CHAPTER 4 NATURAL ENVIRONMENT: AFFECTED ENVIRONMENT, IMPACTS & MITIGATION

4.1 EARTH RESOURCES

4.1.1 Methodology

Information for on-site geology and soil conditions was collected and evaluated utilizing published agency data and previously completed environmental and geotechnical reports on and/or near the project site. General statements based on stratigraphy are difficult with the Project area. This is because historical disturbance and placement of large quantities of fill across the site increase the variability of the subsurface site conditions. Preliminary site-specific geotechnical evaluations have been conducted for the Simpson Pad. In addition, numerous environmental studies have been conducted on the Landfill/Tire Fire site and the Eclipse Mill site which provide data on the conditions. Preliminary geotechnical evaluations have also been conducted on the landfill site with respect to proposed site development, including preliminary recommendations for building support and grading (see Figures 4.1-1 through 4.1-1B, Grading Cross Sections). Prior to final design of all planned improvements, including specific building sizes and locations, preliminary and final geotechnical evaluations are required on each parcel in the areas designated for future construction.

4.1.2 Existing Conditions/Affected Environment

4.1.2.1 General Site Conditions

Information about the greater Everett area historic geologic conditions, seismic activity, seismic hazards, site soils and the associated maps was obtained from the United States Department of Agriculture (USDA) Soil Conservation Service, City of Everett Critical Areas Maps and United States Geological Society (USGS).

4.1.2.2 Everett Area Seismic Activity

The greater Everett area is located at the convergent continental boundary known as the Cascadia Subduction Zone (CSZ). The CSZ is the zone where the westward advancing North American Plate is overriding the subducting Juan de Fuca Plate. The interaction of these two plates results in three potential seismic source zones: (1) the shallow crustal source zone, (2) the Benioff source zone, and (3) the CSZ interplate source zone.

Seismic Hazards On-Site

Seismic hazard areas are typically defined as those areas subject to severe risk of damage as a result of earthquake-induced ground shaking, slope failure, settlement, liquefaction or surface faulting.

Major portions of the site are characterized by the City's Sensitive Areas Maps as having moderate to high potential for seismic hazards, including liquefaction and landslides (see Figure 4.1-2). The large quantities of fill placed on-site overlying the native alluvial deposits make the property prone to these hazards.

Liquefaction Potential

Liquefaction is a phenomenon by which soils experience a rapid loss of internal strength as a consequence of strong ground shaking. Ground settlement, lateral spreading and/or sand boils may result from liquefaction. Structures supported on liquefied soils could suffer foundation settlement or lateral movement that could be severely damaging to the structures.

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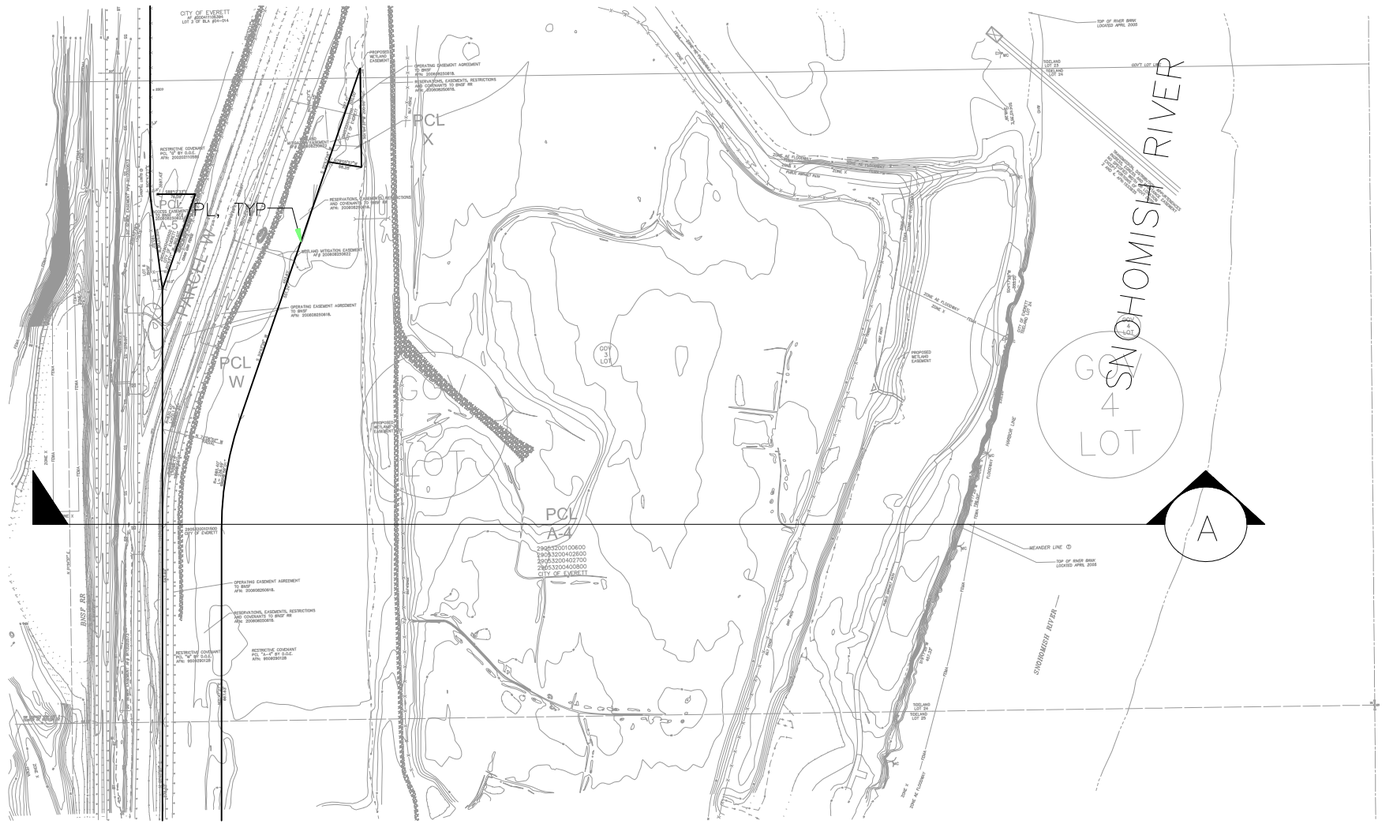

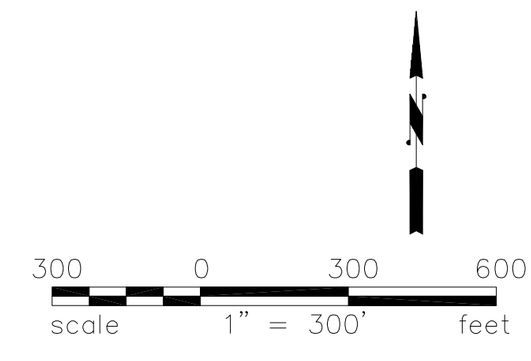

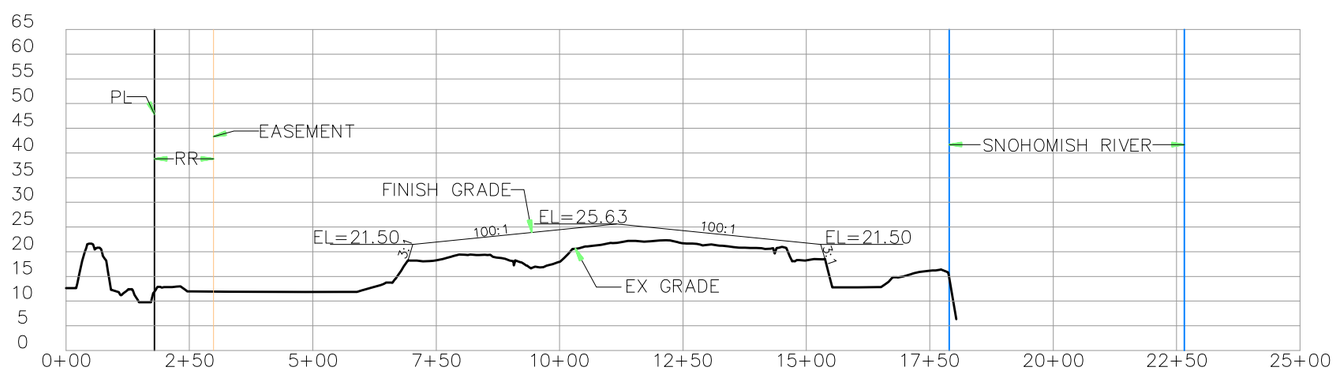

SECTION A

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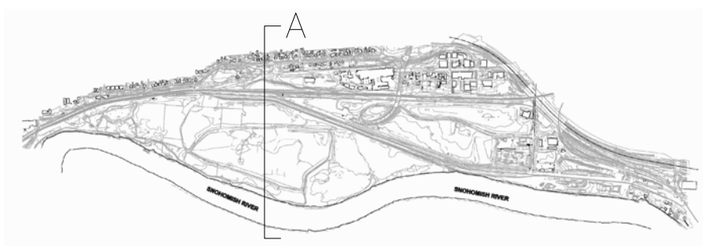

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Reference: 20071109_EverettRiverfront_Sections.dwg obtained from Magnusson Klemencic Associates on 11/09/07.

Notes:
1. The locations of all features shown are approximate.
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Grading Cross-Section
Section A

Everett Riverfront Redevelopment Project
Everett, Washington

Figure 4.1-1

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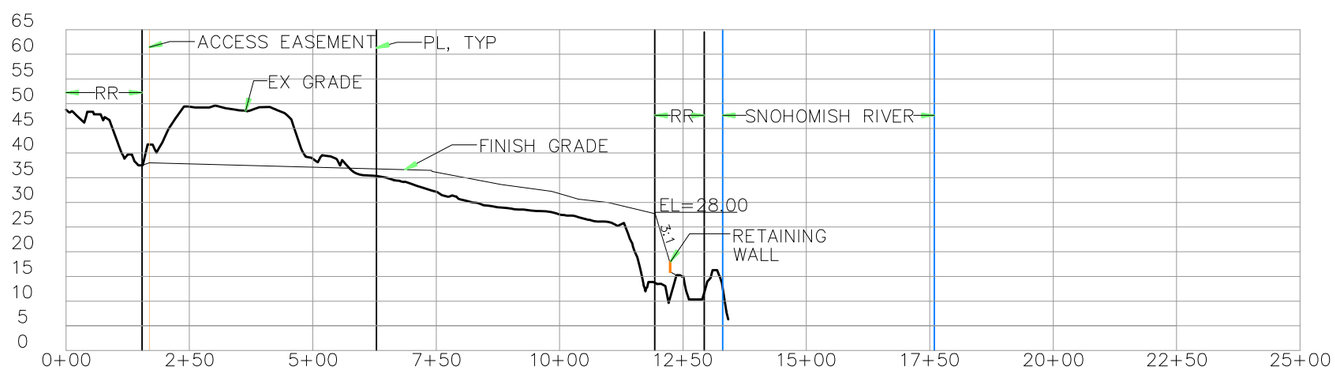

SECTION B

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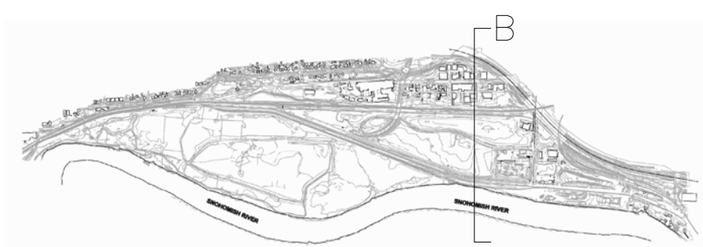

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Grading Cross-Section
Section B

Everett Riverfront Redevelopment Project
Everett, Washington

Figure 4.1-1A

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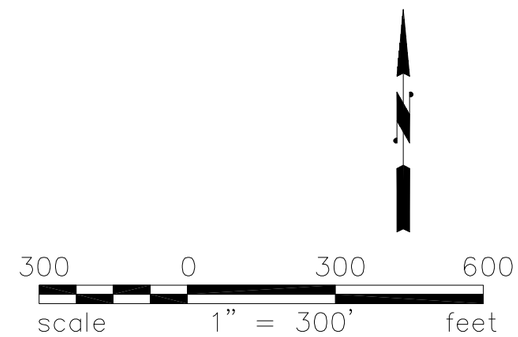

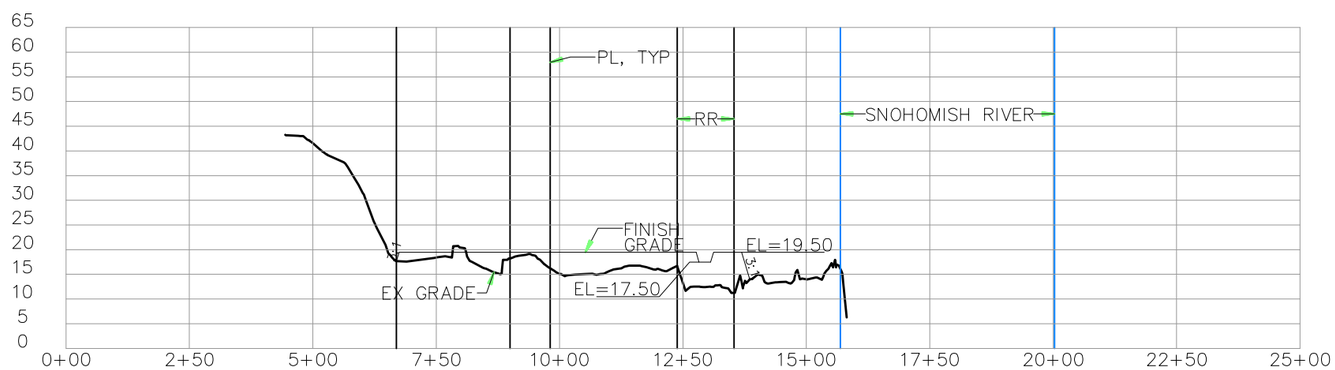

SECTION C

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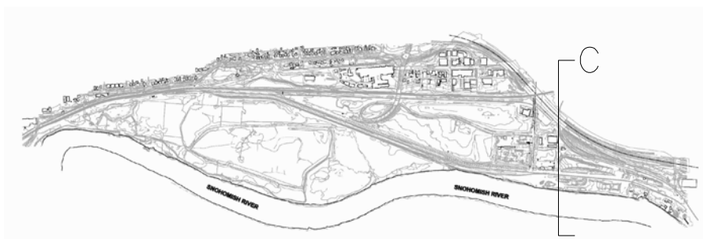

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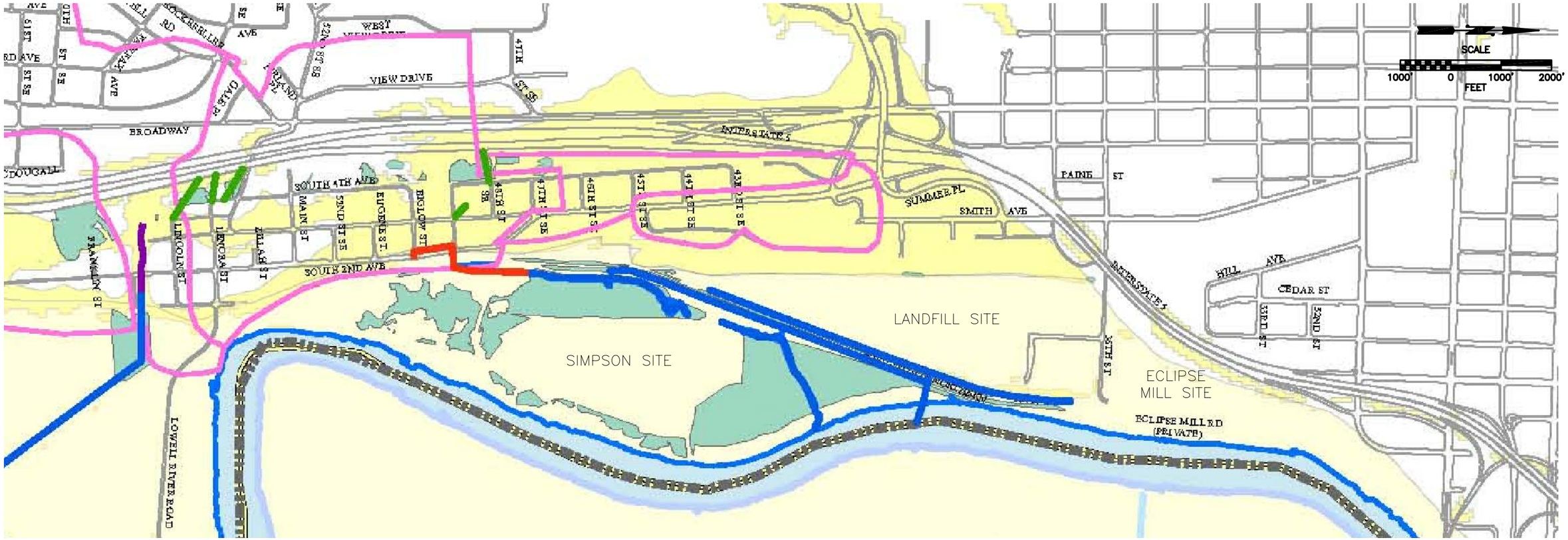
Grading Cross-Section
Section C

Everett Riverfront Redevelopment Project
Everett, Washington

Figure 4.1-1B



Legend:

- Erosion / Landslide Hazard (See Maps 2 - 3)
- Liquefaction Hazard (See Maps 4 - 5)

Streams Revised

- S
- F
- NP
- NS
- Unknown
- Piped
- Outside Everett UGA
- Drainage Basin Boundaries
- Wetlands
- Recharge Site
- Everett City Limits

NOTE: Drawing provided by Perteet, Inc.

Critical Areas

Everett Riverfront Redevelopment Project
Everett, Washington

Figure 4.1-2

Nov 26, 2007 – 2:34pm mformolo P:\6\6191002\01\CAD\Section 4.4 – Water Resources – Stormwater\Fig 25.dwg Layout Name: Fig 25A

Conditions favorable to liquefaction occur in loose to medium dense, clean to moderately silty sand that is below the groundwater level. Dense soils or soils that exhibit cohesion are less likely to be susceptible to liquefaction.

The City of Everett Liquefaction Hazard Map depicts nearly the entire project site as having moderate to high potential for liquefaction (see Figure 4.1-2). Site-specific liquefaction analyses have been completed based on the design earthquake scenario for the Simpson Pad and indicated that 3 to 6 inches of settlement resulting from liquefaction may occur at the site as a result of expected earthquake activity. Additional liquefaction evaluations will need to be conducted in other areas of the site during design development.

Lateral Spreading

Lateral spreading involves lateral displacements of large volumes of liquefied soil during an earthquake. Lateral spreading can occur on near-level ground as blocks of surface soils are displaced relative to adjacent blocks. Lateral spreading also occurs as blocks of surface soils are displaced toward a nearby slope (free face) by movement of the underlying liquefied soil. A free face can include nearby river channels or highway embankments.

A site-specific lateral spreading analysis was conducted on the Simpson Pad portion of the site. Although there is a moderate to high potential for liquefaction at the site, there is a low potential for these soils to spread laterally, with lateral spreading anticipated to occur within 100 to 200 feet of the Snohomish River bank. Seismic design completed by the design team should include a detailed evaluation of the potential for lateral spreading elsewhere on the site.

Ground Rupture

The strongest earthquake activity in the Puget Lowland is widespread subcrustal events ranging from 30 to 50 miles below ground surface. Surface faulting from these deep events has not been documented. The potential for surface fault rupture in the project area is considered low because of the thickness of the non-glacially and glacially consolidated soils below the site and the fact that the estimated distance to the nearest known fault is about 6 miles.

Landsliding/Erosion

Based on literature review, site location and site topography, there does not appear to be active landsliding on site. Thus, earthquake shaking will have a low likelihood of initiating large-scale landsliding. The final design phase for each area of the site should address the potential for landsliding during the design earthquake event.

Shallow surficial sliding is possible, particularly when the ground is saturated. Surficial slides typically occur in the upper 2 to 5 feet of the ground surface, and movement occurs episodically, generally in response to heavy rainfall. Earthquake shaking coinciding with saturated slopes would tend to increase the size of the surficial slide area as well as the frequency of movement.

The City of Everett Landslide Hazard Map shows the western side of the project area near I-5 as having moderate to high potential for landslides. Site-specific landslide analyses will need to be completed based on the planned development and its location with respect to these slopes to fully identify slopes that may be susceptible to landsliding.

Large portions of the site are characterized by the City's Sensitive Areas Maps as being a medium to very high/severe erosion hazard area because of the large quantities of fill placed across the site. Temporary

and permanent erosion control measures will need to be implemented during design and construction to control erosion at the site.

Settlement

In addition to settlement caused by soil liquefaction, settlement will occur at the site because of consolidation of underlying compressible materials. Compressible materials subject to consolidation include native alluvial deposits such as peat, silt and organic silt. Settlement of refuse materials located in the landfill will occur under new loads and with time as the refuse decays.

Consolidation settlement across the site will depend on planned building loads, proposed site grades and new fill, and the subsurface conditions including the thickness and characteristics of the compressible materials. Consolidation settlement at the Simpson Pad site is anticipated to be on the order of 6 to 12 inches based on proposed new site grades and 3 to 8 inches based on anticipated building loads. Settlement of refuse materials at the landfill site can be on the order of several feet, and settlement of the underlying soft alluvial deposits may also be on the order of 12 inches.

4.1.2.3 Site Soils

In general, the upper 20 feet of soil across the Simpson Pad site consists of hydraulic fill from river dredging projects and excess construction fill placed on-site from off-site projects. The landfill portion of the site consists of variable fill placed over a variable thickness of refuse that was dumped over the native alluvial deposits. The site history discussion (Section 2.1) of each area of the project site gives estimates of date, location and amount of fill placed on site. There are also large quantities of wood debris, garbage and scrap metal buried in and under the fill from previous industrial and municipal disposal uses. Large quantities of soils excavated from the nearby I-5 construction projects are presently stored on areas of the Eclipse Mill Site. The native soil information was obtained from the United States Department of Agriculture (USDA) Soil Conservation Service (Figure 4.1-3, Soils Map).

4.1.3 Parcel Site Conditions

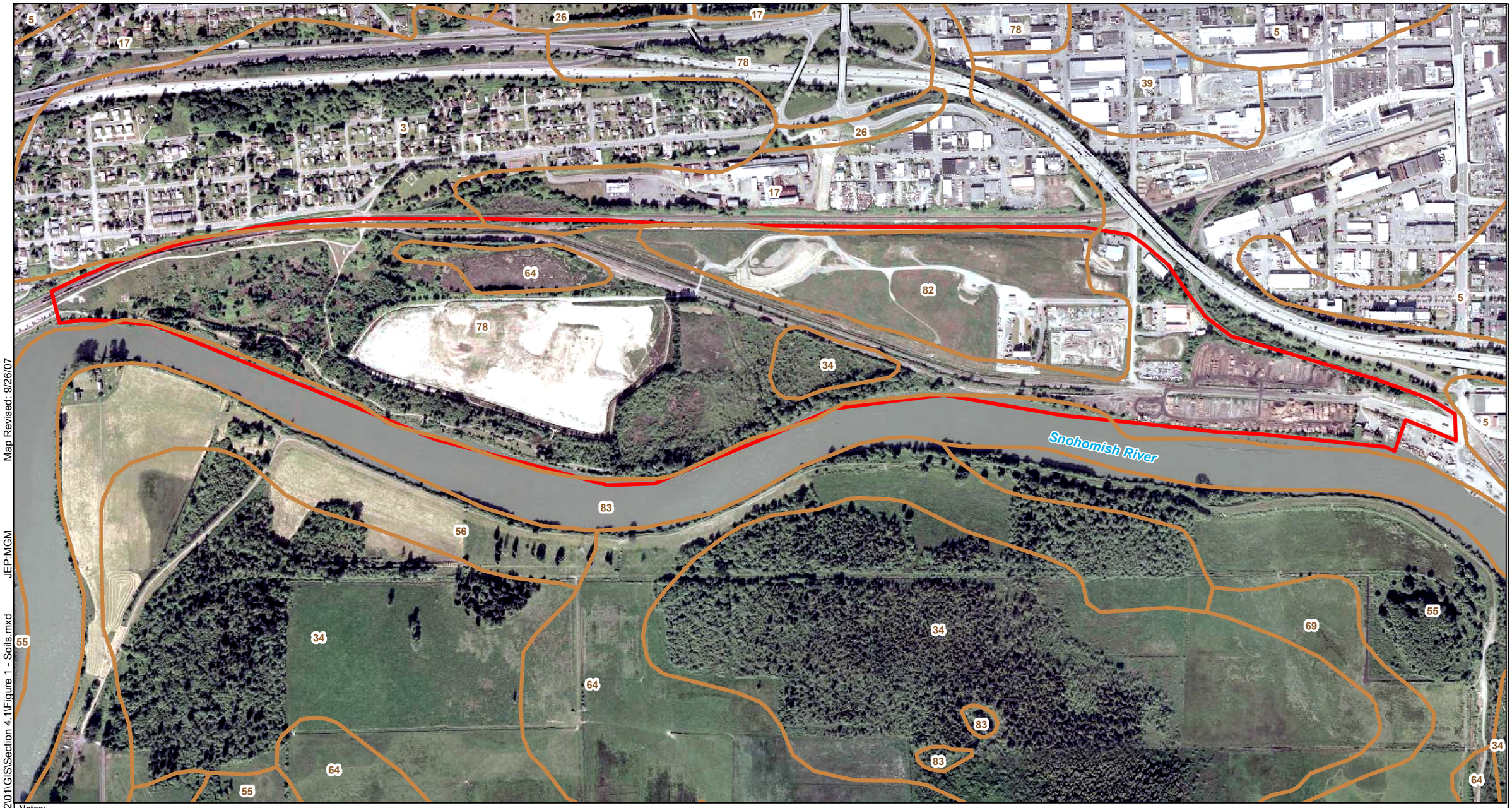
Industrial and municipal disposal uses have left a legacy of soil and groundwater contamination across the Project area. Chemicals associated with wood treatment processing, hazardous leachate and organic gases from the landfill activities present human health concerns. Section 5.7, Environmental Health and Hazardous Materials provides additional details pertaining to soil and groundwater contamination.

4.1.3.1 Simpson Site

The Simpson site consists of three areas of the project site: (1) the Simpson Pad; (2) the Simpson Category 1 Wetlands and Riparian Corridor; and (3) the South Simpson site. See Section 2.1 for the boundaries and a description of each parcel including a history of the site development and fill activities.

Existing Conditions

The Simpson site topography is relatively flat, ranging from 1 to 3 percent, and slopes east toward the Snohomish River. Elevations range from approximately 14 to 20 feet above mean sea level. Recent studies about the Simpson Site conclude that the only developable area is the portion termed the Simpson Pad which has received a substantial amount of fill over the decades and is currently outside of the Snohomish River Floodplain. Environmental site investigations found fill depths range from 6 to over 20 feet in depth across the site, with varying degrees of sand, silt, clay, wood and organic matter (peat). Generally, the fill is deeper on the western portions of the site.



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Data Sources:
Aerial image obtained from TerraServer dated Thursday, June 13, 2002.
NRCS soils data from the United States Department of Agriculture.

Universal Transverse Mercator, Zone 10, North American Datum 1983

Legend

Soils Boundary

Site Boundary

3 = Alderwood gravelly sandy loam, 15 to 25 percent slopes
17 = Everett gravelly sandy loam, 0 to 8 percent slopes
34 = Mukilteo muck
64 = Snohomish silt loam
78 = Urban land
82 = Xerorthents, nearly level
83 = Water

W S N E

700 0 700
Feet

Soils Map

Everett Riverfront Redevelopment
Everett, Washington

GeoEngineers

Figure 4.1-3

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Wetlands

There are approximately 50 acres of wetland located around the Simpson site which are commonly found adjacent to the Snohomish River and the East Ditch (Shoreline Management Agreement #78-008, #86-001, #95-005, #05-014 and #05-015). Most of the wetlands are concentrated on the southern portion of the project site surrounding the majority of the Simpson Pad and including lower Bigelow Creek. Approximately 30 acres of wetlands are found on the portion known as the Simpson Category 1 Wetlands and Riparian Corridor. The site also includes numerous streams and ditches that are hydraulically connected with the river. A more detailed description of the wetland areas associated with the project site has been provided in Section 4.5 of this document.

Subsurface Conditions

A preliminary geotechnical study of the Simpson Pad performed by GeoEngineers (2007) and the associated subsurface explorations found about 10 to 20 feet of fill consisting primarily of silty sand, silt, and fine to medium sand with varying amounts of silt and gravel (see Appendix B, GeoEngineers, Inc. *Preliminary Geotechnical Engineering Services Report, Everett Riverfront Redevelopment Project – Simpson Pad, Everett, Washington.* dated June 7, 2007). The fill was placed over the alluvial deposits, including areas containing peat. The compressible fine-grained alluvial soils are generally underlain by coarser-grained alluvial deposits consisting of sand with variable silt content and occasional silt layers. In some of the explorations, the coarse-grained alluvial deposits are underlain by fine-grained deposits. These deposits are composed of organic silt, silt, and interbedded silts and sands. Peat layers were also observed throughout this deposit.

Exploration done by GeoEngineers in 2007 found fine-grained alluvium underlying the fill and was generally observed extending to depths ranging from 32 to 47 feet below the existing ground surface. Gravel was encountered towards the bottom of the fill layer, and occasional organic matter (wood chips and decayed vegetation) and scattered brick fragments were also observed.

The fine-grained alluvial deposits are underlain by coarse-grained alluvial deposits generally consisting of sand with variable silt content and interbedded layers of silt. The explorations indicate that the upper surface of the coarse-grained alluvial deposits is typically encountered at depths between about 32 and 46 feet below existing ground surface, except where a historical river channel may traverse the southern portion of the site and the sand was observed at depths ranging from 68 to 93 feet below the ground surface.

Fine-grained alluvium was also observed underlying the coarse-grained deposits in several explorations. The deeper fine-grained alluvial deposits were typically observed between 61 and 92 feet below the ground surface when they were encountered. The deep fine-grained alluvial deposits generally consist of organic silt and silt with variable sand content, including interbedded sand layers and organic soils.

Deeper coarse-grained deposits including sand with gravel and gravel layers were observed at depths below the deep fine-grained deposits. The deep course-grained alluvium was generally observed at depths of 80 to 95 feet below the existing ground surface. These deposits generally consist of silty sand, sands with variable silt content, and gravel with occasional interbeds of fine-grained soils.

Although not encountered in the explorations, sources indicate that many of the concrete foundations from the previous industrial facilities are still in place within the fill below the ground surface. For further information including boring logs representing subsurface conditions, refer to the preliminary geotechnical report (GeoEngineers Report 2007) in Appendix B.

Groundwater

Previous environmental studies at the site (HWA GeoSciences, 2003) indicate that a shallow aquifer exists below the site at depths ranging from about 3½ to 12 feet below the ground surface. The aquifer reportedly flows in a northerly direction and is not hydraulically connected to the Snohomish River. Groundwater was observed in borings at depths typically ranging from 3 to 7 feet below the ground surface. Groundwater was also encountered as deep as 14 feet below the existing ground surface during the 2003 investigation. Other environmental explorations performed by the Floyd and Snider team on the Simpson Pad encountered groundwater at depths of 2½ to 9 feet below the ground surface. In general, it is anticipated that groundwater levels will fluctuate as a function of the season, precipitation, and other factors

4.1.3.2 Landfill/Tire Fire Site

Existing Conditions

The Landfill/Tire Fire site topography is relatively flat, ranging from 1 to 3 percent, and slopes east toward the Snohomish River. Elevations range from approximately 14 to 20 feet above MSL. See Section 5.7.2.1 for more details on the existing conditions of the Landfill/Tire Fire site in the context of environmental health and hazardous materials.

Subsurface Conditions

Refuse from the landfill activities is on the order of 33 feet deep, varying across the site, and consists of primarily of municipal solid waste, wood, tires, metal, cloth, paper and other debris in a mixture of silt, sand and organic matter. Below the refuse, intermixed alluvial layers of peat and organic silts and clays exist. Layers of peat were found up to 19 feet in thickness, and layers of organic clay and silt were found in depths of up to 35 feet in thickness (HWA GeoSciences, 2005). These organic deposits are deepest on the southeastern portion of the property. Other organic materials, including peat mixed with varying amounts of silt, are also found at the surface.

Native glacial soils composed of coarse-grained sand and silty sands are found on the western portion of the site and under the refuse at depths ranging to 33 feet and below. Stiff silt and silty sands overlay the glacial soils in some areas of the western site and were found under the refuse materials. The eastern portion of the landfill is underlain with loose alluvial sand deposits and peat to depths of 30 to 35 feet.

Further geotechnical studies need to be performed on this site to further evaluate the on-site soil engineering properties and potential requirements for engineered foundations and foundation structures prior to final site design and layout. A final preconstruction geotechnical study will be required to evaluate the proposed final design for all improvements including structures, parking facilities and common areas among others.

Groundwater

There is a shallow aquifer, a confining layer and a deep sand aquifer underlying the landfill site. The shallow aquifer is perched above the confining layer composed of silt and, under natural conditions prior to site disturbance, was formed in recent alluvium deposited by the Snohomish River. The deep aquifer is located in a sandy, alluvial formation underlying the aquitard.

The shallow and deep aquifers are separated by an aquitard, which acts as a barrier to vertical groundwater flow between the aquifers. The aquitard is composed of both young (recent) alluvial deposits and older sediments described as transitional beds (Floyd and Snider Inc. et al., 2000). The alluvial deposits consist of “soft silt and clay soils” (Floyd and Snider Inc. et al., 2000). The transitional beds consist of “thinly bedded stiff to hard clay and silt with some fine sand and sand interbeds” (Floyd

and Snider Inc. et al., 2000). The top of the aquitard was reported to be at an elevation of approximately 4 to 8 feet below mean sea level (MSL) and was up to 40 feet thick beneath the southeast corner of the landfill site (Floyd and Snider Inc. et al., 2000). Further groundwater documentation is provided in Section 4.3 Water Resources.

4.1.3.3 North Parcel Group (Eclipse Mill, Drywall Site, Stuchell and Newland Properties)

Existing Conditions

The Eclipse Mill, Drywall site and Stuchell/Newland site topography is relatively flat, ranging from 1 to 3 percent, and slopes east toward the Snohomish River. However, some stockpiling of soil materials from offsite sources has occurred on the site over the past several years resulting in several larger soil piles on the site. Elevations range from approximately 14 to 20 feet above MSL.

Subsurface Conditions

Environmental investigations performed by Earth Consultants, Inc. (2001) found that 5½ to 16½ feet of fill covered the site at that time (prior to the recent placement of dirt from the freeway construction). Fill consisted of silt with varying amounts of sand and organics. Brick, concrete and wood were also found at varying depths across the site. Alluvial silts and clays were found beneath the fill and contained high concentrations of wood debris and organics.

Borings performed by URS, Inc. (2005) found that the upper 8 to 9 feet of the on-site soils are fill materials consisting of sand, silt, clay, gravel, wood and concrete. Alluvial deposits of sand with varying amounts of silt and clay were found beneath the fill materials at a depth of approximately 8 to 20 feet below ground surface. Borings specific to the 1.2-acre Newland portion of the site had similar subsurface conditions, but possessed more silt than clay in the alluvial deposits.

Groundwater

Groundwater elevations for the Eclipse area has been found at 6 to 8 feet below ground surface (prior to the I-5 construction soil stockpiling activities) It has also been found as shallow as 4 feet below ground surface near the edge of the Snohomish River (URS, Inc., 2005).

4.1.4 Potential Effects / Impacts of the Project

Major portions of the site are characterized by the City's Sensitive Areas Maps as having moderate to high potential for seismic hazards, liquefaction and landslides with medium to very high/severe hazards with regard to erosion. The relatively high groundwater table and native alluvial soils underlying the site make the property prone to these hazards.

4.1.4.1 Impacts Common to the "Action" Alternatives

Both Alternative 1 (Preferred Alternative) and Alternative 2 would include filling and grading activities with the construction of building foundations, access roads, public areas/right of ways, stormwater facilities, parking areas and new utility corridors (within proposed road alignment). The required amount of imported fill has been estimated by OliverMcMillan to be approximately 600,000 cy. The fill to be imported will be from a pre-tested site and non-contaminated source and specified to have construction and foundation support characteristics.

The potential impacts identified below would be addressed by site-specific geotechnical reports, recommendations for site development, design documents, and earthwork construction standards that will be developed in conjunction with the Preferred Alternative.

Seismic Hazards – Construction and Operation

The site's location on native alluvial deposits combined with the potential for shallow crustal earthquakes in the region and the CSZ increases the potential for seismically induced ground settlement from a major seismic event. The primary impacts may include settlement of buildings, hardscape, pavement areas and retaining walls, buckling or damage to roadways and utilities, and lateral movement and damage to bulkheads and embankments.

Liquefaction risk exists across the site because of the shallow depth to water table and soil type and density within 50 feet of the ground surface. Strong shaking should be anticipated across the project site. If not mitigated, portions of the site may be subject to settlement and possible lateral movement. Earthquake engineering practices designed to withstand seismic activity will need to be incorporated into any build alternative. The City's Design and Construction Standards and Specifications manual along with applicable International Building Codes will be referenced during the design phase of the proposed construction.

Erosion – Construction

Large portions of the site are characterized by the City's Sensitive Areas Maps as being medium to very high/severe erosion hazard areas because of the large quantities of fill placed in some areas. Construction activities could cause increases in erosion unless mitigated. Soil exposed during construction is vulnerable to erosion, especially during and after removal of ground cover or pavement areas, and demolition of buildings. The most immediate erosion threat from project construction will be sediment deposition into the adjoining wetlands and Bigelow Creek. Only a portion of the site is immediately adjacent to the Snohomish River and therefore the threat of sedimentation being discharged into the river from project construction is reduced by simple proportional exposure. In addition, the sites to be developed are relatively flat and the only slopes to be seriously concerned about are those that surround the development pads of the Simpson and landfill sites. These border areas are also protected by wetland and stream setbacks that will further reduce risk of erosion and sediment releases into critical areas.

On-site controls and City-approved best management practices (BMPs) will be necessary to minimize erosion and to control sediment discharge. A more detailed description of the proposed stormwater management system has been provided in Section 4.5 of this document.

Erosion – Operation

In general, erosion potential of site soils will be reduced after construction. Soils exposed and disturbed by construction would be paved, covered by structures or vegetated with landscaping. Hard-surfaced areas would not be subject to erosion, and the erosion potential of landscaped areas would be similar to or better than predevelopment conditions.

The primary risk of erosion after construction would be in areas where stormwater is concentrated and/or allowed to flow uncontrolled over erosion-prone areas. Stormwater from roof-top drains, parking lots and all impervious areas will need to be routed to stormwater control measures and treatment facilities and not be allowed to flow onto erosion hazard areas within or adjacent to the project site.

4.1.4.2 Permanent Effects

Permanent changes to the earth as a result of this Project will be on the order to complete landform transformation from open reclaimed lands following cleanup actions to commercial and residential development.

4.1.4.3 Impacts Common to the No-Action Alternative

As noted in Section 2.3, Project Alternatives, future development impacts of Alternative 3 (No-Action Alternative) would at a minimum be similar to Alternative 2 as described in Section 2.3.

- Therefore, impacts to the site under the no-action alternative would be similar to those impacts described above for the "action" alternatives.

4.1.5 Mitigation

The following mitigation impacts do not reflect site-specific investigations, but instead give general mitigation requirements based on known limitations for the on-site soils and the area's potential for seismic activity.

Seismic-Liquefaction Risk

Stone columns and/or pile foundations may be used to support structures at the Simpson Pad site and to mitigate damage to structures resulting soil liquefaction. (Stone columns involve the partial replacement of loose, liquefiable soils with a vertical column of compacted stone. A hollow tube driven in the ground to a desired depth and, as it is withdrawn crushed stone is fed in and compacted. The resulting column of dense stone penetrates loose, liquefiable soil and transfers loads into the underlying non-liquefiable soils. The column also creates a composite of higher density and shear strength than the native soil alone. It can also densify potentially liquefiable soils reducing susceptibility to liquefaction.) Preloading may be used to mitigate potential consolidation settlement at the Simpson Pad site, but preloading will not mitigate potential settlement resulting from soil liquefaction. Pile foundations will be needed to support heavy structures planned over the Landfill/Tire Fire and potentially the Eclipse Mill portion of the site. It is understood that construction and foundation work will comply with applicable International Building Codes (IBC) (see Figure 4.1-4, Areas to be Preloaded Prior to Obtaining Shoreline Permit).

Seismic Design Standards for Earthquakes

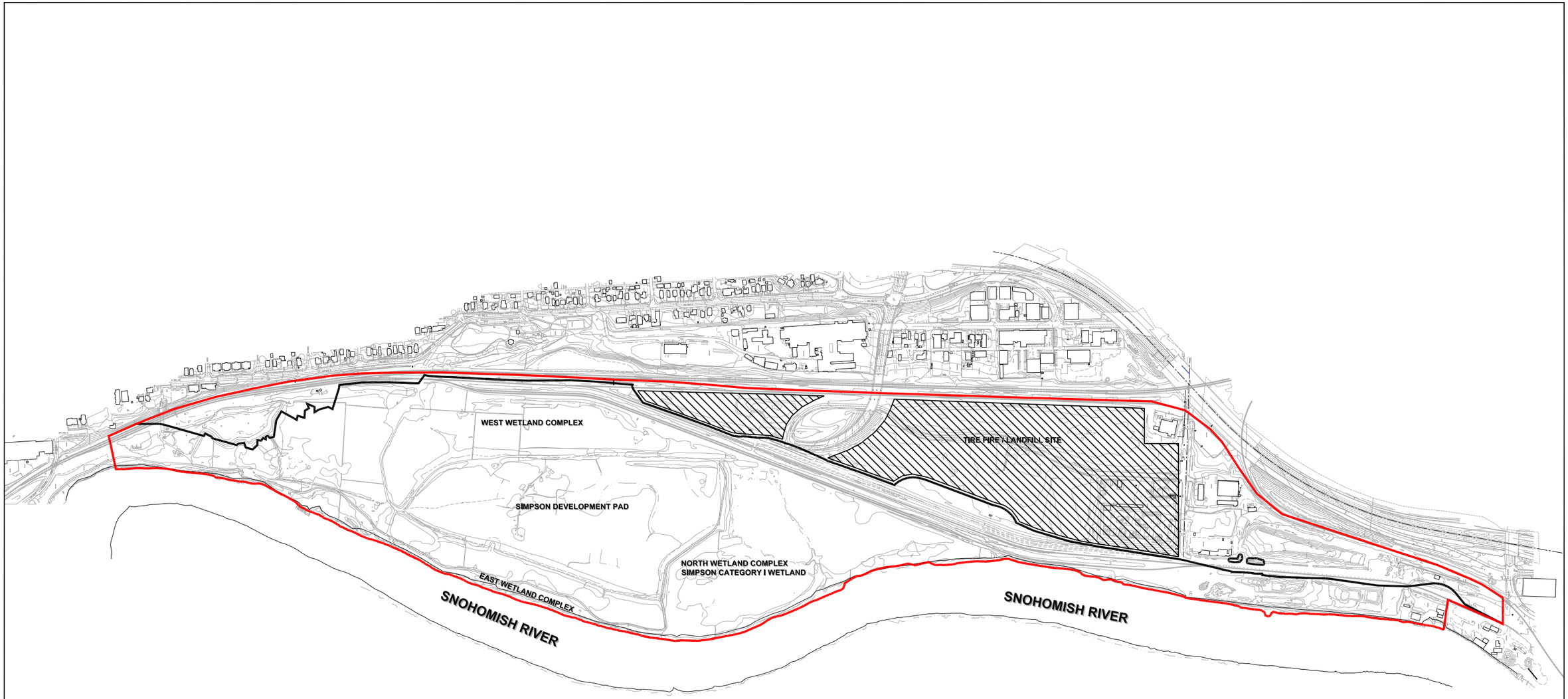
Design elements should be in accordance with the 2006 International Building Code (IBC) (which is the standard used by the City of Everett). The project site is classified as Site Class F for determining seismic requirements in IBC. This designation is required because of the moderate to high liquefaction potential of the native soils during a design earthquake event. However, for structures with a natural period of less than 0.5 seconds, the IBC allows the designation of Site Class E. If ground improvement, such as "stone columns", is used to mitigate the liquefaction hazard at the Simpson Pad site or if pile foundations are used to support buildings on the Landfill/Tire Fire site (see below), then the IBC 2006 Site Class should change to D and E, respectively.

Settlement

In addition to mitigating seismically induced settlement at the site, settlement resulting from consolidation of soft and compressible materials will also need to be evaluated and mitigated, if needed during the development phase. Preloading can be implemented to reduce the effects of short-term and long-term settlement at the site. Preloading can be used to mitigate settlement of the refuse materials at the landfill site and to mitigate settlement of soft native soils including peat, silt and organic silt. Pile foundations and stone columns may also be used in areas of concern and where preloading may not alleviate settlement concerns. Preloading will not mitigate the site for potential soil liquefaction.

Erosion

To mitigate potential erosion impacts and loss of soil resources (see figures 4.1-5 and 4.1-6, Existing Site Topography), a site-specific stormwater plan should be developed according to the EMC Chapter 14.28 Surface and Storm Drainage, and Washington State Department of Ecology (Ecology) requirements.



Notes:
1. The locations of all features shown are approximate.
2. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. can not guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.

Reference: Base drawing provided by Perteet, Inc.

Legend

- Site Boundary
- Approximate Areas to be Preloaded
- Shoreline and Shoreland Jurisdiction Line

W S N E

370 0 370
Feet

Areas to be Preloaded Prior to Obtaining Shoreline Permit

Everett Riverfront Redevelopment
Everett, Washington

GEOENGINEERS

Figure 4.1-4

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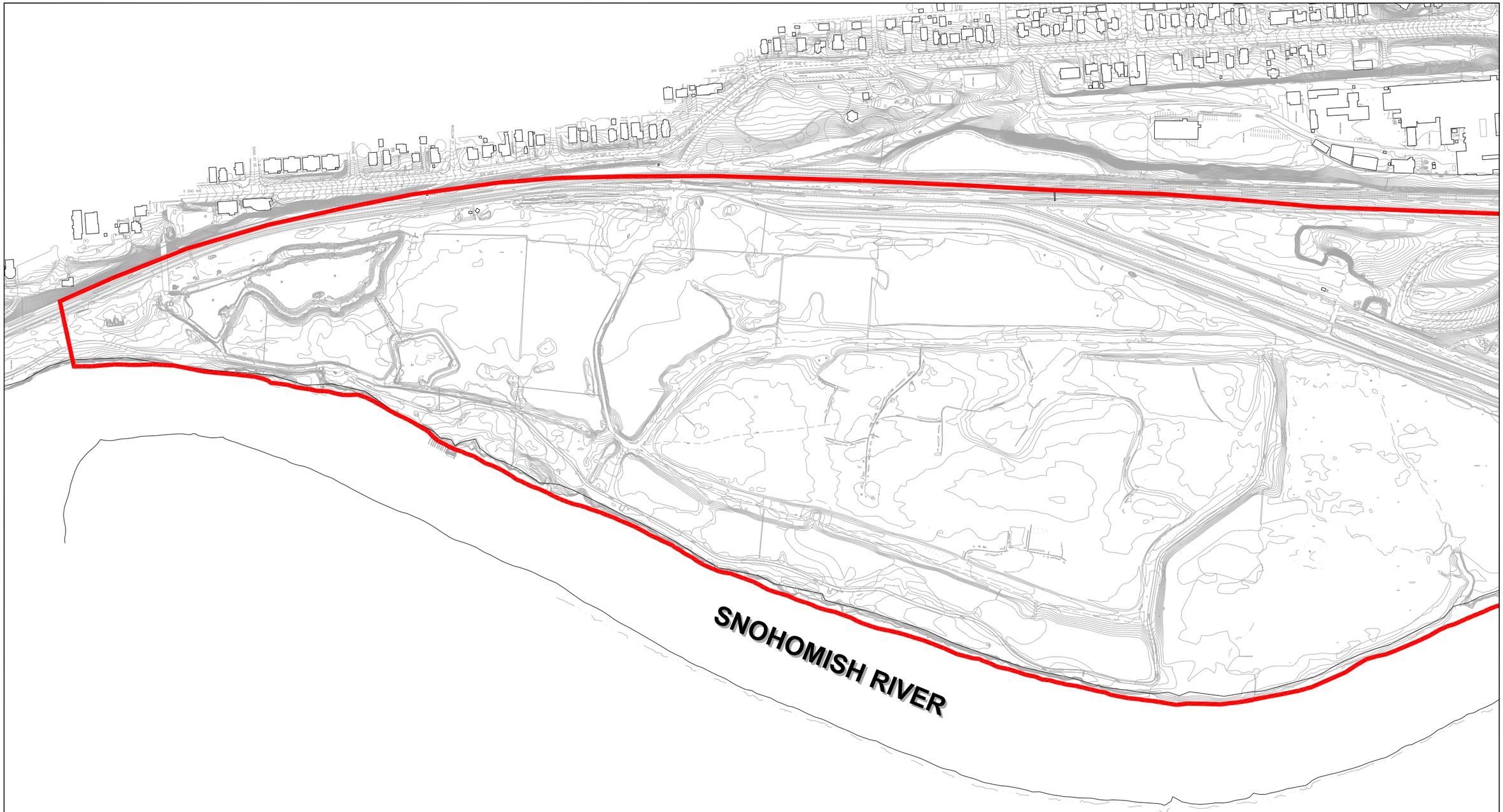

Legend

Site Boundary

Notes:
1. The locations of all features shown are approximate.
2. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. can not guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.

Reference: Base drawing provided by Perteet, Inc.

180 0 180
Feet

Existing Site Topography - South

Everett Riverfront Redevelopment
Everett, Washington

GeoEngineers

Figure 4.1-5

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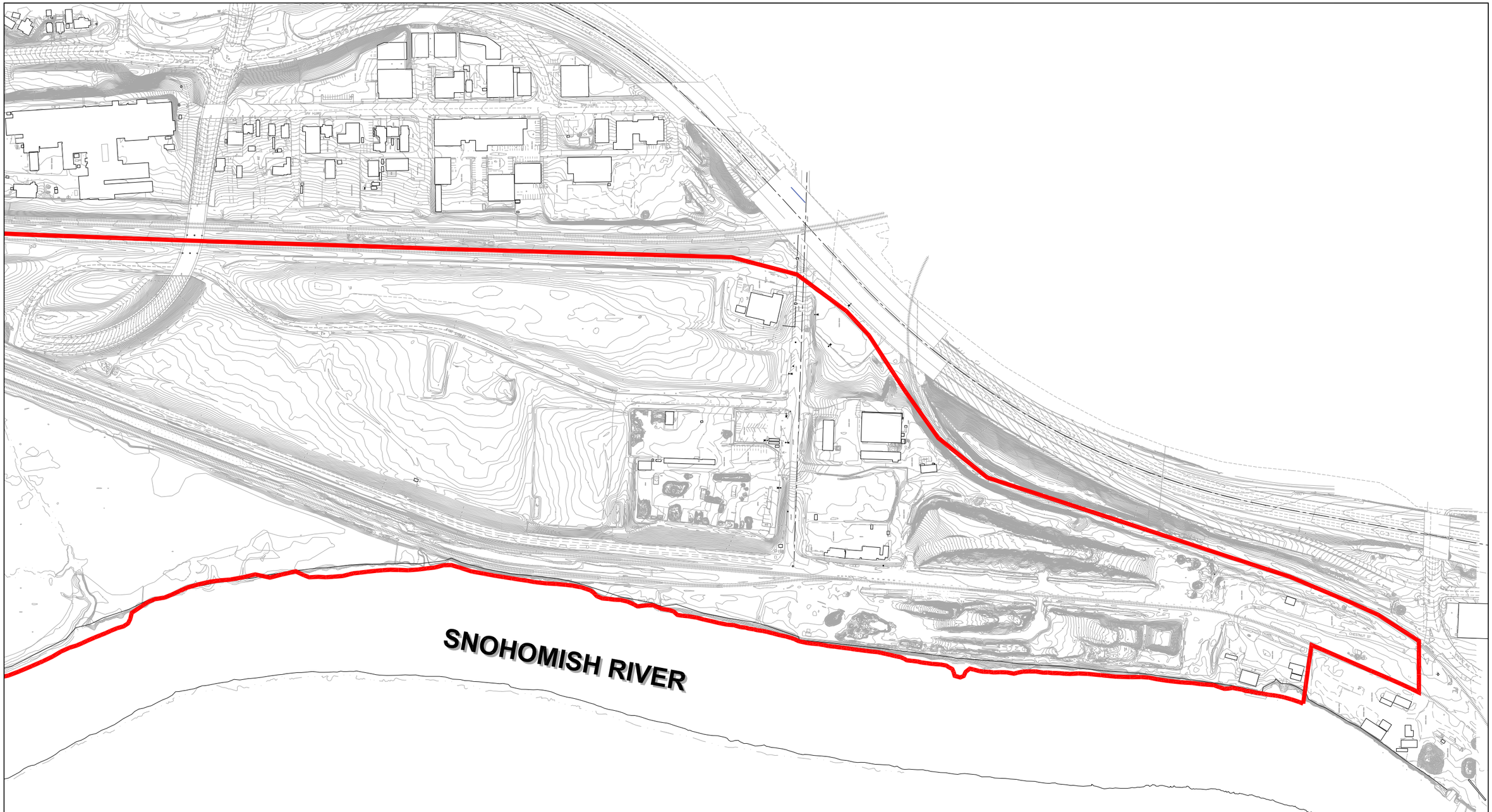

Legend

Site Boundary

Notes:
1. The locations of all features shown are approximate.
2. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. can not guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.

Reference: Base drawing provided by Perteet, Inc.

W S N E

180 0 180
Feet

Existing Site Topography - North

Everett Riverfront Redevelopment
Everett, Washington

GEOENGINEERS

Figure 4.1-6

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The stormwater plan should incorporate the following basic strategies and elements:

- Schedule/coordinate grading and construction activities to minimize soil exposure;
- Rapidly vegetate and/or mulch denuded areas;
- Keep runoff velocities low;
- Intercept and direct surface water to a stabilized discharge outlet;
- Prepare drainage and outlets to accommodate concentrated or increased runoff;
- Trap sediment on-site utilizing BMPs including: interceptor swales, straw bale barriers; silt fences, straw mulch among other methods;
- Inspect and maintain control measures frequently; and
- Locate stormwater retention and convenience systems downgradient from areas believed to have previous soil/groundwater contamination to prevent "soaking" of potentially hazardous or mobile soils.
- Maintain and protect critical areas buffers. If possible, perform critical areas and buffer enhancements prior to upland construction to establish vegetation and stabilize slopes more completely.

BMPs and erosion control measures will be specifically designed to address the individual causes and sources of erosion and sedimentation. The stormwater plan should include primary and secondary control measures to prevent over-reliance on a single design feature to control erosion and sedimentation. Monitoring and maintenance should be conducted on a regular basis and after all large storm events by qualified personnel. Provisions for modifications to the erosion control system, based on monitoring and maintenance observations should be included in the stormwater plan.

Post construction landscaping can be added to increase infiltration, increase retention times, and reduce stormwater runoff. Vegetated swales, vegetated infiltration basins and other BMPs utilizing plant materials can be included in the stormwater control plan.

Section 5.7, Environmental Health and Hazardous Materials provides additional details pertaining to soil and groundwater contamination and potential mitigation options.

4.2 AIR QUALITY

This section describes the air quality impact and mitigation analysis for the construction and operation of the proposed project. It includes discussion of applicable air quality rules and regulations, existing conditions on the project site, potential impacts of the alternatives, site suitability and potential mitigation measures related to construction. Potential odor issues are also addressed.

4.2.1 Methodology

The air pollutant of major concern with the transportation components of such projects is carbon monoxide (CO). Of the various vehicular emissions that are regulated, CO is the pollutant emitted in the largest quantity. Therefore, the implications of traffic related to the project were examined using two standard computerized tools to conduct CO "hot-spot" modeling. Existing (2007) and future (2030) predicted traffic conditions with and without the project were used to estimate worst-case CO concentrations near project-affected intersections.

Peak-hour pollutant emission rates were computed using the latest U.S. Environmental Protection Agency (EPA) vehicle emissions factor model, Mobile6.2, and then incorporated into the EPA CAL3QHC dispersion model. Mobile6.2 calculates average carbon monoxide emission factors based on a wide array of vehicle classes, basic emission rates, driving patterns, separation of start and running emissions, improved correction factors and fleet composition. For this analysis, the Puget Sound Regional Council (PSRC) provided Geomatrix with emissions factors calculated using Mobile6.2, using input parameters consistent with those used in the development of the latest Washington State Implementation Plan (SIP) for CO (PSRC 2007).

Geomatrix used the CAL3QHC dispersion model (version 2) to calculate peak-hour CO concentrations near the most project-affected intersections (described below). CAL3QHC is designed to calculate pollutant concentrations caused by transportation sources. It considers "free-flow" and "queue" emissions (based on Mobile emission factors) together with intersection geometry, wind direction and other meteorological factors. The CAL3QHC model was configured to calculate CO concentrations under worst-case meteorological conditions. A background 1-hour CO concentration of 5.0 parts per million (ppm) was used to represent other urban and nearby freeway sources in the project area, which is likely a conservative assumption.

Consistent with EPA guidance, signalized intersections that would be affected by the proposed project were screened for possible dispersion modeling by reviewing the intersection level of service (LOS) analyses of p.m. peak traffic conditions in the project's existing (2007) and design (2030) years (EPA, 1992). The review examined the average delay per vehicle, the traffic volume and the cumulative peak-hour delay predicted at each of the intersections. Pacific Avenue and Broadway, 41st Street and Rucker Avenue, and 52nd Street and Broadway were identified as the three project-affected intersections with the greatest potential for air quality impacts. The LOS and delay of these intersections is presented in Table 4.2-2 in Section 4.2.3.3, below.

4.2.2 Existing Conditions/Affected Environment

Air quality is generally assessed in terms of whether concentrations of air pollutants are higher or lower than ambient air quality standards set to protect human health and welfare. Three agencies have jurisdiction over the ambient air quality in the proposed project area: the EPA, Ecology and the Puget Sound Clean Air Agency (PSCAA). These agencies establish regulations that govern both the concentrations of pollutants in the outdoor air and contaminant emissions from air pollution sources. Selected applicable local, state and federal ambient air quality standards are displayed in Table 4.2-1.

To measure existing air quality, Ecology and PSCAA maintain a network of monitoring stations throughout the Puget Sound region. Generally, these stations are placed where air quality problems may occur, and so they are usually in or near urban areas or close to specific large air pollution sources. Other stations in more remote areas indicate regional air pollution levels. Based on monitoring information collected over a period of years, the state (Ecology) and federal (EPA) agencies designate regions as being "attainment" or "nonattainment" areas for particular air pollutants. Attainment status is therefore a measure of whether air quality in an area complies with the National Ambient Air Quality Standard (NAAQS). Regions that were once designated nonattainment that have since attained the standard are considered "maintenance" areas. The project area is in maintenance areas for CO and ozone pollutants under the NAAQS.

Table 4.2-1. Ambient Air Quality Standards

Pollutant	National (EPA)		Washington	Local
	Primary	Secondary	Ecology	PSCAA
Inhalable Coarse Particulate Matter (PM10)				
Annual Average (µg/m^3)			50	54 [c]
24-Hour Average (µg/m^3)	150 [a, b]		150 [a]	154 [d]
Fine Particulate Matter (PM2.5)				
Annual Average (µg/m^3)	15 [e]	15 [e]		15 [c]
24-Hour Average (µg/m^3)	35 [f]			35 [g]
Carbon Monoxide (CO)				
8-Hour Average (ppm) [a]	9		9	9.4
1-Hour Average (ppm) [a]	35		35	35
Ozone (O_3)				
8-Hour Average (ppm)[h]	0.08	0.08		0.08
1-Hour Average (ppm)	(i)	(i)	0.12	(i)

Notes:
µg/m^3 = micrograms per cubic meter; **ppm** = parts per million; **blank cells** indicate no standard
All values not to be exceeded except as noted; all averages arithmetic except TSP annual geometric mean.
(a) Not to be exceeded more than once per year
(b) Particles <10 micrometers in size; federal annual PM10 standard revoked as of Sept. 21, 2006 (EPA 2006)
(c) The 3-year annual average of the daily concentrations must not exceed level
(d) The 3-year average of the 99th percentile (based on the number of samples taken) of the daily concentrations must not exceed level
(e) Attainment based on the 3-year average of the weighted annual mean PM2.5 concentrations from single or multiple community-oriented monitors not exceeding level
(f) Attainment based on the 3-year average of the 98th percentile of 24-hour concentrations at each population-oriented monitor within an area not exceeding level
(g) The federal 24-hour standard for PM2.5 was revised as of Sept. 21, 2006. The current PSCAA standard of 65 ppm is based on the previous federal standard but has been superseded by the new federal limits. Although PSCAA has not yet adopted the new federal standard, it must do so soon. To avoid confusion, only the prevailing federal standard is reported to represent the maximum level that PSCAA can adopt.
(h) Attainment based on 3-year average of the 4th highest daily maximum 8-hour ozone concentration at each monitoring location
(ji) Federal 1-hour ozone standard was revoked in all areas except 14 remaining nonattainment areas. The federal and the PSCAA 1-hour standard lapsed on June 15, 2005.
Source: Geomatrix Consultants, Inc. based on most recent local, state and federal rules.

Historically, several air quality monitoring stations in the City have documented air quality problems. However, with continuing reductions in vehicle emissions and other air pollution control requirements, air quality in the region has improved markedly, and none of the City's monitoring stations have measured a pollutant concentration exceeding the NAAQS since 1996. Because of the downward trend in the City's pollutant levels, all monitoring sites in the City were discontinued as of March 2003 (EPA 2007).

Typical air pollution sources in the project area include vehicular traffic, train locomotives, light industrial, commercial and retail businesses, and residential wood-burning devices. Each source type contributes to the pollutant concentrations in the project vicinity. For example, residential wood burning produces a variety of air contaminants, including large quantities of fine particulate matter (PM_{10} and $PM_{2.5}$) and CO. Pollutant emissions from diesel sources (such as locomotives) include $PM_{2.5}$ and a variety of toxic air pollutants. Non-diesel vehicle emissions are composed primarily of CO, but also include small amounts of sulfur dioxide (SO_2), toxic air pollutants, and both hydrocarbons and nitrogen oxides, which can transform to become ground-level ozone. Vehicles also emit PM_{10} and $PM_{2.5}$ directly in their exhaust and indirectly as a function of their tires raising dust on paved and unpaved roads, but the

amounts of particulate matter generated by individual vehicles are small compared with other sources (for example, a wood-burning stove).

4.2.3 Potential Effects / Impacts of the Project

4.2.3.1 Impacts Common to the "Action" Alternatives

The following sections describe the impacts common to Alternative 1 (the Preferred Alternative) and Alternative 2. Alternative 2 and the no-action alternative would have similar land use composition, and therefore, impacts related to Alternative 2 would likely to be similar to that of the no-action alternative. The alternatives are described in Section 2.3, Project Alternatives.

4.2.3.2 Impacts Related to Construction

Construction of either of the proposed "action" alternatives could result in temporary minor, localized impacts to air quality because of emissions from construction-related sources and activities. For example, dust from short-term construction activities such as excavation, grading, sloping and filling would contribute to ambient concentrations of suspended particulate matter

Demolition of any existing structures could require the removal and disposal of building materials that could contain asbestos. The demolition contractors would be required to comply with EPA and PSCAA regulations related to the safe removal and disposal of any asbestos-containing materials.

Construction would require use of heavy trucks and smaller equipment such as generators and compressors. The engines on such equipment would emit air pollutants that would slightly degrade local air quality, but these emissions and the resulting concentrations would be far outweighed by emissions from existing traffic around the project area. Nonetheless, emissions from such sources, and especially from diesel-fueled engines, are coming under increasing scrutiny because of their suspected risk to human health. Specific effects are unknown, but long-term exposure to excessive amounts of diesel emissions could represent a health risk, especially to sensitive individuals like the chronically ill, the old and the very young. Hence, although there is little or no danger of such emissions resulting in pollutant concentrations that would exceed an applicable ambient air quality standard, pollution control agencies are now urging that emissions from diesel equipment be minimized to the extent practicable in order to reduce potential health risks. In addition, construction equipment and material hauling can affect traffic flow in a project area.

Some phases of construction would cause odors detectable to some people in the area. This would be particularly true during excavation, grading, and foundation work that would disturb the on-site landfill cap and could require on-site temporary handling and storage of aged landfill materials. Paving operations using asphalt also would cause short-term odors. Odors from grading and paving operations would be short term and unlikely to cause impacts. But operations that disturb the landfill cap as well as the handling and temporary storage of old landfill waste could impact uses near the active areas of work.

There is a potential for dust to affect on-site residences during construction of the residential and commercial facilities if the residences are occupied before project construction is complete. Any impacts from construction or equipment emissions would be temporary and probably minor after implementation of reasonable methods to control dust emissions. However, construction-related dust or equipment emissions could represent a health risk to sensitive individuals like the chronically ill, the old and the very young.

4.2.3.3 Operational Impacts - Off-Site Traffic

Project-related traffic could affect operation of off-site transportation facilities and thereby increase pollutant concentrations beyond the project site. The air pollutant of major concern with transportation sources is CO. Because of the larger number of trips it would generate, the preferred Alternative 1 would cause greater increases in delays at project-affected intersections than either Alternative 2 or the no-action alternative.

Details of the analysis methods and the models used are included in Section 4.2.1, Methodology.

The intersections included in the air quality modeling analysis were selected by reviewing the projected p.m. peak-hour performance (the amount of delay) and the change in delay expected in 2030 with all alternatives. Based on these data, the three intersections that would be most affected by project-related traffic were selected for dispersion modeling. These intersections would be most affected by traffic volume changes because of the relative increase in total delay. As a result, they provide an indication of worst-case project-related impacts on air quality in the project vicinity. The selected intersections and data considered in this review are presented in Table 4.2-2.

Table 4.2-2. Modeled Intersection Level of Service and Delay (sec/veh)

Intersection	2007 Existing	2030	
		No Action & Alternative 2	Preferred (Alternative 1)
Pacific Avenue and Broadway	D / 53.8	F / 92.7	F / 99.7
41st Street and Rucker Avenue	E / 68.4	E / 63.5	E / 74.0
52nd Street and Broadway	E / 58.2	F / 152.1	F / 174.8

Notes:
Source: Parametrix 2007

4.2.3.4 Dispersion Modeling Results

The results of the CAL3QHC dispersion modeling analysis for existing and future traffic scenarios are presented in Table 4.2-3. As shown, calculated worst-case CO concentrations at the intersections most affected by the project are below the levels allowed by the applicable 35-ppm 1-hour or the 9-ppm 8-hour ambient air quality standards. Modeling indicates there would be no air quality problems with the existing conditions or the 2030 no-action or action alternatives. Although project-related traffic delays increase in 2030 over existing conditions, maximum predicted CO concentrations remain about the same or decrease slightly in 2030 because of vehicle emissions reduction measures implemented by federal and state regulatory requirements in future years. The specific modeling results are discussed further below.

Table 4.2-3. Maximum-Predicted CO Modeling Results (ppm)

Intersection	Existing		2030 No Action and Alternative 2		2030 Alternative 1	
	1-hr	8-hr	1-hr	8-hr	1-hr	8-hr
Pacific Avenue and Broadway	10	7	8.5	6	8.6	6.0
41st Street and Rucker Avenue	10.3	7.2	9.9	6.9	10.7	7.5
52nd Street and Broadway	8.1	5.7	7.5	5.3	7.6	5.3

Notes:
Predicted CO modeling results include an assumed background concentration of 5.0 ppm to account for other emission sources in the area. This is likely a very conservative assumption.
In accordance with EPA guidelines, 8-hr concentrations were calculated using a 0.7 "persistence factor" to account for changes in concentrations that would occur due to fluctuations in traffic and meteorological conditions over an 8-hour period.
Source: Geomatrix Consultants, Inc.

4.2.3.5 2007 Existing Conditions

At model receptor locations near the project-affected intersections, maximum predicted CO concentrations under worst-case modeling conditions are less than 30 percent of the 1-hour 35 ppm NAAQS. The highest calculated maximum 8-hour concentration reaches 7.2 ppm, less than the standard of 9 ppm. This finding indicates that under worst-case meteorological conditions, existing peak period traffic is not likely to produce elevated CO levels near the most congested intersections in the project vicinity.

4.2.3.6 2030 Alternatives

Alternative 1
Similar to Alternative 2 and the no-action alternative, maximum predicted CO concentrations generally decrease from the existing conditions. Although traffic volumes are expected to increase in future years, CO levels are reduced by lower vehicle emission rates. Comparing Alternative 1 with Alternative 2 and the no-action alternative, the maximum calculated 1-hour CO concentrations with Alternative 1 increases over the other alternatives by 0.8 ppm at the 41st Street and Rucker Avenue intersection. However, maximum CO concentrations remain well below the ambient air quality standards.

The analysis indicates that under worst-case traffic and meteorological conditions, the maximum-predicted CO levels are likely to remain far below the 1-hour and 8-hour ambient air quality standards. Therefore, project-related traffic would not be expected to affect air quality under any of the potential future actions considered.

Alternative 2 and the No-Action Alternative
Increasingly stringent federal emission reduction requirements reduce Mobile6.2 vehicle emission rates in future years, offsetting expected increases in traffic volumes and congestion by the year 2030. As a result, maximum calculated CO concentrations with the Alternative 2 and the no-action alternative are less than the existing model-predicted CO concentrations and do not exceed the ambient air quality standards.

4.2.3.7 Other Operational Impacts

The proposed mixed-use development is intended to provide a walking path along the waterfront, retail and business space, and restaurants for site visitors as well as on-site residences. These land uses, while incorporated into distinct districts, are likely to interact and overlap into each other, and thereby create potential land use conflicts.

Potential air quality impacts from these neighboring on-site activities would be limited by ambient air quality standards and air quality nuisance rules (such as odor). These rules are intended to protect sensitive individuals from unhealthy pollutant concentrations in ambient (outdoor) air. Therefore, any potential impact from a regulated source would be subject to rules limiting pollutant emissions to minimize potentially unhealthy air quality concentrations to the nearest neighboring land uses. With that said, the potential for impacts perceived as annoying (as opposed to unhealthy) could still exist from some sources and activities despite meeting applicable air quality rules. For example, even small amounts of fugitive dust or odors from restaurant ventilation can be perceived as an annoyance

It is also possible that naturally-occurring odors resulting from the wetland and riverfront environment could affect sensitive users in residential areas. These types of exposures could be considered problematic by some future users, so the potential for this type of conflict could be minimized by disclosing the possibility for such emissions and odors to those seeking residence who may be unfamiliar with the environment.

4.2.4 Impacts Common to the No-Action Alternative

Redevelopment of the riverfront properties has been outlined in the City's existing Comprehensive Plan. The Comprehensive Plan is meant to guide the growth of the City through 2025. The no-action alternative would delay redevelopment of the riverfront area until such time that the City has identified another future user or users. The 2030 no-action alternative, therefore, assumes that the property would be developed primarily for office and commercial use, similar to Alternative 2.

- Therefore, project-related impacts under the no-action alternative would be similar to those impacts described above for the "action" alternatives. Under the no-action alternative, issues related to mixed-use developments, such as odors affecting on-site residents, would not be a concern. Although there may be no on-site residents, care should be taken during construction and operation to minimize impacts to neighboring residences, especially those on the south end, closest to the project site.

4.2.5 Mitigation

4.2.5.1 Construction Impact Mitigation

Although air quality impacts related to construction are not anticipated, the construction contractor or contractors would be required to comply with all relevant federal, state and local air quality laws and would be required to prepare a plan for minimizing dust and odors sufficiently to comply with PSCAA Regulation I, Sections 9.11 and 9.15. The Associated General Contractors of Washington's Guide to Handling Fugitive Dust from Construction Projects provides practical examples of suggested best management practices necessary to comply with air quality regulations involved in the construction process. The following is a list of possible mitigation measures specified in the guide that could be implemented to reduce potential temporary air quality impacts during construction of the project.

- In general, construction activities that comply with applicable rules and regulations would not be expected to affect air quality under either of the "action" alternatives.
- Use only equipment and trucks that are maintained in optimal operational condition.
- Require all off-road equipment to be retrofitted with emission reduction equipment (that is, require participation in Puget Sound region diesel solutions by project sponsors and contractors).
- Minimize on-site diesel engine idling and locate any idling trucks as far as possible from nearby residences.
- Use biodiesel or other lower emission fuels for vehicles and equipment.
- Use carpooling or other trip-reduction strategies for construction workers.
- Stage construction to minimize overall transportation system congestion and delays to reduce regional emissions of pollutants during construction.
- Implement construction curbs on hot days when the region is at risk for exceeding the ozone NAAQS, and work at night instead.
- Locate construction equipment and construction staging zones as far away as possible from sensitive receptors such as fresh air intakes to buildings, air conditioners and sensitive populations such as the elderly and the young.
- Spray exposed soil with water or other suppressant to reduce emissions of PM10 and deposition of particulate matter.
- Pave or use gravel on staging areas and roads that would be exposed for long periods.
- Cover all trucks transporting materials, wet materials in trucks, or provide adequate freeboard (space from the top of the material to the top of the truck bed), to reduce PM10 emissions and deposition during transport.
- Provide wheel washers to remove particulate matter that would otherwise be carried off-site by vehicles to decrease deposition of particulate matter on area roadways.
- Remove particulate matter deposited on paved, public roads, sidewalks and bicycle and pedestrian paths to reduce mud and dust; sweep and wash streets frequently to reduce emissions.
- Cover dirt, gravel and debris piles as needed to reduce dust and wind-blown debris.
- Communication with residential and other sensitive users during construction and implementation of a construction management plan could prevent or minimize the potential for health risk to sensitive individuals.

4.2.5.2 Odor Impacts Mitigation

Work on the landfill that exposes buried landfill waste has the potential to generate odors that may be perceptible at neighboring properties. The Department of Ecology Consent Decree and Cleanup Action Plan specify that during Site construction activities dust and odor controls are required to prevent migration of materials at levels of concern outside the construction zone. These measures will include daily cover of any exposed waste and could include localized wetting, application of suppressant foams or use of temporary cover materials to manage generation of odors.

4.2.5.3 Operational Impacts Mitigation

The air quality impact analysis indicates that the proposed project alternatives would not be anticipated to result in adverse air quality impacts in the study area resulting from off-site traffic. Consequently, no operational impact mitigation measures are warranted or proposed for project-related traffic.

4.2.5.4 Unavoidable Adverse Impacts

No significant unavoidable adverse air quality impacts have been identified related to the proposed project alternatives.

4.3 WATER RESOURCES – SURFACE WATER AND CHANNEL MIGRATION

The proposal includes alterations to existing site topography through various cut and fill activities. These changes in turn may cause variations in existing surface water and groundwater flow and conditions. This section summarizes the existing site conditions related to potential groundwater and surface water impacts associated with the proposed alternatives. The groundwater discussion focuses on existing groundwater conditions and quality, and the surface water sections discuss the potential impacts that the alternatives may have on the flooding and channel migration characteristics of the adjacent water bodies: Bigelow Creek and the Snohomish River. Note that stream and wetland habitats are addressed in Section 4.5 Plant and Animal Resources.

4.3.1 Methodology

Information for on-site groundwater conditions was collected and evaluated from published agency data and previously completed environmental and geotechnical reports. Groundwater is also addressed in Section 5.7, Environmental Health and Hazardous Materials.

Data for surface water analysis were collected from a variety of sources, including the United States Geological Survey (USGS), the US Army Corps of Engineers (Corps), Snohomish County, the National Oceanic and Atmospheric Administration (NOAA) and multiple consultant reports. A flood hazard and channel migration zone analysis was completed for the site by GeoEngineers (see Appendix C, *Revised Flood Hazard Analysis, Channel Migration Potential, and Slope Stability Evaluation Report* dated February 26, 2007). This document is the primary source for the findings presented here related to surface water impacts.

4.3.2 Existing Conditions/Affected Environment

4.3.2.1 Surface Water

Regional Setting

The Snohomish River Basin, encompassing 1,856 square miles, is the second largest river basin draining to the Puget Sound. The basin is drained by three major rivers: the Skykomish, the Snoqualmie and the Snohomish. The Snohomish River flows through broad lowland glaciated valleys, entering Possession Sound near Everett. The upper portion of the Snohomish River Basin encompasses the mountainous river systems of the Western Cascades (Snohomish Basin Salmonid Recovery Technical Committee, 1999). This subbasin provides significant sediment production, and the river's gradient is generally high. The lower portion of the Snohomish River basin, of which the project site is a part, encompasses wetlands, sloughs, delta and forested transition zone (Snohomish Basin Salmonid Recovery Technical Committee, 1999). The Snohomish River Estuary has been heavily influenced by farming and levees.

The Snohomish River delta is drained by numerous drainage channels and freshwater tributary creeks that join with the mainstem Snohomish River and sloughs. This section of the Snohomish River has a relatively low gradient and typically develops a channel bottom composed of fine sands and silts (Water Resource Inventory Area [WRIA] 7).

Local Setting

The project site is located approximately between River Mile 5 and 6.77 in the Snohomish River Estuary within the broader Snohomish River delta. The project site is bounded to the west by erosion-resistant uplands and by the Snohomish River to the east. Although the Snohomish River at this site is dominated by riverine processes, the elevation of flows in the river are influenced by tides; the diurnal tidal fluctuation (difference in mean higher high and mean lower low tide levels) measured in Everett (Station 9447659) is about 11 feet (NOAA, 2007).

Hydrology

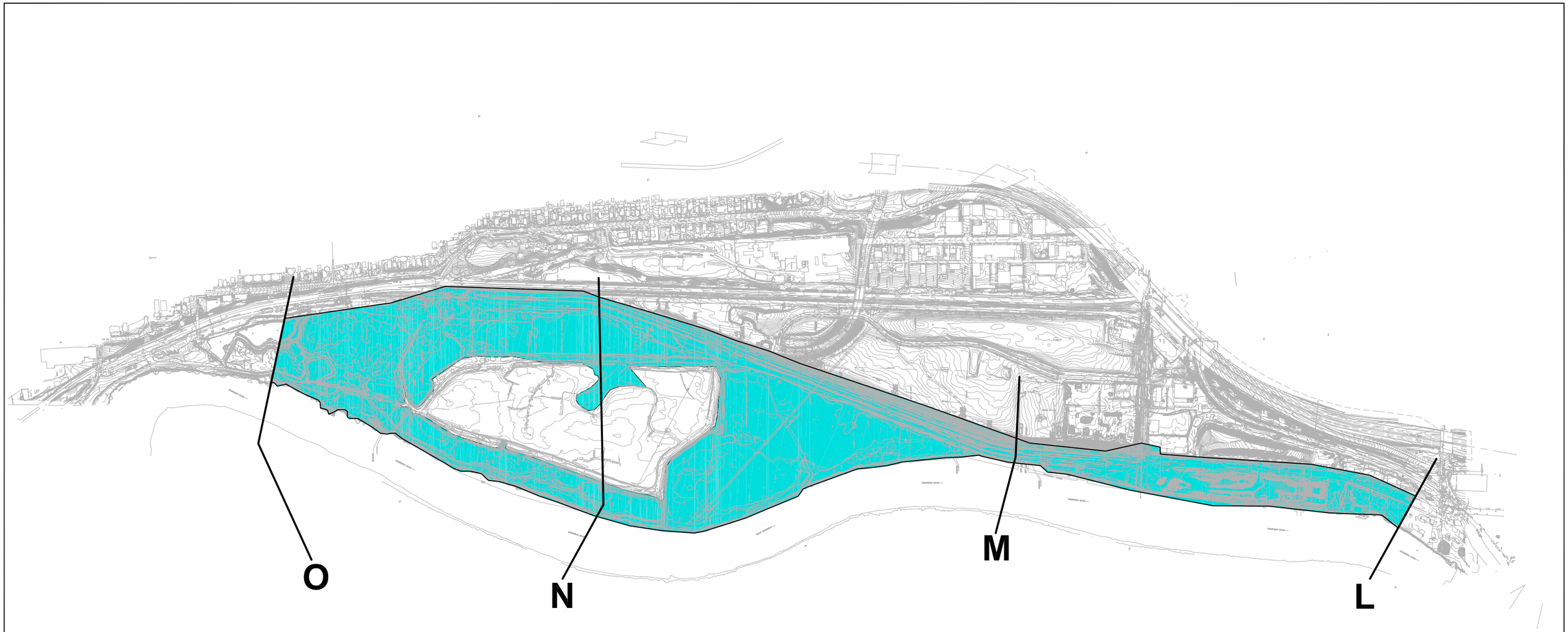
The Snohomish River at the confluence of the Snoqualmie and Skykomish Rivers has an average runoff of 6,973,000 acre-feet per year (afy) and an average discharge of 9,625 cubic feet per second (cfs). The extremes recorded for the period of record (water years 1964-1998) are a maximum of 150,000 cfs on November 25, 1990, and a low of 763 cfs on October 30, 1987 (USGS gauge # 12150800). The mean annual hydrograph of the Snohomish River is characterized by a dual peak; one occurs during late autumn or early winter, driven by autumn rains and rain-on-snow events, and the other is in late spring or early summer, driven primarily by snowmelt in the upper watershed. Low flows occur in late summer through early autumn.

Water Surface Elevations

GeoEngineers evaluated flood surface elevations across the site for the "existing conditions" scenario. A UNET hydraulic model was developed by West Consultants for Snohomish County as part of a 2001 Flood Insurance Study of the Snohomish River for the Federal Emergency Management Agency (FEMA). UNET Version 3.2 is an open channel hydraulic model that provides time histories of stage, flow, velocity, and other hydraulic variables at specified cross section locations along the river. Output for all cross sections in the vicinity of the proposed development was evaluated. The site runs adjacent to cross sections L, M, N, and O, as shown in Figures 4.3-1, Estimated 100-Year Flood Extent, and 4.3-2, Estimated 500-Year Flood Extent.

The base flood elevations (BFE's) for the 10-, 50-, 100-, and 500-year floods predicted by the model have been adopted by FEMA. Local jurisdictions are required to update their regulations to include the most recently adopted floodway and floodway fringe if they elect to participate in the federal flood insurance program.

The elevations used for the UNET model are generated in vertical datum NGVD 29. The FEMA floodway maps also present flood elevations in vertical datum NGVD 29. Some current topographic data is provided in a more current vertical datum, NAVD 88. To avoid confusion over the differing datum, flood elevation data is presented in both NAVD 88 and NDGVD 29. In addition, a brief summary of vertical datum for the Everett region is provided below. To apply the flood elevation data to ground topography, both sets of data must be in the same vertical datum, otherwise there could be an error of 3.7 feet, which is the local difference between the datum.



Notes:

1. The locations of all features shown are approximate.
2. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. can not guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.
3. Actual flood extents on the Simpson Pad and areas in the west wetland complex are based on culvert flow, and dependent on both duration and stage of flows in the Snohomish River. Estimated flood extent is extrapolated from modeled water elevations in the Snohomish River and no culvert flow was determined.

Reference: Base survey layer obtained from Pertect, Inc.

Legend:

Estimated 100-Year Flood Extent

O — FEMA Flood Insurance Study Cross Sections

W S N E

800 0 800
FEET

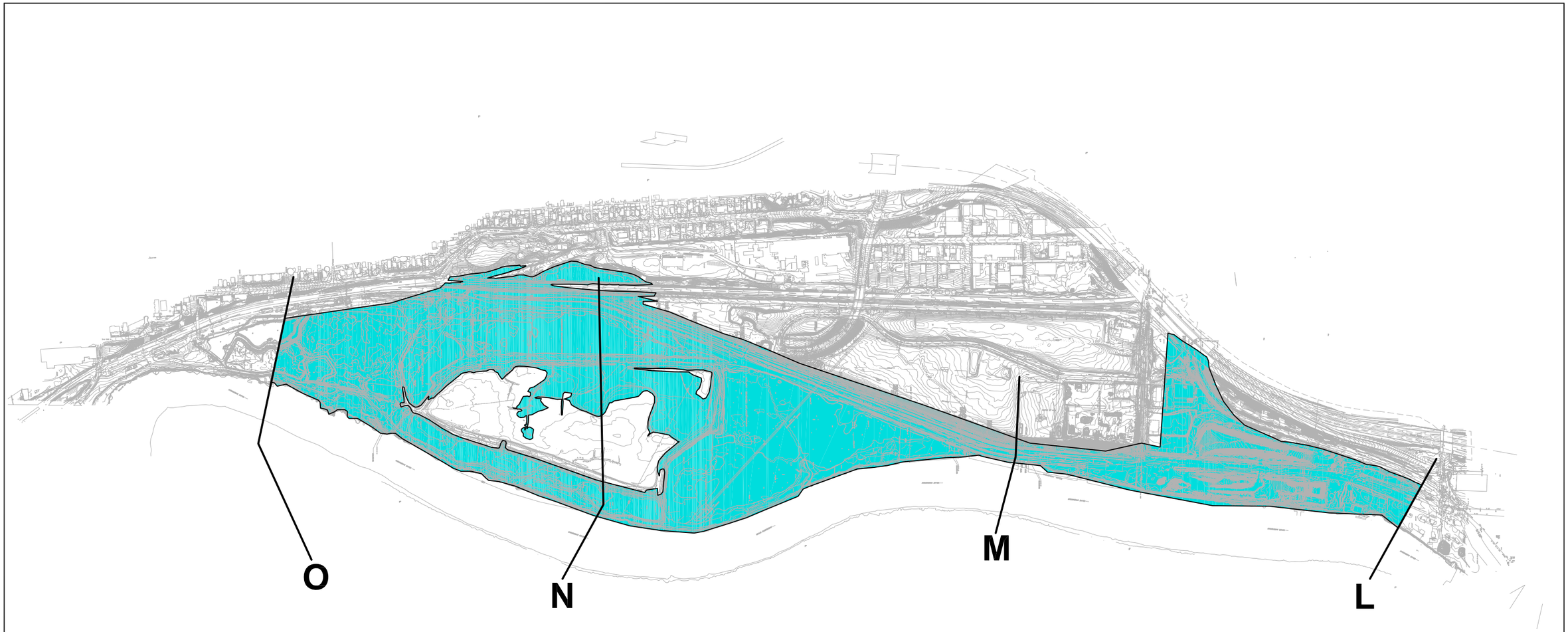
Estimated 100-Year Flood Extent

Everett Riverfront Redevelopment Project
Landfill Site
Everett, Washington

GEOENGINEERS

4.3-1

W:\REDMOND\PROJECTS\1619\002\03\CAD\FLOOD FIGURE.DWG\TAB:4.3-1 MODIFIED BY GGLADDEN ON NOV 16, 2007 - 11:27



Notes:

1. The locations of all features shown are approximate.
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3. Actual flood extents on the Simpson Pad and areas in the west wetland complex are based on culvert flow, and dependent on both duration and stage of flows in the Snohomish River. Estimated flood extent is extrapolated from modeled water elevations in the Snohomish River and no culvert flow was determined.

Reference: Base survey layer obtained from Pertect, Inc.

Legend:

Estimated 500-Year Flood Extent

O — FEMA Flood Insurance Study Cross Sections

800 0 800
FEET

Estimated 500-Year Flood Extent

Everett Riverfront Redevelopment Project
Landfill Site
Everett, Washington

GeoEngineers

4.3-2

W:\Redmond\Projects\6\6\9\002\03\CAD\FLOOD FIGURE.dwg\TAB:4.3-2 modified by ggladden on Nov 16, 2007 - 11:27

Vertical Datum

Mean Sea Level (MSL) is a tidal datum determined over a 19-year National Tidal Datum Epoch. It pertains to local mean sea level and should not be confused with the fixed datums of North American Vertical Datum of 1988 (NAVD 88). NGVD 29 and NAVD 88 are fixed geodetic datums whose elevation relationships to local MSL and other tidal datums may not be consistent from one location to another.

NGVD 29 is a fixed datum adopted as a national standard geodetic reference for heights but is now considered superseded. NGVD 29 is sometimes referred to as Sea Level Datum of 1929 or as Mean Sea Level on some early issues of Geological Survey Topographic Quads. NGVD 29 was originally derived from a general adjustment of the first-order leveling networks of the U.S. and Canada after holding mean sea level observed at 26 long term tide stations as fixed. Numerous local and wide-spread adjustments have been made since establishment in 1929. Bench mark elevations relative to NGVD 29 are available from the National Geodetic Survey (NGS) data base via the World Wide Web at National Geodetic Survey.

NAVD 88 is a fixed datum derived from a simultaneous, least squares, minimum constraint adjustment of Canadian/Mexican/United States leveling observations. Local mean sea level observed at Father Point/Rimouski, Canada was held fixed as the single initial constraint. NAVD 88 replaces NGVD 29 as the national standard geodetic reference for heights. Bench mark elevations relative to NAVD 88 are available from NGS through the World Wide Web at National Geodetic Survey.

Table 4.3-1 below shows conversion between the three vertical datum for Everett. For Everett, NAVD 88 is 3.68 feet higher than NGVD 29.

Table 4.3-1. Tidal Datum Regions, Whidbey Island Region 99 – Everett, Washington Relation Between Various Datum Planes

Datum Plane	MLLW	NGVD 29	NAVD88
Highest Estimated Tide	14.50 +/- 0.5	8.6	12.28
Mean Higher High Water	11.11	5.18	8.86
Mean High Water	10.25	4.32	8.00
Mean (Half) Tide Level	6.52	0.59	4.27
NGVD	5.93	0.00	3.68
Mean Low Water	2.80	-3.13	0.55
Mean Lower Low Water	0.00	-5.93	-2.25

Notes:
US Army Corps of Engineers http://www.nwd-wc.usace.army.mil/nws/hh/tides/

It is important to note that for tidally influenced river systems, FEMA normally requires that the boundary conditions assume a fixed downstream stage equal to mean higher high water (MHHW) plus 1 foot. The Seattle District Corps of Engineers conducted a tidal surge analysis, and established tidal surge elevations at the mouth of the Snohomish River for the 10-, 50-, 100- and 500-year events. These tidal elevations, shown in Table 4.3-2, Tidal Elevations at Everett, Washington, superseded any lower water surface elevations simulated in the UNET model and were used as the downstream boundary conditions for the water surface predictions.

Table 4.3-2. Tidal Elevations at Everett, Washington

Flood Interval	Tidal Elevation (NGVD 29)
500-year	8.7
100-year	8.4
50-year	8.2
10-year	7.8
MHHW	5.2

The significance of the assumed boundary conditions is the conservatism in the water surface elevation predictions. The modeling method assumes that the highest river flows coincide with the highest tidal elevations. This provides a clear factor of safety for planning purposes and for a flood insurance study; however, from a process-based perspective there is no reason to assume that peak flows will occur simultaneously with high tides.

Cross sections for the UNET model were provided by Snohomish County, from an FEQ model of the system. This data was supplemented with data from the US Army Corps, Washington Department of Transportation, Burlington Northern Santa Fe Railroad, and various additional surveys throughout the study area. The cross sections that correspond to the project reach are L, M, N, and O. The locations of these sections are shown in Figures 4.3-1 and 4.3-2. Data output for these cross sections are shown in Tables 4.3-3 through 4.3-6.

The UNET model assumes conditions are constant from one cross section to the next cross section downstream. This means that water surfaces calculated for cross section O, for example, are considered valid from O through N; and data from cross section N is considered valid through M, and so on. Hydraulic models such as UNET require a calibration process to determine that water surface predictions are consistent with field observations. The intent of this report is not to document the calibration process that was completed; however, it should be noted that the model was calibrated to both bankfull and high flow conditions. GeoEngineers review of the calibration process completed by West Consultants for the UNET provides a high degree of confidence in the results. Results of the UNET model demonstrate that the river at this location is dominated by riverine rather than tidal processes. Although tidal influence does extend upstream through the project reach, the impact of tidal processes on channel morphology and hydrology is not as great as the impact of riverine processes. This means the river in this reach is subject to moderately high energy flooding events, velocities, and shear stresses, as presented in Tables 4.3-3 through 4.3-6.

The data presented in Tables 4.3-3 through 4.3-6 presents hydraulic model output from the FEMA study completed for the Snohomish River. West Consultants completed the model for the FEMA study and provided select data to GeoEngineers for inclusion in this report. The FEMA cross section identifies which cross section adjacent to the project site that data has been generated for. These cross sections match the designations in the FEMA study. It is important to note here that the results of this study are not intended to define the FEMA floodway, but are used to define the flood hazard along the proposed Everett Riverfront development. The purpose of this study is to demonstrate the extent of inundation the site can expect with the 100 and 500 year flood events, under existing topographic conditions. It was assumed that the flood control levees along the Snohomish River through the reach will remain intact during flood events.

Stage refers to the maximum water surface elevation for the given flood event, provided in both NAVD 88 and NGVD 29. Total flow is the streamflow volume (in cubic feet per second) in the Snohomish River calculated for each given flood recurrence interval. Channel velocity is the average, modeled channel velocity through each cross section under each flood event. Shear stress is a function of velocity and depth and is a measure of the erosive force acting on the channel boundary through a cross section. The values in the tables represent the maximum shear over the channel boundary at a cross section. Typically, 1 lb/ft^2 is a good indication of the threshold between soft engineering and hard structures to withstand forces acting on a stream bank. Maximum shear stress values calculated for the 100-year and 500-year floods demonstrate that this reach of river is fairly low energy, with little erosive potential applied to the streambed or stream banks. Essentially, this can be interpreted as a measure of high channel stability through the reach.

Table 4.3-3. Results for 10-Year Flow

FEMA Cross Section	River Mile	Stage NGVD 29	Stage NAVD 88	Total Flow (cubic feet/second)	Channel Velocity (ft/s)	Max Shear (lb/ft^2)
L	5	10.23	13.91	58836	5.84	0.75
M	5.59	11.45	15.13	60743	5.39	0.63
N	6.25	12.49	16.17	60826	5.46	0.63
O	6.77	13.33	17.01	61250	6.82	0.93

Table 4.3-4. Results for 50-Year Flow

FEMA Cross Section	River Mile	Stage NGVD 29	Stage NAVD 88	Total Flow (cubic feet/second)	Channel Velocity (ft/s)	Max Shear (lb/ft^2)
L	5	10.86	14.54	65282	6.31	0.92
M	5.59	12.02	15.7	65583	5.67	0.89
N	6.25	13.15	16.83	65597	5.59	0.74
O	6.77	13.96	17.64	65686	6.96	1.09

Table 4.3-5. Results for 100-Year Flow

FEMA Cross Section	River Mile	Stage NGVD 29	Stage NAVD 88	Total Flow (cubic feet/second)	Channel Velocity (ft/s)	Max Shear (lb/ft^2)
L	5	10.94	14.62	66133	6.37	0.97
M	5.59	12.34	16.02	68538	5.84	1.02
N	6.25	13.52	17.2	68606	5.69	0.85
O	6.77	14.38	18.06	68944	7.04	1.22

Table 4.3-6. Results for 500-Year Flow

FEMA Cross Section	River Mile	Stage NGVD 29	Stage NAVD 88	Total Flow (cubic feet/second)	Channel Velocity (ft/s)	Max Shear (lb/ft^2)
L	5	13.01	16.69	84943	7.51	1.08
M	5.59	14.9	18.58	102272	7.75	1.19
N	6.25	16.68	20.36	110944	7.19	1.01
O	6.77	17.9	21.58	114624	8.85	1.47

Figure 4.3-1 presents the extent of predicted flooding across the site for the 100-year peak flow. The predicted water surface elevations for the 100-year flow at cross section M (roughly in the middle of the project reach) is 16.02 (NAVD 88). Floodwaters are expected to inundate portions of the North, East, and West wetland complexes surrounding the Simpson Pad. A small lobe along the Northwest of the Simpson pad is shown to flood; this area, along with the West wetland complex, receives flood waters via a culvert that passes flow from the Snohomish River near the Southeast corner of the pad. The Eclipse Mill site waterward of the BNSF rail prism also floods under the 100-year water surface elevation.

Figure 4.3-2 presents the predicted flood surface across the project area for a 500-year peak flow event. At cross section M, the 500-year flood elevation is estimated to be 18.58 feet (NAVD 88). Additional areas flooded under a 500-year event include a greater portion of the Simpson Pad, along with portions of the southern site to the west of the BNSF rail prism. The major area protected under the 100-year event but flooded under the 500-year event is the Eclipse Mill sites.

Proposed finish grades for the development are presented in Figures 4.1-1, 4.1-1A, and 4.1-1B of the Environmental Impact Statement. Figure 4.1-1 shows finish grades for the area near the East Wetland Complex and the Simpson Pad. The plan shows that the pad will be raised to elevations above the 500-year water surface. Figure 4.1-1B shows planned grades for the Eclipse Mill site. This area is shown to also have finish grades above the 500-year flood elevation. Significant improvements for flood protection under extreme events will result from the proposed finish grades throughout the development.

Floodplain Management

Floodplains[2] are managed in an integrated federal, state and local system. At the root of the system is the National Flood Insurance Program (NFIP) managed by the Federal Emergency Management Agency (FEMA). The NFIP is a system of risk assessment to establish rates for insurance premiums. The federal government is the insurer (with management contracted to a private entity that then works with other private insurers). Under the NFIP flood risk is quantified through maps (Flood Insurance Rate Maps-FIRM). State and local governments must have programs in place to establish FIRM maps in areas under

[2] 44 CFR 9.4 *Floodplain* means the lowland and relatively flat areas adjoining inland and coastal waters including, at a minimum, that area subject to a one percent or greater chance of flooding in any given year. Wherever in this regulation the term ''floodplain'' is used, if a critical action is involved, ''floodplain'' shall mean the area subject to inundation from a flood having a 0.2 percent chance of occurring in any given year (500-year floodplain). *Floodway* means that portion of the floodplain which is effective in carrying flow, within which this carrying capacity must be preserved and where the flood hazard is generally highest, i.e., where water depths and velocities are the greatest. It is that area which provides for the discharge of the base flood so the cumulative increase in water surface elevation is no more than 1 foot. *Flood Fringe* means that portion of the floodplain outside of the floodway (often referred to as ''floodway fringe'').

their jurisdiction and then subsequently manage land uses in flood prone areas to meet federal and local requirements for minimizing the risk of damage from floods. While the federal government may, in times of declared emergencies, provide some assistance to private parties for flood damage, the form of assistance available to private parties is typically loans (with direct grants typically being made to government agencies for impacts to publicly owned assets).

The basic purpose of the NFIP is not to prohibit floodplain development, but to guide development in floodplain areas in such a way as to greatly lessen the economic loss and social disruption caused by impending flood events.[3] Washington State's flood program is managed by the Department of Ecology. Everett's floodplain regulations, embodied in Chapter 30 of the Zoning Code have been adopted and approved by the state pursuant to RCW Chapter 86.

Floodplain maps are the basis for implementing floodplain regulations. Most communities have a Flood Insurance Rate Map (FIRM) based on a flood insurance study (FIS) The FIRMs generally include Base Flood Elevations (BFEs), flood zones, floodways, and flood elevations at specific sites within a community. (A Flood Insurance Study (FIS) is prepared by FEMA to determine the flood hazards present in a community and insurance zones that are used to write flood insurance. The FIS includes a written report containing a description of flooding conditions, and flood profiles showing the 500-, 100-, 50- and 10-year flood elevations for each stream reach studied.[4] In addition; the FIS contains specific field reference points to aid surveyors in establishing the relationship between Base Flood elevation (BFE) and a specific development site.

FIS are performed periodically. Floodplain data can be revised for various reasons including correction of minor errors, better ground elevation data, authorized filling in the floodplain, better flood data or new flood works. These changes can be made in the form of a Letter of Map Amendment (LOMA) or Letter of Map Revision Based on Fill (LOMR-F). An activity that could change how flood waters move (a channel or potential obstruction such as a bridge) requires a new analysis and physical map change.

Everett's floodplain regulations apply overlay zones to properties based on the zones shown on the most recent FIRM for Snohomish County (2005). The overlay zones that apply to the Riverfront development are Floodway, and Urban Flood Fringe District (UFFD). Activities in the Floodway, since that is the area carrying the greatest flood flow, are restricted to those which will not obstruct flood flows and with low flood danger (such as lawns, parking areas, boat-launch ramps). The fringe is outside of the floodway and has less carrying capacity and less risk. Developments in the flood fringe districts are required to employ flood protection measures which include elevating structures, outdoor storage, and areas within 15 feet two feet or more above the regulatory flood protection elevation. Parking areas and driveways may be no lower than one foot below the regulatory flood protection elevation. Following construction of structures, a floodplain development certification is required to verify the actual elevation and certify that floodproofing criteria have been met.

Channel Migration Zone Potential of the Snohomish River

Snohomish County guidance for channel migration zone delineation dictates that this site is not subject to lateral migration. Beyond referencing the Snohomish County study, GeoEngineers also conducted a study of channel migration potential based on the Forest Practices Board approach.

[3] Floodplain Management A Local Floodplain Administrator's Guide to the National Flood Insurance Program 3rd Edition, Region 10 Federal Emergency Management Agency, January 2000 p. 1

[4] Floodplain Management A Local Floodplain Administrator's Guide to the National Flood Insurance Program 3rd Edition, Region 10 Federal Emergency Management Agency, January 2000 p. 4

To complete the Forest Practices Board Manual approach regarding whether the channel may possibly migrate, the historical migration zone was assessed by GeoEngineers (2007) (Appendix C) through a comparison of the 1869 General Land Office (GLO) map and historical aerial photographs from 1938 and 1967 with recent aerial photographs from 2002 relative to the current channel configuration in the project area. The comparison of the 2002 photographs to the GLO map and the 1938 and 1967 historical aerial photographs clearly indicates that the basic channel pattern or configuration has not changed appreciably, and there has been no observable channel migration.

Based on both the Snohomish County and Forest Practices Board approaches, it is determined that the potential for future migration of the Snohomish River at the project location is very low. Based on a review of aerial photographs, soil conditions and field observations, GeoEngineers determined that undercutting of the levee and native material may continue to erode the river banks during flood events. However, any future loss of levee or other bank fill material will not increase the risk of channel migration or avulsion based on the geomorphic characteristic of the channel (GeoEngineers Channel Migration Report 2007, see Appendix C). The minor erosion observed (absent channel migration) will have no impact on activities set back and separated from the bank and levees by additional fill and development.

Potential Effects of Climate Change on Surface Water Elevations at the Everett Riverfront Development

A National Wildlife Federation (NWF) document titled "Sea Level Rise and Coastal Habitats in the Pacific Northwest, An Analysis for Puget Sound, Southwestern Washington, and Northwestern Oregon" predicts a rise of sea level in the Snohomish River Estuary and Everett of 1.5 meters by 2100. The study references a model named Sea Level Affecting Marshes Model, Version 5.0, and predicts habitat modifications resulting from the sea level fluctuation.

It should be noted that a brief review of sea level rise scenarios presented by agencies such as the United States Geological Survey (USGS) and the United Nations Environment Program (UNEP) demonstrates little consensus. UNEP estimates of global average sea level rise by 2100 range from 10 centimeters to 1.1 meters. Although there is general consensus in the scientific community regarding the fact that global temperatures are rising, the rates of that increase over the next 100 years depend on numerous variables which could change over time. Sea level rise is contingent on the rates of global warming and melting of the ice sheets, both of which are multi-variable and temporal processes that are subject to significant unknowns.

Tidal Elevations and Climate Change

Assuming that the predictions presented by the NWF may be correct, a 1.5 meter, or 5 foot, rise in sea level could occur in the Everett area by 2100. The immediate impact this could have on the Everett Riverfront development project is an increase in tidally driven water elevation adjacent to the site. Table 4.3-7 presents the current tidal elevation data for the project area.

Table 4.3-7. Tidal Datum Regions, Whidbey Island Region 99 – Everett Relation Between Various Datum Planes

Datum Plane	MLLW	NGVD	NAVD88
Highest Estimated Tide	14.50 +/- 0.5	8.6	12.28
Mean Higher High Water	11.11	5.18	8.86
Mean High Water	10.25	4.32	8.00
Mean (Half) Tide Level	6.52	0.59	4.27
NGVD	5.93	0.00	3.68
Mean Low Water	2.80	-3.13	0.55
Mean Lower Low Water	0.00	-5.93	-2.25

*Source: US Army Corps of Engineers http://www.nwd-wc.usace.army.mil/nws/hh/tides/

According to tide datum information, mean higher high water is 8.86 ft (NAVD 88) and the highest estimated tide is 12.28 feet (NAVD 88). Assuming an increase in sea level of 1.5 meters (4.9 feet), it could be expected that mean higher high water could reach an elevation of 13.7 feet (NAVD 88) with a possible highest estimated tide of 17.8 feet (NAVD 88).

The Everett Riverfront project area is protected by levees for flood elevations along the Snohomish River, which are much higher than current tidal elevations. The predicted water surface elevation for the 100-year flood event along the project area varies from 18.3 feet (NAVD 88) at the upstream limit of the site to 14.62 feet (NAVD 88) along the downstream end of the project area. Current flood control levees along the development zones vary between 14 and 18 feet (NAVD 88). The margins of the Simpson pad are over 20 feet elevation (NAVD 88). A majority of the site is currently protected to heights near those potentially accessed by the 1.5 meter predicted sea level rise. In the event that daily or annual tidal elevation swings encroached upon the current levee elevations, raising the elevations of levees along the river should be a simple process considering the current, extensive footprint already in place.

Flood Elevations and Climate Change

As mentioned, levees along the Everett Riverfront project are designed to contain flood elevations and would be little impacted by predicted increases in sea level. Another factor to consider with respect to climate change are the potential impacts that global warming may have on the hydrologic regime of the Snohomish River.

Research on the hydrologic implications of climate change suggests that the historic runoff patterns in Western Washington river systems is likely to change as a result of global warming. Currently, runoff in river systems on the west side of the Cascades is characterized by a dual peak, one in response to fall and early winter rain storms, and a second peak in the spring or early summer driven by melting snowpack.

Research at the University of Washington Climate Impacts Group (http://www.hydro.washington.edu/Lettenmaier/Presentations.html) points out that snowpack in the Cascade Mountains are particularly sensitive to small increases in temperature, since snow falls at relatively low elevations and high temperatures. Increases in mountain temperature will cause more rain at higher elevations, less snowpack accumulation, and earlier melting of the snowpack. The combined influence of these factors may lead to a merging of the dual peak hydrograph into a single-peak runoff pattern that occurs in late winter or early spring.

As summers extend into fall and spring comes earlier, the impact on Cascade river systems could be significant. The timing of salmon migration may alter as spikes in stream flow no longer occur during the historical spawning seasons. The timing of runoff will undoubtedly affect reservoir storage and hydropower operations. There seems to be broad consensus that climate change will affect the timing and duration of peak flow patterns in Western Washington river systems. However, there seems to be little prediction that this shift will result in greater streamflow volumes, or increase flow significantly from historic levels. Thus, there is no evidence that the water surface elevation of the 100-year flood adjacent to the project area will elevate above current levels, or that additional flood protection would be necessary from freshwater volume increases.

4.3.2.2 Groundwater

Existing groundwater conditions are described in conjunction with earth resources in Section 4.1.3.

4.3.3 Potential Effects of the Project / Impacts

4.3.3.1 Impacts Common to the "Action" Alternatives

The impacts to water resources are included in the discussion of impacts on earth resources in Section 5.7, Environmental Health and Hazardous Materials.

4.3.3.2 Permanent Effects

Groundwater Resources
Long-term impacts could result from creating hydraulic connections between contaminated media and receptors, such as surface water. Penetration of the landfill aquitard is one example. Other examples would be installation of a utility conduit though soil containing hydrocarbons which in return may create a migratory pathway for contaminants to reach/discharge into Snohomish River.

Flooding and Channel Migration Zone Hazards
The proposed development alternatives should have no long-term impacts on the flood hazard or the channel migration hazard than currently exist throughout the site. As Figure 4.3-1 illustrates that flows from the 100-year event are limited to the rail corridor and areas of the Eclipse Mill site generally east of the current rail line. Further, areas proposed for development that would be affected by the 500 year flood are limited to the Eclipse (including Port and Drywall) site. The major area within the project subject to flooding includes the large wetland and riparian complex to the east of the Simpson Pad. This area will remain in its native condition or enhanced as part of the proposed development. This area will be subject to no fill, and thus there will be no displacement of flood storage capacity to any undeveloped areas.

4.3.3.3 Impacts of the No-Action Alternative

The impacts to water resources are included in the discussion of impacts on earth resources in Section 2.3, Chapter 2, Site/Proposal Description and Alternatives.

4.3.4 Mitigation

4.3.4.1 Flooding and Channel Migration Zone Hazards

Mitigation for potential flood impacts includes filling the Eclipse site to be at least 2 feet above the 100-year flood elevations and above the 500 year flood level. Additional fill on the Simpson Pad (about 3 feet) and the Landfill/Tire Fire Site (about 5 feet) will increase the elevation of those areas to take them

out of the 500 year flood plain as well. Because there are no long-term impacts identified for channel migration zone hazards, no mitigation measure are identified here to offset such impacts. Additionally, it should be noted that there are plans in place to enhance existing wetland and riparian areas along the Snohomish River and Bigelow Creek. Enhancing these areas will benefit the flood storage potential, water quality filtering and habitat quality of these streamside ecosystems.

4.4 STORMWATER

4.4.1 Methodology

Redevelopment of the Riverfront properties will result in changes in the quality and quantity of stormwater runoff from the properties. These changes in stormwater runoff could have negative mpacts to adjacent surface water is left unaddressed. The methodology for avoiding stormwater impacts for this development is to manage stormwater in accordance with the 2005 Stormwater Management Manual for Western Washington published by the Washington State Department of Ecology (DOE). The stated objective of the Ecology manual is to "provide guidance on measures necessary to control the quantity and quality of stormwater produced by new development and redevelopment such that they comply with water quality standards and contribute to the protection of beneficial uses of the receiving waters." It is presumed that, if stormwater controls are implemented in accordance with the Ecology Manual, a development's receiving waters will be protected from the adverse impacts of stormwater runoff. Ecology's approach requires the use of continuous stormwater modeling for the sizing of detention and water quality facilities. The program MGS Flood was used to satisfy the modeling requirements. In addition to mitigating for the normal impacts from stormwater runoff, the Ecology Manual requires impacts to other natural resources such as wetlands to be analyzed.

A wetland hydroperiod analysis was performed. A wetland's hydroperiod is the pattern of fluctuation of water depth and the frequency and duration of exceeding certain levels, including the length and onset of drying in the summer, (Ecology Manual). The hydroperiod. analysis follows the goals put forth by Ecology's Wetlands and Stormwater Management Guidelines, which are found in Appendix D of Volume 1 of Ecology's Stormwater Management Manual for Western Washington (2005) (Ecology Manual). The specific criteria for the hydroperiod analysis are found in Guide Sheet 2B and are summarized as follows:

1. Determine the existing hydroperiod baseline hydrologic characterization of wetlands: This was done through continuous simulation modeling using the MGS Flood computer software. This software is a continuous simulation modeling program that is accepted by Ecology.
2. Forecast future hydroperiod impacts on the wetland through continuous simulation modeling using MGS Flood. These results are given in terms of stage excursions, both mean annual, specifically during the amphibian breeding period, as well as a dry period analysis.
3. Provide a description of the potential impacts from the project on the receiving waters for both stormwater quantity and quality with a description of how these potential impacts will be mitigated, using both temporary construction measures and permanent control measures, often referred to as BMPs.

Stormwater concept plans have been prepared for each of the build alternatives. Included in this section are plans that show the on-site drainage basins, collection points, major storm conveyance routes, stormwater treatment and detention locations, and outfall locations. The stormwater treatment and detention alternatives for each of the build alternatives have been sized using the MGS Flood software. The treatment measures have been selected from the presumptive BMP alternatives identified in the Ecology Manual.

Regulatory Compliance Issues and Standards

The project must comply with the 2005 Ecology Manual. It is assumed that compliance with this manual will result in mitigation of all significant stormwater impacts of the development.

According to the 2005 Ecology Manual:

- Detention flow rates created from developed conditions should not exceed the predeveloped discharge as follows:
    1. Flow rates from 50 percent of the 2-year event up to the 2-year event should not be exceeded.
    2. Flow durations from the 2-year event up to the 50-year event should not be exceeded in time by more than 10 percent.
- For flow control, predeveloped land use is assumed to be forested conditions, as specified in the Ecology standards.
- Modeling for the sizing of detention facilities is to be the continuous simulation model WWHM or MGS Flood (using HSPF computational process), approved by Ecology.
- Stormwater quality treatment facilities are designed for a defined volume and flow rates:
    - Volume: Provide treatment for 100 percent of the volume of runoff predicted from a 6-month, 24-hour storm event
    - Flow rate preceding detention: Provide treatment for the flow rate at or below 91 percent of the runoff volume for all storms analyzed or mean annual storm (from a continuous simulation model based on HSPF).
    - Flow rate following detention: Provide treatment for the flow rate resulting from a 2-year storm event, which is discharged from detention facilities.
- Stormwater quality is designed for "Enhanced Treatment" level, as defined by the 2005 Ecology drainage standards, if discharging into creeks and wetlands;
- All stormwater ponds have 1 foot of freeboard.
- Stormwater treatment wetlands have no more than 3 feet of water over depth, for the 2-year storm event.

Detention is not required or warranted at locations where there is direct discharge into the Snohomish River. This is in accordance with Appendix 1-E of the Ecology Manual, "Flow Control Exempt Receiving Waters," and is because this river is a major water body. Therefore, detention will be provided only where stormwater will discharge into creeks or wetlands.

A separate set of conditions applies to runoff from the Landfill/Tire Fire site. The Ecology Consent Decree and CAP require that stormwater derived from this site be discharged off site and not allowed to infiltrate into the underlying refuse. Runoff from this area could also be conveyed into the City combined sewer system.

In addition, the City has further preferences and restrictions with respect to stormwater systems that the City will own and/or operate. The mitigation methods chosen for publicly owned and/or operated systems will meet both the City's and DOE's criteria.

4.4.2 Existing Conditions/Affected Environment

For the purposes of stormwater management, the project site has been divided into three areas: the Simpson site, the Landfill/Tire Fire site, and the Eclipse Mill site (see Figure 4.4-1, Site Areas Used for Stormwater Analysis). Most of the project area, or approximately the southern two-thirds of the site and the surrounding areas, are located within the Lowell Drainage Basin, as defined by the City. The remaining portion of the project is located within the 36th Street Combined Basin.

The off-site drainage basins are shown in Figure 4.4-2; note that Bigelow Creek Basin is a sub-basin of the larger Lowell Basin as depicted in the figure. The land generally slopes easterly down towards the Snohomish River. Between the river and the BNSF railroad tracks, the terrain is relatively flat with land slopes generally in the range of 1 to 3 percent. The BNSF railroad tracks traverse the toe of a hillside, with hillside grades in most areas from 3 to 35 percent (steeper in some areas). The flatter terrain along the BNSF railroad track and extending east to the Snohomish River has several wetlands and channels, including the Bigelow Creek channel. A railroad spur with two parallel tracks separates the closed Landfill/Tire Fire site from the Simpson Pad site. Bigelow Creek flows northerly along and between these spurs and flows across the tracks. There is no culvert under these tracks at this location; instead, beaver activity has caused the stream to pond against the tracks and flow through the railroad ballast fill. This is shown as a large area of ponded water on Figure 4.4-3A. Bigelow Creek then flows north along the tracks and discharges to the Snohomish River. This is depicted on Figures 4.4-3A and 4.4-3B.

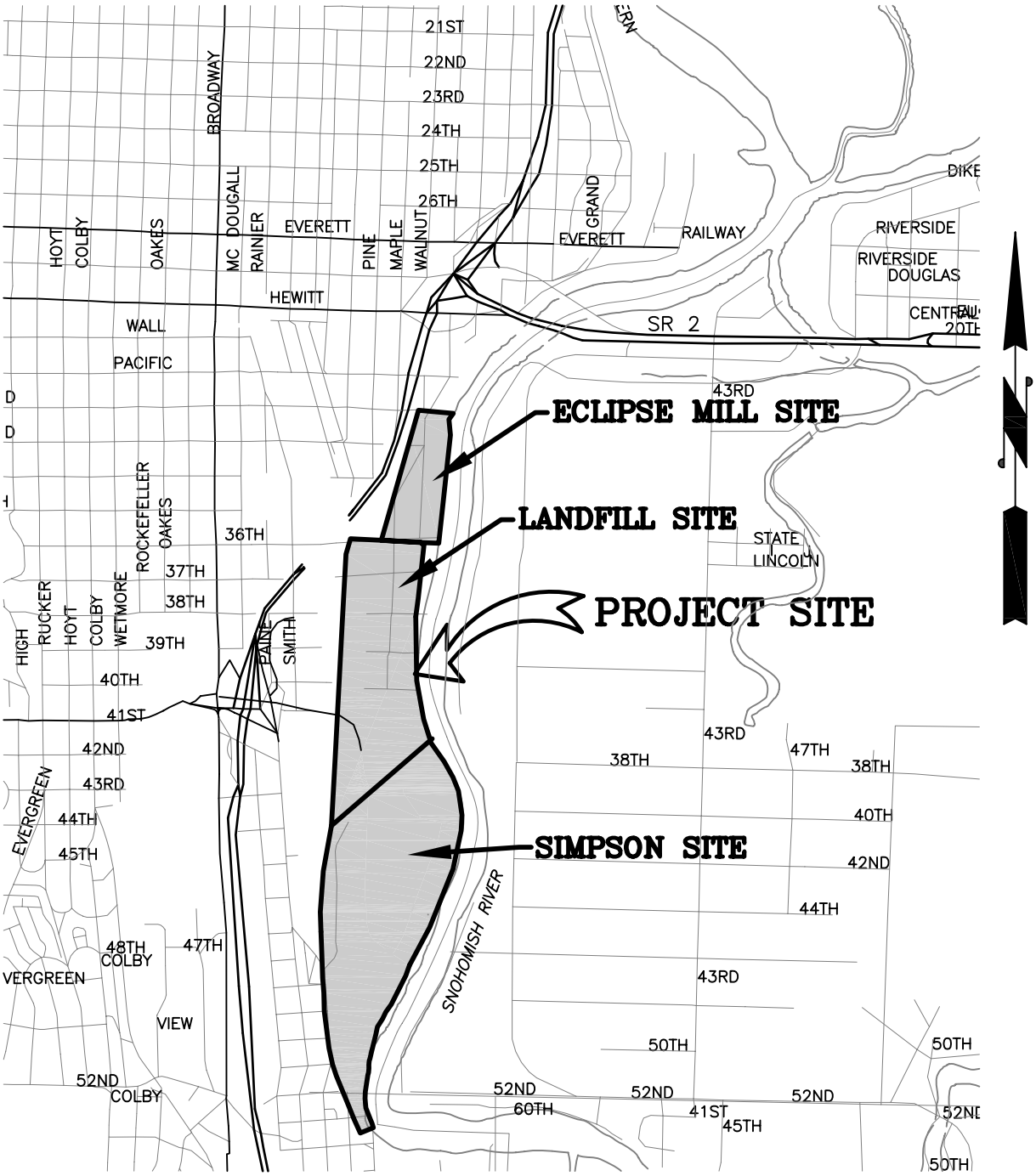
The smaller north portion of the Landfill/Tire Fire site (approximately one-third of the site) enters the 36th Street combined sewer system where currently surface flows are collected and sent to the combined storm-sewer pipe and to the sewer treatment plant for treatment.

Simpson Site

The topography and fill for the Simpson site are described in the discussion of earth resources in Section 4.1.3.

Currently this site is a vacant cleared field and is divided into three subbasins, as referenced in this EIS, called North, East and West. The site is situated next to the Snohomish River and almost entirely surrounded by three different wetland water bodies.

The surface water runoff from the West subbasin sheet flows west and enters existing wetlands, which then discharges through the railroad ballast and over and across the railroad tracks to Bigelow Creek. The surface water runoff from the North subbasin flows north to an existing wetland, which discharges to the Snohomish River by flowing over an existing beaver dam. The surface water runoff from the East subbasin flows east to an existing wetland, which discharges to the Snohomish River. The surface flow characteristics of this Simpson site are shown in Figure 4.4-3A. While Figure 4.4-3A shows where the surface water would flow due to the contours of the site; hydrologic modeling of the existing conditions indicates that there is very little runoff from Simpson site. The existing site hydrology was modeled using the WSDOT program MGS Flood. The preexisting land cover was assumed to be forest over outwash soils. When modeled, the entire 23-acre West subbasin only releases: 0.062 cubic feet per second, (cfs), in the 10-year event, (i.e. an event that statistically occurs once in ten years), 0.127 cfs in the 25-year event, and 0.424 cfs in the 100-year event. These modeled flows are small enough to ignore for the purpose of this analysis, therefore, it is assumed that the existing site currently infiltrates all of the stormwater.

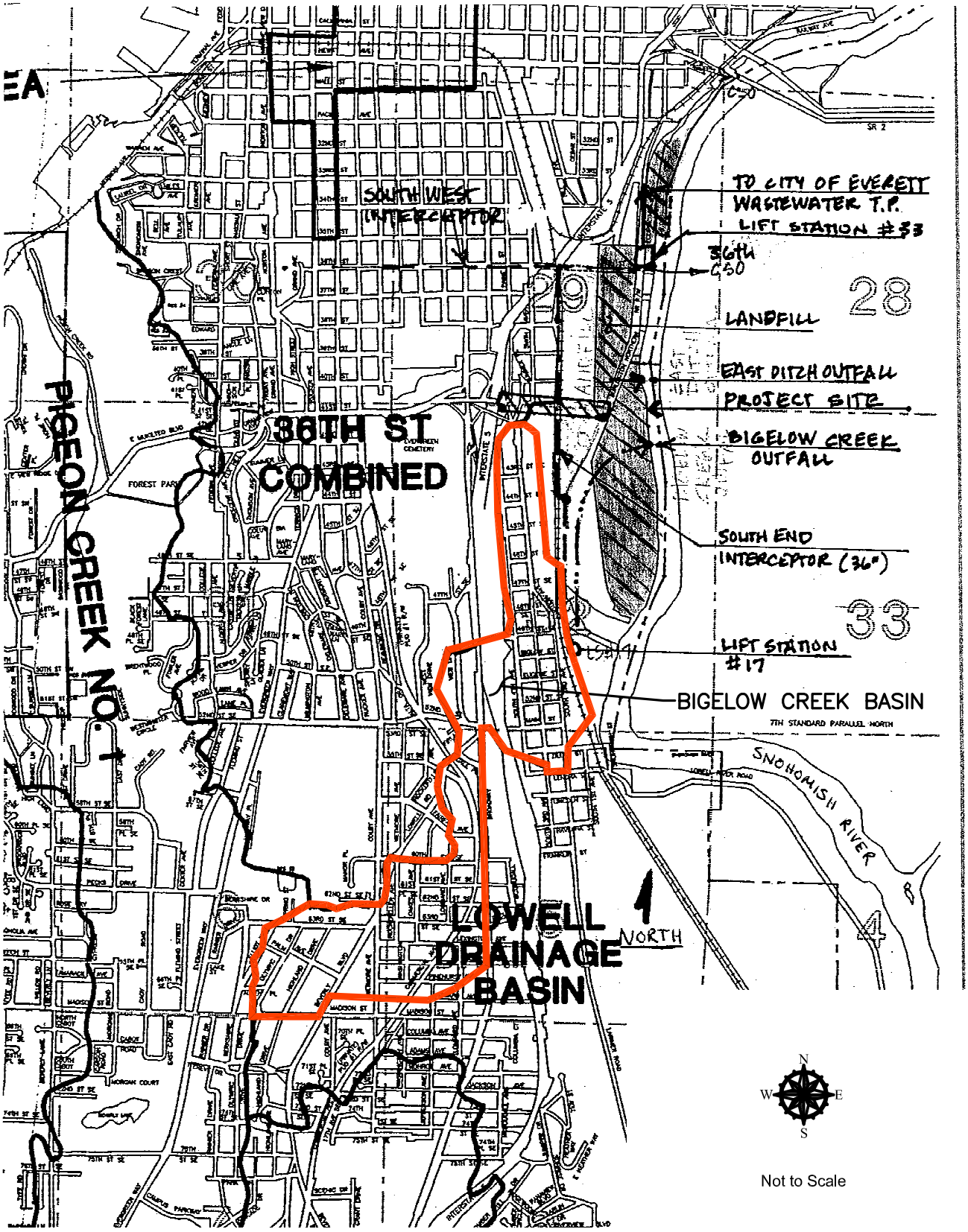


Site Areas Used for Stormwater Analysis

Everett Riverfront Redevelopment Project
Everett, Washington

Figure 4.4-1

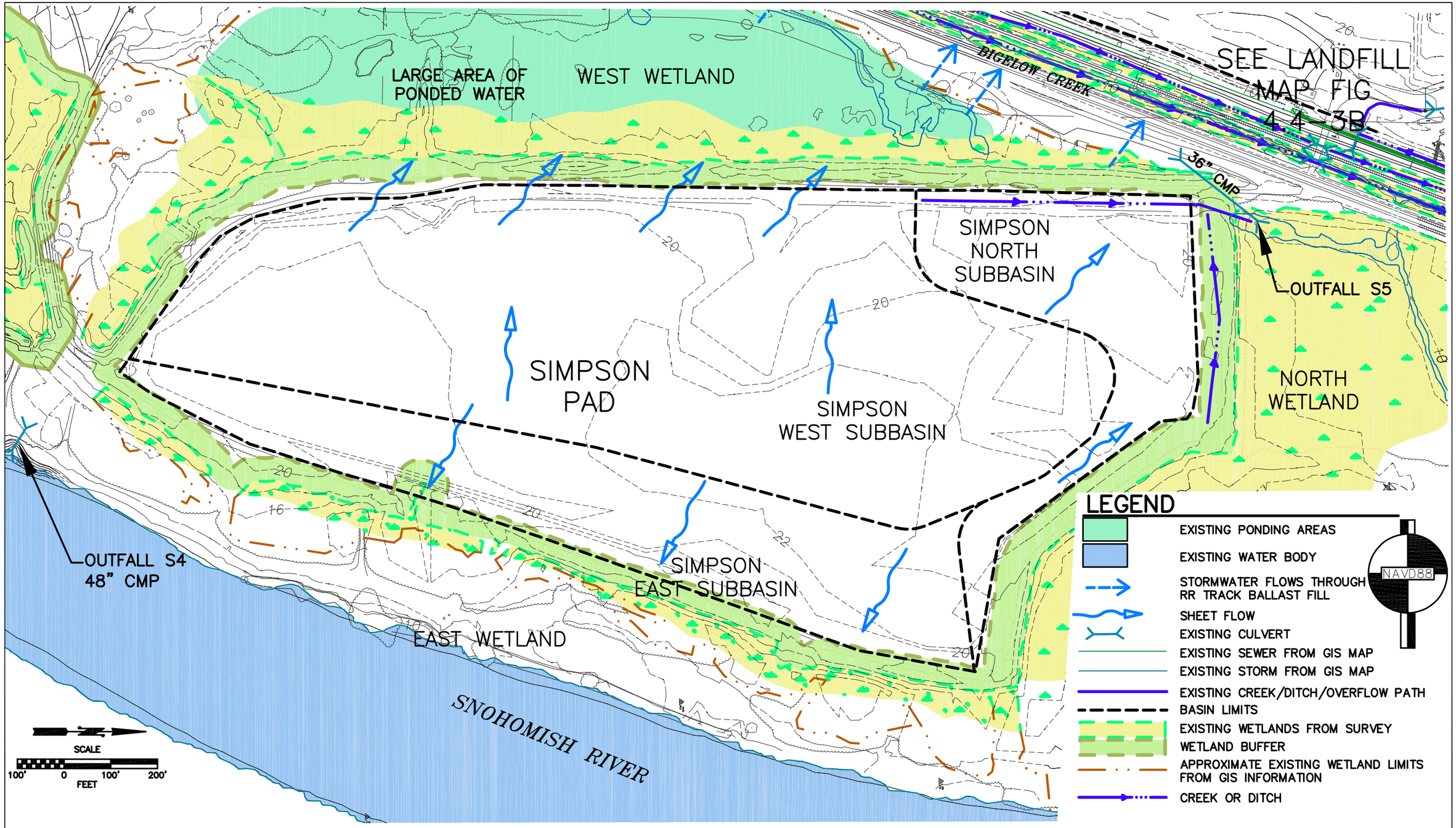
BOIS\P:\6\6191002\01\CAD\Section 4.4\Fig 1 – Vicinity Map.DWG JEP:MGM 06/14/07



Note: This drawing may differ slightly from the final proposed site layout.

Upstream Basin	
Everett Riverfront Redevelopment Project Everett, Washington	**Figure 4.4-2**

BOISE\P:\6\6191002\01\CAD\Section 4.4\Fig 2.Ddwg JEP:MGM 6/14/07



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Overall Surface Water Features
Simpson Site

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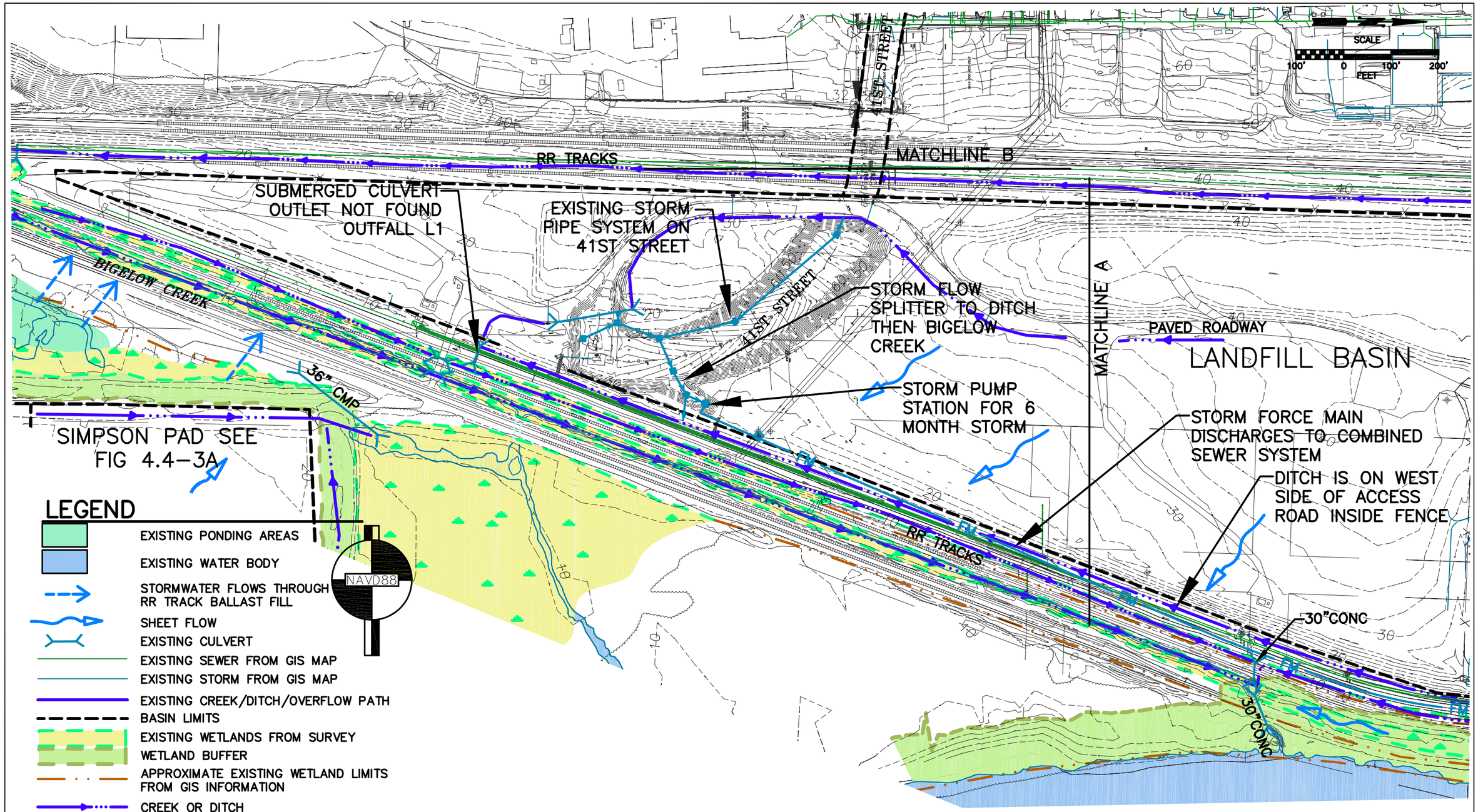
Figure 4.4-3A

Nov 14, 2007 - 8:23am mickeyb J:\Surface_Water\25038.004 - Riverfront EIS Drainage\CAD\25038-4.4-3A to 3C.dwg Layout Name: Simpson



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Overall Surface Water Features
Landfill Site

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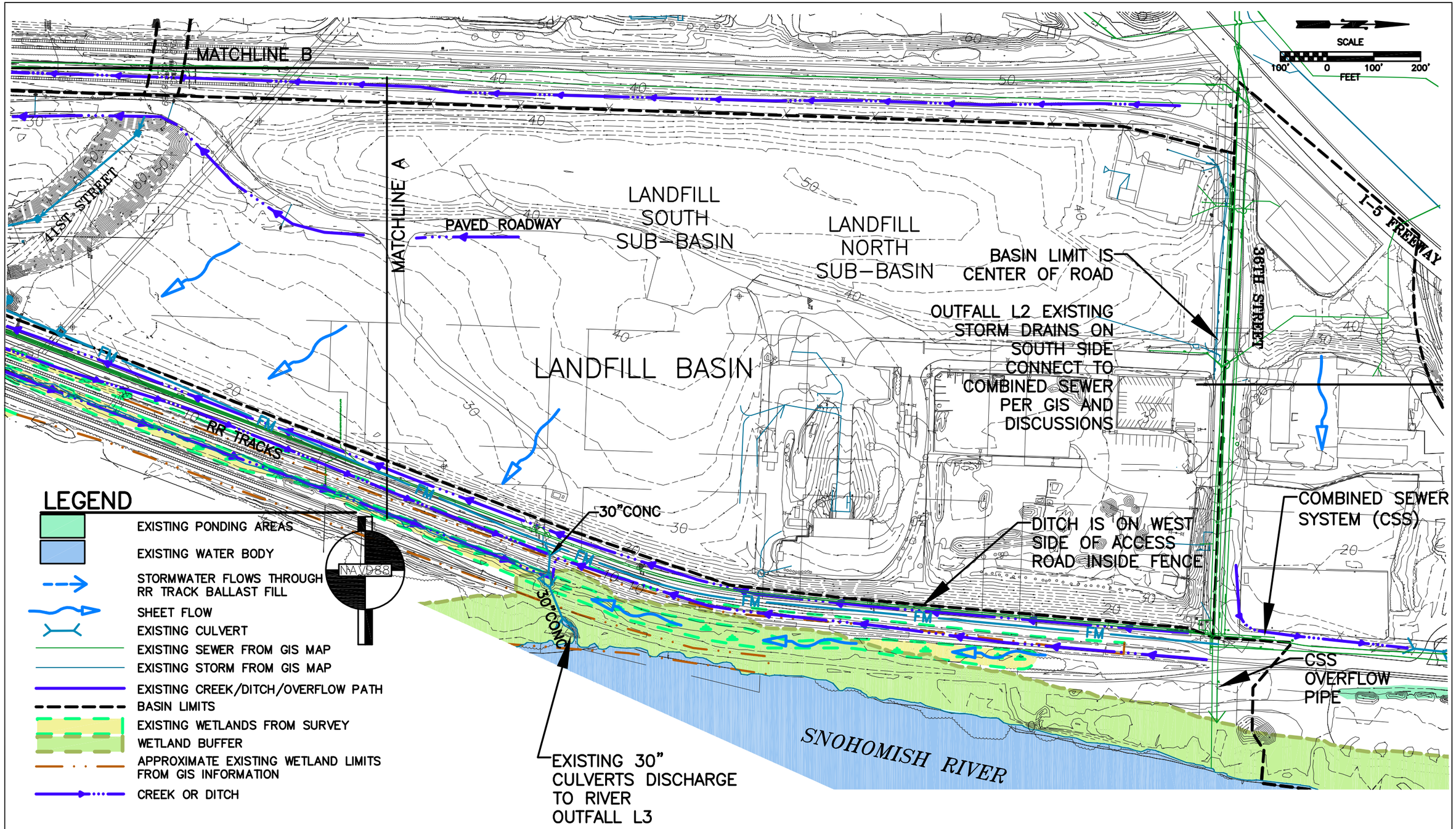
Figure 4.4-3B
Sheet 1

Nov 14, 2007 - 8:25am mickeyb J:\Surface_Water\25038.004 - Riverfront EIS Drainage\CAD\25038-4.4-3A to 3C.dwg Layout Name: Landfill



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Overall Surface Water Features
Landfill Site

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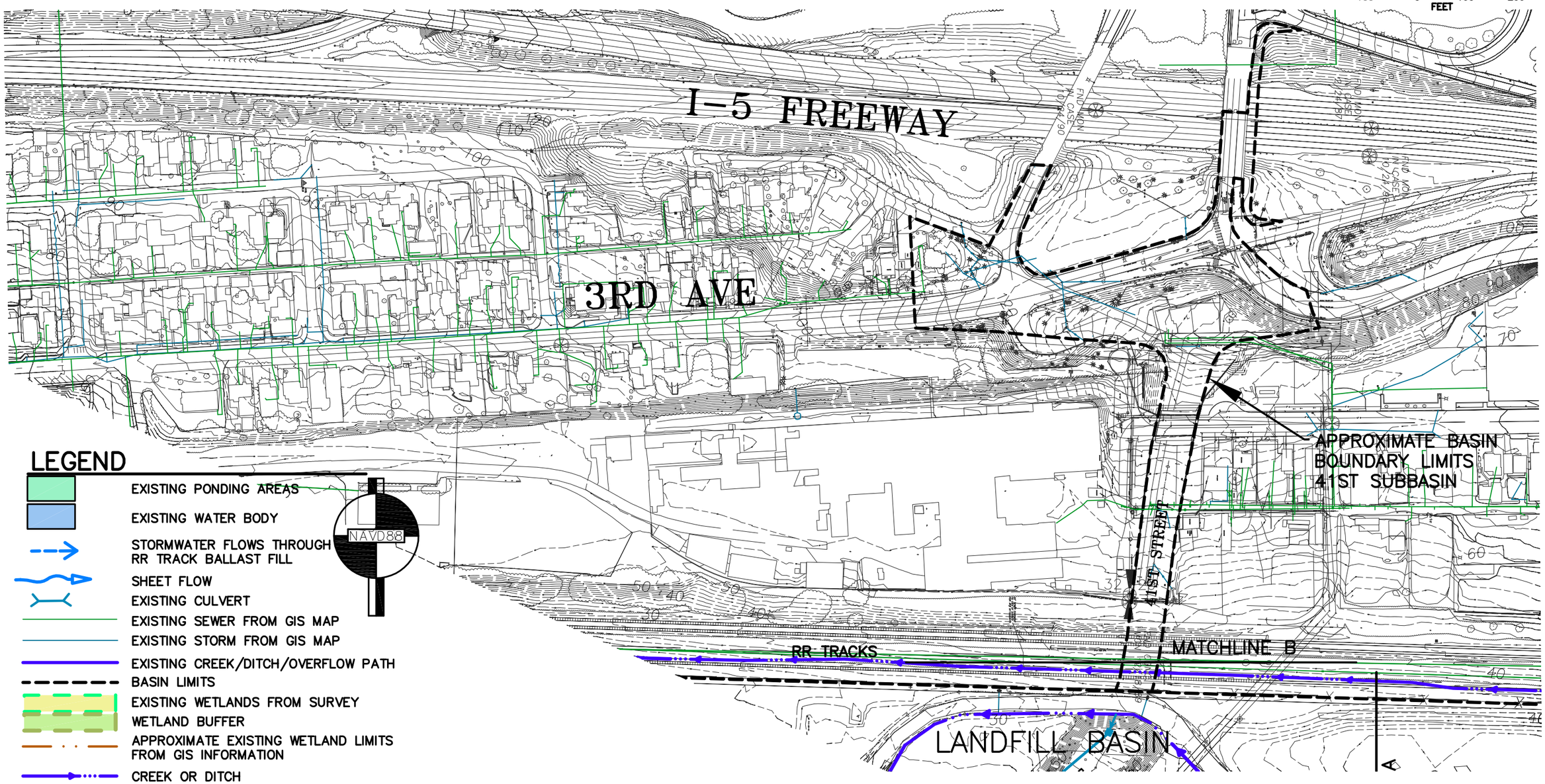
Figure 4.4-3B
Sheet 2

Nov 14, 2007 - 8:26am mlckeyb J:\Surface_Water\25038.004 - Riverfront EIS Drainage\CAD\25038-4.4-3A to 3C.dwg Layout Name: Landfill (2)



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Overall Surface Water Features
Landfill Site

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Figure 4.4-3B
Sheet 3

Nov 14, 2007 - 8:27am mickeyb J:\Surface_Water\25038.004 - Riverfront EIS Drainage\CAD\25038-4.4-3A to 3C.dwg Layout Name: Landfill (5)

Landfill/Tire Fire Site

The closed landfill has a cover of a soil barrier, topsoil and vegetation. The Landfill/Tire Fire site is divided into two existing subbasins, named North and South. The North subbasin flows to 36th Street and enters the combined sewer basin. Most of the South subbasin discharges stormwater runoff via sheet flow to the easterly end of the site and is collected in a ditch that runs parallel to a gravel maintenance road and east perimeter fence. An on-site asphalt roadway has a paved ditch to collect stormwater. The flows from this ditch and the on-site ditch combine in the West Ditch and flow northeast to the Snohomish River.

An area west of I-5 and the 41st Street Bridge across I-5 drains onto the Landfill/Tire Fire site. This area is included in the basin area for this site.

Stormwater runoff from the elevated roadway surfaces are directed to a storm pump station, where the stormwater is pumped to the City's wastewater treatment plant. This collection system is designed to pump stormwater for flow rates up to and including the 6-month storm event (that is, the water quality design storm). Flow rates above the water quality design flow are directed, with a flow splitter, to an open ditch conveyance system and then discharge into Bigelow Creek at a culvert outfall. The discharge into Bigelow Creek is via a culvert located on the southeast end of the Landfill/Tire Fire site, identified as Bigelow Creek Outfall L-1, shown in Figure 4.4-3B (Sheet 1).

The existing site hydrology was modeled using the program MGS Flood. The results of the modeling can be seen in Tables 4.4-6 and 4.4-7 under the heading *Predevelopment Runoff*. The flows from the site are larger than the flows from the Simpson site. This is due to the different soils located onsite. Where the Simpson site was modeled assuming an underlaying permeable outwash soil, the landfill site was modeled using a relatively impermeable till soil. The preexisting land cover was assumed to be forest over till soils.

The roadway surfaces that have runoff directed to the pump station for stormwater treatment include:

1. Part of 41st Street that extends from the Landfill/Tire Fire site westerly to the I-5 freeway, along with the connecting portions of 3rd Avenue adjacent to 41st Street. This is shown in Figure 4.4-3B (Sheet 3).
2. The paved roadway located within the Landfill/Tire Fire Site. This is shown in Figure 4.4-3B (Sheet 1).

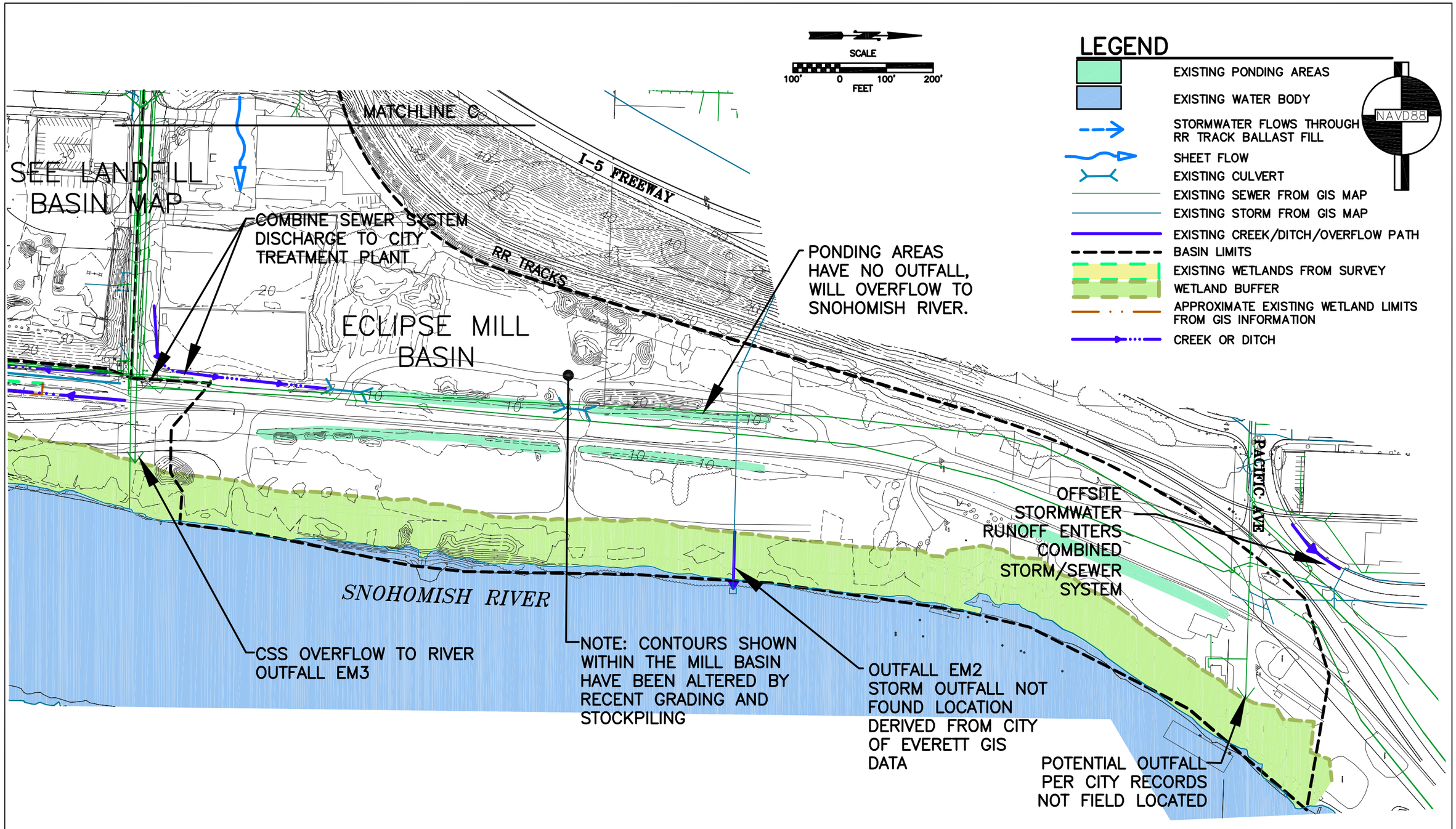
The surface flow characteristics of the Landfill/Tire Fire site are shown in Figure 4.4-3B Sheets 1 and 2.

Eclipse Mill Site

The Eclipse Mill site is primarily vacant land. The site is being used as a stockpile area with raw grading occurring within a large portion of the site which is encompassed by existing silt fence. The topography and fill for the Eclipse Mill site are described in the discussion of earth resources in Section 4.1.3. The surface flow characteristics of the Eclipse Mill site are shown in Figure 4.4-3C Sheets 1 and 2.

The basin flow characteristics are that the Eclipse Mill site drains generally to the east toward the Snohomish River.

The Eclipse Mill site was modeled in the existing condition and the results can be seen in Table 4.4-7 under the heading of *Predevelopment Runoff*. The pre-existing land cover was assumed to be forest over till soils.



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Overall Surface Water Features
Eclipse Mill Site

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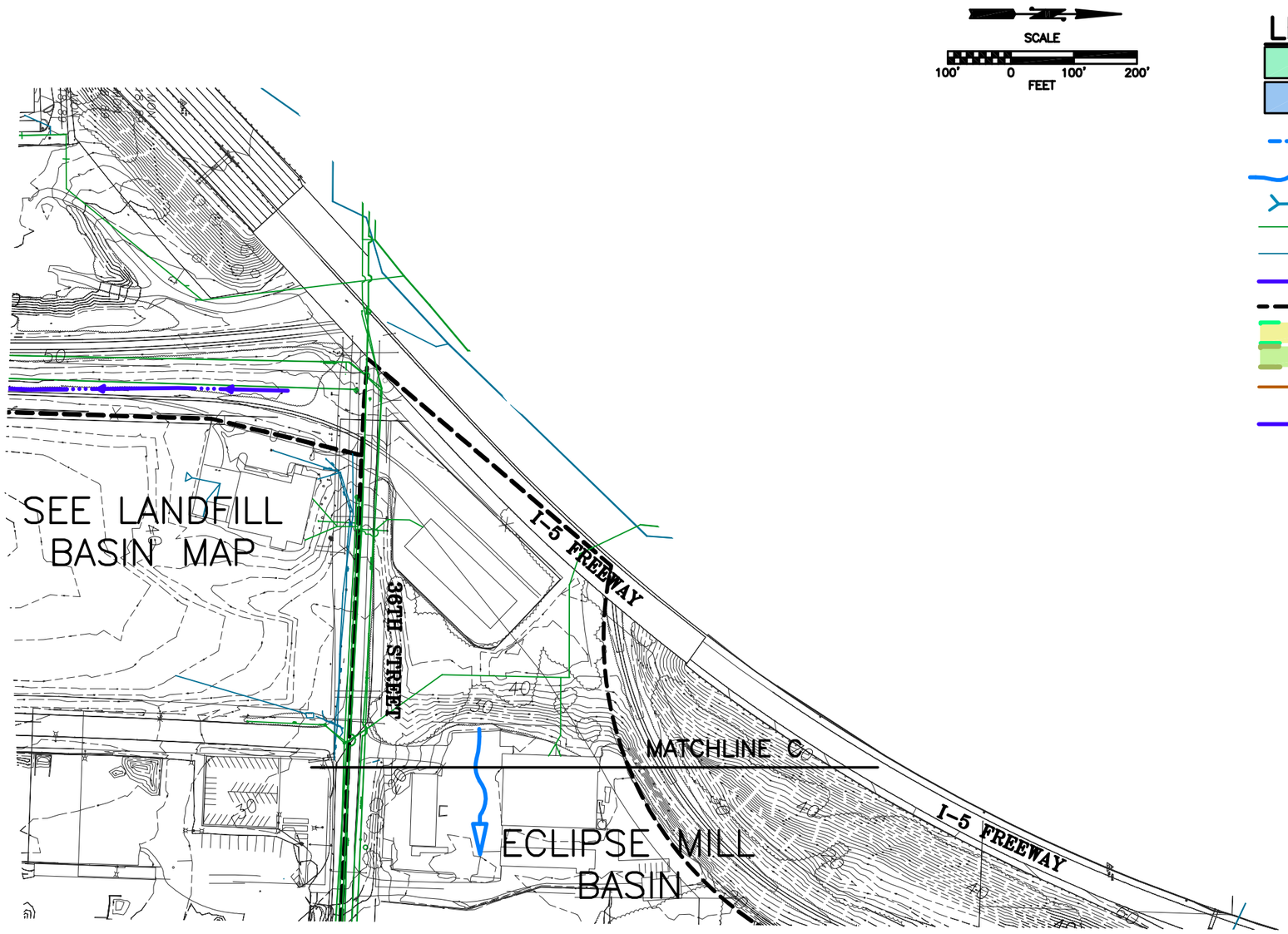
Everett, Washington

Figure 4.4-3C
Sheet 1

Nov 14, 2007 - 8:28am mickeyb J:\Surface_Water\25038.004 - Riverfront EIS Drainage\CAD\25038-4.4-3A to 3C.dwg Layout Name: MILL



LEGEND

- EXISTING PONDING AREAS
- EXISTING WATER BODY
- STORMWATER FLOWS THROUGH RR TRACK BALLAST FILL
- SHEET FLOW
- EXISTING CULVERT
- EXISTING SEWER FROM GIS MAP
- EXISTING STORM FROM GIS MAP
- EXISTING CREEK/DITCH/OVERFLOW PATH
- BASIN LIMITS
- EXISTING WETLANDS FROM SURVEY
- WETLAND BUFFER
- APPROXIMATE EXISTING WETLAND LIMITS FROM GIS INFORMATION
- CREEK OR DITCH

NAVD88

Note: This drawing may differ slightly from the final proposed site layout.

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Overall Surface Water Features
Eclipse Mill Site

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Figure 4.4-3C
Sheet 2

Nov 14, 2007 - 8:29am mickeyb J:\Surface_Water\25038.004 - Riverfront EIS Drainage\CAD\25038-4.4-3A to 3C.dwg Layout Name: MILL (3)

Existing Conditions of All Three Areas

Table 4.4-1. Basin Areas Summary

Drainage Basin Information	Individual Basin Information Predeveloped Conditions				
	Eclipse Mill Site Subbasin Areas[1]				
	SW	*S*	*N*	*NE*	*Total*
On-Site Subbasin Area (acres)	*6.20*	*9.38*	*9.20*	*5.28*	*30.06*
	Simpson Site Subbasin Areas				
	W	*N*	*E*		*Total*
On-Site Subbasin Area (acres)	*23.03*	*6.86*	*8.83*		*38.72*
	Landfill/Tire Fire Site Basin Areas[1]				
On-Site Basin Area (acres)	*67.40*				

Notes:
1. Basins Assumed 100% Impervious for Water Quality Calculations

Wetlands

There are several existing wetlands and streams on the site, as noted in Table 4.4-2.

Table 4.4-2. Wetlands & Streams

Wetlands by Adjacent Drainage Basin				
Simpson Site[1]	*W*	*N*	*E*	*Total*
Adjacent Wetlands Area (acres)[1]	*16.03*	*9.38*	*3.72*	*29.12*

Note:
1. The entire limits of the wetlands are based on best available information at the time of this report. The wetlands are shown in Figure 4.4-3A

Stormwater Discharge/Outfalls

There are eight existing outfalls on the site, as shown in Table 4.4-3.

Table 4.4-3. Existing Storm Outfalls

Outfalls Listed by Adjacent Drainage Basin			
	Subbasin ID		
Simpson Site	*W*	*N*	*E*
Outfall ID[1]	*Sheet Flows*	*Sheet Flows and S5*	*S4*
Landfill/Tire Fire Site	*N*	*S*	
Outfall ID[1]	*L1, L3*	*L2*	
Eclipse Mill Site	*Site*		
Outfall ID[1]	*Sheet Flows and EM2*		

Note:
[1.] The outfall locations and outfall IDs are shown in Figures 4.4-3A, 4.4-3B, 4.4-3C

Two culvert outfalls are adjacent to the Simpson site. One lies south and east of the site and is a 48-inch-diameter corrugated metal pipe (CMP) that is partially collapsed (Outfall S4). Although it is likely that the culvert still has adequate capacity to convey the flows being delivered to it, options which include this culvert have recommended that this pipe be repaired or replaced. The second existing outfall serving the landfill site is a 36-inch-diameter CMP (Outfall S5). This culvert connects the wetlands west of the site to the wetlands north of the site. Beaver activity has altered this natural flow pattern such that the wetlands west of the site combine with Bigelow Creek and now flow across the existing railroad spur. As a result, outfall S5 now has no water flowing through the existing 36-inch-diameter culvert. Sheet flows on the Simpson Site represent both the existing and the proposed conditions of flows entering the surrounding wetlands.

The Landfill/Tire Fire site has two existing outfalls that serve this area. The first is the outfall connecting the site to Bigelow Creek (Outfall L1). The combined flows from the Landfill/Tire Fire site and Bigelow Creek then flow to the Snohomish River through an existing 30-inch-diameter culvert (Outfall L3). The other outfall is the existing combined sewer storm drain connection that serves the North Basin (Outfall L2). The landfill lies partially in the combined sewer basin within which most stormwater flows enter the sewer system (see Figure 4.4-3B Sheet 2). An existing sewer storm drain serves this area as well as the southern portion of the Eclipse Mill site.

Most the Eclipse Mill site has unimproved drainage features. During times of heavy rain, ponds form that overflow across the site and enter the side ditches. The ponded areas are described in Figure 4.4-3C Sheet 1, and will overflow to the Snohomish River. An existing WSDOT outfall on this site serves the I-5 freeway. This is the outfall labeled EM2. Outfall EM3 represents an existing combined sewer overflow pipe that connects to the Snohomish River. Outfalls EM2 and EM3 were not found during the site investigation. The location shown on Figure 4.4-3C Sheet 1 are derived from the City's geographic information system (GIS) maps.

Off-Site Drainage Areas

The off-site area that contributes runoff through the riverfront properties includes two segments:

1. The watershed for Bigelow Creek, which is a channel that separates the Simpson site from the Landfill/Tire Fire site. The Bigelow Creek watershed is a subbasin of the larger Lowell Drainage Basin (see Figure 4.4-2).
2. Part of 41st Street that extends from the Landfill/Tire Fire site westerly to I-5, along with the connecting portions of 3rd Avenue adjacent to 41st Street. This is shown in Figure 4.4-3B (Sheet 3), and is identified as the 41st Street Subbasin.

The 41st Street subbasin will continue to discharge runoff into the Landfill/Tire Fire site, under post-developed conditions. Therefore, under developed conditions, the new storm pump station, or other type of treatment mechanism, needs to take into account runoff from this contributing off-site area.

4.4.3 Stormwater Facility Layout Options for EIS Alternative 1

4.4.3.1 Simpson Site

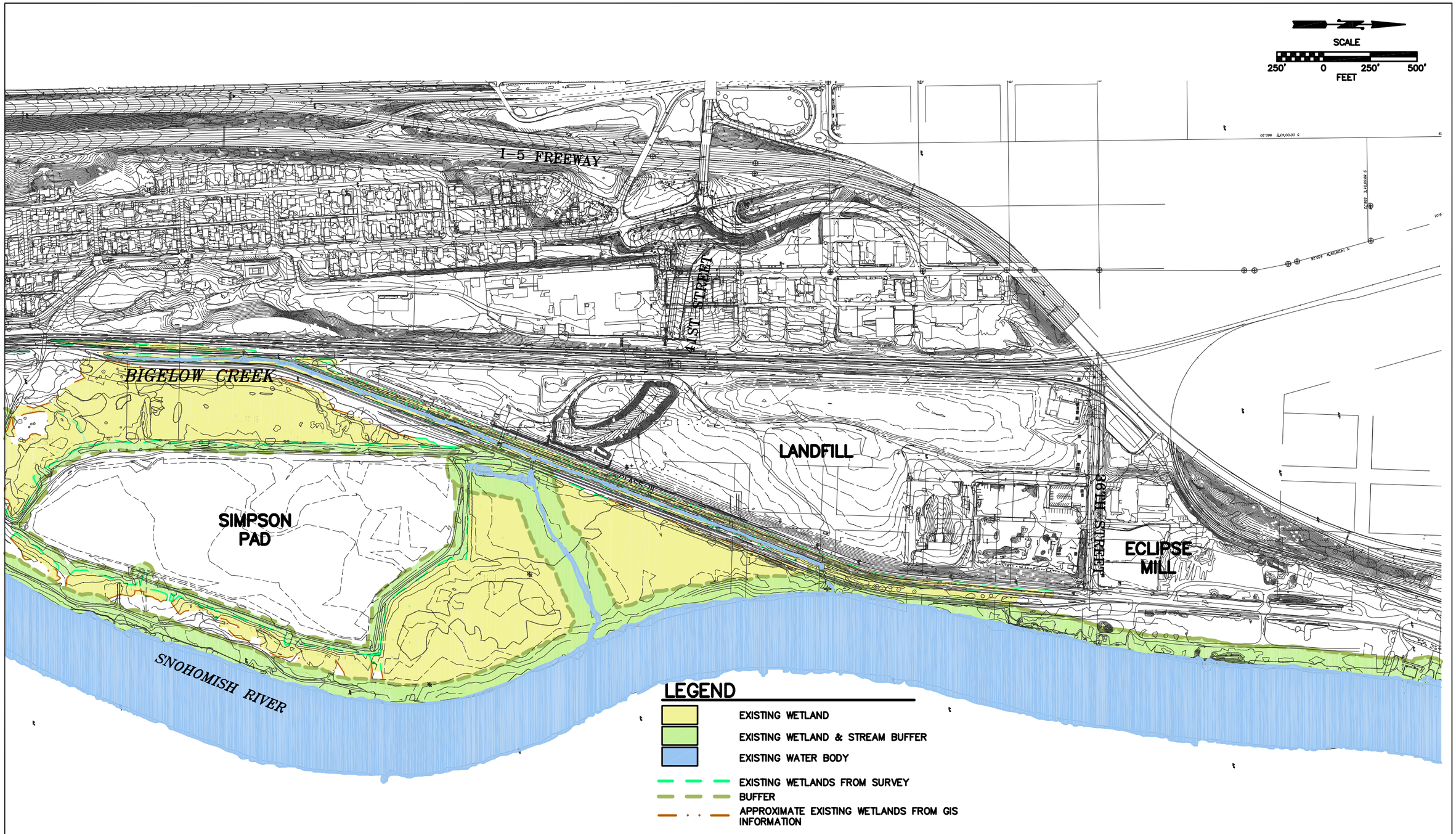
The developed Simpson site includes three subbasin areas that were established to match the existing subbasins on the site. These are labeled as the North, West, and East subbasins in Figures 4.4-3A. A fourth subbasin area accounts for the bridge crossing over Bigelow Creek. This serves as the access point to connect the Simpson site to 41st Street. The stormwater management option has been identified for the Simpson site Alternative 1 and it is the use of Rain Gardens as shown in Figure 4.4-5A. A detailed description is provided below. Schematic cross sections of both rain garden configurations are provided in Figures 4.4-5B and 4.4-6. Outfall locations have been selected to match as closely as possible the existing conditions. The existing site sheet flows from the Simpson Pad to the existing wetlands as described below. The conveyance system used to deliver the stormwater from the developed site to the stormwater treatment facilities closely matches the contributing areas of this existing condition.

Rain Gardens

Rain gardens are shown throughout Figure 4.4-5A. These rain gardens are natural looking and functioning stormwater flow control and water quality features that can have native vegetation, and they can be constructed using native soils. The planter strip rain garden will be located adjacent to roadways and will fit in the space normally provided for a standard planter strip. The rain gardens that are proposed to be located within the wetland buffers will be limited to the outside edge of the buffer. Specifically the maintained portion of the rain garden, the portion that may have to have the soils replaced every 20 to 30 years, will be limited to the outer 10 feet of the wetland buffer. A schematic view of a rain garden is provided in Figure 4.4-5B and Figure 4.4-6.

The rain garden concept can infiltrate 100 percent of the modeled stormwater runoff from the developed basin up to and including the 50-year storm event. A redundant overflow is required as a factor of safety, and the designed water surface elevation within the rain garden will have to be approximately 1 foot lower than the overflow. This redundant overflow outfall will connect via sheet flow across the rain garden berm to the wetlands adjacent to each basin on the site.

The on-site conveyance layout provides for short pipe runs to limit the amount of grading that will be required. These pipes allow the stormwater runoff from the site to enter the rain gardens. Rain gardens are currently planned for stormwater mitigation for the Simpson site, but rain gardens are only one option available that complies with the DOE manual. Because other options could be chosen by the developer it is necessary to talk about possible stormwater discharges to the Snohomish River. The Snohomish River's detention requirement exemption could result in a design that includes the discharge of undetained stormwater flows after the flows have been treated for water quality. Two potential outfall locations have been identified for the Simpson site for this possibility. These outfall locations are shown in Figure 4.4-15.



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Sensitive Areas

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Figure 4.4-4

Nov 13, 2007 - 2:02pm mickeyb J:\Surface_Water\25038.004 - Riverfront EIS Drainage\CAD\25038-Fig 4.4-4.dwg Layout Name: FIG 2.2

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Simpson Site Alternative 1 Stormwater Layout

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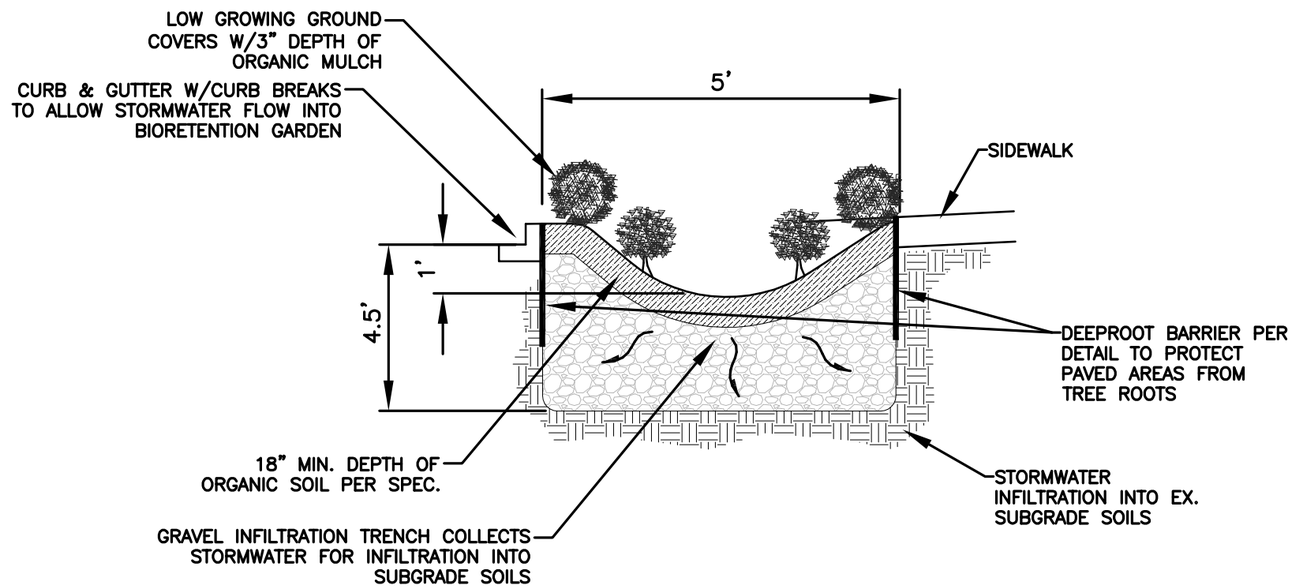
Figure 4.4-5A

Nov 14, 2007 - 12:38pm mickeyb J:\Surface_Water\25038.004 - Riverfront EIS Drainage\CAD\25038-Fig 4.4-5 to 4.4-8.dwg Layout Name: Simpson



PLANTER STRIP RAIN GARDEN SECTION

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Simpson Site Alternative 1 Stormwater Layout Option

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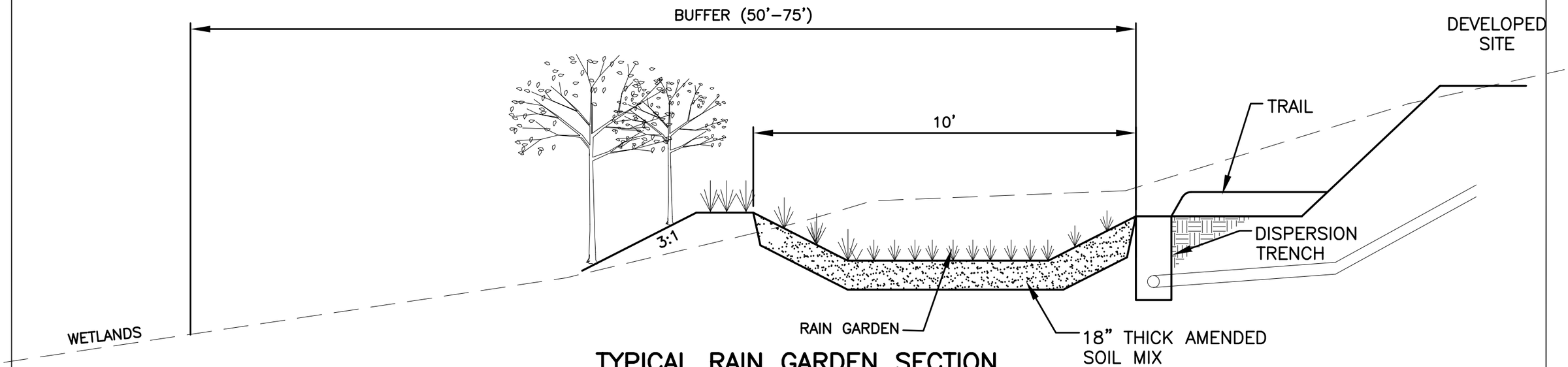
Figure 4.4-5B

Nov 13, 2007 - 2:13pm mickeyb J:\Surface_Water\25038.004 - Riverfront EIS Drainage\CAD\25038-Fig 4.4-5B-Rain Garden.dwg Layout Name: FIG4.4-5B



TYPICAL RAIN GARDEN SECTION

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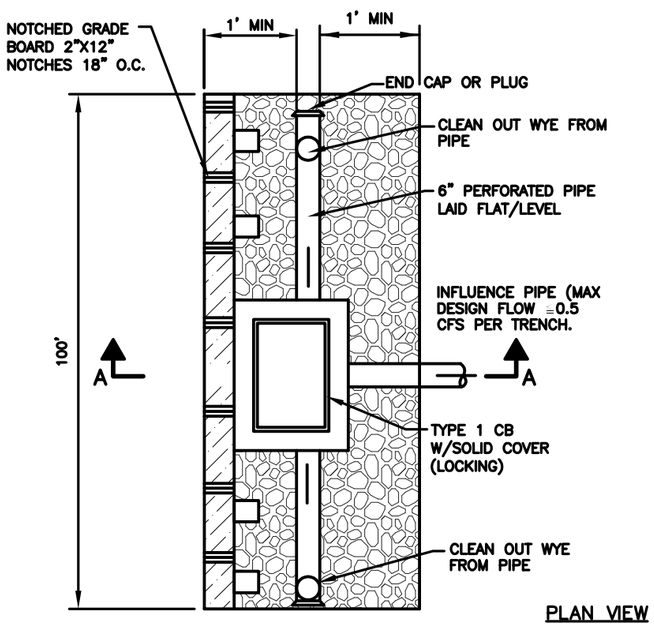
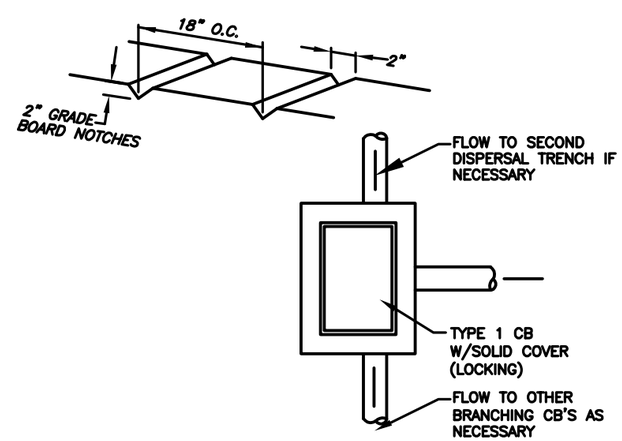


PLAN VIEW



STORM DISPERSION TRENCH

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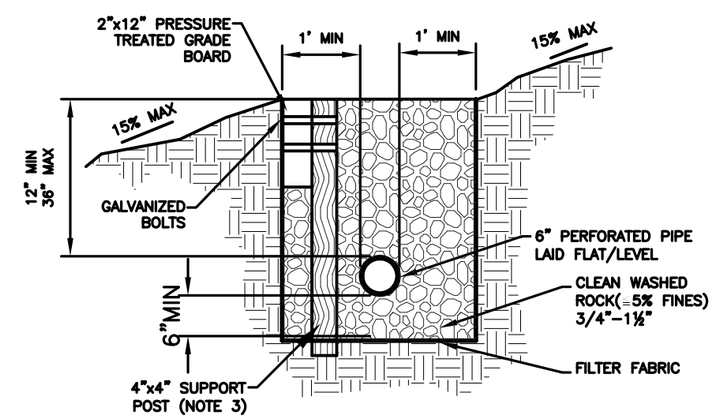

SECTION A–A

POINT DISCHARGE TO TRENCH

NOTES:
1. THIS TRENCH SHALL BE CONSTRUCTED SO AS TO PREVENT POINT DISCHARGE AND/OR EROSION.
2. TRENCH AND GRADE BOARD MUST BE LEVEL. ALIGN TO FOLLOW CONTOURS ONSITE.
3. SUPPORT POST SPACING AS REQUIRED BY SOIL CONDITION TO ENSURE GRADE BOARD REMAINS LEVEL.
4. NOTE: DESIGN FLOW IS LESS THAN 0.25 CFS.

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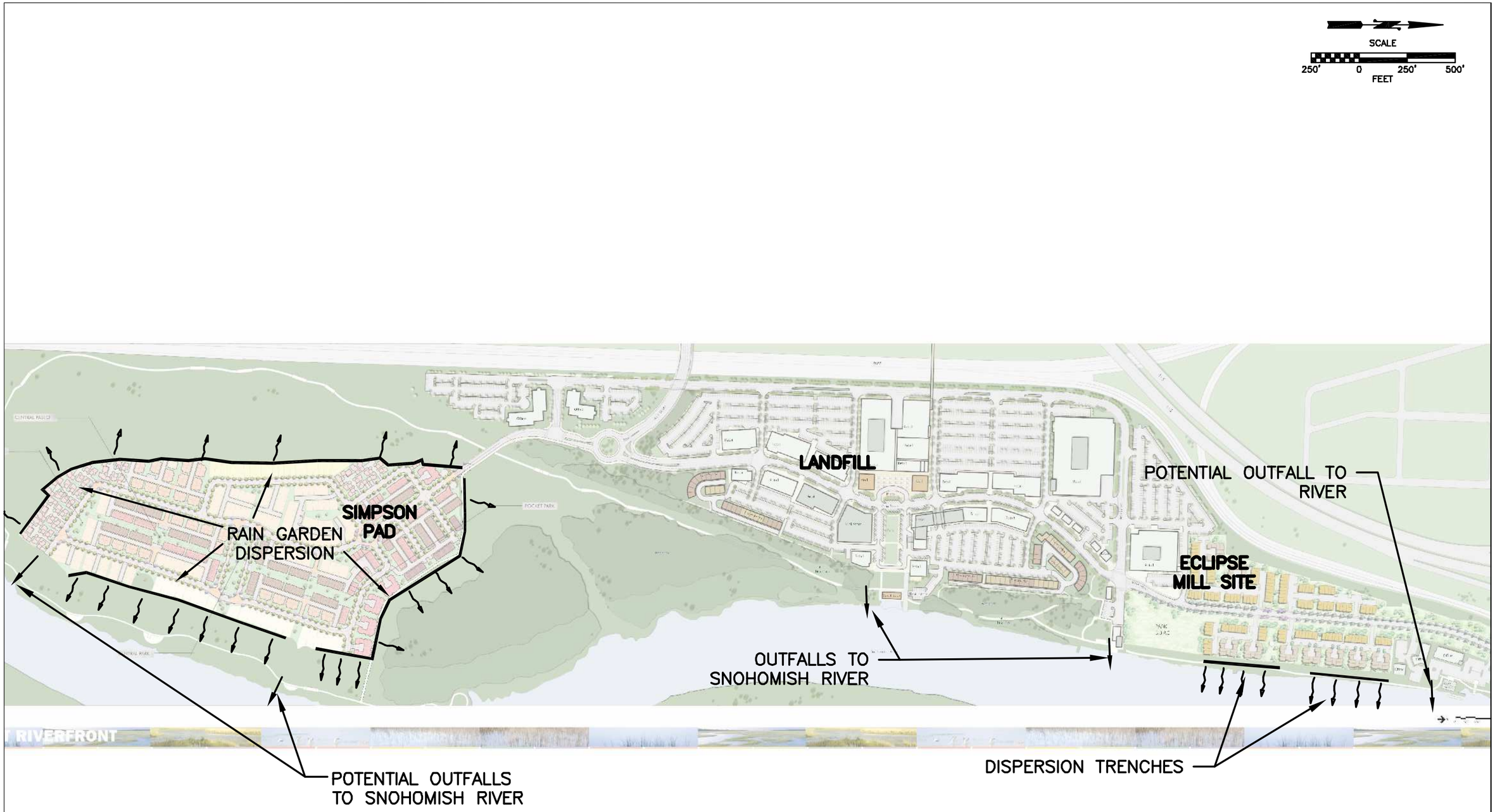
Simpson Site Alternative 1
Stormwater Layout Option

Everett Riverfront Redevelopment Project
Everett, Washington

Figure 4.4-6

Nov 13, 2007 - 2:22pm mickeyb J:\Surface_Water\25038.004 - Riverfront EIS Drainage\CAD\25038-Fig 4.4-6-Details.dwg Layout Name: FIG4.4-5B



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Proposed Outfalls

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Figure 4.4-15

Nov 14, 2007 - 1:32pm mickeyb J:\Surface_Water\25038.004 - Riverfront EIS Drainage\CAD\25038-FIG 4.4-15.dwg Layout Name: Outfalls

4.4.3.2 Landfill/Tire Fire Site

The developed site includes two on-site subbasin areas that were established to match the existing subbasins on the site. These are labeled as the North subbasin and the South subbasin on Figure 4.4-3B Sheet 2. In addition, there is a small basin area that consists of the 41st Street bridge crossing over the I-5 freeway and the areas west of this bridge, which are tributary to the landfill site. One stormwater facility option has been identified for the Landfill/Tire Fire site Alternative 1, and it is to install a pump station with an overflow. This option is shown in Figure 4.4-7, Landfill Site Alternative 1. A detailed description is provided below.

Stormwater management alternatives are limited because the area is a closed landfill site. The site currently has a Cleanup Action Plan that prohibits the infiltration of stormwater into the refuse layer. Limiting the amount of water introduced into the refuse layer limits the amount of leachate that has to be collected and treated. Off-site discharge of stormwater from developed areas is required on the landfill site.

Storm runoff from 41st Street is included in the design of the drainage facilities for the closed landfill. The project does not propose to modify this off-site drainage system. These existing basin limits for 41st Street are shown in Figure 4.4-3B Sheet 3.

Pump Water Quality Flow to Sanitary Sewer

A pump station will convey all stormwater up to and including the 6-month storm event to the existing combined sewer system (CSS) that serves this area. The CSS discharges to the City's wastewater treatment plant. This option is shown in Figure 4.4-7. The remaining stormwater will flow through an overflow pipe and connect to the outfall (L3) where Bigelow Creek connects to the Snohomish River.

4.4.3.3 Eclipse Mill Site

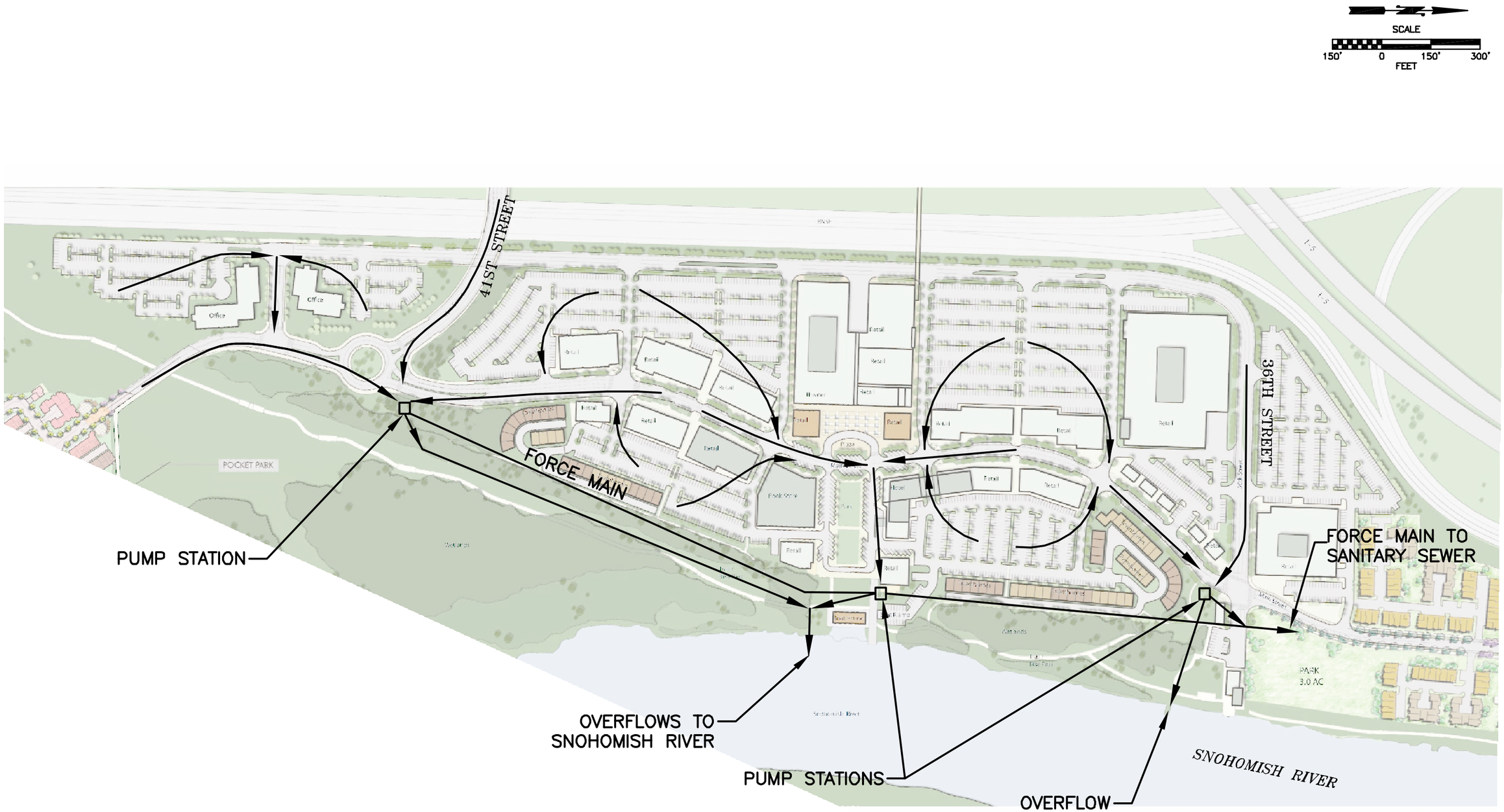
Stormwater facility options have been identified for the Eclipse Mill site and they include the use of stormwater filter vaults and/or wetponds. A conceptual stormwater plan for Alternative 1 is shown in Figure 4.4-8 and it includes the use of both a wetpond and filter vaults. While both methods successfully meet the treatment standards, their use will depend on other factors such as available space. Wetponds take up surface area, where stormwater filter vaults can be located underground.

Wetponds

Wetponds are an effective method to treat stormwater. Their treatment methods include both biological and physical processes. Biological processes include the establishment of microorganisms that feed on common pollutants of concern for our receiving water bodies. Physical processes include the removal of pollutants mainly by settling and the effectiveness depends on the settling properties of the pollutants. A typical cross section of a wetpond is represented in Figure 4.4-10.

Stormfilter Vaults

Stormfilter vaults are a pre-manufactured vault containing filtration cartridges. These cartridges are filled with an array of media (perlite-a product from volcanic ash for example) selected to treat the specific pollutant loadings at each site. The typical unit is composed of three bays: the inlet, filtration and the outlet. Stormwater first enters the inlet through a pipe and is directed through a flow spreader and an energy dissipater into the filtration bay for full treatment. The flow spreader in the inlet acts as a baffle, trapping some floatables (oils, and surface scum) as the stormwater is directed towards the filtration bay. Once in the filtration bay, the stormwater begins to pond and percolate horizontally through the media contained in the filter cartridges. After passing through the media, treated water that has collected in the cartridge is



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Landfill Site Alternative 1
Stormwater Layout

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Everett, Washington

Figure 4.4-7

Nov 14, 2007 - 1:04pm mickeyb J:\Surface_Water\25038.004 - Riverfront EIS Drainage\CAD\25038-Fig 4.4-5 to 4.4-8.dwg Layout Name: Landfill

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Eclipse Mill Alternative 1 Stormwater Layout

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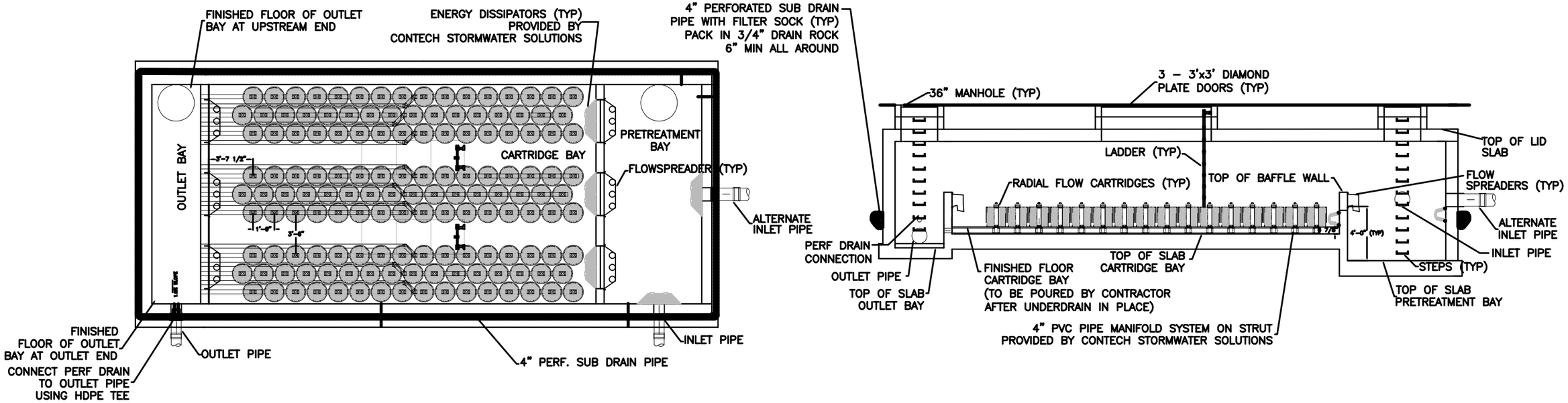
Figure 4.4-8

Nov 14, 2007 - 1:05pm mickeyb J:\Surface_Water\25038.004 - Riverfront EIS Drainage\CAD\25038-Fig 4.4-5 to 4.4-8.dwg Layout Name: MILL



STORMFILTER CAST–IN–PLACE VAULT

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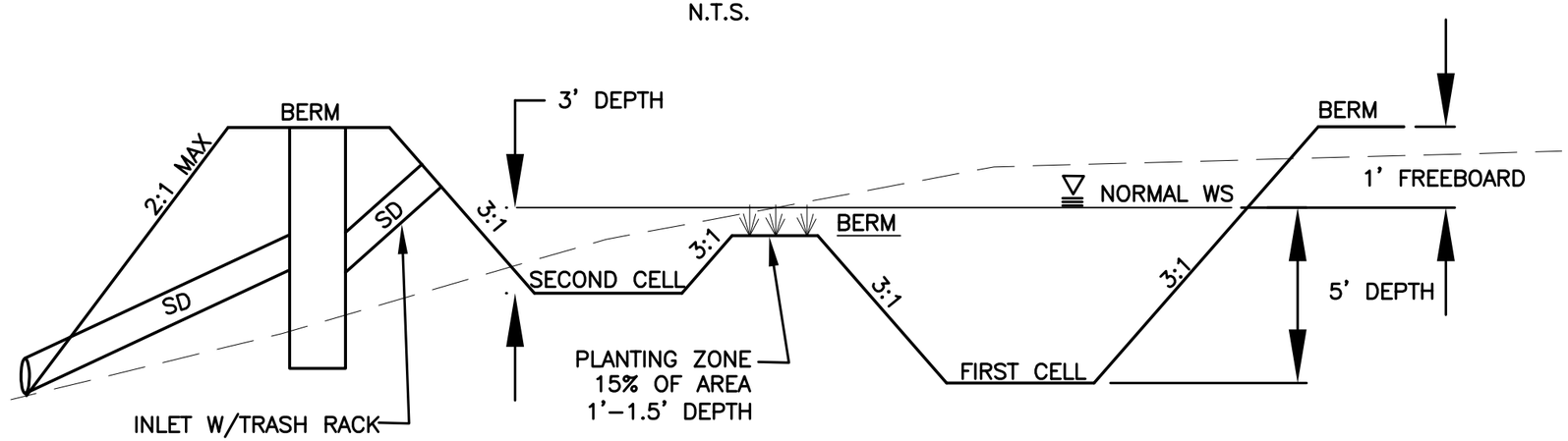

TYPICAL WET POND SECTION

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Simpson Site Alternative 1
Stormwater Layout Option

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Everett, Washington

Figure 4.4-10

Nov 14, 2007 - 11:26am mickeyb J:\Surface_Water\25038.004 - Riverfront EIS Drainage\CAD\25038-Fig 4.4-10-Details.dwg Layout Name: FIG4.4-5B

directed into the outlet at which point it can be discharged. A schematic cross section view of a filter vault is provided in Figure 4.4-10.

Neither option for the Eclipse Mill site provides for flow control because releases to the Snohomish River are exempt from the flow control standards. Both options include the use of dispersion trenches for releasing the treated water to the river. A detail of the dispersion trench is contained in Figure 4.4-9.

4.4.4 Stormwater Facility Layout Options for Alternatives 2, 2B and 3

There are little differences in the methods of stormwater mitigation for all of the Alternatives. For brevity Alternatives 2, 2B and 3 will be discussed together in the following sections.

4.4.4.1 Simpson Site

Alternative 3 is the no-action alternative, and the impact of Alternative 3 is assumed to be similar to Alternative 2. Alternatives 2 and 3 will result in the same scenario with respect to stormwater. Both Alternatives assume roughly the same amount of land coverage as Alternative 1. However, with Alternatives 2 and 3 that coverage is commercial rather than the mixed use represented in Alternative 1. Figure 4.4-11 contains a conceptual site layout for Alternative 2. The principle method for handling the generated stormwater is rain gardens. Rain gardens will be placed in planter strips, open areas between the buildings and ringing the site with the rain garden buffer enhancement.

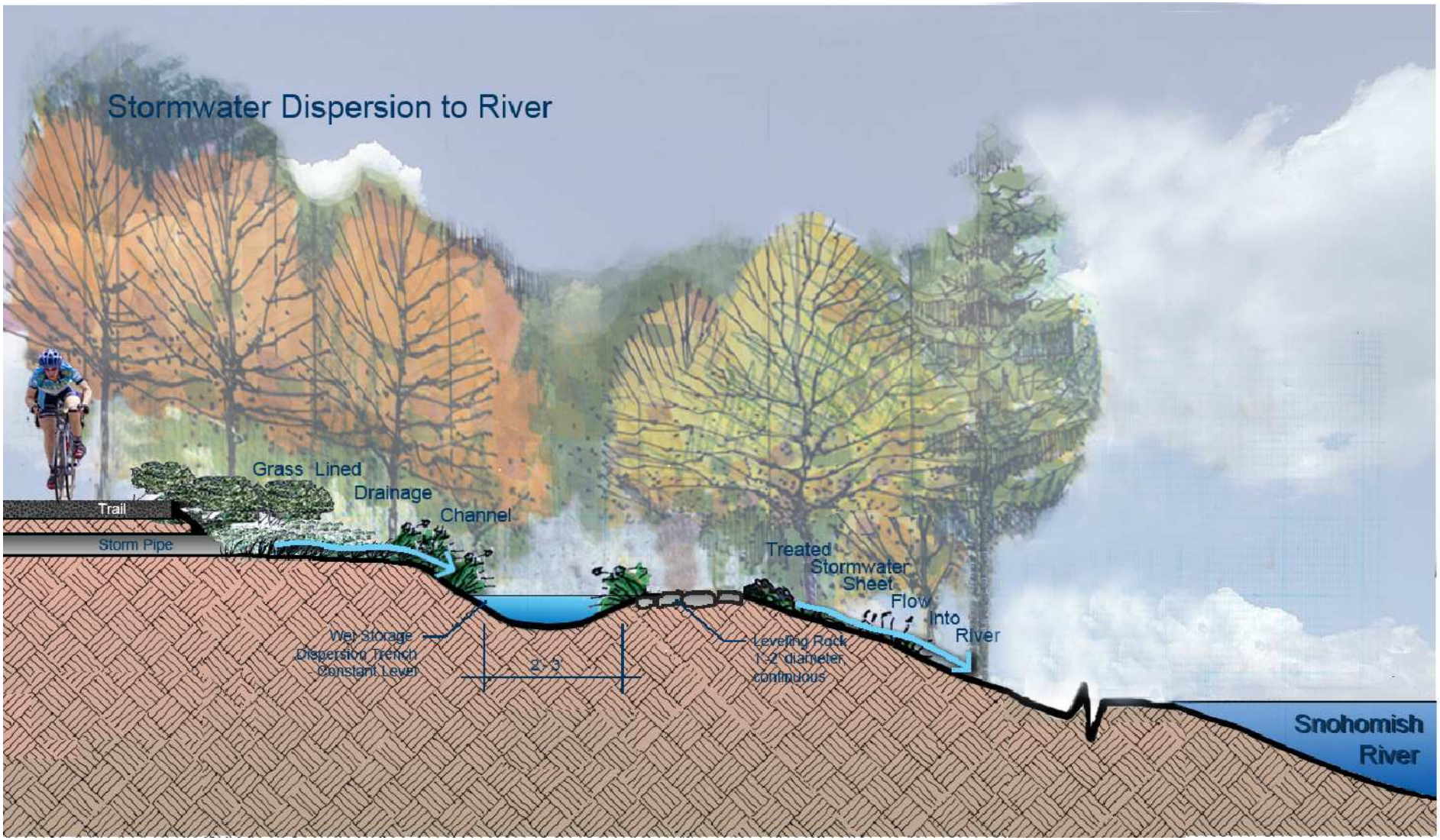
Alternative 2B is a commercial layout similar to Alternative 2, except with a reduced level of development. Figure 4.4-14 contains the stormwater layout for Alternative 2B. The conceptual stormwater layout includes the use of planter strip rain gardens and a larger centralized rain garden.

4.4.4.2 Landfill/Tire Fire Site

All of the alternatives for the landfill site assume that the stormwater treatment requirement will be met through pumping the stormwater into the sanitary sewer system. Stormwater discharges in excess of the 6-month storm will be piped to the Snohomish River. The conceptual plan for Alternatives 2 and 2B can be seen in Figure 4.4-12. The current concept calls for the construction of three pump stations with two new proposed overflow discharges to the river. Again, Alternative 3 is assumed to be similar to Alternative 2.

4.4.4.3 Eclipse Mill Site

The stormwater layout for Alternatives 2 and 2B is represented in Figure 4.4-13. The alternatives assume that the site will be developed with commercial uses. The stormwater mitigation activities for Alternatives 2 and 2B include the use of wetponds and stormwater filter vaults. The stormwater flows from the site will receive water quality treatment and then will be discharged without detention to the Snohomish River. The method for this discharge is slated to be a series of dispersion trenches as depicted on Fig 4.4-9. Alternative 3 is assumed to be similar to Alternative 2.



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DISPERSION TRENCH

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Fig 4-4.9

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Simpson Site Alternative 2
Stormwater Layout

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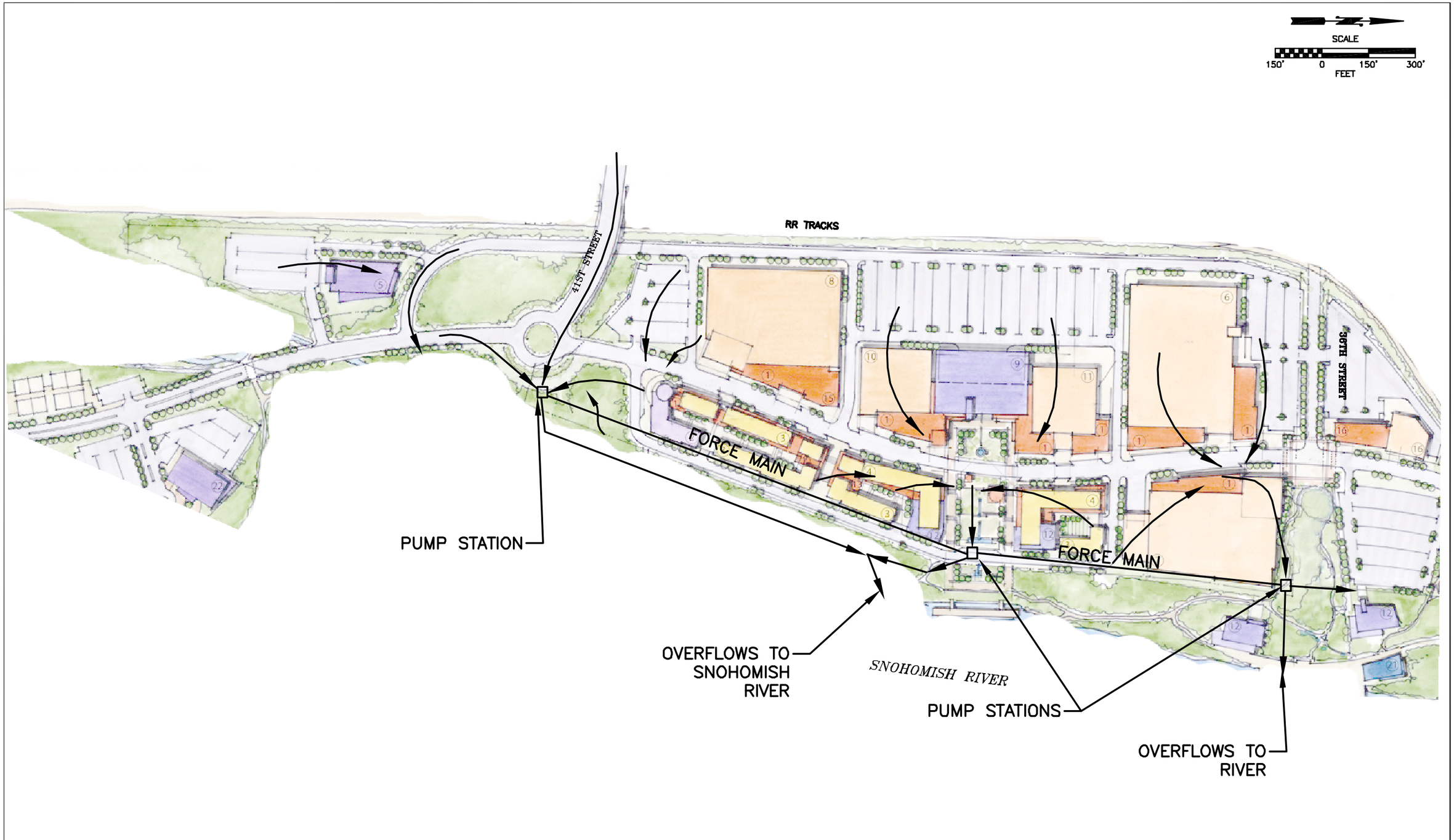
Figure 4.4-11

Nov 14, 2007 - 1:06pm mickeyb J:\Surface_Water\25038.004 - Riverfront EIS Drainage\CAD\25038-Fig 4.4-11 to 4.4-13.dwg Layout Name: Simpson



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Landfill Site Alternative 2 & 2B Stormwater Layout

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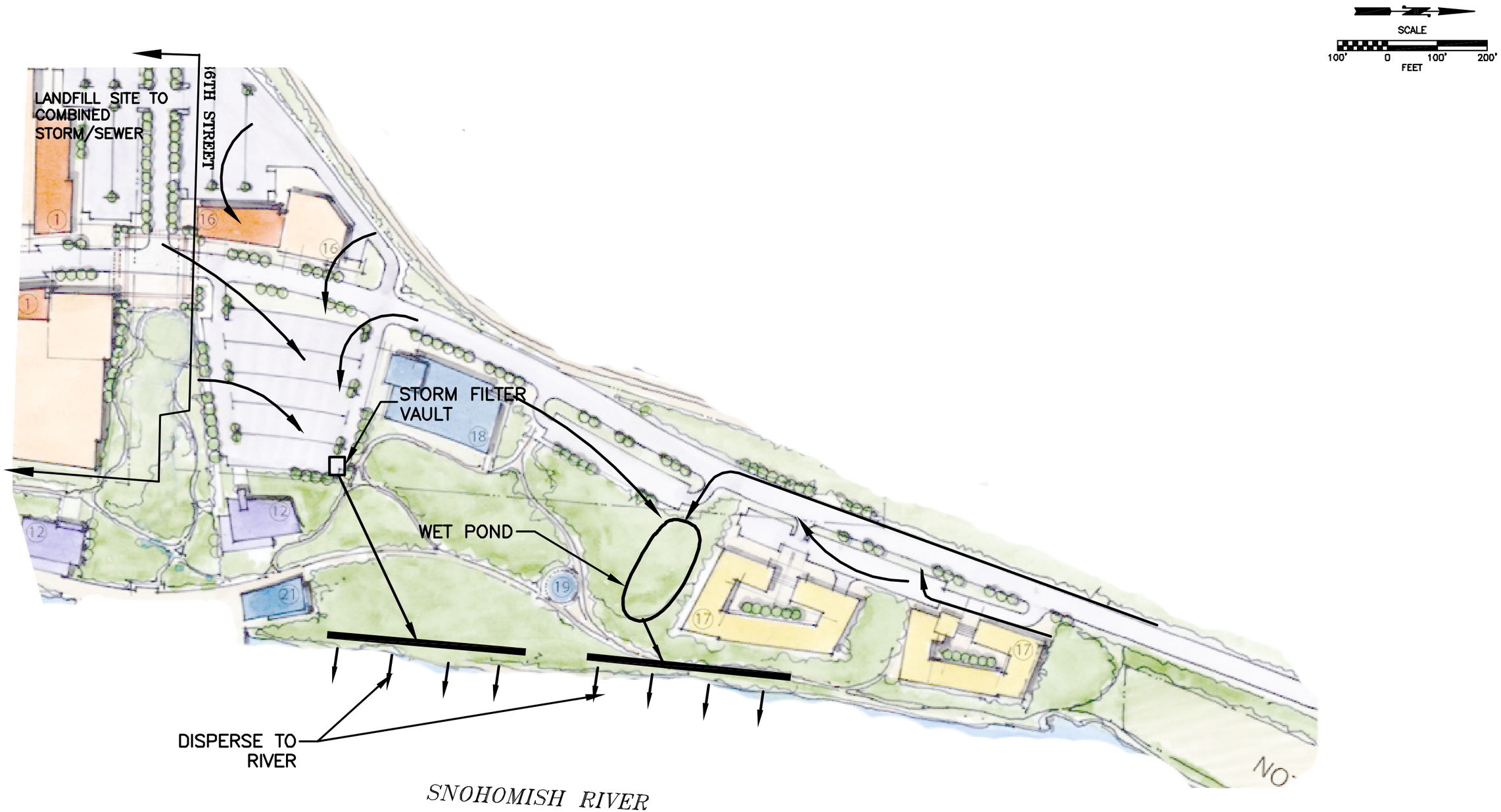
Figure 4.4-12

Nov 14, 2007 - 1:10pm mickeyb J:\Surface_Water\250038.004 - Riverfront EIS Drainage\CAD\250038-Fig 4.4-11 to 4.4-13.dwg Layout Name: Landfill



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Eclipse Mill Site Alternative 2 & 2B Stormwater Layout

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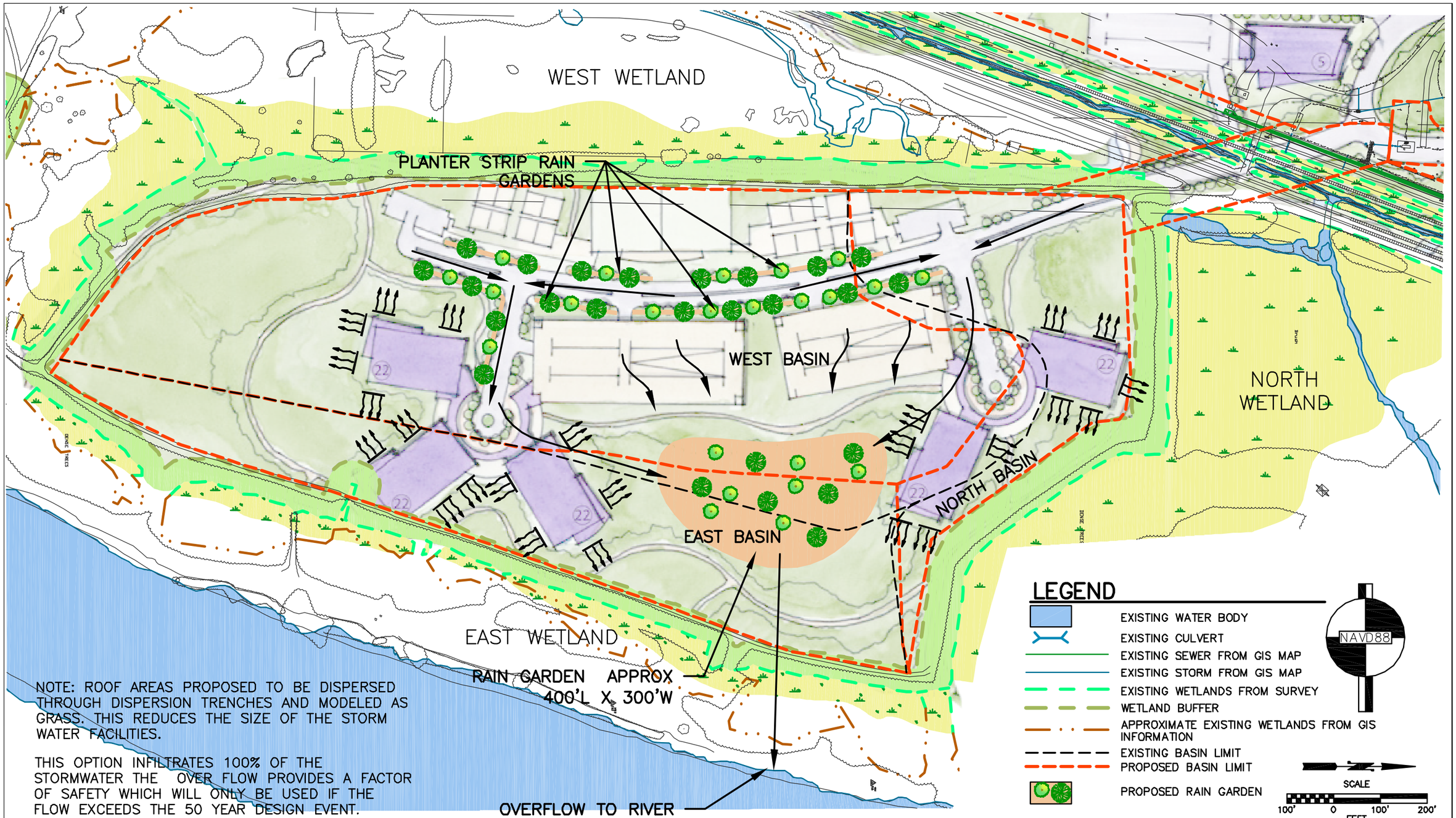
Figure 4.4-13

Nov 14, 2007 - 1:13pm mickeyb J:\Surface_Water\250038.004 - Riverfront EIS Drainage\CAD\250038-Fig 4.4-11 to 4.4-13.dwg Layout Name: MILL



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Simpson Site Alternative 2B Stormwater Layout

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Figure 4.4-14

Nov 14, 2007 - 1:30pm mickeyb J:\Surface_Water\250038.004 - Riverfront EIS Drainage\CAD\250038-Fig 4.4-14.dwg Layout Name: Simpson

4.4.5 Impacts Common to All Alternatives

All of the alternatives will result in changes in the nature of the stormwater runoff. Designing and constructing stormwater management facilities using the Ecology Manual will result in the mitigation the majority of the changes. Some common changes that are associated with development are an increase in the volume of runoff, and the potential for anthropogenic activities to result in the discharge of polluted stormwater. The volume increases will not be a factor in this project because the receiving water is the Snohomish River, and the normal flows in the river dwarf the releases from the project site. The potential for highly polluted stormwater discharges is small as a result of the stormwater treatment methods proposed for the project.

The stormwater mitigation activities for all alternatives are similar in nature but different in size. Alternatives with less proposed footprint require less mitigating activities. The following table, Table 4.4-4, was prepared to summarize the anticipated size of mitigating activities for all alternatives.

Table 4.4-4. Summary of Mitigation Requirements

	Approximate Footprint (acres)	**Approximate Volume[1] (cubic feet)**
Simpson Site		
Alternative 1, 2 and 3	Rain Gardens[2] **4.6**	
Alternative 2B	Rain Gardens[2] **2.8**	
Landfill Site		
All Alternatives	Pump to Sewer **Minimal[3]**	
Eclipse Mill Site		
All Alternatives		
Only Using Stormfilters	**Minimal[4]**	
Only Using Wetponds	**1.2**	**135,000**

Notes:
1. When applicable
2. Rain garden area requirements are based on an assumed infiltration rate of 10 in/hr for planning purposes
3. Pump to Sewer would require the construction of pump stations
4. Stormfilter vaults are underground, and it is assumed that every option would require a total of around 300 filter cartridges

4.4.5.1 Storm Discharge Locations

The existing stormwater discharges were described above in greater detail in section 4.4.2. Many of the options presented utilize these existing outfalls. The proposed storm outfalls are described in the descriptions for each option within this section and are represented in Figure 4.4-15.

4.4.5.2 Issues and Impacts to the Snohomish River

The Snohomish River is identified in the Ecology Manual as a water body that is exempt from flow control requirements. Major receiving waters receive this designation. For this reason, project sites that discharge directly to the Snohomish River are exempt from providing detention. In this segment of the

river, there is also tidal influence, given the close proximity to the Puget Sound. However, water quality treatment is required. This includes all of the options that outfall to the Snohomish River, including the river outfall at the location of an existing stream outfall (L3) for Bigelow Creek.

In addition to being exempt from flow control, the Snohomish River is listed in the Ecology Manual as a basic treatment receiving water. This means that the methods found in the Ecology Manual and listed as providing basic treatment are to be used. This list is identified in Section 4.4.1 of this report under the heading, "Basic Treatment BMPs…" Several options are presented that meet these standards.

By following these standards, the project will minimize impacts to the Snohomish River; however, additional measures to avoid, reduce and mitigate impacts are described below.

4.4.5.3 Issues and Impacts to Bigelow Creek

The Ecology Manual requires that the portions of this project that discharge to Bigelow Creek or the existing wetlands comply with the flow control standards listed at the beginning of this section. There is no flow control exemption for Bigelow Creek. For options that discharge to the Snohomish River at the location of the existing Bigelow Creek outfall, the Snohomish river flow control exemption described in the previous section applies.

Bigelow Creek is a fish-bearing stream. The lower reach of this stream and some of the wetlands associated with this reach of the stream are often inundated by the Snohomish River. This inundation likely occurs on daily basis because this portion of the Snohomish River is tidally influenced. This daily inundation improves fish access to this stream and the connected wetlands.

For this reason, enhanced treatment standards apply to portions of the project that discharge to Bigelow Creek and wetlands. This means that the methods found in the Ecology Manual and listed as providing enhanced treatment are to be used. This list is identified in Section 4.4.1 of this report under the heading, "Enhanced Treatment BMPs..." Several options are presented that meet these standards.

By following these standards, the project will minimize impacts to Bigelow Creek. Additional measures to avoid, reduce and mitigate impacts are described below.

4.4.5.4 Issues and Impacts to Wetlands

There are several wetlands adjacent to the project site. These wetlands are connected to the Snohomish River, Bigelow Creek, or both so that they are considered to be fish-bearing. There are three main wetlands on this site for which a hydroperiod analysis was completed. The Ecology Manual requires that the portions of this project that discharge to these wetlands meet the normal flow control standards and complete a hydroperiod analysis showing what change (if any), due to the development of the site, will occur to wetlands water surface stage, dry period and amphibian breeding period. (A hydroperiod analysis is a form of hydrologic assessment used to measure or estimate elements of an area's hydroperiod under pre-development and anticipated post-development conditions. The "hydroperiod" is a term for the seasonal occurrence of flooding and/or soil saturation including depth, frequency, duration, and seasonal

pattern of inundation.) Hydroperiod analysis calculations are found in the EIS Drainage Report (Perteet, May 25, 2007), and are summarized in the text below.

By following these standards, the project will minimize impacts to the wetlands; however, additional measures to avoid, reduce and mitigate impacts are described below.

Another potential impact to nearby water bodies can occur when undetained and untreated water is allowed to flood these water bodies. By meeting the water quality treatment and flow control standards, these potential impacts can be avoided and/or mitigated. By employing the flow control requirements found in the Ecology Manual, erosive forces that can be created in channels are mitigated.

In order to model these wetlands, the area of the wetlands was identified as well as the natural outlet characteristics. These two parameters were entered into MGS Flood, which modeled the continuous stage of the wetlands and output the results described above.

The outfall of the North wetlands, which lie immediately north of and adjacent to the Simpson site, was identified as an existing beaver dam that is approximately 10 feet long. These wetlands are often inundated by the Snohomish River during times of high tide.

The outfall of the wetlands adjacent to and immediately west of the Simpson site was identified as the BNSF railroad grade. A railroad spur with two parallel tracks serves as a weir for the flows which leave these wetlands. Bigelow Creek enters the wetlands from the South. It then flows along these spurs and flows across the tracks. Field observation showed no culvert under these tracks in this area. Therefore, this was input into the model to function as a long, natural weir.

The outfall of the wetlands adjacent to and immediately east of the Simpson Pad was identified as sheet flow across the existing paved walking path. This was entered as a weir. Field observation showed evidence of this occurring.

These results are given in terms of stage excursions, both mean annual, and specifically during the amphibian breeding period. The average monthly change in wetland water surface elevation is given. The number of stage excursions that exceed 0.5 feet during each year of the model is given.

Stage excursions are defined as the difference between the predeveloped and postdeveloped water surface elevation above a specified threshold. The default threshold is 15 cm (0.5 feet). Thus, each time that the absolute value of the difference between simulated predeveloped and postdeveloped water surface elevation exceeds the threshold, an excursion begins. When the difference drops below the threshold, the excursion ends.

The MGS Flood program computes stage excursions for the entire simulation period and outputs several excursion statistics in the project report. These include:

- Number of stage excursions per year;
- The total duration of excursions per year;
- The average duration of each excursion per year;
- The maximum excursion for each year; and
- The duration of the longest excursion during the year.

The dry period analysis shows the number of hours each year that the wetland would be dry if the only runoff to enter the wetland was the stormwater runoff from the Simpson site. In this way, one can see if the project will cause an impact during the dry season. This is given for both the predeveloped and postdeveloped condition.

The program tracks the number of hours per year that the water surface elevation drops below a user-specified value. The default value for "dry" conditions is a depth less than 0.01 feet. The statistic is computed for both predeveloped and postdeveloped conditions and reported for each year simulated.

The amphibian breeding period analysis is done for each year of the model. The program computes hydroperiod limits for a user-specified amphibian breeding period (with a default of February 1 through May 31). The program reports the duration of stage excursions above or below the predevelopment level in continuous 30-day periods during the breeding months. The default stage excursion threshold is 8 cm (0.25 feet). These statistics allow for the evaluation of amphibian criteria, which state that the magnitude of stage excursions above or below the predevelopment stage should not exceed 8 cm for more than 24 hours in any 30-day period.

The land use areas and hydrologic modeling outputs are summarized below. The flows entering these wetlands are from very large off-site basins including the Snohomish River Basin and the Bigelow Creek Basin. Also, the outfall for these wetlands consists of wide flat weirs that have a large capacity increase as the stage increases. For these reasons, the results quite predictably indicate that this project will have no measurable impact on the wetlands hydroperiod.

The Simpson site is the only site that is tributary to these wetlands, so the hydroperiod analysis was completed for this site. The stormwater option considered at this site was also studied. A hydroperiod analysis calculation is provided in the EIS Drainage Report prepared by Perteet, dated May 25, 2007, and summary text below.

The results of the wetland hydroperiod analysis show that the rain garden drainage option presented for all three alternatives will not create any wetland water surface stage excursions, or additional dry periods, or any impacts to the amphibian breeding period. In addition, the modeled change in water surface elevation within the wetland is negligible (less than 0.01 feet).

4.4.6 Flow Duration Impacts to Snohomish River

The Simpson site does not have a flow duration impact on the Snohomish River due to the fact that all of the stormwater runoff from the site will be infiltrated.

The Landfill/Tire Fire site is exempt from the flow control standards, as described above in Section 4.4.4.2. A portion of the runoff from the Landfill/Tire Fire site will be directed to the sewer treatment plant. This is equal to the water quality design flow rate which is 5.8 cfs. Table 4.4-5 is copied directly from the MGS Flood calculations found in the *EIS Drainage Report* prepared by Perteet, dated May 25, 2007. The flow rate of 5.8 cfs, which is the flow that enters the sanitary sewer system, is included in the discharge flowrates.

Table 4.4-5. Landfill/Tire Fire Site - Combined Discharge to Snohomish River

***** Point of Compliance Flow Frequency Data *****

Recurrence Interval Computed Using Gringorten Plotting Position

Combined Sewer and Overflow			
Predevelopment Runoff		**Postdevelopment Runoff**	
Tr (Years)	**Discharge (cfs)**	**Tr (Years)**	**Discharge (cfs)**
2-Year	1.393	2-Year	17.519
5-Year	2.330	5-Year	22.091
10-Year	2.831	10-Year	26.433
25-Year	3.797	25-Year	30.742
50-Year	4.630	50-Year	37.891
100-Year	5.063	100-Year	41.136
200-Year	5.537	200-Year	47.917

Subtracting the 5.8 cfs shows that the flows leaving the site are as indicated in Table 4.4-6.

Table 4.4-6. Landfill/Tire Fire Site - Discharge to Snohomish River Excluding Sewer

***** Point of Compliance Flow Frequency Data *****

Recurrence Interval Computed Using Gringorten Plotting Position

Overflow only (subtract flow to sewer)			
Predevelopment Runoff		**Postdevelopment Runoff**	
Tr (Years)	**Discharge (cfs)**	**Tr (Years)**	**Discharge (cfs)**
2-Year	1.393	2-Year	11.72
5-Year	2.330	5-Year	16.29
10-Year	2.831	10-Year	20.63
25-Year	3.797	25-Year	24.94
50-Year	4.630	50-Year	32.09
100-Year	5.063	100-Year	35.34
200-Year	5.537	200-Year	42.12

The Eclipse Mill site is exempt from the flow control standards, as described above in Section 4.4.4.3. The flow rates under predeveloped and postdeveloped conditions are shown in Table 4.4-7. Table 4.4-7 is copied directly from the MGS Flood calculations found in the *EIS Drainage Report* prepared by Perteet, dated May 25, 2007.

Table 4.4-7. Eclipse Mill Site - Discharge to Snohomish River

***** Point of Compliance Flow Frequency Data *****

Recurrence Interval Computed Using Gringorten Plotting Position

Predevelopment Runoff		Postdevelopment Runoff	
Tr (Years)	**Discharge (cfs)**	**Tr (Years)**	**Discharge (cfs)**
2-Year	0.621	2-Year	7.813
5-Year	1.039	5-Year	9.852
10-Year	1.263	10-Year	11.789
25-Year	1.693	25-Year	13.711
50-Year	2.065	50-Year	16.899
100-Year	2.258	100-Year	18.347
200-Year	2.470	200-Year	21.371

** Record too Short to Compute Peak Discharge for These Recurrence Intervals

In addition to the peak flow change, the duration of time that the peak flow is maintained will also increase. The flow durations that exceed the predeveloped peak flows are shown in Tables 4.4-8 and 4.4-9.

Table 4.4-8. Flow Duration Impacts Discharge to Snohomish River – Landfill/Tire Fire Site

Landfill Basin Predevelopment Recurrent Interval (Years)	Discharge (cfs)	Average Hours per Year Discharge Rage will be Exceeded (hours/year)		Average Increase in Duration (hours/years
		Predeveloped	Postdeveloped	
2-year	1.39	14	492	478
10-year	2.83	1	232	231
100-Year	5.06	0	81	81

Table 4.4-9. Flow Duration Impacts Discharge to Snohomish River – Eclipse Mill Site Eclipse Mill All 4 Sub-basins

Predevelopment Recurrence Interval (Years)	Discharge (cfs)	Average Hours per Year Discharge Rate Will Be Exceeded (hours/year)		Average Increase In Duration (hours/year)
		Predeveloped	Postdeveloped	
2-year	0.62	14	492	478
10-year	1.26	1	232	231
100-Year	2.26	0	81	81

4.4.7 Mitigation

4.4.7.1 Temporary Erosion Control

One of the most important ways by which site development projects can minimize impacts to existing water bodies such as wetlands, streams and rivers is by implementing an effective erosion control plan during construction. Typical erosion control BMPs greatly reduce these impacts. One BMP type is used to establish a barrier around the site to reduce the silt in the surface water runoff. Examples of this include: installation of silt fencing, maintaining existing vegetated buffers through the use of high visibility clearing limits fencing, storm drain inlet protection and compost filter berm. Another effective type of erosion control BMP includes temporary sediment traps. Also, reduction of exposed areas through the use of temporary mulching or covering and construction sequencing can be used to reduce the amount of silt that enters the water. These BMPs and others found in the Ecology Manual will be employed on the site.

4.4.7.2 Storm Outfalls

Another possible impact that will be mitigated deals with permanent energy dissipation at outfalls. Concentrated water traveling at high velocities can produce site-specific erosion at outfalls. This project will use several methods to avoid this. One method is to use dispersion that creates a wide area of shallow flow, thereby reducing velocity and erosive forces. Connecting or improving existing stabilized pipe outfalls is another means by which this project can avoid creating erosive conditions at the proposed discharge locations.

4.4.7.3 Stormwater Treatment

Stormwater treatment BMPs will be used on this project to remove pollutants from stormwater by gravity settling, filtration, biological uptake and soil adsorption. The Ecology Manual is intended to provide project proponents, regulatory agencies and others with technically sound stormwater management practices which are *presumed* to protect water quality and in stream habitat – and meet the stated environmental objectives of the regulations described in this chapter. The following excerpt from the Ecology Manual explains this approach:

> "*Presumptive Approach - The Stormwater Management Manual for Western Washington provides a default set of stormwater practices based on current science which satisfy State and Federal stormwater requirements.*"

One of these BMPs is infiltration. Infiltration is a highly effective method of reducing pollutant loads when infiltrating through appropriate soil matrix. It most closely emulates the original natural conditions under which these water bodies formed. Infiltration reduces the amount of runoff that leaves the site as surface flow. Infiltration options have been presented for the Simpson site where soils data support the use of infiltration. The Landfill/Tire Fire site cannot be used as an infiltration site because directing additional groundwater towards the buried garbage would cause adverse water quality impacts. The Eclipse Mill site has been an active industrial yard for decades. Combined with the highly variable nature of the soils on the site, infiltration of stormwater is not supported without additional detailed underground investigations.

4.5 PLANT AND ANIMAL RESOURCES

This section includes an extensive compilation of existing information collected through a literature review regarding plant and animal resources at the project site. Included is a summary of the information

found in the Plants and Animals Technical Data Summary, a description of potential effects related to the aquatic and terrestrial biotic communities and actions that will be taken to avoid or mitigate negative effects to plant and animal resources.

4.5.1 Existing Conditions/Affected Environment

Snohomish County is characterized by two ecoregions, the Puget Lowland and the Cascade Range, based on topography, climate, land uses, soils, geology and naturally occurring vegetation. The project site lies within the Puget Lowland ecoregion, which has been characterized by the U.S. Environmental Protection Agency (EPA) and DellaSala et al. (2001) as follows:

> *This broad rolling lowland is characterized by a mild maritime climate. It occupies a continental glacial trough and is composed of many islands, peninsulas, and bays in the Puget Sound area. The region is relatively wet, receiving in the neighborhood of 45" of rain per year and was historically forested with conifers. Coniferous forest originally grew on the ecoregion's ground moraines, outwash plains, floodplains, and terraces. Currently the Puget Lowland ecoregion is the most heavily populated and modified region of the Pacific Northwest and includes the cities of Bellingham, Friday Harbor, Port Townsend, Seattle, Shelton, Olympia, Chehalis, and Kelso. Much of the land is either urban or agricultural.*

Deltas and small estuaries within the Puget Lowland ecoregion tend to be characterized by soft sediments and gradual salinity changes. Salinity and the gradient from freshwater to brackish and marine waters affect habitat types and the species that can be supported.

4.5.1.1 Snohomish Estuary

The Snohomish Estuary includes parts of Possession Sound, Port Gardner Bay and the mouth of the Snohomish River; and it is a major source of fresh water for the Puget Sound (Gustafson et al., 2000). This estuary is highly productive, supporting many species of estuarine and near-shore marine plant and animal species. The estuary provides essential ecological functions for anadromous salmonids, including feeding (rearing), migration, predator avoidance, and saltwater/freshwater osmoregulatory adaptation (City of Everett and Pentec Environmental, 2001).

The project is within the floodplains of the Snohomish Estuary. The portion of the estuary near the project site is included in Ecological Management Unit (EMU) 1 of the Snohomish Estuary Wetland Integration Plan (SEWIP) (1997). As described in SEWIP, EMU 1 generally includes freshwater wetlands in the southern portion of the Snohomish Estuary. Salt-sensitive plant species that distinguish this area include skunk cabbage (*Lysichiton americanum*), yellow marsh marigold (*Caltha palustris*) and red-osier dogwood (*Cornus stolonifera*). The majority of the wetlands within this unit are diked and in agricultural production. River and slough banks are typically steep, consisting of sands with rock riprap and occasional pilings. A narrow shoreline of sandy silts (mud) is present throughout. Prior to diking, the area was a mosaic of tidal marshes, forested wetlands, sloughs and mudflats that were flooded daily. Agriculture has been the primary land use in the unit.

4.5.1.2 Snohomish River

The bank of the Snohomish River adjacent to the site consists of steeply diked banks with areas of riprap protection and occasional pilings. These extensive man-made earthen dikes have been in place since the mid-1930s and confine the limits and influence of the river (Haring, 2002). The water surface elevation of the Snohomish River within the project area is controlled by tides and raises and lowers with the flow and ebb of the tides. However, because of a weak salt wedge influence, there are no salt-tolerant plant

species in the area immediately adjacent to the river. The riparian vegetation consists primarily of Himalayan blackberry (*Rubus armeniacus*), Sitka willow (*Salix sitchensis*), Pacific willow (*Salix lasiandra*), salmonberry (*Rubus spectabilis*), red alder (*Alnus rubra*), cottonwood (*Populus trichocarpa*) and big-leaf maple (*Acer macrophyllum*) and few coniferous trees.

Lack of riparian vegetation and species diversity, in conjunction with extensive diking, results in limited recruitment of large woody debris (LWD) that is large enough to function as cover or influence channel morphology (Haring, 2002). In addition to production losses experienced to date, future production potential for salmonids (parr and pre-smolt) in the river could decrease if existing LWD continues to decay and is not replenished through new recruitment (Haas and Collins, 2001).

4.5.1.3 Bigelow Creek

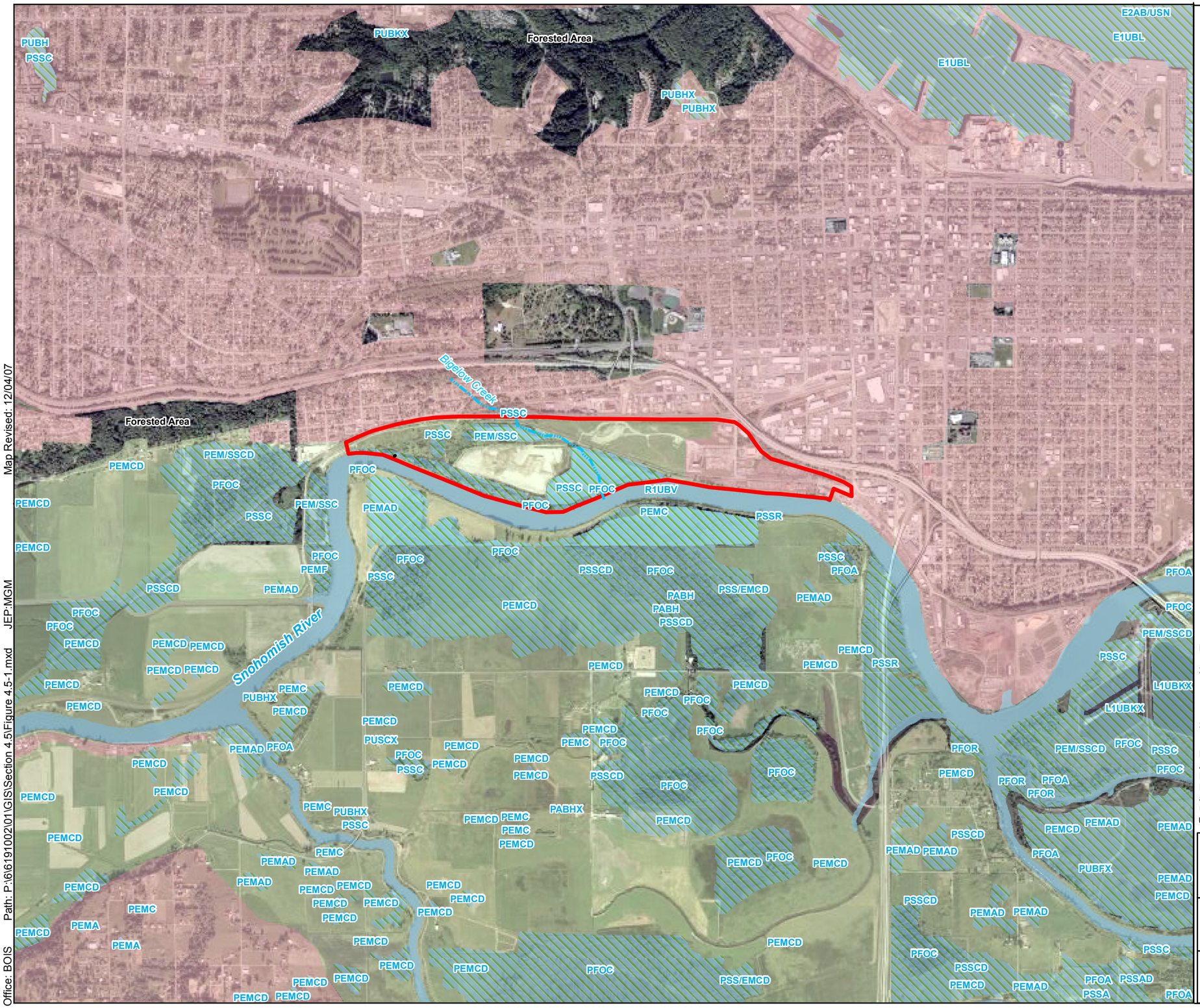
Bigelow Creek is located on the project site and enters the west bank of the Snohomish River north of the Simpson Pad. The creek flows through the partially filled Simpson Category 1 Wetlands and Riparian corridor prior to entering the Snohomish River (see Figure 4.5-1). The creek flows through an old mill site, where it has been heavily altered from natural conditions. Extensive fill was placed in historical wetlands, and the creek was ditched, channelized and culverted through the mill site and along the railroad (Haring, 2002). Some of the channel characteristics have been restored where the creek flows along the railroad tracks, including open wetlands in the denser vegetated areas (Haring, 2002). A tide gate through the dike at the mouth of Bigelow Creek previously impaired access into the creek, but has been removed (Haring, 2002). Since the removal of the tide gate, the creek experiences tidal influence from the Snohomish River.

The overall rating for the riparian condition of Bigelow Creek is poor to fair in the anadromous zone of the watershed, but recognizes the potential to improve as riparian vegetation matures. Juvenile salmonid use has been documented by the Tulalip Tribes (Loch, 1999), and is also documented in Haring (2002). The creek has a large and extensive network of beaver (*Castor canadensis*) dams that has contributed to adjacent wetlands, used in turn by other animal species.

West Ditch Drainage

The project area currently includes numerous ditches between the Tire Fire/Landfill Site and the Simpson Development Pad that are hydrologically connected with the Snohomish River. These drainages serve to capture and redirect stormwater and some overflow from Bigelow Creek. The West Ditch Drainage originates from an off-site wetland and then flows into three small wetlands before entering Stream CC which discharges into the Snohomish River. Stream CC is the confluence of Bigelow Creek and West Ditch Drainage between two other small wetlands.

Stream buffer conditions and functions vary from very low to non-existent due to the railroad grades, tracks and lack of native vegetation. The hydrologic connection to the Snohomish River through culverts allows for access by listed priority fish species. However, habitat value for listed species is very low and the overall riparian condition is poor in the anadromous zone of the watershed due to the current linear ditch configuration, existing culverts, presence of invasive species, poor habitat function and current lack of a vegetative buffer.



Explanation

- Project Site
- Wetlands
- Urban
- Agiculture/Herbaceous Area

E1U - Estuarine, Subtidal, Unconsolidated Bottom
L1UB - Lacustrine, Limnetic, Unconsolidated Bottom
PAB - Palustrine, Aquatic Bed
PEM/SS - Palustrine, Emergent / Scrub-Shrub
PEM - Palustrine, Emergent
PFO - Palustrine, Forested
PSS/EM - Palustrine, Scrub-Shrub / Emergent
PSS - Palustrine,Scrub-Shrub
PUB - Palustrine, Unconsolidated Bottom
PUS - Palustrine, Unconsolidated Shore
R1UB - Riverine, Tidal, Unconsolidated Bottom

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Feet

Notes:
1. The locations of all features shown are approximate.
2. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. can not guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.
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Data Sources:
Aerial image obtained from TerraServer dated Thursday, June 13, 2002.
Habitat and Species data from Washington Department of Fish and Wildlife. Wetland data from NWI data from National Fish and Wildlife (obtained April 2006) & staff delineation.
Urban, wildlife corridor and forested areadelineated from field staff.
Universal Transverse Mercator, Zone 10, North American Datum 1983

Habitat Types and Plant Communities within Project Vicinity

Everett Riverfront Redevelopment
Everett, Washington

GeoEngineers

Figure 4.5-1

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4.5.1.4 Wetland Habitat

Wetlands provide specific water quality protection through displacement and filtering of pollutants and sediments, reducing downstream erosion and peak flows, groundwater recharge, shoreline stabilization, thermal cover and temperature moderation for aquatic species and specific habitat features such as food, cover, nesting, perches and wildlife corridors. Buffers next to wetland habitat also increase habitat heterogeneity by providing multiple niches for more species: invertebrates, amphibians, wetland associated birds, wetland associated mammals, native plan richness and primary production and export (Sheldon et al., 2005).

Industrial, railroad and related activities over more than a century resulted in filling of wetland areas throughout the project boundaries. There are now 67.2 acres of wetlands within the project boundaries. Most of the wetlands are concentrated on the southern portion of the site, which comprises various portions of the Simpson Site.

Wetland features within the project vicinity and their respective associated community types (Cowardin classification) are identified by the USFWS (National Wetland Inventory maps) and the WDFW (PHS data). Wetland community types within the project area are; palustrine emergent (PEM), palustrine scrub/shrub (PSS), palustrine forest (PFO) and riverine tidal. The location of wetland community types within the project area and adjacent parcels are shown in Figure 2.1-13 through 2.1-13B, Wetlands Delineation and Buffer Map.

Wetlands within the project area have been previously delineated and described in Pentec Environmental, Inc. (1994), City of Everett and Pentec Environmental (2001), Associated Earth Sciences, Inc. (2003), and The Watershed Company (2005 and 2006). The most recent wetland delineation and classification was performed by ESA Adolfson, who was retained by the City of Everett.

Aforementioned reports prepared for the project area provide extensive discussion and description of the wetland features within the project area. Although the advantages of having multiple site investigations and reports, encompassing nearly 15 years, are numerous, labeling of on-site features has remained inconsistent. All wetland features within the project area and their respective boundaries have been determined by previous consultants and have been summarized in the GeoEngineers report entitled *"Wetland and Stream Compilation and Review, Everett Riverfront Redevelopment"* (Appendix E).

Wetlands are interrupted from the Snohomish River by levees and dikes (with some exceptions at culverts or Bigelow Creek). Thus, most of the on-site wetlands are not in direct continuity with the river or tidal influence according to applicable provisions of the Washington Administrative Code.

4.5.1.5 Simpson Category 1 Wetlands and Riparian Corridor

Approximately 30 acres of wetlands are found on the portion known as the Simpson Category 1 Wetlands and Riparian Corridor. Because of the large size, diverse quality habitat, seasonal and permanent open water habitat, the association with Bigelow Creek and the tidal influence of the Snohomish River, these wetlands are considered by the City as a "Significant Biological Area of Local Importance."

4.5.1.6 Upland Habitat

The Landfill/Tire Fire site and the Simpson Pad can be characterized as monotypic, early-successional native plant communities that co-dominate with non-native, invasive plant communities because of the amount of disturbance. The Eclipse Mill site is an urban area with extensive development. The Newland

site is composed of asphalt and small commercial buildings. Upland vegetation adjacent to wetlands within the South Simpson site and the Simpson Category 1 Wetlands and Riparian Corridor may be characterized as scrub/shrub or forested. However, because of the extensive amount of historical wetland fill projects completed before regulations were in place, upland buffer quality within the project area should not be considered pristine nor is it considered priority habitat.

4.5.1.7 Wildlife Corridors

Physical destruction of vegetation and habitat resulting from human development activities within the vicinity of the project has been extensive and of long duration. The construction of levees and dikes separated the Snohomish River from the floodplain and wetlands. In addition, buildings, railroads and highways have fragmented formerly continuous forests, thus eliminating and/or restricting habitat use to animals. There is no sizable amount of intact habitat remaining in the vicinity of the project site compared to historical standards (Haring 2002).

The existing habitats and potential wildlife corridors, as well as potential barriers to movement within the project vicinity, have been mapped based on interconnection of habitats and ecosystems where human activity is limited and availability of habitats within the landscape. Figure 4.5-2, Wildlife Corridor and Species Use Map, identifies the areas, types of habitat and potential corridors located within the vicinity of the project site. This figure illustrates that the habitat connections to other upland areas are limited by I-5, the existing railroad tracks, the parking lot northwest of Rotary Park, and Lenora Street and Lowell-Snohomish River Road. The Snohomish River provides a corridor for wildlife movement and is near large areas of floodplain with agricultural fields and wetlands that provide varied wildlife corridors

4.5.1.8 Plant Species

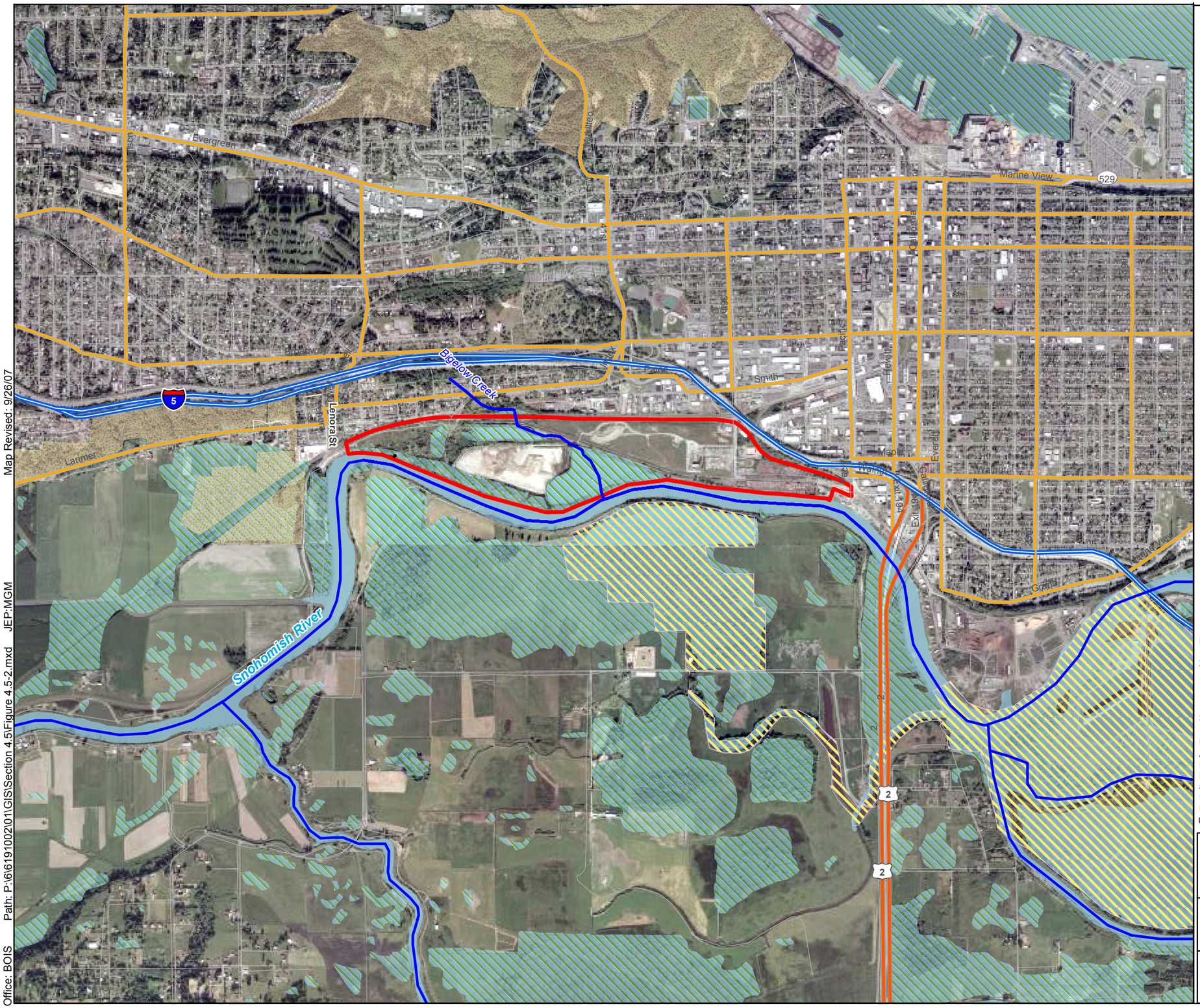
Freshwater plant species exist along the riparian and shallow water areas of the site. Monotypic, early-successional native plant communities that co-dominate with non-native, invasive plant communities exist on the site and where present may be characterized as emergent, scrub/shrub or forested. Most vegetation is associated with or is near wetlands or riparian areas. No sensitive vascular or non-vascular plants have been identified for the project site, and they are not expected to occur in the area.

4.5.1.9 Animals – Invertebrates

There are no threatened or endangered invertebrate species documented as occurring in Snohomish County (Adams et al. 2004 and GeoEngineers, Inc. 2007, *Plants and Animals technical data summary report*). The game/food species for human consumption that are present are most likely to occur in the Snohomish Estuary and not within the project site.

4.5.1.10 Fish

Table 4.5-1 is a list of priority fish that are present in the proposed project area. These priority fish species require very specialized water temperature and other habitat conditions for spawning and early rearing. Bigelow Creek is accessible to adult salmon, but is not documented as a spawning stream and does not provide valuable spawning habitat because the substrate is primarily silty mud and degraded habitat resulting from the lack of riparian vegetation and artificial banks. The existing wetland and stream habitat and buffers of Bigelow Creek and the West Ditch have been impacted by the construction and maintenance of the adjacent rail-lines for decades. The channels have been constructed as linear, low gradient drainages with little to no channel complexity, receive untreated runoff, and exhibit no riparian conditions. Natural LWD is lacking and pool or riffle segments are absent. Salmonid spawning does not



Explanation

- Anadromous and Resident Fish Presence
- Streams / Rivers
- BNSF Railroads
- Project Site
- Wildlife Corridor
- Waterfowl Concentrations
- Wetlands

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Urban areas and wildlife corridor delineated from field staff.
Road data provided from ESRI Data & Maps, Street Maps 2005.
Universal Transverse Mercator, Zone 10, North American Datum 1983

Wildlife Corridor and Species Use Map

Everett Riverfront Redevelopment
Everett, Washington

GeoEngineers

Figure 4.5-2

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occur in the Snohomish River adjacent to, downstream of or immediately upstream of the project site. Salmonid use of the project area includes upstream and downstream migration and year-round rearing activity but does not include spawning (Appendix D).

The project site includes critical habitat for Puget Sound Chinook (*Oncorhynchus tschawytscha*) and bull trout/Dolly Varden (*Salvelinus confluentis/Salvelinus malma*) along the Snohomish River. Special habitat protection consideration is warranted in these areas to ensure that necessary habitat conditions are maintained.

Effective June 11, 2007, NOAA Fisheries listed steelhead (*Oncorhynchus mykiss*) in Puget Sound, Washington, as a threatened species under the Endangered Species Act (ESA). Final protective regulations and proposed critical habitat are expected to be issued in a separate rulemaking. Although no critical habitat has yet been identified, a proposed delineation of a habitat is being developed for future designation. Although there is currently no critical habitat designated, chinook and bull trout/dolly varden critical habitat presence will encompass essential habitat for steelhead because of the similarities in life history. This EIS addresses effects of the project as if critical habitat for steelhead exists within the project site.

Table 4.5-1. Priority Fish Presence within the Proposed Project Area

Scientific Name	Common Name	Location	Federal Status	Critical Habitat Designated
Oncorhynchus clarki	Resident Cutthroat Trout	Snohomish River/Bigelow Creek	Not Listed	No
Oncorhynchus gorbuscha	Pink Salmon	Snohomish River/Bigelow Creek	Not Listed	No
Oncorhynchus keta	Fall Chum Salmon	Snohomish River/Bigelow Creek	Not Listed	No
Oncorhynchus kisutch	Coho Salmon	Snohomish River/Bigelow Creek	Species of Concern	No
Oncorhynchus tschawytscha	Summer Chinook Salmon	Snohomish River/Bigelow Creek	Threatened	Yes
Oncorhynchus tschawytscha	Fall Chinook Salmon	Snohomish River/Bigelow Creek	Threatened	Yes
Oncorhynchus mykiss	Winter Steelhead	Snohomish River/Bigelow Creek[1]	Threatened	Under development
Oncorhynchus mykiss	Summer Steelhead	Snohomish River/Bigelow Creek[1]	Threatened	Under development
Oncorhynchus nerka	Sockeye Salmon	Snohomish River	Not Listed	No
Salvelinus confluentis	Bull Trout	Snohomish River	Threatened	Yes
Salvelinus malma	Dolly Varden	Snohomish River	Threatened	Yes
Micropterus salmoides	Largemouth Bass	Snohomish River	Not Listed	No

Notes:

1. Priority Habitat and Species (PHS) data from Washington Department of Fish and Wildlife (WDFW) do not list steelhead in Bigelow Creek; one 17.78-centimeter juvenile steelhead was documented by an aquatic ecologist with the Tulalip Tribes during a field investigation of fish usage in Bigelow Creek (Loch, 1999) but does not indicate summer- or winter-run. PHS data do indicate that both summer- and winter-run steelhead have been identified within the Snohomish River and have access to Bigelow Creek; thus, both summer and winter-run steelhead have been listed for Bigelow Creek.

Other documented fish species include three-spine stickleback (*Gasterosteus aculeatus*), longnose dace (*Rhinchthys cataractae*), sculpin (*Cottus* sp.), brown bullhead (*Ameirus nebulosus*), peamouth (*Mylocheilus caurinus*) and lamprey (*Lampetra* sp.).

4.5.1.11 Reptiles and Amphibians

No priority or listed reptile or amphibian species have been documented within the project site. The only documentation of reptilian or amphibian species within the project area found during the literature search consists of the vocalizations of a bullfrog (*Rana catesbeiana*) documented by Pentec Environmental (1994). Bullfrogs are an exotic invasive species in Washington that have displaced many native species and are an unnatural predator. This species is not of concern when documenting project effects to animals. Because of the presence of aquatic resources and vegetative habitat, other common reptile and amphibian species are expected to be present.

4.5.1.12 Birds

There are more than 150 bird species that have been documented within Snohomish County. Priority bird species in the area of the project site as documented on PHS maps (WDFW, 2007) include: bald eagle (*Haliaeetus leucocephalus*), with two nests located along the waterfront in Everett more than 1½ miles west of the project site (not in line sight and not within typical noise impact areas); peregrine falcon (*Falco peregrinus*) nest and purple martin (*Progne subis*) presence at the confluence of the Snohomish River; osprey (*Pandion haliaetus*) nest located in a log storage yard at the confluence of the Snohomish River; and artic tern (*Sterna paradisaea*) breeding on a gravel construction site on a Navy base located northwest of the subject site. Priority habitat for listed marbled murrelets (*Brachyramphus marmoratus*) and spotted owls (*Strix occidentalis caurina*) is designated for Snohomish County by the United States Fish and Wildlife Service (USFWS). This habitat, which is characterized as old-growth forested habitat, is not present within the boundaries of the project site (see Figures 4.5-1 and 4.5-2).

Table 4.5-2 lists the bird species observed within the proposed project area through personal observations or as indicated by Pentec Environmental, Inc. (1994). Of these species, only the osprey and the great blue heron (*Ardea herodias*) are monitored at a species level. Because there were no nests or rookeries observed, their presence is expected to occur on an opportunistic foraging basis.

Table 4.5-2. Bird Species Observed within the Project Site

Common Name	Scientific Name	Common Name	Scientific Name
Barn Swallow	*Hirundo rustica*	Towhee	*Pipilo maculates*
American Robin	*Turdus migratorius*	American Goldfinch	*Carduelis tristis*
Song Sparrow	*Melospiza melodia*	Flycatcher sp.	*Empidonax sp.*
Townsend's Solitaire	*Myadestes townsendi*	European Starling	*Sturnus vulgaris*
Hairy Woodpecker	*Picoides villosus*	Black-capped Chickadee	*Parus atricapillus*
Common Yellowthroat	*Geothlypis trichas*	Rock Pigeon	*Columba livia*
California Quail	*Callipepla californica*	Great Blue Heron	*Ardea herodias*
Redwing Blackbird	*Agelaius phoeniceus*	Belted Kingfisher	*Ceryle alcyon*
Bonaparte's Gull	*Larus philadelphia*	Redtailed Hawk	*Buteo jamaicensis*
Mew Gull	*Larus canus*	American Crow	*Corvus brachyrhynchos*

Common Name	Scientific Name	Common Name	Scientific Name
California Gull	*Larus californicus*	Northwestern Crow	*Corvus caurinus*
Herring Gull	*Larus argentatus*	Canada Goose	*Branta canadensis*
Northern Harrier	*Circus cyaneus*	Mallard	*Anas platyrhynchos*
Night-hawk	*Caprimulgus americanus*	Marsh Wren	*Cistothorus palustris*
Osprey	*Pandion haliaetus*		

4.5.1.13 Mammals

Small mammals and those adapted to urban environments or to foraging in agricultural areas are common throughout the project site because of the loss of upland habitat, loss of forested habitat within the Snohomish Estuary and loss of corridors connecting to upland habitat. It is expected that the project site will provide habitat for small mammalian species utilizing discrete areas or herbaceous disturbed areas. There are numerous mammal species that have been documented within Snohomish County and could be within the project vicinity. Mammalian species observed on the subject site through personal observations or as indicated by Pentec Environmental, Inc. (1994) include coyote (*Canis latrans*), cottontail rabbit (*Sylvilagus floridanus*), beaver (*Castor Canadensis*), weasel (*Mustela sp.*) and rat (*Rattus sp.*). There are no documented occurrences of priority mammal species on the project site. The only mammals documented on PHS maps (WDFW, 2007) include: a California sea lion (*Zalophus californianus*) haulout site outside of the project site within the Snohomish Estuary.

4.5.2 Potential Effects/Impacts of the Project on Aquatic and Terrestrial Biotic Communities

The proposed development project has the potential for both negative and positive effects on plants and animals on the project site and the project vicinity. Fish, wildlife, plants, invertebrates and their habitats can be adversely affected by the development of buildings, roads, parking areas, walkways and other infrastructure typically associated with mixed-use developments. These organisms and habitats also may be positively affected by restoration actions proposed as part of the development project.

A Consent Decree between the City and Ecology for the Landfill/Tire Fire site includes a detailed CAP that specifies requirements for existing, undeveloped conditions and for potential future developed conditions. These requirements address all environmental exposure pathways of concern (landfill gas, groundwater, surface water and direct contact) and include both design/performance standards and review/approval procedures (City of Everett and Department of Ecology 2001) (see Section 5.7 Environmental Health and Hazardous Materials for further detail).

An Environmental Assessment (EA) was prepared by the City and the FHWA in 2004 for the 41st Street Overcrossing Freight Mobility and Railroad Track Removal and Upgrade Projects (City of Everett and FHWA, 2004) and included a 2003 Supplemental Biological Assessment (the 2003 Supp. BA) by Associated Earth Sciences, Inc. (AESI). The 2004 EA and 2003 Supp. BA were completed to evaluate the overcrossing and railroad track projects and included evaluation of redevelopment at the Landfill/Tire Fire and Simpson sites as part of a cumulative effects analysis. These documents assumed development of these sites would include full build-out of 1.2 million square feet on 39 acres of impervious surface on the Simpson Site and 68 acres of buildable surface at the Landfill/Tire Fire site, similar to that of the build alternatives for this report. Although those two reports did not consider the potential effects of redevelopment of the Eclipse Mill site, they were used as a primary references for this EIS.

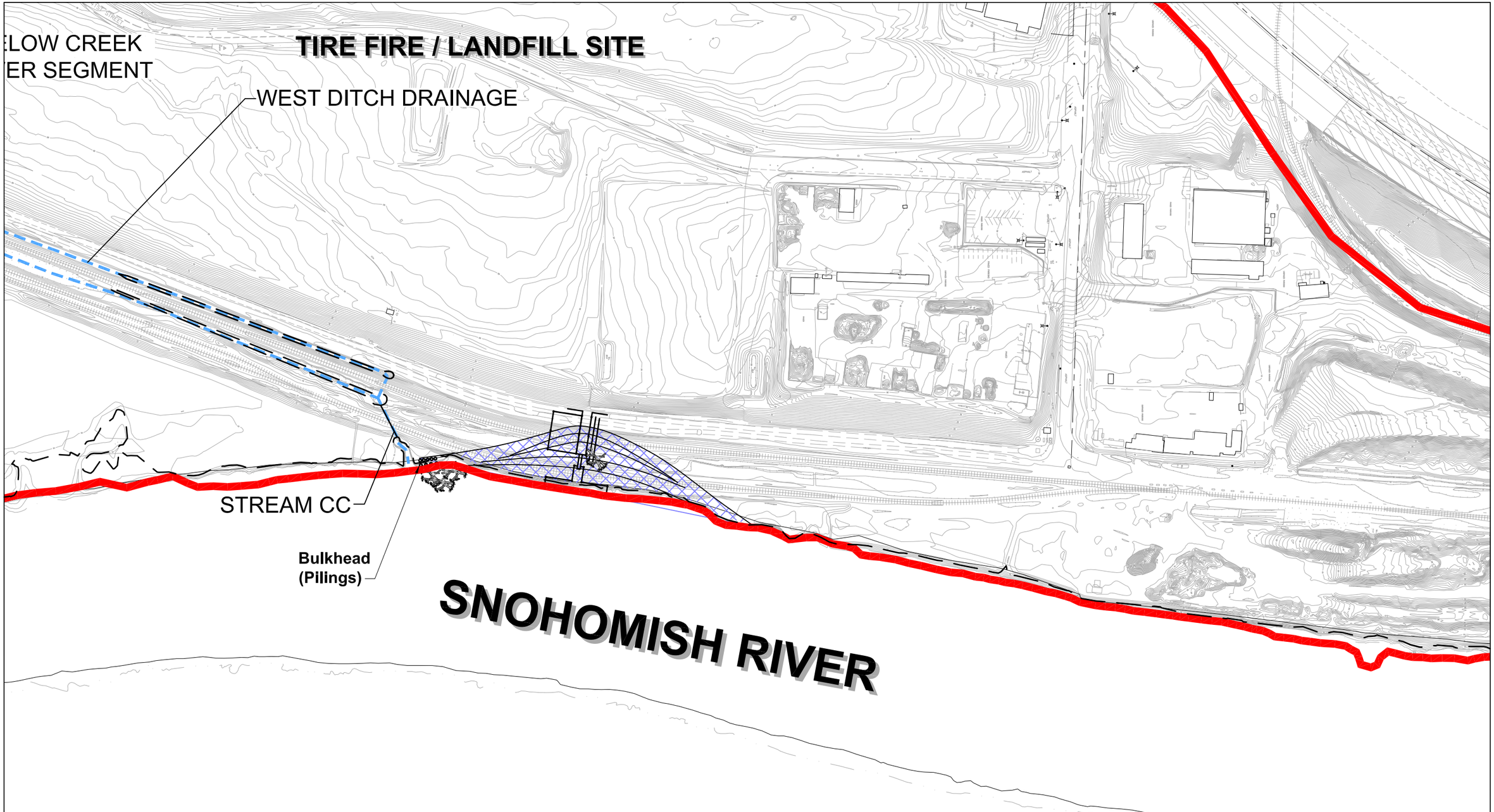
A Biological Assessment and Habitat Management Plan (BA/HMP) entitled "Biological Assessment and Habitat Management Plan Everett Riverfront Redevelopment Everett, Washington" (GeoEngineers, Inc. 2007) has been completed and is included with this document as Appendix D. The BA/HMP report has been completed as part of the federal permit application package to assess potential impacts of the proposed development project on species and critical habitats listed or proposed for listing under the ESA as well as avoidance and minimization measures that will be in place during construction. The BA describes the level of use of the project area by each listed species, describes the potential effect that this project may have on each species and their habitat and addresses the review process for federal permits required for wetland fill and shoreline modifications under Section 7 of the ESA a formal consultation process that will be completed with the U.S. Army Corps of Engineers (USACE) and the services (USFWS and NOAA).

Impacts associated with the project have first been considered based on habitat (Snohomish River and Estuary, Bigelow Creek, wetlands and uplands) and secondly based on individual species groups (plants and animals separately). Overall, impacts from this project on plants and animals will be the unavoidable result of a developed community center across a previously developed and now vacant land mass. The proposed project will result in an increase of stormwater volume from developed lands, increased noise and light from human activities, increased use of chemicals for lawn maintenance and other human needs, and overall increased human presence within and surrounding the project. An extensive review of impacts to ESA-listed species and critical habitat and fisheries is included in the BA/HMP (Appendix D) and are summarized below.

4.5.2.1 Snohomish River and Estuary

Shoreline impacts have been documented and illustrated in the BA/HMP found in Appendix D as figures 14 and 14A, Proposed/Conceptual Shoreline Impacts, Mitigation, and Aquatic Access. These illustrations have also been provided as Figures 4.5-3 and 4.5-3A of this section. The conceptual drawings of the proposed public amenities consisting of an over and in-water structure (kayak/small dock and launch) have been designed to reduce adverse impacts from shoreline development and provide a diverse nearshore habitat to reduce predation on juvenile salmonids. The over and in-water structures do not extend into the river beyond the existing Ordinary High Water Mark, but rather will be set back into the bank by excavation of uplands along the shoreline bank to create the areas needed to establish the dock area. The development of buildings, roads and infrastructure associated with the proposed project is not anticipated to have a direct effect on the Snohomish River or Estuary. The kayak/small boat dock and launch and certain phases of habitat restoration and enhancement along the Snohomish River shoreline will require direct in-water work that will have negative impacts associated with construction activities as well as impacts during operational activities (boaters and boat traffic). Increased human activity could disturb wildlife and damage plant species (propeller wash), and small motor boats could have small oil and gas spills.

Proposed shoreline restoration (that is, removal of numerous remnant creosote pilings along the entire face of the project, installation of habitat log complexes) would result in temporary negative effects on habitat and habitat use while construction occurs. However, these actions would provide long-term enhancement of habitat functions. Habitat enhancement actions within Bigelow Creek and associated wetlands could indirectly affect Snohomish River and Estuary habitat in two ways. First, enhancement of these habitats may improve stormwater retention and treatment capabilities, thereby reducing the potential effects from existing runoff as well as runoff from the proposed redevelopment project. Second, habitat



Legend

- Snohomish River OHWM
- Shorline Habitat Mitigation

Notes:
1. The locations of all features shown are approximate.
2. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. can not guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.

Reference: Base drawing provided by Perteet, Inc.

100 0 100
Feet

Proposed/Conceptual Shoreline Impacts, Mitigation and Aquatic Access

Everett Riverfront Redevelopment
Everett, Washington

GeoEngineers

Figure 4.5-3

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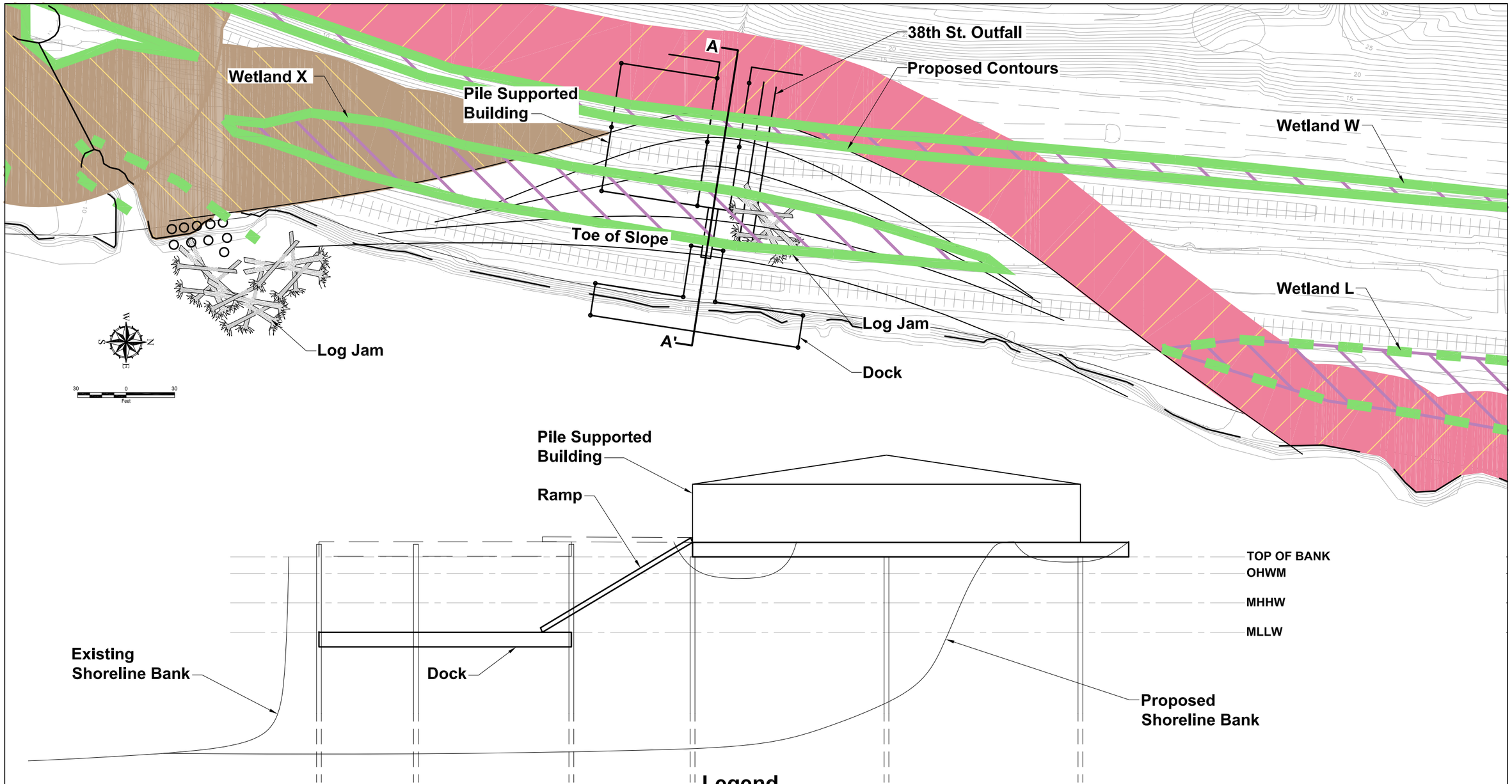

Cross Section A-A'

Legend

- Snohomish River OHWM
- Proposed Contours
- Proposed Wetland Fill
- 100 Foot Proposed Buffer Enhancement by OliverMcMillan
- 50 Foot Proposed Buffer Enhancement by OliverMcMillan
- 50 Foot Proposed Buffer Enhancement by the City of Everett
- Estimated Wetland Boundary not Surveyed
- Log Jam

Notes:
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Reference: Base drawing provided by Perteet, Inc.

Conceptual Aquatic Access Cross Section A-A'

Everett Riverfront Redevelopment
Everett, Washington

GeoEngineers

Figure 4.5-3A

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enhancement as part of the redevelopment project may improve conditions for aquatic species inhabiting the lower Snohomish River, by providing access to off-channel refugia, rearing habitat and improved food production.

The Snohomish River and Estuary may also be affected by indirect effects of the proposed redevelopment project. Snohomish River habitat function may be indirectly affected by changes in flow regime and water quality. Redevelopment of the project site may create a potential for fisheries impacts to the Snohomish River. Potential impacts could result from stormwater runoff during project construction and operation. Any increase in stormwater flow to the river should not negatively affect the local and downstream aquatic system because stormwater BMPs would be followed to manage stormwater quality, and the flow volume would be an extremely small percentage of the river's overall flow. Water quality, water volume, and flow rates in the Snohomish River are not expected to be negatively impacted, as described in the water resources sections of this report (Sections 4.3 and 4.4).

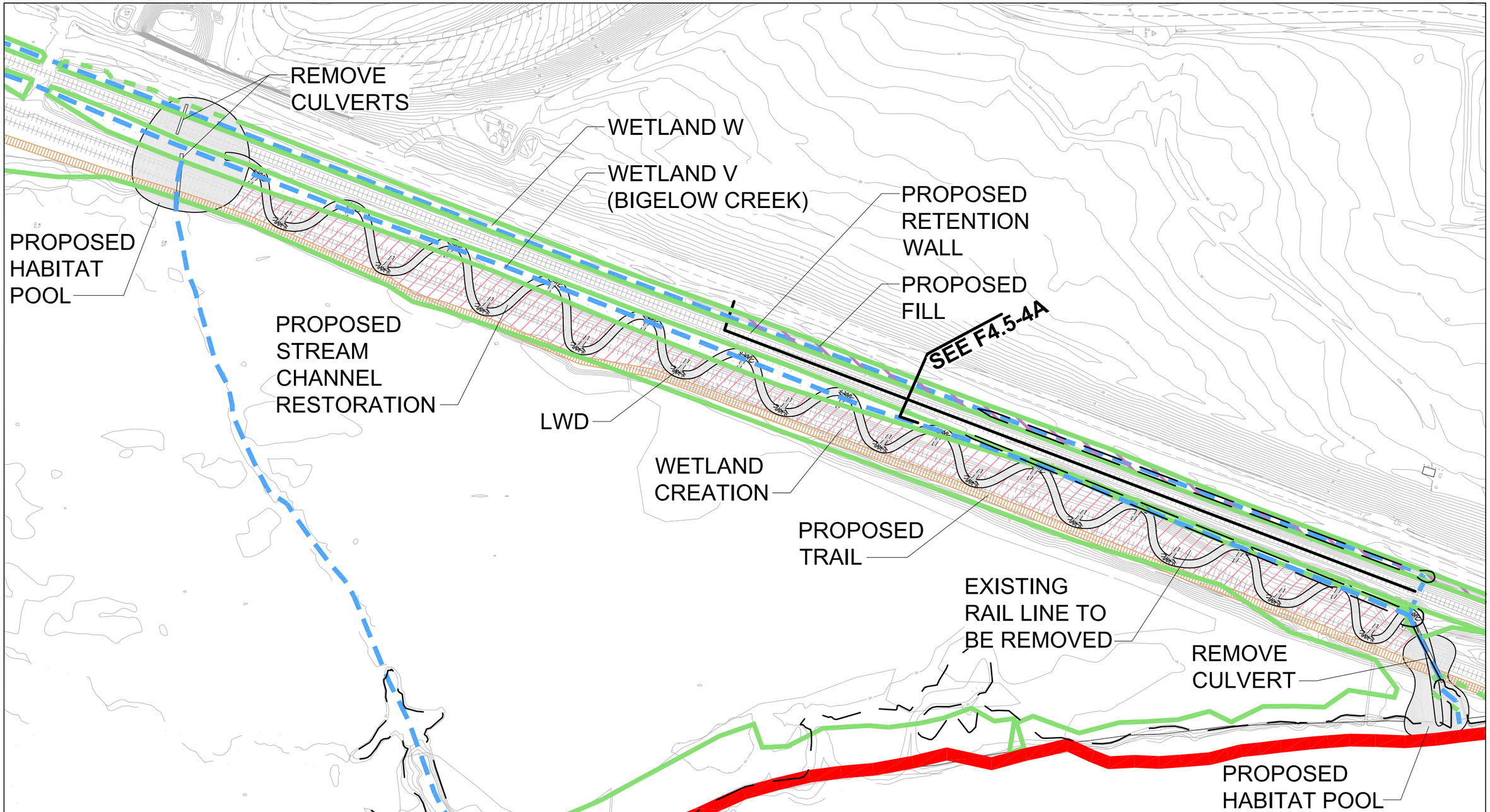
The project will be required to comply with wastewater and stormwater management regulations, and pursuant to the 1995 Ecology CAP, stormwater drainage features at the landfill site associated with redevelopment would be isolated from direct contact with landfill material through the City's existing stormwater and leachate collection systems at the site. This would eliminate potential impacts to both groundwater hydrology and groundwater quality from future redevelopment. Moreover, required stormwater treatment systems would remove pollutants through settling, biological uptake, filtration and flotation of oil particles. Compliance with required permits and regulations would prevent significant adverse impacts to surface water quality in the Snohomish River or Bigelow Creek.

The current shoreline buffers along the Snohomish River range from 0 to 50 feet with some segments 100 feet wide and some wider segments where railroad tracks and wetlands provide added separation from the river. The buffer enhancement plan proposed for this project attempts to increase the function of the river buffer over current conditions. Only native plants will be used within the buffer enhancement areas. Please see the BA/HMP for more details on the buffer vegetative enhancements. Additional details pertaining to the potential effects of the redevelopment project on listed salmonids and other fish are provided in the BA/HMP and the Essential Fish Habitat section of the BA/HMP, and more detailed descriptions of habitat enhancement actions are provided later in this report, in the BA/HMP (Appendix D).

4.5.2.2 Bigelow Creek

Bigelow Creek impacts have been documented and illustrated in the BA/HMP found in Appendix D as Figures 15 and 15A, Conceptual Bigelow Creek Wetland and Channel Restoration and Cross Section. These illustrations have also been provided as Figures 4.5-4 and 4.5-4A of this section. The redevelopment of the Landfill Parcel requires the strategic placement of engineered fill material on the site to compact the soils and underlying refuse material ("surcharge"). The purpose of the surcharge is to provide a more stable base for construction of buildings, roads and infrastructure, and to increase the depth of the landfill cap. To assure proper structural integrity and avoid differential settlement, it is necessary to place the fill over the *entire* landfill and cover all areas under which there is refuse material. This requires that the surcharge extend to the outer edge of the landfill on the east side because the underlying refuse material extends to this edge.

With the surcharge in place, it will be necessary to place fill material on the eastern side of the landfill site to create an appropriate grade from the higher landfill site down to the lower levels towards the river. To establish this grade, it is necessary to partially fill (927 linear feet) of the "West Ditch Drainage" which is associated with Bigelow Creek where it flows between the two railroad tracks and into the Snohomish



Notes:
1. The locations of all features shown are approximate.
2. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. can not guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.
3. This map represents delineations conducted in 2007 by ESA Adolfson which were provided by the City of Everett for this report.

Reference: Base drawing provided by Perteet, Inc.

Legend

- Site Boundary
- Snohomish River OHWM
- Stream
- Proposed Wetland Fill
- Proposed Creation (60,134 sq. ft.)
- Estimated Wetland Boundary not Surveyed

W S N E

60 0 60
Feet

Conceptual Bigelow Creek Wetland and Channel Restoration

Everett Riverfront Redevelopment
Everett, Washington

GEOENGINEERS

Figure 4.5-4

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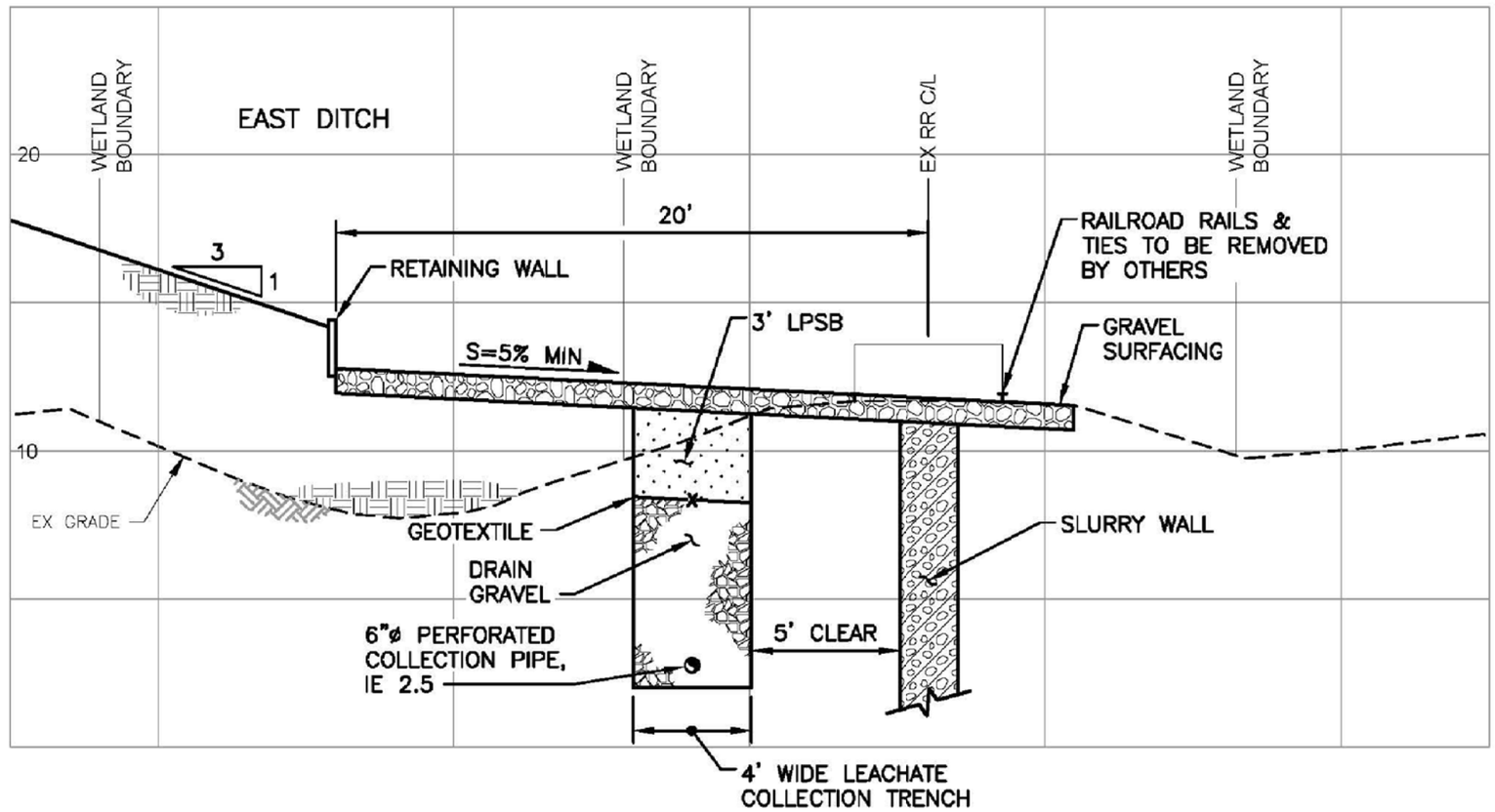

Notes:
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Reference: Drawing provided by Perteet, Inc.

Conceptual Bigelow Creek Wetland and Channel Restoration - Cross Section

Everett Riverfront Redevelopment
Everett, Washington

GEOENGINEERS

Figure 4.5-4A

BOISE\P:\6191002\01\CAD\619100201F4.5-4A.dwg JEP:BMK 12/12/07

River. The impacts from this effort will be short term loss of aquatic habitat. However, to mitigate for this impact, a new stream channel and edge habitat would be constructed via removal of BNSF track sections for a net gain in aquatic habitat and function.

Proposed habitat restoration and enhancement in and around Bigelow Creek as well as associated drainage ditches would require direct in-water work that would displace any fish, amphibians, or other plants and animals that occur in affected stream reaches. Proposed habitat mitigation and enhancement may include actions identified in the BA/HMP. Actions to improve habitat would result in temporary negative effects on habitat and habitat use, but such work would be done to provide long-term enhancement of habitat functions. The potential effects, both positive and negative, of the redevelopment project on habitat in Bigelow Creek and associated drainage ditches are influenced by the current condition of the habitat and habitat potential of the site. Currently habitat conditions in Bigelow Creek and associated drainage channels are not suitable for anadromous or resident salmonid spawning because of the silt-dominated channels. The upper reaches of Bigelow Creek, in the Lowell Park vicinity, are not available for salmonid spawning or rearing purposes because of man-made barriers. The creek and ditches can provide some refuge for salmonids during high-flow events and can provide some rearing opportunity outside of summer low-flow periods when the higher water temperatures make these waters less suitable for juvenile rearing. Mitigation for the proposed fill of Wetland W will restore the lower segment of Bigelow Creek and provide a direct connection to the Snohomish River.

Bigelow Creek and associated channels may have once been part of a forested wetland complex in the Snohomish River delta (City of Everett and FHWA, 2004). A properly functioning forested wetland complex and associated estuary area of a river like the Snohomish River would likely have had silt-dominated channels unsuitable for salmonid spawning. Efforts to protect and enhance the area will need to reflect the small channel, and tidally influenced wetland habitat historically present. The mitigation plan proposed for this project accomplishes this goal. Habitat restoration plans for Bigelow Creek and drainage ditches reflect much of this historical habitat value and will significantly enhance habitat in this area.

There are no direct discharges planned for release into Bigelow Creek or the restored areas of the stream. The redevelopment project will comply with the Ecology's 2005 Stormwater Manual. The specific methods used to treat stormwater have been established as detailed in Section 4.4 Stormwater of this report. Stormwater would be treated in accordance with Ecology's 2005 Stormwater Manual and, potentially, released directly into the Snohomish River or routed into the City's stormwater system. The approach to stormwater management minimizes the potential indirect effects (i.e. minimized sheet flow from slopes by way of increased vegetation restored by enhancement plan) of the redevelopment project on the habitat in Bigelow Creek and the associated drainage ditches. As such, the redevelopment project may, in fact, have positive effects on habitat in Bigelow Creek and the associated drainage ditches.

4.5.2.3 Wetlands

Within the project area, 24 wetlands have been identified, delineated, and classified under both City of Everett and Department of Ecology rating systems (Table 4.5-3 and Figures 2.1-13 , 2.1-13A and 2.1-13B in this DEIS.) The proposal includes filling 1.2 acres with mitigation including creation of 1.38 acres. Besides different rating systems there are two sets of local critical area regulations that potentially apply to the proposal. In areas of Everett that are within shoreline jurisdiction EMC19.33D regulations apply. In areas of Everett that are not in shoreline jurisdiction, regulations in EMC 19.37 apply. As a result, similarly classified wetlands could have different buffer and replacement ratios. As it relates to this specific proposal, all of the areas of potential wetland impacts are within Shoreline Jurisdiction and consequently the provisions of EMC19.33D are the applicable regulations. Wetland impacts have been documented and illustrated in greater detail within the BA/HMP found in Appendix D.

Table 4.5-3. Summary of Wetland Classification, Functions and Rating, Category and Required Buffer Widths

Wetland	Approximate Area		Western Washington Wetland Rating Functions (points)[2]				Rating		Buffer Width (feet)	
	Acres	Square feet	Water Quality	Hydrologic	Habitat	Total	Ecology[2]	City	EMC 19 33 D[3]	Other[4]
C	30.59	1,332,664	28	18	25	71	I	I	100’	75’
D	17.98	783,509	22	20	24	66	II	II	75’	50’
E	0.42	18,261	16	14	17	47	III	III	50’	50’
F	1.10	47,918	16	14	17	47	III	III	50’	50’
G	0.007	306	20	14	11	45	III	III	50’	50’
H	0.17	7,546	16	14	16	46	III	III	50’	50’
I	2.71	12,185	16	14	22	52	II	II	75’	50’
J	0.05	2,192	16	8	6	30	III	III	50’	N/A
K	0.08	3,369	16	8	7	31	III	III	50’	N/A
L[1]	0.28	12,185	18	10	14	42	III	III	50’	N/A
M	0.16	679	16	8	7	30	III	III	60’	N/A
N	6.96	303,252	28	28	20	76	I	I	100’	N/A
O	0.04	1,707	10	10	14	34	III	II	50’	N/A
P	0.006	277	16	8	9	33	III	III	50’	N/A
Q	0.08	3,332	16	9	12	37	III	III	50’	N/A
R	2.08	90,640	16	12	19	47	III	III	50’	N/A
S	0.55	24,074	16	8	8	32	III	III	50’	N/A
T	1.31	57,180	16	8	8	32	III	III	50’	N/A
U	0.50	21,837	22	16	10	48	III	III	50’	N/A
V	0.73	31,810	16	8	8	32	III	III	50’	N/A
W	0.56	24,572	16	8	8	32	III	III	50’	N/A
X	0.29	12,775	16	14	12	42	III	III	50	N/A
Y[1]	0.06	2,724	20	16	17	53	II	II	75’	N/A
Z	0.30	13,220	16	8	8	32	III	III	50’	N/A

Notes:
1 Approximated areas were based on hand-sketched maps provided by ESA Adolfson and digitized by GeoEngineers.
2 Washington State Wetland Rating System for Western Washington, Revised (Hruby, 2004). Rating forms provided by ESA Adolfson.
3 Buffer widths were assigned based on Everett Municipal Code Title 19, Chapter 33D.
4 Buffer widths pertaining to the Simpson Development Pad were determined by the Settlement Agreement between The Tulalip Tribes and The City of Everett (EIS Appendix 3.3B).

Wetlands J and M

These wetlands were not previously identified or delineated during investigations prior to 2007. Wetland J is 0.05 acres (2,192 square feet) and Wetland M is 0.16 acres (679 square feet). These wetlands are isolated by railroad grade and tracks, diked berms or human disturbance. Most of the wetland edges are steeply sloped due to the ditch characteristic and the adjacent railroad grade. Vegetation in these wetlands were described by Adolfson as scrub-shrub and/ or emergent and consisting of less than five species. These wetlands will be filled to accommodate a primary access road connecting development on the landfill site to Pacific Avenue.

ESA/Adolfson rated Wetland J and M as Category III depressional wetlands according to Ecology's rating system for Western Washington (Hruby 2004), These are also classified as Category III wetlands under the City' rating system. The wetlands scored moderately on water quality because of the ability to store some stormwater before entering the Snohomish River. Since the wetlands are isolated and do not have diverse vegetation structures the wetlands scored low on hydrologic and habitat functions. The buffers associated with these wetlands are highly disturbed and essentially non-existent due to the railroad grades and human disturbance.

Wetlands L and X

Wetlands L and X were (see Figure 4.5-5, Wetland Resources Impact Map, not previously identified or delineated during investigations prior to 2007. Wetland L is 0.28 acres (12,185 square feet) and Wetland X is 0.29 acres (12,775 square feet). Both wetlands are adjacent to the Snohomish River.

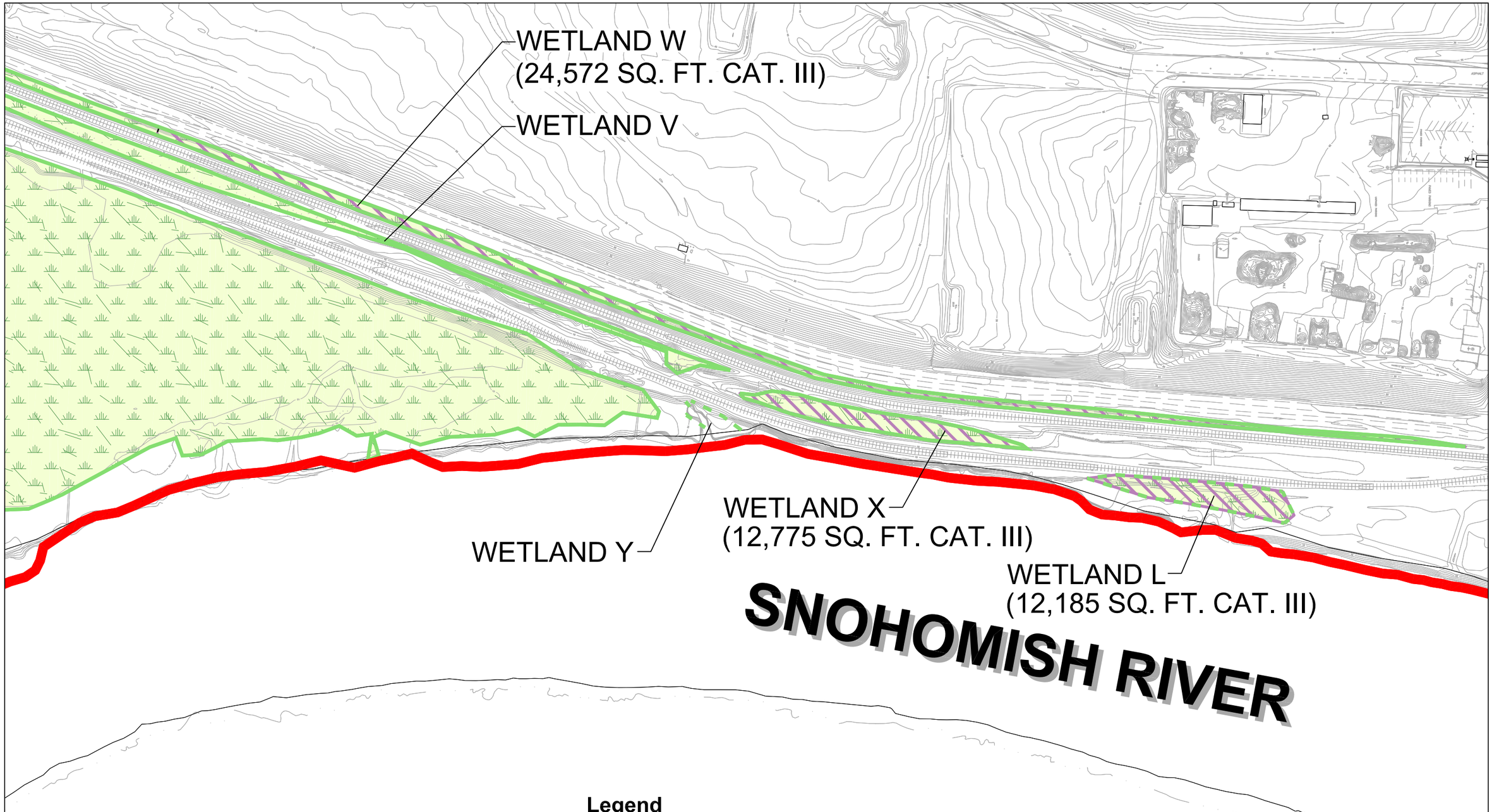
Wetland L is isolated by railroad grade and tracks along the west boundary and by diked berms along the eastern boundary. A dike separates the wetland from the river and prevents a permanent surface water connection between the wetland and the Snohomish River, unless under extreme flooding events. Himalayan blackberry borders much of the wetland and dominates most of the northern section. Red-osier dogwood dominates the shrub layer within the wetland. The wetland edge followed a defined topographic and vegetative transition. Other species observed within the wetland include pacific ninebark (*Physocarpus capitatus)*, salmonberry, pacific willow and skunk cabbage.

Wetland L has been rated as a Category III depressional wetland (Adolfson 2007) following Ecology's rating system for Western Washington (Hruby 2004 [ESA Adolfson 2007]). L is also classified as a Category III wetlands under the City' rating system. The wetland performs minor function on water quality, hydrologic and habitat functions, because the depression is shallow and is isolated by railroad tracks and dikes that severely restrict the use of the wetland by fish and wildlifespecies. While a portion of these wetlands are disturbed by railroad grades and tracks, both wetlands have a forested vegetation structure which could provide creation and enhancement mitigation opportunities.

Wetland X is isolated by railroad grade and tracks, berms and human disturbance. Most of the wetland edges are steeply sloped due to the ditch characteristic and the adjacent railroad grade. Vegetation in the wetland is described as emergent, scrub-shrub and forested, and has been rated as a Category III depressional wetland according to Ecology's rating system for Western Washington (Hruby 2004). X is also classified as a Category III wetlands under the City' rating system.

Wetland buffer conditions and functions are very low and are in effect non-existent due to the railroad grades, tracks and lack of native vegetation. This wetland provides excellent mitigation opportunities due to the linear ditch configuration and current lack of vegetative buffer.

Both Wetland L and X are proposed to be filled to accommodate proposed public amenities and shoreline access areas.



Legend

- Site Boundary
- Wetlands
- Proposed Wetland Fill (49,532 sq. ft.)
- Estimated Wetland Boundary not Surveyed

Notes:
1. The locations of all features shown are approximate.
2. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. can not guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.

Reference: Base drawing provided by Perteet, Inc.

Wetland Resources Impact Map

Everett Riverfront Redevelopment
Everett, Washington

GEOENGINEERS

Figure 4.5-5

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Wetland W

This ditched and channelized wetland is resultant of activities associated with construction of the adjacent railroad grade to the east and the Tire Fire/Landfill site to the west. Wetland W has been rated as Category III depressional wetlands according to Ecology's rating system for Western Washington (Hruby 2004 [GeoEngineers 2007e]) and is a Category III under the City's rating system. The wetland is similar in shape and community structure to wetlands associated with Bigelow Creek (Wetlands T, V and Z). Remedial activities, consisting of potential

contaminated soil removal, have been conducted within the ditch. Wetland W is 0.86 acres (37,473 square feet), of which 0.56 (24,572 square feet) have been proposed to be filled to accommodate the proposed fill pad. Vegetative species observed within the wetland and adjacent margins, includes but is not limited to: common cattail, hardhack, purple loosestrife, reed canary grass, slough sedge, small-fruited bulrush (*Scirpus validus*), water plantain and western dock (*Rumex occidentalis*). The wetland edges are steeply sloped due to the ditch characteristic of the stream channel and associated wetland. Vegetative species observed along the wetland margins, include but are not limited to, bittersweet nightshade (*Salanum dulcamara*), clover (*Trifolium sp.*), cutleaf blackberry (*Rubus laciniatus*), Himalayan blackberry, Japanese knotweed (*Polygonum cuspidatum*), morning glory (*Convolulus sp.*), Nootka rose (*Rosa nutkana*), salmonberry and Scotch broom.

Wetland buffer conditions and functions are very low and are in effect non-existent due to the railroad grades, tracks and lack of native vegetation. The hydrologic connection to the Snohomish River through culverts allows for access by listed priority species. However, habitat value for listed species is very low and the overall riparian condition is poor in the anadromous zone of the watershed. The wetland provides an excellent mitigation opportunity (rehabilitation, enhancements or creation) due to the current linear ditch configuration, presence of invasive species, poor habitat function and current lack of a vegetative buffer.

4.5.2.4 Uplands

As described in Section 4.5.1, upland habitat is highly degraded. Most of this upland area is reclaimed land that was previously used as a landfill site. Development of buildings, roads and infrastructure associated with the redevelopment project is anticipated to occur on these surfaces. Although a large percentage of the upland habitat area would be converted to impervious surface, those areas that will be landscaped may provide higher quality and a greater variety of upland habitats as compared to the highly altered and degraded development pads.

Perhaps the most actively managed upland areas on the site will be buffers surrounding the development pads, wetlands, Bigelow Creek and the Snohomish River. Given the site development history and damaged nature of the site critical areas buffers, a management plan for buffer zones has been developed in the BA/HMP document (Appendix D). Wetland buffers surrounding the Simpson Pad have been targeted for 50 to 75 feet in width and include integration of the rain garden infiltration systems to provide hydrology to the buffer areas. The functioning native vegetation structure that currently exists will be maintained to the extent possible. However, all the on-site wetland buffers will be planted with native vegetation to promote wetland protection and function as conceptually presented in the BA/HMP (Appendix D).

Local, state and federal regulatory controls at the site would direct development of buildings and infrastructure to existing development pads at the site. Potential indirect effects would be limited to the construction period, and come in the form of construction-related runoff.

4.5.2.5 Plant Resources

Most vegetation is associated with or is near wetlands or riparian areas. Areas to be developed are characterized by flat topography, have already been cleared and are dominated by grasses and non-native, invasive plant communities. As described in other subsections of this Section 4.5.3, both development and habitat enhancement efforts associated with the proposed redevelopment project are anticipated to protect or restore conditions at the site. This is expected to result in protection of highly functioning area (for example, Category 1 wetland), where plant species are presently found. The proposed redevelopment project is also expected to enhance lesser-functioning areas through active habitat restoration, where additional native plant species will be planted. Operational impacts of the developed areas may include mowing, tree trimming, use of herbicides and infrequent winter road treatments such as salting and sanding. These measures may benefit generalist or invasive plant species within these edge habitats. Trails and/or boardwalks within wetlands and the impacts to plant resources will be part of the supplemental environmental review once design details are known.

4.5.2.6 Animal Resources

There would be minor adverse effect on wildlife from the combined impacts of the proposed project. For the most part, these areas have already been developed or are already highly disturbed. Animal resources, including invertebrates, fish, reptiles, amphibians, birds and mammals, will be protected from negative effects that may be caused by the redevelopment through a combination of project design (that is, wetland and shoreline buffers allowed by building setbacks and reduction in stormwater due to low impact development techniques) and use of appropriate measures for erosion and sediment control and surface water drainage. Habitat restoration at the project site will have favorable effects on animals once the project is completed. It is estimated that approximately two-thirds of the Simpson site will remain as open space/wetland habitat. Habitat in this area will be protected and enhanced, enabling the colonization of areas formerly inaccessible or unsuitable to priority fish species. This includes ongoing restoration of wetlands at the project site, which may benefit threatened and endangered salmonids and other priority species.

The development of buildings, roads and infrastructure (including fire access) associated with the project would increase human activity and traffic within the project site and would increase noise levels. Road noise may negatively affect animal species in numerous ways, including a reduction in breeding density of some bird species near roads. Roads act as barriers movement of animals and disconnect habitat areas. Impacts from construction activities will directly disturb wildlife in adjacent habitats over the short term of construction.

Increased dust, noise, lights, and generally higher levels of human activity will discourage wildlife from using habitats near active construction. Noise levels associated with impact pile driving would be the highest level generated from the construction of the project. Normal construction noise would be higher than background at distances extending up to about 0.08 mile from the work areas, and the pile driving noise would exceed background about 0.3 mile away. Operational noise would be less than construction noise. High-mobility species, such as small mammals and birds, would be expected to move away from active construction. Songbirds have been shown to be very sensitive to noise; avoidance during construction could cause nest failure if conducted during breeding. It could also create localized crowding as individuals move into already occupied home ranges and breeding territories. Low-mobility species such as reptiles and amphibians will have increased exposure to disturbance for foraging and breeding. If they cannot leave native habitat that is being cleared, they may be killed or injured. Because construction activities and development will occur mostly within the upland habitat (including the fire access through some buffer areas) that consists of grasses, impacts will eliminate breeding habitat for

mice, voles, moles and other small mammals as well as foraging habitat for raptors, snakes and other predators.

The BA/HMP prepared for this project evaluated the potential effects of redevelopment of the project site on ESA-listed species and Essential Fish Habitat. The listed wildlife species documented as occurring in the vicinity of the project site include chinook, steelhead and bull trout. Marbled murrelets because of their use of Port Gardner Bay and Possession Sound for foraging, and Steller sea lions because of the presence of a California sea lion haulout site in Port Gardner Bay, were also included in the BA/HMP. A determination was made that actions described in the BA/HMP will have no effect on marbled murrelets or Steller sea lions and may affect, but is not likely to adversely affect bull trout, chinook or steelhead, their habitat, and prey base, provided that the appropriate BMPs, environmental conservation measures and restoration and enhancement activities are implemented for the project.. NOAA-Fisheries and USFWS concurrence with these findings is pending completion of a possible review. After a review, any findings or additional information will be incorporated into the final EIS that will be prepared for this project.

4.5.3 Impacts of the No-Action Alternative

Impacts to the site under the "No Action" alternative would be similar to those impacts described under the "Action" Alternatives above. Furthermore, this alternative has less certainty with respect to the scope and timing of actions that could benefit on site habitat resources. Under the "no Action" alternative the development of the Everett Riverfront project would be delayed which, in turn, would result in certain benefits and disadvantages. Benefits of the delaying the development would delay the increased human uses and activities on the site. Disadvantages of delaying the development are:

- No guarantee of the scope of habitat improvements included in a proposal,
- Longer time until degraded habitat is improved and/or replaced with better functioning habitat,
- Delay in installation of buffers in many areas that either have none, are less than what would be implemented and/or are improved to remove invasive plants and install plant species more beneficial to animals,
- Delay in opening water areas to salmonid use.

4.5.4 Mitigation

4.5.4.1 Wetland and Shoreline Restoration

Wetland, stream, and buffer impacts will occur to: 1) gain access between the development sites by crossing ditched wetlands located between the BNSF railroad tracks and providing access from the north via Pacific Avenue, 2) accommodate leachate system relocation and preload along the West ditch for the development footprint, 3) provide trails for pedestrian access 4) realign an existing gravel trail to allow adequate emergency access to the Simpson Pad from the south and 5) provide shoreline access including a small public boat facility. The project will directly impact approximately 1.20 acres of wetlands and 927 linear feet of ditch drainage associated with Bigelow Creek. Table 4.5-4 outlines the areas of wetlands potentially impacted and mitigation rations from various applicable sources. Locations proposed for the dock structures in the Snohomish River will be altered by excavating upland along the shoreline to create backwater areas for the dock facilities, which will increase aquatic habitat, provide better riverbank stability, remove selected bank armoring, and improve river access.

The development of buildings, roads and infrastructure associated with the proposed redevelopment project will require partial filling (927 linear feet) of the "West Ditch" which is associated with Bigelow

Creek where it flows between the two railroad tracks and into the Snohomish River. The impact (filling) to West Ditch is associated with the relocation of the leachate system and redevelopment of the Landfill Parcel and will require mitigation.

A variety of actions will be taken to avoid or minimize potential project effects on natural resources. The following describes potential actions and summarizes how the measures would avoid or minimize potential effects and otherwise provide benefits to natural resources. **Please see the BA/HMP in Appendix D for further detail regarding the proposed compensatory mitigation plan**.

Table 4.5-4. Wetland Impact Summary and Replacement Ratios

Wetland	Habitat Classification[1]		City of Everett Wetland Rating	Ecology Restoration/Creation and Rehabilitation Ratios(ft^2 restored/created:ft^2 impacted and ft^2 rehabilitated: ft^2 impacted)	SEWIP Restoration/Creation Ratios (ft^2 Restored/Created: ft^2 impacted	Area Impacted (ft^2)	Proposed Area created (ft^2)
	System	Class					
C	Palustrine	Aquatic Bed	I	(1:1 R/C and 6:1 RH)	1:1 R/C	N/A	
		Emergent		(1:1 R/C and 6:1 RH)			
		Forested		(1:1 R/C and 10:1 RH)			
		Scrub-Shrub		(1:1 R/C and 6:1 RH)			
D	Palustrine	Aquatic Bed	II	(1:1 R/C and 4:1 RH)	1:1 R/C	N/A	
		Emergent		(1:1 R/C and 4:1 RH)	1:1 R/C		
		Scrub-Shrub		(1:1 R/C and 4:1 RH)	1:1 R/C		
E	Palustrine	Forested	III	(1:1 R/C and 2:1 RH)	1:1 R/C	N/A	
F	Palustrine	Forested	III	(1:1 R/C and 2:1 RH)	1:1 R/C	**N/A**	
G	Palustrine	Forested	III	(1:1 R/C and 2:1 RH)	1:1 R/C	**N/A**	
H	Palustrine	Forested	III	(1:1 R/C and 2:1 RH)	1:1 R/C	**N/A**	
I	Palustrine	Forested	II	(1:1 R/C and 4:1 RH)	1:1 R/C	**N/A**	
J	Palustrine	Scrub-Shrub	III	(1:1 R/C and 2:1 RH)	1:1 R/C	**2,192**	**2,520**
K	Palustrine	Scrub-Shrub	III	(1:1 R/C and 2:1 RH)	1:1 R/C	N/A	
L[1]	Palustrine	Forested	III	(1:1 R/C and 10:1 RH)	1:1 R/C	**12,185**	**14,012**
		Scrub-Shrub		(1:1 R/C and 2:1 RH)			
M	Palustrine	Emergent	III	(1:1 R/C and 6:1 RH)	1:1 R/C	**679**	**780**
N	Palustrine	Emergent	I	(1:1 R/C and 6:1 RH)	1:1 R/C	N/A	
		Forested		(1:1 R/C and 10:1 RH)	1:1 R/C		
		Scrub-Shrub		(1:1 R/C and 2:1 RH)	1:1 R/C		
O[1]	Riverine	Emergent	II	(1:1 R/C and 4:1 RH)	1:1 R/C	N/A	N/A
P[1]	Palustrine	Emergent	III	(1:1 R/C and 6:1 RH)	1:1 R/C	N/A	N/A
Q[1]	Palustrine	Forested	III	(1:1 R/C and 10:1 RH)	1:1 R/C	N/A	N/A
R[1]	Palustrine	Forested	III	(1:1 R/C and 10:1 RH)	1:1 R/C	N/A	N/A
S	Riverine	Emergent	III	(1:1 R/C and 6:1 RH	1:1 R/C	N/A	N/A
T	Riverine	Emergent	III	(1:1 R/C and 6:1 RH	1:1 R/C	N/A	N/A
U	Riverine	Emergent	III	(1:1 R/C and 6:1 RH	1:1 R/C	N/A	N/A

Wetland	Habitat Classification[1]		City of Everett Wetland Rating	Ecology Restoration/Creation and Rehabilitation Ratios(ft^2 restored/created:ft^2 impacted and ft^2 rehabilitated: ft^2 impacted)	SEWIP Restoration/Creation Ratios (ft^2 Restored/Created: ft^2 impacted	Area Impacted (ft^2)	Proposed Area created (ft^2)
	System	Class					
V[1]	Riverine	Emergent	III	(1:1 R/C and 6:1 RH	1:1 R/C	N/A	N/A
W1	Riverine	Emergent	III	(1:1 R/C and 6:1 RH	1:1 R/C	**24,572**	**28,258**
X	Palustrine	Emergent	III	(1:1 R/C and 2:1 RH)	1:1 R/C	**12,775**	**14,691**
Y	Riverine	Forested	II	(1:1 R/C and 4:1 RH)	1:1 R/C	N/A	N/A
Z	Riverine	Emergent	III	(1:1 R/C and 6:1 RH	1:1 R/C	N/A	N/A

Mitigation and restoration efforts have been considered in relation to the production potential and the anticipated benefits to plant and animal resources. Several areas where habitat is currently in relatively good condition will be protected (for example, Simpson Category I Wetlands and Riparian Corridor). Other degraded habitats that have potential to provide excellent habitat and warrant special consideration (for example, Snohomish River shoreline) will be enhanced. Unfortunately, the habitat in some areas has been severely degraded as a result of previous human actions at the site, and this factor limits the restoration potential because of a potential release of contaminants.

Approximately 60,134 square feet of wetland creation, are proposed to occur in Wetland V to compensate for impacts to Wetlands J, L, M, W and X (see Figure 4.5-4). Wetland V has been rated as a Category III wetland (Adolfson 2007) following Ecology's rating system for Western Washington (Hruby 2004 [ESA Adolfson 2007]) and is classified as riverine emergent wetland because of its association with Bigelow Creek. The wetland is currently hydrologically connected to the Snohomish River. Due to backwater characteristics, restricted flow and standing water within the stream channel, wetland characteristics are prevalent within the ditched segments of Bigelow Creek, along the railroad grade. The wetland is characterized by emergent and scrub-shrub communities. Vegetative species observed with the wetland include but are not limited to: common cattail, hardhack, purple loosestrife, reed canary grass, slough sedge, small-fruited bulrush, water plantain and western dock. The wetland edges are steeply sloped due to the ditch characteristic of the stream channel and associated wetland. Vegetative species observed along the wetland margin, includes but are not limited to, bittersweet nightshade, clover, cutleaf blackberry, Himalayan blackberry, Japanese knotweed, morning glory, Nootka rose, salmonberry and Scotch broom. The overall disturbed habitat conditions are not conducive to many native wildlife and fish species.

Mitgation activities proposed in Wetland V will be associated with proposed habitat enhancement of the lower segement of Bigelow Creek. Connectivity of Bigelow Creek to the Snohomish River and the adjacent wetlands (Wetlands C and D) is extremely critical as it provides fish habitat and hydrologic functions and allows for the exchange of water, nutrients, and wildlife. Enhancements to Bigelow Creek are proposed along the west edge of Wetland C from the culvert at the south end of Wetland C to the confluence with the Snohomish River. The existing culverts at Wetland C and the confluence with the Snohomish River will be removed at these locations to provide open channel restoration. The existing rail lines will be removed and the rail grade will be excavated. A new sinuous channel will be excavated and floodplain with associated wetlands will be created (see Figure 4.5-4). Channel complexity will be increased with the creation of pools and riffles and the addition of LWD within the newly created channel.

The proposed mitigation has been planned based on the SEWIP, Everett Critical Areas Ordinance, Washington State Department of Ecology and USACOE guidance documents. The proposed conceptual mitigation measures have been planned to meet the minimum replacement ratios from the various guidance documents and the SEWIP analysis resulted in a minimum 1:1 ratio for replacement for the identified impacts (Please see the BA/HMP Appendix for the detailed analysis of the regulatory overlay and mitigation ratio analysis). The proposed mitigation is to replace impacted aquatic habitat at a ratio of 1.15:1 created to impacted area. Hydrology from the Bigelow Creek watershed and the backwater condition from the Snohomish River at high tide will make the proposed concept functional and effective. The proposed sinuosity is initially set to meet the impact to the linear ditch. The conceptual plan may be altered as necessary to meet overall mitigation goals for this project. The proposed trail position may be altered or adjusted as necessary.

The creation of wetland within the Bigelow Creek channel will compensate for the loss of 2,192 square feet of Wetland J, 12,185 square feet of Wetland L, 679 square feet of Wetland M, 24,572 square feet of Wetland W and 12,775 square feet of Wetland X. The goal of the proposed mitigation activities will be to replace impacted habitat and significantly improve wetland functions. The subsequent proposed restoration activities will improve the existing wetland rating of Wetland V to Category I due to the proposed direct association with the River. Improvements to the existing and created wetland will include increasing wetland hydrology, removal of non-native plant species, and planting of native hydrophytic vegetation.

Log and wood structures (including large woody debris) will be added into the channel to create habitat complexity, restore beneficial and productive edge habitat, and to armor erosive bank areas. Large woody debris is important for the ecosystem as it contributes to stream and channel morphology, slowing water velocities and creating natural meanders. Increased sediment capacity and settling and increased channel stability can result from the naturally deposited wood debris.

Large woody debris deposited into streams and wetlands has been shown to be beneficial for fish and wildlife in the Pacific Northwest. Valuable habitat such as pools, refugia, spawning grounds are created for fish by the addition of woody debris and, it can also provide substrate for aquatic invertebrate prey. The wood can also enhance and create fish passage areas. Birds and other wildlife benefit from increased perching and basking sites from the downed wood. LWD can enhance primary productivity of a stream by adding organic matter and nutrients (Fischenich and Morrow, 2000).

Invasive non-native vegetation will be removed and native vegetation suited for the soils and hydrology will be chosen and planted in this wetland. Conifers and associated riparian and fringe vegetation plantings will add habitat diversity and improve wetland functions and value. Tree species planted along the edge of wetland areas will provide potential long term recruitment of LWD into wetlands.

The proposed wetland mitigation will provide improved wetland functions over much of the project site. To develop the mitigation approach, the existing wetland conditions were compared to the SEWIP and other mitigation planning documents to generate the most advantageous and appropriate mitigation concepts. Water quality, hydrologic retention, and available wildlife habitat was considered in the planning process and is expected to increase as a result of the greater wetland area and added complexity to the habitat. The Category III wetland will be replaced with Category I wetland which will result in a higher level of wetland functions for a variety of fish and wildlife species.

The Everett codes call for enhancements that focus on establishing opportunities for large woody debris (LWD) to become established through planned plantings and recruitment. In addition, the mitigation plan includes specific additions of downed LWD at selected locations along the wetland margins and buffer

interfaces. Buffer preservation and enhancement surrounding the mitigation wetland will ensure that wetland functions remain intact and are sufficiently isolated from surrounding development. The planned wetland buffer enhancements have focused on LWD production and shading along the wetland margins where currently there is minimal or only deciduous species of vegetation. Many of the buffers are damaged from past practices on the site and have developed patchwork vegetation that is less effective as wildlife habitat, water quality improvement, and shade areas to the adjacent wetlands. Vegetated wetland buffer widths are also quite variable on the site and range from 0 to 50 feet in most cases. There are a few areas that have some wider buffer zones but in general, buffers offer little effectiveness. The proposed 75-foot buffer surrounding the Simpson Pad will provide a continuous wildlife corridor, LWD production, increased shade, and better water quality treatment as compared to current conditions. The installation of stormwater rain gardens along the development margins of the buffer will also provide hydrology to the buffer to water plants and also to the wetland to support wetland hydrology over time.

The proposed 75-foot buffer on the north face of the Simpson Pad is the most efficient buffer width for the project site based on landscape position, past land disturbances and proposed project stormwater treatment and control. The site is isolated from other contiguous wildlife habitats, surrounded by major roads and highways, includes significant human built environments railroad and urban development) that preclude large mammal use or connection to significant habitats. The proposed buffer widths attempt to provide continuity for small mammals, birds, adequate protection for aquatic species, and are also of sufficient width to provide a barrier or separation between human and natural environment.

To mitigate for impacts related to water dependent uses along the Snohomish River, up to 50 creosote pilings will be removed along the shoreline in the area proposed for public amenities and access. Removal of these pilings will reduce the amount of contaminants leaching into the River, decrease dangerous isolated obstacles in the water, and create a more aesthetically pleasing view of the river. Additional mitigation for the marina area will include creation of a pocket beach, installation of log jams and establishment of a native vegetation buffer zone along the River. Although temporary impacts such as decreased water quality from sediment and construction activities are anticipated with the excavation for the marina and boat dock and during piling removal, the proposed habitat improvements will have a net increase of and benefit for shoreline habitat.

Conservation measure for over and in-water structure design include; grating features, plank spacing and/or the use of prisms to reduce shade impacts, use of inert durable and non-toxic materials, walkways will be as narrow as possible, skirting will be eliminated, pilings will be concrete and will not contain creosote, the number and size of pilings will be minimized, and the distance between pilings will be maximized. The proposal includes excavation of uplands along the shoreline bank to create the areas needed to establish the small dock areas. This will increase the amount of available shoreline habitat by providing pocket beach habitat and increasing the overall square footage of River shoreline. The existing shoreline slope will be excavated and a new, more gradual slope will be created. This gradual slope will allow for installation of habitat features such as LWD and provide planting areas for native shoreline vegetation. The assumption was made that these areas are not contaminated and therefore are available for the proposed facility development. Prior to excavation, the necessary level of site investigation to determine soil contamination status will be completed.

The establishment of a series of log jams is also proposed along the shoreline. The log jams will be strategically placed to the north of the shore at the outfall of Bigelow Creek. These log jams will provide in river habitat, be sited outside of the transit lanes of the river and protect the proposed marina areas from elevated river flows and floating debris.

Buffers will be preserved and enhanced to protect wetlands, streams and shoreline areas and their functions from potential impacts from the proposed development. Buffer enhancement is proposed to occur along the Snohomish River shoreline from the area north of Wetland C to the north edge of the Newland Construction property, along the western margin of the lower segment of Bigelow Creek, along the of boundaries of Wetlands C, D, N, U, V and W, and along the perimeter of the Simpson pad. Where existing structures are located on the shoreline, buffers will not be enhanced and existing uses and activities will continue. Conceptual buffer enhancement activities include enhancement of 2.50 acres of Snohomish River shoreline buffer and 20.67 acres of wetland buffer within the project boundaries. The proposed buffer enhancement activities have been documented and are presented in the BA/HMP found in Appendix D, Figure series 10, 11 and 12. These illustrations have also been provided as Figures 4.5-6 through 4.5-6B, Proposed Buffer Enhancement, 4.5-7, Buffer Enhancement-Shoreline Eclipse Mill, 4.5-8, Proposed Buffer Enhancement-Simpson Development Pad, and 4.5-8A, Proposed Buffer Conditions-Simpson Development Pad of this section.

Buffer enhancement will entail removal of non-native vegetation and the planting of native vegetation. Native vegetation will also be established along areas where the buffer is currently absent. Planting of native plants not only increases habitat complexity, but can increase soil stabilization, water attenuation and infiltration, potential LWD recruitment and improve water quality by reducing sedimentation and contaminants.

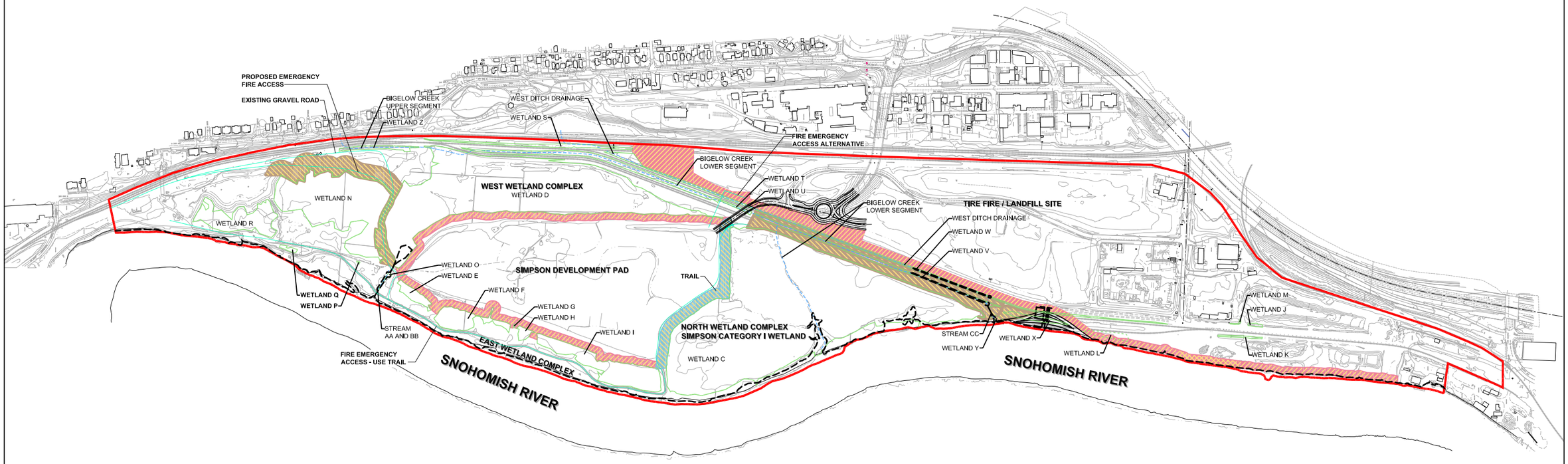
The water dependent use area will also include an enhanced buffer area. The buffer surrounding the facilities will be planted with native vegetation and large woody debris (LWD) will be placed along the shoreline edge to provide habitat for fish and wildlife.

4.5.4.2 City Critical Area and Stormwater Consistency

Areas that have been identified as significant features of the landscape (for example, wetland, critical habitat, erosion hazard, estuary and stream corridors) have been designated in the project conceptual designs as permanent open space. Two of the most prominent features of the natural landscape, the Simpson Category 1 Wetlands and Riparian Corridor and Bigelow Creek, are retained both for their value to biota and because of their value moderating floodwater, retaining and naturally treating stormwater, and protecting water quality. Protection and enhancement of these features will reduce the potential effects of the project.

As mentioned above, the mitigation plan has been developed to address the SEWIP, Everett Critical Areas Ordinance, Washington State Department of Ecology and USACOE guidance. Where possible, the mitigation area is larger than the minimum required based on the SEWIP analysis (see the BA/HMP Appendix D). The buffer areas have also been planned to address increased LWD production, increased continuity and wildlife opportunity by adding a wider a more diverse array of native plant species. The entire project area has experienced severe disturbances over the past 100 years and the resulting existing conditions are a patchwork of buffer widths, straightened stream channels, diked and isolated wetlands, and hardened river banks with minimal vegetation and creosote piles along the entire river edge. The proposed mitigation incorporates a package of mitigation items that address all these issues and results in a more favorable environment and promotes the proposed development in concert with environmental protection.

The proposed buffer plan for the site has been developed with existing conditions and City of Everett regulations in mind in concert with the proposed development and future public amenities. Buffer enhancements have targeted increased densities of native plant species, production of LWD, increased habitat availability for those species likely to utilize the site, protection of aquatic species, and separation between human and natural environments. This topic is discussed in greater detail above and in Appendix D the BA/HMP.



Legend

- Site Boundary
- Stream
- Snohomish River OHWM
- 100 Foot Proposed Buffer Enhancement by OliverMcMillan
- 75 Foot Proposed Buffer Enhancement by OliverMcMillan
- 50 Foot Proposed Buffer Enhancement by OliverMcMillan
- 50 Foot Proposed Buffer Enhancement by the City of Everett
- Estimated Wetland Boundary not Surveyed
- Proposed Fire Access Road

370 0 370
Feet

Notes:
1. The locations of all features shown are approximate.
2. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. can not guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.

Reference: Base drawing provided by Perteet, Inc.

Proposed Buffer Enhancement

Everett Riverfront Redevelopment
Everett, Washington

GEOENGINEERS

Figure 4.5-6

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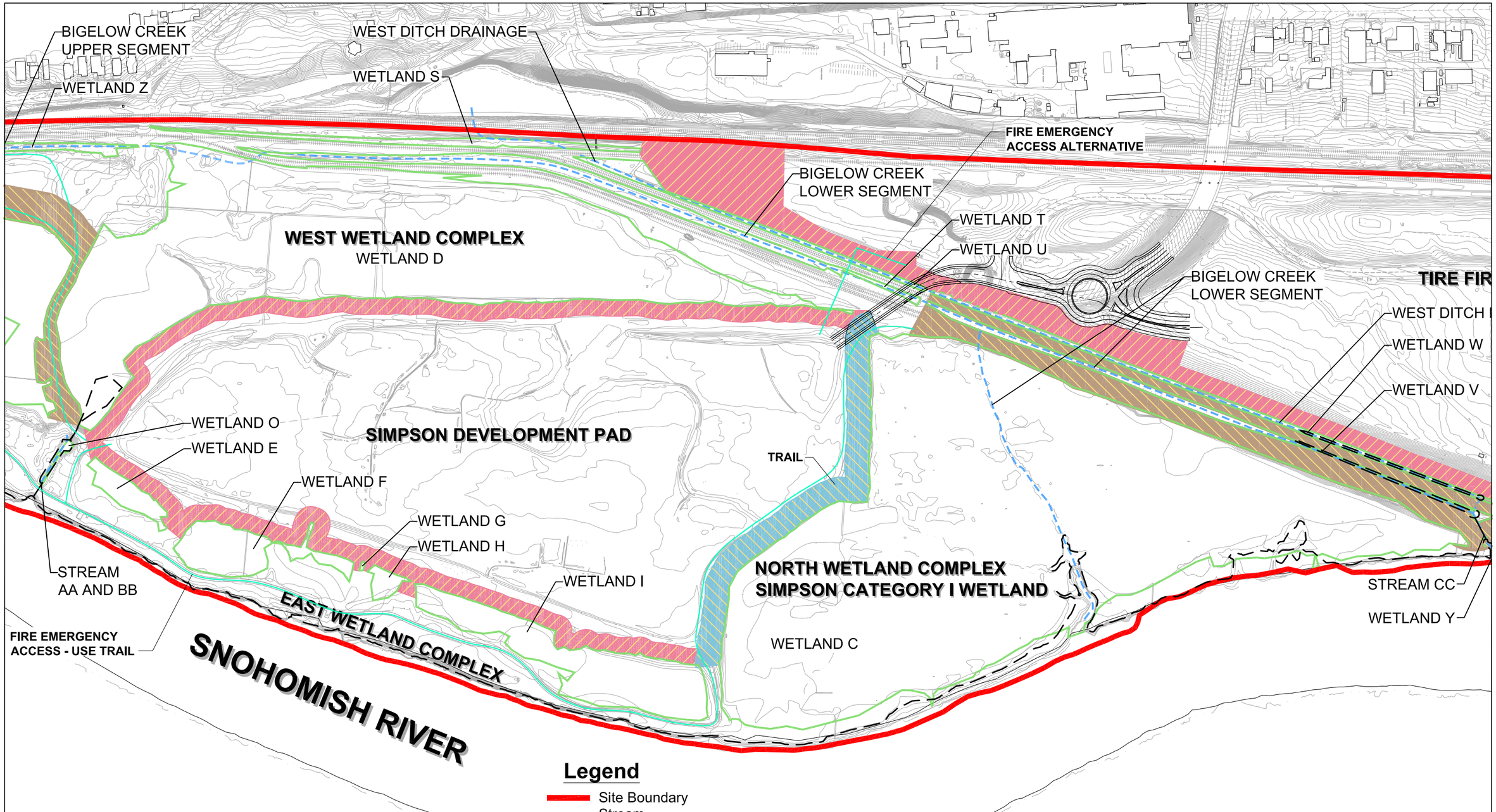

Legend

- Site Boundary
- Stream
- Snohomish River OHWM
- 100 Foot Proposed Buffer Enhancement by OliverMcMillan
- 75 Foot Proposed Buffer Enhancement by OliverMcMillan
- 50 Foot Proposed Buffer Enhancement by OliverMcMillan
- 50 Foot Proposed Buffer Enhancement by the City of Everett
- Estimated Wetland Boundary not Surveyed
- Proposed Fire Access Road

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Reference: Base drawing provided by Perteet, Inc.

Proposed Buffer Enhancement

Everett Riverfront Redevelopment
Everett, Washington

GeoEngineers

Figure 4.5-6A

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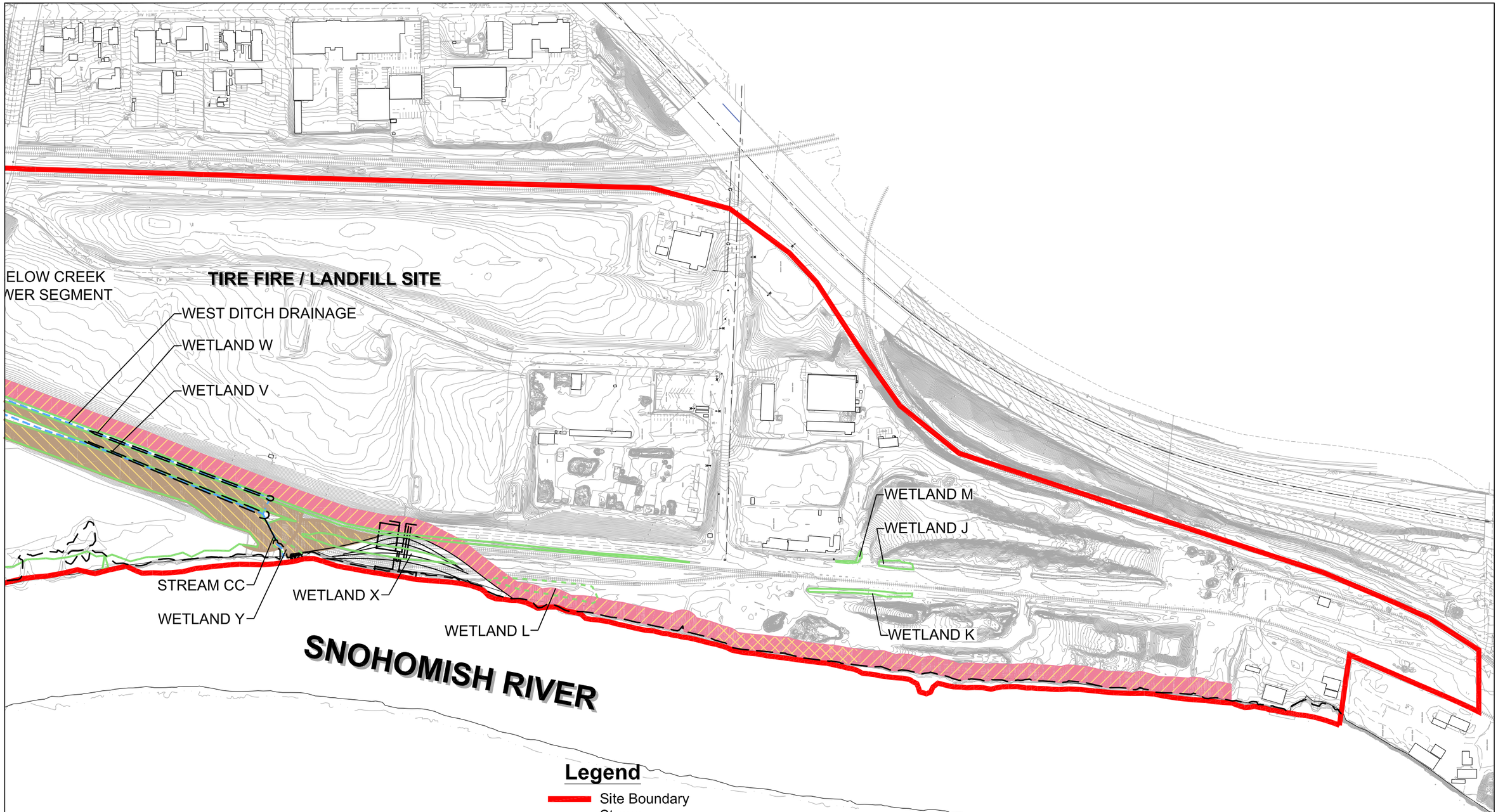

Legend

- Site Boundary
- Stream
- Snohomish River OHWM
- 100 Foot Proposed Buffer Enhancement by OliverMcMillan
- 75 Foot Proposed Buffer Enhancement by OliverMcMillan
- 50 Foot Proposed Buffer Enhancement by OliverMcMillan
- 50 Foot Proposed Buffer Enhancement by the City of Everett
- Estimated Wetland Boundary not Surveyed
- Proposed Fire Access Road

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Reference: Base drawing provided by Perteet, Inc.

Proposed Buffer Enhancement

Everett Riverfront Redevelopment
Everett, Washington

GeoEngineers

Figure 4.5-6B

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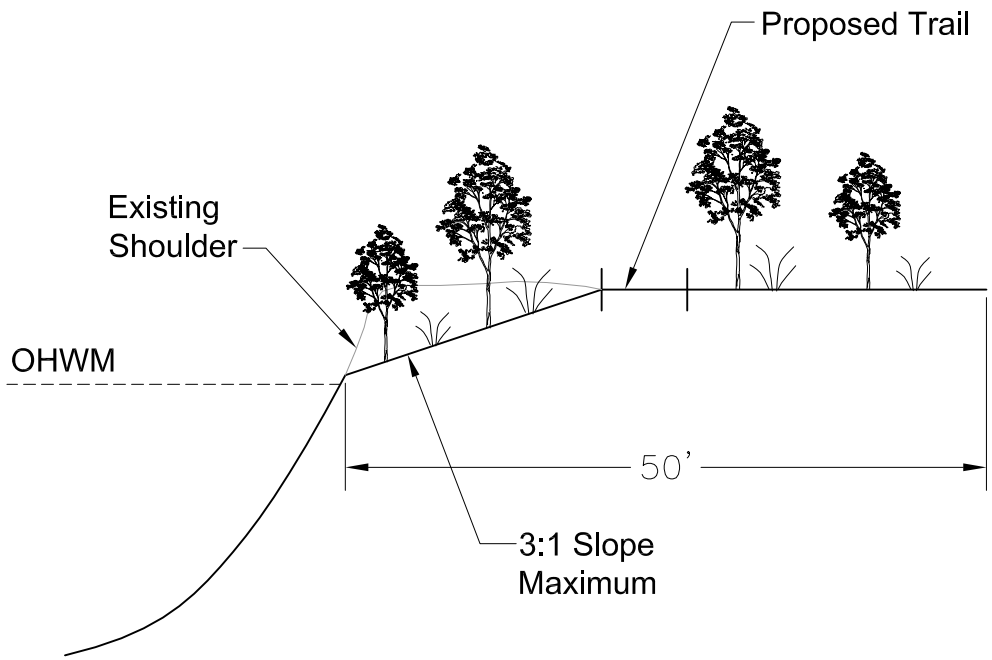

NOT TO SCALE

Notes:
1. The locations of all features shown are approximate.
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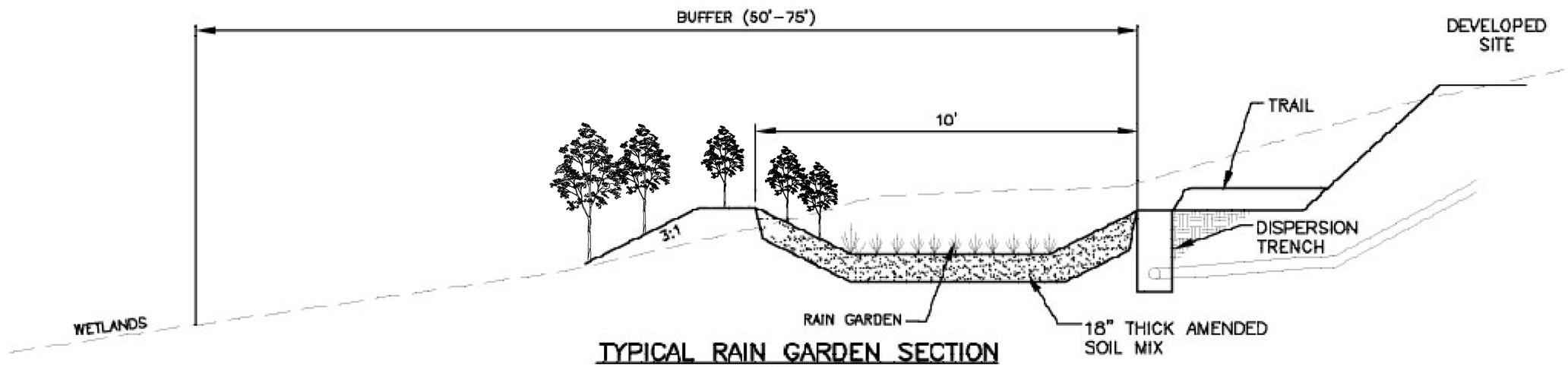
Reference: Drawing provided by GeoEngineers.

Buffer Enhancement - Shoreline Eclipse Mill

Everett Riverfront Redevelopment
Everett, Washington

GEOENGINEERS

Figure 4.5-7



TYPICAL RAIN GARDEN SECTION
N.T.S.

Notes:
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Reference: Drawing provided by Perteet, Inc.

Proposed Buffer Enhancement - Simpson Development Pad

Everett Riverfront Redevelopment
Everett, Washington

GEOENGINEERS

Figure 4.5-8

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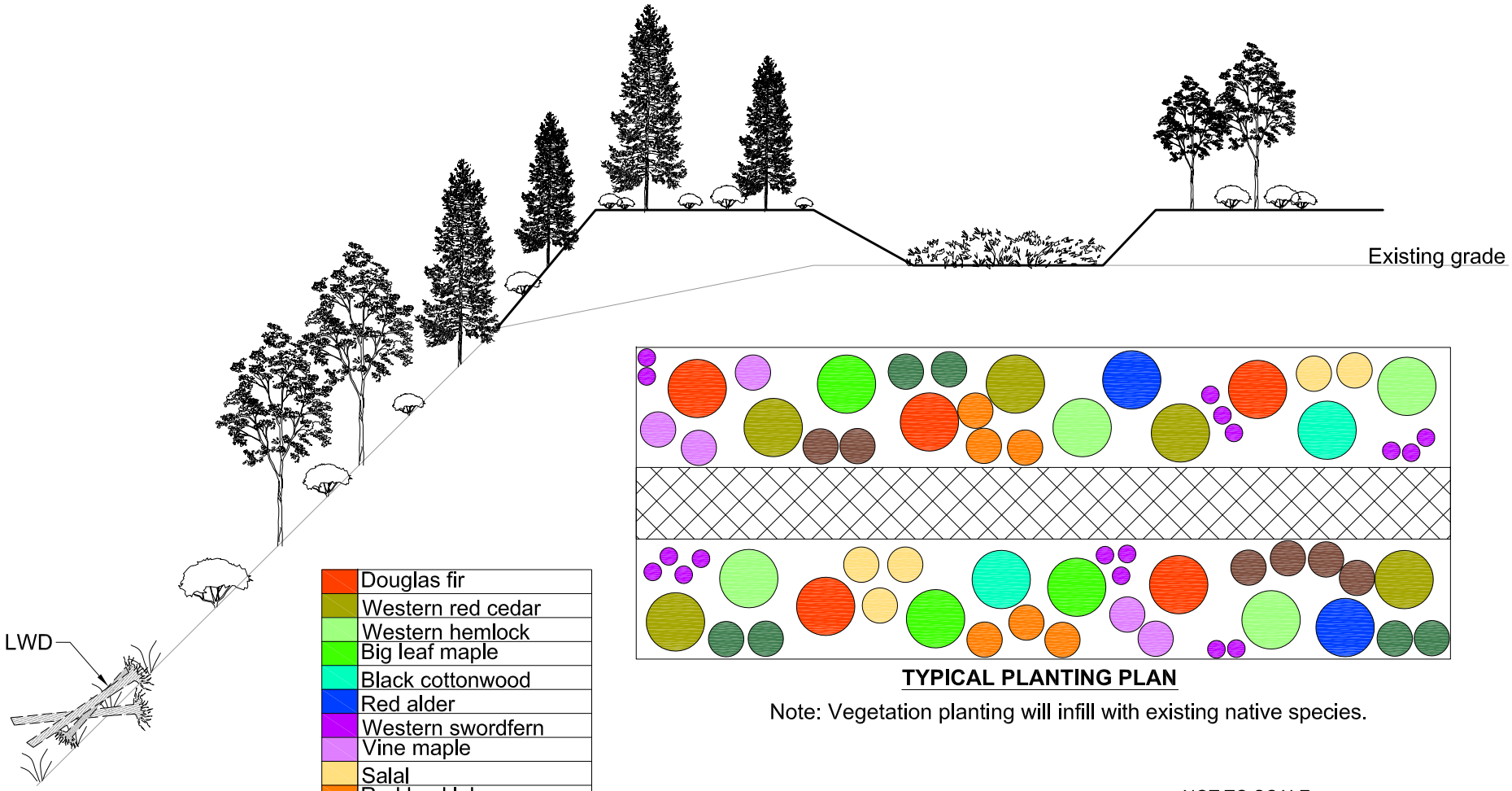

	Douglas fir
	Western red cedar
	Western hemlock
	Big leaf maple
	Black cottonwood
	Red alder
	Western swordfern
	Vine maple
	Salal
	Red huckleberry
	Evergreen huckleberry
	Salmonberry
	Emergent vegetation

TYPICAL PLANTING PLAN

Note: Vegetation planting will infill with existing native species.

NOT TO SCALE

Notes:
1. The locations of all features shown are approximate.
2. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. can not guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.

Proposed Buffer Conditions - Simpson Development Pad

Everett Riverfront Redevelopment
Everett, Washington

GEOENGINEERS

Figure 4.5-8A

The stormwater treatment and release element associated with the buffer enhancement plan has been designed to comply with Washington Department of Ecology and City regulations, including Critical Areas and Stormwater Design regulations and guidelines.

4.5.4.3 Construction Activities Impacts

BMPs will be followed throughout the construction activities proposed for the project and will be in accordance with the latest local and state regulatory guidance for each respective activity. Appropriate erosion control devices, such as silt fencing, mulch berms and erosion control matting, used where appropriate during all aspects of the project will mitigate potential erosion and sedimentation impacts to animals. The use of heavy machinery consolidated into the shortest time periods allowable will minimize noise impacts to animals and humans. Construction staging will be confined to discrete areas of the site away from the shoreline, which will minimize disturbance to surrounding fish and wildlife and their habitat. Construction debris and/or supplies will not be placed in or along the shoreline or the wetland. Defining the limits of construction and posting wetland and critical/sensitive area signs would serve as an indicator of restricted areas where construction activities would need to be avoided. Posting of these signs and security fences should not be within wetland and critical/sensitive areas but within upland areas. Work to be conducted in wetlands and stream areas will be conducted during the dry portion of the year and within designated work windows relative to the species of interest. Security lighting during construction activities should be directed away from wetlands and buffers.

Coinciding with or immediately subsequent to the completion of the construction work, the restoration and stabilization of bare ground will occur. Restoration and stabilization activities include the application of a native seed mix and landscape stabilization of any cut and filled areas using native plant species. To prevent the spread of noxious weeds, insects and soil-borne pests, construction equipment will be thoroughly cleaned prior to mobilization and prior to removal. If work is performed within known weed and/or soil-borne pest infested area, special attention will be paid to preventing the spread of the weed and/or pest. Mulch, straw/hay bales and seed used on-site will be free of noxious weeds. Likewise, materials used for grading will be inspected for the presence of noxious weed seed sources prior to use.

4.5.4.4 Noise Impacts

Construction activities associated with the proposed development are not expected to have significant noise impacts on the environment around the site and should not have any effect on nesting bald eagles because nesting activities are identified more than 1½ miles from the project site. Noise impacts to fish species from in-water pile driving activities will occur. This area is a highly developed area, and existing traffic and noise levels are relatively high. However, conservation measures could be used to reduce noise impacts to wildlife and neighbors. The use of heavy machinery could be minimized and consolidated. An attempt should be made to organize work requiring heavy machinery into single events. Noise impacts to fish species from in-water pile driving activities can be minimized through proper construction techniques and sequencing (that is, use of a bubble curtain, minimizing duration and by adhering to USACE-approved fish work windows) as described in the BA/HMP. Additional pedestrian and automobile traffic will be generated once the project is completed. Noise abatement measures implemented as part of reducing impacts from the 41st Street Overcrossing project and measures to reduce I-5 corridor effects may minimize negative effects of noise on wildlife at the project site.

4.5.4.5 Occupational Impacts

During the occupational phase of the project, residents and business owners should be made aware of the responsibility associated with activities in close proximity to a wetland and shoreline environment.

Permanent posting of wetland and critical/sensitive area signs will serve as a reminder and will designate areas for protection. Planting mature dense native vegetation will provide buffer areas and separation between human activity and critical areas along the margins of the development areas unless sited as nature trails within wetlands or along the shoreline. The City of Everett will be provided details of nature trails at a later date. Pedestrian traffic should be confined to trails lined with shrubs or on walkways. Residential areas and the operation of commercial businesses should include a covenant limiting the use of pesticides or chemicals in a way that it may enter stormwater. Soil or yard waste, paints, chemicals or fuels should not be dumped into or in a way that it may enter waterways.

Lighting should be directed away from wetlands and buffers or low-voltage motion detected directed in downward using ballards and/or baffles. Any future landscaping features should be compatible and blend with the native buffer and native wildlife. Bird boxes or feeders should be placed on the developed portions of the property to promote native species. Bird boxes can be built and placed on live trees according to the native bird species requirements that may be most likely to utilize habitat at the site. WDFW Backyard Wildlife Sanctuary Program and The National Wildlife Federation (NWF) sponsor certification and recognition programs designed for those who plan and voluntarily implement a wildlife habitat plan. Future homeowners should be made aware of this information and encouraged to participate in the program.

Educational materials should be posted at boat launches and docks to inform patrons of ways to minimize their impact to natural resources. Sufficient garbage receptacles and collection tubes for monofilament should be placed at access areas. Access points should be clearly designated and designed to allow use of the shoreline without a gradual expansion of the access or "blow out" of any nearby riparian vegetation caused by foot, vehicle or boat traffic. This can be accomplished by planting mature native vegetation along the edges to clearly delineate the access point.

4.6 Energy and Natural Resources

4.6.1 Methodology

This section provides a summary of readily available information pertaining to the current and future availability, distribution and use of energy and natural resources at the project site. A review of energy and natural resource literature was completed, and energy service providers were contacted for information about the availability of resources and the extent of infrastructure at the site.

The proposal is anticipated to use energy and natural resources during all phases of construction, operation and maintenance of the final site design. Opportunities to minimize and mitigate energy and natural resource consumption are also considered in this report.

4.6.2 Existing Conditions/Affected Environment

Existing energy resources within the project vicinity include electricity, natural gas and a variety of fossil fuels, including gasoline, diesel fuels and lubricating oils. Existing natural resources within the project vicinity include nonrenewable resources (sand and gravel) and naturally renewable resources (wood fiber, wind, tidal energy and sunlight). The following sections further describe resource availability, use of these resources at the project site, and the potential effects on these resources through the proposed redevelopment project.

4.6.2.1 Electrical Power

Electricity is currently available and used at the project site. Electrical energy service is provided by the Snohomish County Public Utility District No. 1 (Snohomish PUD), a municipal electric and water utility. Snohomish PUD generates electricity at the Henry M. Jackson Hydroelectric Project and at the Everett Cogeneration Project. Additional electricity is also obtained through contracts with the Bonneville Power Administration (BPA). Power is provided to customers, including the project site, through the Snohomish PUD transmission system.

Overhead electrical service currently exists on 36th Street and extends to the animal shelter on the site. Existing overhead electrical lines extend approximately to the site boundary on 41st Street.

The area is presently served by the Everett substation 12-kilovolt (kV) distribution system. The existing 37th and McDougal and 52nd Street substations and associated 12kV circuits serve approximately 7,750 customers in this area including commercial and industrial customers in the eastern part of the City and the residential loads south of the city. The project site is potentially served by the Everett substation with backup from the 52nd Street substation.

4.6.2.2 Natural Gas

Natural gas is provided to the City by Puget Sound Energy (PSE), an investor-owned utility that serves as a primary local distribution company (LDC) in the Puget Sound area (personal communication, January 30, 2007 PSE Senior Project Manager).

PSE has made investments in the natural gas infrastructure in the area of the site to accommodate growth in the City. PSE presently has the capacity and anticipates having the ability to serve current and future needs in the Everett area. PSE presently has a 12-inch high-pressure natural gas line along Smith Avenue, just west of the project site. This line operates at a load of approximately 250 pounds per square inch (psi), well in excess of the pressure typically needed for residential, mixed commercial or hotel needs (personal communication January 30, PSE Senior Project Manager).

Puget Sound Energy (PSE) provides natural gas service in the City. An existing 2-inch-diameter line currently serves the animal shelter at the north end of the project site. No other natural gas lines are located within the project area. The existing 2-inch line does not have adequate capacity to serve the proposed project, necessitating upgrades to PSE's system to accommodate the expected load growth.

4.6.2.3 Other Nonrenewable Resources

There is presently limited use of nonrenewable resources at the project site. Nonrenewable resources such as fossil fuels, sand, gravel and rock fill have been used at the site during reclamation of the Landfill/Tire Fire and Simpson Pad sites. The following sections provide additional detail about the availability of these resources.

4.6.2.4 Fossil Fuels (Petroleum Products)

There is presently limited use of fossil fuels at the project site. Fossil fuels such as gasoline, diesel and lubricating oils are commonly used by automobiles, machinery and other mechanical equipment. There has been limited use of fossil fuels at the project site during reclamation of the Landfill/Tire Fire and Simpson Pad sites, and by vehicles used to convey people to and from the project site.

Fossil fuels and petroleum products typically needed for construction, transportation, and operation and maintenance of facilities are not produced in the project vicinity but are readily available through numerous commercial outlets in the City and the project vicinity.

4.6.2.5 Sand and Gravel

Rock, sand and gravel mining is the most prevalent nonrenewable resource used in the vicinity of the project site. This resource is most often consumed locally during construction projects (sand, gravel, concrete, roads, building materials).

A large number of sand, gravel, concrete and rock-based building material vendors are listed for the Everett area. Although the materials are not manufactured on-site, these vendors make sand, gravel, rock and other rock-based building materials readily available in the City and project vicinity.

4.6.2.6 Renewable Resources

Materials that can be regenerated such as wood, other fibers, wind, tidal energy and sunlight are considered renewable resources. None of these resources are prominent features in the project vicinity and are not presently used at the project site.

4.6.3 Potential Effects/Impacts of the Project

The project will result in an increased need for electricity, natural gas and fossil fuel. Snohomish PUD working with the City to upgrade a utility pole and make associated changes at the project site. To accommodate the City's growth, PSE has been expanding its natural gas infrastructure around the project site and presently has a natural gas line to the west of the project site. Fossil fuels such as gasoline and diesel are commercially available within the project vicinity and may be found around the area because of transportation activities. No potential effects involving mining for mineral resources and sand and gravel and renewable resources (wood fibers, wind, tidal energy and sunlight) are expected. Landfill gas could provide a potential form of renewable energy. Methane in landfill gas has the potential to be recovered and converted to heat or electricity.

4.6.3.1 Impacts Common to the "Action" Alternatives

Alternatives 1 and 2 would necessitate an increase of electrical and natural gas resources to provide power and energy to the proposed development. Fossil fuels consumption would increase. Plans to limit potential impacts to the following energy and natural resources will be addressed by clarifying build alternatives for the project site and working in conjunction with the Snohomish PUD, PSE, and the City.

Electricity

The redevelopment project would increase the electrical demand at the project site. The difference between existing use and potential future use at the site can be estimated. Estimates of current and future electrical usage at the site have not been finalized but it is anticipated that approximately 11,000kV will be needed to begin site development.

Existing utility lines could be modified or relocated to accommodate the final design of the redevelopment project. Snohomish PUD is currently capable of providing electricity to the site through existing infrastructure. Discussions with Snohomish PUD uncovered their interest in exploring the possibility of replacing overhead wires that serve power to the site, after crossing I-5, with alternative designs that could be more cost-effective and involve less risk. One alternative identified by the

Snohomish PUD (Everett Customer Engineer for Snohomish PUD January 30, 2007) would be to replace overhead wires with electrical cables routed through conduit attached to the 41st Street overcrossing.

Natural Gas

As such, any natural gas used for heating, cooking or other uses at the site would be an increase above existing levels. The difference between existing use and potential future use at the site can be estimated. Estimates of current and future natural gas usage for the designed development have not been completed at this time.

PSE has preliminarily identified the need for a pressure regulation station, intermediate gas mains and gas regulators to serve natural gas to buildings developed on the project site. For example, a pressure regulation station could be built near the intersection of Smith and 41st Street, connecting to the existing 12-inch gas main. Intermediate mains operating at approximately 45 to 60 psi could be routed from the pressure regulation station to the project site and gas pressure regulators (pers. comm. January 30, 2007, PSE Senior Project Manager).

PSE recommends that project proponents contact a New Customer Construction agent well before development to assist with the design and construction of natural gas infrastructure.

Fossil Fuels

Usage of fossil fuels (including gasoline, diesel and lubricating oils) on the site has been limited, and these fossil fuels and components are not produced within the project vicinity. Indirect increases in fossil fuel components may occur above current levels because of increased traffic, transportation and vehicle activities on the project site. Actual differences between existing use and potential future use on the site can be estimated when a build alternative has been determined for the project site.

Mineral Resources

Although the Snohomish County mineral lands inventory did not cover the southwest portion of the county (which encompasses the project site), the county recommended an alternative use because of the watershed sensitivity and potential transportation issues. Mineral resources have not been mined on the project site, and there are no plans to conduct this work in the future.

Sand and Gravel

Numerous gravel pits and quarries for sand and gravel mining are located in Snohomish County, but only one permit was issued for mining relatively close to the project site. No sand and gravel has been mined on-site, and no increase in sand and gravel mining is anticipated due to the lack of available material on site. Sand and gravel resources will be used for the development for buildings, roads and other uses.

Landfill Gasses

While landfill gases are being collected and vented from the site it is infeasible to economically recover energy from that potential resource. Landfill gases are generated as a by-product of the decomposition of organic wastes that were buried. As the decomposition of the wastes continue the amount of gas generated decreases. Based upon modeling (EPA) the landfill reached its peak production of gas in 1975 and has been steadily decreasing since. The 2007 volume of gas was estimated at 174 cfm which is about a quarter of its peak generation and is decreasing at a rate of about 6 cfm per year.

The volume of gas generated by the landfill is irrelevant to energy production if it cannot be collected in a concentration which would allow it to be used. The present perimeter gas collection system is not capable of capturing the gas estimated to be generated in the model nor can it collect it in concentrations sufficient for use

Under present technology the most cost-effective system to recover energy from the landfill gas produced at the project would be a micro-turbine system designed for this type of gas These systems use banks of small (30 kwh) turbines to generate electricity. Using the most optimistic assumptions such a system would lose money or require a subsidy over present prices for green power. That subsidy or higher price would have to begin about 13% above present green power prices and would need to increase at a rate of about 4% per year as the gas generation decreases, simply for the project to break even. Such a scenario would also require the system to remove a micro turbine about every two years as the gas decreases and the capacity is no longer useable.

Renewable Resources

Renewable resources such as wood and other natural fibers, wind, tidal energy and sunlight are not prominent features and are not used on the project site. These renewable resources are unlikely to be developed on a large scale in the project vicinity, although limited, small-scale solar capabilities may be implemented as part of the efforts to use sustainable building practices such as those found in the LEED program.

4.6.3.2 Impacts of the No-Action Alternative

The no-action alternative would likely delay the timing of energy and natural resources development on this project site. As noted in Section 2.3, Project Alternatives, future development impacts of the no-action alternative would be similar to Alternative 2.

4.6.4 Mitigation

A variety of actions could be taken to avoid or minimize potential project effects on energy and natural resources and may also serve to protect human health, environmental quality and quality of life while reducing cost of construction and operation of facilities. The following sections describe potential actions and summarize how the measures could avoid or minimize potential effects or otherwise realize benefits to people or natural resources.

4.6.4.1 Centralized Utilities

Centralized utilities are used as part of large developments to efficiently manage energy resources. Centralized heating and cooling systems and high-voltage electrical capacities can be designed and constructed as part of large projects to realize efficiencies of scale. Satellite systems can also realize efficiencies of scale if space is too limited for centralized systems.

4.6.4.2 Compliance with Energy Codes

Energy codes have been developed across jurisdictional scales (for example, federal, state and local). Energy codes serve a variety of purposes including maximizing energy efficiency, thereby minimizing impacts of new construction on existing and future uses. Compliance with energy codes would serve to minimize the potential effects of project actions on current and future energy resources.

4.6.4.3 Voluntary Compliance with Electrical Energy Standards

The City and OliverMcMillan LLC could voluntarily apply high-performance, energy-efficient building design and construction standards for new construction on the project site. Use of a nationally recognized system of standards such as LEED for new construction as guidance at the site would create a record of measurable efficiencies and mitigating actions.

Sustainable Building Practices (i.e., LEED)

The proposed development will be constructed using sustainable building and development practices such as those found in the U.S. Green Building Council's Leadership in Energy and Environmental Design (LEED) system. LEED products focus primarily on green building practices, with burgeoning efforts aimed at factors such as site selection and design, These programs places emphasis on the design and construction elements that bring buildings together into a neighborhood, and relate the neighborhood to its larger region and landscape.

Systems like LEED provide guidance on practices like energy design with various methods for energy efficiency. For example, residential buildings can comply with Energy Star" performance paths (Energy Star is a partnership program of US Department of Energy, EPA and HUD). Energy Star use has been estimated to result in 20-30% savings in energy usage (although the actual savings is based on comparisons with a wide variety of "baseline" energy codes). Another method is for the residential buildings to meet a targeted savings in energy compared to standard construction practices. Commercial and retail buildings can meet similar design parameters compared to modeled baselines or meet ASHRAE standards established for the building types. Similar to Energy Star results, ASHRAE programs have also reported energy savings of about 25 percent from their use compared to following local and state code requirements.

4.6.5 Renewable Resources

Renewable resources such as wood, other fibers, wind, tidal energy and sunlight have the potential to offset energy and natural resource demands caused by construction, operation and maintenance of the proposed Everett Riverfront Redevelopment Project. None of these resources are prominent features in the project vicinity and are therefore unlikely to serve as continuous sources of energy or natural resources at the project site.

4.6.5.1 Wood Fiber

There is some wood fiber on the site, but it is mostly associated with wetlands and riparian areas (see GeoEngineers, Inc. February 7, 2007, Plants and Animals Technical Data Summary Report) and is not available for use on the site.

4.6.5.2 Wind

The Puget Sound area, including the project site, is not considered a reliable source of wind energy. The closest wind-based electrical power project is located in Ellensburg (Wild Horse Project), Washington, which is located over 100 miles from the project site on the east side of the Cascade Mountain range. Other wind energy projects are located in the Columbia and Snake River basins near the tri-cities (Pasco, Kennewick, Richland) and Walla Walla (American Wind Energy Association [AWEA], 2007).

4.6.5.3 Tidal Energy

Tidal energy is a potential renewable energy source that might develop in the Puget Sound area. Tidal energy is not likely to be developed in the immediate project vicinity. This energy source is, however, being considered by a variety of proponents at the following Puget Sound, Washington, locations (Puget Sound Tidal Energy, 2007).

4.6.5.4 Sunlight

Sunlight is a renewable energy source that could be put to limited use at the project site. Some limited, small-scale uses could be developed as part of the project design considering recommendations from programs such as LEED. "In many cases, heating costs could be more than 50% lower than the cost of heating the same house that does not include passive solar design."