5.8 Air Quality

Clean air is important to a community's wellbeing and the environment. Pollutants in the air can have negative effects on human health and cause harm to animals, plants, and materials. Emissions from cars, trucks, and buses are a major factor affecting air quality, particularly in urban areas. Maintaining good air quality will be important to freeway users, neighbors, and the community at large.

Heavy traffic on I-405

Please refer to the Kirkland Nickel Project Air Quality Discipline Report in Appendix Q (on CD) for a complete discussion of the air quality analysis.

Is air quality a concern in the project area?

Because of heavy traffic congestion in the project area, there are several air pollutants associated with vehicle emissions. These pollutants include oxides of nitrogen (NO_x), carbon monoxide (CO), particulate matter (PM_{10}) [1], ozone, hazardous air pollutants, and greenhouse gases, primarily carbon dioxide (CO_2). CO is a colorless, odorless, and poisonous gas generated by automobiles that reduces the oxygen-carrying capability of the blood. Nitrogen oxides (NO_x) and hydrocarbons contribute to the ozone formation on a regional scale. Ozone, also referred to as smog, is an irritant, reduces lung function, and can damage plants and materials. PM_{10} refers to particles less than 10 micrometers in size; it includes small dust particles and diesel particulate. The small particles can be inhaled deeply into the lungs, potentially leading to respiratory diseases. PM_{10} is an important concern during construction.

How was air quality evaluated for the project?

Air pollution is treated as a regional issue; however, some pollutants, such as CO, can have localized areas of high concentrations or "hot spots" under stable atmospheric conditions.

Regionally, the Kirkland Nickel Project was evaluated as part of the I-405 Corridor Program by the Puget Sound Regional Council. Air quality modeling results show that the Puget Sound Region, including the I-405 Corridor Program improvements, will conform to the Clean Air Act.

What is the Clean Air Act?

The Clean Air Act of 1970, 42 USC 7401 et seq., was enacted to protect and enhance air quality and to assist state and local governments with air pollution prevention programs. Under the Clean Air Act Amendments of 1990, USDOT cannot fund, authorize, or approve federal actions to support programs or projects that are not first found to conform to Clean Air Act requirements.

[1] Any liquid or solid particles present in the atmosphere.

What are air quality standards?

Under the federal Clean Air Act, the US Environmental Protection Agency (EPA) has set National Ambient Air Quality Standards (NAAQS) that specify maximum concentrations for specific pollutants. Transportation projects must conform to the NAAQS by demonstrating that:

- the proposed project will not cause or contribute to any new violation of NAAQS;
- the project will not increase the frequency or severity of any existing violation of any NAAQS; and
- the project will not delay timely attainment of the NAAQS within the region.
- It will not increase a CO reading in the design year (2030) over the CO reading in the existing year.

In addition to federal requirements, the Kirkland Nickel Project must conform to Air Quality Maintenance Plans (AQMPs) for ozone and CO that have been established for the Puget Sound region.

WSDOT evaluated how the Kirkland Nickel Project will affect regional air quality characteristics such as greenhouse gas emissions and ozone formation, as well as particulate matter.

Two future years were evaluated, 2014 and 2030. The year 2014 was analyzed to determine the project's effects on air quality in the year when the entire Kirkland Nickel Project is anticipated to be completed. The year 2030 was also evaluated to show the project's long-term effects.

How will air quality change with the project?

Based on the results of modeling, WSDOT has concluded that there will be no substantial air quality effects from CO concentrations as a result of the Kirkland Nickel Project.

WSDOT studied air quality at the four intersections with the highest traffic volumes and the most congestion (Exhibit 5-25). We used these intersections to model worst-case CO levels under existing conditions, as well as future conditions projected for both the proposed Build and the No Build alternatives. The modeled results represent the worst anticipated atmospheric conditions of cold, stable air, and peak-period traffic.

Because more traffic will move through some intersections with the project, the worst-case CO concentrations will be slightly higher at some locations with the project than without; however, none of the predicted future concentrations will exceed the NAAQS for CO; therefore, the project will not have a substantial negative effect on localized CO levels (Exhibits 5-26 and 5-27).

How will construction activities affect air quality?

Construction activities typical of roadway projects will temporarily generate particulate matter (mostly dust) and small amounts of other pollutants.

Emissions during construction activities will be temporary, limited to the immediate area surrounding the construction site, and will contribute only a small amount to the total emissions in the project area.

Exhibit 5-25
Intersections Studied for Air Quality

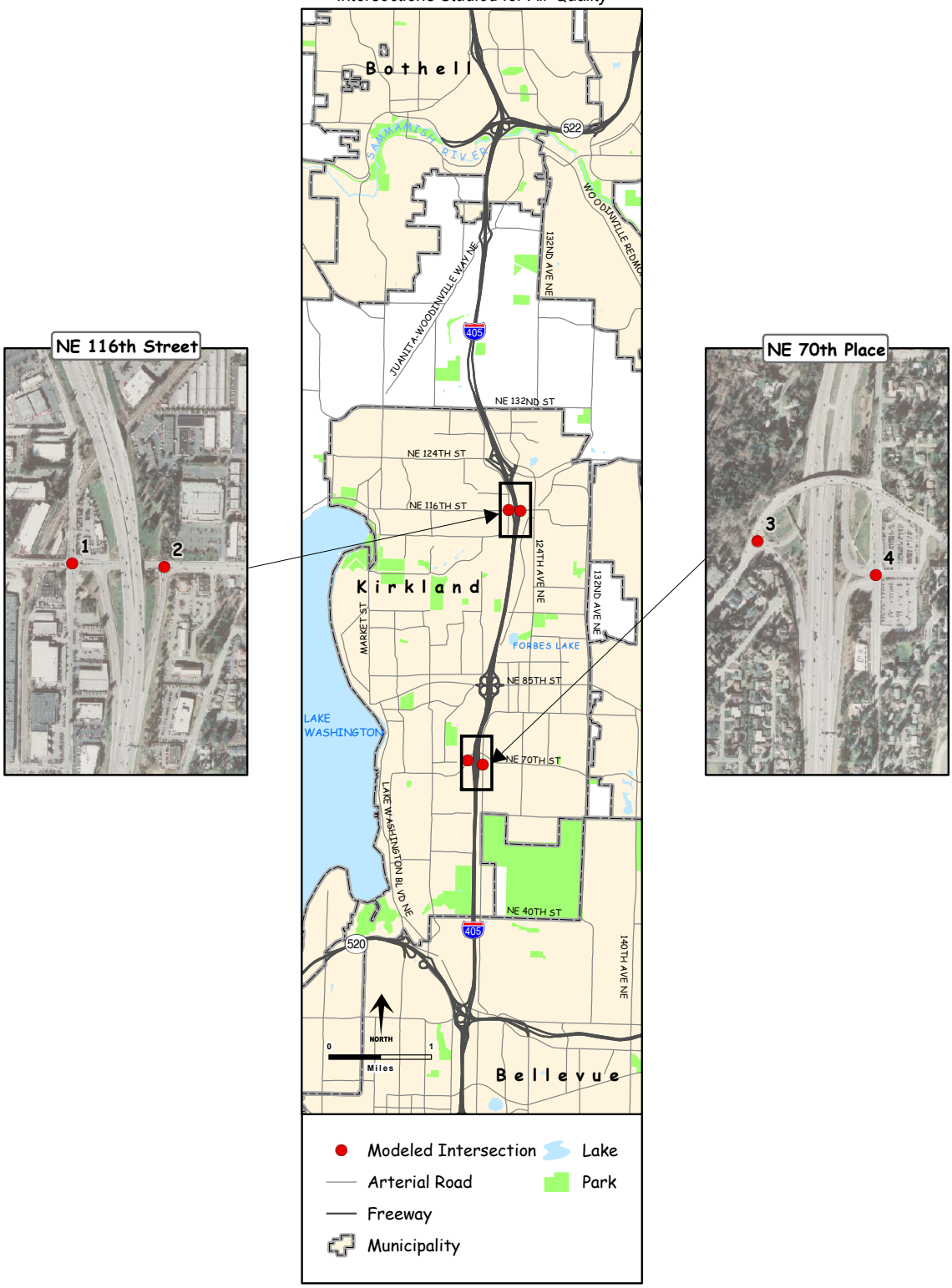


Exhibit 5-26

One-hour Average CO Concentrations

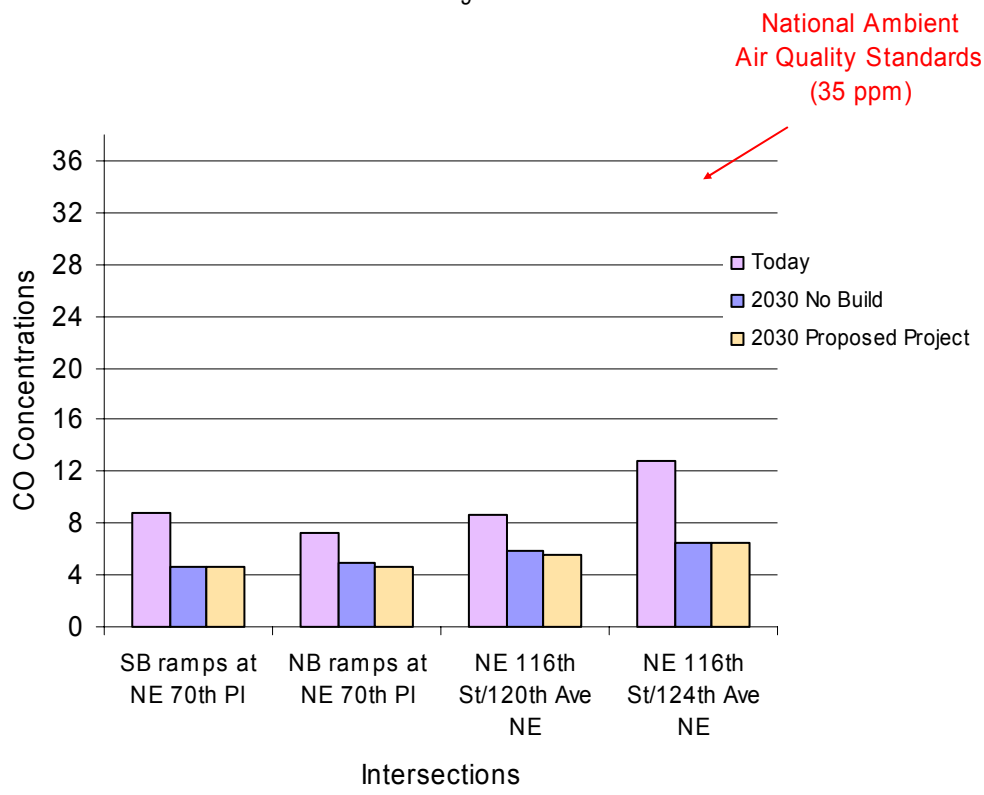
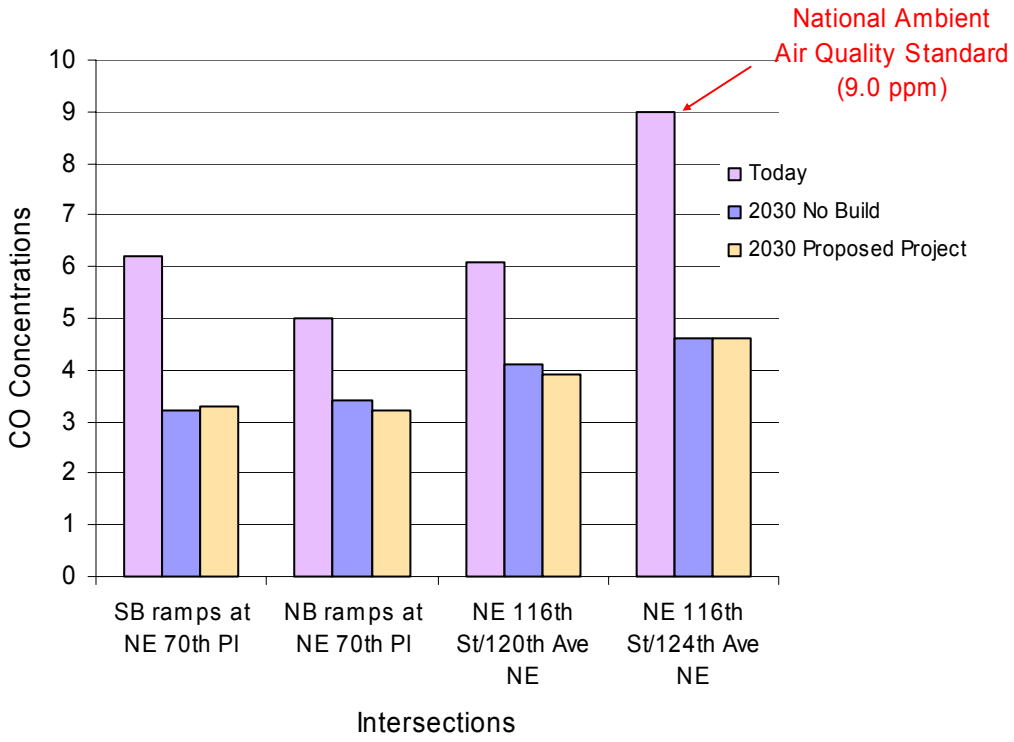


Exhibit 5-27

Eight-hour Average CO Concentrations



What measures are proposed to avoid or minimize effects to air quality during construction?

Measures to reduce air quality emissions during construction were discussed in the *I-405 Corridor EIS*. The measures applicable to the Kirkland Nickel Project are summarized here.

Fugitive dust will be controlled by the contractor in accordance with the Memorandum of Agreement between WSDOT and PSCAA Regarding Control of Fugitive Dust from Construction Projects (October 1999).

The following measures will be used to control dust (PM_{10}), transmission of particulate matter, and emissions of CO and NO_x during construction:

- Exposed soil will be sprayed with water to reduce emissions of PM_{10} and deposition of particulate matter.
- All truck loads will be covered, and materials in trucks will be wetted or providing adequate freeboard (space from the top of the material to the top of the truck) to reduce PM_{10} and deposition of particulates during transport.
- Wheel washers will be provided to remove particulate matter that would otherwise be carried off site by vehicles to decrease deposition of particulate matter on area roadways.
- Particulate matter deposited on public roads will be removed to reduce mud on area roadways.
- Dirt, gravel, and debris piles will be covered or wetted during periods of high wind when the stockpiles are not in use.
- Construction trucks will be routed and scheduled to reduce travel delays and unnecessary fuel consumption.

5.9 Water Resources

Water resources are essential to maintaining human health, fish and wildlife habitat, and vegetation. These resources can be affected by roadway projects because increased impervious surfaces can lead to changes in hydrology, degrade the surface waters that drain to streams and, thereby, affect natural habitats. These changes can also influence flooding effects and groundwater recharge[1].

The Kirkland Nickel Project will benefit local water quality and baseline hydrology by treating almost three times as much impervious surface as the project will create.

Please refer to the Kirkland Nickel Project Water Quality, Surface Water and Floodplains, and the Geology, Soils. And Groundwater discipline reports in Appendices R, S, and T, respectively, (on CD) for a complete discussion of water resources analyses.

How were water resources evaluated for the project?

To identify water resources within the Kirkland Nickel Project area, WSDOT scientists and staff reviewed numerous maps and plans, GIS databases, aerial photographs, water quality studies, databases on point sources (such as pipes, ditches, channels, and wells), agency Web pages, and other recent data.

What water resources are found in the project area?

Natural water resources typically include surface water (also in the form of stormwater), floodplains, lakes, wetlands, and groundwater. Within the Kirkland Nickel Project area, a wide range of these resources exists.

Surface Water

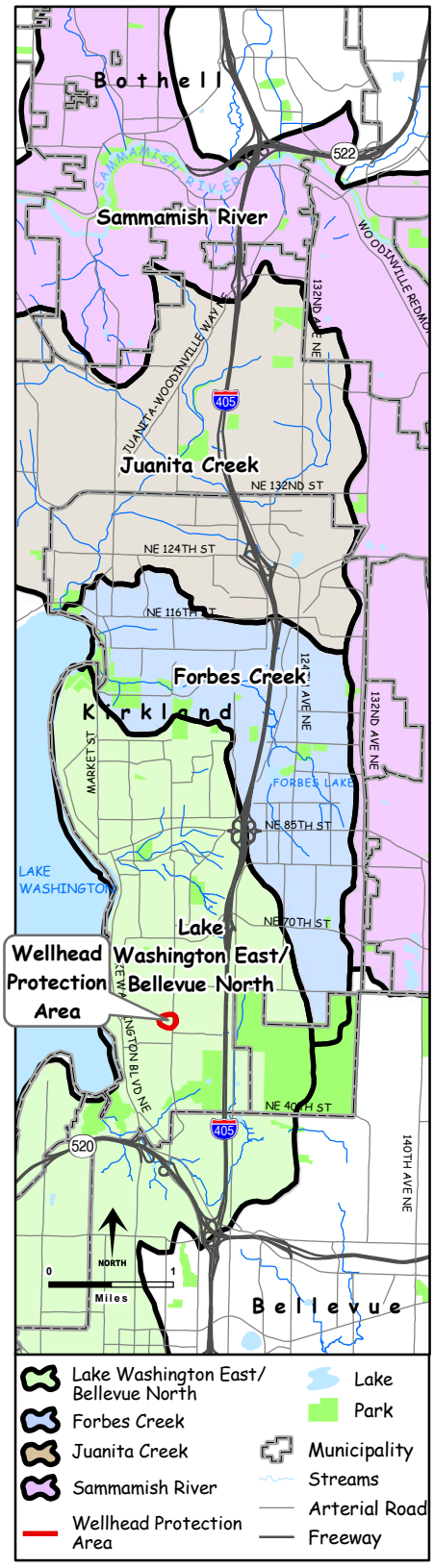
Surface waters are waters stored or flowing at the earth's surface including natural bodies of water (rivers, lakes, and wetlands), as well as water in human-made storage and conveyance facilities (lakes, detention ponds, and piped drainage systems). Discharges to these waters are regulated by the Clean Water Act. Effects to surface waters can occur when pervious (permeable) areas are converted to impervious (hard, impermeable) surfaces such as pavement. When

What is the Clean Water Act?

The Water Pollution Control Act, better known as the Clean Water Act, 33 USC 1251 et seq., provides for comprehensive federal regulation of all sources of water pollution. It prohibits the discharge of pollutants from non-permitted sources. In Washington, authority to administer the Clean Water Act is delegated primarily to the US Army Corps of Engineers and the Department of Ecology.

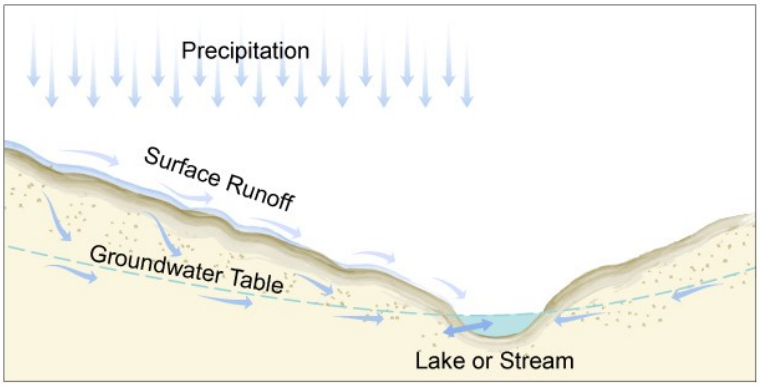
[1] The infiltration of water into the earth. Groundwater recharge may increase the total amount of water stored underground or only replenish supplies depleted through pumping or natural discharge.

Exhibit 5-29
Watersheds and Associated Streams



surface water, sometimes in the form of stormwater, cannot be absorbed by the ground, runoff occurs and volumes increase. Changes in runoff volumes and velocities can cause stream bank erosion, streambed scouring, and increased flooding risks (Exhibit 5-28).

Exhibit 5-28: How does water move across and below the ground?



The Kirkland Nickel Project area includes four watersheds[2]: Lake Washington East/Bellevue North, Forbes Creek, Juanita Creek, and the Sammamish River. The main receiving surface waters include Yarrow, Forbes, and Juanita Creeks, the Sammamish River, and Lake Washington.

Additional small tributaries that contribute to the Sammamish River and Lake Washington, and drainages that cross or run parallel to I-405 and receive runoff from the Kirkland Nickel Project area are also part of the project's affected environment. Exhibit 5-29 shows the area's watersheds and their associated rivers, streams, and waterbodies.

Floodplains

There are no 100-year floodplains in the Kirkland Nickel Project area that have been designated as Areas of Special Flood Hazard by the Federal Emergency Management Agency. With the exception of limited work in Forbes and Juanita creeks, the proposed project will not encroach on any existing floodplains; furthermore, it will not substantially change downstream floodplains or flooding characteristics.

[2] A geographic region within which water drains into a particular river, stream, or body of water.

Groundwater

The Group-A Groundwater Supply Well System, referred to as the Kirkland Well Field, is located about 3,000 feet west and down-gradient of I-405 between MP 16.5 and MP 16.6 (Exhibit 5-29). This system is operated by King County Water District No. 1 as a public water supply. These wells provide domestic water to approximately 200 Yarrow Point residences.

Based on studies conducted by King County, groundwater travel time from I-405 to the Kirkland Well Field is about five years. The Kirkland Nickel Project will avoid impacts to this water supply by piping stormwater discharged from I-405 around the recharge area for the well field..

According to the Washington Department of Health, the use of the Kirkland Well Field may be discontinued in the near future. A request to obtain potable water from Bellevue has been made for the Yarrow Point community (Washington Department of Health, 2004). The date for transferring service and future use of the Kirkland Well Field is unknown at this time.

A culvert that crosses under the I-405 northbound lanes

How is stormwater from I-405 currently managed?

The project has been designed to comply with WSDOT's *Highway Runoff Manual* (2004) and *Hydraulics Manual* (2004). Best Management Practices from the *Highway Runoff Manual* have been incorporated into the design.

The I-405 roadway within the Kirkland Nickel Project area has about 263 acres of impervious surfaces. Currently, the stormwater runoff drains to nearby streams or municipal storm drainage systems, and, ultimately to Lake Washington. Cross-culverts along the project corridor convey upstream (off-site) runoff from the east, and some roadway (on-site) runoff to urban creeks, the Sammamish River, and small watercourses and urban storm drains.

How will stormwater be affected once the project is built?

The proposed project will include enhanced water quality treatment facilities consisting of ecology embankments[3] and a combination of stormwater treatment wetlands/detention

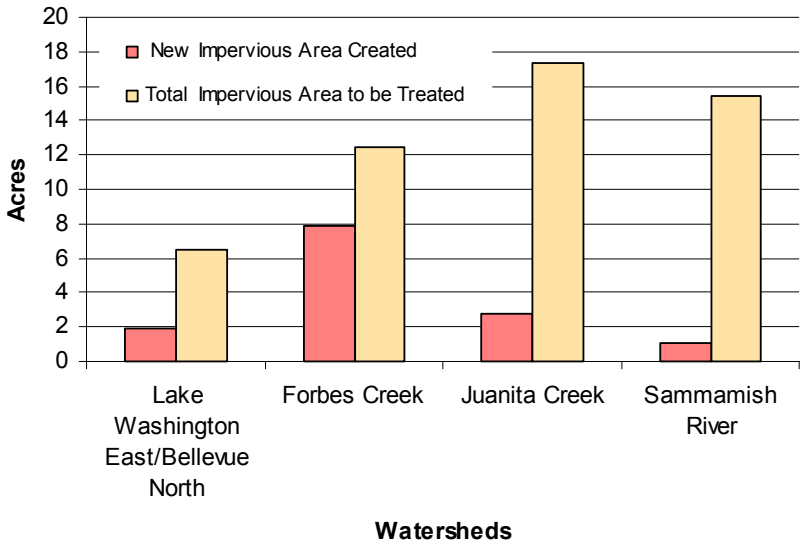
What is enhanced water quality treatment?

Enhanced water quality treatment is the use of best management practices to capture dissolved metals. The performance goal for enhanced treatment is 50-percent removal of certain metals.

[3] A stormwater treatment facility constructed in the pervious shoulder area of a highway, consisting of a vegetation-covered french drain containing filter media (see Exhibit 4-7).

ponds. These facilities will provide enhanced treatment for the proposed 13.56 acres of new impervious surfaces, and 38.17 acres (approximately 14.5 percent of existing impervious surfaces within this portion of I-405) of presently untreated impervious surfaces (Exhibit 5-30).

Exhibit 5-30
Stormwater Treatment



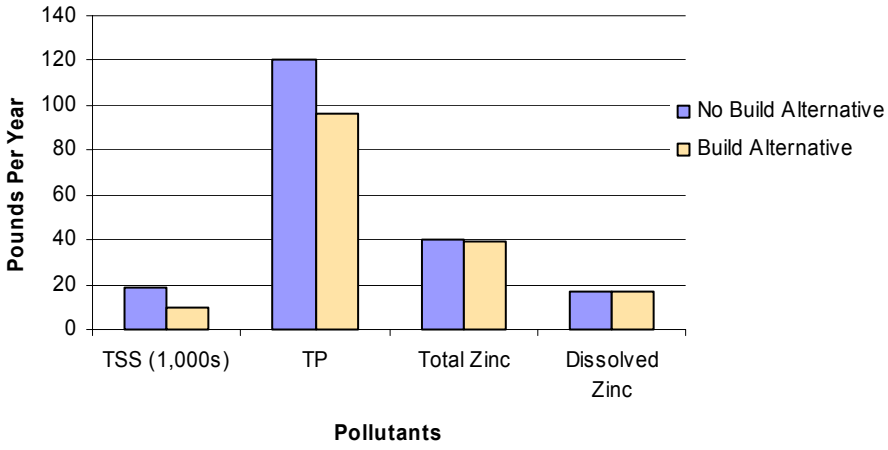
Four pollutants (suspended solids, zinc, dissolved zinc, and phosphorous) are important because there is sufficient data on these constituents to estimate runoff based on average daily traffic loads. Elevated levels of suspended solids are a concern because turbid water can directly impair aquatic life. Suspended solids can also indirectly degrade downstream receiving waters because many other pollutants can absorb onto the particles.

Total and dissolved zinc are important because they represent heavy metals impacts. Phosphorus is evaluated because of its potential to increase eutrophication of streams and lakes. Other pollutants in highway runoff can also be a concern, depending on the receiving waters and the relative amount of pollutant loading. In-stream temperatures are another water quality concern in the project area. In-stream temperatures above water quality standards are functions of ambient air temperature, surface area, stream volume, and shaded riparian cover. Stormwater runoff is generally a minor consideration, since the vast majority of runoff events do not

occur in summer or early fall when stream temperatures tend to be elevated. The other pollutant of concern for streams in the project area is fecal coliform, which is typically not associated with highway runoff.

Overall, the proposed project will improve water quality with a net decrease in the annual pollutant loading of total suspended solids (TSS), total phosphorus (TP), and zinc. Most notably, the proposed treatment will reduce annual pollutant loading to the main receiving water, Lake Washington (Exhibit 5-31).

Exhibit 5-31
Pollutant Loadings



Stormwater Detention

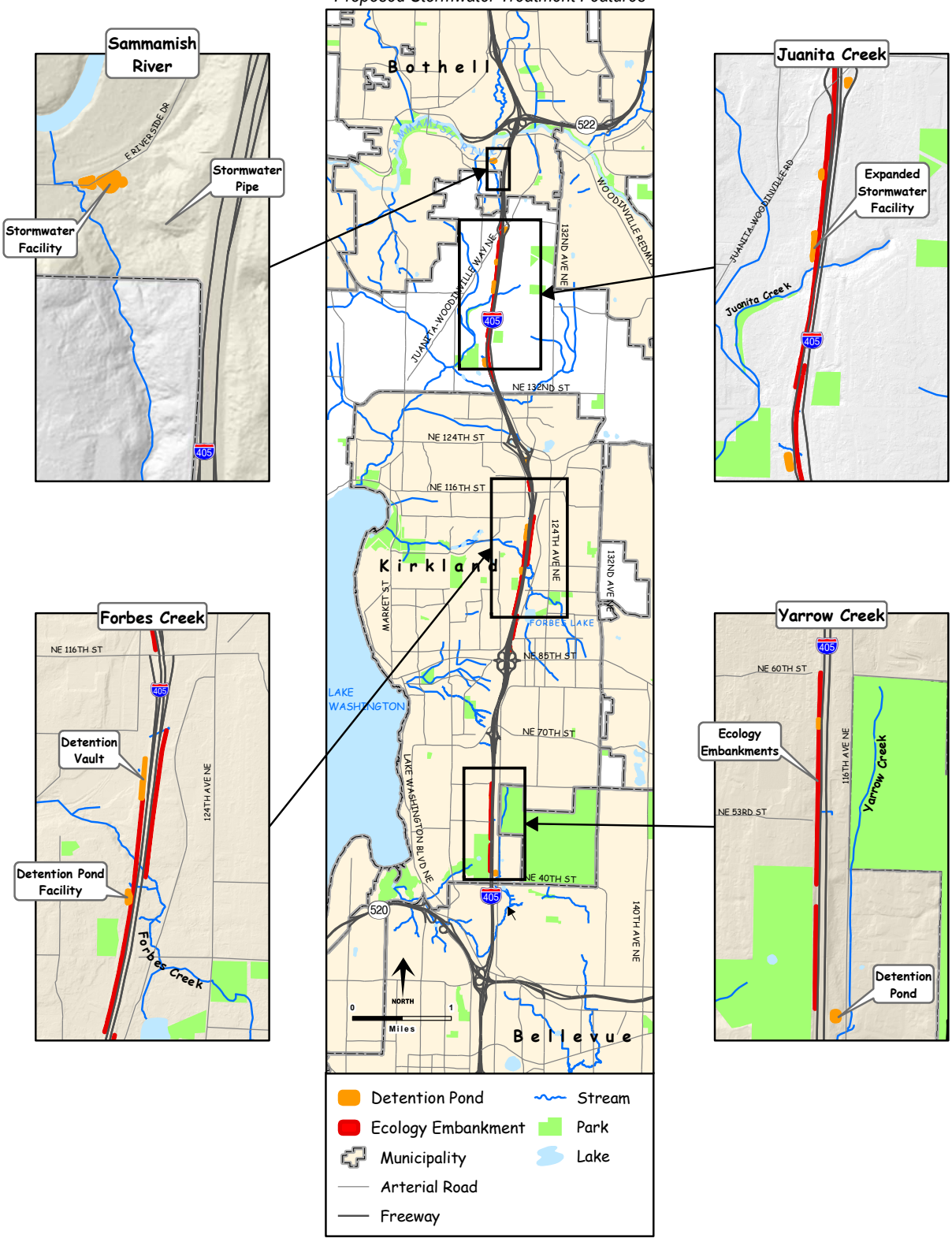
Stormwater detention systems for half of the two-year through 50-year storm events will be incorporated into the project, as required. The proposed permanent drainage improvements will collect and treat runoff prior to release into municipal storm drains or the following downstream waterbodies, including:

- Yarrow Creek – a detention pond along the east side of the corridor (approximately MP 15.9) will discharge waters through a swale that leads to Yarrow Creek (Exhibit 5-32). Enhanced water quality treatment will be provided by ecology embankments along the west side of I-405 adjacent to the new pavement areas.
- Forbes Creek – The Forbes Creek watershed will receive treatment for flow control by a detention pond

and a large detention vault on the west side of the freeway (approximately MP 19.1). The detention pond will discharge runoff to the existing ditch leading to the Forbes Creek ravine. An additional detention vault will be constructed at approximately MP 19.4. This vault will replace an existing small detention pond. Discharge will continue to the Forbes Creek tributary.

- Juanita Creek – The I-405 project will re-route a portion of the stormwater from the west side of the freeway that discharges into a tributary to Juanita Creek. Re-routing of this flow to an expanded detention pond will provide relief to existing culvert capacity.
- Sammamish River – There is a steep and deeply-incised ravine within the Sammamish Watershed that has been identified as a landslide, erosion, and seismic hazard area. Drainage improvements for this area will re-route high storm flows around the ravine, but not change the overall drainage pattern. Freeway runoff and off-site runoff will be separated and routed independently to the Sammamish River. Off-site runoff will be distributed to three separate existing outfalls to the Sammamish River by the use of flow splitters. On-site runoff will be routed to a detention pond at the bottom of the ravine, and then flow through an existing roadside ditch to an open channel to the Sammamish River.

Exhibit 5-32
Proposed Stormwater Treatment Features



How will construction activities affect water resources in the project area?

Construction activities are expected to include the building of new culverts, detention facilities, stream crossings, new storm drain systems, enhanced water quality treatment facilities, and paving. These activities will affect water quality and water quantity as described below.

Construction effects to water quality

Project construction may have minor effects on water quality of the small tributaries; however, the effects will be temporary. No long-term adverse effects on receiving streams or Lake Washington are anticipated.

The contractor will be required to prepare a temporary erosion and sedimentation control (TESC) plan and a spill prevention control and countermeasures (SPCC) plan prior to initiating construction. Implementing these plans will minimize erosion effects, decrease the sediments entering receiving waters from the construction area, and protect against effects from harmful material spills to streams.

Automotive-related substances, such as petroleum hydrocarbons and heavy metals, are another concern during construction. These substances may be found in staging areas, on temporary roads, or on other work surfaces such as the freeway. If discharged directly to surface waters, these contaminants can reach concentrations that are toxic to aquatic life. The SPCC plan will specify that equipment fueling and maintenance and storage of fuels and toxic materials can only take place away from surface waters.

Construction effects to water quantity

There will be increased amounts of runoff during construction. Detention provided during construction will help prevent downstream flooding, erosion, and sedimentation. The increased runoff will not have any appreciable effect on Lake Washington because of the lake's large size and volume in comparison to the small amount of runoff from the freeway. Other waterbodies that convey water to Lake Washington will each receive a small amount of flow from the construction areas. Each waterbody should have sufficient capacity to convey the flow without increasing flood risk.

What measures are proposed to avoid or minimize effects to water resources during construction?

Several measures will be incorporated into construction plans and specifications to reduce effects to water resources.

Groundwater

- Groundwater will be protected with the use of standard best management practices (BMPs).
- A TESC plan and a SPCC plan will be prepared and implemented.
- The contractor will be required to take added measures during construction within the Kirkland Well Field's Wellhead Protection Area to protect the area, such as prohibition of fuel and chemical storage and refueling operations. Also, construction specifications will require stormwater collection with either a lined or piped conveyance system within the Wellhead Protection Area. Stormwater will be directed and discharged outside of the Kirkland Wellhead Protection Area to prevent any possible degradation of water quality. No permanent stormwater facilities will be constructed in the Kirkland Wellhead Protection Area.
- The contractor will identify and develop staging areas for equipment repair and maintenance away from all drainage courses. Washout from concrete trucks will not be dumped into storm drains or onto soil or pavement that carries stormwater runoff. Thinners and solvents will not be used to wash oil, grease, or similar substances from heavy machinery or machine parts. The contractor will be required to designate a washdown area for equipment and concrete trucks.
- Prior to construction, a National Pollutant Discharge Elimination System (NPDES) Stormwater Construction Permit covering activity in the highway right of way will be obtained from the Washington State Department of Ecology.
- WSDOT will obtain a Hydraulic Project Approval (HPA) from the Washington Department of Fish and Wildlife (WDFW) prior to construction. The HPA will address impacts from water quality and quantity.

What are best management practices?

Best management practices (BMPs) are actions or structures that reduce or prevent pollutants from entering stormwater and degrading water quality. There are many different types of BMPs – some are treatment technologies, such as stormwater treatment ponds. Others are typical measures that can be implemented as part of a project, such as sweeping streets to eliminate debris. Some BMPs are permanent features of a project, others can be temporary measures used during construction.

- For work within waters of the United States (such as stream crossings) WSDOT will obtain a Section 404 permit from the US Army Corps of Engineers.

What measures are proposed to avoid or minimize effects to water resources during operation?

Groundwater

- The SPCC plan will address the project's long-term operational phases. Permanent stormwater collection, conveyance, and discharge systems will capture and control spills and prevent contamination of the groundwater aquifers.

Water Quality

- Permanent controls for the mitigation or containment of spills will be provided for new pavement (or equivalent pavement areas) within the project area. Stormwater treatment facilities for flow control and water quality runoff treatment will provide successive levels of protection for downstream conveyance systems by intercepting and retaining spilled contaminants. Subsequent maintenance activities would remove the contaminants from the treatment facilities and restore normal operation to the system.
- Scheduled maintenance programs developed for the stormwater treatment system will include provisions for the regular removal of contaminants and restoration of treatment operations.
- Oil and other petroleum products will be removed with oil treatment facilities.

5.10 Wetlands

Wetlands are a valuable resource to our environment. They can help moderate stormwater flows by slowing down and retaining flood waters during periods of rain. They can help reduce flooding downstream and clean the water of material such as dirt and oil. Wetlands may also provide vital habitat for many plants and animals.

How were wetlands identified in the project area?

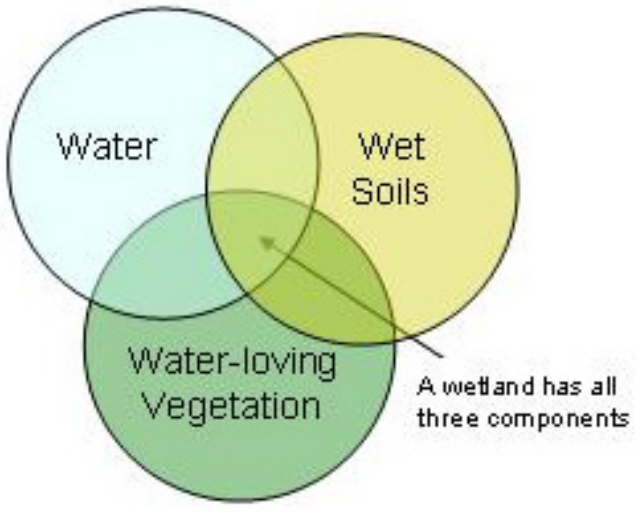
WSDOT biologists conducted literature reviews and field investigations using methods defined by the Washington State Wetlands Identification and Delineation Manual (Ecology, 1997) to determine wetland boundaries and characteristics. This method is in agreement with the US Army Corps of Engineers' method (1987).

Wetlands are made up of three components, as shown in Exhibit 5-33, and categorized according to their quality.

Are wetlands located in the project area?

There are several wetlands located in the project area. Exhibit 5-34 shows these sites along the Kirkland section of I-405, together with map insets that indicate the wetlands that will be affected by the project.

Exhibit 5-33: Components of a Wetland



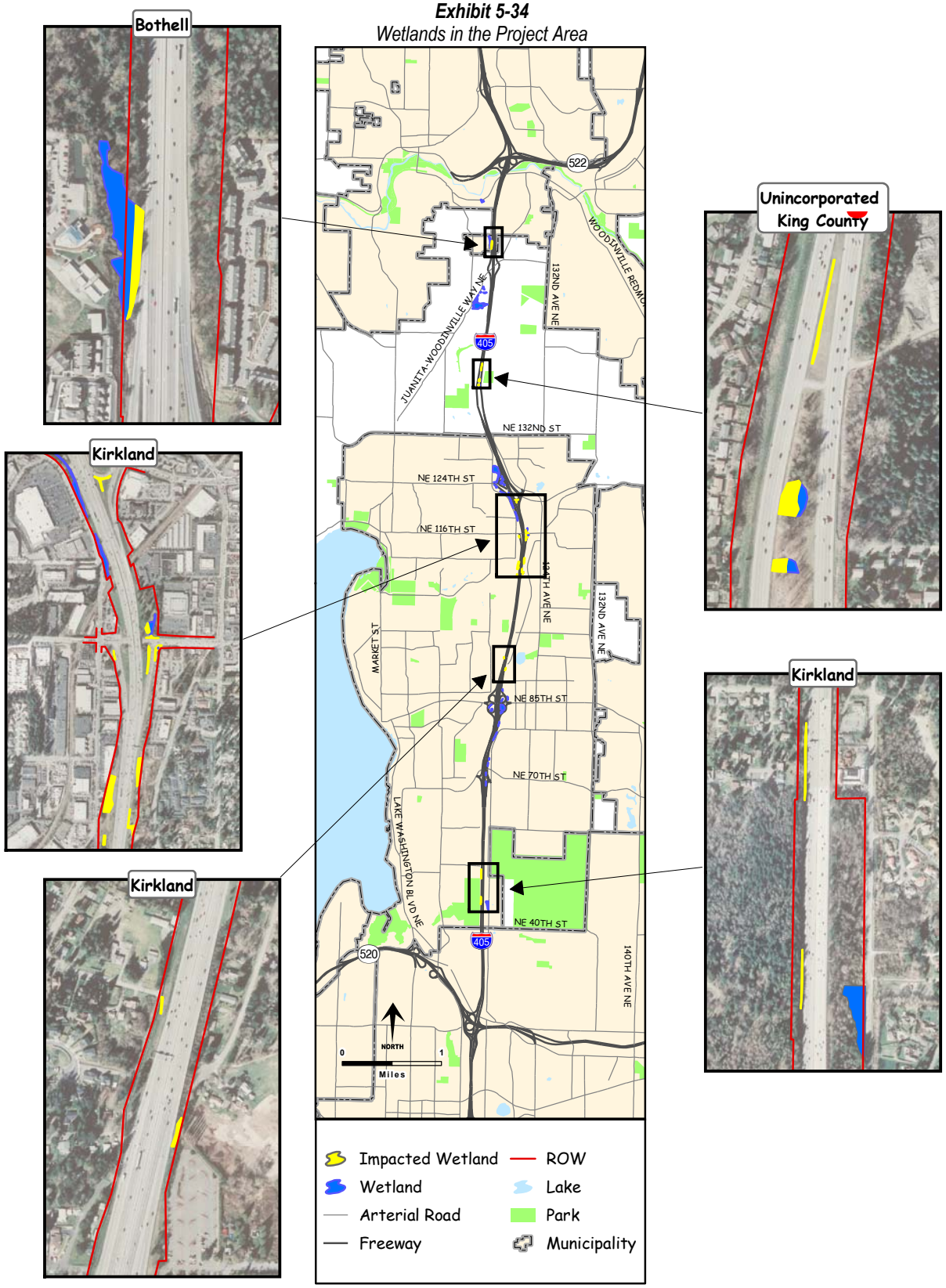
Roadside wetland along I-405

Please refer to the Kirkland Nickel Project Wetlands Discipline Report in Appendix U (on CD) for a complete discussion of wetlands analysis.

How are wetlands categorized?

Wetlands are categorized according to their size, vegetation and benefit to society. Lower quality wetlands are generally small, lack trees and shrubs, and have been disturbed by past development. Medium-quality wetlands contain some younger trees and shrubs; and high quality wetlands contain primarily mature trees and bushes and are used by a lot of animals.

Exhibit 5-34
Wetlands in the Project Area



How will wetlands be affected by the project?

The Kirkland Nickel Project will affect wetland areas along both sides of I-405, primarily within the WSDOT right of way. Two additional locations, where the project extends into privately-owned property, will be affected by stormwater detention, interchange improvements, or roadway widening where wetlands are present.

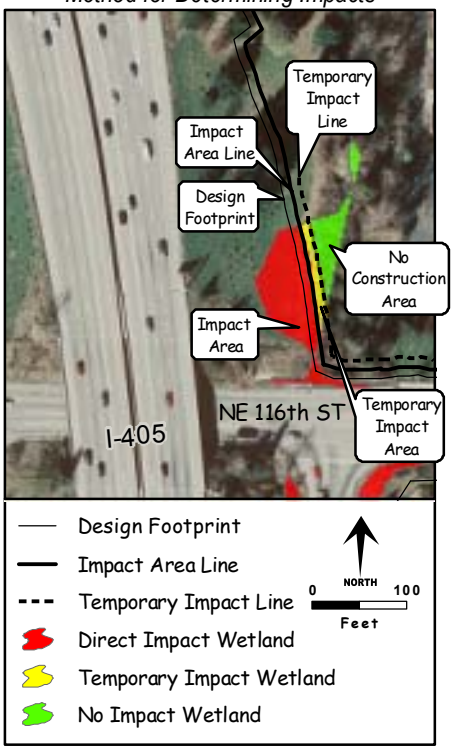
The project team compared wetland survey data files with project engineering data. The project footprint was then overlain onto the wetland survey data to determine the number and extent of affected wetlands. Exhibit 5-35 illustrates the method for determining impacts. Construction of the Kirkland Nickel Project will affect wetlands regulated by King County, and the cities of Bothell and Kirkland.

Because of a long history of disturbance from past roadway construction and other development, wetland quality in the I-405 Corridor is generally poor. Thirteen of the 14 affected wetlands in the Kirkland Nickel Project area can be characterized as lower-quality wetlands, typically associated with ditches alongside the road. The remaining wetlands can be characterized as medium quality, which provide minimal water quality improvement and habitat value. Exhibits 5-36 and 5-37 are examples of these types of wetlands. The larger medium- or high-quality wetlands, which provide valuable habitat functions, are usually more natural and occur outside the WSDOT right of way and will not be affected.

When the I-405 roadway is widened, wetlands totaling 1.6 acres will be permanently filled. The majority of these wetlands are located adjacent to the roadway in the form of ditches or stormwater detention facilities.

Wetlands occur in areas along I-405 that have been modified by creating ditches and re-grading the soil to control stormwater. Water from these wetlands typically flows into culverts that extend beneath I-405 or adjacent roads, or into storm drains.

Exhibit 5-35
Method for Determining Impacts



Design Footprint
Cut and fill line or design limit

Impact Area Line
10' offset of design footprint - limit of construction

Temporary Impact Line
10' offset of impact area line - occurs only along environmentally sensitive areas.

Impact Area
Area between existing roadway and design footprint. Construction may occur up to the Impact Area Line.

Temporary Impact Area
Area between impact line and temporary impact line - This area may be cleared for construction, but will be restored to pre-project conditions.

No Construction Area
Construction is prohibited.

Exhibit 5-36
Seep Wetland

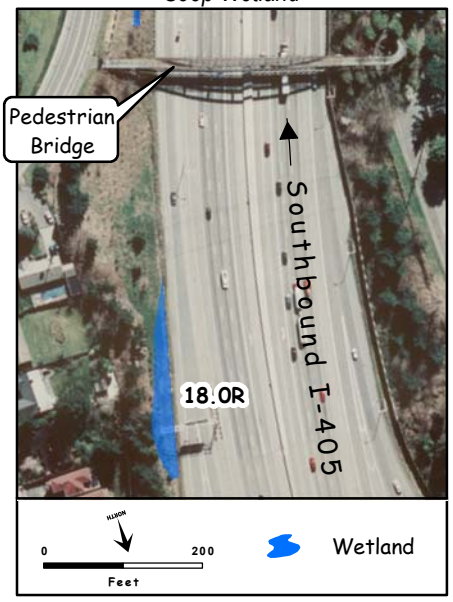
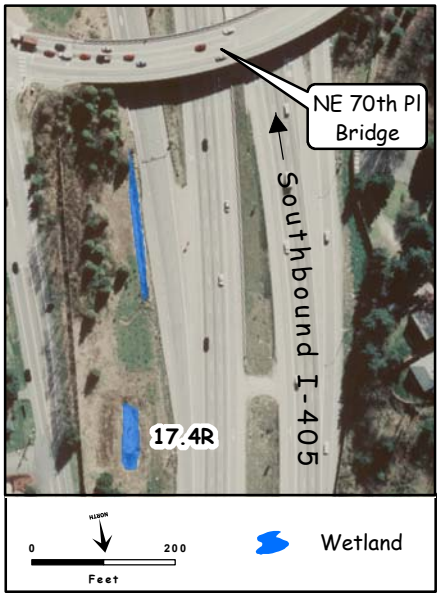
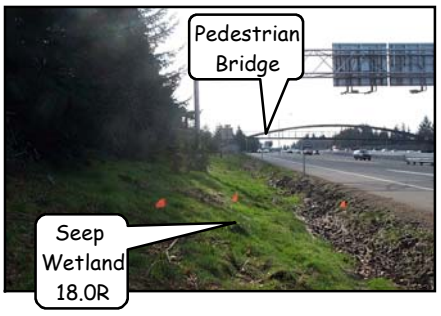
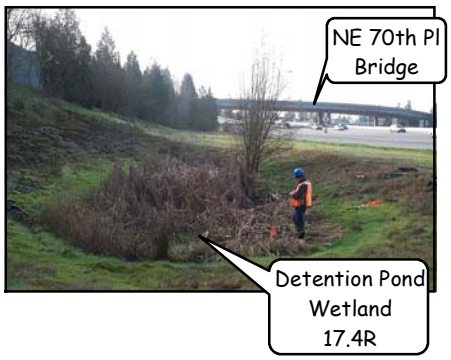


Exhibit 5-37
Detention Pond Wetland







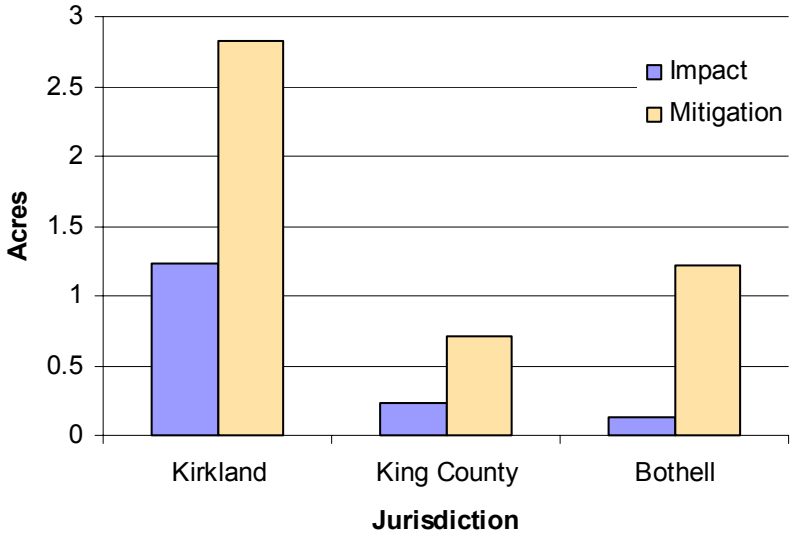
Because the affected wetlands will occur in three separate jurisdictions, each jurisdiction will use its specific guidance to determine how the effects to wetlands will be addressed. Exhibits 5-38 and 5-39 compare the extent of wetland effects, and show proposed mitigation for each jurisdiction.

Exhibit 5-38: Wetland Impacts and Proposed Mitigation

Local Jurisdiction	Number of Affected Wetlands	Acres of Temporary Impacts	Acres of Permanent Impacts	Acres of Mitigation
City of Bothell	1	0.099	0.136	1.220
City of Kirkland	10	0.050	1.229	2.828
King County	3	0.031	0.235	0.704
Total	14	0.180	1.600	4.752

Exhibit 5-39

Permanent Wetland Impacts and Proposed Mitigation



How will construction activities affect wetlands?

Most construction effects are temporary. However, temporary effects can result in a short-term loss of wetland functions during construction and for up to five years following construction. WSDOT does not expect these effects to result in a complete loss of wetlands once the project is completed and disturbed vegetation or wetland hydrology is reestablished.

WSDOT anticipates that the equipment will need 10 feet beyond the grading limits during construction for space to turn and move about. Within this space, machinery may disturb wetlands and possibly cause dirt to mix with excess water from the project and spill into the wetlands. Such conditions can degrade wetland functions.

What measures are proposed to avoid or minimize effects to wetlands during construction?

The following activities will be undertaken to avoid or minimize effects to wetlands:

- WSDOT and the contractor will protect, preserve, and enhance the wetlands in the project area during the planning, construction, and operation of transportation facilities and projects consistent with USDOT Order

5660.1A; Executive Order 11990 and Governor's Executive Orders EO 89-10 and EO 90-04.

- The project will follow guidance contained in the WSDOT *Environmental Procedures Manual* (WSDOT, 2004a), which outlines the issues and actions to be addressed prior to authorizing work that could affect wetlands.
- The contractor will use fencing to clearly mark wetlands to be avoided in the construction area.
- Project-level design and environmental review has included avoidance, minimization, restoration, and compensation of wetlands. The contractor will implement these measures to reduce temporal losses of wetland functions.

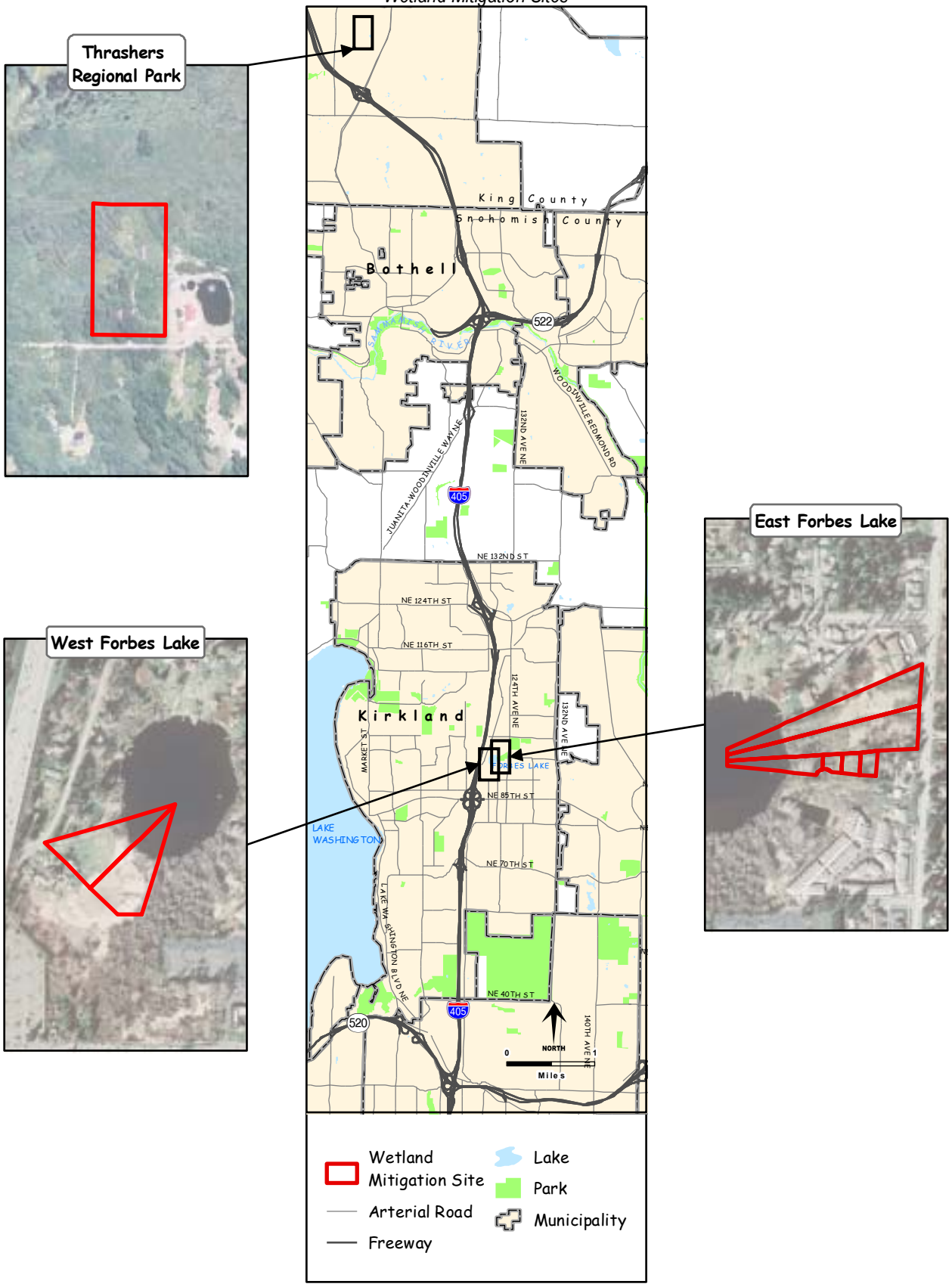
The Kirkland Nickel Project mitigation strategy includes the use of guidance by local governments to select projects that provide substantially greater functions and values than the affected wetland. WSDOT has worked with the cities of Kirkland and Bothell, as well as King County to coordinate activities to avoid or minimize effects. The mitigation strategy must satisfy the requirements of each jurisdiction to compensate for the respective loss of wetlands within the Kirkland Nickel Project area (Exhibit 5-39).

Despite WSDOT's efforts to avoid wetlands during construction, 0.180 acres of wetlands will be temporarily disturbed, which the contractor will be required to restore. An additional 1.6 acres of wetlands will be permanently filled. The acreage of filled wetlands is distributed among local jurisdictions accordingly:

- Kirkland – 1.229 acres
- Bothell – 0.136 acres
- Unincorporated King County – 0.235 acres

Three sites (Exhibit 5-40) will be used to provide the required wetland mitigation to replace filled wetlands. These sites provide adequate area according to replacement ratios of each jurisdiction to fully mitigate for the filled wetlands.

Exhibit 5-40
Wetland Mitigation Sites



The sites selected for mitigation are:

- Property on the west side of Forbes Lake – WSDOT will use 2.9 acres of acquired property for mitigation. After wetland mitigation has been constructed and monitored, the private property will be deeded to the City of Kirkland.
- Property on the east side of Forbes Lake – WSDOT will use 4.5 acres of City of Kirkland property for mitigation.
- Property south of Thrashers Regional Park – WSDOT will acquire 4.7 acres of private property west of SR 527 (Bothell-Everett Highway) and north of 214th Street SE. After wetland mitigation has been constructed and monitored, the acquired property will be deeded to the City of Bothell.

5.11 Wildlife and Vegetation

Wildlife presence within urban landscapes depends on the availability of suitable habitat. Habitat loss, along with increasing habitat fragmentation, is a primary reason for species decline in urban environments. Greater human access to these areas can also influence the presence and abundance of wildlife in urban environments. Most of the Kirkland Nickel Project area is highly developed for residential, commercial, and industrial activities.

Red-tailed hawks are commonly seen in the project area

How were wildlife and vegetation studied within the project area?

WSDOT reviewed information provided by the Washington Department of Fish and Wildlife (WDFW) and the Washington Department of Natural Resources (WDNR), and conducted field surveys within the project area. WSDOT also contacted resource agencies to validate information and to target field studies.

The study area covered one mile on each side of the freeway (Exhibit 5-41) as well as the adjoining, disturbed mixed-forests[1].

Riparian[2] (streamside) areas were mapped along the major drainages within the project area, including Yarrow Creek, Forbes Creek, and Juanita Creek, to determine existing habitats.

A Biological Assessment (BA) was prepared for the project to comply with the Endangered Species Act. The BA made a finding of "no effect" for bald eagles and a finding of "may affect, not likely to adversely affect" for chinook salmon and bull trout. The US Fish and Wildlife Service (USFWS) and NOAA Fisheries issued letters of concurrence on the BA on October 25, 2004, and October 28, 2004, respectively.

Please refer to the Kirkland Nickel Project Wildlife and Vegetation Discipline Report in Appendix V (on CD) for a complete discussion of the wildlife and vegetation analysis.

What is the Endangered Species Act?

A 1973 federal law, amended in 1978 and 1982, was enacted to protect troubled species from extinction. NOAA Fisheries and the US Fish and Wildlife Service decide whether to list species as threatened or endangered. Federal agencies must avoid jeopardy to and aid in the recovery of listed species. Similar responsibilities apply to non-federal entities.

[1] Forest of hardwood and softwood trees that has been disturbed from development activities.
[2] Land that occurs along or interacts with flowing water.

Exhibit 5-41
Wildlife and Vegetation Study Area

What types of wildlife and vegetation are found in the project area?

Generally, habitats within the I-405 Corridor have been intensely fragmented by urban development, including the freeway. This fragmentation has reduced the value of wildlife habitat by interrupting movement within and through the project area. Wetland and riparian habitats associated with Juanita Creek and Forbes Creek, for example, have been highly fragmented, creating a patchwork of isolated habitat areas, often poorly suited for wildlife.

Wildlife Species

The Kirkland Nickel Project area is dominated by landscaped areas, patches of native vegetation, and maintained grasses. WSDOT manages vegetation within the right of way to discourage use by wildlife that can enter the roadway and cause accidents. With respect to wildlife habitat, these resources typically have low value and are generally highly disturbed (WSDOT, 2002).

Although there is low-value habitat within the project area, the mowed right of way in the I-405 Project Corridor is used extensively as foraging habitat for red-tailed hawks; other wildlife species also use these mowed areas. Given the extensive level of development that has eliminated large expanses of red-tailed hawk habitat, the grass-dominated portions of the right of way likely provide important habitat for the species (WSDOT, 2002).

Vegetation Species

Both landscaped and unlandscaped areas within the Kirkland Nickel Project area are dominated by invasive Himalayan blackberry, sword fern, crab grass, quackgrass, and domestic cherry, among many weed species. The vegetation along the roadway consists of mowed grasses and scattered trees. Approximately 95 acres of disturbed and landscaped vegetation are located within the right of way.

The stream-side vegetation associated with Juanita Creek and Forbes Creek is dominated by sword fern, salmonberry, Himalayan blackberry, and reed canarygrass. Cottonwood, alder, big-leaf maple, fir, and cedar comprise the forested canopy (The Watershed Company, 1998).

Approximately 159 acres of disturbed mixed-forest occur in patches within, or adjacent to, the I-405 proposed Kirkland

Nickel Project area. Most of these patches include successional[3] native forests dominated by a relatively homogeneous mixture of native and non-native species. Western red cedar, western hemlock, Douglas-fir, red alder, and big-leaf maple typically dominate these areas, with an understory of sword fern and scattered vine maple.

Threatened and Endangered Species

WDFW (2004) identified one bald eagle nesting zone within one mile of the project area, the Hunts Point Bald Eagle Territory. This territory has been active since 1992 and contains two nests, both of which are located 1.25 miles or more from the project area. No roost trees are located within one mile of the project area.

How will wildlife and vegetation be affected by the project?

In total, approximately 80 acres of potential habitat is expected to be removed as a result of the project. Of this total, approximately 60 acres of ruderal or landscaped vegetation, 0.28 acres of stream-side habitat, and 20 acres of disturbed mixed-forest will be cleared. Areas with mixed forest, however, will not be removed for temporary use (i.e., construction staging). Areas of disturbed mixed-forest that will be removed for roadway construction will be replaced with plantings of native tree and shrub species (acre for acre) within the project area.

There will be minimal removal of shrubs and trees in stream-side areas associated with Forbes Creek during the proposed culvert replacement beneath I-405 (Exhibit 5-42). Disturbance to stream-side vegetation along Juanita Creek will occur on the west side of I-405 (Exhibit 5-43).

Removal of vegetation will result in some displacement of wildlife, including small mammals and amphibians that exist in these low-quality habitats.

Construction effects on wildlife can be caused by noise associated with equipment movement, excavation, cutting, filling, and grading. Noise during construction activities will

Exhibit 5-42
Vegetation Impacts - Forbes Creek (KL5)

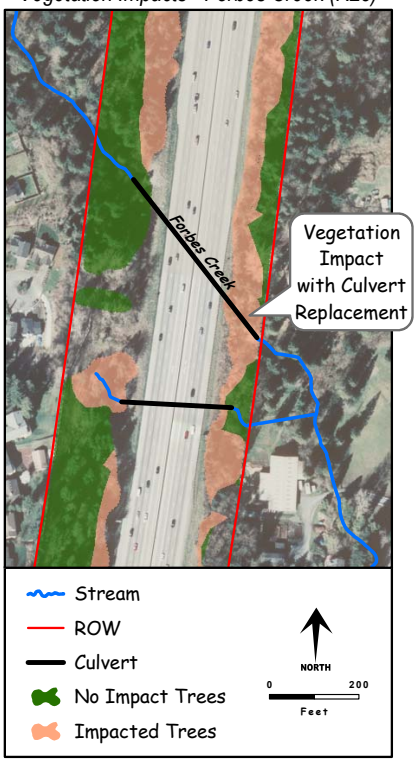
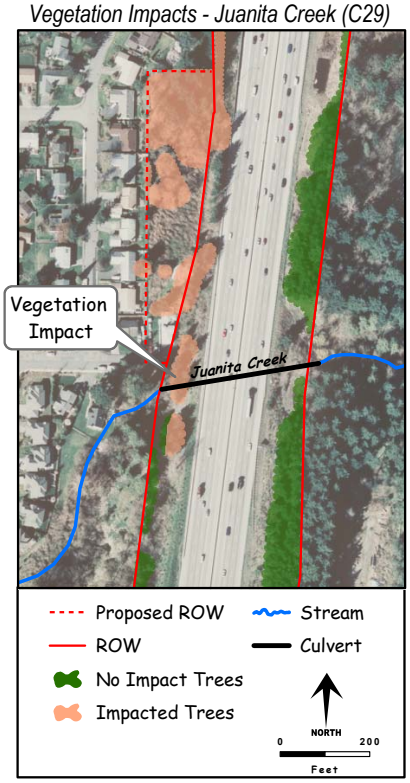


Exhibit 5-43
Vegetation Impacts - Juanita Creek (C29)



[3] The gradual and orderly process of change in an ecosystem brought about by the progressive replacement of one community by another until a stable climax is established.

disturb small rodents, songbirds, and birds of prey. These effects will be minor.

Interstate 405 is a freeway that has been in operation for many years. After construction of the Kirkland Nickel Project, conditions for wildlife will be similar.

What measures are proposed to avoid or minimize effects to wildlife and vegetation during construction?

The mitigation measures established in the *I-405 Corridor EIS* will be used for implementation of the Kirkland Nickel Project.

- The contractor will be required to prepare and implement a revegetation plan that has been approved by WSDOT. In addition, areas with mixed forest will not be removed for temporary use (i.e., construction staging). If the contractor must permanently remove an area of mixed forest for roadway construction, it will be replaced with plantings of native tree and shrub species (acre for acre) within the affected area.
- The contractor will adhere to project conditions identified in the Biological Assessment and agency concurrence letters.

5.12 Fish, Aquatic Habitat, and Threatened and Endangered Fish Species

Finfish, shellfish, and aquatic organisms make use of several streams within the project area during some stage of their life cycle (e.g., spawning, rearing, and migrating). Most streams were modified over time and contain limited habitat for fish. A Biological Assessment was prepared for the project, in compliance with the Endangered Species Act, that made a finding of "may affect, not likely to adversely effect" for chinook salmon and bull trout.

How were aquatic resources evaluated for the project?

WSDOT surveyed habitat conditions on all the streams were surveyed in the Kirkland Nickel Project area (Exhibit 5-44). The surveys focused on fish life and habitat conditions to determine potential effects to aquatic resources that could result from project construction and operation.

What streams are in the project area and what fish species live in the streams?

The affected aquatic environment includes several streams within 300 feet of I-405 that flow beneath or parallel to the roadway. One additional stream segment, at the lower end of Stream KL14, was surveyed in the City of Bothell near a stormwater detention facility (see Exhibit 5-44). Only four of the affected streams were identified by traditional names on maps. They are Yarrow, Juanita, and Forbes creeks, and the Sammamish River. The remaining streams were identified by project fisheries biologists using an alpha-numeric code, e.g., KL2 or C2.

Avoiding or minimizing project impacts to aquatic resources is a vital component of the project. Special consideration is given to these resources because of the biological, environmental, economic, and cultural importance of fish and aquatic species in the Pacific Northwest.

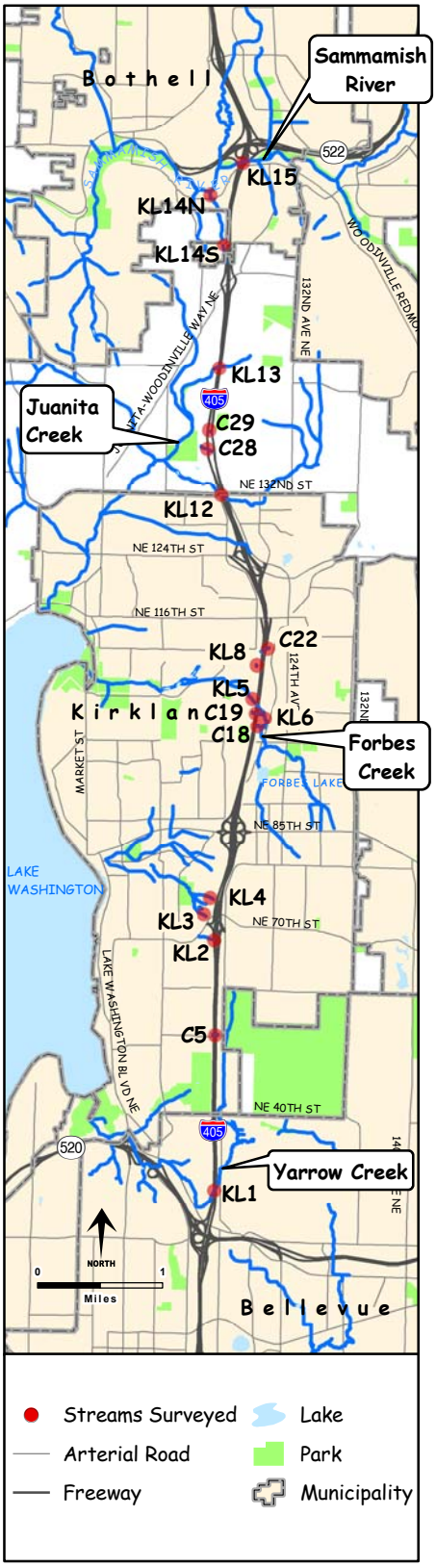
The primary species to consider are the federal Endangered Species Act-listed salmonids. The listed species include fall chinook salmon and bull trout.

Please refer to the Kirkland Nickel Project Fish and Aquatic Habitat Discipline Report and the Supplemental Stream Habitat Survey Report and Impact Assessment in Appendix W (on CD) for a complete discussion of the fish and aquatic resources analyses.

What is spawning?

Spawning is the production and deposition or laying of eggs.

Exhibit 5-44
Streams Surveyed in the Project Area



Other important species within the project area include coho, sockeye, and kokanee salmon; steelhead, rainbow, Dolly Varden, and cutthroat trout; and mountain whitefish (WSDOT, 2002). Information provided by the USFWS indicates that migratory native char, including bull trout and Dolly Varden, occur within the Lake Washington system, but with low frequency (Dan Lantz, USFWS, pers comm., September 29, 2004; unpublished data). Bull trout adults or sub-adults may be present in Lake Washington (also in Lake Union and Lake Sammamish) year round, depending on the availability of prey resources. Currently, within the Cedar-Sammamish water resource inventory area (WRIA 8), there are no reproducing bull trout populations below the winter snow line (WDFW, 1999). There is no known evidence that any of the streams in the vicinity of the Kirkland Nickel Project area currently support bull trout.

There are several non-salmonid species present within the project area. They are either resident, migratory, exotic, warm water, or shellfish species, or some combination of the above. Non-salmonid species that may be present include sculpin, dace, stickleback, lamprey, crayfish, freshwater mussels, chub, northern pikeminnow, suckers, yellow perch, carp, whitefish, and bullheads.

What type of habitat is required for these fish?

Fish habitat was evaluated upstream and downstream of I-405 even though the presence of migrating salmon is extremely limited because of impassable barriers downstream.

Salmon have specific habitat requirements. Different species have different needs for both juveniles and adults. Many of the I-405 streams provide habitat for juveniles but not for adults. Historically, many of these streams were too small for larger adult salmon spawning activities, especially chinook. Of the smaller salmon species, coho, sockeye, and kokanee salmon, and cutthroat trout have the potential to occur in five water bodies within the project area; Yarrow Creek, Forbes Creek, KL6 (a tributary to Forbes Creek) Juanita Creek, and the Sammamish River.

Bull trout require very cold water and high quality stream habitat. For a typical stream, this includes many deep pools with plenty of wood in the stream, and year-round flow.

Habitat conditions were evaluated to determine which resident fish could be present. Resident fish and most of the non-salmonids are different from the migratory salmon species because they live in streams or lakes all their life—that is, they do not migrate to the ocean. Resident fish may include native species as well as introduced species. Like salmon, resident species have unique habitat requirements for food, temperature, shade, or the presence of small gravels.

What are salmonids?

Salmonids are fish that are members of the family Salmonidae, which includes salmon, trout, char, and whitefish.

What is the condition of the fish habitat?

Use by salmon and resident species is limited in many of the streams because of natural and unnatural conditions, including but not limited to poor water quality, lack of spawning substrate, limited open channels, steep gradients, non-passable culverts, and other hydrologic sources such as stormwater.

What are resident fish?

Resident fish are fish that remain in freshwater for their complete life cycle.

Many of the streams exhibit poor habitat and a low potential for salmon or resident species. This is attributed to conditions such as limited food sources, no cover, or no water.

Two major problems occur in these streams: 1) a lack of water, and 2) a lack of open channels (because of pipes and culverts, and water routed through stormwater control basins). Many of the unnamed urban drainages retain less than one half of their historic open-water channels because the remainder is piped underground. For others, during the dry summer months the flow disappears underground.

For bull trout, the streams are too warm; they do not have enough woody debris for cover; and they do not contain the type of gravels needed for bull trout to lay eggs. Because of natural limiting factors, historic use by bull trout of the small streams in the project area probably ranged from extremely limited to no presence at all.

Cutthroat trout are more tolerant of urban stream conditions and appear in some of the streams that flow beneath I-405 within the project area. Cutthroat trout can survive as a year-round freshwater resident or they can migrate to the ocean. Most of the cutthroat in the project streams are considered as year-round residents. Habitat in the project streams is adequate for cutthroat trout to spawn, hatch, and rear to adulthood.

How will the project affect fish, aquatic habitat, and threatened and endangered fish species?

The I-405 project will be built in an urban area where people, buildings, and roads have existed here for many decades, often in conflict with fish and streams. The Kirkland Nickel Project has the opportunity to demonstrate how a highway can be constructed in an urban environment without conflicting with natural resources, such as fish and streams.

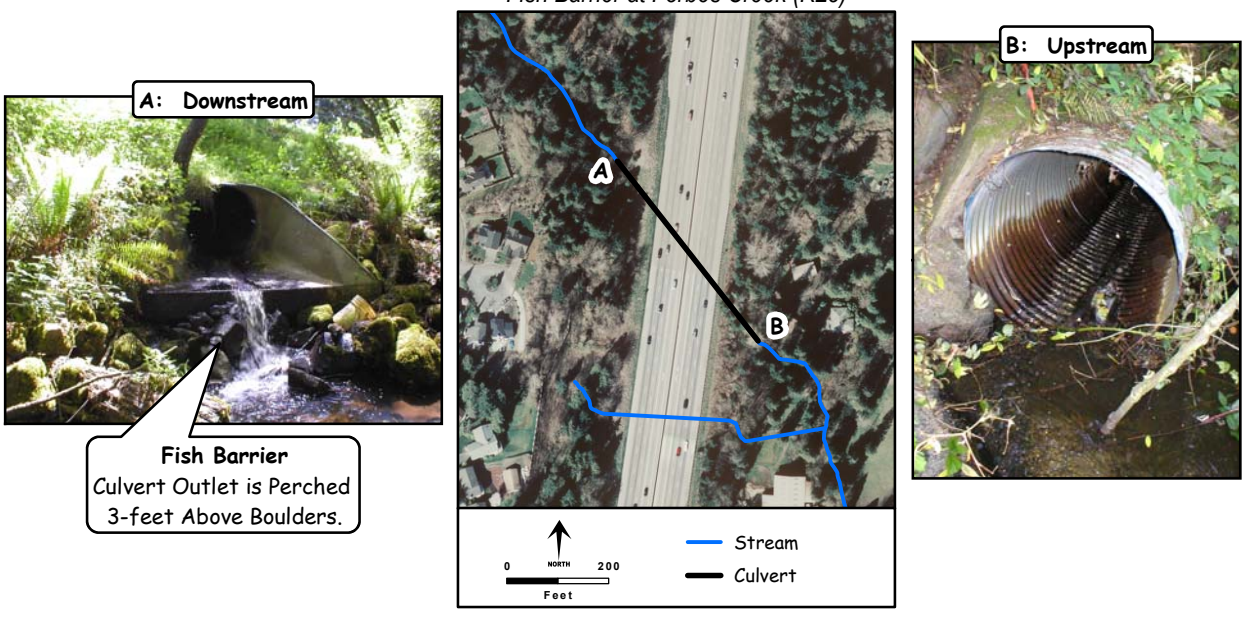
The project will have short-term, long-term, and minor effects to the aquatic resources within the area. WSDOT's goal is to minimize the harmful effects and maximize the long-term, beneficial effects by maintaining existing aquatic resources, and then by improving those resources over time.

Exhibit 5-45 shows the fish barrier at Forbes Creek. A new fish passage structure will be constructed under I-405 to allow upstream fish movement. A long-term benefit will be to improve the quality of water that is entering the streams during storm events. The project will also use the best available science regarding stormwater treatment.

Chinook salmon require very cold water to survive; therefore, WSDOT will manage vegetation to benefit these species by ensuring:

- Vegetation will remain in place near the roadway streams and waterways;

Figure 5-45
Fish Barrier at Forbes Creek (KL5)



- Vegetation will be planted where necessary to provide cover and keep the water cool through more shade; and
- Vegetation will be kept healthy and functioning over time.

Most of the other aquatic resources, including small insects, will also benefit from the colder water and extra vegetation.

In addition to shade, vegetation provides other long-term benefits including:

- Plants reduce erosion, thereby creating less sand and dirt in the streams;
- Dead vegetation helps create big pools in the streams that attract fish;
- Tiny insects live on the wood and leaves of plants and provide food; and
- The stream banks and shoreline remain natural.

How will construction activities affect fish, aquatic habitat, and threatened and endangered fish species?

Construction activities that could affect fish and stream habitat include:

- Filling and grading;
- Removing stream-side vegetation; and
- Temporarily diverting streams and dewatering.

Road widening, culvert replacement and extension, as well as construction of headwalls, retaining walls, and stormwater conveyance systems and associated outfalls to streams, will involve some work in streams, resulting in some loss of instream habitat (e.g., pool and riffle areas). These disturbances may affect spawning, rearing, and migration habitat; however, these impacts are usually short-term because of beneficial revegetation or restoration of other stream functions.

In-water work also results in short-term increases in turbidity and sedimentation, similar to the effects of removing stream-side vegetation. Culvert replacement, culvert extension, or headwalls may require temporary disturbance to the stream bank. There is the potential for bank erosion and downstream

sediment transport during the initial growing period of any stream bank segment subjected to disturbances associated with culvert replacement.

There will be an approximate loss of 2,540 square feet of aquatic habitat as a result of project construction. During construction of the Kirkland Nickel Project, the stream crossing culvert for Forbes Creek (KL5) will be replaced. On average, approximately 10 to 15 linear feet of stream on each side of I-405 may be affected long term (e.g., filled and graded). However, after a fish-friendly culvert is constructed, approximately 7,500 linear feet of stream will become available for fish use between the freeway and Forbes Lake.

Streamside (i.e., riparian) vegetation plays a number of important roles in supporting instream habitat functions. They provide large woody debris, food, stream bank stabilization, water storage, and water quality (Poole and Berman, 2001). Therefore, removal of stream-side vegetation is likely to impact these habitat functions. The extent of vegetation removal determines the type and degree of the effect, especially regarding large woody debris recruitment.

Stream-side vegetation removal can alter soil stability. Loose soils cause erosion, which, in turn, increase sediment deposition in streams or fill the pool habitat (Berman, 1998). In addition, reduction in canopy cover promotes higher temperatures and increases sediment transport from cleared areas (Bolton and Shellberg, 2001).

Vegetation clearing can adversely affect salmonid habitat. Depending on the duration, timing, frequency, and level of turbidity, the associated sedimentation can cause behavioral, sublethal, and lethal effects in juvenile and adult salmonids (Newcombe and Jensen, 1996). However, this loss will be offset by the 7,500 linear feet of stream habitat gained for fish use after construction of the culvert or other fish passage structure at Forbes Creek.

Impacts to stream-side, vegetated areas will result in permanent removal of an estimated 12,340 square feet (0.28 acres) of stream-side habitat.

During in-water construction work at Forbes Creek, the dewatering and temporary stream diversion could harm fish. Harmful activities include fish seining, electrofishing, fish exposure to turbidity (although rare), and small losses of

stream-side functions because of vegetation removal. These fish stressors may induce responses ranging from behavioral to lethal. The contractor will use WSDOT and NOAA Fisheries handling procedures to minimize harmful effects to fish species.

In addition, macro invertebrates and amphibians occupying the dewatered segments of the stream channel will be displaced, thereby temporarily disrupting food sources for fish. However, numerous studies have indicated that benthic invertebrates drift from upstream, rapidly recolonizing the affected area (Barton, 1977; Reed, 1977; Chisolm and Downs, 1978; Waters, 1995). Likewise, aquatic insect production is seldom affected in the long term by minimal habitat displacement and short-term pulses of suspended sediment (Spence et al., 1996). Therefore, any effects on benthic macro invertebrates and aquatic insects are expected to be short-term.

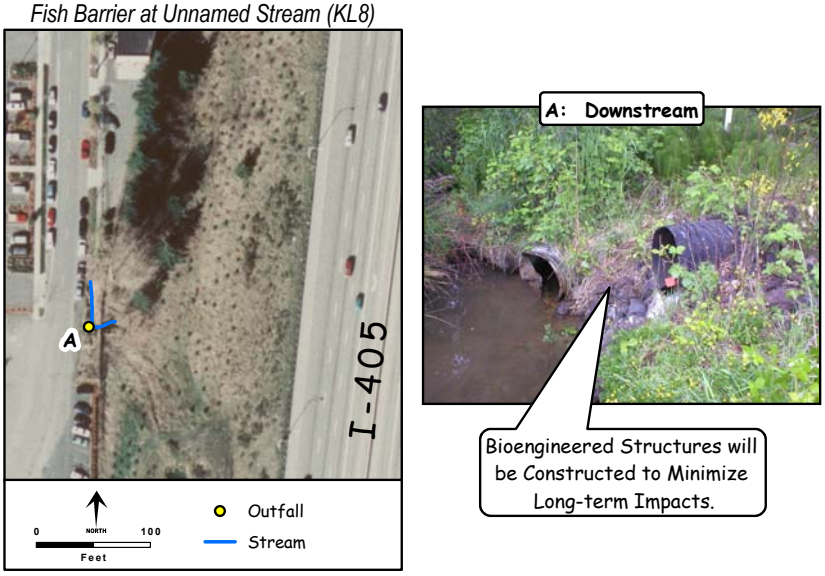
What are the operational effects of the proposed project?

Operational effects are direct effects caused by the existence, use, and maintenance of the project elements, including new or altered stream crossing culverts, over-water structures, stormwater facilities, and impervious surfaces. These features may permanently affect fish and aquatic resources, and their effects could be beneficial or harmful. The primary operational impact to stream habitat will result from new impervious surfaces and subsequent changes in stormwater runoff. New stormwater treatment facilities will be constructed and existing infrastructure will be modified to reduce adverse effects to streams and, in several areas, improve conditions compared to those that exist today (see Chapter 5.9, Water Resources).

Although project elements are designed and sited to avoid or minimize adverse effects on aquatic life, some residual effects are likely during operation of the project.

The Kirkland Nickel Project will extend culverts and construct headwalls to accommodate a wider roadway span in the vicinity of Forbes Creek (KL5), an unnamed stream (KL8) and Juanita Creek (C28, C29), (Exhibits 5-46 and 5-47).

Figure 5-46
Fish Barrier at Unnamed Stream (KL8)



Most of the existing runoff from the highway drains to streams, watercourses, and storm drains with minimal treatment for quantity or quality. The Kirkland Nickel Project will have beneficial effects on fish life in streams and potentially in Lake Washington by improving existing water quality conditions through the removal of sediments, petroleum products and other roadway pollutants. Proper maintenance and improvements to these stormwater structures over time will continue to provide benefits to the aquatic environment.

The project will add impervious surface areas that can result in adverse changes in peak and base streamflow arising from an increase in stormwater runoff. However, a design criterion for the I-405 Kirkland Nickel Project is to limit or reduce peak flows resulting from stormwater facilities discharging to the streams in the area. As a result, the increase in impervious surfaces and the proper operation of stormwater detention facilities will not adversely affect peak and base streamflow in the Kirkland Nickel Project area streams.

Detailed stream-by-stream discussions of the effects of the specific project elements on fish species and aquatic habitat are presented in the Kirkland Nickel Project Fish and Aquatic Resources Discipline Report (Appendix W on CD).

Will the project remove barriers to fish passage?

There are several beneficial actions that will restore and improve fish passage as a result of the project.

One benefit to fish life will occur where a fish-friendly culvert or bridge at Forbes Creek will be constructed to restore fish passage. After this structure is constructed, juvenile salmonids will be able to swim upstream and downstream beneath the freeway. Initially, cutthroat trout and other resident species already upstream of fish barriers will benefit the most. In the future, if barriers are removed, coho and sockeye salmon may benefit. All of these species currently exist in either lower Forbes Creek or throughout the greater Forbes Creek watershed.

Improvements to the stormwater treatment structures also have indirect benefits to fish passage. The new stormwater structures will help maintain normal stream flows, thereby making it easier during a storm event for young fish to swim upstream. This means fish will have better access to habitats.

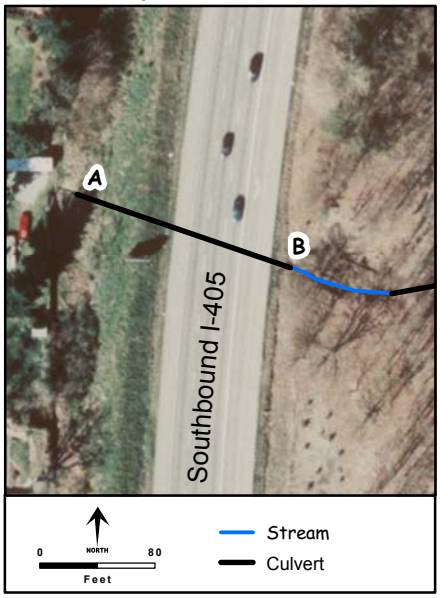
Additionally, revegetation will help retain more water in the streams for longer periods of time. During the critical dry summer months, fish will benefit from improved access to habitats and have a higher likelihood of survival.

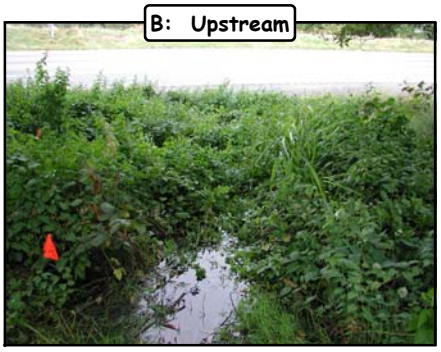
What measures are proposed to avoid or minimize effects to fish and aquatic species during construction?

The following measures will be followed to avoid or minimize effects to fish and aquatic resources during construction:

- The contractor will be required to implement construction BMPs (such as silt fencing or sedimentation ponds) and to avoid disturbing sensitive areas during the development and use of any staging areas, access roads, and turnouts associated with resurfacing activities.
- The contractor will not allow any in-water work to occur except during seasonal work windows established to protect fish.
- The fish-friendly culvert or bridge constructed at Forbes Creek will restore fish passage beneath the freeway. Approximately 7,500 linear feet of stream

Exhibit 5-47
Tributary to Juanita Creek - C29





between the freeway and Forbes Lake will become available for fish use.

- If conditions allow, the contractor will use bio-engineering techniques at new stormwater outfalls near Yarrow Creek, Juanita Creek, Forbes Creek, and the Sammamish River.
- New stormwater discharged to Forbes Creek will be conveyed to Forbes Creek via existing stormwater conveyances so no new outfalls (requiring grading or filling with bank-stabilizing or energy-dissipating riprap) will be constructed in Forbes Creek.
- If the width of the road prism[1] increases to accommodate the wider span of roadway at Forbes Creek and at Stream KL8, headwalls[2] will be constructed at the culvert inlet and outlet to minimize the amount of grading and filling.
- The detention pond on the west side of I-405 will be sited at a sufficient distance south of Forbes Creek so no grading or filling in Forbes Creek or its stream-side zone will be required.
- The combined stormwater treatment wetland/ detention to be constructed near Riverside Drive will be sited at a sufficient distance from both the Sammamish River and the unnamed stream KL14 (at Riverside Drive) so no grading or filling in the streams or the stream-side zones will be required.

What measures are proposed to avoid or minimize effects to fish and aquatic species during operation?

The following measures will be used to avoid or minimize impacts to fish and aquatic resources during operation of the project:

- Stormwater will be controlled so peak and base flows in Yarrow Creek, Forbes Creek, Juanita Creek, and Sammamish River are not adversely affected by treated stormwater discharge from the expanded impervious

[1] The portion of the highway between the ditch lines, curb lines, or toe of fill lines.
[2] A concrete structure at the end of a culvert to protect the embankment slopes, anchor the culvert, and prevent undercutting.

surface areas created by the project. The sheet flow from the roadway surfaces will be captured and held in detention facilities prior to its controlled discharge into streams within the same drainage basin. As a result, peak and base stream flows will not be adversely affected by the increase in impervious surfaces.

- Off-site flow to unnamed stream KL14 will be managed so peak and base flows are not adversely affected by the new stormwater treatment and detention facilities in the vicinity of this stream.
- Ongoing maintenance of stormwater treatment and detention facilities will not include the application of any chemical weed control agents (e.g., herbicides).

Letters of concurrence on the Biological Assessment from the U.S. Fish and Wildlife Service and National Oceanic and Atmospheric Administration Fisheries (NOAA Fisheries) are included in Appendix D.

5.13 Geology and Soils

Geology is the study of the origin, history, materials, and structure of the earth, along with the forces and processes operating to produce changes within and on the earth. When we consider the geologic features of a project area, we must consider how improvements will interact with the soils, groundwater, and topography, as well as the area's unique physical features. Through focused study, we can make determinations about erosion, suitability of soils for construction, slope stability, and other factors.

Ancient landslide area

How were geology and soils evaluated for the Kirkland Nickel Project?

Scientists and planners studied the geology, soils, topography, physical features, and potential for erosion in the study area. They also considered how subsurface water conditions can affect soil moisture, water supplies, wetlands, and water movement, and how they might affect construction activities. Their data sources included geological maps, aerial photos, and geotechnical reports.

Please refer to the Kirkland Nickel Project Geology, Soils, and Groundwater Discipline Report in Appendix T (on CD) for a complete discussion of geology and soils analysis.

What is the geology of the project area?

The Kirkland Nickel Project area is located along an upland separating the Lake Washington and Lake Sammamish troughs. Most of the present day geologic and topographic conditions are the result of glaciers that covered the land long ago. These conditions affect geologic, soil, and groundwater resources.

The last glaciers left behind a mixture of clay, silt, sand, and gravel. These materials were deposited on top of older glacial materials; the bedrock beneath these deposits is over 1,500 feet below the surface in most areas. As the last glacier receded, a sculpted landscape of long narrow uplands and intervening troughs or valleys remained.

Post glacial deposition has occurred along modern drainages and lakes. Locally, these deposits include accumulations of organic silts, peats, soft clays, and loose sands.

Exhibit 5-48
Landslide and Loose Soil Area

An ancient landslide feature underlies one area at the northern end of the project. The landslide area shows no signs of recent instability except for some areas of highway cuts upslope of the northbound lanes, and a small slide area downslope of the southbound lanes. Evidence of slope instability also exists on the uphill cut side of older roads in the area. Such geologic features set the stage for the soil and groundwater conditions to be addressed during freeway design and construction.

What soils are found in the project area?

The majority of the project area is underlain by dense glacial soils. The roadway alignment crosses several drainages and lowlands underlain by soils deposited after the glaciers receded. Localized areas of these soils include artificial fill, materials deposited by flowing water, lake and peat deposits, and recessional outwash. The only major areas of these recent soils include the soft and loose soils adjacent to Totem Lake at the NE 124th Street interchange, and areas of past landslide activity at the northern end of the alignment at SR 522 (Exhibit 5-48). Areas underlain by these soft and loose recent soils generally require different design and construction considerations than those characterized by dense or stiff glacial soils.

How will geologic resources be affected by the project?

Design and construction of the proposed project will be based on the existing geologic and soil conditions following well-established WSDOT design practices for managing the types of conditions found in the project area. Design elements will be incorporated into the project specifications to address the identified conditions. The project description in Chapter 4 includes several design and construction elements that have been incorporated into the project to address conditions such as slope stability and landslide areas, soft ground areas, and protection of groundwater resources (see also Chapter 5.9, Water Resources).

What measures are proposed to avoid or minimize effects to geology and soils during construction?

Slope Stability and Landslide Areas

- A large landslide feature was identified at the northern end of the project. The design geotechnical investigation will fully examine the landslide area and develop appropriate construction procedures to maintain or enhance slope stability.
- The contractor will be required to submit earthwork and wall placement sequencing plans, construction drainage plans, and a slope monitoring program.
- During construction, areas of observed or suspected groundwater seepage will be drained to reduce the risk of landslide and surface sloughing through the use of gravel drainage blankets, french drains, horizontal drains, and/or placement of a surface rock facing or similar methods.

What is a landslide?

A landslide is the sudden release of a mass of rock and earth down a slope.

Soft Ground Areas

- During the design process, geotechnical engineers will assess potential settlement problems associated with existing utilities or structures. If deemed necessary, structures could be underpinned and utilities relocated or made more flexible. In cases where it is an acceptable solution, the settlement will be allowed, with repairs made after settlement is complete. When appropriate, project engineers will conduct pre-construction surveys and monitor construction settlements.
- Construction vibration, particularly generated by driven pile installation (if allowed by resource agencies), large diameter drilled pier installation, and any required ground improvement, can cause settlement of adjacent areas underlain by loose granular soils. Project engineers will identify these areas during the design phase. The contractor will be required to develop the means and methods to avoid or minimize settlement.

Erosion

- The contractor will be required to prepare and implement a temporary erosion and sedimentation control (TESC) plan.
- Should any BMP or other operation not function as intended, the contractor will take additional action to minimize erosion, maintain water quality, and achieve the intended environmental performance.

What measures are proposed to avoid or minimize effects to geology and soils during operation?

Erosion

- A stormwater pollution prevention plan (SWPPP) for operational activities will document drainage facilities and specify their inspection, operation, and maintenance requirements.

5.14 Hazardous Materials

Hazardous materials can be encountered during the construction and operation of public projects. Examples of common hazardous materials include asbestos, lead-based paint, and total petroleum hydrocarbons[1], also known as TPH. Without proper handling, removal, and containment, these materials can pose dangers to human health and the environment. Identifying known and potential contamination prior to construction is important because it can substantially reduce the possibility of exposure to people and the environment.

Asbestos is a common hazardous material found in older structures

How were hazardous materials and wastes identified within the project area?

The project team reviewed historical land uses, regulatory agency database lists (Environmental Data Resources, Inc. [EDR], 2004), and Washington State Department of Ecology (Ecology) site files. A windshield survey of properties within the project area was also conducted.

Please refer to the Kirkland Nickel Project Wildlife and Vegetation Discipline Report in Appendix X (on CD) for a complete discussion of the hazardous waste analysis.

Are there any potentially contaminated sites in the project area?

Studies indicate that contaminated materials exist on sites located within the proposed right of way or located up-gradient to the proposed right of way. However, within the Kirkland Nickel Project area, no "substantially contaminated" properties were identified.

Seventeen (17) "reasonably predictable" properties, either within the proposed project right of way, or above-gradient to the proposed right of way, were identified for more detailed analysis (Exhibits 5-49 and 5-50). Petroleum hydrocarbons[2] may be encountered in the soil and groundwater at 10 of the 17 identified properties. Six of the 17 properties were listed as

What are "substantially contaminated" properties?

"Substantially contaminated" properties typically refer to sites with large volumes of contaminated materials, a long history of industrial or commercial use, and sites with contaminants that are persistent, difficult, or expensive to manage.

[1] Total petroleum hydrocarbons (TPH) is a term used to describe a large family of several hundred chemical compounds that originally come from crude oil.

[2] Chemical compounds that originate from crude oil.

What are "reasonably predictable" properties?

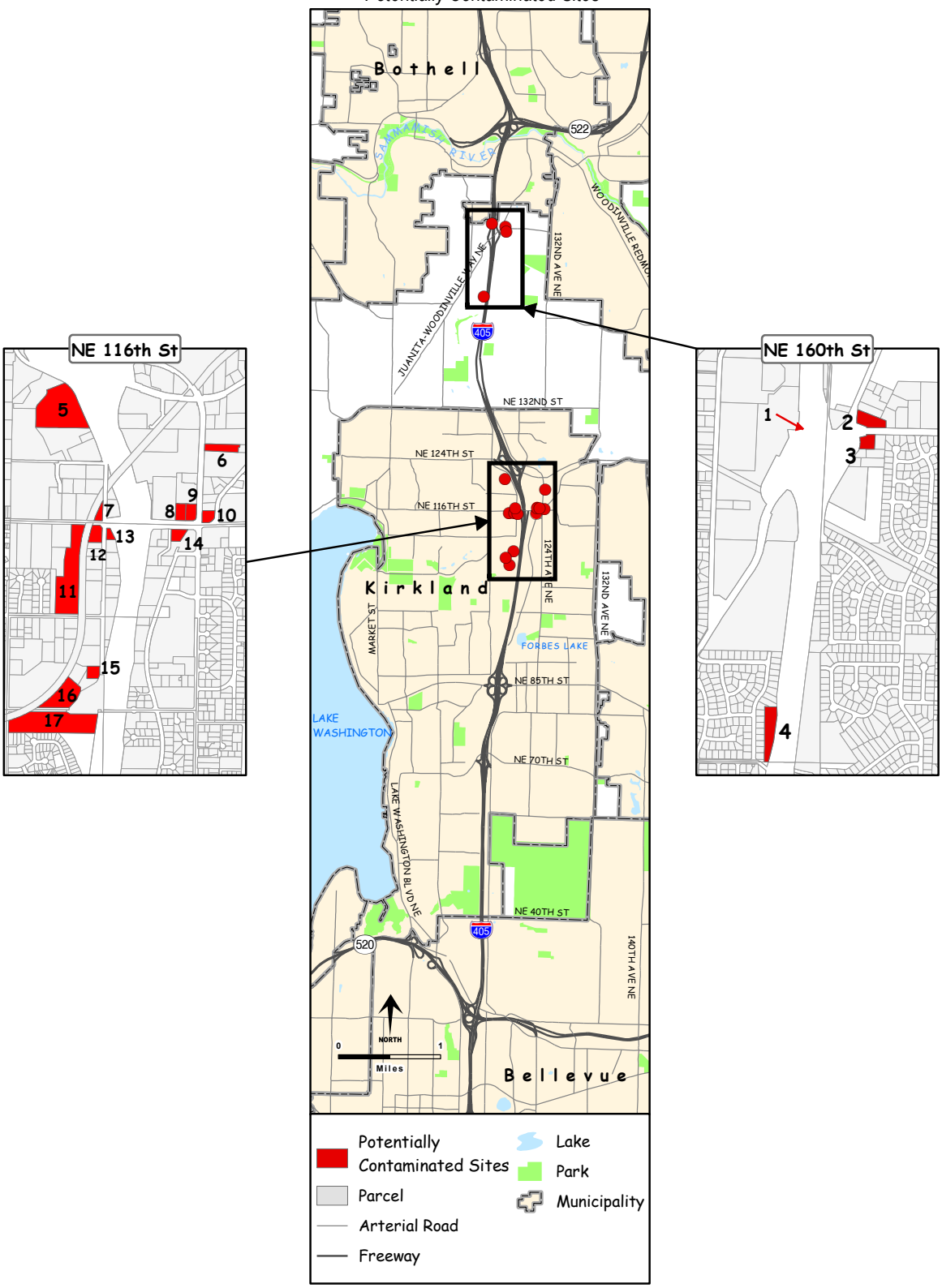
"Reasonably predictable" properties refer to sites with recognized environmental conditions based on existing data, or they can be predicted to have those conditions based on site observations, previous experience, or by using best professional judgment. Common examples of reasonably predictable sites might include a dry cleaning business or a former gas station. These properties are typically small; contaminants are localized and are relatively non-toxic; and abatement or remediation activities are routine.

small-quantity generators (less than 220 pounds of hazardous waste per month). Additionally, six of the 17 properties may contain asbestos-containing materials or lead-based paint (ACM/LBP), based on the age of the structures located on the properties.

Exhibit 5-49: Reasonably Predictable Properties

Map ID No.	Property
1	I-405 and NE 160th Street Exit SB
2	Texaco #632321469/ Star Mart #120531/Shell Oil Products
3	Chevron USA Products 93299
4	Residence
5	Fred Meyer Totem Lake
6	Buchan Brothers Investment Property
7	Quality Transmission, Inc.
8	Eschem Automotive Inc./ Bel Kirk Body Shop Inc. DBA Clarks Wheel
9	Ultra 1-Hr Cleaners
10	ARCO Facility/CYJ Inc.
11	Stericycle of Washington, Inc. Transfer Facility
12	John Coleman
13	Eastside Petroleum Co., Inc.
14	Exxon #7 3640/Tosco 0314730113/BP Service Station 03147/Conoco Phillips Co 2603147
15	Cascade Structures, Inc.
16	Weathervane Windows/Vander Hoek Corporation
17	Pacific Systems/ Tel Tone

Exhibit 5-50
Potentially Contaminated Sites



Spills are infrequent along I-405 in the project area. Between 2002 and 2004, there were only 19 spills involving a total of 161 gallons. These spills consisted of motor/hydraulic oil (21 gallons), diesel (70 gallons), class A firefighting foam (10 gallons), paint (150 gallons), and gasoline (10 gallons).

Will the project affect any hazardous materials sites?

At least two hazardous materials sites have been identified within the project right of way.

During construction, the contractor will comply with all applicable environmental rules and regulations as described in the Kirkland Nickel project description (see Chapter 4). Despite measures to manage risks associated with hazardous materials, spills can occur or unknown contaminants can be encountered. These materials can result in short-term contamination to the environment before avoidance actions can be taken.

What measures are proposed to avoid or minimize effects from hazardous materials during construction?

Known or Suspected Contamination within the Project Right of Way

- The contractor will prepare a spill prevention control and countermeasure (SPCC) plan that provides specific guidance for managing contaminated media that may be encountered within the right of way.
- WSDOT may be responsible for the remediation and monitoring of contaminated properties that will be acquired for this project. In such cases, WSDOT will further evaluate the identified properties to assess their condition before acquisition or construction occurs.
- Prior to construction, the contractor will have a thorough asbestos containing materials/lead-based paint (ACM/LBP) building survey completed by a certified building inspector on all property structures that will be acquired and/or demolished.
- If WSDOT acquires a portion or all of a property (building, structure) suspected of containing ACM/LBP, the contractor will properly abate and dispose of any existing ACM and LBP contamination prior to construction activities. Depending on the

concentration of lead in the demolition debris, some debris may need to be disposed of as dangerous waste, which will require Ecology to be notified and that appropriate regulations are followed.

- If the contractor encounters an underground storage tank (UST) within the right of way, WSDOT will assume cleanup liability for the appropriate decommissioning and removal of the UST. If this occurs, WSDOT and the contractor will follow all applicable rules and regulations associated with UST removal activities.
- Construction waste material, such as concrete or other harmful materials' disposal/treatment, will take place at approved sites.
- WSDOT may acquire the responsibility for cleanup of any soil or groundwater contamination encountered during construction within WSDOT right of way. Contamination will be evaluated relative to Model Toxics Control Act (MTCA) cleanup levels.
- The contractor will be required to meet all regulatory conditions imposed at contaminated properties (e.g., Consent Decree) associated with construction. These conditions could include ensuring that the surrounding properties and population are not exposed to the contaminants on the site; i.e., the contractor will ensure that the site is properly contained after construction is completed so that contaminants do not migrate offsite and so that the health and safety of all on-site personnel are protected during work at the site.
- WSDOT will consider entering into a pre-purchaser's agreement for the purposes of indemnifying WSDOT against acquiring the responsibility for any long-term cleanup and monitoring costs.

Known or Suspected Contamination Outside of the Project Right of Way

- Contaminated groundwater originating from properties located up-gradient of the right of way could migrate to the project area. WSDOT generally will not incur liability for groundwater contamination that has migrated into the project footprint as long as

the agency does not acquire the source of the contamination. However, WSDOT will manage the contaminated media in accordance with all applicable rules and regulations.

Unknown Contamination

- If WSDOT acquires a property that has unknown contamination, the agency could incur liability for any contamination discovered after acquisition, as well as liability for the removal of any stored materials remaining onsite at the time of the acquisition. WSDOT could be responsible for cleanup or disposal of these unknown substances, for example, USTs and contaminated media (including ACM and LBP). If unknown contamination is discovered during construction, the contractor will follow the SPCC plan as well as all appropriate regulations.

Worker and Public Health and Safety

The contractor will comply with the following regulations and agreements:

- State Dangerous Waste Regulations (Chapter 173-303 WAC);
- Safety Standards for Construction Work (Chapter 296-155 WAC);
- National Emission Standards for Hazardous Air Pollutants (NESHAP) (Code of Federal Regulations, Title 40, Volume 5, Parts 61 to 71);
- General Occupational Health Standards (Chapter 296-62 WAC); and
- Implementing Agreement between Ecology and WSDOT Concerning Hazardous Waste Management (April 1993).

Hazardous Materials Spills During Construction

- The contractor will prepare and implement a SPCC plan to minimize or avoid effects on soil, surface water, and groundwater as described in Chapter 5.9, Water Resources.