6-F
GROUNDWATER AND STORMWATER MANAGEMENT AT THE CANDIDATE PORTAL SITES

FINAL
ENVIRONMENTAL
IMPACT STATEMENT

Brightwater
Regional Wastewater
Treatment System

APPENDICES

King County Brightwater TREATMENT SYSTEM

Final

Appendix 6-F
Groundwater and Stormwater Management at the Candidate Portal Sites

October 2003

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King County
Department of Natural Resources and Parks
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Introduction

King County has prepared a Draft Environmental Impact Statement (Draft EIS) and Final Environmental Impact Statement (Final EIS) on the Brightwater Regional Wastewater Treatment System. The Final EIS is intended to provide decision-makers, regulatory agencies and the public with information regarding the probable significant adverse impacts of the Brightwater proposal and identify alternatives and reasonable mitigation measures.

King County Executive Ron Sims has identified a preferred alternative, which is outlined in the Final EIS. This preferred alternative is for public information only, and is not intended in any way to prejudge the County's final decision, which will be made following the issuance of the Final EIS with accompanying technical appendices, comments on the Draft EIS and responses from King County, and additional supporting information. After issuance of the Final EIS, the King County Executive will select final locations for a treatment plant, marine outfall and associated conveyances.

The County Executive authorized the preparation of a set of Technical Reports, in support of the Final EIS. These reports represent a substantial volume of additional investigation on the identified Brightwater alternatives, as appropriate, to identify probable significant adverse environmental impacts as required by the State Environmental Policy Act (SEPA). The collection of pertinent information and evaluation of impacts and mitigation measures on the Brightwater proposal is an ongoing process. The Final EIS incorporates this updated information and additional analysis of the probable significant adverse environmental impacts of the Brightwater alternatives, along with identification of reasonable mitigation measures. Additional evaluation will continue as part of meeting federal, state and local permitting requirements.

Thus, the readers of this Technical Report should take into account the preliminary nature of the data contained herein, as well as the fact that new information relating to Brightwater may become available as the permit process gets underway. It is released at this time as part of King County's commitment to share information with the public as it is being developed.

Purpose

This Technical Memorandum (TM) presents a discussion of stormwater and groundwater management at the Conveyance System portal sites during construction and operation for all of the Brightwater Conveyance System Alternatives. This TM will be included in the Final EIS as an Attachment to Chapter 6. The first section of this TM discusses regulations and permitting that apply to both stormwater and dewatered groundwater discharges to storm drains or surface waters. Additional regulatory requirements that apply to only stormwater or only dewatered groundwater are contained within the stormwater or groundwater management sections of this TM. The second section of this TM discusses dewatered groundwater management at the primary portal sites during construction. Dewatered groundwater management includes estimated dewatered groundwater rates, discharge options and applicable discharge conditions, as well as available treatment methods. The third section of this TM discusses stormwater management at the portal sites during construction. Stormwater management includes regulatory requirements, treatment options and flow-control facility sizing. This TM addresses stormwater and groundwater management at primary portals on all three alignments. Primary portals and portal sites that are necessary for conveyance construction will be built on the selected alignment.

Regulations and Permitting

Activities in and near surface water are subject to laws and regulations at the federal, state and local levels. The federal Clean Water Act (CWA) of 1972 and its amendments regulate surface waters. In Washington, the Washington Department of Ecology (Ecology) has been delegated the authority to implement and enforce CWA sections 401 and 402. Ecology regulates the point source discharge of stormwater (including dewatered groundwater) from construction sites of one acre or more through the National Pollutant Discharge Elimination System (NPDES) Permits. Stormwater runoff from new and redevelopment projects may also be subject to the guidance in Ecology's Stormwater Management Manual for Western Washington (Ecology, 2001).

Construction sites that will disturb one acre or more and will have a point source discharge of stormwater or dewatered groundwater from the project site to surface water must apply for an NPDES permit. Ecology has developed a General Construction Stormwater Permit, which requires best management practices, including application of stabilization and structural practices to reduce the potential for erosion and the discharge of sediments from the site. The stabilization and structural practices cited in the permit are similar to the minimum requirements for sedimentation and erosion control in Volume I of Ecology's manual.

For large projects, such as Brightwater, current permitting trends and discussions with Ecology indicate that one or more Individual NPDES Permits for Stormwater Associated with Construction Activities would be needed, rather than a General NPDES Permit. The Individual NPDES permits would be drafted specifically for the Brightwater construction project. Among other requirements, it is anticipated that Ecology will require that all stages of the Brightwater construction project meet the minimum requirements outlined in the Ecology manual.

Minimum Requirements for New and Redevelopment Projects

During construction, the Brightwater project is expected to meet the requirements of the Ecology Stormwater Management Manual for Western Washington or an equivalent manual.

Ecology has established ten minimum requirements and conditions for new and redevelopment projects. The Minimum Requirements (Ecology, 2001, Volume 1) are listed as follows:

- Preparation of Stormwater Site Plan
- Construction Stormwater Pollution Prevention Plan (SWPPP)
- Source Control of Pollution
- Preservation of Natural Drainage Systems and Outfalls
- Onsite Stormwater Management
- Runoff Treatment
- Flow Control
- Wetlands Protection
- Basin/Watershed Planning

- Operation and Maintenance

Additional details are discussed in the Stormwater Management at the Portal Construction Sites section of this TM.

Stormwater Compliance

Stormwater regulations for local jurisdictions along the proposed conveyance corridors are summarized in Table 1. Ecology has indicated that in cases where the local government requirements for construction sites are at least as stringent as Ecology's, it will accept compliance with the local requirements (Ecology, 2001). However, where the local requirements are less stringent than Ecology's requirements, the project will be required to meet the more stringent Ecology requirements. Therefore, the Ecology requirements are the basis for the discussion and analysis in this memorandum.

Table 1. Stormwater Manuals Used by Jurisdictions at Primary Portal Sites

Jurisdiction	Manual Used by Jurisdiction	Proposed Corridor (Primary Portal Site No.)
City of Bothell	King County Surface Water Design Manual (1998)	Unocal (14), 228th Street (39, 41), 195th Street (41)
City of Brier	Ecology Stormwater Management Manual (2001)	228th Street (33)
City of Edmonds	Ecology Stormwater Management Manual (1992), with addendum ordinance 18-30 (1995)	Unocal (3), 228th Street (26)
City of Kenmore	King County Surface Water Design Manual (1998)	Unocal (11), 195th Street (11, 44), 228th Street (34)
City of Lake Forest Park	King County Surface Water Design Manual (1998)	Unocal (7)
City of Mountlake Terrace	Ecology Stormwater Management Manual (2001)[a]	228th Street (26), 195th Street (5, 19)
City of Shoreline	King County Surface Water Design Manual (1998)	195th Street
Snohomish County	Ecology Stormwater Management Manual (2001)	Unocal (3), 195th Street (19), 228th Street (33)
Town of Woodway	Ecology Stormwater Management Manual (1992)	Unocal (19), 195th Street (19)

[a] By administrative action, the City of Mountlake Terrace is using Ecology's 2001 manual, although the City has formally adopted only Ecology's 1992 manual.

All jurisdictions within the proposed corridors issue permits prior to development and/or land disturbing activities. Drainage plans must be submitted and approved before the permit can be authorized. The drainage plans must specify how stormwater will be treated and discharged. Local regulations allow for discharge of stormwater and dewatered water into surface and stormwater systems; however, conditions and requirements exist to ensure that water quality standards are met and that increased flow rates do not impact downstream properties or stream and wetland habitat. Table 2 summarizes specific drainage and critical area requirements for discharge of construction stormwater runoff and dewatered groundwater to surface waters and wetlands.

Table 2. Jurisdiction, Drainage Requirements, and Critical Area Requirements

Jurisdiction (Year of Municipal Code)	Proposed Corridor and Construction Sites	Drainage Requirements	Critical Area Requirements
City of Bothell (1997)	Unocal (Portal 14) 228th Street (Portal 39, Portal 41) Microtunnel access pits for North Creek Pump Station Connection 195th Street (Portal 41)	Drainage plan required for development permit; all stormwater from project sites with land disturbing activities must be treated prior to discharge	Alteration permit may be required for altering water levels of a wetland (mitigation may be required). Development activities are restricted in buffers of wetlands and streams including stormwater[a] discharge.
City of Brier (2001)	228th Street (Portal 33)	Drainage plan required for development permit, and would include temporary erosion and sediment control and subsurface drainage plan	Alterations to wetlands and streams and their buffers that may adversely affect their functions may require a permit.
City of Edmonds (2002)	Unocal (Portal 3) 228th Street (Portal 26)	Drainage plan required for development permit; dewater systems must discharge to sediment trap or sediment pond; wetlands created for mitigation of wetland loss cannot be used to treat stormwater	Alterations to wetlands and their buffers may require a permit including use for stormwater[a] discharge. Wetlands cannot be used for stormwater treatment. Stormwater[a] swales are allowed in the outer 25 percent of Class 3 wetland buffer, if no other alternative is available. Pre-treated stormwater[a] may be passed through Class 3 wetland buffers, if no other alternative is available.

Table 2. Jurisdiction, Drainage Requirements, and Critical Area Requirements (continued)

Jurisdiction (Year of Municipal Code)	Proposed Corridor and Construction Sites	Drainage Requirements	Critical Area Requirements
City of Kenmore (2000)	Unocal (Portal 11) 195th Street (Portal 11) 228th Street (Portal 44)	Drainage review required for development permit	Alterations to wetlands and their buffers may require a permit including use for stormwater[a] discharge or stormwater detention. Stormwater[a] energy dissipators or discharge from detention facilities may be allowed in wetland and stream buffers, if they do not increase flow or decrease water quality in the wetland or stream. Stormwater[a] discharge from a treatment facility to a stream may be allowed if in compliance with the King County Surface Water Design Manual.
City of Lake Forest Park (2002)	Unocal (Portal 7) 195th Street Open–cut for local connections	Drainage plan and temporary sediment and erosion control plan required for development permit	Alterations to wetlands and their buffers may require a permit including use for stormwater[a] discharge. Wetlands may not be used for stormwater[a] retention/detention, except that public agency regional detention facilities may be allowed in Class 2 or 3 wetlands pursuant to Chapter 16.18 of the code. Stormwater[a] must be pre-treated prior to discharge into wetlands and streams. Stormwater[a] discharges to streams from detention facilities may be allowed if they do not increase flow or decrease water quality.
City of Mountlake Terrace (2002)	228th Street (Portal 26) 195th Street (Portal 5)	Drainage plan and drainage permit required	Alterations to wetlands and streams and their buffers that may adversely affect their functions may require a permit. Class 3 wetlands may be used for stormwater detention facilities, Class 1 and 2 may not.
City of Shoreline (2002)	195th Street (Portal 5 and 19)	Drainage review required for development permit	Alterations to wetlands and streams and their buffers that may adversely affect their functions may require a permit. Stormwater[a] management facilities, such as grass-lined swales, are allowed outside the minimum regulated wetland or stream buffer but within the standard wetland or stream buffer of a wetland buffer, as long as adverse effects to functions will not occur.

Table 2. Jurisdiction, Drainage Requirements, and Critical Area Requirements (continued)

Jurisdiction (Year of Municipal Code)	Proposed Corridor and Construction Sites	Drainage Requirements	Critical Area Requirements
Snohomish County (2003)	Unocal (Portal 3) 195th Street (Portal 19) 228th Street (Portal 33)	Drainage review required for development permit; dewater systems must discharge to sediment trap or sediment pond; natural wetlands and wetlands created to mitigate loss of wetlands would not be used to treat stormwater	Alterations to wetlands and streams and their buffers that may adversely affect their functions may require a permit. Stormwater[a] retention/detention facilities, ditches, and biofilter swales are allowed in wetland and stream buffers. Stormwater[a] discharges to streams or wetlands that contain Endangered Species Act (ESA) listed species may have additional restrictions to the standard requirements discussed above. Stormwater discharges must meet drainage regulation requirements.
Town of Woodway (2000)	Unocal (Portal 19) 195th Street (Portal 19)	To be determined	Alterations to wetlands and streams and their buffers including stormwater[a] facilities may require a permit. Stormwater[a] management facilities, such as grass-lined swales, are allowed at the outer 50 percent of a wetland buffer and within fish and wildlife habitat area buffers, as long as adverse effects to functions will not occur.

[a] This is based on the assumption that the local jurisdiction will regulate dewatering water discharge to surface waters including wetlands similar to that for stormwater discharge.

Groundwater Management at Portal Sites

Some portions of the proposed conveyance system components would be near or below the existing groundwater table, necessitating groundwater control during construction. Open trenching, microtunnel pits, and portal excavations are construction activities that typically require dewatering. This section discusses potential discharge options for dewatered groundwater at the primary portal sites for the alternative conveyance systems.

Estimated Dewatering Rates

Dewatering rates would depend upon local geotechnical conditions such as:

- Soil type
- Presence or absence of shallow unconfined aquifers or deep aquifers
- Height of the groundwater table above the bottom of the trench, the excavation pit, or the portal shaft
- Construction method

Table 3 summarizes the estimated dewatering rates for the primary portal alternatives. Appendix 6-B Geology and Groundwater, Section 5 contains a discussion of the dewatering sources and assumptions used to determine the dewatering rates.

Table 3. Estimated Dewatering Rates at the Primary Portals

Route 9 - 195th Street Conveyance System Alternative	
Portal	**Estimated Rates**
11	- 20 to 80 gpm for 0.5 year of portal construction - Up to 80 gpm for the 1 year of tunnel excavation, and up to 250 gpm for a 2-week period during this time - Up to 50 gallons per minute (gpm) for the 1 year of tunnel lining
44	- 1 to 10 gpm for 0.5 year of portal construction - Up to 140 gpm for the 2 years of tunnel excavation, and up to 250 gpm for two 2-week periods during this time - Up to 110 gpm for the 1 year of tunnel lining
41	- 20 to 100 gpm depending on use of jet grout for 0.5 year of portal construction - Up to 100 gpm for the 1 year of tunnel excavation, and up to 250 gpm for a 2-week period during this time - Up to 70 gpm for the 1.5 years of tunnel lining
5	- 1 to 10 gpm for the 1 year of portal construction activity
19	- 1 to 10 gpm for 0.5 year of portal construction - Up to 130 gpm for the 2 years of tunnel excavation, and up to 250 gpm for two 2-week periods during this time - Up to 100 gpm for the 1 year of tunnel lining
Route 9 - 228th Street Conveyance System Alternative	
Portal	**Estimated Rates**
11	Same as 195th Street Alternative
44	Same as 195th Street Alternative
41	- 20 to 100 gpm depending on use of jet grout for 0.5 year of portal construction - Up to 100 gpm for the 1 year of tunnel excavation, and up to 250 gpm for a 2-week period during this time - Up to 70 gpm for the 1 year of tunnel lining
39	- 1 to 20 gpm for 0.5 year of portal construction - Up to 110 gpm for the 1.5 years of tunnel excavation, and up to 250 gpm for two 2-week periods during this time - Up to 80 gpm for the 1 year of tunnel lining
33	- 1 to 20 gpm for 0.5 year of portal construction - Up to 130 gpm for the 1.5 years of tunnel excavation, and up to 250 gpm for two 2-week periods during this time - Up to 100 gpm for the 1 year of tunnel lining

Table 3. Estimated Dewatering Rates at the Primary Portals (continued)

Route 9 - 228th Street Conveyance System Alternative (Continued)	
Portal	**Estimated Rates**
26	- 1 to 10 gpm for the 1 year of portal construction activity
19	- 1 to 10 gpm for 0.5 year of portal construction - Up to 140 gpm for the 2 years of tunnel excavation, and up to 250 gpm for two 2-week periods during this time - Up to 110 gpm for the 1 year of tunnel lining
Unocal Conveyance System Alternative	
14	- 20 to 80 gpm for the 1 year of portal construction activity
11	- 0 to 20 gpm for 0.5 year of portal construction - Up to 120 gpm for the 1.5 years of tunnel excavation, and up to 250 gpm for four, 2-week periods during this time - Up to 90 gpm for the 1.5 years of tunnel lining
7	- 1 to 10 gpm for 0.5 year of portal construction - Up to 110 gpm for the 1.5 years of tunnel excavation, and up to 250 gpm for two, 2-week periods during this time - Up to 80 gpm for the 1 year of tunnel lining
3	- 20 to 50 gpm for the 1 year of portal construction activity

Dewatering during construction would be minimized to reduce discharge quantities and to limit potential impacts to existing aquifers and surface water bodies. Dewatering requirements would be specified as part of final design of the project and would be in compliance with the applicable regulations.

Dewatered Groundwater Quality

Groundwater quality in the greater Brightwater Conveyance System area is generally good, with no known widespread contamination issues, as reported in the USGS study on groundwater systems and quality in western Snohomish County (Thomas et al., 1997). Therefore, the basic quality of water that may seep into the tunnel during construction is anticipated to be good. However, as the water seeps into the tunnel during construction, water drained from the tunnel is expected to be turbid, with varying, but relatively high levels of sediments and sub-micron sized particles. During periods of active liner grouting or injection grouting for soil stabilization, dewatered groundwater may periodically show elevated pH levels as it comes in contact with uncured Portland cement grout. There is also the potential for chemicals, fuels, and oils used during the tunneling operations to be carried in the construction seepage. These could include lubricating and motor oils, equipment degreasers, gasoline or diesel fuel, concrete form compounds, paints, adhesives, etc.

Groundwater discharged from portal locations due to shaft construction is expected to be close to that of aquifer quality and generally to contain low turbidity and dissolved solids. Inside the shafts, the groundwater seepage collected at the base of shafts in sumps or trenches and pumped to the surface for discharge can be expected to have higher suspended-solid loads and associated turbidity. The pH of water seeping through a base plug composed of Portland cement grout may also be elevated. Water collected in sumps may also contain trace concentrations of fuels, lubricants, and other construction chemicals.

Depending on the historical and current land use activities at the site and in the vicinity of the site, groundwater at the portal site may also contain existing site-specific contaminants. Portals 11 and 19 are located in industrial areas. Contaminants at these sites could include petroleum hydrocarbons, metals, volatile organic compounds, polynuclear aromatic hydrocarbons (PAHs), polychlorinated biphenyls (PCBs) and other semivolatile organic compounds, pesticides/herbicides, and conventional pollutants (HDR, 2002). Soil and groundwater contamination associated with commercial and industrial operations is typically localized and concentrated within a few tens of feet of ground surface. Deeper contamination could be found in areas where commercial activity has occurred for many years and permeable soils extend to depth.

Discharge Options for Dewatered Groundwater

The options for disposing of dewatered groundwater are site specific and would depend on the water quality and flow rate. The potential discharge options are:

- Discharge into a stormwater drain
- Discharge to a surface water system
- Discharge into a local sanitary sewer
- Re-injecting into the aquifer (groundwater recharge)
- Transporting water off-site in vehicles (such as a vacuum flush truck)
- A combination of some, or all, of the above

Clean, non-turbid dewatered groundwater, such as from wells or wellpoints, can be discharged to systems tributary to state surface waters, provided the dewatering flow does not cause erosion or flooding of the receiving waters, and that these clean waters would not be mixed with untreated stormwater and clean groundwater. Dewatered groundwater that is clean and non-turbid would not be mixed with turbid dewatered groundwater or stormwater; however, the discharge has to meet the water quality standards (Ecology, 1997) for surface waters of the State of Washington, which are discussed later in the report.

Turbid, or otherwise contaminated, dewatering water from activities such as construction equipment operation, clamshell digging, or concrete of ground tremie pour, would need water quality treatment before leaving the site. Contaminated or turbid dewatering water should be handled separately from stormwater at the site. A pre-sedimentation pond may be required to hold the water and to allow settling of larger particles. Also, structural Best Management Practices (BMPs), such as filtration systems or other suitable treatment may be needed to comply with discharge requirements.

Discharge to a sanitary sewer could be used for contaminated groundwater or in locations where storm drains or surface water systems are either not available or are of insufficient capacity. Soil and groundwater sampling would be performed during design to investigate the potential for contamination. Appropriate treatment and discharge options would be designed for any portals with contaminated groundwater. Additionally, sanitary sewer discharge may be used during the summer, low-flow months to supplement flows in the sewer and help to alleviate odor and corrosion potential.

A strategic approach would be developed such that the dewatered groundwater from the portal sites could be discharged either into the local sanitary sewer or into the storm drain depending on the groundwater quality. Multiple discharge locations and treatment options would be assessed to determine the most suitable discharge option. Environmental sampling of groundwater at the portal sites would be performed prior to evaluation and design of discharge and treatment options. The use of groundwater recharge would depend on the portal site location and existing soil.

In case of peak short-term dewatering flows that cannot be discharged into the storm drain, sanitary sewer, or nearby surface water drainage due to insufficient discharge capacity, groundwater could be transported off-site using trucks.

Table 4 summarizes available dewatered groundwater discharge options for each of the primary portal sites. Detailed requirements for discharging dewatered groundwater into the local sanitary sewer, stormwater drain or nearby natural surface water drainage systems are discussed later in this TM.

Table 4. Discharge Options for Dewatered Groundwater at the Primary Portal Sites

Portal #	Portal Site	Sewer	Stormwater Drain	Ditch	Creek /Lake /Stream Nearby the Site	Apparent Options
195th Street Alternative						
5	B	√	√	–	–	Storm drain along Ballinger Rd NE (estimated 1,500 gpm capacity). Alternatively, sewer manhole also exists at the site.
5	G	√	√	–	–	Storm drain along Ballinger Rd NE (estimated 1,500 gpm capacity). Alternatively, sewer manhole also exists at the site.
5	X	√	√	–	–	Storm drain along Ballinger Rd NE (estimated 1,500 gpm capacity). Alternatively, sewer manhole also exists at the site.
44	C	√	–	√	Little Swamp Creek tributary located nearby	Ditch (estimated 1,400 gpm capacity) along 80th Ave NE. Discharge into nearby creek/wetland could also be used.
44	D	√	–	√	Little Swamp Creek tributary located nearby	Ditch (estimated 1,400 gpm capacity) along 80th Ave NE. Discharge into nearby creek/wetland could also be used.
44	E	√	√	√	Little Swamp Creek tributary located nearby	Storm drain (estimated 700 gpm capacity), storm drain appears to flow toward nearby stormwater detention facility along Swamp Creek tributary. Sewer line at the site may also be used as an alternative option for discharge.
41	A	√	√	–	North Creek just north of the site	Storm drain (estimated 700 gpm capacity) along both NE 195th Street and North Creek Pkwy.; storm drain appears to flow toward North Creek (south of the site). Alternatively, discharge to North Creek may also be used.
41	C	√	√	–	–	Storm manhole at the intersection of NE 195th St & 120th Ave NE and catch basin at the NW corner of the site are the nearest available options. Sewer line also exists on the street adjacent to the site.
41	D	√	√	–	Sammamish River tributary adjacent to the west side of the site	Storm drain (estimated 6000 gpm capacity) located at the SE corner of the site. Discharge into Sammamish River tributary adjacent to the west side of the site may also be used.
41	X	√	√		Sammamish River tributary	North Creek Pump Station at the site would be the best apparent option. Alternatively, existing stormwater drain may also be used.
41	W	√	√		North Creek and local wetland located nearby	Storm drain along Beardslee Blvd. Alternatively, sewer on the street adjacent to the site may be used.
41	J	√	√		Sammamish River tributary	Storm drain (estimated 700 gpm capacity) along both NE 195th St and North Creek Parkway; storm drain appears to flow toward North Creek (south of the site). The man-made stormwater drainage on the southeast side of the site could also be used.
11	A	√	√	–	Sammamish River	Storm drain (estimated 6000 gpm capacity) exists near the site. Alternatively, Kenmore Pump Station / Metro Interceptor may be used.
11	B	√	√	√	Sammamish River	Storm drain (estimated 6000 gpm capacity) exists near the site. Alternatively, Kenmore Pump Station / Metro Interceptor may be used.

Table 4. Discharge Options for Dewatered Groundwater at the Primary Portal Sites (continued)

Portal #	Portal Site	Sewer	Stormwater Drain	Ditch	Creek /Lake /Stream Nearby the Site	Apparent Options
11	C	√	√	–	Sammamish River	Storm drain at the site (estimated 700 gpm capacity) is the nearest discharge option. Alternatively, sewer on the street adjacent to the site may be used.
19	A	√	√	–	Puget Sound is nearby	Storm drain adjacent to the site. Alternatively, nearby sanitary sewer may be used.
19	C	√	√	–	Puget Sound is nearby	Storm drain adjacent to the site. Alternatively, nearby sanitary sewer may be used.
19	E	√	√	–	Barnacle Creek; Puget Sound is nearby	Storm drain at the site. The Richmond Beach Pump Station is located on the site and, therefore, sewer at the pump station could also be used.
228th Street Alternative						
11	A, B & C				–	Same as described for Portal 11 of 195th Street Conveyance System Alternative.
41	A, C, D, X, J and W	√	√	–	–	Same as described for Portal 41 of 195th Street Conveyance System Alternative.
44	C, D & E				–	Same as described for Portal 44 of 195th Street Conveyance System Alternative
39	B	√	√	–	Storm drain flows west to east, toward Palm Creek	Storm drain flowing toward Palm Creek. A sewer discharge on 228th St SE adjacent to the site may also be used.
39	C	√	√	–	–	Storm drain on 228th Street SE adjacent to the site appears to be the nearest discharge option.
39	D	–	√	–	–	Storm drain on 228th Street SE adjacent to site appears to be the nearest discharge option.
33	A	–	–	–	Swamp Creek flows through the northeastern side of the site	Discharge to Swamp Creek may be used.
33	C	√	√	–	–	Storm drain along 228th Street SW south of the site. A sewer on 228th Street SW may also be used.
33	D	√	√	–	–	Storm drain along 228th Street SW north of the site. A sewer on 228th St SW may also be used.
26	A	√	√	–	Hall Creek flows along the west boundary of the site	Storm drain (estimated 700 gpm capacity) along Lakeview Drive east of the site may be used. Hall Creek flowing through the site may be used as an alternative. Sewer line also exists on Lakeview Drive adjacent to the site.
26	C	√	√	–	–	Storm drain at the site appears to be the nearest discharge option. As an alternative, the sewer manhole on the southern part of the site may also be used.
26	D	√	√	–	Hall Creek flows through the eastern side of the site	Hall Creek, flowing east of the site, appears to be the most viable option. However, a sewer on 228th Street SW may also be used as an alternative.
19	A, C & E					Same as described for Portal 19 of 195th Street Conveyance System Alternative

Table 4. Discharge Options for Dewatered Groundwater at the Primary Portal Sites (continued)

Portal #	Portal Site	Sewer	Stormwater Drain	Ditch	Creek /Lake /Stream Nearby the Site	Apparent Options
Unocal Alternative						
3	D	√	√	–	–	Sewer discharge is the nearest discharge option at the site. Storm drain also exists near Edmonds Way and 232nd Street SW intersection.
3	E	√	√	√	–	Storm drain (estimated 700 gpm capacity) exists on Edmonds Way east of the site. Small ditch west of the site may also be considered as a secondary option.
3	F	√	–	√	–	Ditch (estimated 700 gpm capacity) exists east of the site. Sewer discharge may also be used.
7	A	√	√	–	–	Storm drain (estimated 2,500 gpm capacity) along 25th Ave. NE. Sewer is also available as an alternative option.
7	B	√	√	√	–	Storm drain (estimated 2,500 gpm capacity) along 25th Ave. NE. Sewer is also available as an alternative option.
7	C	√	–	√	The West Fork of Lyon Creek flows through the site	Storm drain (estimated 2,500 gpm capacity) along 25th Ave. NE. Small ditch (estimated 700 gpm capacity) and sewer are also available as alternative options.
11	A, C & D	√	√	–	Sammamish River	Same as described for Portal 11 of 195th Street Conveyance System Alternative.
14	A	√	√	√	Sammamish River tributary flows along the west side of the site	Storm drain (estimated 1500-gpm capacity) flowing into Sammamish River tributary. Discharge into the Sammamish River tributary, which flows west of the site. Sewer may also be used.
14	B	√	√	√	Sammamish River tributary flows along the west side of the site	Discharge into the major storm drain (estimated 1500-gpm capacity) discharging to the Sammamish River tributary, which flows west of the site; sewer can also be considered as an alternative option.
14	D	√	√	√	Sammamish River tributary buffer on the southwest corner of the site	Discharge into the Sammamish River tributary which flows west of the site or disposing into the major storm drain (estimated 1500 gpm capacity) flowing into Sammamish River tributary appears to be the most suitable discharge option. Sewer can also be used as an alternative option.

√ = indicates availability.

Discharge of Groundwater into Storm Drain or Surface Water

Methods of dewatered groundwater discharge include discharge into a stormwater drain or to a surface water system. Any discharge into the storm drain or discharge to the nearest surface water system would comply with applicable regulations and permit requirements. Ecology has indicated that a discharge greater than 10 percent of the receiving surface water flow rate may require additional analysis.

Compliance with Water Quality Standards

All discharges associated with construction activities are subject to applicable state water quality and sediment management standards. Water quality standards (Ecology, 1997) for surface waters of the State of Washington specify the quality requirement for discharging dewatered groundwater into the surface water system. The State requires that all known, available, and reasonable treatment (AKART) methods be applied to all discharges associated with construction activities to prevent and control the pollution of the waters of the State of Washington.

Pollutants that are frequently present in dewatered groundwater during construction activity include turbidity, pH, metal, naturally occurring organic compounds, and petroleum products. The majority of surface water discharges for the Brightwater portal sites are to Class AA receiving waters of the State. The water quality standard for Class AA freshwater includes the following requirements:

- Turbidity shall not exceed 5 Nephelometric Turbidity Unit (NTU) over background turbidity when the background turbidity is 50 NTU or less, or have more than a 10 percent increase in turbidity when the background turbidity is more than 50 NTU.
- pH shall be within the range of 6.5 to 8.5 (freshwater) with a human-caused variation within a range of less than 0.2 units for Class AA waters and 0.5 for Class A waters.
- Although there is no specific water quality standard for petroleum products, the hazardous waste rules under RCW 90.56 can be interpreted under RCW 90.48 to allow no visible sheen in the stormwater discharge or in the receiving water.
- Dissolved oxygen shall exceed 9.5 milligrams per liter (mg/L).
- Temperature shall not exceed 16 ^{o}C. When natural conditions exceed 16 ^{o}C, no temperature increase will be allowed greater than 0.3 ^{o}C.
- Toxic, radioactive, or deleterious material (metals, pesticides, organic compounds) concentrations shall be below those which have the potential either singularly or cumulatively to adversely affect the characteristic water uses, cause acute or chronic conditions to the most sensitive biota dependent upon those waters, or adversely affect public health, as determined by the department (WAC 173-201A-040 and 173-201A-050).

The water quality standard for Lake Class is generally the same as the Class AA requirements as described above. Dissolved oxygen, pH and temperature standards are set as no measurable change from natural condition. Turbidity should not exceed 5 NTU over background conditions. After AKART has been applied, mixing zones are also authorized by the surface water quality standards.

Ecology has adopted a new water quality standard that was adapted by Ecology and submitted to EPA on July 1, 2003. The new standards will change to a use-based system for designating beneficial uses of water bodies. Standards proposed for change include temperature, bacteria, and ammonia. The new standards also contain an anti-degradation rule. The proposed revisions to the water quality standards are not expected to substantially affect discharges from the portal sites.

Compliance with Water Quantity Requirements

Dewatered water that is discharged to waters of the State would be subject to quantity regulations established by the Washington Department of Ecology. Because Ecology has indicated that discharges greater than 10 percent of the flow rate of the receiving water body may require additional analysis, this TM presents estimated dewatering rates.

Table 5 presents estimates of dewatering rates for each primary portal for the conveyance alternatives. Also listed is the average annual discharge, in cubic feet per second (cfs), for the receiving water body. Ecology's 10-percent guideline is calculated using the instantaneous flow rate of the receiving water body at the time of dewatering discharge. During summer low flow periods, flow rates are lower than those listed in Table 5. Therefore, a hydrologic impact study may be required for some portal sites in the summer in order to discharge to those receiving waters. Alternate discharge methods may be required at some portal sites.

Table 5. Comparison of Portal Dewatering Rates and Receiving Water Flow Rates

Primary Portal (Alternative)	Long-term Dewatering Rate (cfs), (Peak for up to 2 week period)	Receiving Water*	Receiving Water average monthly discharge, (cfs) min, max[a, b]	Comments**
11 (all alternative conveyance systems)	0.04 – 0.18, (0.56)	Sammamish River	117 – 824 [c]	Could be discharged to local storm drain flowing into the Sammamish River.
44 (195th Street & 228th Street)	0.002 – 0.31, (0.56)	Little Swamp Creek	<1[f]	Discharge into local storm drain or nearby Little Swamp Creek could exceed 10 percent flow rate guideline. Sanitary sewer could be used for discharge as needed.
41 (195th Street & 228th Street)	0.04 – 0.22, (0.56)	North Creek	3.38 – 258 [d]	Discharge into North Creek or to local storm drain could be used during wet seasons[b]. However, during dry season peak discharge into local storm drain or into North Creek could exceed 10 percent flow rate guideline. Sanitary sewer could be used for discharge as needed.
5 (195th Street)	0.002 – 0.01, (0)	McAleer Creek	4.37 – 22.7 [e]	Discharge into McAleer Creek or to local storm drain could be used during both dry and wet seasons[b].
19 (195th Street & 228th Street)	0.002 – 0.31, (0.56)	Puget Sound	NA	Could be discharged to local storm drain flowing into Puget Sound.
39 (228th Street)	0.002 – 0.25, (0.56)	Palm Creek	<1[f]	Discharge into local storm drain or nearby Palm Creek could exceed 10 percent flow rate guideline. Sanitary sewer could be used for discharge as needed.
33 (228th Street)	0.002 – 0.29, (0.56)	Swamp Creek	4.95 - 122 [e]	Discharge into Swamp Creek or to local storm drain could be used during wet season[b]. However, during dry season peak discharge into local storm drain or into Swamp Creek could exceed 10 percent flow rate guideline. Sanitary sewer could be used for discharge as needed.

Table 5. Comparison of Portal Dewatering Rates and Receiving Water Flow Rates (continued)

Primary Portal (Alternative)	Long-term Dewatering Rate (cfs), (Peak for up to 2-week period)	Receiving Water*	Receiving Water average monthly discharge, (cfs) (min, max)[a, b]	Comments**
26 (228th Street)	0.002 – 0.02	Hall Creek	5 [g]	Can be discharged into Hall Creek or to local storm drain.
14 (Unocal)	0.09 – 0.18	Sammamish River tributary	<1[f]	Discharge into local storm drain or nearby Sammamish River tributary could exceed 10 percent flow rate guideline. Sanitary sewer would be used for discharge as needed.
7 (Unocal)	0.002 – 0.25, (0.56)	West Fork Lyon Creek	<1 [f]	Discharge into local storm drain or nearby West Fork Lyon Creek could exceed 10 percent flow rate guideline. Sanitary sewer would be used for discharge as needed.
3 (Unocal)	0.04 – 0.11	None	None	Sanitary sewer would be used for discharge.

[a] To meet the 10 percent guideline established by Ecology, dewatering discharge rates must be compared to receiving water flow rates.

[b] Dry season is June – October, wet season is November – May.

[c] Ecology website, based on manual measurements 1959 - 1999

[d] Snohomish County website, based on hourly mean flow data from stream gauge, 1995 - 2001

[e] King County hydrologic website; based on daily mean flow data from stream gauge for water years 1992-1994 and 2001 (McAleer Creek) and for water years 1999-2002 (Swamp Creek)

[f] Estimated

[g] City of Mountlake Terrace, 1993; 1992 Water Quality Report

* Receiving water is defined as nearest surface water system that receive flows from stormwater drain near the portal site or surface water system that flows along the site and can be considered for discharge.

** Comments are based on discharge quantity limit not exceeding 10 percent of the flow rate of the receiving water body at any time. Long-term dewatering rate is compared with receiving surface water flow rate in this assessment.

Treatment Methods

To comply with discharge requirements, some treatment of dewatered groundwater may be necessary prior to discharge into a storm drain or nearby surface water system. Several methods are available to treat the dewatered groundwater prior to discharge. Treatment methods are discussed in Appendix 6-C of the Final EIS.

Discharge of Groundwater into the Sanitary Sewer

Another potential discharge alternative for dewatered groundwater is to discharge into the local sanitary sewer. Portals 11, 41, 44, and 5 along the Route 9-195th Street Conveyance System Alternative and Portals 3, 7, and 14 along the Unocal Alternative are within the King County Sanitary Sewer System, and dewatered groundwater could be disposed of into the local sanitary sewer system with discharge permission from the King County Industrial Waste Program. Discharge of dewatered groundwater into the King County sewer system is regulated by a Public Rule entitled "Discharge of Construction Dewatering to the Sanitary Sewer." It outlines the policies and conditions for discharge of dewatering to the County's sanitary sewer. In addition to King County approval, permission from the local sewer agency would also be also be required.

Types of Approvals

The Industrial Waste Program issues several types of approvals to industries discharging into the King County wastewater treatment system. The type of approval is determined by the nature of the business, the rate and characteristics of the wastewater, and the potential risk to the system. Types of approvals are:

- Permit:
  - Wastewater discharge generally greater than 25,000 gallons per day (gpd)
  - Federally required industry (categorical industry)
- Discharge Authorization:
  - Wastewater discharge generally less than 25,000 gpd, but more than 1,000 gpd
- Letter of Authorization:
  - Wastewater discharge generally less than 1,000 gpd
- Verbal Authorization:
  - Small and one-time discharges

Proper authorization must be obtained from the Industrial Waste Program before discharging any industrial waste to the sewer.

Discharge Conditions

Discharge approval may include the following and may vary due to site-specific conditions:

- Requirement to self-monitor for specified substances
- Limits for solids capable of settling (less than 7 milliliters per liter)
- Limits for FOG (fats, oils and grease):
  - Non-polar FOG (mineral origin) – 100 mg/L
  - Polar FOG (animal and vegetable) – minimize free floating polar FOG

- Limits for organic pollutants that result in the presence of toxic gases, vapors, or fumes within a public or private sewer or treatment facility in a quantity that may cause acute worker health and safety problems. Organic pollutants subject to this restriction include but are not limited to:
    - Any organic compound listed in 40 CFR Section 433.11(e), Total Toxic Organics (TTO) definition (Appendix 9.1). Compounds such as benzene (0.13 ppm), toluene (1.5 ppm) and ethyl benzene (1.4 ppm) are some of the major organic contaminants listed in 40 CFR Section 433.11(e). These appendices are available from the Department of Natural Resources, Industrial Waste Program.
    - Acetone, 2-butanone (MEK), 4-methyl-2-pentanone (MIBK), xylenes
    - Individual permit limits for specific industrial discharges may also be established for the above organic pollutants on a case-by-case basis pursuant to K.C.C. 28.84.060 (King County, September 2001).
- Sedimentation-control methods
- Prohibited discharge of materials such as ashes, sand, grass and gravel
- Limit for hydrogen sulfide:
    - Atmospheric hydrogen sulfide limit: 10.0 ppm
    - Soluble sulfide limits may be established on a case-by-case basis depending upon rate of discharge and conditions in the receiving sewer, including oxygen content and existing sulfide concentrations
- Limit for corrosive substances:
    - Maximum - pH 12.0
    - Instantaneous minimum - pH 5.0
    - Daily minimum - pH 5.5
- Limits for heavy metals and cyanide as shown in Table 6.

Table 6. Limit for Heavy Metals in Sanitary Sewer Discharge

Metals of Concern	Daily Average (ppm)	Instantaneous Maximum (ppm)	Daily Maximum (ppm)
Arsenic	1.0	4.0	4.0
Cadmium	0.5	0.6	0.6
Chromium	2.75	5.0	5.0
Copper	3.0	8.0	8.0
Lead	2.0	4.0	4.0
Mercury	1.0	2.0	2.0
Nickel	2.5	5.0	5.0
Silver	1.0	3.0	3.0
Zinc	5.0	10.0	10.0
Cyanide	2.0	3.0	3.0

(King County, September 2001).

The metal limits apply to total metals, not only dissolved metals. For discharges less than 5,000 gallons per day, the instantaneous limit is applicable.

The Construction-Dewatering Rule limits discharges during the wet season to 25,000 gpd or less. Permission for discharging more than 25,000 gpd can be obtained if it is demonstrated to King County's satisfaction that a surface water discharge authorization cannot be obtained due to site restrictions and/or regulatory restrictions enforced by State and federal agencies including but not limited to Ecology, the King County Department of Natural Resources, Fish and Wildlife, and the U.S. EPA.

For sites with suspected contaminated groundwater, King County requires an applicant to demonstrate the discharge meets King County discharge limits as set in K.C.C 28.84.060 (Ordinance No. 11034) and the local discharge limits contained in this Public Rule (King County, 2003). The King County Department of Natural Resources, Industrial Waste Program, is responsible for the enforcement of the local discharge limits contained in this public rule (King County, September 2001).

Portals 26, 33, 37 and 39 along the Route 9-228th Street Conveyance System Alternative are within the Alderwood Sewer District, and Discharge Authorization is required from the District to dispose of dewatering water into the sanitary sewer. Discharge Authorization from Alderwood Water & Wastewater District may contain the following conditions (Alderwood Water & Wastewater District, 2000):

- Discharge authorization duration shall not exceed 5 years.
- Requirements for self-monitoring, sampling, reporting, notification and record keeping.
- Limits on the average and/or maximum rate of discharge, and time of discharge.
- Applicable pretreatment standards and requirements, including any special requirements.
- Limits for FOG (fats, oils and grease) (250 mg/L of FOG).
- Limits for gasoline, kerosene, naptha, benzene, toluene, xylene, ethers and other organic compounds, bromines, carbides, hydrides, Stoddard solvent and any other substances in quantities which are a fire hazard or hazard to the system.
- Maximum daily limits for metals: arsenic (0.5 mg/L), cadmium (0.24 mg/L), chromium (5.0 mg/L), copper (3.0 mg/L), cyanide (0.65 mg/L), lead (1.89 mg/L), mercury (0.1 mg/L), nickel (2.83 mg/L), silver (0.49 mg/L) and zinc (4.0 mg/L).

Re-injecting Groundwater into the Aquifer

Re-injecting into the aquifer is another option for discharge of dewatered groundwater. Discharge into the aquifer would need to be performed in accordance with federal and state regulations. In Washington State, all groundwater is considered a potential source of drinking water. Regulations aim to maintain the highest possible standards and protect existing and future beneficial uses of the groundwater through reduction or elimination of the discharge of contaminants to the State's groundwaters.

The discharge of fluids, such as dewatered groundwater, into the subsurface aquifer is regulated by the Underground Injection Control (UIC) Program. The UIC Program, authorized by the Safe Drinking Water Act, is administered under *Title 40 Code of Federal Regulations (CFR) part 144*. The Washington Department of Ecology was delegated primacy by the U.S. EPA in 1984 to administer the program (RCW 43-21A.445).

Only clean non-turbid dewatered groundwater can be considered for discharge into the aquifer. Turbid dewatered groundwater containing sediment or micron-sized particles and other contaminants would require treatment with all known, available, and reasonable treatment (AKART) methods before being injected into the aquifer. Some of the applicable treatment methods are discussed earlier. Water quality standards (WAC 173–200) for groundwaters of the State of Washington specify the quality requirements for discharging dewatered groundwater into the subsurface.

Injection wells that are used to inject uncontaminated groundwater into or above an underground source of drinking water are classified as *Class 5*. In many cases, these aquifers are shallow, unconfined or surficial. Aquifer recharge wells that are used to recharge depleted aquifers by injecting fluids from a variety of sources, including clean dewatered groundwater from other aquifers, are coded as *5R21* (Ecology, 2003). Most injection wells in the Pacific Northwest are relatively simple devices used to emplace fluids into the shallow subsurface under the force of gravity. Examples include sumps, drywells, and drainfields.

All existing and new *Class V* wells must apply to the Washington Department of Ecology's UIC Program for approval (Ecology, UIC Program, 2003). The program is rule authorized, which means the wells have to be registered but do not require a permit. There are two main requirements of the program.

- A "*non-endangerment"* performance standard must be met so that underground sources of drinking water can be protected from injection of fluid containing any contamination. Water quality standards (WAC 173–200) for groundwater of the State of Washington are used as enforcement limits for compliance. When the background groundwater quality exceeds a criterion set in WAC 173-200, the enforcement limit at the point of compliance shall not exceed the background groundwater quality for that criterion.
- Injection wells must be registered. Well owners or operators of an injection well must provide *inventory information*. Registration fulfills the inventory requirement. The contents of the inventory information typically include the following:
    - Facility/Site Information:
        - Name, address and location
        - Nature of business and material handled
        - Potential contaminant source(s)
        - Pollution prevention methods
        - Site geology
        - Groundwater quality
        - Pollution treatment methods

- Owner/Operator Information
- Well and Groundwater Information including nature and type of injection well(s)
- Injected Fluid Information

(Ecology, UIC Program, 2003)

Stormwater Management at the Portal Sites

This section provides information on stormwater management at the conveyance system portal sites. The information on requirements is followed by preliminary information on the approximate size of detention and treatment facilities required for stormwater at the portal sites. The sizing information presented is based on conceptual layouts of facilities at the portal sites.

Some of the portal sites are located in jurisdictions whose current stormwater requirements are less stringent than Ecology's 2001 manual. However, based on comments received by Ecology on the Draft EIS for the Brightwater Regional Wastewater Treatment System, Ecology expects the entire project "to meet or exceed the standards and specifications in the August 2001 version of Ecology's Stormwater Management Manual for Western Washington" (Ecology, 2001). Brightwater may use other technical guidance in place of or in addition to Ecology's manual. Ecology recently entered into a settlement agreement regarding the Industrial Stormwater General Permit, which requires that mandatory language be placed in the stormwater manual allowing the use of other technical guidance. The settlement also states that the manual is a guidance manual and has no independent regulatory authority (Stipulation and Agreed Order of Dismissal, PLHB Nos. 02-162-164) (2003). In addition, Ecology has indicated that one or more Individual NPDES Construction Stormwater Permits would be required for this project (as opposed to an NPDES General Construction Permit). These two issues are significant factors affecting stormwater management for the project.

The Individual NPDES Permit will contain requirements that govern stormwater discharges from the construction activity. This TM was prepared based on anticipated requirements that may be contained in the NPDES permit.

Potential Portal Stormwater Requirements

Based on the Ecology stormwater manual, the developed portal site designs (site areas, impervious areas, and site disturbance) will be required to meet each of Ecology's 10 Minimum Requirements. Construction activities will be required to meet Minimum Requirements #2 (the SWPPP), in addition to requirements of local municipalities. Other minimum requirements of particular importance are #6 Run-off Treatment, and #7 Flow Control. Minimum Requirement #2 includes 12 elements that "must be considered in the development of the Construction SWPPP unless site conditions render the element unnecessary" (Ecology 2001).

The 12 elements are:

- Mark clearing limits.
- Establish construction access.
- Control flow rates.
- Install sediment controls.
- Stabilize soils.
- Protect slopes.
- Protect drain inlets.
- Stabilize channels and outlets.
- Control pollutants.
- Control dewatering.
- Maintain Best Management Practices (BMPs).
- Manage the project.

Estimated Stormwater Flow Control and Treatment

This section evaluates the estimated general design requirements for stormwater flow control and treatment and assesses the site area requirements. Stormwater discharges from the facilities described below will flow to a stormwater drain, a ditch, or a receiving water body, depending on the portal location. Discharge location options are the same as those presented in Table 4 for dewatered groundwater, excluding the sewer option.

Stormwater treatment and detention facilities were sized based on the Ecology manual for construction activities and permanent facilities. These facility-sizing estimates are intended for general illustrative purposes only. It is likely that actual stormwater management facilities for the portal sites will be a combination of those appropriate for construction sites and permanent sites. These conceptual design-level facilities do not represent preferred or recommended designs for any of the portal sites.

The following general simplifying assumptions were made in sizing facilities based on minimum requirements #6 and #7. As design of the portal sites proceeds, more specific assumptions will be applied.

- Rooftop runoff will not be separated from other area runoff (e.g., disturbed ground, parking, etc.). Therefore all impervious areas will also be pollution-generating areas.
- Specific process areas of the site may have their own dedicated stormwater containment and/or treatment facilities (this is consistent with typical Ecology construction requirements). Therefore, the footprints of these facilities were not included in the impervious area calculations or the total site area values. The runoff water and process water generated in these areas will not be routed to the site stormwater treatment and detention facilities. It is also assumed that dewatered groundwater will be dealt with separately, as described previously. Stormwater facilities were sized with sufficient capacity for stormwater discharges only. All discharges will be treated in accordance with Ecology guidance.

- When appropriate, the construction site stormwater runoff treatment and detention facilities will be designed to remove pollutants other than sediment from stormwater.
- The assumed "settlement pond" areas shown in the portal site layouts were excluded from the total site area.
- Sand filters were assumed to have a maximum ponding depth of three feet. The detention facilities were assumed to have a maximum storage depth of four feet, plus as much an additional four feet for the water quality (wet pool) portion of the combined detention/wet pool facility.
- Setbacks, pond/filter maintenance access, pond berm and embankment widths and rates, and other detailed design requirements were approximated using a safety factor of 20 percent when estimating the treatment and detention facility areas.

Based on these assumptions, the following portal site characteristics were determined:

Working Portals: Total site area = 85,050 sf (approximately 2 acres)
Total effective impervious area = 76,900 sf
Total pollution generating area = 76,900 sf

Retrieval Portals: Total site area = 46,350 sf (approximately 1 acre)
Total effective impervious area = 37,000 sf
Total pollution generating area = 37,000 sf

The 2001 Ecology manual (specifically Minimum Requirement #6) explains that the purpose of runoff treatment is to reduce pollutant loads and concentrations in stormwater runoff using physical, biological, and chemical removal mechanisms, so that beneficial uses of receiving waters are maintained, and where applicable, restored. In addition, the manual specifies that enhanced treatment be used when discharging to fish-bearing streams.

Under the permanent facilities guidance in the Ecology manual, runoff that is discharged to fish-bearing streams requires enhanced treatment. Enhanced treatment is defined as treatment systems that are expected to provide higher levels of treatment in order to protect significant receiving waters. Several options for meeting the enhanced treatment requirement are presented in the manual. For example, at this stage of conceptual design, a combined detention/wet pool followed by a basic sand filter was sized. Required site areas could be reduced substantially by using underground treatment and/or detention vaults. However, the costs would be significantly greater for the underground facilities. Therefore, for this analysis a wet pool and sand filter vault were sized in accordance with Ecology's 2001 treatment requirements.

Minimum Requirement #7 specifies that stormwater discharges to streams shall match developed discharge durations to predeveloped durations for the range of predeveloped discharge rates from 50 percent of the 2-year peak flow up to the full 50-year peak flow. In addition, the developed peak discharge rates should not exceed the predeveloped peak discharge rates for 2-, 10-, and 50-year return periods (Ecology, 2001). In addition to the stormwater treatment facilities described previously, this analysis also includes conceptual sizing design of stormwater detention facilities in accordance with this requirement.

Available site information and the applicable requirements were used to compute the following approximate facility size requirements. The values represent the approximate footprint required for the facilities, including a 20 percent safety factor to account for access, berms, setbacks, etc.:

Working Portals: Combined detention/wet pool facility area = 16,500 sf
Basic sand filter area (downstream of detention) = 650 sf
Total flow and treatment area requirement = 17,150 sf

Retrieval Portals: Combined detention/wet pool facility area = 9,000 sf
Basic sand filter area (downstream of detention) = 300 sf
Total flow and treatment area requirement = 9,300 sf

These calculations were based on the "minimum" construction area needed. Should a site contain larger construction facilities, or increased open area to allow for better access and mobility at the site, the stormwater facility sizes would need to be expanded accordingly.

If stormwater facilities are sized in accordance with Minimum Requirement #2, specific to construction activities, pond areas will be smaller. Sediment ponds of this type are typically designed to remove sediment no smaller than medium silt (0.02 mm), and the ponds do not provide flow control detention. Based on Ecology requirements, the ponds would be sized for the 10-year peak flow, and would have a footprint of approximately 2,080 square feet. Peak runoff rates for the 10-year storm would be approximately 0.340 cfs at the retrieval portals, and 0.707 cfs at the working portals. Based on preliminary modeling, stormwater discharges for the working portals may range from up to 0.343 cfs for the 6-month storm to 1.076 cfs for the 100-year storm. Stormwater discharges at the retrieval portals may range from up to 0.165 cfs for the 6-month storm to 0.518 cfs for the 100-year storm. Requirements for additional facilities and flow control to limit discharge below these rates depend on the expected life of the construction project, the anticipated downstream effects, and the anticipated weather conditions during construction.

Specific runoff rates and required sizes for stormwater facilities at each portal site will vary depending on the final size and configuration of each site, and will be within the range of sizes presented in this section. The information and sizes presented above will be refined as the design for each portal site moves from conceptual design to predesign. Specific requirements will be determined through the process of obtaining the NPDES Individual permit.

Low Impact Development (LID)

The Brightwater Project is committed to achieving a high degree of sustainability. As part of that commitment, Low Impact Development (LID) measures will be used in the final development at the portal sites, wherever feasible. Instead of relying solely on engineered piping systems, LID emphasizes decentralized stormwater management using vegetation and infiltration to reduce the runoff quantity and runoff flow rate. LID has the additional advantage of reducing stormwater runoff and therefore reducing the required size of the stormwater facilities. The LID approaches that can be applied to the portal sites potentially include open site design, vegetation planting, vegetated roof, pervious pavement, bioretention

swales, and amended soil. Some of the approaches may only be feasible at some of the portal sites. These approaches are discussed below.

- *Minimize the impervious surface*. The project site will be developed to minimize the impervious surface area while maximizing open vegetated space.
- *Landscaping/forest establishment*. Planted trees and shrubs and/or landscaping areas within the project site can retain more stormwater onsite, and reduce the stormwater runoff into the drainage system.
- *Vegetated roofs*. Vegetated roofs, also known as green roofs, can be used on some of the buildings. Green roofs greatly reduce runoff rates, providing natural detention and retention of rainfall. Any buildings with green roofs will require adequate structural support for the additional weight on the roof.
- *Pervious Pavement*. Using pervious pavement for parking areas, light-use roadways, and sidewalks can promote stormwater retention and infiltration, thus greatly reducing runoff from these areas. The infiltration rate is dependent upon the nature of the soil and depth to groundwater. Further site study would be necessary to determine the feasibility of using pervious pavement, once the specific location of project facilities is finalized.
- *Amended soils*. The use of amended soil in all landscaped areas can increase stormwater retention within the soil. Runoff from roof downspouts and paved areas can be conveyed into these landscaped areas to utilize the water-holding capacity of the soil.

Maximizing onsite stormwater retention through implementation of LID strategies will reduce the amount of runoff, improve the quality of the runoff, and reduce the needed size of the stormwater detention and treatment facilities. LID concepts are being encouraged by many agencies in Western Washington. However, it will be important to work closely with the agencies to assure that they agree with the LID measures adopted at the project site, particularly the amount of reduction in required detention that the project will receive. For purposes of the Environmental Impact Statement (EIS), the stormwater analyses have assumed no reduction in stormwater runoff from LID implementation.

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