rototilling process should be done in multiple lifts, or the prepared soil system shall be prepared properly and then placed to achieve the specified depth.
- Organic matter is the most appropriate form of "fertilizer" because it provides nutrients (including nitrogen, phosphorus, and potassium) in the least water-soluble form. A natural system typically releases 2-10 percent of its nutrients annually. Chemical fertilizers have since been formulated to simulate what organic matter does naturally.
- In general, 10-4-6 N-P-K (nitrogen-phosphorus-potassium) fertilizer can be used at a rate of 90 pounds per acre. Slow-release fertilizers should always be used because they are more efficient and have fewer environmental impacts. It is recommended that areas being seeded for final landscaping conduct soil tests to determine the exact type and quantity of fertilizer needed. This will prevent the over-application of fertilizer. Fertilizer should not be added to the hydromulch machine and agitated more than 20 minutes before it is to be used. If agitated too much, the slow-release coating is destroyed.
- There are numerous products available on the market that take the place of chemical fertilizers. These include several with seaweed extracts that are beneficial to soil microbes and organisms. If 100 percent cottonseed meal is used as the mulch in hydroseed, chemical fertilizer may not be necessary. Cottonseed meal is a good source of long-term, slow-release, available nitrogen.
- Hydroseed applications shall include a minimum of 1,500 pounds per acre of mulch with 3 percent tackifier. Mulch may be made up of 100 percent: cottonseed meal; fibers made of wood, recycled cellulose, hemp, and kenaf; compost; or blends of these. Tackifier shall be plant-based, such as guar or alpha plantago, or chemical-based such as polyacrylamide or polymers. Any mulch or tackifier product used shall be installed per manufacturer's instructions. Generally, mulches come in 40-50 pound bags. Seed and fertilizer are added at time of application.

- Mulch is always required for seeding. Mulch can be applied on top of the seed or simultaneously by hydroseeding.
- On steep slopes, Bonded Fiber Matrix (BFM) or Mechanically Bonded Fiber Matrix (MBFM) products should be used. BFM/MBFM products are applied at a minimum rate of 3,000 pounds per acre of mulch with approximately 10 percent tackifier. Application is made so that a minimum of 95 percent soil coverage is achieved. Numerous products are available commercially and should be installed per manufacturer's instructions. Most products require 24-36 hours to cure before a rainfall and cannot be installed on wet or saturated soils. Generally, these products come in 40-50 pound bags and include all necessary ingredients except for seed and fertilizer.

BFMs and MBFMs have some advantages over blankets:

- No surface preparation required;
- Can be installed via helicopter in remote areas;
- On slopes steeper than 2.5:1, blanket installers may need to be roped and harnessed for safety;
- They are at least $1,000 per acre cheaper installed.

In most cases, the shear strength of blankets is not a factor when used on slopes, only when used in channels. BFMs and MBFMs are good alternatives to blankets in most situations where vegetation establishment is the goal.

- When installing seed via hydroseeding operations, only about 1/3 of the seed actually ends up in contact with the soil surface. This reduces the ability to establish a good stand of grass quickly. One way to overcome this is to increase seed quantities by up to 50 percent.
- Vegetation establishment can also be enhanced by dividing the hydromulch operation into two phases:
  1. Phase 1- Install all seed and fertilizer with 25-30 percent mulch and tackifier onto soil in the first lift;
  2. Phase 2- Install the rest of the mulch and tackifier over the first lift.

An alternative is to install the mulch, seed, fertilizer, and tackifier in one lift. Then, spread or blow straw over the top of the hydromulch at a rate of about 800-1000 pounds per acre. Hold straw in place with a standard tackifier. Both of these approaches will increase cost moderately but will greatly improve and enhance vegetative establishment. The increased cost may be offset by the reduced need for:

1. Irrigation
2. Reapplication of mulch
3. Repair of failed slope surfaces

This technique works with standard hydromulch (1,500 pounds per acre minimum) and BFM/MBFMs (3,000 pounds per acre minimum).

- Areas to be permanently landscaped shall provide a healthy topsoil that reduces the need for fertilizers, improves overall topsoil quality, provides for better vegetal health and vitality, improves hydrologic characteristics, and reduces the need for irrigation. This can be accomplished in a number of ways:

  Recent research has shown that the best method to improve till soils is to amend these soils with compost. The optimum mixture is approximately two parts soil to one part compost. This equates to 4 inches of compost mixed to a depth of 12 inches in till soils. Increasing the concentration of compost beyond this level can have negative effects on vegetal health, while decreasing the concentrations can reduce the benefits of amended soils. Please note: The compost should meet specifications for Grade A quality compost in Ecology Publication 94-038.

  Other soils, such as gravel or cobble outwash soils, may require different approaches. Organics and fines easily migrate through the loose structure of these soils. Therefore, the importation of at least 6 inches of quality topsoil, underlain by some type of filter fabric to prevent the migration of fines, may be more appropriate for these soils.

  Areas that already have good topsoil, such as undisturbed areas, do not require soil amendments.

- Areas that will be seeded only and not landscaped may need compost or meal-based mulch included in the hydroseed in order to establish vegetation. Native topsoil should be re-installed on the disturbed soil surface before application.
- Seed that is installed as a temporary measure may be installed by hand if it will be covered by straw, mulch, or topsoil. Seed that is installed as a permanent measure may be installed by hand on small areas (usually less than 1 acre) that will be covered with mulch, topsoil, or erosion blankets. The seed mixes listed below include recommended mixes for both temporary and permanent seeding. These mixes, with the exception of the wetland mix, shall be applied at a rate of 120 pounds per acre. This rate can be reduced if soil amendments or slow-release fertilizers are used. Local suppliers or the local conservation district should be consulted for their recommendations because the appropriate mix depends on a variety of factors, including location, exposure, soil type, slope, and expected foot traffic. Alternative seed mixes approved by the local authority may be used.

Table 4.1 represents the standard mix for those areas where just a temporary vegetative cover is required.

Table 4.1
Temporary Erosion Control Seed Mix

	% Weight	% Purity	% Germination
Chewings or annual blue grass *Festuca rubra var. commutata* or *Poa anna*	40	98	90
Perennial rye - *Lolium perenne*	50	98	90
Redtop or colonial bentgrass *Agrostis alba* or *Agrostis tenuis*	5	92	85
White dutch clover *Trifolium repens*	5	98	90

Table 4.2 provides just one recommended possibility for landscaping seed.

Table 4.2
Landscaping Seed Mix

	% Weight	% Purity	% Germination
Perennial rye blend *Lolium perenne*	70	98	90
Chewings and red fescue blend *Festuca rubra var. commutata* or *Festuca rubra*	30	98	90

This turf seed mix in Table 4.3 is for dry situations where there is no need for much water. The advantage is that this mix requires very little maintenance.

Table 4.3
Low-Growing Turf Seed Mix

	% Weight	% Purity	% Germination
Dwarf tall fescue (several varieties) *Festuca arundinacea var.*	45	98	90
Dwarf perennial rye (Barclay) *Lolium perenne var. barclay*	30	98	90
Red fescue *Festuca rubra*	20	98	90
Colonial bentgrass *Agrostis tenuis*	5	98	90

Table 4.4 presents a mix recommended for bioswales and other intermittently wet areas.

Table 4.4
Bioswale Seed Mix*

	% Weight	% Purity	% Germination
Tall or meadow fescue *Festuca arundinacea* or *Festuca elatior*	75-80	98	90
Seaside/Creeping bentgrass *Agrostis palustris*	10-15	92	85
Redtop bentgrass *Agrostis alba* or *Agrostis gigantea*	5-10	90	80

** Modified Briargreen, Inc. Hydroseeding Guide Wetlands Seed Mix*

The seed mix shown in Table 4.5 is a recommended low-growing, relatively non-invasive seed mix appropriate for very wet areas that are not regulated wetlands. Other mixes may be appropriate, depending on the soil type and hydrology of the area. Recent research suggests that bentgrass (agrostis sp.) should be emphasized in wet-area seed mixes. Apply this mixture at a rate of 60 pounds per acre.

Table 4.5
Wet Area Seed Mix*

	% Weight	% Purity	% Germination
Tall or meadow fescue *Festuca arundinacea* or *Festuca elatior*	60-70	98	90
Seaside/Creeping bentgrass *Agrostis palustris*	10-15	98	85
Meadow foxtail *Alepocurus pratensis*	10-15	90	80
Alsike clover *Trifolium hybridum*	1-6	98	90
Redtop bentgrass *Agrostis alba*	1-6	92	85

** Modified Briargreen, Inc. Hydroseeding Guide Wetlands Seed Mix*

The meadow seed mix in Table 4.6 is recommended for areas that will be maintained infrequently or not at all and where colonization by native plants is desirable. Likely applications include rural road and utility right-of-way. Seeding should take place in September or very early October in order to obtain adequate establishment prior to the winter months. The appropriateness of clover in the mix may need to be considered, as this can be a fairly invasive species. If the soil is amended, the addition of clover may not be necessary.

Table 4.6
Meadow Seed Mix

	% Weight	% Purity	% Germination
Redtop or Oregon bentgrass *Agrostis alba* or *Agrostis oregonensis*	20	92	85
Red fescue *Festuca rubra*	70	98	90
White dutch clover *Trifolium repens*	10	98	90

Maintenance Standards

- Any seeded areas that fail to establish at least 80 percent cover (100 percent cover for areas that receive sheet or concentrated flows) shall be reseeded. If reseeding is ineffective, an alternate method, such as sodding, mulching, or nets/blankets, shall be used. If winter weather prevents adequate grass growth, this time limit may be relaxed at the discretion of the local authority when sensitive areas would otherwise be protected.

- After adequate cover is achieved, any areas that experience erosion shall be reseeded and protected by mulch. If the erosion problem is drainage related, the problem shall be fixed and the eroded area reseeded and protected by mulch.
- Seeded areas shall be supplied with adequate moisture, but not watered to the extent that it causes runoff.

BMP C121: Mulching

Purpose

The purpose of mulching soils is to provide immediate temporary protection from erosion. Mulch also enhances plant establishment by conserving moisture, holding fertilizer, seed, and topsoil in place, and moderating soil temperatures. There is an enormous variety of mulches that can be used. Only the most common types are discussed in this section.

Conditions of Use

As a temporary cover measure, mulch should be used:

- On disturbed areas that require cover measures for less than 30 days.
- As a cover for seed during the wet season and during the hot summer months.
- During the wet season on slopes steeper than 3H:1V with more than 10 feet of vertical relief.
- Mulch may be applied at any time of the year and must be refreshed periodically.

Design and Installation Specifications

For mulch materials, application rates, and specifications, see Table 4.7. Note: Thicknesses may be increased for disturbed areas in or near sensitive areas or other areas highly susceptible to erosion.

Mulch used within the ordinary high-water mark of surface waters should be selected to minimize potential flotation of organic matter. Composted organic materials have higher specific gravities (densities) than straw, wood, or chipped material.

Maintenance Standards

- The thickness of the cover must be maintained.
- Any areas that experience erosion shall be remulched and/or protected with a net or blanket. If the erosion problem is drainage related, then the problem shall be fixed and the eroded area remulched.

Table 4.7
Mulch Standards and Guidelines

Mulch Material	Quality Standards	Application Rates	Remarks
Straw	Air-dried; free from undesirable seed and coarse material.	2"-3" thick; 5 bales per 1000 sf or 2-3 tons per acre	Cost-effective protection when applied with adequate thickness. Hand-application generally requires greater thickness than blown straw. The thickness of straw may be reduced by half when used in conjunction with seeding. In windy areas straw must be held in place by crimping, using a tackifier, or covering with netting. Blown straw always has to be held in place with a tackifier as even light winds will blow it away. Straw, however, has several deficiencies that should be considered when selecting mulch materials. It often introduces and/or encourages the propagation of weed species and it has no significant long-term benefits. Straw should be used only if mulches with long-term benefits are unavailable locally. It should also not be used within the ordinary high-water elevation of surface waters (due to flotation).
Hydromulch	No growth inhibiting factors.	Approx. 25-30 lbs per 1000 sf or 1500 - 2000 lbs per acre	Shall be applied with hydromulcher. Shall not be used without seed and tackifier unless the application rate is at least doubled. Fibers longer than about ¾-1 inch clog hydromulch equipment. Fibers should be kept to less than ¾ inch.
Composted Mulch and Compost	No visible water or dust during handling. Must be purchased from supplier with Solid Waste Handling Permit (unless exempt).	2" thick min.; approx. 100 tons per acre (approx. 800 lbs per yard)	More effective control can be obtained by increasing thickness to 3". Excellent mulch for protecting final grades until landscaping because it can be directly seeded or tilled into soil as an amendment. Composted mulch has a coarser size gradation than compost. It is more stable and practical to use in wet areas and during rainy weather conditions.
Chipped Site Vegetation	Average size shall be several inches. Gradations from fines to 6 inches in length for texture, variation, and interlocking properties.	2" minimum thickness	This is a cost-effective way to dispose of debris from clearing and grubbing, and it eliminates the problems associated with burning. Generally, it should not be used on slopes above approx. 10% because of its tendency to be transported by runoff. It is not recommended within 200 feet of surface waters. If seeding is expected shortly after mulch, the decomposition of the chipped vegetation may tie up nutrients important to grass establishment.
Wood-based Mulch	No visible water or dust during handling. Must be purchased from a supplier with a Solid Waste Handling Permit or one exempt from solid waste regulations.	2” thick; approx. 100 tons per acre (approx. 800 lbs. per cubic yard)	This material is often called “hog or hogged fuel.” It is usable as a material for Stabilized Construction Entrances (BMP C105) and as a mulch. The use of mulch ultimately improves the organic matter in the soil. Special caution is advised regarding the source and composition of wood-based mulches. Its preparation typically does not provide any weed seed control, so evidence of residual vegetation in its composition or known inclusion of weed plants or seeds should be monitored and prevented (or minimized).

BMP C124: Sodding

Purpose

The purpose of sodding is to establish permanent turf for immediate erosion protection and to stabilize drainage ways where concentrated overland flow will occur.

Conditions of Use

Sodding may be used in the following areas:

- Disturbed areas that require short-term or long-term cover.
- Disturbed areas that require immediate vegetative cover.
- All waterways that require vegetative lining. Waterways may also be seeded rather than sodded, and protected with a net or blanket.

Design and Installation Specifications

Sod shall be free of weeds, of uniform thickness (approximately 1-inch thick), and shall have a dense root mat for mechanical strength.

The following steps are recommended for sod installation:

- Shape and smooth the surface to final grade in accordance with the approved grading plan. The swale needs to be overexcavated 4 to 6 inches below design elevation to allow room for placing soil amendment and sod.
- Amend 4 inches (minimum) of compost into the top 8 inches of the soil if the organic content of the soil is less than ten percent or the permeability is less than 0.6 inches per hour. Compost used should meet Ecology publication 94-038 specifications for Grade A quality compost.
- Fertilize according to the supplier's recommendations.
- Work lime and fertilizer 1 to 2 inches into the soil, and smooth the surface.
- Lay strips of sod beginning at the lowest area to be sodded and perpendicular to the direction of water flow. Wedge strips securely into place. Square the ends of each strip to provide for a close, tight fit. Stagger joints at least 12 inches. Staple on slopes steeper than 3H:1V. Staple the upstream edge of each sod strip.
- Roll the sodded area and irrigate.
- When sodding is carried out in alternating strips or other patterns, seed the areas between the sod immediately after sodding.

Maintenance Standards

If the grass is unhealthy, the cause shall be determined and appropriate action taken to reestablish a healthy groundcover. If it is impossible to establish a healthy groundcover due to frequent saturation, instability, or some other cause, the sod shall be removed, the area seeded with an appropriate mix, and protected with a net or blanket.

BMP C140: Dust Control

Purpose

Dust control prevents wind transport of dust from disturbed soil surfaces onto roadways, drainage ways, and surface waters.

Conditions of Use

- In areas (including roadways) subject to surface and air movement of dust where on-site and off-site impacts to roadways, drainage ways, or surface waters are likely.

Design and Installation Specifications

- Vegetate or mulch areas that will not receive vehicle traffic. In areas where planting, mulching, or paving is impractical, apply gravel or landscaping rock.
- Limit dust generation by clearing only those areas where immediate activity will take place, leaving the remaining area(s) in the original condition, if stable. Maintain the original ground cover as long as practical.
- Construct natural or artificial windbreaks or windscreens. These may be designed as enclosures for small dust sources.
- Sprinkle the site with water until surface is wet. Repeat as needed. To prevent carryout of mud onto street, refer to Stabilized Construction Entrance (BMP C105).
- Irrigation water can be used for dust control. Irrigation systems should be installed as a first step on sites where dust control is a concern.
- Spray exposed soil areas with a dust palliative, following the manufacturer's instructions and cautions regarding handling and application. Used oil is prohibited from use as a dust suppressant. Local governments may approve other dust palliatives such as calcium chloride or PAM.
- PAM (BMP C126) added to water at a rate of 0.5 lbs. per 1,000 gallons of water per acre and applied from a water truck is more effective than water alone. This is due to the increased infiltration of water into the soil and reduced evaporation. In addition, small soil particles are bonded together and are not as easily transported by wind. Adding PAM may actually reduce the quantity of water needed for dust control, especially in eastern Washington. Since the wholesale cost of PAM is about $ 4.00 per pound, this is an extremely cost-effective dust control method.

Techniques that can be used for unpaved roads and lots include:

- Lower speed limits. High vehicle speed increases the amount of dust stirred up from unpaved roads and lots.
- Upgrade the road surface strength by improving particle size, shape, and mineral types that make up the surface and base materials.

- Add surface gravel to reduce the source of dust emission. Limit the amount of fine particles (those smaller than .075 mm) to 10 to 20 percent.
- Use geotextile fabrics to increase the strength of new roads or roads undergoing reconstruction.
- Encourage the use of alternate, paved routes, if available.
- Restrict use by tracked vehicles and heavy trucks to prevent damage to road surface and base.
- Apply chemical dust suppressants using the admix method, blending the product with the top few inches of surface material. Suppressants may also be applied as surface treatments.
- Pave unpaved permanent roads and other trafficked areas.
- Use vacuum street sweepers.
- Remove mud and other dirt promptly so it does not dry and then turn into dust.
- Limit dust-causing work on windy days.
- Contact your local Air Pollution Control Authority for guidance and training on other dust control measures. Compliance with the local Air Pollution Control Authority constitutes compliance with this BMP.

Maintenance Standards

Respray area as necessary to keep dust to a minimum.

BMP C153: Material Delivery, Storage and Containment

Purpose

Prevent, reduce, or eliminate the discharge of pollutants from material delivery and storage to the stormwater system or watercourses by minimizing the storage of hazardous materials onsite, storing materials in a designated area, and installing secondary containment.

Conditions of Use

These procedures are suitable for use at all construction sites with delivery and storage of the following materials:

- Petroleum products such as fuel, oil and grease
- Soil stabilizers and binders (e.g. Polyacrylamide)
- Fertilizers, pesticides and herbicides
- Detergents
- Asphalt and concrete compounds
- Hazardous chemicals such as acids, lime, adhesives, paints, solvents and curing compounds
- Any other material that may be detrimental if released to the environment

Design and Installation Specifications

The following steps should be taken to minimize risk:

- Temporary storage area should be located away from vehicular traffic, near the construction entrance(s), and away from waterways or storm drains.
- Material Safety Data Sheets (MSDS) should be supplied for all materials stored. Chemicals should be kept in their original labeled containers.
- Hazardous material storage on-site should be minimized.
- Hazardous materials should be handled as infrequently as possible.
- During the wet weather season (Oct 1 – April 30), consider storing materials in a covered area.
- Materials should be stored in secondary containments, such as earthen dike, horse trough, or even a children’s wading pool for non-reactive materials such as detergents, oil, grease, and paints. Small amounts of material may be secondarily contained in “bus boy” trays or concrete mixing trays.
- Do not store chemicals, drums, or bagged materials directly on the ground. Place these items on a pallet and, when possible, in secondary containment.

- If drums must be kept uncovered, store them at a slight angle to reduce ponding of rainwater on the lids to reduce corrosion. Domed plastic covers are inexpensive and snap to the top of drums, preventing water from collecting.

Material Storage Areas and Secondary Containment Practices:

- Liquids, petroleum products, and substances listed in 40 CFR Parts 110, 117, or 302 shall be stored in approved containers and drums and shall not be overfilled. Containers and drums shall be stored in temporary secondary containment facilities.
- Temporary secondary containment facilities shall provide for a spill containment volume able to contain precipitation from a 25 year, 24 hour storm event, <u>plus</u> 10% of the total enclosed container volume of all containers, <u>or</u> 110% of the capacity of the largest container within its boundary, whichever is greater.
- Secondary containment facilities shall be impervious to the materials stored therein for a minimum contact time of 72 hours.
- Secondary containment facilities shall be maintained free of accumulated rainwater and spills. In the event of spills or leaks, accumulated rainwater and spills shall be collected and placed into drums. These liquids shall be handled as hazardous waste unless testing determines them to be non-hazardous.
- Sufficient separation should be provided between stored containers to allow for spill cleanup and emergency response access.
- During the wet weather season (Oct 1 – April 30), each secondary containment facility shall be covered during non-working days, prior to and during rain events.
- Keep material storage areas clean, organized and equipped with an ample supply of appropriate spill clean-up material (spill kit).
- The spill kit should include, at a minimum:
    - 1-Water Resistant Nylon Bag
    - 3-Oil Absorbent Socks 3”x 4’
    - 2-Oil Absorbent Socks 3”x 10’
    - 12-Oil Absorbent Pads 17”x19”
    - 1-Pair Splash Resistant Goggles
    - 3-Pair Nitrile Gloves
    - 10-Disposable Bags with Ties
    - Instructions

Minimum Requirements for ESC Training and Certification Courses

General Requirements

1. The course shall teach the construction stormwater pollution prevention guidance provided in the most recent version of:
    a. The Washington State Dept. of Ecology Stormwater Management Manual for Western Washington,
    b. Other equivalent stormwater management manuals approved by Ecology.

2. Upon completion of course, each attendee shall receive documentation of certification, including, at a minimum, a wallet-sized card that certifies completion of the course. Certification shall remain valid for three years. Recertification may be obtained by completing the 8-hour refresher course or by taking the initial 16-hour training course again.

3. The initial certification course shall be a minimum of 16 hours (with a reasonable time allowance for lunch, breaks, and travel to and from field) and include a field element and test.
    a. The field element must familiarize students with the proper installation, maintenance and inspection of common erosion and sediment control BMPs including, but not limited to, blankets, check dams, silt fence, straw mulch, plastic, and seeding.
    b. The test shall be open book and a passing score is not required for certification. Upon completion of the test, the correct answers shall be provided and discussed.

4. The refresher course shall be a minimum of 8 hours and include a test.
    a. The refresher course shall include:
        i. Applicable updates to the Stormwater Management Manual that is used to teach the course, including new or updated BMPs; and
        ii. Applicable changes to the NPDES General Permit for Construction Activities.
    b. The refresher course test shall be open book and a passing score is not required for certification. Upon completion of the test, the correct answers shall be provided and discussed.
    c. The refresher course may be taught using an alternative format (e.g. internet, CD ROM, etc.) if the module is approved by Ecology.

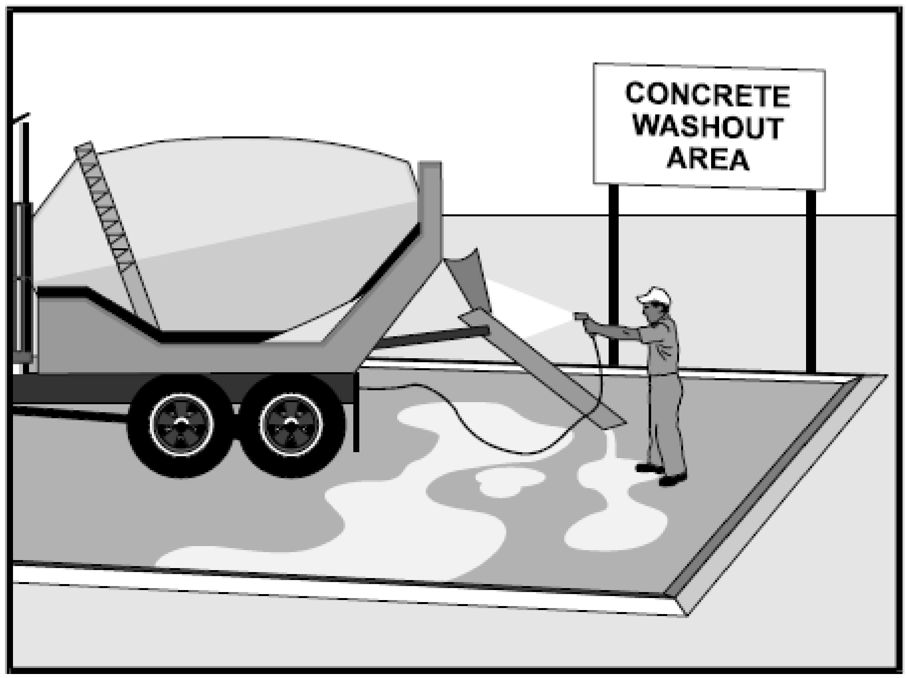
Required Course Elements

1. Erosion and Sedimentation Impacts
    a. Examples/Case studies

BMP C154: Concrete Washout Area

Purpose

Prevent or reduce the discharge of pollutants to stormwater from concrete waste by conducting washout offsite, or performing onsite washout in a designated area to prevent pollutants from entering surface waters or groundwater.



Conditions of Use

Concrete washout area best management practices are implemented on construction projects where:

- Concrete is used as a construction material
- It is not possible to dispose of all concrete wastewater and washout offsite (ready mix plant, etc.).
- Concrete trucks, pumpers, or other concrete coated equipment are washed onsite.

Design and Installation Specifications

Implementation

The following steps will help reduce stormwater pollution from concrete wastes:

- Perform washout of concrete trucks offsite or in designated concrete washout areas only.
- Do not wash out concrete trucks onto the ground, or into storm drains, open ditches, streets, or streams.
- Do not allow excess concrete to be dumped onsite, except in designated concrete washout areas.

- Concrete washout areas may be prefabricated concrete washout containers, or self-installed structures (above-grade or below-grade).
    - Prefabricated containers are most resistant to damage and protect against spills and leaks. Companies may offer delivery service and provide regular maintenance and disposal of solid and liquid waste.
    - If self-installed concrete washout areas are used, below-grade structures are preferred over above-grade structures because they are less prone to spills and leaks.
    - Self-installed above-grade structures should only be used if excavation is not practical.

Education

- Discuss the concrete management techniques described in this BMP with the ready-mix concrete supplier before any deliveries are made.
- Educate employees and subcontractors on the concrete waste management techniques described in this BMP.
- Arrange for contractor's superintendent or Certified Erosion and Sediment Control Lead (CESCL) to oversee and enforce concrete waste management procedures.
- A sign should be installed adjacent to each temporary concrete washout facility to inform concrete equipment operators to utilize the proper facilities.

Contracts

- Incorporate requirements for concrete waste management into concrete supplier and subcontractor agreements.

Location and Placement

- Locate washout area at least 50 feet from sensitive areas such as storm drains, open ditches, or water bodies, including wetlands.
- Allow convenient access for concrete trucks, preferably near the area where the concrete is being poured.
- If trucks need to leave a paved area to access washout, prevent track-out with a pad of rock or quarry spalls (see Ecology BMP C105). These areas should be far enough away from other construction traffic to reduce the likelihood of accidental damage and spills.
- The number of facilities you install should depend on the expected demand for storage capacity.
- On large sites with extensive concrete work, washouts should be placed in multiple locations for ease of use by concrete truck drivers.

Onsite Temporary Concrete Washout Facility, Transit Truck Washout Procedures:

- Temporary concrete washout facilities shall be located a minimum of 50 ft from sensitive areas including storm drain inlets, open drainage facilities, and watercourses.
- Concrete washout facilities shall be constructed and maintained in sufficient quantity and size to contain all liquid and concrete waste generated by washout operations.
    - Approximately 7 gallons of wash water are used to wash one truck chute.
    - Approximately 50 gallons are used to wash out the hopper of a concrete pump truck
- Washout of concrete trucks shall be performed in designated areas only.
- Concrete washout from concrete pumper bins can be washed into concrete pumper trucks and discharged into designated washout area or properly disposed of offsite.
- Once concrete wastes are washed into the designated area and allowed to harden, the concrete should be broken up, removed, and disposed of per applicable solid waste regulations. Dispose of hardened concrete on a regular basis.

- Temporary Above-Grade Concrete Washout Facility
    - Temporary concrete washout facility (type above grade) should be constructed as shown on the details at the end of this BMP, with a recommended minimum length and minimum width of 10 ft, but with sufficient quantity and volume to contain all liquid and concrete waste generated by washout operations.
    - Straw bales and staking materials shall conform to the provisions in BMP C230: Straw Bale Barrier.
    - Plastic lining material should be a minimum of 10 mil polyethylene sheeting and should be free of holes, tears, or other defects that compromise the impermeability of the material.

- Temporary Below-Grade Concrete Washout Facility
    - Temporary concrete washout facilities (type below grade) should be constructed as shown on the details at the end of this BMP, with a recommended minimum length and minimum width of 10 ft. The quantity and volume should be sufficient to contain all liquid and concrete waste generated by washout operations.
    - Lath and flagging should be commercial type.
    - Plastic lining material shall be a minimum of 10 mil polyethylene sheeting and should be free of holes, tears,

    - or other defects that compromise the impermeability of the material.
    - Liner seams shall be installed in accordance with manufacturers' recommendations.
    - Soil base shall be prepared free of rocks or other debris that may cause tears or holes in the plastic lining material.

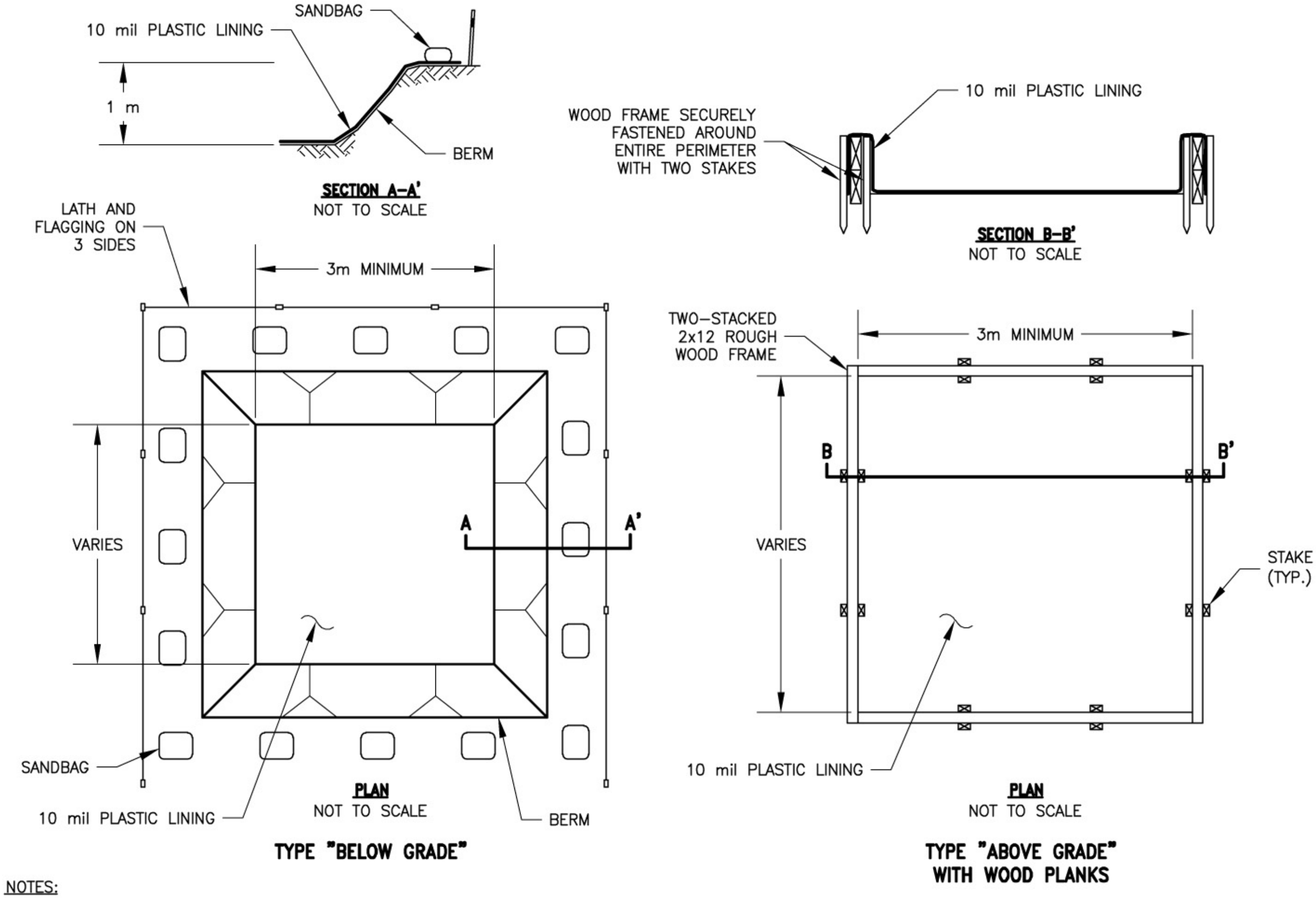
Inspection and Maintenance

- Inspect and verify that concrete washout BMPs are in place prior to the commencement of concrete work.
- During periods of concrete work, inspect daily to verify continued performance.
    - Check overall condition and performance.
    - Check remaining capacity (% full).
    - If using self-installed washout facilities, verify plastic liners are intact and sidewalls are not damaged.
    - If using prefabricated containers, check for leaks.
- Washout facilities shall be maintained to provide adequate holding capacity with a minimum freeboard of 12 inches.
- Washout facilities must be cleaned, or new facilities must be constructed and ready for use once the washout is 75% full.
- If the washout is nearing capacity, vacuum and dispose of the waste material in an approved manner.
    - Do not discharge liquid or slurry to waterways, storm drains or directly onto ground.
    - Do not use sanitary sewer without local approval.
    - Place a secure, non-collapsing, non-water collecting cover over the concrete washout facility prior to predicted wet weather to prevent accumulation and overflow of precipitation.
    - Remove and dispose of hardened concrete and return the structure to a functional condition. Concrete may be reused onsite or hauled away for disposal or recycling.
- When you remove materials from the self-installed concrete washout, build a new structure; or, if the previous structure is still intact, inspect for signs of weakening or damage, and make any necessary repairs. Re-line the structure with new plastic after each cleaning.

Removal of Temporary Concrete Washout Facilities

- When temporary concrete washout facilities are no longer required for the work, the hardened concrete, slurries and liquids shall be removed and properly disposed of.

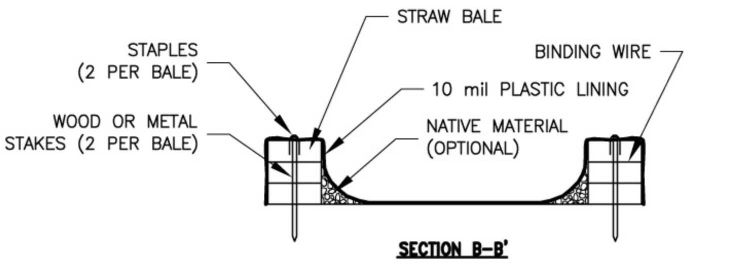
- Materials used to construct temporary concrete washout facilities shall be removed from the site of the work and disposed of or recycled.
- Holes, depressions or other ground disturbance caused by the removal of the temporary concrete washout facilities shall be backfilled, repaired, and stabilized to prevent erosion.



NOTES:

1. ACTUAL LAYOUT DETERMINED IN THE FIELD.
2. THE CONCRETE WASHOUT SIGN (SEE PAGE 6) SHALL BE INSTALLED WITHIN 10 m OF THE TEMPORARY CONCRETE WASHOUT FACILITY.

ATTACHMENT 18



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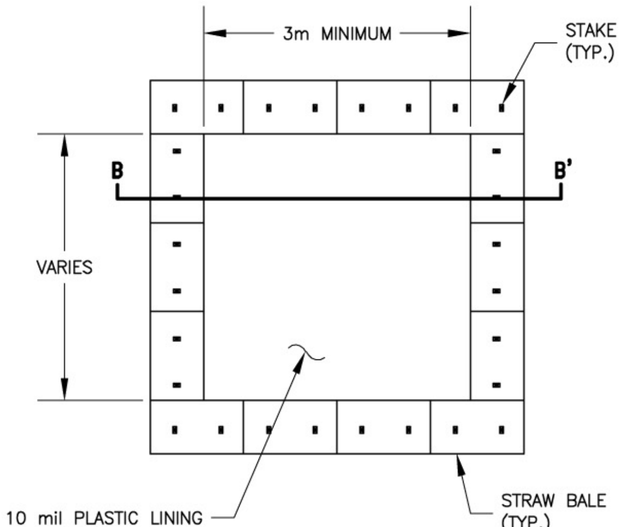

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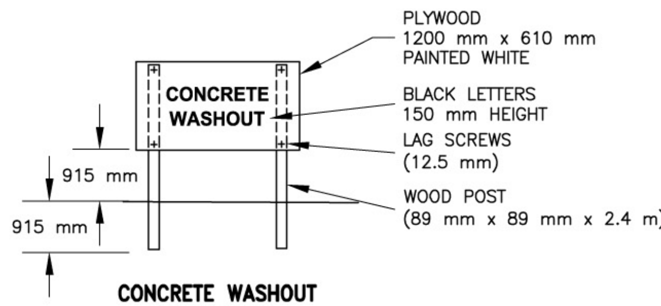
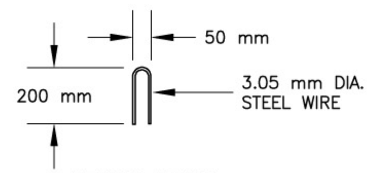
TYPE "ABOVE GRADE" WITH STRAW BALES



CONCRETE WASHOUT SIGN DETAIL (OR EQUIVALENT)

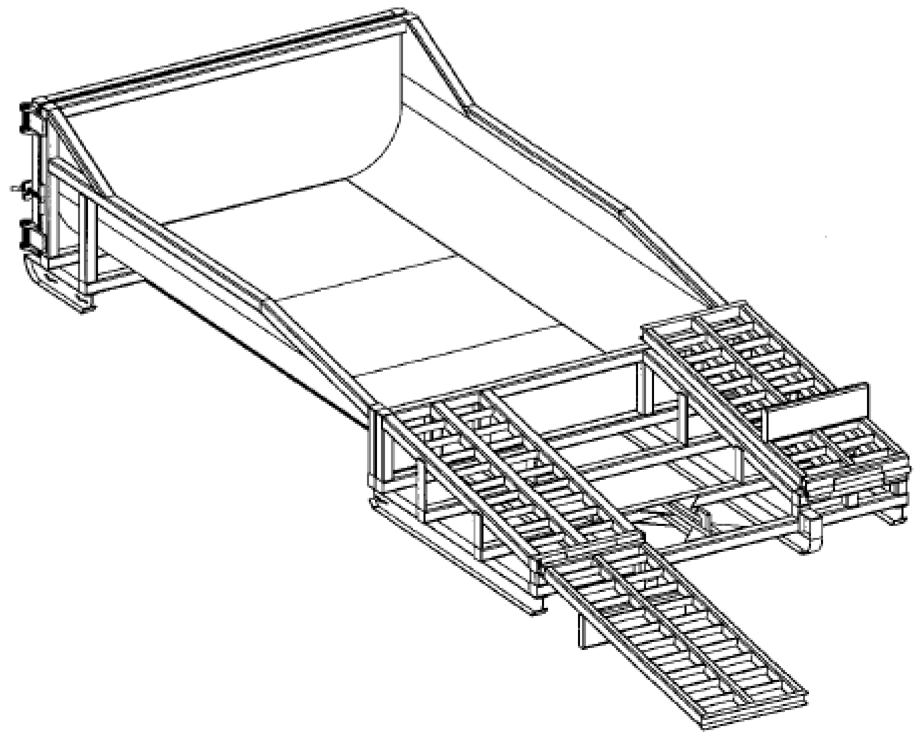


STAPLE DETAIL

NOTES:

1. ACTUAL LAYOUT DETERMINED IN THE FIELD.
2. THE CONCRETE WASHOUT SIGN (SEE FIG. 4–15) SHALL BE INSTALLED WITHIN 10 m OF THE TEMPORARY CONCRETE WASHOUT FACILITIY.

CALTRANS/FIG4–14.DWG SAC 8–14–02



Prefabricated Concrete Washout Container w/Ramp

BMP C160: Certified Erosion and Sediment Control Lead

Purpose The project proponent designates at least one person as the responsible representative in charge of erosion and sediment control (ESC), and water quality protection. The designated person shall be the Certified Erosion and Sediment Control Lead (CESCL) who is responsible for ensuring compliance with all local, state, and federal erosion and sediment control and water quality requirements.

Conditions of Use A CESCL shall be made available on projects one acre or larger that discharge stormwater to surface waters of the state

- The CESCL shall:
  - Have a current certificate proving attendance in an erosion and sediment control training course that meets the minimum ESC training and certification requirements established by Ecology (see details below).

    Ecology will maintain a list of ESC training and certification providers at: www.ecy.wa.gov/programs/wq/stormwater.

  OR

  - Be a Certified Professional in Erosion and Sediment Control (CPESC); for additional information go to: www.cpesc.net

Specifications

- Certification shall remain valid for three years.
- The CESCL shall have authority to act on behalf of the contractor or developer and shall be available, on call, 24 hours per day throughout the period of construction.
- The Construction SWPPP shall include the name, telephone number, fax number, and address of the designated CESCL.
- A CESCL may provide inspection and compliance services for multiple construction projects in the same geographic region.

Duties and responsibilities of the CESCL shall include, but are not limited to the following:

- Maintaining permit file on site at all times which includes the SWPPP and any associated permits and plans.
- Directing BMP installation, inspection, maintenance, modification, and removal.
- Updating all project drawings and the Construction SWPPP with changes made.

- Keeping daily logs, and inspection reports. Inspection reports should include:
  - Inspection date/time.
  - Weather information; general conditions during inspection and approximate amount of precipitation since the last inspection.
  - A summary or list of all BMPs implemented, including observations of all erosion/sediment control structures or practices. The following shall be noted:

    1) Locations of BMPs inspected,

    2) Locations of BMPs that need maintenance,

    3) Locations of BMPs that failed to operate as designed or intended, and

    4) Locations of where additional or different BMPs are required.
  - Visual monitoring results, including a description of discharged stormwater. The presence of suspended sediment, turbid water, discoloration, and oil sheen shall be noted, as applicable.
  - Any water quality monitoring performed during inspection.
  - General comments and notes, including a brief description of any BMP repairs, maintenance or installations made as a result of the inspection.
- Facilitate, participate in, and take corrective actions resulting from inspections performed by outside agencies or the owner.

2. Erosion and Sedimentation Processes
    a. Definitions
    b. Types of erosion
    c. Sedimentation
        i. Basic settling concepts
        ii. Problems with clays/turbidity

3. Factors Influencing Erosion Potential
    a. Soil
    b. Vegetation
    c. Topography
    d. Climate

4. Regulatory Requirements
    a. NPDES - Construction Stormwater General Permit
    b. Local requirements and permits
    c. Other regulatory requirements

5. Stormwater Pollution Prevention Plan (SWPPP)
    a. SWPPP is a living document – should be revised as necessary
    b. 12 Elements of a SWPPP; discuss suggested BMPs (with examples)
        1. Mark Clearing Limits
        2. Establish Construction Access
        3. Control Flow Rates
        4. Install Sediment Controls
        5. Stabilize Soils
        6. Protect Slopes
        7. Protect Drain Inlets
        8. Stabilize Channels and Outlets
        9. Control Pollutants
        10. Control De-watering
        11. Maintain BMPs
        12. Manage the Project

6. Monitoring/Reporting/Recordkeeping
    a. Site inspections/visual monitoring
        i. Disturbed areas
        ii. BMPs
        iii. Stormwater discharge points
    b. Water quality sampling/analysis
        i. Turbidity
        ii. pH
    c. Monitoring frequency
        i. Set by NPDES permit
        ii. Inactive sites - reduced frequency

d. Adaptive Management
   i. When monitoring indicates problem, take appropriate action (e.g. install/maintain BMPs)
   ii. Document the corrective action(s) in SWPPP
e. Reporting
   i. Inspection reports/checklists
   ii. Discharge Monitoring Reports (DMR)
   iii. Non-compliance notification

Instructor Qualifications

1. Instructors must be qualified to effectively teach the required course elements.

2. At a minimum, instructors must have:

   a. Current certification as a Certified Professional in Erosion and Sediment Control (CPESC), or
   b. Completed a training program for teaching the required course elements, or
   c. The academic credentials and instructional experience necessary for teaching the required course elements.

3. Instructors must demonstrate competent instructional skills and knowledge of the applicable subject matter.

4.2 Runoff Conveyance and Treatment BMPs

BMP C200: Interceptor Dike and Swale

Purpose

Provide a ridge of compacted soil, or a ridge with an upslope swale, at the top or base of a disturbed slope or along the perimeter of a disturbed construction area to convey stormwater. Use the dike and/or swale to intercept the runoff from unprotected areas and direct it to areas where erosion can be controlled. This can prevent storm runoff from entering the work area or sediment-laden runoff from leaving the construction site.

Conditions of Use

Where the runoff from an exposed site or disturbed slope must be conveyed to an erosion control facility which can safely convey the stormwater.

- Locate upslope of a construction site to prevent runoff from entering disturbed area.
- When placed horizontally across a disturbed slope, it reduces the amount and velocity of runoff flowing down the slope.
- Locate downslope to collect runoff from a disturbed area and direct it to a sediment basin.

Design and Installation Specifications

- Dike and/or swale and channel must be stabilized with temporary or permanent vegetation or other channel protection during construction.
- Channel requires a positive grade for drainage; steeper grades require channel protection and check dams.
- Review construction for areas where overtopping may occur.
- Can be used at top of new fill before vegetation is established.
- May be used as a permanent diversion channel to carry the runoff.
- Sub-basin tributary area should be one acre or less.
- Design capacity for the peak flow from a 10-year, 24-hour storm, assuming a Type 1A rainfall distribution, for temporary facilities. Alternatively, use 1.6 times the 10-year, 1-hour flow indicated by an approved continuous runoff model. For facilities that will also serve on a permanent basis, consult the local government's drainage requirements.

Interceptor dikes shall meet the following criteria:

Top Width	2 feet minimum.
Height	1.5 feet minimum on berm.
Side Slope	2:1 or flatter.
Grade	Depends on topography, however, dike system minimum is 0.5%, maximum is 1%.
Compaction	Minimum of 90 percent ASTM D698 standard proctor.

Horizontal Spacing of Interceptor Dikes:

Average Slope	Slope Percent	Flowpath Length
20H:1V or less	3-5%	300 feet
(10 to 20)H:1V	5-10%	200 feet
(4 to 10)H:1V	10-25%	100 feet
(2 to 4)H:1V	25-50%	50 feet

Stabilization depends on velocity and reach

Slopes <5% Seed and mulch applied within 5 days of dike construction (*see BMP C121, Mulching*).

Slopes 5 - 40% Dependent on runoff velocities and dike materials. Stabilization should be done immediately using either sod or riprap or other measures to avoid erosion.

- The upslope side of the dike shall provide positive drainage to the dike outlet. No erosion shall occur at the outlet. Provide energy dissipation measures as necessary. Sediment-laden runoff must be released through a sediment trapping facility.
- Minimize construction traffic over temporary dikes. Use temporary cross culverts for channel crossing.

Interceptor swales shall meet the following criteria:

Bottom Width	2 feet minimum; the bottom shall be level.
Depth	1-foot minimum.
Side Slope	2:1 or flatter.
Grade	Maximum 5 percent, with positive drainage to a suitable outlet (such as a sediment pond).
Stabilization	Seed as per *BMP C120, Temporary and Permanent Seeding*, or *BMP C202, Channel Lining*, 12 inches thick of riprap pressed into the bank and extending at least 8 inches vertical from the bottom.

- Inspect diversion dikes and interceptor swales once a week and after every rainfall. Immediately remove sediment from the flow area.
- Damage caused by construction traffic or other activity must be repaired before the end of each working day.

Check outlets and make timely repairs as needed to avoid gully formation. When the area below the temporary diversion dike is permanently stabilized, remove the dike and fill and stabilize the channel to blend with the natural surface.

BMP C209: Outlet Protection

Purpose

Outlet protection prevents scour at conveyance outlets and minimizes the potential for downstream erosion by reducing the velocity of concentrated stormwater flows.

Conditions of use

Outlet protection is required at the outlets of all ponds, pipes, ditches, or other conveyances, and where runoff is conveyed to a natural or manmade drainage feature such as a stream, wetland, lake, or ditch.

Design and Installation Specifications

The receiving channel at the outlet of a culvert shall be protected from erosion by rock lining a minimum of 6 feet downstream and extending up the channel sides a minimum of 1–foot above the maximum tailwater elevation or 1-foot above the crown, whichever is higher. For large pipes (more than 18 inches in diameter), the outlet protection lining of the channel is lengthened to four times the diameter of the culvert.

- Standard wingwalls, and tapered outlets and paved channels should also be considered when appropriate for permanent culvert outlet protection. (See WSDOT Hydraulic Manual, available through WSDOT Engineering Publications).
- Organic or synthetic erosion blankets, with or without vegetation, are usually more effective than rock, cheaper, and easier to install. Materials can be chosen using manufacturer product specifications. ASTM test results are available for most products and the designer can choose the correct material for the expected flow.
- With low flows, vegetation (including sod) can be effective.
- The following guidelines shall be used for riprap outlet protection:
    1. If the discharge velocity at the outlet is less than 5 fps (pipe slope less than 1 percent), use 2-inch to 8-inch riprap. Minimum thickness is 1-foot.
    2. For 5 to 10 fps discharge velocity at the outlet (pipe slope less than 3 percent), use 24-inch to 4-foot riprap. Minimum thickness is 2 feet.
    3. For outlets at the base of steep slope pipes (pipe slope greater than 10 percent), an engineered energy dissipater shall be used.
- Filter fabric or erosion control blankets should always be used under riprap to prevent scour and channel erosion.
- New pipe outfalls can provide an opportunity for low-cost fish habitat improvements. For example, an alcove of low-velocity water can be created by constructing the pipe outfall and associated energy dissipater back from the stream edge and digging a channel, over-widened to the upstream side, from the outfall. Overwintering juvenile and migrating adult salmonids may use the alcove as shelter during

high flows. Bank stabilization, bioengineering, and habitat features may be required for disturbed areas. See Volume V for more information on outfall system design.

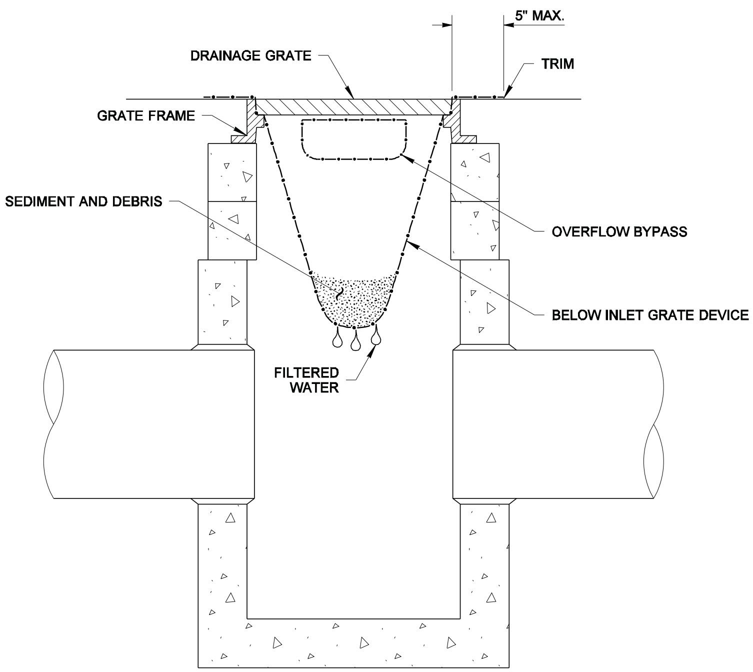
Maintenance Standards

- Inspect and repair as needed.
- Add rock as needed to maintain the intended function.
- Clean energy dissipater if sediment builds up.

DRAWN BY: LISA CYFORD

NOTES

1. Size the Below Inlet Grate Device (BIGD) for the storm water structure it will service.
2. The BIGD shall have a built-in high-flow relief system (overflow bypass).
3. The retrieval system must allow removal of the BIGD without spilling the collected material.
4. Perform maintenance in accordance with Standard Specification 8-01.3(15).



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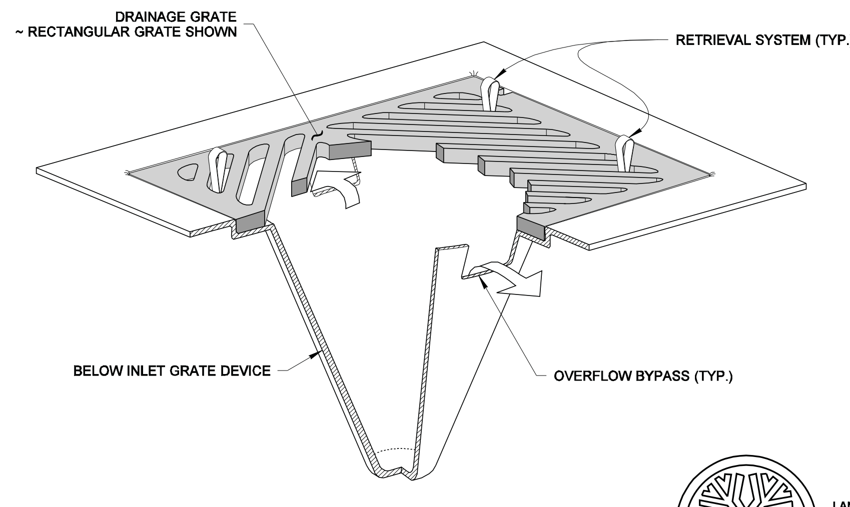


ISOMETRIC VIEW

STATE OF WASHINGTON REGISTERED LANDSCAPE ARCHITECT

MARK W. MAURER
CERTIFICATE NO. 00593

NOTE: THIS PLAN IS NOT A LEGAL ENGINEERING DOCUMENT BUT AN ELECTRONIC DUPLICATE. THE ORIGINAL, SIGNED BY THE ENGINEER AND APPROVED FOR PUBLICATION, IS KEPT ON FILE AT THE WASHINGTON STATE DEPARTMENT OF TRANSPORTATION. A COPY MAY BE OBTAINED UPON REQUEST.

STORM DRAIN INLET PROTECTION

STANDARD PLAN I-40.20-00

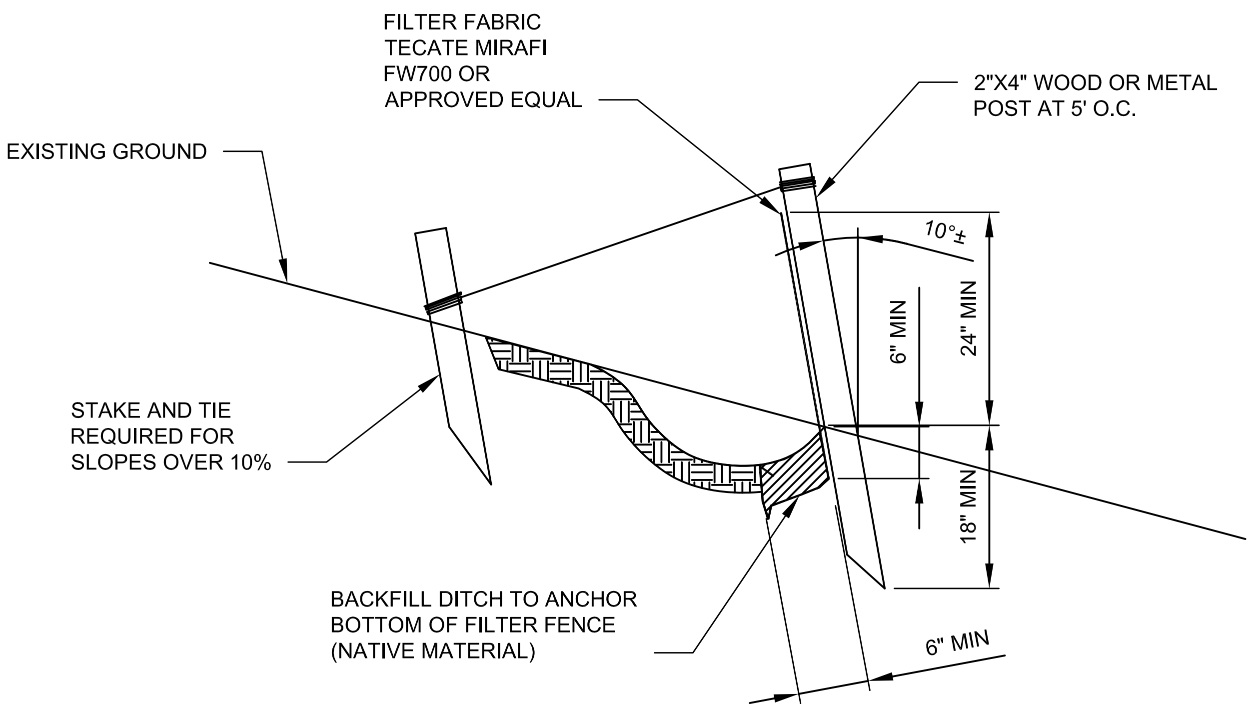
SHEET 1 OF 1 SHEET

APPROVED FOR PUBLICATION

Pasco Bakotich III — STATE DESIGN ENGINEER — *09-20-07* DATE

Washington State Department of Transportation

ATTACHMENT 18



FILTER FABRIC FENCE

NTS

CITY OF REDMOND, WASHINGTON			STANDARD DETAILS	
APPROVED BY: RON GRANT CITY ENGINEER	RONALD D. GRANT STATE OF WASHINGTON 22521 REGISTERED PROFESSIONAL ENGINEER	City of Redmond WASHINGTON	**FILTER FABRIC FENCE**	
REVISION DATE: MARCH 01, 2012			FILE NAME: SD502.DWG	DETAIL NUMBER: **502**

BMP C241: Temporary Sediment Pond

Purpose

Sediment ponds remove sediment from runoff originating from disturbed areas of the site. Sediment ponds are typically designed to remove sediment no smaller than medium silt (0.02 mm). Consequently, they usually reduce turbidity only slightly.

Conditions of Use

Prior to leaving a construction site, stormwater runoff must pass through a sediment pond or other appropriate sediment removal best management practice.

A sediment pond shall be used where the contributing drainage area is 3 acres or more. Ponds must be used in conjunction with erosion control practices to reduce the amount of sediment flowing into the basin.

Design and Installation Specifications

- Sediment basins must be installed only on sites where failure of the structure would not result in loss of life, damage to homes or buildings, or interruption of use or service of public roads or utilities. Also, sediment traps and ponds are attractive to children and can be very dangerous. Compliance with local ordinances regarding health and safety must be addressed. If fencing of the pond is required, the type of fence and its location shall be shown on the ESC plan.
- Structures having a maximum storage capacity at the top of the dam of 10 acre-ft (435,600 ft^3) or more are subject to the Washington Dam Safety Regulations (Chapter 173-175 WAC).
- See Figure 4.24, Figure 4.25, and Figure 4.26 for details.
- If permanent runoff control facilities are part of the project, they should be used for sediment retention. The surface area requirements of the sediment basin must be met. This may require enlarging the permanent basin to comply with the surface area requirements. If a permanent control structure is used, it may be advisable to partially restrict the lower orifice with gravel to increase residence time while still allowing dewatering of the basin.
- Use of infiltration facilities for sedimentation basins during construction tends to clog the soils and reduce their capacity to infiltrate. If infiltration facilities are to be used, the sides and bottom of the facility must only be rough excavated to a minimum of 2 feet above final grade. Final grading of the infiltration facility shall occur only when all contributing drainage areas are fully stabilized. The infiltration pretreatment facility should be fully constructed and used with the sedimentation basin to help prevent clogging.
- Determining Pond Geometry

  Obtain the discharge from the hydrologic calculations of the peak flow for the 2-year runoff event (Q_2). The 10-year peak flow shall be used if the project size, expected timing and duration of construction, or downstream conditions warrant a higher level of protection. If no hydrologic analysis is required, the Rational Method may be used.

Determine the required surface area at the top of the riser pipe with the equation:

SA = 2 x Q_2/0.00096 or
2080 square feet per cfs of inflow

See BMP C240 for more information on the derivation of the surface area calculation.

The basic geometry of the pond can now be determined using the following design criteria:

- Required surface area SA (from Step 2 above) at top of riser.
- Minimum 3.5-foot depth from top of riser to bottom of pond.
- Maximum 3:1 interior side slopes and maximum 2:1 exterior slopes. The interior slopes can be increased to a maximum of 2:1 if fencing is provided at or above the maximum water surface.
- One foot of freeboard between the top of the riser and the crest of the emergency spillway.
- Flat bottom.
- Minimum 1-foot deep spillway.
- Length-to-width ratio between 3:1 and 6:1.
- Sizing of Discharge Mechanisms.

The outlet for the basin consists of a combination of principal and emergency spillways. These outlets must pass the peak runoff expected from the contributing drainage area for a 100-year storm. If, due to site conditions and basin geometry, a separate emergency spill-way is not feasible, the principal spillway must pass the entire peak runoff expected from the 100-year storm. However, an attempt to provide a separate emergency spillway should always be made. The runoff calculations should be based on the site conditions during construction. The flow through the dewatering orifice cannot be utilized when calculating the 100-year storm elevation because of its potential to become clogged; therefore, available spillway storage must begin at the principal spillway riser crest.

The principal spillway designed by the procedures contained in this standard will result in some reduction in the peak rate of runoff. However, the riser outlet design will not adequately control the basin discharge to the predevelopment discharge limitations as stated in Minimum Requirement #7: Flow Control. However, if the basin for a permanent stormwater detention pond is used for a temporary sedimentation basin, the control structure for the permanent pond can be used to maintain predevelopment discharge limitations. The size of the basin, the expected life of the construction project, the anticipated downstream effects and the anticipated weather conditions during construction, should be considered to determine the need of additional discharge control. See Figure 4.28 for riser inflow curves.

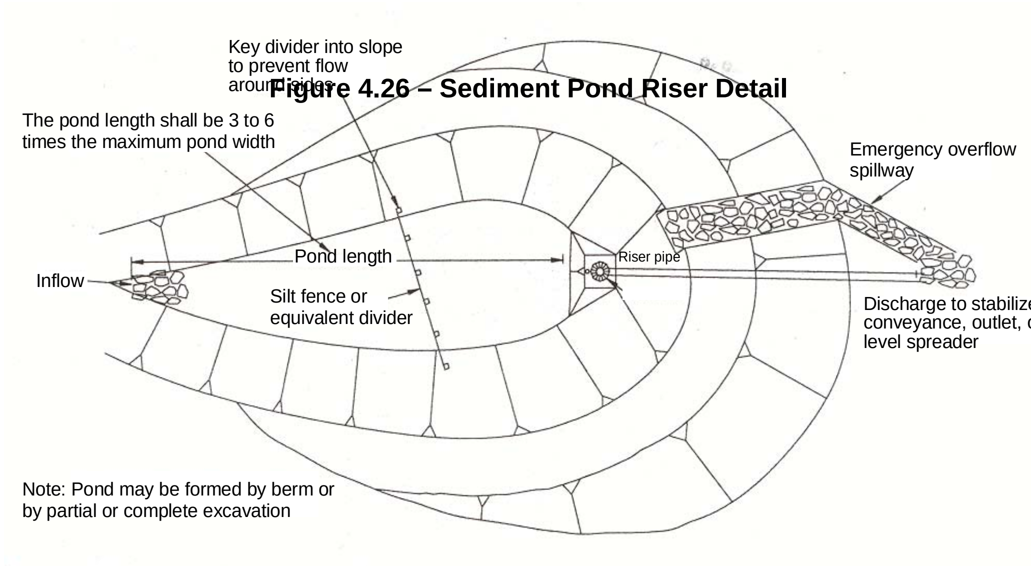


Figure 4.26 – Sediment Pond Riser Detail

Figure 4.24 – Sediment Pond Plan View

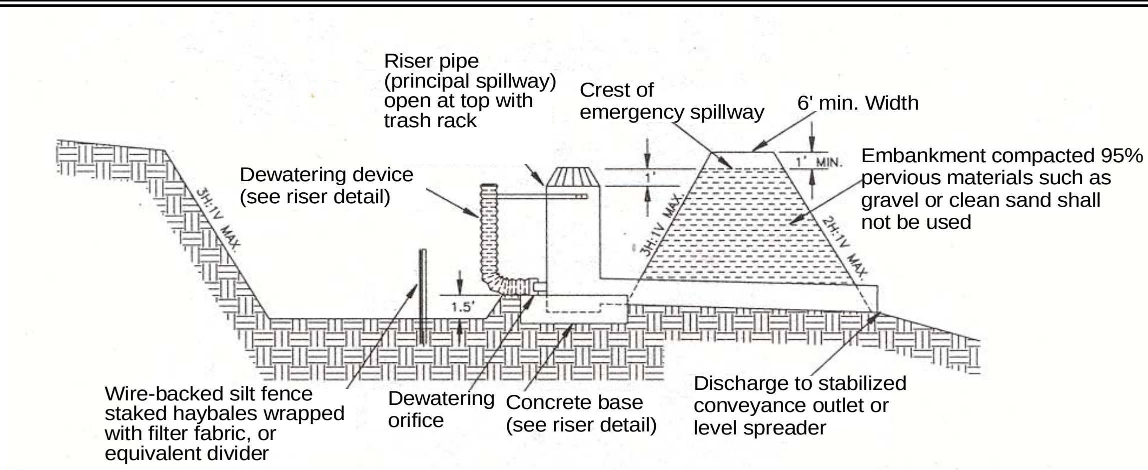


Figure 4.25 – Sediment Pond Cross Section

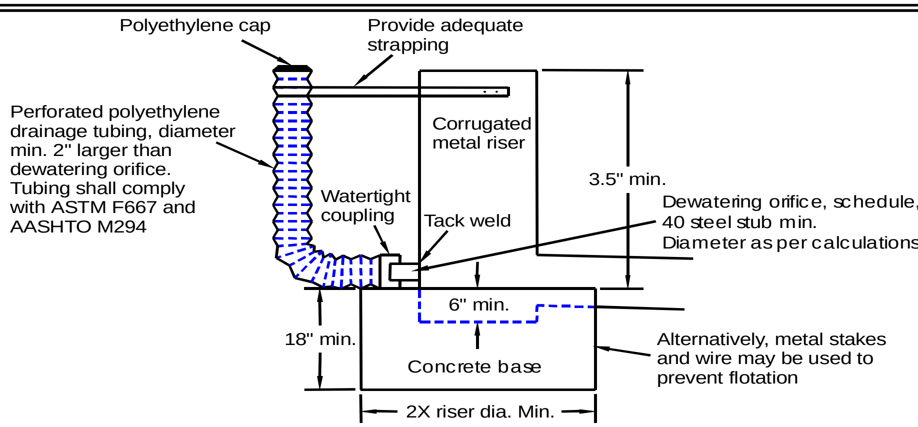


Figure 4.26 – Sediment Pond Riser Detail

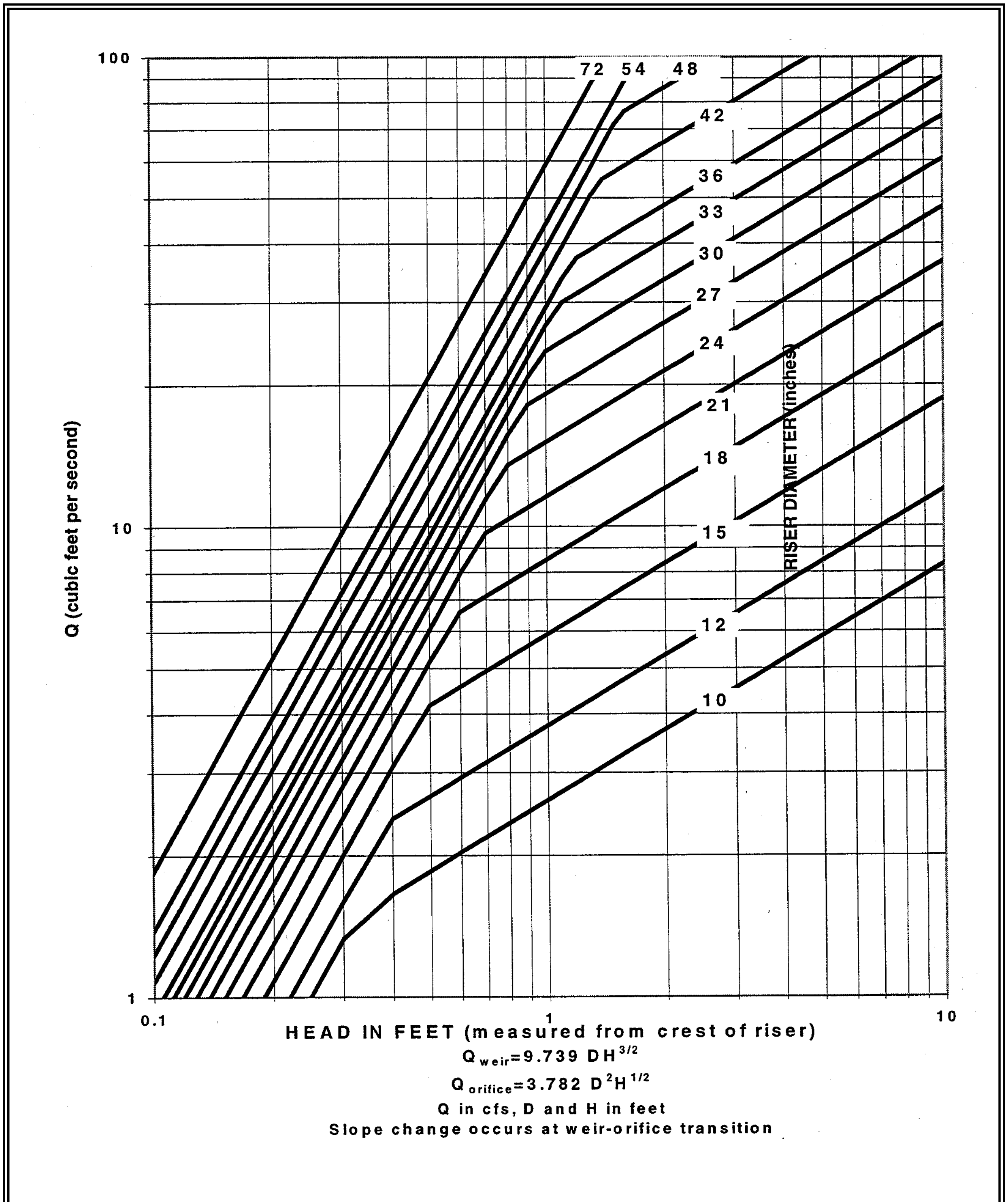


Figure 4.27 – Riser Inflow Curves

Principal Spillway: Determine the required diameter for the principal spillway (riser pipe). The diameter shall be the minimum necessary to pass the pre-developed 10-year peak flow (Q_{10}). Use Figure 4.28 to determine this diameter (h = 1-foot). *Note: A permanent control structure may be used instead of a temporary riser.*

Emergency Overflow Spillway: Determine the required size and design of the emergency overflow spillway for the developed 100-year peak flow using the method contained in Volume III.

Dewatering Orifice: Determine the size of the dewatering orifice(s) (minimum 1-inch diameter) using a modified version of the discharge equation for a vertical orifice and a basic equation for the area of a circular orifice. Determine the required area of the orifice with the following equation:

$$A_o = \frac{A_s (2h)^{0.5}}{0.6 \mathrm{x} 3600 T g^{0.5}}$$

where	A_O	=	orifice area (square feet)
	A_S	=	pond surface area (square feet)
	h	=	head of water above orifice (height of riser in feet)
	T	=	dewatering time (24 hours)
	g	=	acceleration of gravity (32.2 feet/second^2)

Convert the required surface area to the required diameter D of the orifice:

$$D = 24 \mathrm{x} \sqrt{\frac{A_o}{\pi}} = 13.54 \mathrm{x} \sqrt{A_o}$$

The vertical, perforated tubing connected to the dewatering orifice must be at least 2 inches larger in diameter than the orifice to improve flow characteristics. The size and number of perforations in the tubing should be large enough so that the tubing does not restrict flow. The orifice should control the flow rate.

- Additional Design Specifications

  The **pond shall be divided** into two roughly equal volume cells by a permeable divider that will reduce turbulence while allowing movement of water between cells. The divider shall be at least one-half the height of the riser and a minimum of one foot below the top of the riser. Wire-backed, 2- to 3-foot high, extra strength filter fabric supported by treated 4"x4"s can be used as a divider. Alternatively, staked straw bales wrapped with filter fabric (geotextile) may be used. If the pond is more than 6 feet deep, a different mechanism must be proposed. A riprap embankment is one acceptable method of separation for deeper ponds. Other designs that satisfy the intent of this provision are allowed as long as the divider is permeable, structurally sound, and designed to prevent erosion under or around the barrier.

To aid in determining sediment depth, **one-foot intervals** shall be prominently marked on the riser.

If an **embankment** of more than 6 feet is proposed, the pond must comply with the criteria contained in Volume III regarding dam safety for detention BMPs.

- The most common structural failure of sedimentation basins is caused by piping. Piping refers to two phenomena: (1) water seeping through fine-grained soil, eroding the soil grain by grain and forming pipes or tunnels; and, (2) water under pressure flowing upward through a granular soil with a head of sufficient magnitude to cause soil grains to lose contact and capability for support.

  The most critical construction sequences to prevent piping will be:

  1. Tight connections between riser and barrel and other pipe connections.
  2. Adequate anchoring of riser.
  3. Proper soil compaction of the embankment and riser footing.
  4. Proper construction of anti-seep devices.

Maintenance Standards

- Sediment shall be removed from the pond when it reaches 1–foot in depth.
- Any damage to the pond embankments or slopes shall be repaired.

Appendix C – Alternative BMPs

The following includes a list of possible alternative BMPs for each of the 12 elements not described in the main SWPPP text. This list can be referenced in the event a BMP for a specific element is not functioning as designed and an alternative BMP needs to be implemented.

Element #1 - Mark Clearing Limits
BMP C101: Preserving Natural Vegetation

> If natural vegetation exists on site and is schedule to be retained, prior to any construction near the vegetation, clearly mark areas around trees to be saved at least as far away as their drip line. Avoid any disturbance by construction equipment, grade changes, and/or excavation within marked area.

Element #2 - Establish Construction Access
BMP C106: Wheel Wash

> If wheel wash shall be installed

Element #3 - Control Flow Rates
BMP C240: Sediment Trap

> A sediment trap shall be installed downstream of the construction area where stormwater may pass through the trap slowing the velocity of the stormwater.

Element #4 - Install Sediment Controls
BMP C235: Straw Wattles

> The above noted BMPs shall be installed downstream of the construction area where stormwater may pass through the bales to slow the velocity of the storm water allowing sediment to settle.

Element #5 - Stabilize Soils
BMP C122: Nets and Blankets
BMP C123: Plastic Covering

> The above noted BMPs shall be applied/placed on exposed slopes when slopes are left unworked for more than 7 days during the dry season and 2 days during the wet season.

Element #6 - Protect Slopes
BMP C130: Surface Roughening

> All slopes greater than 3:1 and greater than 5 vertical feet are require surface roughening. In addition, areas that will not be stabilized immediately may be roughened to reduce runoff velocity until seeding takes place.

Element #7 – Protect Drain Inlets
NONE

Element #8 - Stabilize Channels and Outlets
None

Element #9 – Control Pollutants
NONE

Element #10 - Control Dewatering
NONE

4.1 Source Control BMPs

BMP C101: Preserving Natural Vegetation

Purpose

The purpose of preserving natural vegetation is to reduce erosion wherever practicable. Limiting site disturbance is the single most effective method for reducing erosion. For example, conifers can hold up to about 50 percent of all rain that falls during a storm. Up to 20-30 percent of this rain may never reach the ground but is taken up by the tree or evaporates. Another benefit is that the rain held in the tree can be released slowly to the ground after the storm.

Conditions of Use

- Natural vegetation should be preserved on steep slopes, near perennial and intermittent watercourses or swales, and on building sites in wooded areas.
- As required by local governments.

Design and Installation Specifications

Natural vegetation can be preserved in natural clumps or as individual trees, shrubs and vines.

The preservation of individual plants is more difficult because heavy equipment is generally used to remove unwanted vegetation. The points to remember when attempting to save individual plants are:

- Is the plant worth saving? Consider the location, species, size, age, vigor, and the work involved. Local governments may also have ordinances to save natural vegetation and trees.
- Fence or clearly mark areas around trees that are to be saved. It is preferable to keep ground disturbance away from the trees at least as far out as the dripline.

Plants need protection from three kinds of injuries:

- *Construction Equipment* - This injury can be above or below the ground level. Damage results from scarring, cutting of roots, and compaction of the soil. Placing a fenced buffer zone around plants to be saved prior to construction can prevent construction equipment injuries.
- *Grade Changes* - Changing the natural ground level will alter grades, which affects the plant's ability to obtain the necessary air, water, and minerals. Minor fills usually do not cause problems although sensitivity between species does vary and should be checked. Trees can tolerate fill of 6 inches or less. For shrubs and other plants, the fill should be less.

  When there are major changes in grade, it may become necessary to supply air to the roots of plants. This can be done by placing a layer of gravel and a tile system over the roots before the fill is made. A tile system protects a tree from a raised grade. The tile system should be laid out on the original grade leading from a dry well around the tree trunk. The system should then be covered with small stones to allow air to circulate over the root area.

Lowering the natural ground level can seriously damage trees and shrubs. The highest percentage of the plant roots are in the upper 12 inches of the soil and cuts of only 2-3 inches can cause serious injury. To protect the roots it may be necessary to terrace the immediate area around the plants to be saved. If roots are exposed, construction of retaining walls may be needed to keep the soil in place. Plants can also be preserved by leaving them on an undisturbed, gently sloping mound. To increase the chances for survival, it is best to limit grade changes and other soil disturbances to areas outside the dripline of the plant.

- *Excavations* **-** Protect trees and other plants when excavating for drainfields, power, water, and sewer lines. Where possible, the trenches should be routed around trees and large shrubs. When this is not possible, it is best to tunnel under them. This can be done with hand tools or with power augers. If it is not possible to route the trench around plants to be saved, then the following should be observed:

  Cut as few roots as possible. When you have to cut, cut clean. Paint cut root ends with a wood dressing like asphalt base paint.

  Backfill the trench as soon as possible.

  Tunnel beneath root systems as close to the center of the main trunk to preserve most of the important feeder roots.

Some problems that can be encountered with a few specific trees are:

- Maple, Dogwood, Red alder, Western hemlock, Western red cedar, and Douglas fir do not readily adjust to changes in environment and special care should be taken to protect these trees.
- The windthrow hazard of Pacific silver fir and madronna is high, while that of Western hemlock is moderate. The danger of windthrow increases where dense stands have been thinned. Other species (unless they are on shallow, wet soils less than 20 inches deep) have a low windthrow hazard.
- Cottonwoods, maples, and willows have water-seeking roots. These can cause trouble in sewer lines and infiltration fields. On the other hand, they thrive in high moisture conditions that other trees would not.
- Thinning operations in pure or mixed stands of Grand fir, Pacific silver fir, Noble fir, Sitka spruce, Western red cedar, Western hemlock,

Pacific dogwood, and Red alder can cause serious disease problems. Disease can become established through damaged limbs, trunks, roots, and freshly cut stumps. Diseased and weakened trees are also susceptible to insect attack.

Maintenance Standards

- Inspect flagged and/or fenced areas regularly to make sure flagging or fencing has not been removed or damaged. If the flagging or fencing has been damaged or visibility reduced, it shall be repaired or replaced immediately and visibility restored.
- If tree roots have been exposed or injured, "prune" cleanly with an appropriate pruning saw or lopers directly above the damaged roots and recover with native soils. Treatment of sap flowing trees (fir, hemlock, pine, soft maples) is not advised as sap forms a natural healing barrier.

BMP C104: Stake and Wire Fence

Purpose

Fencing is intended to: (1) restrict clearing to approved limits; (2) prevent disturbance of sensitive areas, their buffers, and other areas required to be left undisturbed; (3) limit construction traffic to designated construction entrances or roads; and, (4) protect any areas where marking with survey tape may not provide adequate protection.

Conditions of Use

To establish clearing limits, stake or wire fence may be used:

- At the boundary of sensitive areas, their buffers, and other areas required to be left uncleared.
- As necessary, to control vehicle access to and on the site.

Design and Installation Specifications

- See Figure 4.1 for details.
- More substantial fencing shall be used if the fence does not prevent encroachment into those areas that are not to be disturbed.

Maintenance Standards

- If the fence has been damaged or visibility reduced, it shall be repaired or replaced immediately and visibility restored.

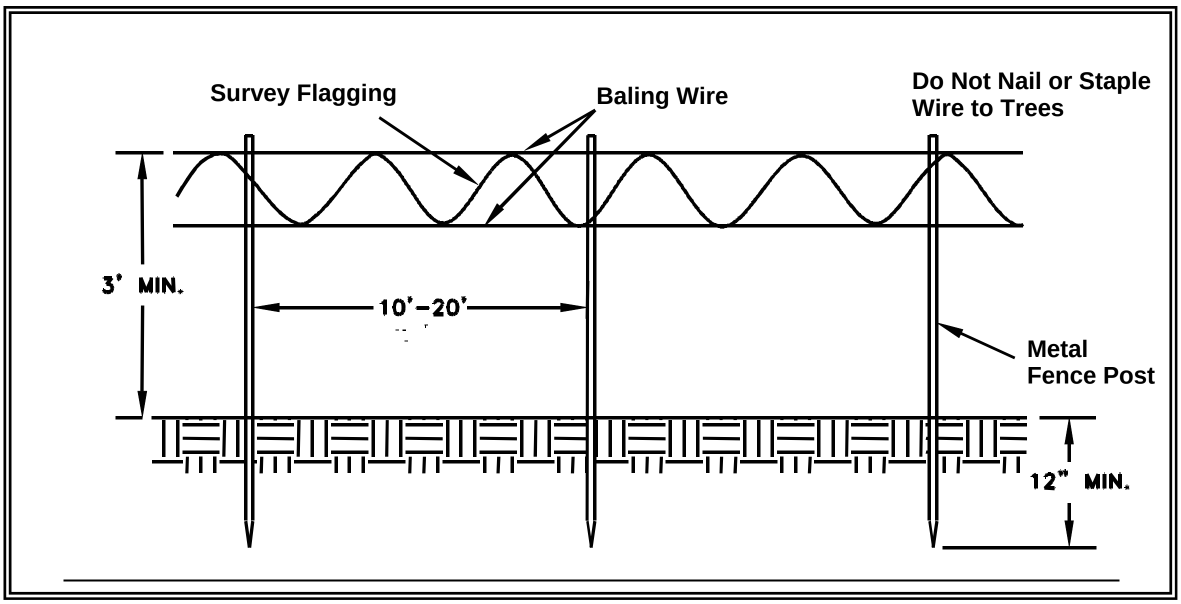


Figure 4.1 – Stake and Wire Fence

BMP C106: Wheel Wash

Purpose

Wheel washes reduce the amount of sediment transported onto paved roads by motor vehicles.

Conditions of Use

When a stabilized construction entrance (see BMP C105) is not preventing sediment from being tracked onto pavement.

- Wheel washing is generally an effective BMP when installed with careful attention to topography. For example, a wheel wash can be detrimental if installed at the top of a slope abutting a right-of-way where the water from the dripping truck can run unimpeded into the street.
- Pressure washing combined with an adequately sized and surfaced pad with direct drainage to a large 10-foot x 10-foot sump can be very effective.

Design and Installation Specifications

Suggested details are shown in Figure 4.3. The Local Permitting Authority may allow other designs. A minimum of 6 inches of asphalt treated base (ATB) over crushed base material or 8 inches over a good subgrade is recommended to pave the wheel wash.

Use a low clearance truck to test the wheel wash before paving. Either a belly dump or lowboy will work well to test clearance.

Keep the water level from 12 to 14 inches deep to avoid damage to truck hubs and filling the truck tongues with water.

Midpoint spray nozzles are only needed in extremely muddy conditions.

Wheel wash systems should be designed with a small grade change, 6 to 12 inches for a 10-foot-wide pond, to allow sediment to flow to the low side of pond to help prevent re-suspension of sediment. A drainpipe with a 2- to 3-foot riser should be installed on the low side of the pond to allow for easy cleaning and refilling. Polymers may be used to promote coagulation and flocculation in a closed-loop system. Polyacrylamide (PAM) added to the wheel wash water at a rate of 0.25 - 0.5 pounds per 1,000 gallons of water increases effectiveness and reduces cleanup time. If PAM is already being used for dust or erosion control and is being applied by a water truck, the same truck can be used to change the wash water.

Maintenance Standards

The wheel wash should start out the day with fresh water.

The wash water should be changed a minimum of once per day. On large earthwork jobs where more than 10-20 trucks per hour are expected, the wash water will need to be changed more often.

Wheel wash or tire bath wastewater shall be discharged to a separate on-site treatment system, such as closed-loop recirculation or land application, or to the sanitary sewer with proper local sewer district approval.

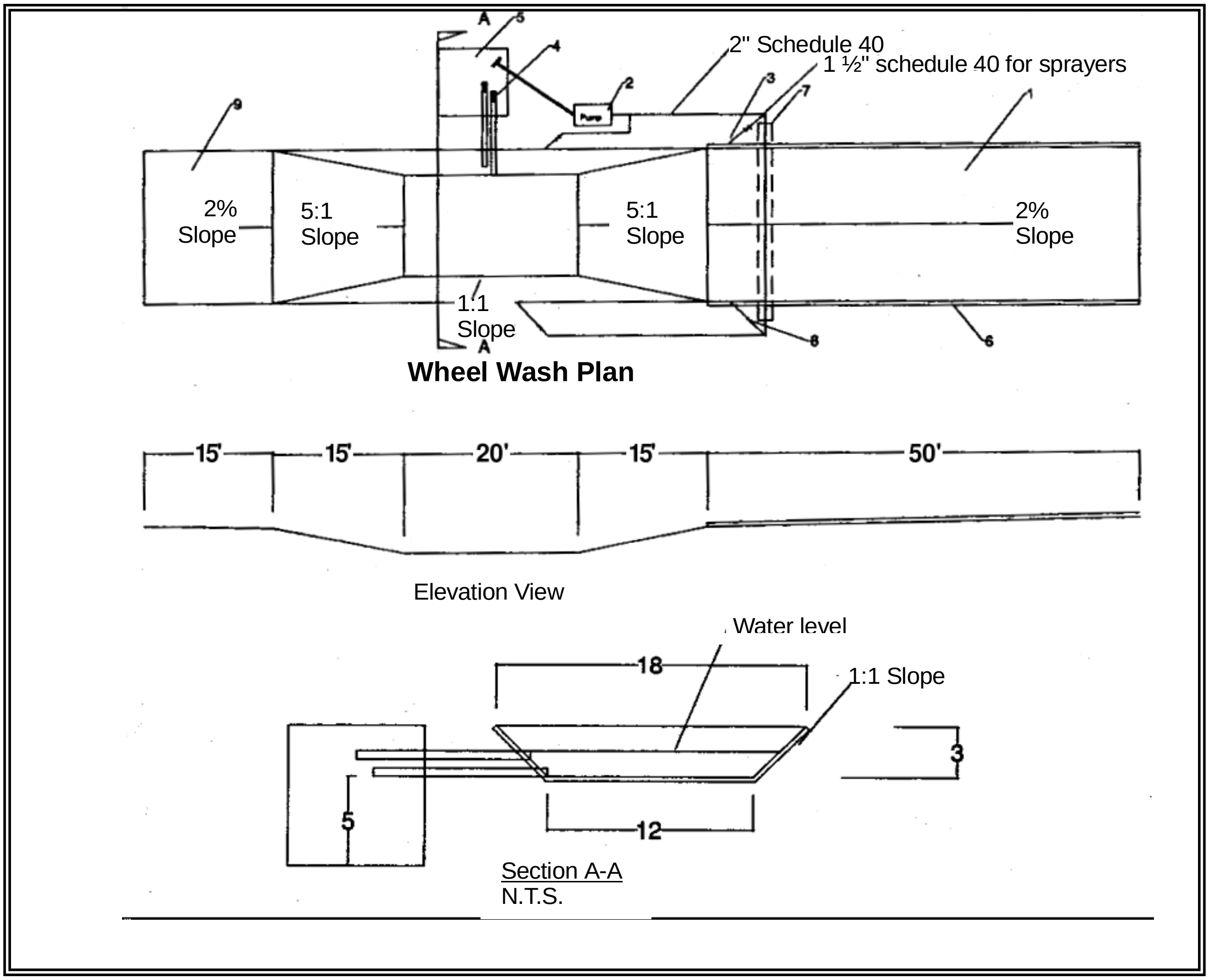


Figure 4.3 Wheel Wash

Notes:

1. Asphalt construction entrance 6 in. asphalt treated base (ATB).
2. 3-inch trash pump with floats on the suction hose.
3. Midpoint spray nozzles, if needed.
4. 6-inch sewer pipe with butterfly valves. Bottom one is a drain. Locate top pipe's invert 1 foot above bottom of wheel wash.
5. 8 foot x 8 foot sump with 5 feet of catch. Build so can be cleaned with trackhoe.
6. Asphalt curb on the low road side to direct water back to pond.
7. 6-inch sleeve under road.
8. Ball valves.
9. 15 foot. ATB apron to protect ground from splashing water.

BMP C122: Nets and Blankets

Purpose

Erosion control nets and blankets are intended to prevent erosion and hold seed and mulch in place on steep slopes and in channels so that vegetation can become well established. In addition, some nets and blankets can be used to permanently reinforce turf to protect drainage ways during high flows. Nets (commonly called matting) are strands of material woven into an open, but high-tensile strength net (for example, coconut fiber matting). Blankets are strands of material that are not tightly woven, but instead form a layer of interlocking fibers, typically held together by a biodegradable or photodegradable netting (for example, excelsior or straw blankets). They generally have lower tensile strength than nets, but cover the ground more completely. Coir (coconut fiber) fabric comes as both nets and blankets.

Conditions of Use

Erosion control nets and blankets should be used:

- To aid permanent vegetated stabilization of slopes 2H:1V or greater and with more than 10 feet of vertical relief.
- For drainage ditches and swales (highly recommended). The application of appropriate netting or blanket to drainage ditches and swales can protect bare soil from channelized runoff while vegetation is established. Nets and blankets also can capture a great deal of sediment due to their open, porous structure. Synthetic nets and blankets can be used to permanently stabilize channels and may provide a cost-effective, environmentally preferable alternative to riprap. 100 percent synthetic blankets manufactured for use in ditches may be easily reused as temporary ditch liners.

Disadvantages of blankets include:

- Surface preparation required;
- On slopes steeper than 2.5:1, blanket installers may need to be roped and harnessed for safety;
- They cost at least $4,000-6,000 per acre installed.

Advantages of blankets include:

- Can be installed without mobilizing special equipment;
- Can be installed by anyone with minimal training;
- Can be installed in stages or phases as the project progresses;
- Seed and fertilizer can be hand-placed by the installers as they progress down the slope;
- Can be installed in any weather;
- There are numerous types of blankets that can be designed with various parameters in mind. Those parameters include: fiber blend, mesh strength, longevity, biodegradability, cost, and availability.

Design and Installation Specifications

- See Figure 4.4 and Figure 4.5 for typical orientation and installation of blankets used in channels and as slope protection. Note: these are typical only; all blankets must be installed per manufacturer's installation instructions.
- Installation is critical to the effectiveness of these products. If good ground contact is not achieved, runoff can concentrate under the product, resulting in significant erosion.
- Installation of Blankets on Slopes:
  1. Complete final grade and track walk up and down the slope.
  2. Install hydromulch with seed and fertilizer.
  3. Dig a small trench, approximately 12 inches wide by 6 inches deep along the top of the slope.
  4. Install the leading edge of the blanket into the small trench and staple approximately every 18 inches. NOTE: Staples are metal,"U"-shaped, and a minimum of 6 inches long. Longer staples are used in sandy soils. Biodegradable stakes are also available.
  5. Roll the blanket slowly down the slope as installer walks backwards. NOTE: The blanket rests against the installer's legs. Staples are installed as the blanket is unrolled. It is critical that the proper staple pattern is used for the blanket being installed. The blanket is not to be allowed to roll down the slope on its own as this stretches the blanket making it impossible to maintain soil contact. In addition, no one is allowed to walk on the blanket after it is in place.
  6. If the blanket is not long enough to cover the entire slope length, the trailing edge of the upper blanket should overlap the leading edge of the lower blanket and be stapled. On steeper slopes, this overlap should be installed in a small trench, stapled, and covered with soil.
- With the variety of products available, it is impossible to cover all the details of appropriate use and installation. Therefore, it is critical that the design engineer consults the manufacturer's information and that a site visit takes place in order to insure that the product specified is appropriate. Information is also available at the following web sites:
  1. WSDOT: http://www.wsdot.wa.gov/eesc/environmental/
  2. Texas Transportation Institute: http://www.dot.state.tx.us/insdtdot/orgchart/cmd/erosion/contents.htm

- Jute matting must be used in conjunction with mulch (BMP C121). Excelsior, woven straw blankets and coir (coconut fiber) blankets may be installed without mulch. There are many other types of erosion control nets and blankets on the market that may be appropriate in certain circumstances.
- In general, most nets (e.g., jute matting) require mulch in order to prevent erosion because they have a fairly open structure. Blankets typically do not require mulch because they usually provide complete protection of the surface.
- Extremely steep, unstable, wet, or rocky slopes are often appropriate candidates for use of synthetic blankets, as are riverbanks, beaches and other high-energy environments. If synthetic blankets are used, the soil should be hydromulched first.
- 100 percent biodegradable blankets are available for use in sensitive areas. These organic blankets are usually held together with a paper or fiber mesh and stitching which may last up to a year.
- Most netting used with blankets is photodegradable, meaning they break down under sunlight (not UV stabilized). However, this process can take months or years even under bright sun. Once vegetation is established, sunlight does not reach the mesh. It is not uncommon to find non-degraded netting still in place several years after installation. This can be a problem if maintenance requires the use of mowers or ditch cleaning equipment. In addition, birds and small animals can become trapped in the netting.

Maintenance Standards

- Good contact with the ground must be maintained, and erosion must not occur beneath the net or blanket.
- Any areas of the net or blanket that are damaged or not in close contact with the ground shall be repaired and stapled.
- If erosion occurs due to poorly controlled drainage, the problem shall be fixed and the eroded area protected.

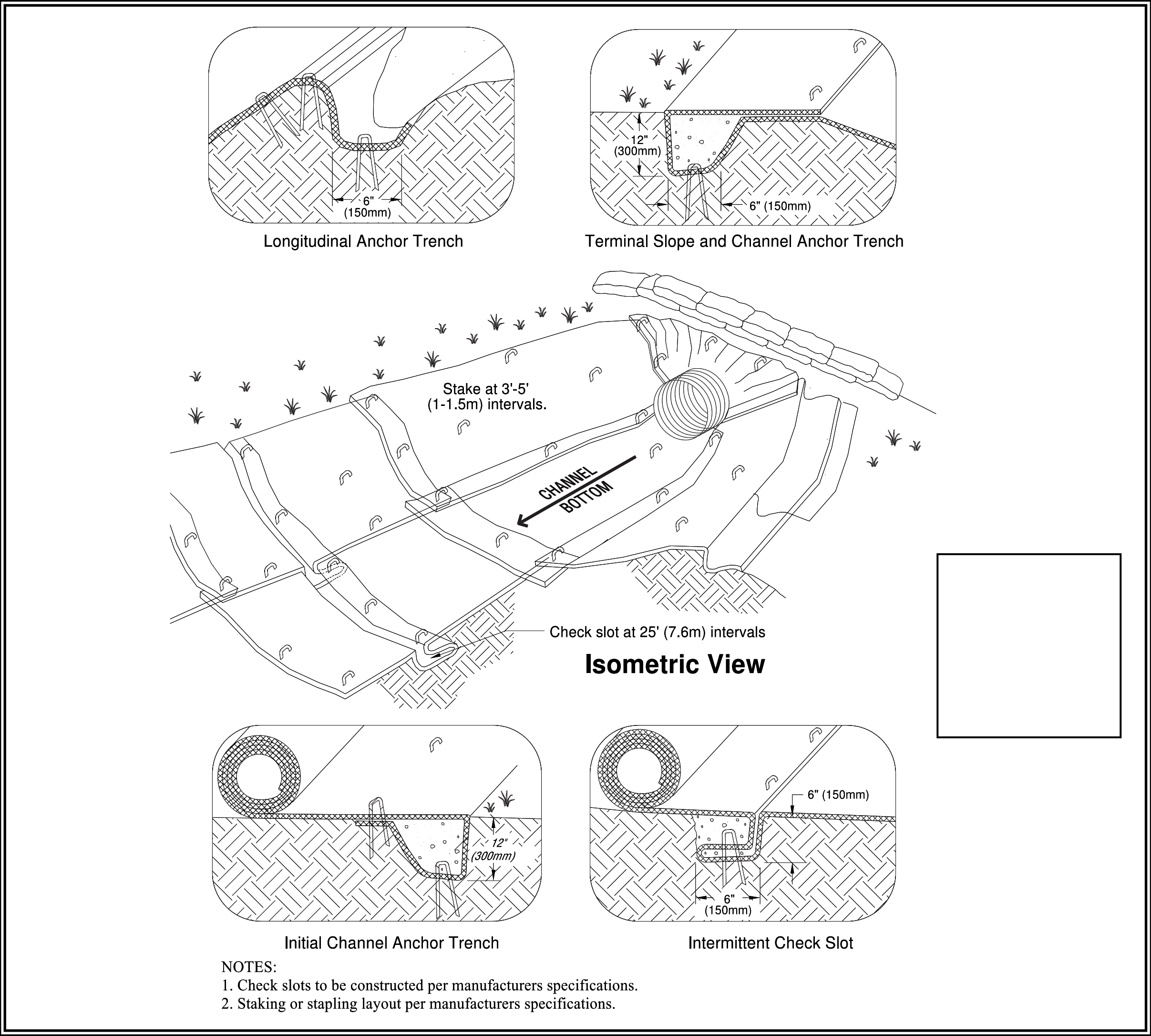


Figure 4.4 – Channel Installation

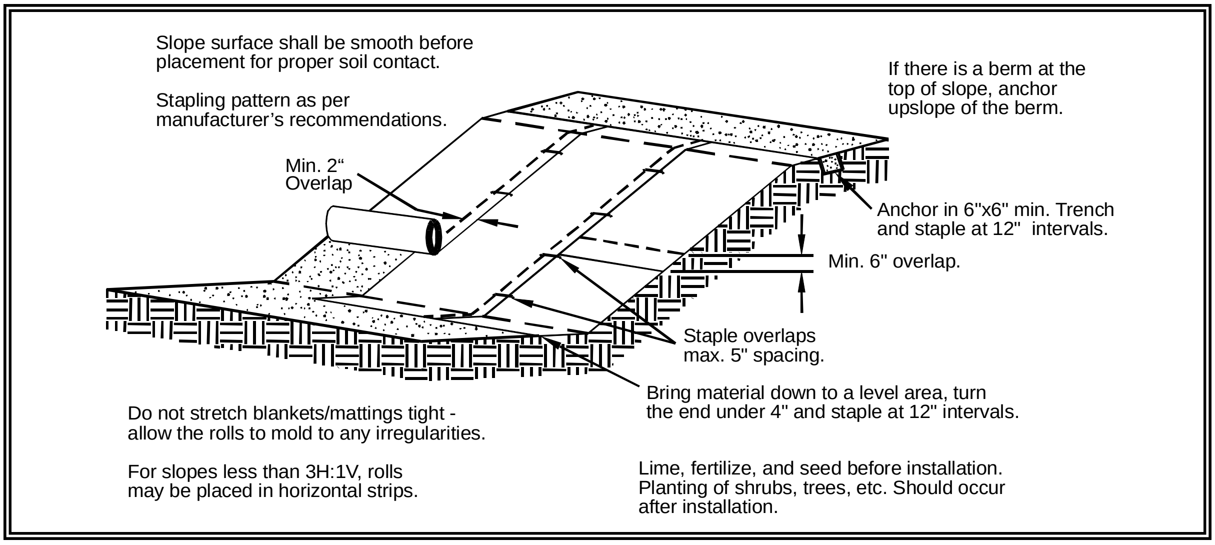


Figure 4.5 – Slope Installation

BMP C123: Plastic Covering

Purpose

Plastic covering provides immediate, short-term erosion protection to slopes and disturbed areas.

Conditions of Use

- Plastic covering may be used on disturbed areas that require cover measures for less than 30 days, except as stated below.
- Plastic is particularly useful for protecting cut and fill slopes and stockpiles. Note: The relatively rapid breakdown of most polyethylene sheeting makes it unsuitable for long-term (greater than six months) applications.
- Clear plastic sheeting can be used over newly-seeded areas to create a greenhouse effect and encourage grass growth if the hydroseed was installed too late in the season to establish 75 percent grass cover, or if the wet season started earlier than normal. Clear plastic should not be used for this purpose during the summer months because the resulting high temperatures can kill the grass.
- Due to rapid runoff caused by plastic sheeting, this method shall not be used upslope of areas that might be adversely impacted by concentrated runoff. Such areas include steep and/or unstable slopes.
- While plastic is inexpensive to purchase, the added cost of installation, maintenance, removal, and disposal make this an expensive material, up to $1.50-2.00 per square yard.
- Whenever plastic is used to protect slopes, water collection measures must be installed at the base of the slope. These measures include plastic-covered berms, channels, and pipes used to covey clean rainwater away from bare soil and disturbed areas. At no time is clean runoff from a plastic covered slope to be mixed with dirty runoff from a project.
- Other uses for plastic include:
  1. Temporary ditch liner;
  2. Pond liner in temporary sediment pond;
  3. Liner for bermed temporary fuel storage area if plastic is not reactive to the type of fuel being stored;
  4. Emergency slope protection during heavy rains; and,
  5. Temporary drainpipe (“elephant trunk”) used to direct water.

Design and Installation Specifications

- Plastic slope cover must be installed as follows:
  1. Run plastic up and down slope, not across slope;
  2. Plastic may be installed perpendicular to a slope if the slope length is less than 10 feet;
  3. Minimum of 8-inch overlap at seams;
  4. On long or wide slopes, or slopes subject to wind, all seams should be taped;
  5. Place plastic into a small (12-inch wide by 6-inch deep) slot trench at the top of the slope and backfill with soil to keep water from flowing underneath;
  6. Place sand filled burlap or geotextile bags every 3 to 6 feet along seams and pound a wooden stake through each to hold them in place;
  7. Inspect plastic for rips, tears, and open seams regularly and repair immediately. This prevents high velocity runoff from contacting bare soil which causes extreme erosion;
  8. Sandbags may be lowered into place tied to ropes. However, all sandbags must be staked in place.
- Plastic sheeting shall have a minimum thickness of 0.06 millimeters.
- If erosion at the toe of a slope is likely, a gravel berm, riprap, or other suitable protection shall be installed at the toe of the slope in order to reduce the velocity of runoff.

Maintenance Standards

- Torn sheets must be replaced and open seams repaired.
- If the plastic begins to deteriorate due to ultraviolet radiation, it must be completely removed and replaced.
- When the plastic is no longer needed, it shall be completely removed.
- Dispose of old tires appropriately.

BMP C130: Surface Roughening

Purpose

Surface roughening aids in the establishment of vegetative cover, reduces runoff velocity, increases infiltration, and provides for sediment trapping through the provision of a rough soil surface. Horizontal depressions are created by operating a tiller or other suitable equipment on the contour or by leaving slopes in a roughened condition by not fine grading them.

Conditions for Use

- All slopes steeper than 3:1 and greater than 5 vertical feet require surface roughening.
- Areas with grades steeper than 3:1 should be roughened to a depth of 2 to 4 inches prior to seeding.
- Areas that will not be stabilized immediately may be roughened to reduce runoff velocity until seeding takes place.
- Slopes with a stable rock face do not require roughening.
- Slopes where mowing is planned should not be excessively roughened.

Design and Installation Specifications

There are different methods for achieving a roughened soil surface on a slope, and the selection of an appropriate method depends upon the type of slope. Roughening methods include stair-step grading, grooving, contour furrows, and tracking. See Figure 4.6 for tracking and contour furrows. Factors to be considered in choosing a method are slope steepness, mowing requirements, and whether the slope is formed by cutting or filling.

- Disturbed areas that will not require mowing may be stair-step graded, grooved, or left rough after filling.
- Stair-step grading is particularly appropriate in soils containing large amounts of soft rock. Each "step" catches material that sloughs from above, and provides a level site where vegetation can become established. Stairs should be wide enough to work with standard earth moving equipment. Stair steps must be on contour or gullies will form on the slope.
- Areas that will be mowed (these areas should have slopes less steep than 3:1) may have small furrows left by disking, harrowing, raking, or seed-planting machinery operated on the contour.
- Graded areas with slopes greater than 3:1 but less than 2:1 should be roughened before seeding. This can be accomplished in a variety of ways, including "track walking," or driving a crawler tractor up and down the slope, leaving a pattern of cleat imprints parallel to slope contours.
- Tracking is done by operating equipment up and down the slope to leave horizontal depressions in the soil.

Maintenance Standards

- Areas that are graded in this manner should be seeded as quickly as possible.
- Regular inspections should be made of the area. If rills appear, they should be re-graded and re-seeded immediately.

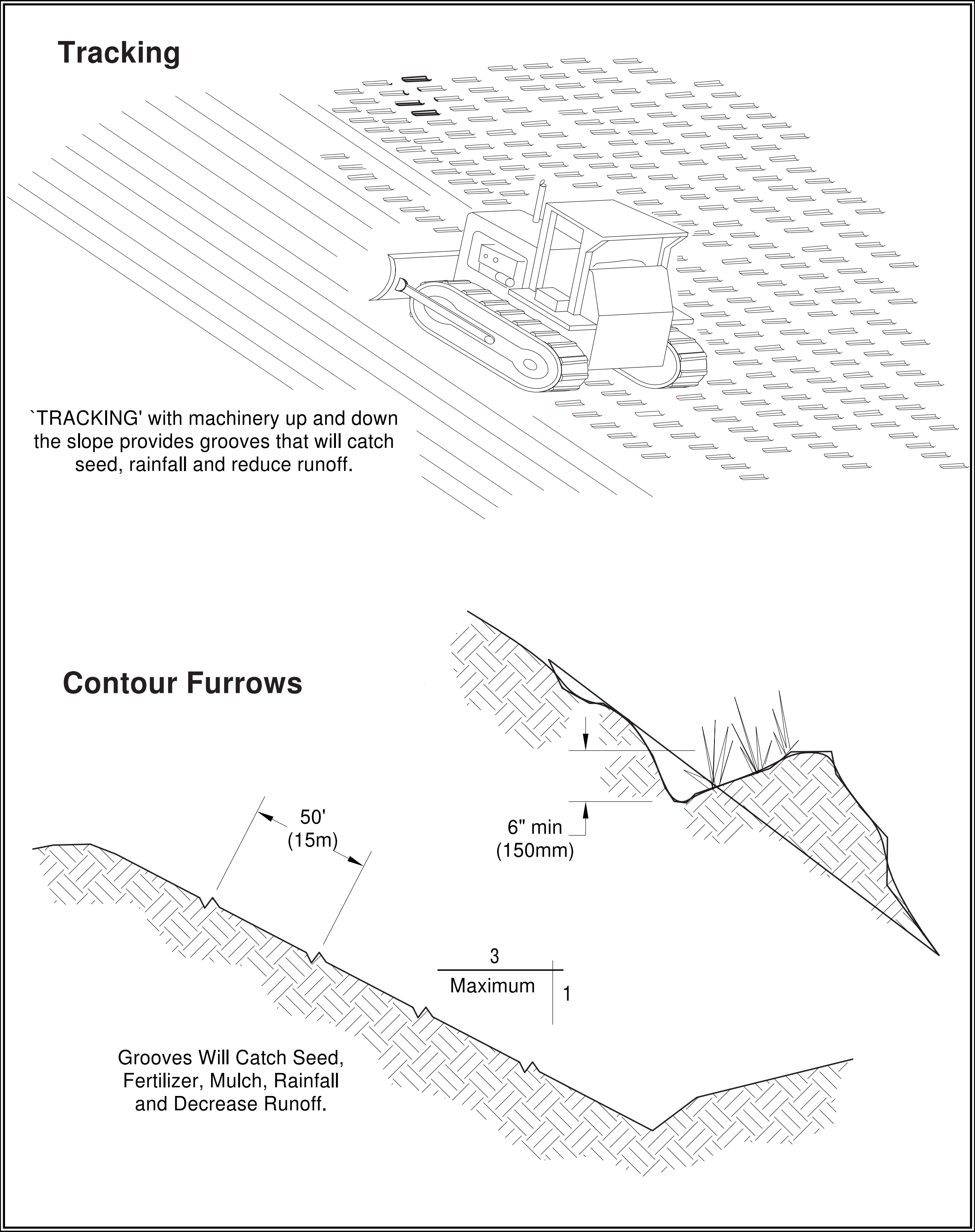


Figure 4.6 – Surface Roughening by Tracking and Contour Furrows

4.2 Runoff Conveyance and Treatment BMPs

BMP C200: Interceptor Dike and Swale

Purpose Provide a ridge of compacted soil, or a ridge with an upslope swale, at the top or base of a disturbed slope or along the perimeter of a disturbed construction area to convey stormwater. Use the dike and/or swale to intercept the runoff from unprotected areas and direct it to areas where erosion can be controlled. This can prevent storm runoff from entering the work area or sediment-laden runoff from leaving the construction site.

Conditions of Use Where the runoff from an exposed site or disturbed slope must be conveyed to an erosion control facility which can safely convey the stormwater.

- Locate upslope of a construction site to prevent runoff from entering disturbed area.
- When placed horizontally across a disturbed slope, it reduces the amount and velocity of runoff flowing down the slope.
- Locate downslope to collect runoff from a disturbed area and direct it to a sediment basin.

Design and Installation Specifications

- Dike and/or swale and channel must be stabilized with temporary or permanent vegetation or other channel protection during construction.
- Channel requires a positive grade for drainage; steeper grades require channel protection and check dams.
- Review construction for areas where overtopping may occur.
- Can be used at top of new fill before vegetation is established.
- May be used as a permanent diversion channel to carry the runoff.
- Sub-basin tributary area should be one acre or less.
- Design capacity for the peak flow from a 10-year, 24-hour storm, assuming a Type 1A rainfall distribution, for temporary facilities. Alternatively, use 1.6 times the 10-year, 1-hour flow indicated by an approved continuous runoff model. For facilities that will also serve on a permanent basis, consult the local government's drainage requirements.

Interceptor dikes shall meet the following criteria:

Top Width	2 feet minimum.
Height	1.5 feet minimum on berm.
Side Slope	2:1 or flatter.
Grade	Depends on topography, however, dike system minimum is 0.5%, maximum is 1%.
Compaction	Minimum of 90 percent ASTM D698 standard proctor.

Horizontal Spacing of Interceptor Dikes:

Average Slope	Slope Percent	Flowpath Length
20H:1V or less	3-5%	300 feet
(10 to 20)H:1V	5-10%	200 feet
(4 to 10)H:1V	10-25%	100 feet
(2 to 4)H:1V	25-50%	50 feet

Stabilization depends on velocity and reach

Slopes <5%	Seed and mulch applied within 5 days of dike construction (*see BMP C121, Mulching*).
Slopes 5 - 40%	**Dependent on runoff velocities and dike materials. Stabilization should be done immediately using either sod or riprap or other measures to avoid erosion.**

- The upslope side of the dike shall provide positive drainage to the dike outlet. No erosion shall occur at the outlet. Provide energy dissipation measures as necessary. Sediment-laden runoff must be released through a sediment trapping facility.

- Minimize construction traffic over temporary dikes. Use temporary cross culverts for channel crossing.

Interceptor swales shall meet the following criteria:

Bottom Width	2 feet minimum; the bottom shall be level.
Depth	1-foot minimum.
Side Slope	2:1 or flatter.
Grade	Maximum 5 percent, with positive drainage to a suitable outlet (such as a sediment pond).
Stabilization	Seed as per *BMP C120, Temporary and Permanent Seeding*, or *BMP C202, Channel Lining,* 12 inches thick of riprap pressed into the bank and extending at least 8 inches vertical from the bottom.

- Inspect diversion dikes and interceptor swales once a week and after every rainfall. Immediately remove sediment from the flow area.

- Damage caused by construction traffic or other activity must be repaired before the end of each working day.

Check outlets and make timely repairs as needed to avoid gully formation. When the area below the temporary diversion dike is permanently stabilized, remove the dike and fill and stabilize the channel to blend with the natural surface.

BMP C202: Channel Lining

Purpose

To protect erodible channels by providing a channel liner using either blankets or riprap.

Conditions of Use

When natural soils or vegetated stabilized soils in a channel are not adequate to prevent channel erosion.

- When a permanent ditch or pipe system is to be installed and a temporary measure is needed.
- In almost all cases, synthetic and organic coconut blankets are more effective than riprap for protecting channels from erosion. Blankets can be used with and without vegetation. Blanketed channels can be designed to handle any expected flow and longevity requirement. Some synthetic blankets have a predicted life span of 50 years or more, even in sunlight.
- Other reasons why blankets are better than rock include the availability of blankets over rock. In many areas of the state, rock is not easily obtainable or is very expensive to haul to a site. Blankets can be delivered anywhere. Rock requires the use of dump trucks to haul and heavy equipment to place. Blankets usually only require laborers with hand tools, and sometimes a backhoe.
- The Federal Highway Administration recommends not using flexible liners whenever the slope exceeds 10 percent or the shear stress exceeds 8 lbs/ft^2.

Design and Installation Specifications

See BMP C122 for information on blankets.

Since riprap is used where erosion potential is high, construction must be sequenced so that the riprap is put in place with the minimum possible delay.

- Disturbance of areas where riprap is to be placed should be undertaken only when final preparation and placement of the riprap can follow immediately behind the initial disturbance. Where riprap is used for outlet protection, the riprap should be placed before or in conjunction with the construction of the pipe or channel so that it is in place when the pipe or channel begins to operate.
- The designer, after determining the riprap size that will be stable under the flow conditions, shall consider that size to be a minimum size and then, based on riprap gradations actually available in the area, select the size or sizes that equal or exceed the minimum size. The possibility of drainage structure damage by children shall be considered in selecting a riprap size, especially if there is nearby water or a gully in which to toss the stones.
- Stone for riprap shall consist of field stone or quarry stone of approximately rectangular shape. The stone shall be hard and angular and of such quality that it will not disintegrate on exposure to water or

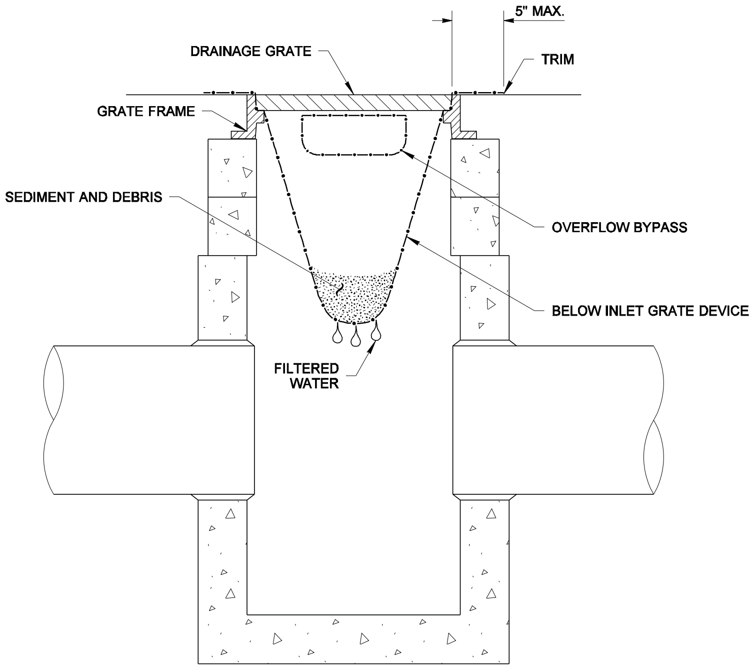
weathering and it shall be suitable in all respects for the purpose intended.

- Rubble concrete may be used provided it has a density of at least 150 pounds per cubic foot, and otherwise meets the requirement of this standard and specification.
- A lining of engineering filter fabric (geotextile) shall be placed between the riprap and the underlying soil surface to prevent soil movement into or through the riprap. The geotextile should be keyed in at the top of the bank.
- Filter fabric shall not be used on slopes greater than 1-1/2:1 as slippage may occur. It should be used in conjunction with a layer of coarse aggregate (granular filter blanket) when the riprap to be placed is 12 inches and larger.

DRAWN BY: LISA CYFORD

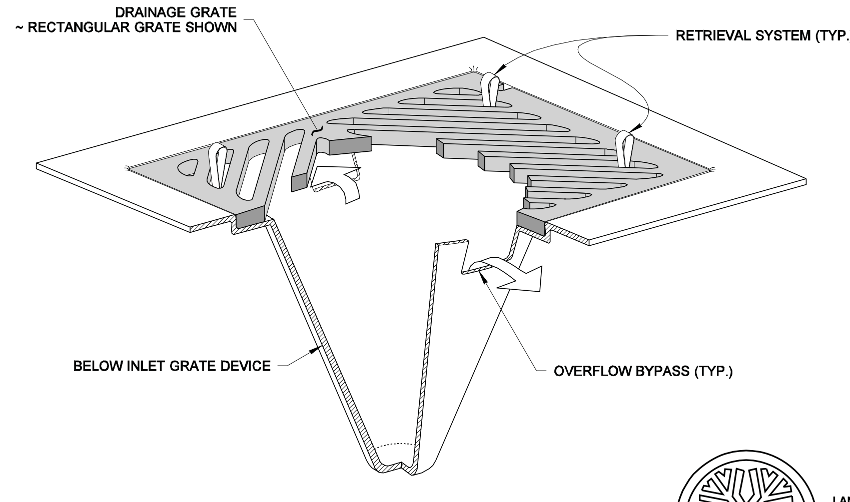
NOTES

1. Size the Below Inlet Grate Device (BIGD) for the storm water structure it will service.
2. The BIGD shall have a built-in high-flow relief system (overflow bypass).
3. The retrieval system must allow removal of the BIGD without spilling the collected material.
4. Perform maintenance in accordance with Standard Specification 8-01.3(15).



SECTION VIEW

NOT TO SCALE



ISOMETRIC VIEW

STATE OF WASHINGTON REGISTERED LANDSCAPE ARCHITECT

MARK W. MAURER

CERTIFICATE NO. 00[illegible]

NOTE: THIS PLAN IS NOT A LEGAL ENGINEERING DOCUMENT BUT AN ELECTRONIC DUPLICATE. THE ORIGINAL, SIGNED BY THE ENGINEER AND APPROVED FOR PUBLICATION, IS KEPT ON FILE AT THE WASHINGTON STATE DEPARTMENT OF TRANSPORTATION. A COPY MAY BE OBTAINED UPON REQUEST.

STORM DRAIN INLET PROTECTION

STANDARD PLAN I-40.20-00

SHEET 1 OF 1 SHEET

APPROVED FOR PUBLICATION

Pasco Bakotich III 09-20-07

STATE DESIGN ENGINEER DATE

Washington State Department of Transportation

ATTACHMENT 18

BMP C235: Straw Wattles

Purpose

Straw wattles are temporary erosion and sediment control barriers consisting of straw that is wrapped in biodegradable tubular plastic or similar encasing material. They reduce the velocity and can spread the flow of rill and sheet runoff, and can capture and retain sediment. Straw wattles are typically 8 to 10 inches in diameter and 25 to 30 feet in length. The wattles are placed in shallow trenches and staked along the contour of disturbed or newly constructed slopes. See Figure 4.21 for typical construction details.

Conditions of Use

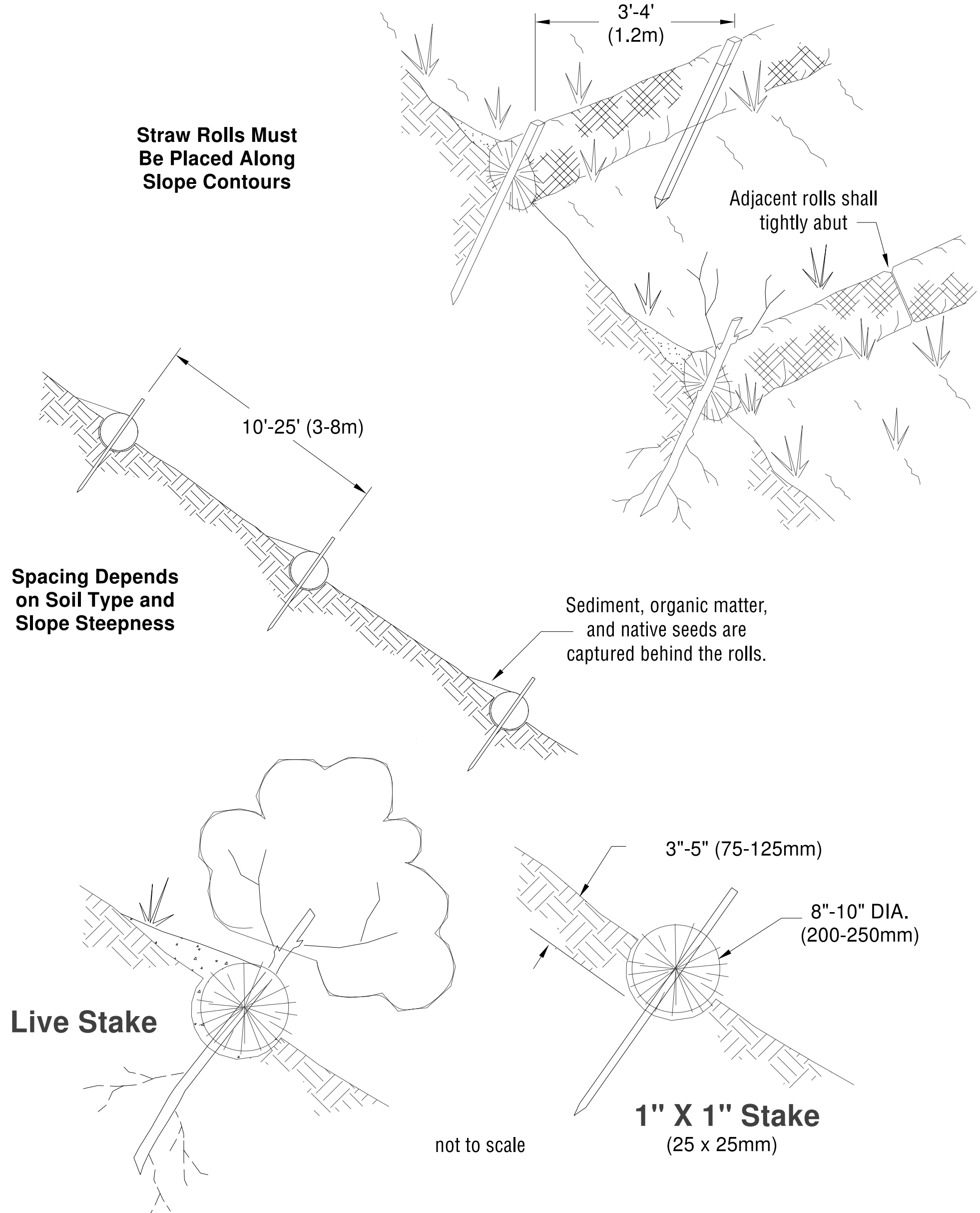
- Disturbed areas that require immediate erosion protection.
- Exposed soils during the period of short construction delays, or over winter months.
- On slopes requiring stabilization until permanent vegetation can be established.
- Straw wattles are effective for one to two seasons.
- If conditions are appropriate, wattles can be staked to the ground using willow cuttings for added revegetation.
- Rilling can occur beneath wattles if not properly entrenched and water can pass between wattles if not tightly abutted together.

Design Criteria

- It is critical that wattles are installed perpendicular to the flow direction and parallel to the slope contour.
- Narrow trenches should be dug across the slope on contour to a depth of 3 to 5 inches on clay soils and soils with gradual slopes. On loose soils, steep slopes, and areas with high rainfall, the trenches should be dug to a depth of 5 to 7 inches, or 1/2 to 2/3 of the thickness of the wattle.
- Start building trenches and installing wattles from the base of the slope and work up. Excavated material should be spread evenly along the uphill slope and compacted using hand tamping or other methods.
- Construct trenches at contour intervals of 3 to 30 feet apart depending on the steepness of the slope, soil type, and rainfall. The steeper the slope the closer together the trenches.
- Install the wattles snugly into the trenches and abut tightly end to end. Do not overlap the ends.
- Install stakes at each end of the wattle, and at 4-foot centers along entire length of wattle.
- If required, install pilot holes for the stakes using a straight bar to drive holes through the wattle and into the soil.
- At a minimum, wooden stakes should be approximately 3/4 x 3/4 x 24 inches. Willow cuttings or 3/8-inch rebar can also be used for stakes.

Maintenance Standards

- Stakes should be driven through the middle of the wattle, leaving 2 to 3 inches of the stake protruding above the wattle.
- Wattles may require maintenance to ensure they are in contact with soil and thoroughly entrenched, especially after significant rainfall on steep sandy soils.
- Inspect the slope after significant storms and repair any areas where wattles are not tightly abutted or water has scoured beneath the wattles.



NOTE:
1. Straw roll installation requires the placement and secure staking of the roll in a trench, 3"-5" (75-125mm) deep, dug on contour. runoff must not be allowed to run under or around roll.

Figure 4.21 – Straw Wattles

BMP C240: Sediment Trap

Purpose

A sediment trap is a small temporary ponding area with a gravel outlet used to collect and store sediment from sites cleared and/or graded during construction. Sediment traps, along with other perimeter controls, shall be installed before any land disturbance takes place in the drainage area.

Conditions of Use

Prior to leaving a construction site, stormwater runoff must pass through a sediment pond or trap or other appropriate sediment removal best management practice. Non-engineered sediment traps may be used on-site prior to an engineered sediment trap or sediment pond to provide additional sediment removal capacity.

It is intended for use on sites where the tributary drainage area is less than 3 acres, with no unusual drainage features, and a projected build-out time of six months or less. The sediment trap is a temporary measure (with a design life of approximately 6 months) and shall be maintained until the site area is permanently protected against erosion by vegetation and/or structures.

Sediment traps and ponds are only effective in removing sediment down to about the medium silt size fraction. Runoff with sediment of finer grades (fine silt and clay) will pass through untreated, emphasizing the need to control erosion to the maximum extent first.

Whenever possible, sediment-laden water shall be discharged into onsite, relatively level, vegetated areas (see BMP C234 – Vegetated Strip). This is the only way to effectively remove fine particles from runoff unless chemical treatment or filtration is used. This can be particularly useful after initial treatment in a sediment trap or pond. The areas of release must be evaluated on a site-by-site basis in order to determine appropriate locations for and methods of releasing runoff. Vegetated wetlands shall not be used for this purpose. Frequently, it may be possible to pump water from the collection point at the downhill end of the site to an upslope vegetated area. Pumping shall only augment the treatment system, not replace it, because of the possibility of pump failure or runoff volume in excess of pump capacity.

All projects that are constructing permanent facilities for runoff quantity control should use the rough-graded or final-graded permanent facilities for traps and ponds. This includes combined facilities and infiltration facilities. When permanent facilities are used as temporary sedimentation facilities, the surface area requirement of a sediment trap or pond must be met. If the surface area requirements are larger than the surface area of the permanent facility, then the trap or pond shall be enlarged to comply with the surface area requirement. The permanent pond shall also be divided into two cells as required for sediment ponds.

Either a permanent control structure or the temporary control structure (described in BMP C241, Temporary Sediment Pond) can be used. If a permanent control structure is used, it may be advisable to partially restrict the lower orifice with gravel to increase residence time while still allowing dewatering of the pond. A shut-off valve may be added to the control structure to allow complete retention of stormwater in emergency situations. In this case, an emergency overflow weir must be added.

A skimmer may be used for the sediment trap outlet if approved by the Local Permitting Authority.

Design and Installation Specifications

- See Figures 4.22 and 4.23 for details.
- If permanent runoff control facilities are part of the project, they should be used for sediment retention.
- To determine the sediment trap geometry, first calculate the design surface area (*SA*) of the trap, measured at the invert of the weir. Use the following equation:

  $SA = FS(Q_2/V_S)$

  where

  Q_2 = Design inflow based on the peak discharge from the developed 2-year runoff event from the contributing drainage area as computed in the hydrologic analysis. The 10-year peak flow shall be used if the project size, expected timing and duration of construction, or downstream conditions warrant a higher level of protection. If no hydrologic analysis is required, the Rational Method may be used.

  V_S = The settling velocity of the soil particle of interest. The 0.02 mm (medium silt) particle with an assumed density of 2.65 g/cm^3 has been selected as the particle of interest and has a settling velocity (V_S) of 0.00096 ft/sec.

  FS = A safety factor of 2 to account for non-ideal settling.

  Therefore, the equation for computing surface area becomes:

  $SA = 2 \text{ x } Q_2/0.00096$ or

  2080 square feet per cfs of inflow

  Note: Even if permanent facilities are used, they must still have a surface area that is at least as large as that derived from the above formula. If they do not, the pond must be enlarged.
- To aid in determining sediment depth, all sediment traps shall have a staff gauge with a prominent mark 1-foot above the bottom of the trap.

- Sediment traps may not be feasible on utility projects due to the limited work space or the short-term nature of the work. Portable tanks may be used in place of sediment traps for utility projects.

Maintenance Standards

- Sediment shall be removed from the trap when it reaches 1-foot in depth.
- Any damage to the pond embankments or slopes shall be repaired.

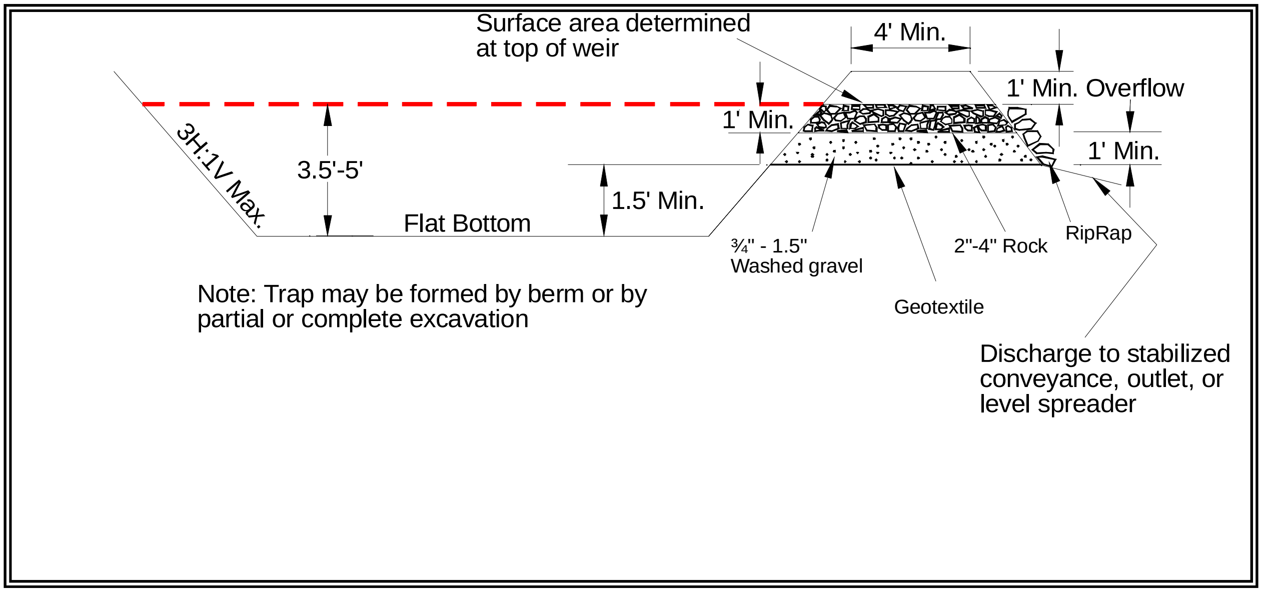


Figure 4.22 Cross Section of Sediment Trap

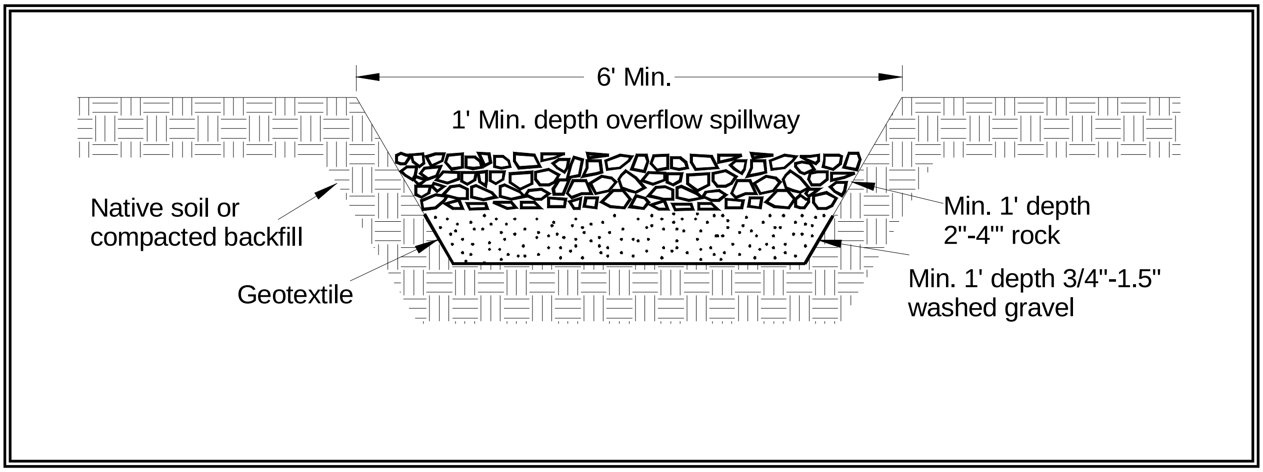


Figure 4.23 Sediment Trap Outlet

BMP C251: Construction Stormwater Filtration

Purpose

Filtration removes sediment from runoff originating from disturbed areas of the site.

Conditions of Use

Traditional BMPs used to control soil erosion and sediment loss from sites under development may not be adequate to ensure compliance with the water quality standard for turbidity in the receiving water. Filtration may be used in conjunction with gravity settling to remove sediment as small as fine silt (0.5 µm). The reduction in turbidity will be dependent on the particle size distribution of the sediment in the stormwater. In some circumstances, sedimentation and filtration may achieve compliance with the water quality standard for turbidity.

Unlike chemical treatment, the use of construction stormwater filtration does not require approval from Ecology.

Filtration may also be used in conjunction with polymer treatment in a portable system to assure capture of the flocculated solids.

Design and Installation Specifications

Background Information

Filtration with sand media has been used for over a century to treat water and wastewater. The use of sand filtration for treatment of stormwater has developed recently, generally to treat runoff from streets, parking lots, and residential areas. The application of filtration to construction stormwater treatment is currently under development.

Two types of filtration systems may be applied to construction stormwater treatment: rapid and slow. Rapid sand filters are the typical system used for water and wastewater treatment. They can achieve relatively high hydraulic flow rates, on the order of 2 to 20 gpm/sf, because they have automatic backwash systems to remove accumulated solids. In contrast, slow sand filters have very low hydraulic rates, on the order of 0.02 gpm/sf, because they do not have backwash systems. To date, slow sand filtration has generally been used to treat stormwater. Slow sand filtration is mechanically simple in comparison to rapid sand filtration but requires a much larger filter area.

Filtration Equipment. Sand media filters are available with automatic backwashing features that can filter to 50 µm particle size. Screen or bag filters can filter down to 5 µm. Fiber wound filters can remove particles down to 0.5 µm. Filters should be sequenced from the largest to the smallest pore opening. Sediment removal efficiency will be related to particle size distribution in the stormwater.

Treatment Process Description. Stormwater is collected at interception point(s) on the site and is diverted to a sediment pond or tank for removal of large sediment and storage of the stormwater before it is treated by the filtration system. The stormwater is pumped from the trap, pond, or tank through the filtration system in a rapid sand filtration system. Slow sand filtration systems are designed as flow through systems using gravity.

If large volumes of concrete are being poured, pH adjustment may be necessary.

Maintenance Standards

Rapid sand filters typically have automatic backwash systems that are triggered by a pre-set pressure drop across the filter. If the backwash water volume is not large or substantially more turbid than the stormwater stored in the holding pond or tank, backwash return to the pond or tank may be appropriate. However, land application or another means of treatment and disposal may be necessary.

- Screen, bag, and fiber filters must be cleaned and/or replaced when they become clogged.
- Sediment shall be removed from the storage and/or treatment ponds as necessary. Typically, sediment removal is required once or twice during a wet season and at the decommissioning of the ponds.

Appendix D – General Permit

ATTACHMENT 18

Issuance Date:	December 1, 2010
Effective Date:	January 1, 2011
Expiration Date:	December 31, 2015

CONSTRUCTION STORMWATER GENERAL PERMIT

National Pollutant Discharge Elimination System (NPDES) and State Waste Discharge General Permit for Stormwater Discharges Associated with Construction Activity

State of Washington
Department of Ecology
Olympia, Washington 98504

In compliance with the provisions of
Chapter 90.48 Revised Code of Washington
(State of Washington Water Pollution Control Act)
and
Title 33 United States Code, Section 1251 et seq.
The Federal Water Pollution Control Act (The Clean Water Act)

Until this permit expires, is modified or revoked, Permittees that have properly obtained coverage under this general permit are authorized to discharge in accordance with the special and general conditions that follow.

Kelly Susewind, P.E., P.G.
Water Quality Program Manager
Washington State Department of Ecology

TABLE OF CONTENTS

LIST OF TABLES

SUMMARY OF PERMIT REPORT SUBMITTALS

Refer to the Special and General Conditions within this permit for additional submittal requirements. Appendix A provides a list of definitions. Appendix B provides a list of acronyms.

Table 1. Summary of Permit Report Submittals

Permit Section	Submittal	Frequency	First Submittal Date
S5.A and S8	High Turbidity/Transparency Phone Reporting	As Necessary	Within 24 hours
S5.B	Discharge Monitoring Report	Monthly*	Within 15 days of applicable monitoring period
S5.F and S8	Noncompliance Notification	As necessary	Immediately
S5.F	Noncompliance Notification – Written Report	As necessary	Within 5 Days of non-compliance
G2.	Notice of Change in Authorization	As necessary	
G6.	Permit Application for Substantive Changes to the Discharge	As necessary	
G8.	Application for Permit Renewal	1/permit cycle	No later than 180 days before expiration
G9.	Notice of Permit Transfer	As necessary	
G20.	Notice of Planned Changes	As necessary	
G22.	Reporting Anticipated Non-compliance	As necessary	

SPECIAL NOTE: *Permittees must submit Discharge Monitoring Reports (DMRs) to the Washington State Department of Ecology monthly, regardless of site discharge, for the full duration of permit coverage. Refer to Section S5.B of this General Permit for more specific information regarding DMRs.

Table 2. Summary of Required On-site Documentation

Document Title	Permit Conditions
Permit Coverage Letter	See Conditions S2, S5
Construction Stormwater General Permit	See Conditions S2, S5
Site Log Book	See Conditions S4, S5
Stormwater Pollution Prevention Plan (SWPPP)	See Conditions S9, S5

SPECIAL CONDITIONS

S1. PERMIT COVERAGE

A. Permit Area

This Construction Stormwater General Permit (CSWGP) covers all areas of Washington State, except for federal and Tribal lands as specified in Special Condition S1.E.3.

B. Operators Required to Seek Coverage Under this General Permit:

1. Operators of the following construction activities are required to seek coverage under this CSWGP:

    a. Clearing, grading and/or excavation that results in the disturbance of one or more acres and discharges stormwater to surface waters of the State; and clearing, grading and/or excavation on sites smaller than one acre that are part of a larger common plan of development or sale, if the common plan of development or sale will ultimately disturb one acre or more and discharge stormwater to surface waters of the State.

        i. This includes forest practices (including, but not limited to, class IV conversions) that are part of a construction activity that will result in the disturbance of one or more acres, and discharge to surface waters of the State (that is, forest practices that prepare a site for construction activities); and

    b. Any size construction activity discharging stormwater to waters of the State that the Department of Ecology ("Ecology"):

        i. Determines to be a significant contributor of pollutants to waters of the State of Washington.

        ii. Reasonably expects to cause a violation of any water quality standard.

2. Operators of the following activities are not required to seek coverage under this CSWGP (unless specifically required under Special Condition S1.B.1.b. above):

    a. Construction activities that discharge all stormwater and non-stormwater to ground water, sanitary sewer, or combined sewer, and have no point source discharge to either surface water or a storm sewer system that drains to surface waters of the State.

    b. Construction activities covered under an Erosivity Waiver (Special Condition S2.C).

    c. Routine maintenance that is performed to maintain the original line and grade, hydraulic capacity, or original purpose of a facility.

C. Authorized Discharges:

1. Stormwater Associated with Construction Activity. Subject to compliance with the terms and conditions of this permit, Permittees are authorized to discharge stormwater associated with construction activity to surface waters of the State or to a storm sewer system that drains to surface waters of the State. (Note that "surface waters of the State" may exist on a construction site as well as off site; for example, a creek running through a site.)

2. Stormwater Associated with Construction Support Activity. This permit also authorizes stormwater discharge from support activities related to the permitted construction site (for example, an on-site portable rock crusher, off-site equipment staging yards, material storage areas, borrow areas, etc.) provided:

   a. The support activity relates directly to the permitted construction site that is required to have a NPDES permit; and

   b. The support activity is not a commercial operation serving multiple unrelated construction projects, and does not operate beyond the completion of the construction activity; and

   c. Appropriate controls and measures are identified in the Stormwater Pollution Prevention Plan (SWPPP) for the discharges from the support activity areas.

3. Non-Stormwater Discharges. The categories and sources of non-stormwater discharges identified below are authorized conditionally, provided the discharge is consistent with the terms and conditions of this permit:

   a. Discharges from fire-fighting activities.

   b. Fire hydrant system flushing.

   c. Potable water, including uncontaminated water line flushing.

   d. Pipeline hydrostatic test water.

   e. Uncontaminated air conditioning or compressor condensate.

   f. Uncontaminated ground water or spring water.

   g. Uncontaminated excavation dewatering water (in accordance with S9.D.10).

   h. Uncontaminated discharges from foundation or footing drains.

   i. Water used to control dust. Permittees must minimize the amount of dust control water used.

   j. Routine external building wash down that does not use detergents.

   k. Landscape irrigation water.

   The SWPPP must adequately address all authorized non-stormwater discharges, except for discharges from fire-fighting activities, and must comply with Special

Condition S3. At a minimum, discharges from potable water (including water line flushing), fire hydrant system flushing, and pipeline hydrostatic test water must undergo the following: dechlorination to a concentration of 0.1 parts per million (ppm) or less, and pH adjustment to within 6.5 – 8.5 standard units (su), if necessary.

D. Prohibited Discharges:

The following discharges to waters of the State, including ground water, are prohibited.

1. Concrete wastewater.
2. Wastewater from washout and clean-up of stucco, paint, form release oils, curing compounds and other construction materials.
3. Process wastewater as defined by 40 Code of Federal Regulations (CFR) 122.1 (see Appendix A of this permit).
4. Slurry materials and waste from shaft drilling.
5. Fuels, oils, or other pollutants used in vehicle and equipment operation and maintenance.
6. Soaps or solvents used in vehicle and equipment washing.
7. Wheel wash wastewater, unless discharged according to Special Condition S9.D.9.d.
8. Discharges from dewatering activities, including discharges from dewatering of trenches and excavations, unless managed according to Special Condition S9.D.10.

E. Limits on Coverage

Ecology may require any discharger to apply for and obtain coverage under an individual permit or another more specific general permit. Such alternative coverage will be required when Ecology determines that this CSWGP does not provide adequate assurance that water quality will be protected, or there is a reasonable potential for the project to cause or contribute to a violation of water quality standards.

The following stormwater discharges are not covered by this permit:

1. Post-construction stormwater discharges that originate from the site after completion of construction activities and the site has undergone final stabilization.
2. Non-point source silvicultural activities such as nursery operations, site preparation, reforestation and subsequent cultural treatment, thinning, prescribed burning, pest and fire control, harvesting operations, surface drainage, or road construction and maintenance, from which there is natural runoff as excluded in 40 CFR Subpart 122.
3. Stormwater from any federal project or project on federal land or land within an Indian Reservation except for the Puyallup Reservation. Within the Puyallup

Reservation, any project that discharges to surface water on land held in trust by the federal government may be covered by this permit.

4. Stormwater from any site covered under an existing NPDES individual permit in which stormwater management and/or treatment requirements are included for all stormwater discharges associated with construction activity.

5. Stormwater from a site where an applicable Total Maximum Daily Load (TMDL) requirement specifically precludes or prohibits discharges from construction activity.

S2. APPLICATION REQUIREMENTS

A. Permit Application Forms

1. Notice of Intent Form/Timeline

a. Operators of new or previously unpermitted construction activities must submit a complete and accurate permit application (Notice of Intent, or NOI) to Ecology.

b. The operator must submit the NOI at least 60 days before discharging stormwater from construction activities and must submit it on or before the date of the first public notice (see Special Condition S2.B below for details). The 30-day public comment period required by WAC 173-226-130(5) begins on the publication date of the second public notice. Unless Ecology responds to the complete application in writing, based on public comments, or any other relevant factors, coverage under the general permit will automatically commence on the thirty-first day following receipt by Ecology of a completed NOI, or the issuance date of this permit, whichever is later, unless Ecology specifies a later date in writing.

c. Applicants who propose to discharge to a storm or sewer system operated by Seattle, King County, Snohomish County, Tacoma, Pierce County, or Clark County must also submit a copy of the NOI to the appropriate jurisdiction.

d. If an applicant intends to use a Best Management Practice (BMP) selected on the basis of Special Condition S9.C.4 ("demonstrably equivalent" BMPs), the applicant must notify Ecology of its selection as part of the NOI. In the event the applicant selects BMPs after submission of the NOI, it must provide notice of the selection of an equivalent BMP to Ecology at least 60 days before intended use of the equivalent BMP.

e. Permittees must notify Ecology regarding any changes to the information provided on the NOI by submitting an updated NOI. Examples of such changes include, but are not limited to,

i. changes to the Permittee's mailing address,

ii. changes to the on-site contact person information, and

iii. changes to the area/acreage affected by construction activity.

2. Transfer of Coverage Form

The Permittee can transfer current coverage under this permit to one or more new operators, including operators of sites within a Common Plan of Development, provided the Permittee submits a Transfer of Coverage Form in accordance with General Condition G9. Transfers do not require public notice.

B. Public Notice

For new or previously unpermitted construction activities, the applicant must publish a public notice at least one time each week for two consecutive weeks, at least 7 days apart, in a newspaper with general circulation in the county where the construction is to take place. The notice must contain:

1. A statement that “The applicant is seeking coverage under the Washington State Department of Ecology’s Construction Stormwater NPDES and State Waste Discharge General Permit."
2. The name, address and location of the construction site.
3. The name and address of the applicant.
4. The type of construction activity that will result in a discharge (for example, residential construction, commercial construction, etc.), and the number of acres to be disturbed.
5. The name of the receiving water(s) (that is, the surface water(s) to which the site will discharge), or, if the discharge is through a storm sewer system, the name of the operator of the system.
6. The statement: "Any persons desiring to present their views to the Washington State Department of Ecology regarding this application, or interested in Ecology’s action on this application, may notify Ecology in writing no later than 30 days of the last date of publication of this notice. Ecology reviews public comments and considers whether discharges from this project would cause a measurable change in receiving water quality, and, if so, whether the project is necessary and in the overriding public interest according to Tier II antidegradation requirements under WAC 173-201A-320. Comments can be submitted to: Department of Ecology, P.O. Box 47696, Olympia, WA 98504-7696 Attn: Water Quality Program, Construction Stormwater.”

C. Erosivity Waiver

Construction site operators may qualify for an erosivity waiver from the CSWGP if the following conditions are met:

1. The site will result in the disturbance of fewer than 5 acres and the site is not a portion of a common plan of development or sale that will disturb 5 acres or greater.

2. Calculation of Erosivity "R" Factor and Regional Timeframe:

   a. The project's rainfall erosivity factor ("R" Factor) must be less than 5 during the period of construction activity, as calculated using either the Texas A&M University online rainfall erosivity calculator at: http://ei.tamu.edu/ or EPA's calculator at http://cfpub.epa.gov/npdes/stormwater/lew/lewcalculator.cfm. The period of construction activity starts when the land is first disturbed and ends with final stabilization. In addition:

   b. The entire period of construction activity must fall within the following timeframes:

      i. For sites west of the Cascades Crest: June 15 – September 15.

      ii. For sites east of the Cascades Crest, excluding the Central Basin: June 15 – October 15.

      iii. For sites east of the Cascades Crest, within the Central Basin: no additional timeframe restrictions apply. The Central Basin is defined as the portions of Eastern Washington with mean annual precipitation of less than 12 inches. For a map of the Central Basin (Region 2), refer to http://www.ecy.wa.gov/pubs/ecy070202.pdf.

3. Construction site operators must submit a complete Erosivity Waiver certification form at least one week before disturbing the land. Certification must include statements that the operator will:

   a. Comply with applicable local stormwater requirements; and

   b. Implement appropriate erosion and sediment control BMPs to prevent violations of water quality standards.

4. This waiver is not available for facilities declared significant contributors of pollutants as defined in Special Condition S1.B.1.b.

5. This waiver does not apply to construction activities which include non-stormwater discharges listed in Special Condition S1.C.3.

6. If construction activity extends beyond the certified waiver period for any reason, the operator must either:

   a. Recalculate the rainfall erosivity "R" factor using the original start date and a new projected ending date and, if the "R" factor is still under 5 and the entire project falls within the applicable regional timeframe in Special Condition S2.C.2.b, complete and submit an amended waiver certification form before the original waiver expires; or

b. Submit a complete permit application to Ecology in accordance with Special Condition S2.A and B before the end of the certified waiver period.

S3. COMPLIANCE WITH STANDARDS

A. Discharges must not cause or contribute to a violation of surface water quality standards (Chapter 173-201A WAC), ground water quality standards (Chapter 173-200 WAC), sediment management standards (Chapter 173-204 WAC), and human health-based criteria in the National Toxics Rule (40 CFR Part 131.36). Discharges not in compliance with these standards are not authorized.

B. Prior to the discharge of stormwater and non-stormwater to waters of the State, the Permittee must apply all known, available, and reasonable methods of prevention, control, and treatment (AKART). This includes the preparation and implementation of an adequate Stormwater Pollution Prevention Plan (SWPPP), with all appropriate BMPs installed and maintained in accordance with the SWPPP and the terms and conditions of this permit.

C. Ecology presumes that a Permittee complies with water quality standards unless discharge monitoring data or other site-specific information demonstrates that a discharge causes or contributes to a violation of water quality standards, when the Permittee complies with the following conditions. The Permittee must fully:

1. Comply with all permit conditions, including planning, sampling, monitoring, reporting, and recordkeeping conditions.

2. Implement stormwater BMPs contained in stormwater management manuals published or approved by Ecology, or BMPs that are demonstrably equivalent to BMPs contained in stormwater technical manuals published or approved by Ecology, including the proper selection, implementation, and maintenance of all applicable and appropriate BMPs for on-site pollution control. (For purposes of this section, the stormwater manuals listed in Appendix 10 of the Phase I Municipal Stormwater Permit are approved by Ecology.)

D. Where construction sites also discharge to ground water, the ground water discharges must also meet the terms and conditions of this CSWGP. Permittees who discharge to ground water through an injection well must also comply with any applicable requirements of the Underground Injection Control (UIC) regulations, Chapter 173-218 WAC.

S4. MONITORING REQUIREMENTS, BENCHMARKS AND REPORTING TRIGGERS

Table 3. Summary of Primary Monitoring Requirements

Size of Soil Disturbance[1]	Weekly Site Inspections	Weekly Sampling w/ Turbidity Meter	Weekly Sampling w/ Transparency Tube	Weekly pH Sampling[2]	Requires CESCL Certification?
Sites that disturb less than 1 acre, but are part of a larger Common Plan of Development	Required	Not Required	Not Required	Not Required	No
Sites that disturb 1 acre or more, but fewer than 5 acres	Required	Sampling Required – either method[3]		Required	Yes
Sites that disturb 5 acres or more	Required	Required	Not Required[4]	Required	Yes

A. Site Log Book

The Permittee must maintain a site log book that contains a record of the implementation of the SWPPP and other permit requirements, including the installation and maintenance of BMPs, site inspections, and stormwater monitoring.

B. Site Inspections

The Permittee's (operator's) site inspections must include all areas disturbed by construction activities, all BMPs, and all stormwater discharge points. (See Special Conditions S4.B.3 and B.4 below for detailed requirements of the Permittee's Certified Erosion and Sediment Control Lead [CESCL]).

[1] Soil disturbance is calculated by adding together all areas affected by construction activity. Construction activity means clearing, grading, excavation, and any other activity that disturbs the surface of the land, including ingress/egress from the site.
[2] If construction activity results in the disturbance of 1 acre or more, and involves significant concrete work (1,000 cubic yards of poured or recycled concrete over the life of a project) or the use of engineered soils (soil amendments including but not limited to Portland cement-treated base [CTB], cement kiln dust [CKD], or fly ash), and stormwater from the affected area drains to surface waters of the State or to a storm sewer stormwater collection system that drains to other surface waters of the State, the Permittee must conduct pH monitoring sampling in accordance with Special Condition S4.D.
[3] Sites with one or more acres, but fewer than 5 acres of soil disturbance, must conduct turbidity or transparency sampling in accordance with Special Condition S4.C.
[4] Sites equal to or greater than 5 acres of soil disturbance must conduct turbidity sampling using a turbidity meter in accordance with Special Condition S4.C.

Construction sites one acre or larger that discharge stormwater to surface waters of the State must have site inspections conducted by a certified CESCL. Sites less than one acre may have a person without CESCL certification conduct inspections; sampling is not required on sites that disturb less than an acre.

1. The Permittee must examine stormwater visually for the presence of suspended sediment, turbidity, discoloration, and oil sheen. The Permittee must evaluate the effectiveness of BMPs and determine if it is necessary to install, maintain, or repair BMPs to improve the quality of stormwater discharges.

   Based on the results of the inspection, the Permittee must correct the problems identified by:

   a. Reviewing the SWPPP for compliance with Special Condition S9 and making appropriate revisions within 7 days of the inspection.

   b. Immediately beginning the process of fully implementing and maintaining appropriate source control and/or treatment BMPs as soon as possible, addressing the problems no later than within 10 days of the inspection. If installation of necessary treatment BMPs is not feasible within 10 days, Ecology may approve additional time when an extension is requested by a Permittee within the initial 10-day response period.

   c. Documenting BMP implementation and maintenance in the site log book.

2. The Permittee must inspect all areas disturbed by construction activities, all BMPs, and all stormwater discharge points at least once every calendar week and within 24 hours of any discharge from the site. (For purposes of this condition, individual discharge events that last more than one day do not require daily inspections. For example, if a stormwater pond discharges continuously over the course of a week, only one inspection is required that week.) The Permittee may reduce the inspection frequency for temporarily stabilized, inactive sites to once every calendar month.

3. The Permittee must have staff knowledgeable in the principles and practices of erosion and sediment control. The CESCL (sites one acre or more) or inspector (sites less than one acre) must have the skills to assess the:

   a. Site conditions and construction activities that could impact the quality of stormwater, and

   b. Effectiveness of erosion and sediment control measures used to control the quality of stormwater discharges.

4. The SWPPP must identify the CESCL or inspector, who must be present on site or on-call at all times. The CESCL must obtain this certification through an approved erosion and sediment control training program that meets the minimum training standards established by Ecology (see BMP C160 in the manual referred to in Special Condition S9.C.1 and 2).

5. The Permittee must summarize the results of each inspection in an inspection report or checklist and enter the report/checklist into, or attach it to, the site log book. At a minimum, each inspection report or checklist must include:

   a. Inspection date and time.

   b. Weather information, the general conditions during inspection and the approximate amount of precipitation since the last inspection, and precipitation within the last 24 hours.

   c. A summary or list of all implemented BMPs, including observations of all erosion/sediment control structures or practices.

   d. A description of the locations:

      i. Of BMPs inspected.

      ii. Of BMPs that need maintenance and why.

      iii. Of BMPs that failed to operate as designed or intended, and

      iv. Where additional or different BMPs are needed, and why.

   e. A description of stormwater discharged from the site. The Permittee must note the presence of suspended sediment, turbidity, discoloration, and oil sheen, as applicable.

   f. Any water quality monitoring performed during inspection.

   g. General comments and notes, including a brief description of any BMP repairs, maintenance or installations made following the inspection.

   h. A summary report and a schedule of implementation of the remedial actions that the Permittee plans to take if the site inspection indicates that the site is out of compliance. The remedial actions taken must meet the requirements of the SWPPP and the permit.

   i. The name, title, and signature of the person conducting the site inspection, a phone number or other reliable method to reach this person, and the following statement: "I certify that this report is true, accurate, and complete to the best of my knowledge and belief."

C. <u>Turbidity/Transparency Sampling Requirements</u>

1. Sampling Methods

   a. If construction activity involves the disturbance of 5 acres or more, the Permittee must conduct turbidity sampling per Special Condition S4.C.

   b. If construction activity involves 1 acre or more but fewer than 5 acres of soil disturbance, the Permittee must conduct either transparency sampling **or** turbidity sampling per Special Condition S4.C.

2. Sampling Frequency

   a. The Permittee must sample all discharge locations at least once every calendar week when stormwater (or authorized non-stormwater) discharges from the site or enters any on-site surface waters of the state (for example, a creek running through a site).

   b. Samples must be representative of the flow and characteristics of the discharge.

   c. Sampling is not required when there is no discharge during a calendar week.

   d. Sampling is not required outside of normal working hours or during unsafe conditions.

   e. If the Permittee is unable to sample during a monitoring period, the Permittee must include a brief explanation in the monthly Discharge Monitoring Report (DMR).

   f. Sampling is not required before construction activity begins.

3. Sampling Locations

   a. Sampling is required at all points where stormwater associated with construction activity (or authorized non-stormwater) is discharged off site, including where it enters any on-site surface waters of the state (for example, a creek running through a site).

   b. The Permittee may discontinue sampling at discharge points that drain areas of the project that are fully stabilized to prevent erosion.

   c. The Permittee must identify all sampling point(s) on the SWPPP site map and clearly mark these points in the field with a flag, tape, stake or other visible marker.

   d. Sampling is not required for discharge that is sent directly to sanitary or combined sewer systems.

4. Sampling and Analysis Methods

   a. The Permittee performs turbidity analysis with a calibrated turbidity meter (turbidimeter) either on site or at an accredited lab. The Permittee must record the results in the site log book in nephelometric turbidity units (NTU).

   b. The Permittee performs transparency analysis on site with a 1¾-inch-diameter, 60-centimeter (cm)-long transparency tube. The Permittee will record the results in the site log book in centimeters (cm). Transparency tubes are available from: http://watermonitoringequip.com/pages/stream.html.

Table 4. Monitoring and Reporting Requirements

Parameter	Unit	Analytical Method	Sampling Frequency	Benchmark Value	Phone Reporting Trigger Value
Turbidity	NTU	SM2130 or EPA 180.1	Weekly, if discharging	25 NTU	250 NTU
Transparency	cm	Manufacturer instructions, or Ecology guidance	Weekly, if discharging	33 cm	6 cm

5. Turbidity/Transparency Benchmark Values and Reporting Triggers

The benchmark value for turbidity is 25 NTU or less. The benchmark value for transparency is 33 centimeters (cm). Note: Benchmark values do not apply to discharges to segments of water bodies on Washington State's 303(d) list (Category 5) for turbidity, fine sediment, or phosphorus; these discharges are subject to a numeric effluent limit for turbidity. Refer to Special Condition S8 for more information.

a. <u>Turbidity 26 – 249 NTU, or Transparency 32 – 7 cm:</u>

If the discharge turbidity is 26 to 249 NTU; or if discharge transparency is less than 33 cm, but equal to or greater than 6 cm, the Permittee must:

i. Review the SWPPP for compliance with Special Condition S9 and make appropriate revisions within 7 days of the date the discharge exceeded the benchmark.

ii. Immediately begin the process to fully implement and maintain appropriate source control and/or treatment BMPs as soon as possible, addressing the problems within 10 days of the date the discharge exceeded the benchmark. If installation of necessary treatment BMPs is not feasible within 10 days, Ecology may approve additional time when the Permittee requests an extension within the initial 10-day response period.

iii. Document BMP implementation and maintenance in the site log book.

b. <u>Turbidity 250 NTU or greater, or Transparency 6 cm or less</u>:

If a discharge point's turbidity is 250 NTU or greater, or if discharge transparency is less than or equal to 6 cm, the Permittee must complete the reporting and adaptive management process described below.

i. Telephone the applicable Ecology Region's Environmental Report Tracking System (ERTS) number within 24 hours, in accordance with Special Condition S5.F.

- <u>Central Region</u> (Okanogan, Chelan, Douglas, Kittitas, Yakima, Klickitat, Benton): (509) 575-2490

- Eastern Region (Adams, Asotin, Columbia, Ferry, Franklin, Garfield, Grant, Lincoln, Pend Oreille, Spokane, Stevens, Walla Walla, Whitman): (509) 329-3400
- Northwest Region (Kitsap, Snohomish, Island, King, San Juan, Skagit, Whatcom): (425) 649-7000
- Southwest Region (Grays Harbor, Lewis, Mason, Thurston, Pierce, Clark, Cowlitz, Skamania, Wahkiakum, Clallam, Jefferson, Pacific): (360) 407-6300

These numbers are also listed at the following web site: http://www.ecy.wa.gov/programs/wq/stormwater/construction/permit.html

ii. Review the SWPPP for compliance with Special Condition S9 and make appropriate revisions within 7 days of the date the discharge exceeded the benchmark.

iii. Immediately begin the process to fully implement and maintain appropriate source control and/or treatment BMPs as soon as possible, addressing the problems within 10 days of the date the discharge exceeded the benchmark. If installation of necessary treatment BMPs is not feasible within 10 days, Ecology may approve additional time when the Permittee requests an extension within the initial 10-day response period.

iv. Document BMP implementation and maintenance in the site log book.

v. Continue to sample discharges daily until:

a) Turbidity is 25 NTU (or lower); or

b) Transparency is 33 cm (or greater); or

c) The Permittee has demonstrated compliance with the water quality limit for turbidity:

1) No more than 5 NTU over background turbidity, if background is less than 50 NTU, or

2) No more than 10% over background turbidity, if background is 50 NTU or greater; or

d) The discharge stops or is eliminated.

D. pH Sampling Requirements -- Significant Concrete Work or Engineered Soils

If construction activity results in the disturbance of 1 acre or more, **and** involves significant concrete work (significant concrete work means greater than 1000 cubic yards poured concrete or recycled concrete used over the life of a project) or the use of engineered soils (soil amendments including but not limited to Portland cement-treated base [CTB], cement kiln dust [CKD], or fly ash), and stormwater from the affected area drains to surface waters of the State or to a storm sewer system that drains to surface waters of the state, the Permittee must conduct pH monitoring as set forth below. Note: In addition, discharges to segments of water bodies on Washington State's 303(d) list (Category 5) for high pH are subject to a numeric effluent limit for pH; refer to Special Condition S8.

1. For sites with significant concrete work, the Permittee must begin the pH monitoring period when the concrete is first poured and exposed to precipitation, and continue weekly throughout and after the concrete pour and curing period, until stormwater pH is in the range of 6.5 to 8.5 (su).

2. For sites with engineered soils, the Permittee must begin the pH monitoring period when the soil amendments are first exposed to precipitation and must continue until the area of engineered soils is fully stabilized.

3. During the applicable pH monitoring period defined above, the Permittee must obtain a representative sample of stormwater and conduct pH analysis at least once per week.

4. The Permittee must monitor pH in the sediment trap/pond(s) or other locations that receive stormwater runoff from the area of significant concrete work or engineered soils before the stormwater discharges to surface waters.

5. The benchmark value for pH is 8.5 standard units. Anytime sampling indicates that pH is 8.5 or greater, the Permittee must either:

   a. Prevent the high pH water (8.5 or above) from entering storm sewer systems or surface waters; or

   b. If necessary, adjust or neutralize the high pH water until it is in the range of pH 6.5 to 8.5 (su) using an appropriate treatment BMP such as carbon dioxide (CO_2) sparging or dry ice. The Permittee must obtain written approval from Ecology before using any form of chemical treatment other than CO_2 sparging or dry ice.

6. The Permittee must perform pH analysis on site with a calibrated pH meter, pH test kit, or wide range pH indicator paper. The Permittee must record pH monitoring results in the site log book.

S5. REPORTING AND RECORDKEEPING REQUIREMENTS

A. High Turbidity Phone Reporting

Anytime sampling performed in accordance with Special Condition S4.C indicates turbidity has reached the 250 NTU phone reporting level, the Permittee must call Ecology's Regional office by phone within 24 hours of analysis. The web site is http://www.ecy.wa.gov/programs/wq/stormwater/construction/permit.html. Also see phone numbers in Special Condition S4.C.5.b.i.

B. Discharge Monitoring Reports

Permittees required to conduct water quality sampling in accordance with Special Conditions S4.C (Turbidity/Transparency), S4.D (pH), S8 (303[d]/TMDL sampling), and/or G13 (Additional Sampling) must submit the results to Ecology.

Permittees must submit monitoring data using Ecology's WebDMR program. To find out more information and to sign up for WebDMR go to: http://www.ecy.wa.gov/programs/wq/permits/paris/webdmr.html.

Permittees unable to submit electronically (for example, those who do not have an internet connection) must contact Ecology to request a waiver and obtain instructions on how to obtain a paper copy DMR at:

Mailing Address:
Department of Ecology
Water Quality Program
Attn: Stormwater Compliance Specialist
PO Box 47696
Olympia, WA 98504-7696

Permittees who obtain a waiver not to use WebDMR must use the forms provided to them by Ecology; submittals must be mailed to the address above. Permittees shall submit DMR forms to be received by Ecology within 15 days following the end of each month.

If there was no discharge during a given monitoring period, all Permittees must submit a DMR as required with "no discharge" entered in place of the monitoring results. For more information, contact Ecology staff using information provided at the following web site: http://www.ecy.wa.gov/programs/spills/response/assistancesoil%20map.pdf

C. Records Retention

The Permittee must retain records of all monitoring information (site log book, sampling results, inspection reports/checklists, etc.), Stormwater Pollution Prevention Plan, and any other documentation of compliance with permit requirements for the entire life of the construction project and for a minimum of three years following the termination of permit coverage. Such information must include all calibration and maintenance records, and records of all data used to complete the application for this permit. This period of retention must be extended during the course of any unresolved litigation regarding the discharge of pollutants by the Permittee or when requested by Ecology.

D. Recording Results

For each measurement or sample taken, the Permittee must record the following information:

1. Date, place, method, and time of sampling or measurement.
2. The first and last name of the individual who performed the sampling or measurement.
3. The date(s) the analyses were performed.
4. The first and last name of the individual who performed the analyses.
5. The analytical techniques or methods used.
6. The results of all analyses.

E. Additional Monitoring by the Permittee

If the Permittee monitors any pollutant more frequently than required by this permit using test procedures specified by Special Condition S4 of this permit, the results of this monitoring must be included in the calculation and reporting of the data submitted in the Permittee's DMR.

F. Noncompliance Notification

In the event the Permittee is unable to comply with any part of the terms and conditions of this permit, and the resulting noncompliance may cause a threat to human health or the environment, the Permittee must:

1. Immediately notify Ecology of the failure to comply by calling the applicable Regional office ERTS phone number (find at http://www.ecy.wa.gov/programs/spills/response/assistancesoil%20map.pdf) or refer to Special Condition S4.C.5.b.i.
2. Immediately take action to prevent the discharge/pollution, or otherwise stop or correct the noncompliance, and, if applicable, repeat sampling and analysis of any noncompliance immediately and submit the results to Ecology within five (5) days of becoming aware of the violation.
3. Submit a detailed written report to Ecology within five (5) days, unless requested earlier by Ecology. The report must contain a description of the noncompliance, including exact dates and times, and if the noncompliance has not been corrected, the anticipated time it is expected to continue; and the steps taken or planned to reduce, eliminate, and prevent reoccurrence of the noncompliance.

The Permittee must report any unanticipated bypass and/or upset that exceeds any effluent limit in the permit in accordance with the 24-hour reporting requirement contained in 40 C.F.R. 122.41(l)(6)).

Compliance with these requirements does not relieve the Permittee from responsibility to maintain continuous compliance with the terms and conditions of this permit or the resulting liability for failure to comply. Refer to Section G14 of this permit for specific information regarding non-compliance.

G. Access to Plans and Records

1. The Permittee must retain the following permit documentation (plans and records) on site, or within reasonable access to the site, for use by the operator or for on-site review by Ecology or the local jurisdiction:

   a. General Permit.

   b. Permit Coverage Letter.

   c. Stormwater Pollution Prevention Plan (SWPPP).

   d. Site Log Book.

2. The Permittee must address written requests for plans and records listed above (Special Condition S5.G.1) as follows:

   a. The Permittee must provide a copy of plans and records to Ecology within 14 days of receipt of a written request from Ecology.

   b. The Permittee must provide a copy of plans and records to the public when requested in writing. Upon receiving a written request from the public for the Permittee's plans and records, the Permittee must either:

      i. Provide a copy of the plans and records to the requester within 14 days of a receipt of the written request; or

      ii. Notify the requester within 10 days of receipt of the written request of the location and times within normal business hours when the plans and records may be viewed; and provide access to the plans and records within 14 days of receipt of the written request; or

      Within 14 days of receipt of the written request, the Permittee may submit a copy of the plans and records to Ecology for viewing and/or copying by the requester at an Ecology office, or a mutually agreed location. If plans and records are viewed and/or copied at a location other than at an Ecology office, the Permittee will provide reasonable access to copying services for which a reasonable fee may be charged. The Permittee must notify the requester within 10 days of receipt of the request where the plans and records may be viewed and/or copied.

S6. PERMIT FEES

The Permittee must pay permit fees assessed by Ecology. Fees for stormwater discharges covered under this permit are established by Chapter 173-224 WAC. Ecology continues to assess permit fees until the permit is terminated in accordance with Special Condition S10 or revoked in accordance with General Condition G5.

S7. SOLID AND LIQUID WASTE DISPOSAL

The Permittee must handle and dispose of solid and liquid wastes generated by construction activity, such as demolition debris, construction materials, contaminated materials, and waste materials from maintenance activities, including liquids and solids from cleaning catch basins and other stormwater facilities, in accordance with:

A. Special Condition S3, Compliance with Standards.

B. WAC 173-216-110.

C. Other applicable regulations.

S8. DISCHARGES TO 303(D) OR TMDL WATER BODIES

A. <u>Sampling and Numeric Effluent Limits For Certain Discharges to 303(d)-listed Water Bodies</u>

1. Permittees who discharge to segments of water bodies listed as impaired by the State of Washington under Section 303(d) of the Clean Water Act for turbidity, fine sediment, high pH, or phosphorus, must conduct water quality sampling according to the requirements of this section, and Special Conditions S4.C.2.b-f and S4.C.3.b-d, and must comply with the applicable numeric effluent limitations in S8.C and S8.D.

2. All references and requirements associated with Section 303(d) of the Clean Water Act mean the most current listing by Ecology of impaired waters (Category 5) that exists on January 1, 2011, or the date when the operator's complete permit application is received by Ecology, whichever is later.

B. <u>Limits on Coverage for New Discharges to TMDL or 303(d)-listed Waters</u>

Operators of construction sites that discharge to a 303(d)-listed water body are not eligible for coverage under this permit *unless* the operator:

1. Prevents exposing stormwater to pollutants for which the water body is impaired, and retains documentation in the SWPPP that details procedures taken to prevent exposure on site; or

2. Documents that the pollutants for which the water body is impaired are not present at the site, and retains documentation of this finding within the SWPPP; or

3. Provides Ecology with data indicating the discharge is not expected to cause or contribute to an exceedance of a water quality standard, and retains such data on site with the SWPPP. The operator must provide data and other technical information to Ecology that sufficiently demonstrate:

   a. For discharges to waters without an EPA-approved or -established TMDL, that the discharge of the pollutant for which the water is impaired will meet in-stream water quality criteria at the point of discharge to the water body; or

   b. For discharges to waters with an EPA-approved or -established TMDL, that there is sufficient remaining wasteload allocation in the TMDL to allow construction stormwater discharge and that existing dischargers to the water body are subject to compliance schedules designed to bring the water body into attainment with water quality standards.

   Operators of construction sites are eligible for coverage under this permit if Ecology issues permit coverage based upon an affirmative determination that the discharge will not cause or contribute to the existing impairment.

C. Sampling and Numeric Effluent Limits for Discharges to Water Bodies on the 303(d) List for Turbidity, Fine Sediment, or Phosphorus

1. Permittees who discharge to segments of water bodies on the 303(d) list (Category 5) for turbidity, fine sediment, or phosphorus must conduct turbidity sampling in accordance with Special Condition S4.C.2 and comply with either of the numeric effluent limits noted in Table 5 below.

2. As an alternative to the 25 NTU effluent limit noted in Table 5 below (applied at the point where stormwater [or authorized non-stormwater] is discharged off-site), permittees may choose to comply with the surface water quality standard for turbidity. The standard is: no more than 5 NTU over background turbidity when the background turbidity is 50 NTU or less, or no more than a 10% increase in turbidity when the background turbidity is more than 50 NTU. In order to use the water quality standard requirement, the sampling must take place at the following locations:

   a. Background turbidity in the 303(d)-listed receiving water immediately upstream (upgradient) or outside the area of influence of the discharge.

   b. Turbidity at the point of discharge into the 303(d)-listed receiving water, inside the area of influence of the discharge**.**

3. Discharges that exceed the numeric effluent limit for turbidity constitute a violation of this permit.

4. Permittees whose discharges exceed the numeric effluent limit shall sample discharges daily until the violation is corrected and comply with the non-compliance notification requirements in Special Condition S5.F.

Table 5. Turbidity, Fine Sediment & Phosphorus Sampling and Limits for 303(d)-Listed Waters

Parameter identified in 303(d) listing	Parameter Sampled	Unit	Analytical Method	Sampling Frequency	Numeric Effluent Limit[1]
• Turbidity • Fine Sediment • Phosphorus	Turbidity	NTU	SM2130 or EPA180.1	Weekly, if discharging	25 NTU, at the point where stormwater is discharged from the site; OR In compliance with the surface water quality standard for turbidity (S8.C.1.a)

[1]Permittees subject to a numeric effluent limit for turbidity may, at their discretion, choose either numeric effluent limitation based on site-specific considerations including, but not limited to, safety, access and convenience.

D. Discharges to Water Bodies on the 303(d) List for High pH

1. Permittees who discharge to segments of water bodies on the 303(d) list (Category 5) for high pH must conduct pH sampling in accordance with the table below, and comply with the numeric effluent limit of pH 6.5 to 8.5 su (Table 6).

Table 6. pH Sampling and Limits for 303(d)-Listed Waters

Parameter identified in 303(d) listing	Parameter Sampled/Units	Analytical Method	Sampling Frequency	Numeric Effluent Limit
High pH	pH /Standard Units	pH meter	Weekly, if discharging	In the range of 6.5 – 8.5

2. At the Permittee's discretion, compliance with the limit shall be assessed at one of the following locations:

   a. Directly in the 303(d)-listed water body segment, inside the immediate area of influence of the discharge; or

   b. Alternatively, the permittee may measure pH at the point where the discharge leaves the construction site, rather than in the receiving water.

3. Discharges that exceed the numeric effluent limit for pH (outside the range of 6.5 – 8.5 su) constitute a violation of this permit.

4. Permittees whose discharges exceed the numeric effluent limit shall sample discharges daily until the violation is corrected and comply with the non-compliance notification requirements in Special Condition S5.F.

E. Sampling and Limits for Sites Discharging to Waters Covered by a TMDL or Another Pollution Control Plan

1. Discharges to a water body that is subject to a Total Maximum Daily Load (TMDL) for turbidity, fine sediment, high pH, or phosphorus must be consistent with the TMDL. Refer to http://www.ecy.wa.gov/programs/wq/tmdl/index.html for more information on TMDLs.

   a. Where an applicable TMDL sets specific waste load allocations or requirements for discharges covered by this permit, discharges must be consistent with any specific waste load allocations or requirements established by the applicable TMDL.

      i. The Permittee must sample discharges weekly or as otherwise specified by the TMDL to evaluate compliance with the specific waste load allocations or requirements.

      ii. Analytical methods used to meet the monitoring requirements must conform to the latest revision of the Guidelines Establishing Test Procedures for the Analysis of Pollutants contained in 40 CFR Part 136. Turbidity and pH methods need not be accredited or registered unless conducted at a laboratory which must otherwise be accredited or registered.

   b. Where an applicable TMDL has established a general waste load allocation for construction stormwater discharges, but has not identified specific requirements, compliance with Special Conditions S4 (Monitoring) and S9 (SWPPPs) will constitute compliance with the approved TMDL.

   c. Where an applicable TMDL has not specified a waste load allocation for construction stormwater discharges, but has not excluded these discharges, compliance with Special Conditions S4 (Monitoring) and S9 (SWPPPs) will constitute compliance with the approved TMDL.

   d. Where an applicable TMDL specifically precludes or prohibits discharges from construction activity, the operator is not eligible for coverage under this permit.

2. Applicable TMDL means a TMDL for turbidity, fine sediment, high pH, or phosphorus that is completed and approved by EPA before January 1, 2011, or before the date the operator's complete permit application is received by Ecology, whichever is later. TMDLs completed after the operator's complete permit application is received by Ecology become applicable to the Permittee only if they are imposed through an administrative order by Ecology, or through a modification of permit coverage.

S9. STORMWATER POLLUTION PREVENTION PLAN

The Permittee must prepare and properly implement an adequate Stormwater Pollution Prevention Plan (SWPPP) for construction activity in accordance with the requirements of this permit beginning with initial soil disturbance and until final stabilization.

A. The Permittee's SWPPP must meet the following objectives:

1. To implement best management practices (BMPs) to prevent erosion and sedimentation, and to identify, reduce, eliminate or prevent stormwater contamination and water pollution from construction activity.

2. To prevent violations of surface water quality, ground water quality, or sediment management standards.

3. To control peak volumetric flow rates and velocities of stormwater discharges.

B. General Requirements

1. The SWPPP must include a narrative and drawings. All BMPs must be clearly referenced in the narrative and marked on the drawings. The SWPPP narrative must include documentation to explain and justify the pollution prevention decisions made for the project. Documentation must include:

   a. Information about existing site conditions (topography, drainage, soils, vegetation, etc.).

   b. Potential erosion problem areas.

   c. The 12 elements of a SWPPP in Special Condition S9.D.1-12, including BMPs used to address each element.

   d. Construction phasing/sequence and general BMP implementation schedule.

   e. The actions to be taken if BMP performance goals are not achieved—for example, a contingency plan for additional treatment and/or storage of stormwater that would violate the water quality standards if discharged.

   f. Engineering calculations for ponds and any other designed structures.

2. The Permittee must modify the SWPPP 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, or would be, ineffective in eliminating or significantly minimizing pollutants in stormwater discharges from the site. The Permittee must then:

   a. Review the SWPPP for compliance with Special Condition S9 and make appropriate revisions within 7 days of the inspection or investigation.

   b. Immediately begin the process to fully implement and maintain appropriate source control and/or treatment BMPs as soon as possible, addressing the problems no later than 10 days from the inspection or investigation. If installation of necessary treatment BMPs is not feasible within 10 days, Ecology may approve additional time when an extension is requested by a Permittee within the initial 10-day response period,

c. Document BMP implementation and maintenance in the site log book.

The Permittee must modify the SWPPP whenever there is a change in 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.

C. Stormwater Best Management Practices (BMPs)

BMPs must be consistent with:

1. Stormwater Management Manual for Western Washington (most recent edition), for sites west of the crest of the Cascade Mountains; or

2. Stormwater Management Manual for Eastern Washington (most recent edition), for sites east of the crest of the Cascade Mountains; or

3. Revisions to the manuals listed in Special Condition S9.C.1. & 2., or other stormwater management guidance documents or manuals which provide an equivalent level of pollution prevention, that are approved by Ecology and incorporated into this permit in accordance with the permit modification requirements of WAC 173-226-230; or

4. Documentation in the SWPPP that the BMPs selected provide an equivalent level of pollution prevention, compared to the applicable Stormwater Management Manuals, including:

   a. The technical basis for the selection of all stormwater BMPs (scientific, technical studies, and/or modeling) that support the performance claims for the BMPs being selected.

   b. An assessment of how the selected BMP will satisfy AKART requirements and the applicable federal technology-based treatment requirements under 40 CFR part 125.3.

D. SWPPP – Narrative Contents and Requirements

The Permittee must include each of the 12 elements below in Special Condition S9.D.1-12 in the narrative of the SWPPP and implement them unless site conditions render the element unnecessary and the exemption from that element is clearly justified in the SWPPP.

1. Preserve Vegetation/Mark Clearing Limits

   a. Before beginning land-disturbing activities, including clearing and grading, clearly mark all clearing limits, sensitive areas and their buffers, and trees that are to be preserved within the construction area.

b. Retain the duff layer, native top soil, and natural vegetation in an undisturbed state to the maximum degree practicable.

2. Establish Construction Access

   a. Limit construction vehicle access and exit to one route, if possible.

   b. Stabilize access points with a pad of quarry spalls, crushed rock, or other equivalent BMPs, to minimize tracking sediment onto roads.

   c. Locate wheel wash or tire baths on site, if the stabilized construction entrance is not effective in preventing tracking sediment onto roads.

   d. If sediment is tracked off site, clean the affected roadway thoroughly at the end of each day, or more frequently as necessary (for example, during wet weather). Remove sediment from roads by shoveling, sweeping, or pickup and transport of the sediment to a controlled sediment disposal area.

   e. Conduct street washing only after sediment removal in accordance with Special Condition S9.D.2.d. Control street wash wastewater by pumping back on site or otherwise preventing it from discharging into systems tributary to waters of the State.

3. Control Flow Rates

   a. Protect properties and waterways downstream of development sites from erosion and the associated discharge of turbid waters due to increases in the velocity and peak volumetric flow rate of stormwater runoff from the project site, as required by local plan approval authority.

   b. Where necessary to comply with Special Condition S9.D.3.a, construct stormwater retention or detention facilities as one of the first steps in grading. Assure that detention facilities function properly before constructing site improvements (for example, impervious surfaces).

   c. If permanent infiltration ponds are used for flow control during construction, protect these facilities from siltation during the construction phase.

4. Install Sediment Controls

   The Permittee must design, install and maintain effective erosion controls and sediment controls to minimize the discharge of pollutants. At a minimum, the Permittee must design, install and maintain such controls to:

   a. Construct sediment control BMPs (sediment ponds, traps, filters, etc.) as one of the first steps in grading. These BMPs must be functional before other land disturbing activities take place.

   b. Minimize sediment discharges from the site. The design, installation and maintenance of erosion and sediment controls must address factors such as the amount, frequency, intensity and duration of precipitation, the nature of resulting stormwater runoff, and soil characteristics, including the range of soil particle sizes expected to be present on the site.

c. Direct stormwater runoff from disturbed areas through a sediment pond or other appropriate sediment removal BMP, before the runoff leaves a construction site or before discharge to an infiltration facility. Runoff from fully stabilized areas may be discharged without a sediment removal BMP, but must meet the flow control performance standard of Special Condition S9.D.3.a.

d. Locate BMPs intended to trap sediment on site in a manner to avoid interference with the movement of juvenile salmonids attempting to enter off-channel areas or drainages.

e. Provide and maintain natural buffers around surface waters, direct stormwater to vegetated areas to increase sediment removal and maximize stormwater infiltration, unless infeasible.

f. Where feasible, design outlet structures that withdraw impounded stormwater from the surface to avoid discharging sediment that is still suspended lower in the water column.

5. Stabilize Soils

a. The Permittee must stabilize exposed and unworked soils by application of effective BMPs that prevent erosion. Applicable BMPs include, but are not limited to: temporary and permanent seeding, sodding, mulching, plastic covering, erosion control fabrics and matting, soil application of polyacrylamide (PAM), the early application of gravel base on areas to be paved, and dust control.

b. The Permittee must control stormwater volume and velocity within the site to minimize soil erosion.

c. The Permittee must control stormwater discharges, including both peak flow rates and total stormwater volume, to minimize erosion at outlets and to minimize downstream channel and stream bank erosion.

d. Depending on the geographic location of the project, the Permittee must not allow soils to remain exposed and unworked for more than the time periods set forth below to prevent erosion:

West of the Cascade Mountains Crest
During the dry season (May 1 - Sept. 30): 7 days
During the wet season (October 1 - April 30): 2 days

East of the Cascade Mountains Crest, except for Central Basin*
During the dry season (July 1 - September 30): 10 days
During the wet season (October 1 - June 30): 5 days

The Central Basin*, East of the Cascade Mountains Crest

During the dry Season (July 1 - September 30): 30 days
During the wet season (October 1 - June 30): 15 days

*Note: The Central Basin is defined as the portions of Eastern Washington with mean annual precipitation of less than 12 inches.

e. The Permittee must stabilize soils at the end of the shift before a holiday or weekend if needed based on the weather forecast.

f. The Permittee must stabilize soil stockpiles from erosion, protected with sediment trapping measures, and where possible, be located away from storm drain inlets, waterways, and drainage channels.

g. The Permittee must minimize the amount of soil exposed during construction activity.

h. The Permittee must minimize the disturbance of steep slopes.

i. The Permittee must minimize soil compaction and, unless infeasible, preserve topsoil.

6. Protect Slopes

a. The Permittee must design and construct cut-and-fill slopes in a manner to minimize erosion. Applicable practices include, but are not limited to, reducing continuous length of slope with terracing and diversions, reducing slope steepness, and roughening slope surfaces (for example, track walking).

b. The Permittee must divert off-site stormwater (run-on) or ground water away from slopes and disturbed areas with interceptor dikes, pipes, and/or swales. Off-site stormwater should be managed separately from stormwater generated on the site.

c. At the top of slopes, collect drainage in pipe slope drains or protected channels to prevent erosion.

i. West of the Cascade Mountains Crest: Temporary pipe slope drains must handle the peak 10-minute velocity of flow from a Type 1A, 10-year, 24-hour frequency storm for the developed condition. Alternatively, the 10-year, 1-hour flow rate predicted by an approved continuous runoff model, increased by a factor of 1.6, may be used. The hydrologic analysis must use the existing land cover condition for predicting flow rates from tributary areas outside the project limits. For tributary areas on the project site, the analysis must use the temporary or permanent project land cover condition, whichever will produce the highest flow rates. If using the Western Washington Hydrology Model (WWHM) to predict flows, bare soil areas should be modeled as "landscaped area."

ii. East of the Cascade Mountains Crest: Temporary pipe slope drains must handle the expected peak flow velocity from a 6-month, 3-hour storm for the developed condition, referred to as the short duration storm.

d. Place excavated material on the uphill side of trenches, consistent with safety and space considerations.

e. Place check dams at regular intervals within constructed channels that are cut down a slope.

7. Protect Drain Inlets

a. Protect all storm drain inlets made operable during construction so that stormwater runoff does not enter the conveyance system without first being filtered or treated to remove sediment.

b. Clean or remove and replace inlet protection devices when sediment has filled one-third of the available storage (unless a different standard is specified by the product manufacturer).

8. Stabilize Channels and Outlets

a. Design, construct and stabilize all on-site conveyance channels to prevent erosion from the following expected peak flows:

i. West of the Cascade Mountains Crest: Channels must handle the peak 10-minute velocity of flow from a Type 1A, 10-year, 24-hour frequency storm for the developed condition. Alternatively, the 10-year, 1-hour flow rate indicated by an approved continuous runoff model, increased by a factor of 1.6, may be used. The hydrologic analysis must use the existing land cover condition for predicting flow rates from tributary areas outside the project limits. For tributary areas on the project site, the analysis must use the temporary or permanent project land cover condition, whichever will produce the highest flow rates. If using the WWHM to predict flows, bare soil areas should be modeled as "landscaped area."

ii. East of the Cascade Mountains Crest: Channels must handle the expected peak flow velocity from a 6-month, 3-hour storm for the developed condition, referred to as the short duration storm.

b. Provide stabilization, including armoring material, adequate to prevent erosion of outlets, adjacent stream banks, slopes, and downstream reaches at the outlets of all conveyance systems.

9. Control Pollutants

Design, install, implement and maintain effective pollution prevention measures to minimize the discharge of pollutants. The Permittee must:

a. Handle and dispose of all pollutants, including waste materials and demolition debris that occur on site in a manner that does not cause contamination of stormwater.

b. Provide cover, containment, and protection from vandalism for all chemicals, liquid products, petroleum products, and other materials that have the potential to pose a threat to human health or the environment. On-site fueling tanks must include secondary containment. Secondary containment means placing tanks or containers within an impervious structure capable of containing 110% of the volume contained in the largest tank within the containment structure. Double-walled tanks do not require additional secondary containment.

c. Conduct maintenance, fueling, and repair of heavy equipment and vehicles using spill prevention and control measures. Clean contaminated surfaces immediately following any spill incident.

d. Discharge wheel wash or tire bath wastewater to a separate on-site treatment system that prevents discharge to surface water, such as closed-loop recirculation or upland land application, or to the sanitary sewer with local sewer district approval.

e. Apply fertilizers and pesticides in a manner and at application rates that will not result in loss of chemical to stormwater runoff. Follow manufacturers' label requirements for application rates and procedures.

f. Use BMPs to prevent contamination of stormwater runoff by pH-modifying sources. The sources for this contamination include, but are not limited to: bulk cement, cement kiln dust, fly ash, new concrete washing and curing waters, waste streams generated from concrete grinding and sawing, exposed aggregate processes, dewatering concrete vaults, concrete pumping and mixer washout waters. (Also refer to the definition for "concrete wastewater" in Appendix A--Definitions.)

g. Adjust the pH of stormwater if necessary to prevent violations of water quality standards.

h. Assure that washout of concrete trucks is performed offsite or in designated concrete washout areas only. Do not wash out concrete trucks onto the ground, or into storm drains, open ditches, streets, or streams. Do not dump excess concrete on site, except in designated concrete washout areas. Concrete spillage or concrete discharge to surface waters of the State is prohibited.

i. Obtain written approval from Ecology before using chemical treatment other than CO_2 or dry ice to adjust pH.

10. Control Dewatering

a. Permittees must discharge foundation, vault, and trench dewatering water, which have characteristics similar to stormwater runoff at the site, into a controlled conveyance system before discharge to a sediment trap or sediment pond.

b. Permittees may discharge clean, non-turbid dewatering water, such as well-point ground water, to systems tributary to, or directly into surface waters of the State, as specified in Special Condition S9.D.8, provided the dewatering flow does not cause erosion or flooding of receiving waters. Do not route clean dewatering water through stormwater sediment ponds. Note that "surface waters of the State" may exist on a construction site as well as off site; for example, a creek running through a site.

c. Other treatment or disposal options may include:

   i. Infiltration.

   ii. Transport off site in a vehicle, such as a vacuum flush truck, for legal disposal in a manner that does not pollute state waters.

   iii. Ecology-approved on-site chemical treatment or other suitable treatment technologies.

   iv. Sanitary or combined sewer discharge with local sewer district approval, if there is no other option.

   v. Use of a sedimentation bag with discharge to a ditch or swale for small volumes of localized dewatering.

d. Permittees must handle highly turbid or contaminated dewatering water separately from stormwater.

11. Maintain BMPs

a. Permittees must maintain and repair all temporary and permanent erosion and sediment control BMPs as needed to assure continued performance of their intended function in accordance with BMP specifications.

b. Permittees must remove all temporary erosion and sediment control BMPs within 30 days after achieving final site stabilization or after the temporary BMPs are no longer needed.

12. Manage the Project

a. Phase development projects to the maximum degree practicable and take into account seasonal work limitations.

b. Inspection and monitoring -- Inspect, maintain and repair all BMPs as needed to assure continued performance of their intended function. Conduct site inspections and monitoring in accordance with Special Condition S4.

c. Maintaining an updated construction SWPPP -- Maintain, update, and implement the SWPPP in accordance with Special Conditions S3, S4 and S9.

E. <u>SWPPP – Map Contents and Requirements</u>

The Permittee's SWPPP must also include a vicinity map or general location map (for example, a USGS quadrangle map, a portion of a county or city map, or other appropriate map) with enough detail to identify the location of the construction site and receiving waters within one mile of the site.

The SWPPP must also include a legible site map (or maps) showing the entire construction site. The following features must be identified, unless not applicable due to site conditions:

1. The direction of north, property lines, and existing structures and roads.
2. Cut and fill slopes indicating the top and bottom of slope catch lines.
3. Approximate slopes, contours, and direction of stormwater flow before and after major grading activities.
4. Areas of soil disturbance and areas that will not be disturbed.
5. Locations of structural and nonstructural controls (BMPs) identified in the SWPPP.
6. Locations of off-site material, stockpiles, waste storage, borrow areas, and vehicle/equipment storage areas.
7. Locations of all surface water bodies, including wetlands.
8. Locations where stormwater or non-stormwater discharges off-site and/or to a surface water body, including wetlands.
9. Location of water quality sampling station(s), if sampling is required by state or local permitting authority.
10. Areas where final stabilization has been accomplished and no further construction-phase permit requirements apply.

S10. NOTICE OF TERMINATION

A. The site is eligible for termination of coverage when it has met any of the following conditions:

1. The site has undergone final stabilization, the Permittee has removed all temporary BMPs (except biodegradable BMPs clearly manufactured with the intention for the material to be left in place and not interfere with maintenance or land use), and all stormwater discharges associated with construction activity have been eliminated; or
2. All portions of the site that have not undergone final stabilization per Special Condition S10.A.1 have been sold and/or transferred (per General Condition G9), and the Permittee no longer has operational control of the construction activity; or

3. For residential construction only, the Permittee has completed temporary stabilization and the homeowners have taken possession of the residences.

B. When the site is eligible for termination, the Permittee must submit a complete and accurate Notice of Termination (NOT) form, signed in accordance with General Condition G2, to:

Department of Ecology
Water Quality Program - Construction Stormwater
PO Box 47696
Olympia, Washington 98504-7696

The termination is effective on the date Ecology receives the NOT form, unless Ecology notifies the Permittee within 30 days that termination request is denied because the Permittee has not met the eligibility requirements in Special Condition S10.A.

Permittees transferring the property to a new property owner or operator/permittee are required to complete and submit the Notice of Transfer form to Ecology, but are not required to submit a Notice of Termination form for this type of transaction.

GENERAL CONDITIONS

G1. DISCHARGE VIOLATIONS

All discharges and activities authorized by this general permit must be consistent with the terms and conditions of this general permit. Any discharge of any pollutant more frequent than or at a level in excess of that identified and authorized by the general permit must constitute a violation of the terms and conditions of this permit.

G2. SIGNATORY REQUIREMENTS

A. All permit applications must bear a certification of correctness to be signed:

1. In the case of corporations, by a responsible corporate officer of at least the level of vice president of a corporation;
2. In the case of a partnership, by a general partner of a partnership;
3. In the case of sole proprietorship, by the proprietor; or
4. In the case of a municipal, state, or other public facility, by either a principal executive officer or ranking elected official.

B. All reports required by this permit and other information requested by Ecology must be signed by a person described above or by a duly authorized representative of that person. A person is a duly authorized representative only if:

1. The authorization is made in writing by a person described above and submitted to the Ecology.
2. The authorization specifies either an individual or a position having responsibility for the overall operation of the regulated facility, such as the position of plant manager, superintendent, position of equivalent responsibility, or an individual or position having overall responsibility for environmental matters.

C. Changes to authorization. If an authorization under paragraph G2.B.2 above is no longer accurate because a different individual or position has responsibility for the overall operation of the facility, a new authorization satisfying the requirements of paragraph G2.B.2 above must be submitted to Ecology prior to or together with any reports, information, or applications to be signed by an authorized representative.

D. Certification. Any person signing a document under this section must make the following certification:

"I certify under penalty of law, that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

G3. RIGHT OF INSPECTION AND ENTRY

The Permittee must allow an authorized representative of Ecology, upon the presentation of credentials and such other documents as may be required by law:

A. To enter upon the premises where a discharge is located or where any records are kept under the terms and conditions of this permit.

B. To have access to and copy – at reasonable times and at reasonable cost -- any records required to be kept under the terms and conditions of this permit.

C. To inspect -- at reasonable times – any facilities, equipment (including monitoring and control equipment), practices, methods, or operations regulated or required under this permit.

D. To sample or monitor – at reasonable times – any substances or parameters at any location for purposes of assuring permit compliance or as otherwise authorized by the Clean Water Act.

G4. GENERAL PERMIT MODIFICATION AND REVOCATION

This permit may be modified, revoked and reissued, or terminated in accordance with the provisions of Chapter 173-226 WAC. Grounds for modification, revocation and reissuance, or termination include, but are not limited to, the following:

A. When a change occurs in the technology or practices for control or abatement of pollutants applicable to the category of dischargers covered under this permit.

B. When effluent limitation guidelines or standards are promulgated pursuant to the CWA or Chapter 90.48 RCW, for the category of dischargers covered under this permit.

C. When a water quality management plan containing requirements applicable to the category of dischargers covered under this permit is approved, or

D. When information is obtained that indicates cumulative effects on the environment from dischargers covered under this permit are unacceptable.

G5. REVOCATION OF COVERAGE UNDER THE PERMIT

Pursuant to Chapter 43.21B RCW and Chapter 173-226 WAC, the Director may terminate coverage for any discharger under this permit for cause. Cases where coverage may be terminated include, but are not limited to, the following:

A. Violation of any term or condition of this permit.

B. Obtaining coverage under this permit by misrepresentation or failure to disclose fully all relevant facts.

C. A change in any condition that requires either a temporary or permanent reduction or elimination of the permitted discharge.

D. Failure or refusal of the Permittee to allow entry as required in RCW 90.48.090.

E. A determination that the permitted activity endangers human health or the environment, or contributes to water quality standards violations.

F. Nonpayment of permit fees or penalties assessed pursuant to RCW 90.48.465 and Chapter 173-224 WAC.

G. Failure of the Permittee to satisfy the public notice requirements of WAC 173-226-130(5), when applicable.

The Director may require any discharger under this permit to apply for and obtain coverage under an individual permit or another more specific general permit. Permittees who have their coverage revoked for cause according to WAC 173-226-240 may request temporary coverage under this permit during the time an individual permit is being developed, provided the request is made within ninety (90) days from the time of revocation and is submitted along with a complete individual permit application form.

G6. REPORTING A CAUSE FOR MODIFICATION

The Permittee must submit a new application, or a supplement to the previous application, whenever a material change to the construction activity or in the quantity or type of discharge is anticipated which is not specifically authorized by this permit. This application must be submitted at least sixty (60) days prior to any proposed changes. Filing a request for a permit modification, revocation and reissuance, or termination, or a notification of planned changes or anticipated noncompliance does not relieve the Permittee of the duty to comply with the existing permit until it is modified or reissued.

G7. COMPLIANCE WITH OTHER LAWS AND STATUTES

Nothing in this permit will be construed as excusing the Permittee from compliance with any applicable federal, state, or local statutes, ordinances, or regulations.

G8. DUTY TO REAPPLY

The Permittee must apply for permit renewal at least 180 days prior to the specified expiration date of this permit.

G9. TRANSFER OF GENERAL PERMIT COVERAGE

Coverage under this general permit is automatically transferred to a new discharger, including operators of lots/parcels within a common plan of development or sale, **if**:

A. A written agreement (Transfer of Coverage Form) between the current discharger (Permittee) and new discharger, signed by both parties and containing a specific date for transfer of permit responsibility, coverage, and liability is submitted to the Director; and

B. The Director does not notify the current discharger and new discharger of the Director's intent to revoke coverage under the general permit. If this notice is not given, the transfer is effective on the date specified in the written agreement.

   When a current discharger (Permittee) transfers a portion of a permitted site, the current discharger must also submit an updated application form (NOI) to the Director indicating the remaining permitted acreage after the transfer.

G10. REMOVED SUBSTANCES

The Permittee must not re-suspend or reintroduce collected screenings, grit, solids, sludges, filter backwash, or other pollutants removed in the course of treatment or control of stormwater to the final effluent stream for discharge to state waters.

G11. DUTY TO PROVIDE INFORMATION

The Permittee must submit to Ecology, within a reasonable time, all information that Ecology may request to determine whether cause exists for modifying, revoking and reissuing, or terminating this permit or to determine compliance with this permit. The Permittee must also submit to Ecology, upon request, copies of records required to be kept by this permit [40 CFR 122.41(h)].

G12. OTHER REQUIREMENTS OF 40 CFR

All other requirements of 40 CFR 122.41 and 122.42 are incorporated in this permit by reference.

G13. ADDITIONAL MONITORING

Ecology may establish specific monitoring requirements in addition to those contained in this permit by administrative order or permit modification.

G14. PENALTIES FOR VIOLATING PERMIT CONDITIONS

Any person who is found guilty of willfully violating the terms and conditions of this permit shall be deemed guilty of a crime, and upon conviction thereof shall be punished by a fine of up to ten thousand dollars ($10,000) and costs of prosecution, or by imprisonment in the discretion of the court. Each day upon which a willful violation occurs may be deemed a separate and additional violation.

Any person who violates the terms and conditions of a waste discharge permit shall incur, in addition to any other penalty as provided by law, a civil penalty in the amount of up to ten thousand dollars ($10,000) for every such violation. Each and every such violation shall be a separate and distinct offense, and in case of a continuing violation, every day's continuance shall be deemed to be a separate and distinct violation.

G15. UPSET

Definition – "Upset" means an exceptional incident in which there is unintentional and temporary noncompliance with technology-based permit effluent limitations because of factors beyond the reasonable control of the Permittee. An upset does not include noncompliance to the extent caused by operational error, improperly designed treatment facilities, inadequate treatment facilities, lack of preventive maintenance, or careless or improper operation.

An upset constitutes an affirmative defense to an action brought for noncompliance with such technology-based permit effluent limitations if the requirements of the following paragraph are met.

A Permittee who wishes to establish the affirmative defense of upset must demonstrate, through properly signed, contemporaneous operating logs or other relevant evidence that: 1) an upset occurred and that the Permittee can identify the cause(s) of the upset; 2) the permitted facility was being properly operated at the time of the upset; 3) the Permittee submitted notice of the upset as required in Special Condition S5.F, and; 4) the Permittee complied with any remedial measures required under this permit.

In any enforcement proceeding, the Permittee seeking to establish the occurrence of an upset has the burden of proof.

G16. PROPERTY RIGHTS

This permit does not convey any property rights of any sort, or any exclusive privilege.

G17. DUTY TO COMPLY

The Permittee must comply with all conditions of this permit. Any permit noncompliance constitutes a violation of the Clean Water Act and is grounds for enforcement action; for permit termination, revocation and reissuance, or modification; or denial of a permit renewal application.

G18. TOXIC POLLUTANTS

The Permittee must comply with effluent standards or prohibitions established under Section 307(a) of the Clean Water Act for toxic pollutants within the time provided in the regulations that establish those standards or prohibitions, even if this permit has not yet been modified to incorporate the requirement.

G19. PENALTIES FOR TAMPERING

The Clean Water Act provides that any person who falsifies, tampers with, or knowingly renders inaccurate any monitoring device or method required to be maintained under this permit shall, upon conviction, be punished by a fine of not more than $10,000 per violation, or by imprisonment for not more than two years per violation, or by both. If a conviction of a person is for a violation committed after a first conviction of such person under this condition, punishment shall be a fine of not more than $20,000 per day of violation, or imprisonment of not more than four (4) years, or both.

G20. REPORTING PLANNED CHANGES

The Permittee must, as soon as possible, give notice to Ecology of planned physical alterations, modifications or additions to the permitted construction activity. The Permittee should be aware that, depending on the nature and size of the changes to the original permit, a new public notice and other permit process requirements may be required. Changes in activities that require reporting to Ecology include those that will result in:

A. The permitted facility being determined to be a new source pursuant to 40 CFR 122.29(b).

B. A significant change in the nature or an increase in quantity of pollutants discharged, including but not limited to: for sites 5 acres or larger, a 20% or greater increase in acreage disturbed by construction activity.

C. A change in or addition of surface water(s) receiving stormwater or non-stormwater from the construction activity.

D. A change in the construction plans and/or activity that affects the Permittee's monitoring requirements in Special Condition S4.

Following such notice, permit coverage may be modified, or revoked and reissued pursuant to 40 CFR 122.62(a) to specify and limit any pollutants not previously limited. Until such modification is effective, any new or increased discharge in excess of permit limits or not specifically authorized by this permit constitutes a violation.

G21. REPORTING OTHER INFORMATION

Where the Permittee becomes aware that it failed to submit any relevant facts in a permit application, or submitted incorrect information in a permit application or in any report to Ecology, it must promptly submit such facts or information.

G22. REPORTING ANTICIPATED NON-COMPLIANCE

The Permittee must give advance notice to Ecology by submission of a new application or supplement thereto at least forty-five (45) days prior to commencement of such discharges, of any facility expansions, production increases, or other planned changes, such as process modifications, in the permitted facility or activity which may result in noncompliance with permit limits or conditions. Any maintenance of facilities, which might necessitate unavoidable interruption of operation and degradation of effluent quality, must be scheduled during non-critical water quality periods and carried out in a manner approved by Ecology.

G23. REQUESTS TO BE EXCLUDED FROM COVERAGE UNDER THE PERMIT

Any discharger authorized by this permit may request to be excluded from coverage under the general permit by applying for an individual permit. The discharger must submit to the Director an application as described in WAC 173-220-040 or WAC 173-216-070, whichever is applicable, with reasons supporting the request. These reasons will fully document how an individual permit will apply to the applicant in a way that the general permit cannot. Ecology may make specific requests for information to support the request. The Director will either issue an individual permit or deny the request with a statement explaining the reason for the denial. When an individual permit is issued to a discharger otherwise subject to the construction stormwater general permit, the applicability of the construction stormwater general permit to that Permittee is automatically terminated on the effective date of the individual permit.

G24. APPEALS

A. The terms and conditions of this general permit, as they apply to the appropriate class of dischargers, are subject to appeal by any person within 30 days of issuance of this general permit, in accordance with Chapter 43.21B RCW, and Chapter 173-226 WAC.

B. The terms and conditions of this general permit, as they apply to an individual discharger, are appealable in accordance with Chapter 43.21B RCW within 30 days of the effective date of coverage of that discharger. Consideration of an appeal of general permit coverage of an individual discharger is limited to the general permit’s applicability or nonapplicability to that individual discharger.

C. The appeal of general permit coverage of an individual discharger does not affect any other dischargers covered under this general permit. If the terms and conditions of this general permit are found to be inapplicable to any individual discharger(s), the matter shall be remanded to Ecology for consideration of issuance of an individual permit or permits.

G25. SEVERABILITY

The provisions of this permit are severable, and if any provision of this permit, or application of any provision of this permit to any circumstance, is held invalid, the application of such provision to other circumstances, and the remainder of this permit shall not be affected thereby.

G26. BYPASS PROHIBITED

A. Bypass Procedures

Bypass, which is the intentional diversion of waste streams from any portion of a treatment facility, is prohibited for stormwater events below the design criteria for stormwater management. Ecology may take enforcement action against a Permittee for bypass unless one of the following circumstances (1, 2, 3 or 4) is applicable.

1. Bypass of stormwater is consistent with the design criteria and part of an approved management practice in the applicable stormwater management manual.

2. Bypass for essential maintenance without the potential to cause violation of permit limits or conditions.

   Bypass is authorized if it is for essential maintenance and does not have the potential to cause violations of limitations or other conditions of this permit, or adversely impact public health.

3. Bypass of stormwater is unavoidable, unanticipated, and results in noncompliance of this permit.

   This bypass is permitted only if:

   a. Bypass is unavoidable to prevent loss of life, personal injury, or severe property damage. “Severe property damage” means substantial physical damage to property, damage to the treatment facilities which would cause them to become inoperable, or substantial and permanent loss of natural resources which can reasonably be expected to occur in the absence of a bypass.

   b. There are no feasible alternatives to the bypass, such as the use of auxiliary treatment facilities, retention of untreated wastes, maintenance during normal periods of equipment downtime (but not if adequate backup equipment should have been installed in the exercise of reasonable engineering judgment to prevent a bypass which occurred during normal periods of equipment downtime or preventative maintenance), or transport of untreated wastes to another treatment facility.

c. Ecology is properly notified of the bypass as required in Special Condition S5.F of this permit.

4. A planned action that would cause bypass of stormwater and has the potential to result in noncompliance of this permit during a storm event.

   The Permittee must notify Ecology at least thirty (30) days before the planned date of bypass. The notice must contain:

   a. a description of the bypass and its cause

   b. an analysis of all known alternatives which would eliminate, reduce, or mitigate the need for bypassing.

   c. a cost-effectiveness analysis of alternatives including comparative resource damage assessment.

   d. the minimum and maximum duration of bypass under each alternative.

   e. a recommendation as to the preferred alternative for conducting the bypass.

   f. the projected date of bypass initiation.

   g. a statement of compliance with SEPA.

   h. a request for modification of water quality standards as provided for in WAC 173-201A-110, if an exceedance of any water quality standard is anticipated.

   i. steps taken or planned to reduce, eliminate, and prevent reoccurrence of the bypass.

5. For probable construction bypasses, the need to bypass is to be identified as early in the planning process as possible. The analysis required above must be considered during preparation of the Stormwater Pollution Prevention Plan (SWPPP) and must be included to the extent practical. In cases where the probable need to bypass is determined early, continued analysis is necessary up to and including the construction period in an effort to minimize or eliminate the bypass.

   Ecology will consider the following before issuing an administrative order for this type bypass:

   a. If the bypass is necessary to perform construction or maintenance-related activities essential to meet the requirements of this permit.

   b. If there are feasible alternatives to bypass, such as the use of auxiliary treatment facilities, retention of untreated wastes, stopping production, maintenance during normal periods of equipment down time, or transport of untreated wastes to another treatment facility.

   c. If the bypass is planned and scheduled to minimize adverse effects on the public and the environment.

After consideration of the above and the adverse effects of the proposed bypass and any other relevant factors, Ecology will approve, conditionally approve, or deny the request. The public must be notified and given an opportunity to comment on bypass incidents of significant duration, to the extent feasible. Approval of a request to bypass will be by administrative order issued by Ecology under RCW 90.48.120.

B. Duty to Mitigate

The Permittee is required to take all reasonable steps to minimize or prevent any discharge or sludge use or disposal in violation of this permit that has a reasonable likelihood of adversely affecting human health or the environment.

APPENDIX A – DEFINITIONS

AKART is an acronym for “all known, available, and reasonable methods of prevention, control, and treatment.” AKART represents the most current methodology that can be reasonably required for preventing, controlling, or abating the pollutants and controlling pollution associated with a discharge.

Applicable TMDL means a TMDL for turbidity, fine sediment, high pH, or phosphorus, which was completed and approved by EPA before January 1, 2011, or before the date the operator’s complete permit application is received by Ecology, whichever is later.

Applicant means an operator seeking coverage under this permit.

Best Management Practices (BMPs) means schedules of activities, prohibitions of practices, maintenance procedures, and other physical, structural and/or managerial practices to prevent or reduce the pollution of waters of the State. BMPs include treatment systems, operating procedures, and practices to control: stormwater associated with construction activity, spillage or leaks, sludge or waste disposal, or drainage from raw material storage.

Buffer means an area designated by a local jurisdiction that is contiguous to and intended to protect a sensitive area.

Bypass means the intentional diversion of waste streams from any portion of a treatment facility.

Calendar Day A period of 24 consecutive hours starting at 12:00 midnight and ending the following 12:00 midnight.

Calendar Week (same as Week) means a period of seven consecutive days starting at 12:01 a.m. (0:01 hours) on Sunday.

Certified Erosion and Sediment Control Lead (CESCL) means a person who has current certification through an approved erosion and sediment control training program that meets the minimum training standards established by Ecology (see BMP C160 in the SWMM).

Clean Water Act (CWA) means the Federal Water Pollution Control Act enacted by Public Law 92-500, as amended by Public Laws 95-217, 95-576, 96-483, and 97-117; USC 1251 et seq.

Combined Sewer means a sewer which has been designed to serve as a sanitary sewer and a storm sewer, and into which inflow is allowed by local ordinance.

Common Plan of Development or Sale means a site where multiple separate and distinct construction activities may be taking place at different times on different schedules and/or by different contractors, but still under a single plan. Examples include: 1) phased projects and projects with multiple filings or lots, even if the separate phases or filings/lots will be constructed under separate contract or by separate owners (e.g., a development where lots are sold to separate builders); 2) a development plan that may be phased over multiple years, but is still under a consistent plan for long-term development; 3) projects in a contiguous area that may be unrelated but still under the same contract, such as construction of a building extension and a new parking lot at the same facility; and 4) linear projects such as roads, pipelines, or utilities. If the project is part of a common plan of development or sale, the disturbed area of the entire plan must be used in determining permit requirements.

Composite Sample means a mixture of grab samples collected at the same sampling point at different times, formed either by continuous sampling or by mixing discrete samples. May be "time-composite" (collected at constant time intervals) or "flow-proportional" (collected either as a constant sample volume at time intervals proportional to stream flow, or collected by increasing the volume of each aliquot as the flow increases while maintaining a constant time interval between the aliquots.

Concrete wastewater means any water used in the production, pouring and/or clean-up of concrete or concrete products, and any water used to cut, grind, wash, or otherwise modify concrete or concrete products. Examples include water used for or resulting from concrete truck/mixer/pumper/tool/chute rinsing or washing, concrete saw cutting and surfacing (sawing, coring, grinding, roughening, hydro-demolition, bridge and road surfacing). When stormwater comingles with concrete wastewater, the resulting water is considered concrete wastewater and must be managed to prevent discharge to waters of the state, including ground water.

Construction Activity means land disturbing operations including clearing, grading or excavation which disturbs the surface of the land. Such activities may include road construction, construction of residential houses, office buildings, or industrial buildings, and demolition activity.

Contaminant means any hazardous substance that does not occur naturally or occurs at greater than natural background levels. See definition of “hazardous substance” and WAC 173-340-200.

Demonstrably Equivalent means that the technical basis for the selection of all stormwater BMPs is documented within a SWPPP, including:

1. The method and reasons for choosing the stormwater BMPs selected.
2. The pollutant removal performance expected from the BMPs selected.
3. The technical basis supporting the performance claims for the BMPs selected, including any available data concerning field performance of the BMPs selected.
4. An assessment of how the selected BMPs will comply with state water quality standards.
5. An assessment of how the selected BMPs will satisfy both applicable federal technology-based treatment requirements and state requirements to use all known, available, and reasonable methods of prevention, control, and treatment (AKART).

Department means the Washington State Department of Ecology.

Detention means the temporary storage of stormwater to improve quality and/or to reduce the mass flow rate of discharge.

Dewatering means the act of pumping ground water or stormwater away from an active construction site.

Director means the Director of the Washington Department of Ecology or his/her authorized representative.

Discharger means an owner or operator of any facility or activity subject to regulation under Chapter 90.48 RCW or the Federal Clean Water Act.

Domestic Wastewater means water carrying human wastes, including kitchen, bath, and laundry wastes from residences, buildings, industrial establishments, or other places, together with such ground water infiltration or surface waters as may be present.

Ecology means the Washington State Department of Ecology.

Engineered Soils means the use of soil amendments including, but not limited, to Portland cement treated base (CTB), cement kiln dust (CKD), or fly ash to achieve certain desirable soil characteristics.

Equivalent BMPs means operational, source control, treatment, or innovative BMPs which result in equal or better quality of stormwater discharge to surface water or to ground water than BMPs selected from the SWMM.

Erosion means the wearing away of the land surface by running water, wind, ice, or other geological agents, including such processes as gravitational creep.

Erosion and Sediment Control BMPs means BMPs intended to prevent erosion and sedimentation, such as preserving natural vegetation, seeding, mulching and matting, plastic covering, filter fences, sediment traps, and ponds. Erosion and sediment control BMPs are synonymous with stabilization and structural BMPs.

Final Stabilization (same as fully stabilized or full stabilization) means the establishment of a permanent vegetative cover, or equivalent permanent stabilization measures (such as riprap, gabions or geotextiles) which prevents erosion.

Ground Water means water in a saturated zone or stratum beneath the land surface or a surface water body.

Hazardous Substance means any dangerous or extremely hazardous waste as defined in RCW 70.105.010 (5) and (6), or any dangerous or extremely dangerous waste as designated by rule under chapter 70.105 RCW; any hazardous sub-stance as defined in RCW 70.105.010(14) or any hazardous substance as defined by rule under chapter 70.105 RCW; any substance that, on the effective date of this section, is a hazardous substance under section 101(14) of the federal cleanup law, 42 U.S.C., Sec. 9601(14); petroleum or petroleum products; and any substance or category of substances, including solid waste decomposition products, determined by the director by rule to present a threat to human health or the environment if released into the environment. The term hazardous substance does not include any of the following when contained in an underground storage tank from which there is not a release: crude oil or any fraction thereof or petroleum, if the tank is in compliance with all applicable federal, state, and local law.

Injection Well means a well that is used for the subsurface emplacement of fluids. (See Well.)

Jurisdiction means a political unit such as a city, town or county; incorporated for local self-government.

National Pollutant Discharge Elimination System (NPDES) means the national program for issuing, modifying, revoking and reissuing, terminating, monitoring, and enforcing permits, and imposing and enforcing pretreatment requirements, under sections 307, 402, 318, and 405 of the Federal Clean Water Act, for the discharge of pollutants to surface waters of the State from point sources. These permits are referred to as NPDES permits and, in Washington State, are administered by the Washington Department of Ecology.

Notice of Intent (NOI) means the application for, or a request for coverage under this general permit pursuant to WAC 173-226-200.

Notice of Termination (NOT) means a request for termination of coverage under this general permit as specified by Special Condition S10 of this permit.

Operator means any party associated with a construction project that meets either of the following two criteria:

- The party has operational control over construction plans and specifications, including the ability to make modifications to those plans and specifications; or
- The party has day-to-day operational control of those activities at a project that are necessary to ensure compliance with a SWPPP for the site or other permit conditions (e.g., they are authorized to direct workers at a site to carry out activities required by the SWPPP or comply with other permit conditions).

Permittee means individual or entity that receives notice of coverage under this general permit.

pH means a liquid's measure of acidity or alkalinity. A pH of 7 is defined as neutral. Large variations above or below this value are considered harmful to most aquatic life.

pH monitoring period means the time period in which the pH of stormwater runoff from a site must be tested a minimum of once every seven days to determine if stormwater pH is between 6.5 and 8.5.

Point source means any discernible, confined, and discrete conveyance, including but not limited to, any pipe, ditch, channel, tunnel, conduit, well, discrete fissure, and container from which pollutants are or may be discharged to surface waters of the State. This term does not include return flows from irrigated agriculture. (See Fact Sheet for further explanation.)

Pollutant means dredged spoil, solid waste, incinerator residue, filter backwash, sewage, garbage, domestic sewage sludge (biosolids), munitions, chemical wastes, biological materials, radioactive materials, heat, wrecked or discarded equipment, rock, sand, cellar dirt, and industrial, municipal, and agricultural waste. This term does not include sewage from vessels within the meaning of section 312 of the CWA, nor does it include dredged or fill material discharged in accordance with a permit issued under section 404 of the CWA.

Pollution means contamination or other alteration of the physical, chemical, or biological properties of waters of the State; including change in temperature, taste, color, turbidity, or odor of the waters; or such discharge of any liquid, gaseous, solid, radioactive or other substance into any waters of the State as will or is likely to create a nuisance or render such waters harmful, detrimental or injurious to the public health, safety or welfare; or to domestic, commercial, industrial, agricultural, recreational, or other legitimate beneficial uses; or to livestock, wild animals, birds, fish or other aquatic life.

Process wastewater means any water which, during manufacturing or processing, comes into direct contact with or results from the production or use of any raw material, intermediate product, finished product, byproduct, or waste product (40 CFR 122.1).

Receiving water means the water body at the point of discharge. If the discharge is to a storm sewer system, either surface or subsurface, the receiving water is the water body to which the storm system discharges. Systems designed primarily for other purposes such as for ground water drainage, redirecting stream natural flows, or for conveyance of irrigation water/return flows that coincidentally convey stormwater are considered the receiving water.

Representative means a stormwater or wastewater sample which represents the flow and characteristics of the discharge. Representative samples may be a grab sample, a time-proportionate composite sample, or a flow proportionate sample. Ecology's Construction Stormwater Monitoring Manual provides guidance on representative sampling.

Sanitary sewer means a sewer which is designed to convey domestic wastewater.

Sediment means the fragmented material that originates from the weathering and erosion of rocks or unconsolidated deposits, and is transported by, suspended in, or deposited by water.

Sedimentation means the depositing or formation of sediment.

Sensitive area means a water body, wetland, stream, aquifer recharge area, or channel migration zone.

SEPA (State Environmental Policy Act) means the Washington State Law, RCW 43.21C.020, intended to prevent or eliminate damage to the environment.

Significant Amount means an amount of a pollutant in a discharge that is amenable to available and reasonable methods of prevention or treatment; or an amount of a pollutant that has a reasonable potential to cause a violation of surface or ground water quality or sediment management standards.

Significant concrete work means greater than 1000 cubic yards poured concrete or recycled concrete over the life of a project.

Significant Contributor of Pollutants means a facility determined by Ecology to be a contributor of a significant amount(s) of a pollutant(s) to waters of the State of Washington.

Site means the land or water area where any "facility or activity" is physically located or conducted.

Source control BMPs means physical, structural or mechanical devices or facilities that are intended to prevent pollutants from entering stormwater. A few examples of source control BMPs are erosion control practices, maintenance of stormwater facilities, constructing roofs over storage and working areas, and directing wash water and similar discharges to the sanitary sewer or a dead end sump.

Stabilization means the application of appropriate BMPs to prevent the erosion of soils, such as, temporary and permanent seeding, vegetative covers, mulching and matting, plastic covering and sodding. See also the definition of Erosion and Sediment Control BMPs.

Storm drain means any drain which drains directly into a storm sewer system, usually found along roadways or in parking lots.

Storm sewer system means a means a conveyance, or system of conveyances (including roads with drainage systems, municipal streets, catch basins, curbs, gutters, ditches, manmade channels, or storm drains designed or used for collecting or conveying stormwater. This does not include systems which are part of a combined sewer or Publicly Owned Treatment Works (POTW) as defined at 40 CFR 122.2.

Stormwater means that portion of precipitation that does not naturally percolate into the ground or evaporate, but flows via overland flow, interflow, pipes, and other features of a stormwater drainage system into a defined surface water body, or a constructed infiltration facility.

Stormwater Management Manual (SWMM) or Manual means the technical Manual published by Ecology for use by local governments that contain descriptions of and design criteria for BMPs to prevent, control, or treat pollutants in stormwater.

Stormwater Pollution Prevention Plan (SWPPP) means a documented plan to implement measures to identify, prevent, and control the contamination of point source discharges of stormwater.

Surface Waters of the State includes lakes, rivers, ponds, streams, inland waters, salt waters, and all other surface waters and water courses within the jurisdiction of the state of Washington.

Temporary Stabilization means the exposed ground surface has been covered with appropriate materials to provide temporary stabilization of the surface from water or wind erosion. Materials include, but are not limited to, mulch, riprap, erosion control mats or blankets and temporary cover crops. Seeding alone is not considered stabilization. Temporary stabilization is not a substitute for the more permanent "final stabilization."

Total Maximum Daily Load (TMDL) means a calculation of the maximum amount of a pollutant that a water body can receive and still meet state water quality standards. Percentages of the total maximum daily load are allocated to the various pollutant sources. A TMDL is the sum of the allowable loads of a single pollutant from all contributing point and nonpoint sources. The TMDL calculations must include a "margin of safety" to ensure that the water body can be protected in case there are unforeseen events or unknown sources of the pollutant. The calculation must also account for seasonable variation in water quality.

Treatment BMPs means BMPs that are intended to remove pollutants from stormwater. A few examples of treatment BMPs are detention ponds, oil/water separators, biofiltration, and constructed wetlands.

Transparency means a measurement of water clarity in centimeters (cm), using a 60 cm transparency tube. The transparency tube is used to estimate the relative clarity or transparency of water by noting the depth at which a black and white Secchi disc becomes visible when water is released from a value in the bottom of the tube. A transparency tube is sometimes referred to as a "turbidity tube."

Turbidity means the clarity of water expressed as nephelometric turbidity units (NTU) and measured with a calibrated turbidimeter.

Uncontaminated means free from any contaminant, as defined in MTCA cleanup regulations. See definition of "contaminant" and WAC 173-340-200.

Waste Load Allocation (WLA) means the portion of a receiving water's loading capacity that is allocated to one of its existing or future point sources of pollution. WLAs constitute a type of water quality based effluent limitation (40 CFR 130.2[h]).

Water quality means the chemical, physical, and biological characteristics of water, usually with respect to its suitability for a particular purpose.

Waters of the State includes those waters as defined as "waters of the United States" in 40 CFR Subpart 122.2 within the geographic boundaries of Washington State and "waters of the State" as defined in Chapter 90.48 RCW, which include lakes, rivers, ponds, streams, inland waters, underground waters, salt waters, and all other surface waters and water courses within the jurisdiction of the state of Washington.

Well means a bored, drilled or driven shaft, or dug hole whose depth is greater than the largest surface dimension. (See Injection well.)

Wheel wash wastewater means any water used in, or resulting from the operation of, a tire bath or wheel wash (BMP C106: Wheel Wash), or other structure or practice that uses water to physically remove mud and debris from vehicles leaving a construction site and prevent track-out onto roads. When stormwater comingles with wheel wash wastewater, the resulting water is considered wheel wash wastewater and must be managed according to Special Condition S9.D.9.

APPENDIX B – ACRONYMS

AKART	All Known, Available, and Reasonable Methods of Prevention, Control, and Treatment
BMP	Best Management Practice
CESCL	Certified Erosion and Sediment Control Lead
CFR	Code of Federal Regulations
CKD	Cement Kiln Dust
cm	Centimeters
CTB	Cement-Treated Base
CWA	Clean Water Act
DMR	Discharge Monitoring Report
EPA	Environmental Protection Agency
ESC	Erosion and Sediment Control
FR	Federal Register
NOI	Notice of Intent
NOT	Notice of Termination
NPDES	National Pollutant Discharge Elimination System
NTU	Nephelometric Turbidity Unit
RCW	Revised Code of Washington
SEPA	State Environmental Policy Act
SWMM	Stormwater Management Manual
SWPPP	Stormwater Pollution Prevention Plan
TMDL	Total Maximum Daily Load
UIC	Underground Injection Control
USC	United States Code
USEPA	United States Environmental Protection Agency
WAC	Washington Administrative Code
WQ	Water Quality
WWHM	Western Washington Hydrology Model

Appendix E – Site Inspection Forms (and Site Log)

The results of each inspection shall be summarized in an inspection report or checklist that is entered into or attached to the site log book. It is suggested that the inspection report or checklist be included in this appendix to keep monitoring and inspection information in one document, but this is optional. However, it is mandatory that this SWPPP and the site inspection forms be kept onsite at all times during construction, and that inspections be performed and documented as outlined below.

At a minimum, each inspection report or checklist shall include:

a. Inspection date/times

b. Weather information: general conditions during inspection, approximate amount of precipitation since the last inspection, and approximate amount of precipitation within the last 24 hours.

c. A summary or list of all BMPs that have been implemented, including observations of all erosion/sediment control structures or practices.

d. The following shall be noted:

   i. locations of BMPs inspected,

   ii. locations of BMPs that need maintenance,

   iii. the reason maintenance is needed,

   iv. locations of BMPs that failed to operate as designed or intended, and

   v. locations where additional or different BMPs are needed, and the reason(s) why

e. A description of stormwater discharged from the site. The presence of suspended sediment, turbid water, discoloration, and/or oil sheen shall be noted, as applicable.

f. A description of any water quality monitoring performed during inspection, and the results of that monitoring.

g. General comments and notes, including a brief description of any BMPs repairs, maintenance or installations made as a result of the inspection.

h. A statement that, in the judgment of the person conducting the site inspection, the site is either in compliance or out of compliance with the terms and conditions of the SWPPP and the NPDES permit. If the site inspection indicates that the site is out of compliance, the inspection report shall include a summary of the remedial actions required to bring the site back into compliance, as well as a schedule of implementation.

i. Name, title, and signature of person conducting the site inspection; and the following statement: "I certify under penalty of law that this report is true, accurate, and complete, to the best of my knowledge and belief".

When the site inspection indicates that the site is not in compliance with any terms and conditions of the NPDES permit, the Permittee shall take immediate action(s) to: stop, contain, and clean up the unauthorized discharges, or otherwise stop the noncompliance; correct the problem(s); implement appropriate Best Management Practices (BMPs), and/or conduct maintenance of existing BMPs; and achieve compliance with all applicable standards and permit conditions. In addition, if the noncompliance causes a threat to human health or the environment, the Permittee shall comply with the Noncompliance Notification requirements in Special Condition S5.F of the permit.

ATTACHMENT 18

Construction Stormwater Site Inspection Form

Project Name ________________ Permit # ____________ Inspection Date __________ Time ______

Name of Certified Erosion Sediment Control Lead (CESCL) or qualified inspector if *less than one acre*
Print Name: ____

Approximate rainfall amount since the last inspection (in inches): ______________________________

Approximate rainfall amount in the last 24 hours (in inches): ______________________________

Current Weather Clear ☐ Cloudy ☐ Mist ☐ Rain ☐ Wind ☐ Fog ☐

A. Type of inspection: Weekly ☐ Post Storm Event ☐ Other ☐

B. Phase of Active Construction (*check all that apply*):

Pre Construction/installation of erosion/sediment controls ☐ Clearing/Demo/Grading ☐ Infrastructure/storm/roads ☐
Concrete pours ☐ Vertical Construction/buildings ☐ Utilities ☐
Offsite improvements ☐ Site temporary stabilized ☐ Final stabilization ☐

C. Questions:

1. Were all areas of construction and discharge points inspected? Yes ___ No ___
2. Did you observe the presence of suspended sediment, turbidity, discoloration, or oil sheen Yes ___ No ___
3. Was a water quality sample taken during inspection? (*refer to permit conditions S4 & S5*) Yes ___ No ___
4. Was there a turbid discharge 250 NTU or greater, or Transparency 6 cm or less?* Yes ___ No ___
5. If yes to #4 was it reported to Ecology? Yes ___ No ___
6. Is pH sampling required? pH range required is 6.5 to 8.5. Yes ___ No ___

If answering yes to a discharge, describe the event. Include when, where, and why it happened; what action was taken, and when.

____

____

____

____

*If answering yes to # 4 record NTU/Transparency with continual sampling daily until turbidity is 25 NTU or less/ transparency is 33 cm or greater.

Sampling Results: Date: ______________________

Parameter	**Method (circle one)**	**Result**			**Other/Note**
		NTU	**cm**	**pH**	
Turbidity	tube, meter, laboratory				
pH	Paper, kit, meter				

Construction Stormwater Site Inspection Form

D. Check the observed status of all items. Provide "Action Required "details and dates.

<table>
<tr><th rowspan="2">Element #</th><th rowspan="2">Inspection</th><th colspan="3">BMPs Inspected</th><th rowspan="2">BMP needs maintenance</th><th rowspan="2">BMP failed</th><th rowspan="2">Action required (describe in section F)</th></tr>
<tr><th>yes</th><th>no</th><th>n/a</th></tr>
<tr><td>1
Clearing Limits</td><td>Before beginning land disturbing activities are all clearing limits, natural resource areas (streams, wetlands, buffers, trees) protected with barriers or similar BMPs? (high visibility recommended)</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td rowspan="2">2
Construction Access</td><td>Construction access is stabilized with quarry spalls or equivalent BMP to prevent sediment from being tracked onto roads?</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Sediment tracked onto the road way was cleaned thoroughly at the end of the day or more frequent as necessary.</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td rowspan="2">3
Control Flow Rates</td><td>Are flow control measures installed to control stormwater volumes and velocity during construction and do they protect downstream properties and waterways from erosion?</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>If permanent infiltration ponds are used for flow control during construction, are they protected from siltation?</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td rowspan="3">4
Sediment Controls</td><td>All perimeter sediment controls (e.g. silt fence, wattles, compost socks, berms, etc.) installed, and maintained in accordance with the Stormwater Pollution Prevention Plan (SWPPP).</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Sediment control BMPs (sediment ponds, traps, filters etc.) have been constructed and functional as the first step of grading.</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Stormwater runoff from disturbed areas is directed to sediment removal BMP.</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>5
Stabilize Soils</td><td>Have exposed un-worked soils been stabilized with effective BMP to prevent erosion and sediment deposition?</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
</table>

Construction Stormwater Site Inspection Form

Element #	Inspection	BMPs Inspected yes	BMPs Inspected no	BMPs Inspected n/a	BMP needs maintenance	BMP failed	Action required (describe in section F)
5 Stabilize Soils Cont.	Are stockpiles stabilized from erosion, protected with sediment trapping measures and located away from drain inlet, waterways, and drainage channels?						
	Have soils been stabilized at the end of the shift, before a holiday or weekend if needed based on the weather forecast?						
6 Protect Slopes	Has stormwater and ground water been diverted away from slopes and disturbed areas with interceptor dikes, pipes and or swales?						
	Is off-site storm water managed separately from stormwater generated on the site?						
	Is excavated material placed on uphill side of trenches consistent with safety and space considerations?						
	Have check dams been placed at regular intervals within constructed channels that are cut down a slope?						
7 Drain Inlets	Storm drain inlets made operable during construction are protected.						
	Are existing storm drains within the influence of the project protected?						
8 Stabilize Channel and Outlets	Have all on-site conveyance channels been designed, constructed and stabilized to prevent erosion from expected peak flows?						
	Is stabilization, including armoring material, adequate to prevent erosion of outlets, adjacent stream banks, slopes and downstream conveyance systems?						
9 Control Pollutants	Are waste materials and demolition debris handled and disposed of to prevent contamination of stormwater?						
	Has cover been provided for all chemicals, liquid products, petroleum products, and other material?						
	Has secondary containment been provided capable of containing 110% of the volume?						
	Were contaminated surfaces cleaned immediately after a spill incident?						
	Were BMPs used to prevent contamination of stormwater by a pH modifying sources?						

Construction Stormwater Site Inspection Form

Element #	Inspection	BMPs Inspected			BMP needs maintenance	BMP failed	Action required (describe in section F)
		yes	no	n/a			
9 Cont.	Wheel wash wastewater is handled and disposed of properly.						
10 Control Dewatering	Concrete washout in designated areas. No washout or excess concrete on the ground.						
	Dewatering has been done to an approved source and in compliance with the SWPPP.						
	Were there any clean non turbid dewatering discharges?						
11 Maintain BMP	Are all temporary and permanent erosion and sediment control BMPs maintained to perform as intended?						
12 Manage the Project	Has the project been phased to the maximum degree practicable?						
	Has regular inspection, monitoring and maintenance been performed as required by the permit?						
	Has the SWPPP been updated, implemented and records maintained?						

E. Check all areas that have been inspected. ✔

All in place BMPs ☐ All disturbed soils ☐ All concrete wash out area ☐ All material storage areas ☐
All discharge locations ☐ All equipment storage areas ☐ All construction entrances/exits ☐

F. Elements checked "Action Required" (section D) describe corrective action to be taken. List the element number; be specific on location and work needed. Document, initial, and date when the corrective action has been completed and inspected.

Element #	Description and Location	Action Required	Completion Date	Initials

Attach additional page if needed

<u>Sign the following certification:</u>

"I certify that this report is true, accurate, and complete, to the best of my knowledge and belief"

Inspected by: (print) ____________________ (Signature) ________________________ Date: ______________

Title/Qualification of Inspector: ____

Appendix F – Engineering Calculations

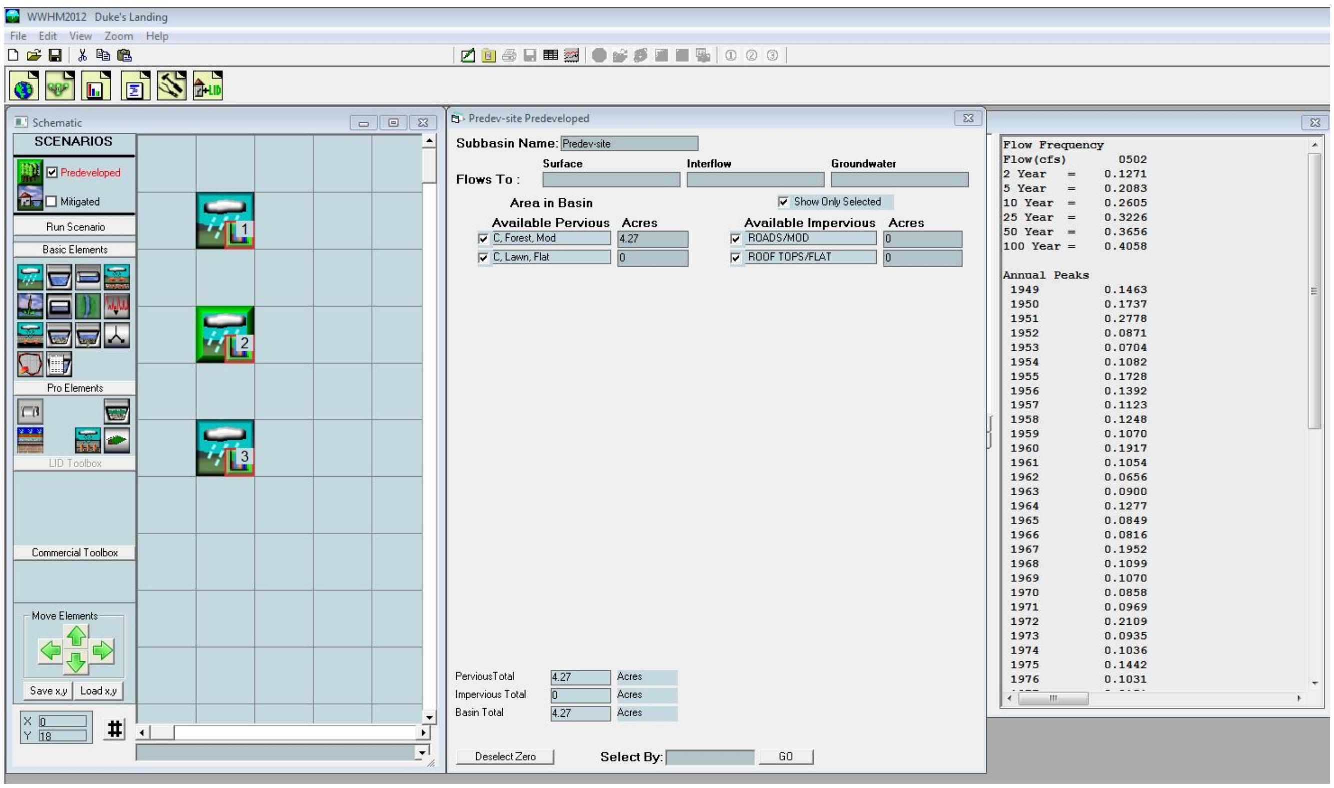


Figure F.1 – Flow Frequency prior to construction

2-year = 0.1271 cfs
10-year = 0.2605 cfs

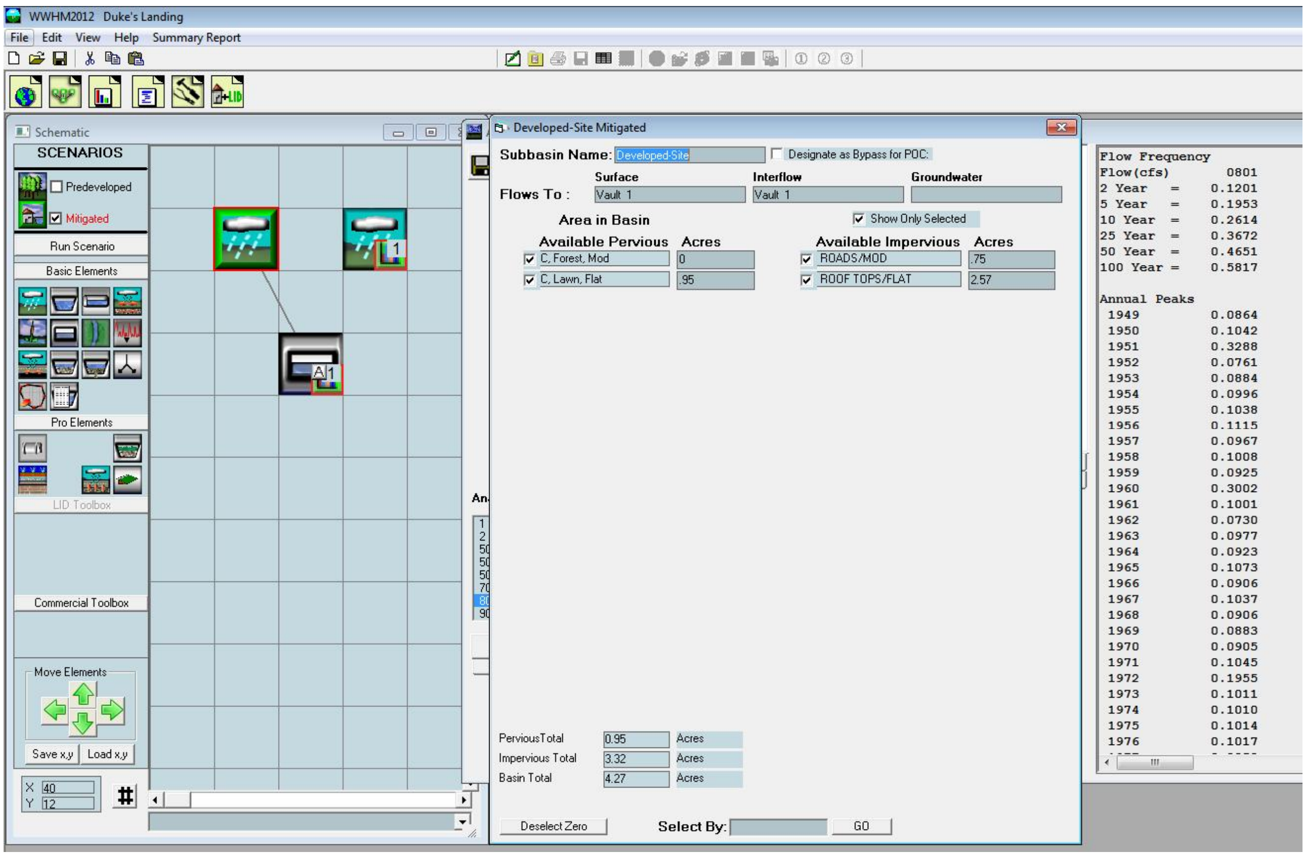


Figure F.2 – Flow Frequency after construction

2-year = 0.1201 cfs
10-year = 0.1953 cfs

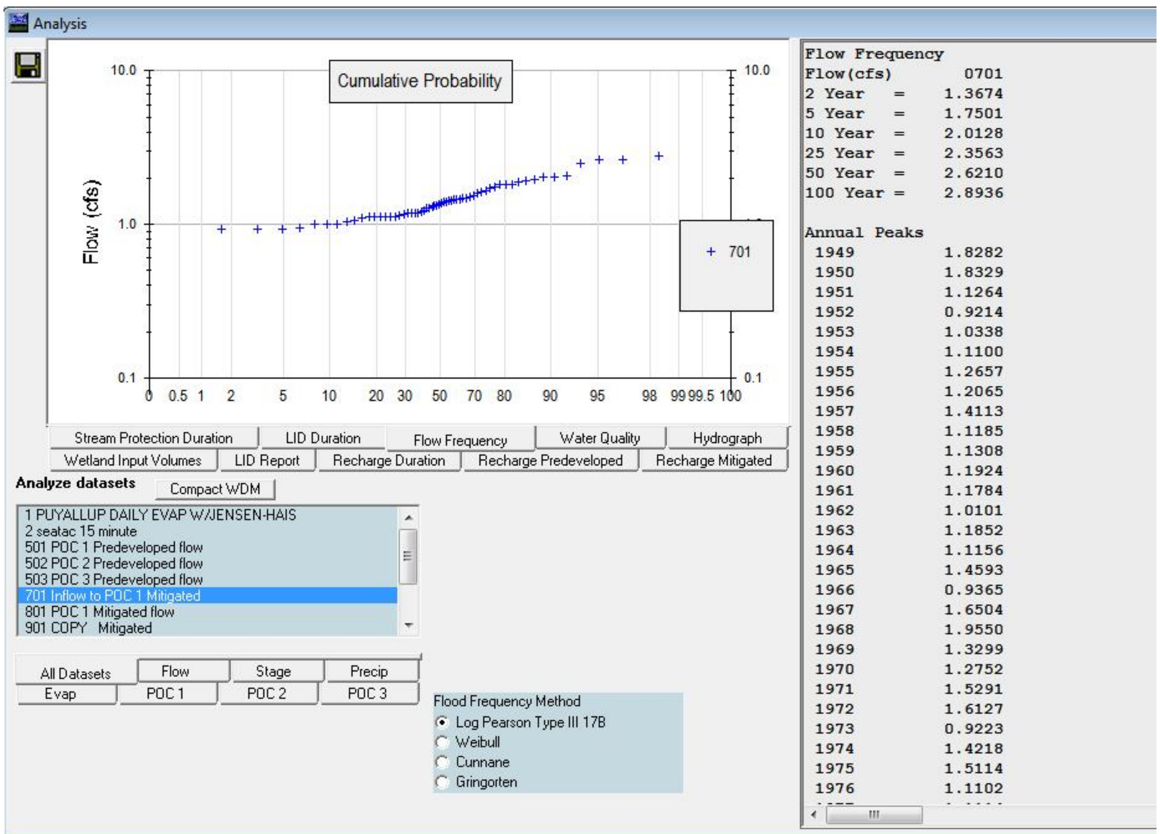


Figure F.3 – Flow Frequency during Construction

2-yr = 1.3674 cfs
10-yr = 1.7501 cfs