3 May 2005

SR 520 Bridge Replacement and HOV Project Draft EIS

Appendix J

Indirect and Cumulative Effects

Discipline Report

Washington State Department of Transportation

Sound Transit

U.S. Department of Transportation
Federal Highway Administration

SR 520 Bridge Replacement
and HOV Project Draft EIS

Indirect and Cumulative Effects

Discipline Report

Prepared for

Washington State Department of Transportation
Federal Highway Administration
Sound Transit

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Acronyms and Abbreviations

BRT	Bus Rapid Transit
EIS	Environmental Impact Statement
FAZ	Forecast Analysis Zone
FHWA	Federal Highway Administration
GMA	Growth Management Act
HOV	high-occupancy vehicle
MOHAI	Museum of History and Industry
mph	miles per hour
NEPA	National Environmental Policy Act
NOAA	National Oceanic and Atmospheric Administration
NRHP	National Register of Historic Places
PSRC	Puget Sound Regional Council
vph	vehicles per hour
WSDOT	Washington State Department of Transportation

Introduction

What are indirect and cumulative effects and why are they considered in an EIS?

The National Environmental Policy Act (NEPA) requires that an EIS include an assessment of indirect and cumulative effects. NEPA defines indirect effects as effects:

> which are caused by the action and are later in time or farther removed in distance, but are still reasonably foreseeable. Indirect effects may include growth-inducing effects and other effects related to induced changes in the pattern of land use, population density or growth rate, and related effects on air and water and other natural systems, including ecosystems (40 CFR Section 1508.8).

NEPA defines cumulative effects as:

> the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time (40 CFR Section 1508.7).

As defined above, "actions" include construction of other transportation or development projects, such as a highway interchange, a light rail route, a housing subdivision, or an office park.

This report considers the indirect and cumulative effects of the SR 520 Bridge Replacement and HOV Project to show, as clearly as possible, how the proposed project could affect the regional transportation system, local communities, and the ecosystem over time.

What are the key points of this report?

During the twentieth century, man altered the natural resources of the Puget Sound region through various public works projects and increasing urbanization. The most substantial changes to the natural environment in the project area were the diversion of the Cedar River and construction of the Lake Washington Ship Canal. While these public works projects were beneficial to the economic development of the region, they also shifted fish migration routes from the rivers to a manmade connection to Puget Sound and changed the characteristics of the aquatic habitat.

Before World War II, residential and commercial uses in the region were concentrated in Seattle. After the war, the Eastside experienced a population and economic boom fueled by the national trend toward suburbanization. The Lake Washington Pontoon Bridge (the forerunner of the Homer M. Hadley and Lacey V. Murrow I-90 floating bridges) replaced the Lake Washington ferry runs and facilitated the move to the suburbs. During the last quarter of the twentieth century, population and employment growth on the Eastside outstripped that of Seattle, and urbanization crept farther into formerly agricultural and undisturbed natural areas.

The Puget Sound Regional Council's (PSRC's) *Destination 2030* provides a plan for the region (Snohomish, King, Pierce, and Kitsap counties) over the next 30 years (PSRC 2001). Population in the region is expected to increase from approximately 3.2 million to nearly 4.7 million. Employment will increase from 1.9 million jobs to 2.6 million jobs. Growth will be focused in established urban growth areas, which will become more densely developed. Density will also increase in the communities adjacent to the urban growth areas, but to a lesser extent.

A population and employment forecasting model was used to identify redistribution of the 2030 population and employment from the No Build Alternative to the 4-Lane and 6-Lane Alternatives in the PSRC's four-county region. (Snohomish, King, Pierce, and Kitsap counties comprise the four-county region, which is the study area for this cumulative and indirect effects analysis.) One forecast was done to assess indirect effects based on the transportation network used for the transportation analysis presented in Appendix R, *Transportation Discipline Report.* The other forecast was used to evaluate potential cumulative effects and was based on a set of reasonable foreseeable regional and local high-priority transportation projects.

Forecasts for both indirect and cumulative effects showed minor differences from the distribution of population and employment for the No Build Alternative to their redistribution under either the 4-Lane or the 6-Lane Alternative. Under the indirect scenario, the differences would range from an increase of less than 1 percent to a decrease of less than 0.5 percent. For the cumulative scenario the range would be similar: less than a 1 percent increase to a 0.75 percent decrease. The alternatives did show a slight difference in where population and employment growth may occur under both scenarios; however, the differences were minor.

Under the indirect scenario, the 4-Lane Alternative would primarily direct population and employment growth to the northeast and east of Lake Washington, including southern Snohomish County. Similar to the 4-Lane Alternative, the 6-Lane Alternative would direct some population and employment growth to the north and northeast of Lake Washington and southern Snohomish County. The increases in population and employment in these areas, however, would be less under the 6-Lane Alternative than the 4-Lane Alternative. Instead, under the 6-Lane Alternative, the Seattle area north of the Ship Canal and portions of Kitsap and Pierce counties on the west side of Puget Sound would experience a slight redistribution of population and employment. The difference between the No Build, 4-Lane, and 6-Lane Alternatives would be negligible.

Under the cumulative scenario, the 4-Lane Alternative would distribute employment growth in a north-south pattern, primarily extending from the eastern developable areas of Snohomish and King counties, and throughout Pierce County. Compared to the No Build Alternative, population and employment growth under the 6-Lane Alternative would tend toward the center of the study area. Development in urbanized areas of Pierce County, such as Tacoma and Lakewood, would shift to Seattle and the industrial area of Bellevue. Population and employment growth in less developed areas of Snohomish, King, and Pierce counties that did not stay in those counties would shift to Kitsap County.

Given the small variation from the No Build Alternative to the 4-Lane and 6-Lane Alternatives, the project would have very little, if any, indirect and cumulative effects on local communities and the ecosystem. In other words, the forecasted distribution of population and employment growth without the project would not be noticeably different from the distribution of population and employment growth that could occur under either of the build alternatives.

What are the project alternatives?

The SR 520 Bridge Replacement and HOV Project area comprises neighborhoods in Seattle from I-5 to the Lake Washington shore, Lake Washington, and Eastside communities and neighborhoods from the Lake Washington shore to 124th Avenue Northeast just east of I-405. Exhibit 1 shows the general location of the project. Neighborhoods and communities in the project area are:

- Seattle neighborhoods—Portage Bay/Roanoke, North Capitol Hill, Montlake, University District, Laurelhurst, and Madison Park

- Eastside communities and neighborhoods—Medina, Hunts Point, Clyde Hill, Yarrow Point, Kirkland (the Lakeview neighborhood), and Bellevue (the North Bellevue, Bridle Trails, and Bel-Red/Northup neighborhoods)

Exhibit 1. Project Vicinity Map

The SR 520 Bridge Replacement and HOV Project Draft EIS evaluates the following three alternatives and one option:

- No Build Alternative
- 4-Lane Alternative
  - Option with pontoons without capacity to carry future high capacity transit
- 6-Lane Alternative

Each of these alternatives is described below. For more information, see the *Description of Alternatives and Construction Techniques Report* contained in Appendix A of this EIS.

What is the No Build Alternative?

All EISs provide an alternative to assess what would happen to the environment in the future if nothing were done to solve the project's identified problem. This alternative, called the No Build Alternative, means that the existing highway would remain the same as it is today (Exhibit 2). The No Build Alternative provides the basis for measuring and comparing the effects of all of the project's build alternatives.

This project is unique because the existing SR 520 bridges may not remain intact through 2030, the project's design year. The fixed spans of the Portage Bay and Evergreen Point bridges are aging and are vulnerable to earthquakes; the floating portion of the Evergreen Point Bridge is vulnerable to wind and waves.

In 1999, the Washington State Department of Transportation (WSDOT) estimated the remaining service life of the Evergreen Point Bridge to be 20 to 25 years based on the existing structural integrity and the likelihood of severe windstorms. The floating portion of the Evergreen Point Bridge was originally designed for a sustained wind speed of 57.5 miles per hour (mph), and was rehabilitated in 1999 to withstand sustained winds of up to 77 mph. The current WSDOT design standard for bridges is to withstand a sustained wind speed of 92 mph. In order to bring the Evergreen Point Bridge up to current design standards to withstand at least 92 mph winds, the floating portion must be completely replaced.

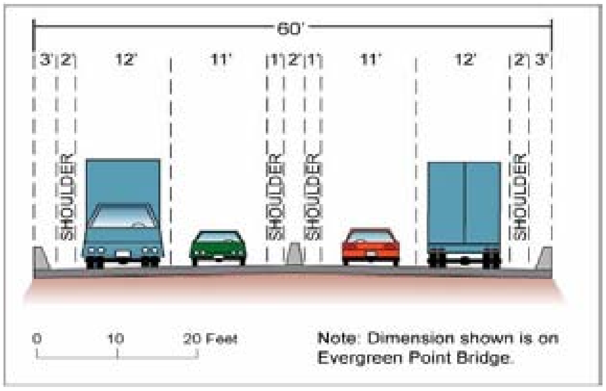


Exhibit 2. No Build Alternative

The fixed structures of the Portage Bay and Evergreen Point bridges do not meet current seismic design standards because the bridge is supported on hollow-core piles. These hollow-core piles were not designed to withstand a large earthquake. They are difficult and cost prohibitive to retrofit to current seismic standards.

If nothing is done to replace the Portage Bay and Evergreen Point bridges, there is a high probability that both structures could fail and become unusable to the public before 2030. WSDOT cannot predict when or how these structures would fail, so it is difficult to determine the actual consequences of doing nothing. To illustrate what could happen, two scenarios representing the extremes of what is possible are evaluated as part of the No Build Alternative. These are the Continued Operation and Catastrophic Failure scenarios.

Under the Continued Operation Scenario, SR 520 would continue to operate as it does today as a 4-lane highway with nonstandard shoulders and without a bicycle/pedestrian path. No new facilities would be added and no existing facilities (including the unused R.H. Thompson Expressway Ramps near the Arboretum) would be removed. WSDOT would continue to maintain SR 520 as it does today. This scenario assumes the Portage Bay and Evergreen Point bridges would remain standing and functional through 2030. No catastrophic events (such as earthquakes or high winds) would be severe enough to cause major damage to the SR 520 bridges. This scenario is the baseline the EIS team used to compare the other alternatives.

In the Catastrophic Failure Scenario, both the Portage Bay and Evergreen Point bridges would be lost due to some type of catastrophic event. Although in a catastrophic event, one bridge might fail while the other stands, this Draft EIS assumes the worst-case scenario—that both bridges would fail. This scenario assumes that both bridges would be seriously damaged and would be unavailable for use by the public for an unspecified length of time.

What is the 4-Lane Alternative?

The 4-Lane Alternative would have four lanes (two general purpose lanes in each direction), the same number of lanes as today (Exhibit 3). SR 520 would be rebuilt from I-5 to Bellevue Way. Both the Portage Bay and Evergreen Point bridges would be replaced. The bridges over SR 520 would also be rebuilt. Roadway shoulders would meet current standards (4-foot inside shoulder and 10-foot outside shoulder). A 14-foot-wide bicycle/pedestrian path would be built along the north side of SR 520 through Montlake, across the Evergreen Point Bridge, and along the south side of SR 520 through Medina, Hunts Point, Clyde Hill, and Yarrow Point to 96th Avenue Northeast, connecting to Northeast Points Drive. Sound walls would be built along much of

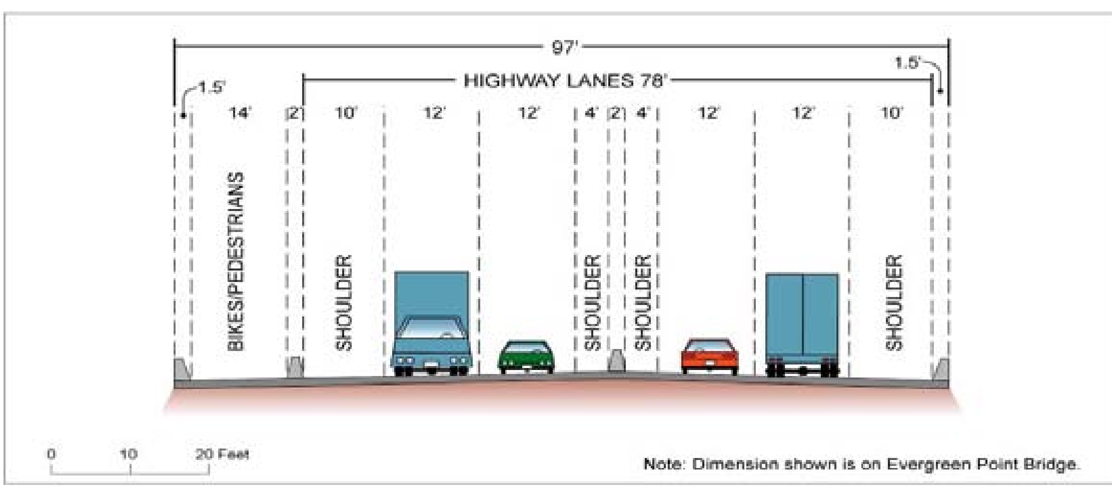


Exhibit 3. 4-Lane Alternative

SR 520 in Seattle and the Eastside. This alternative also includes stormwater treatment and electronic toll collection.

The floating bridge pontoons of the Evergreen Point Bridge would be sized to carry future high-capacity transit. An option with smaller pontoons that could not carry future high-capacity transit is also analyzed. The alternative does not include high-capacity transit.

A bridge operations facility would be built underground beneath the east roadway approach to the bridge as part of the new bridge abutment. A dock to moor two boats for maintenance of the Evergreen Point Bridge would be located under the bridge on the east shore of Lake Washington.

A flexible transportation plan would promote alternative modes of travel and increase the efficiency of the system. Programs include intelligent transportation and technology, traffic systems management, vanpools and transit, education and promotion, and land use as demand management.

What is the 6-Lane Alternative?

The 6-Lane Alternative would include six lanes (two outer general purpose lanes and one inside HOV lane in each direction; Exhibit 4). SR 520 would be rebuilt from I-5 to 108th Avenue Northeast in Bellevue, with an auxiliary lane added on SR 520 eastbound east of I-405 to 124th Avenue Northeast. Both the Portage Bay and Evergreen Point bridges would be replaced. Bridges over SR 520 would also be rebuilt. Roadway shoulders would meet current standards (10-foot-wide inside shoulder and 10-foot-wide outside shoulder). A 14-foot-wide bicycle/pedestrian path would be built along the north side of SR 520 through Montlake, across the Evergreen Point Bridge, and along

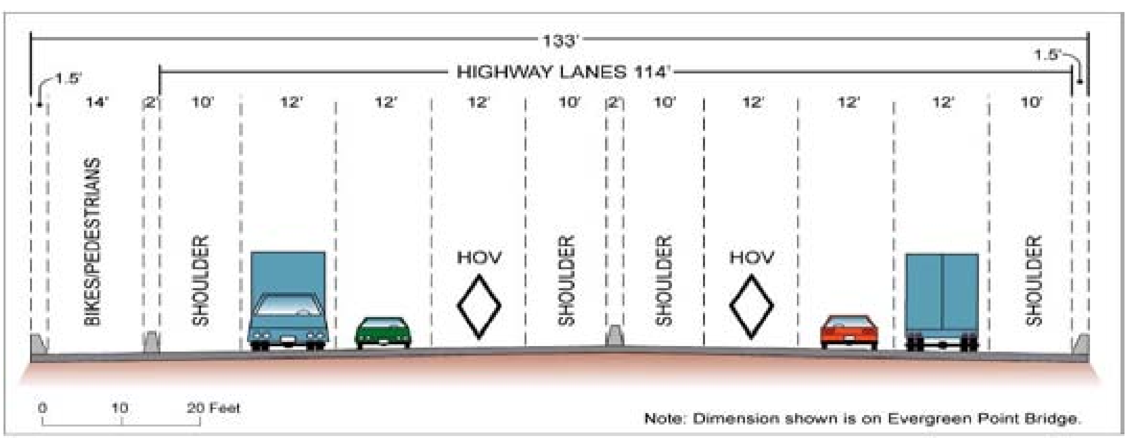


Exhibit 4. 6-Lane Alternative

the south side of SR 520 through the Eastside to 96th Avenue Northeast, connecting to Northeast Points Drive. Sound walls would be built along much of SR 520 in Seattle and the Eastside. This alternative would also include stormwater treatment and electronic toll collection.

This alternative would also add five 500-foot-long landscaped lids to be built across SR 520 to help reconnect communities. These communities are Roanoke, North Capitol Hill, Portage Bay, Montlake, Medina, Hunts Point, Clyde Hill, and Yarrow Point. The lids are located at 10th Avenue East and Delmar Drive East, Montlake Boulevard, Evergreen Point Road, 84th Avenue Northeast, and 92nd Avenue Northeast.

The floating bridge pontoons of the Evergreen Point Bridge would be sized to carry future high-capacity transit. The alternative does not include high-capacity transit.

A bridge operations facility would be built underground beneath the east roadway approach to the bridge as part of the new bridge abutment. A dock to moor two boats and maintain the Evergreen Point Bridge would be located under the bridge on the east shore of Lake Washington.

A flexible transportation plan would promote alternative modes of travel and increase the efficiency of the system. Programs would include intelligent transportation and technology, traffic systems management, vanpools and transit, education and promotion, and land use as demand management.

Affected Environment

How was the information collected?

The indirect and cumulative effects discipline team gathered information about past projects that have influenced development in the project area communities. We used a variety of historical resources, including History Ink/History Link (2004), an online encyclopedia of Seattle, King County, and Washington State history; the Seattle Post-Intelligencer’s Webtowns (2004); and the University of Washington (2004a).

We contacted local jurisdictions (Seattle, Medina, Hunts Point, Clyde Hill, Yarrow Point, Kirkland, and Bellevue) to find out about pending permits or reasonably foreseeable plans for street improvements, development, or redevelopment within approximately 1/4 mile of the proposed project. We reviewed and identified projects listed in the University of Washington master plan semi-annual report (University of Washington 2004b). We reviewed transportation and capital improvement plans, and contacted regional and state transportation departments to compile a list of future transportation projects.

What are the historic and existing characteristics of the project area?

Development in the study area has been shaped by the geography of Lake Washington and how transportation routes to and across the lake have changed over time. Exhibit 5 provides a pictorial overview of the historical development of the project area.

Pre-World War II

Prior to approximately 1870, Native Americans would portage their canoes between Portage Bay in Lake Union and Union Bay in Lake Washington at the narrow point of the isthmus separating the bays. Around 1870, a small canal was constructed at this location to move logs between the two waterbodies. People also used this canal to travel between Lake Union and Lake Washington by canoe. In 1917, King County built the Montlake Cut as part of the Lake Washington Ship Canal and Hiram M. Chittenden Locks (Ballard Locks) project. This enabled people to travel by boat from Lake Union to Lake Washington.

Before 1900, people crossed Lake Washington by canoe or private boats. A public ferry service began in 1900 that supplemented the private boats carrying travelers across the lake. Until 1912, the Cedar River flowed into the Black River, which flowed into the Duwamish River and out into Puget Sound. After serious flooding in Renton in 1911, the Cedar River was diverted away from the Black River and into Lake Washington. The Cedar River now comprises more than half of the inflow to the lake.

Construction of the Ship Canal and the Ballard Locks dramatically changed Lake Washington. In 1916, a temporary dam at Portage Bay was breached, lowering the water level in the lake by 9 feet and allowing water from Lake Washington to enter Lake Union. When the water level dropped, water from Lake Washington ceased to feed the Black River, causing the lake's natural outlet to Puget Sound to dry up. This event caused massive fish mortality and destruction of fish habitat and migration corridors because the river dried up quickly, stranding the fish and leaving them to die in the remaining pools of water.

Construction of the Ship Canal and diversion of the Cedar River shifted fish migration routes from the rivers to a manmade canal connection to Puget Sound. Other habitat characteristics also changed: the shallow waters of Lake Washington were lost and seasonal flooding stopped; the buffer and shade provided by shoreline trees and vegetation and the complexity of the habitat (substrate, large woody debris, pool frequency and quality, off-channel habitat, and refugia) were greatly modified or diminished, including the loss of approximately 1,300 acres of shoreline wetlands; and water quality, species diversity, and natural production decreased. These changes caused a loss of spawning, foraging, and rearing habitat, as well as protective cover for juveniles; altered migratory corridors; and possibly increased exposure to predators.

Residential development started in the Seattle neighborhood of Montlake during the 1900s. The Alaskan-Yukon-Pacific Exposition held in 1909 at the site of the University of Washington campus spurred on that development, which continued through the 1920s. In 1925 the Montlake Bridge opened, spanning the Montlake Cut. The Great Depression halted commercial and residential development; however, during the 1930s the U.S. government constructed many of the Arboretum's historical features (e.g., the Stone Cottage and Azalea Way), the National Oceanic and Atmospheric Administration (NOAA) Northwest Fisheries Science Center North Campus, and the Montlake Playfield.

Substrate is the material upon or within which a plant or animal lives or grows.

Large woody debris refers to branches or tree trunks located in a stream channel. Large woody debris is important because it provides excellent cover to hide and forms pools, which are the best fish habitats.

For more information about fish and vegetation in the project area, see Appendix E, *Ecosystems Discipline Report*.

Homesteaders first populated the Eastside during the 1890s. Farming was the predominant occupation during the first half of the 1900s, with strawberries a popular crop. The region's wealthy found the waterfront property along the eastern shore of Lake Washington an attractive place to build, especially Medina, which acquired the name Gold Coast. These shoreline properties gained land when Lake Washington's water level dropped in 1916. For most of the first half of the 1900s, the Eastside remained predominately rural.

Post-World War II

In 1940, the Lake Washington Pontoon Bridge was built along the route of today's I-90 bridges (the Homer M. Hadley and Lacey V. Murrow floating bridges), ushering in a new era of regional travel. Before that time, ferries had been the only way to cross the lake. With the time required to cross the lake cut dramatically, the communities on the

Seattle	Lake Washington	Eastside

Before 1900

Seattle

Prior to 1916 only a small ditch and later a small canal connected Lake Union's Portage Bay and Lake Washington's Union Bay.

Lake Washington

Lake Washington's outlet was at the south end of the lake near the Black River.

Ferry service started across Lake Washington.

Eastside

NOTE: Eastside includes Bellevue, Kirkland, Medina, Hunts Point, Yarrow Point, and Clyde Hill.

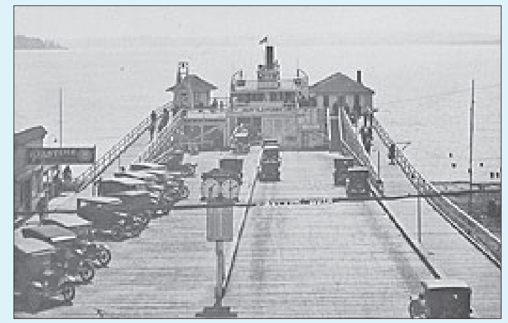
Homesteaders began to settle in Bellevue, Hunts Point, Yarrow Point, Clyde Hill, and Kirkland.

Before World War II

Seattle

In 1916, the dam separating Portage Bay and Union Bay was broken, creating the Montlake Cut.

Lake Washington

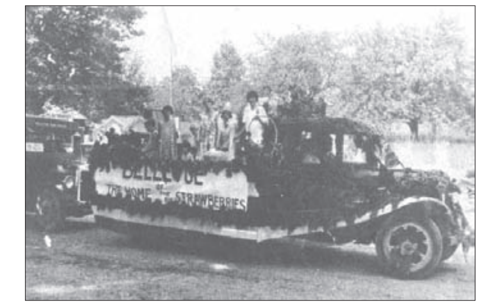


Lake Washington's water level dropped 9 feet in 1916 during construction of the Montlake Cut and Ship Canal.

The lake's connection to the Black River was disrupted, causing the river to dry up.

Ferries and boats continued to be the only means to cross Lake Washington.

Eastside



Following the opening of the Ship Canal, Bellevue's Meydenbauer Bay was used as off-season moorage for whaling ships.

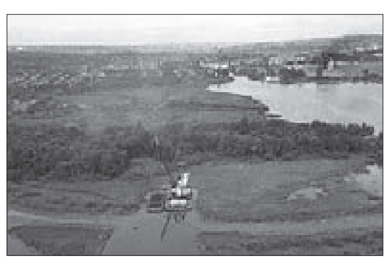
Strawberry farming was a popular livelihood.

After World War II

Seattle

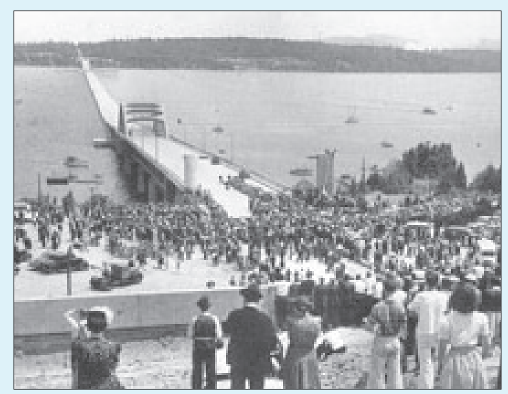
By the end of World War II, much of the Montlake neighborhood was built out.

Construction of SR 520 cut through the Montlake neighborhood and Portage Bay.



Construction crews cut away vegetation to clear a path for the Evergreen Point Bridge near Foster Island.

Lake Washington



Lake Washington Floating Bridge (Lacey V. Murrow) opened in 1940. It was the first roadway connection across Lake Washington.

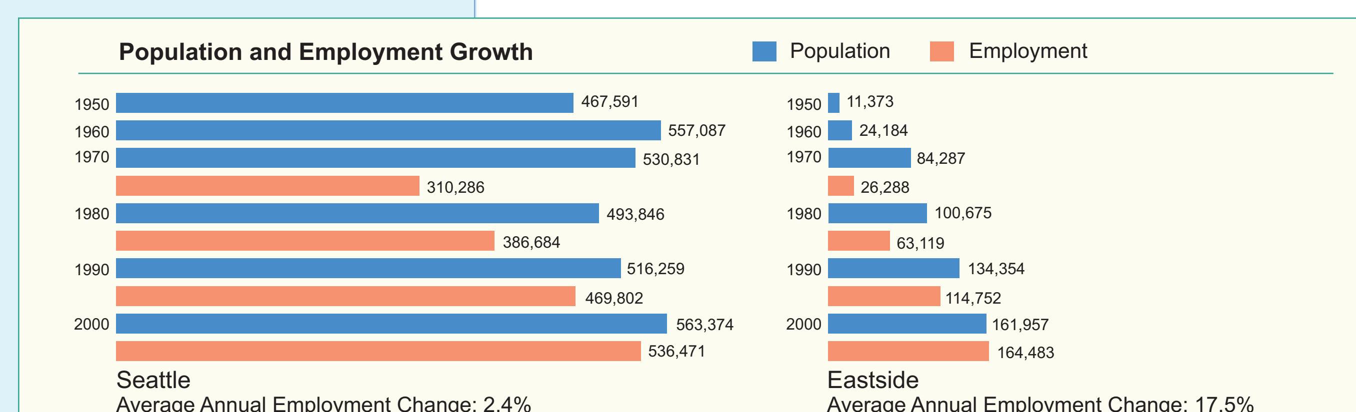
Evergreen Point Bridge opened in 1963.

Eastside

The first Eastside shopping center, Bellevue Square, opened in 1946, replacing strawberry fields.

More people moved to the Eastside to live, but continued to work in Seattle.

Eastside communities incorporated during the 1950s to have a more direct voice in their land use development.



Last Quarter of 20th Century

Seattle

The amount of development at the University of Washington and in downtown Seattle grew through the 1980s and 1990s.

Lake Washington

Homer M. Hadley Floating Bridge (I-90) parallel to the Lacey V. Murrow Floating Bridge opened in 1989.

The Nisqually earthquake in 2001, as well as a barge collision with a bridge pier in 2000, spurred efforts to replace the Evergreen Point Bridge.

Eastside

The Eastside communities of Bellevue, Kirkland, and Redmond attracted commercial and industrial development.

From 1970 to 2000 Eastside employment grew an average of 17.5 percent per year, while Seattle employment grew 2.4 percent.

With the widespread employment growth on the Eastside, a reverse commute developed: some Seattle residents now travel to Eastside suburbs for work.

Sources: U.S. Bureau of Census (1952b). Photographs reproduced by permission from Historylink.org; University of Washington Libraries, Special Collections, UW4290, UW1871, UW18399; Museum of History & Industry, Seattle; Eastside Heritage Center, and WSDOT.

Exhibit 5. **Historical Overview of the Project Area**

SR 520 Bridge Replacement and HOV Project

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Eastside became attractive residential choices for people working in downtown Seattle. Fueled by the postwar economic boom, Seattle followed the trend of cities nationwide, with an increasing number of families moving into the auto-oriented suburbs. Medina, Hunts Point, Clyde Hill, Yarrow Point, and Bellevue incorporated in the 1950s in response to the growing development pressures and the desire to control that development. Kirkland incorporated much earlier in 1905.

As shown on Exhibit 5, from 1950 to 1960, the Eastside population (Medina, Hunts Point, Clyde Hill, Yarrow Point, Bellevue, and Kirkland) more than doubled in size, increasing from 11,373 to 24,184. The decade from 1960 to 1970 saw even greater growth, with the Eastside population growing by nearly 2.5 times from 24,148 to 84,287. Like the Eastside, Seattle grew from 1950 to 1960 but at a much smaller rate, growing less than 20 percent from 467,591 to 557,087. From 1960 to 1970, Seattle lost nearly 5 percent of its population (Andriot 1983; U.S. Bureau of Census 1952a, b; 1963; 1973).

The Evergreen Point Bridge and SR 520 probably contributed to the rapid growth of the Eastside. Built between August 1960 and August 1963, the bridge is 1.4 miles long and crosses from the Montlake neighborhood in Union Bay to Evergreen Point in Medina. Construction of SR 520 from I-5 to Union Bay divided the Montlake neighborhood and removed a number of acres from the Washington Park Arboretum, eliminating fish and wildlife habitat.

Urbanization of the project area has diminished the quality and amount of fisheries and wildlife habitat. As Seattle and the Eastside urbanized after World War II, the number of manmade structures such as bulkheads, bridge structures, and piers in the lake proliferated. This urbanization generally decreased habitat complexity (uniform stream channels and simple nonfunctional riparian areas), impeded and blocked fish passage, increased surface water runoff, and decreased water quality and quantity (USFWS 1998). The effects of urbanization on water quality tended to occur more in the lower reaches of streams, affecting migratory corridors and spawning and rearing habitat for most salmonid species (USFWS 1998).

Lake Washington's water quality was greatly affected by other human activities during the 1950s through the 1970s. In 1955, oceanographer George Anderson discovered a blue-green alga (*Oscillatoria rubescens*) in the lake. Phosphorus from sewage discharged into Lake Washington fostered growth of this alga. Researchers determined that continued growth of the algae would have detrimental effects on the lake's water quality (King County 2004). A September 1958 ballot established Metro to create a sewerage system that would divert sewage from Lake Washington. Two treatment plants, 100 miles of pipes, and 10 years later, the rate of sewage discharge into Lake Washington declined from 20 million gallons per day to 0, reduced phosphorous concentrations from 70 to 16 parts per billion, and increased lake transparency from 30 inches to 17 to 20 feet.

The Last Quarter of the Twentieth Century

From 1970 to 2000, population and employment growth on the Eastside has outstripped Seattle's, increasing the number of vehicles crossing the Evergreen Point Bridge and changing travel patterns. The Eastside population increased by 48 percent between 1970 and 2000, while the Seattle population increased by 6 percent (U.S. Bureau of Census 1982a,b; 1993; 2004). The increase in employment was even more dramatic than the increase in population. During the same time period, the number of Eastside jobs grew 626 percent, compared to 73 percent in Seattle (Exhibit 5). With employment growth on the Eastside exceeding growth in Seattle, traffic across Lake Washington is now heavy in both directions throughout the day. On SR 520, traffic volumes have been virtually equal in both directions since the late 1980s. In fact, since 1993, peak afternoon traffic volumes have been slightly higher westbound than eastbound. According to Chapter 4 of Appendix R, *Transportation Discipline Report*, the p.m. peak period traffic volumes across the Evergreen Point Bridge are currently 4,020 vehicles westbound and 3,580 eastbound.

Now over 40 years old, the Evergreen Point Bridge carries more traffic than it was originally designed to handle. By the time the last toll was collected in 1979, 16 years after the bridge was first opened, four times as many cars and trucks as planned were crossing the bridge each day. By 1988, that number had increased to seven times the original figure, and the bridge had become one of the state's worst traffic bottlenecks. Opening of the parallel Homer M. Hadley Floating Bridge on I-90 in 1989 provided additional traffic capacity, but not enough to offset the growth in traffic across the lake.

By 2001, WSDOT's and the region's concerns about the Evergreen Point Bridge were no longer limited to its carrying capacity, but to its safety as well. The floating portion of the Evergreen Point Bridge is nearing the end of its life because the pontoons will not be able to support the weight of any future retrofitting. Furthermore, the Nisqually earthquake in February 2001 highlighted the seismic vulnerability of the region's aging transportation facilities, including the Portage Bay Bridge and the west and east approach spans of the Evergreen Point Bridge.

How is the region expected to change by 2030?

The PSRC's *Destination 2030* provides a plan for the region (Snohomish, King, Pierce, and Kitsap counties) over the next 30 years (PSRC 2001). Population in the region is expected to increase from approximately 3.2 million to nearly 4.7 million. Employment will increase from 1.9 million jobs to 2.6 million jobs. Growth will be focused to established urban growth areas, which will become more densely developed. Density will also increase in the communities adjacent to the urban growth areas but to a lesser extent. The projected change in population and employment densities from 2000 to 2030 is shown in Exhibit 6. In 2000, most of the communities within the region's urban growth areas had a population and employment density of 1,000 or more residents and jobs per square mile. By 2030, the number of communities with more than 1,000 residents and jobs per square mile will increase. The communities that change from less than 1,000 to more than 1,000 residents and jobs per square mile are adjacent to the urbanized core of the region.

The proportion of the region's population living in the four counties will change slightly, as shown in Exhibit 7.

The final environmental impact statements for Vision 2020 and its 1995 update (PRSC 1995a, b) anticipates that up to 400 square miles of open space land will be converted to urban uses. Vision 2020 also predicted that negative effects on wetlands, wildlife habitat, and vegetation in areas that are currently rural would be less than they would without the establishment of the current urban growth area boundaries. Groundwater and surface water resources will be similarly affected.

What development projects are proposed in the project area?

This section describes the development projects that have been planned and permitted in the project area as of April 2004. The term "development" refers to the construction of new residential, commercial, industrial, and civic projects and does not refer to new transportation projects, which are discussed in the next section.

Seattle

Since January 2003, Seattle has not issued any permits for new development within the project area (City of Seattle 2004a,b). The only known potential project could be the relocation of the Museum of History and Industry (MOHAI) to downtown Seattle, which is anticipated for 2007 at the earliest. Currently, the museum tentatively plans to use the old building for storage and possibly lectures and to share the facility with community groups. The Arboretum and Botanical Garden Committee also proposes to use the old MOHAI building. In the Washington Park Arboretum Master Plan (University of Washington 2003), the committee identifies the old MOHAI building as a possible location for 4,000 square feet of needed office space. The master plan, however, also acknowledges the possibility that the facility may not be available and offices may need to be found elsewhere in the future (University of Washington 2004b).

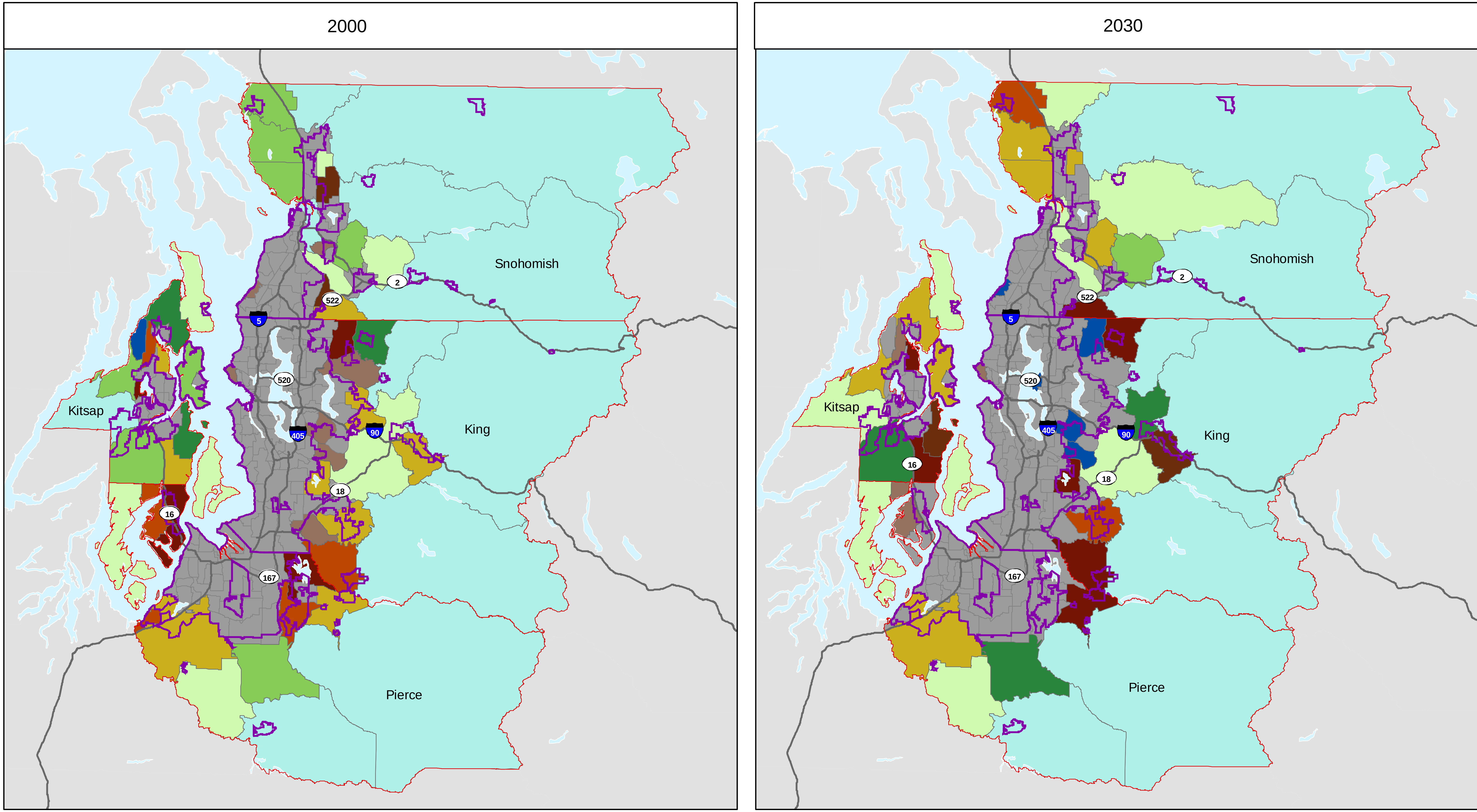
None of the University of Washington’s potential development sites identified in its master plan are near the project area (University of Washington 2004b).

Lake Washington

No new development is planned for Lake Washington.

Eastside

Medina, Hunts Point, Clyde Hill, and Yarrow Point do not anticipate any future development other than the construction of new single-family homes on the few remaining vacant lots in the communities and the demolition of single-family homes to be replaced by larger homes; currently, approximately six homes are under construction (Kellings pers. comm. 2004, McKenzie pers. comm. 2004, Howard pers. comm. 2004, Newbill pers. comm. 2004). Kirkland issued a permit for the redevelopment of the Linbrook Office Park at 3700 Lake Washington Boulevard; the current 105,000-square-foot office building will be replaced with a 300,000-square-foot building over the next 4 to 5 years (Regala pers. comm. 2004, City of Kirkland 2004). Bellevue reported that the city is not aware of any future development plans in the project area that do not currently have a permit (Porco pers. comm. 2004). Only one permitted project is located in the project area—Buchan



Population and Employment Density Per Square Mile

- 0 - 100
- 101 - 200
- 201 - 300
- 301 - 400
- 401 - 500
- 501 - 600
- 601 - 700
- 701 - 800
- 801 - 900
- 901 - 1,000
- 1,001 - 180,000

- Urban Growth Boundaries
- Counties Boundary Area
- Community Planning Area Boundary (FAZ)

Source: Puget Sound Regional Council (2004 b).

N

0 5 10 20 Miles

Exhibit 6. **Comparison of Population and Employment Density per Square Mile in 2000 and 2030 without SR 520 Improvements**

SR 520 Bridge Replacement and HOV Project

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Exhibit 7. Current and Future Regional Population Proportions

	2000		2030	
County	Population	% Population in Region	Population	% Population in Region
Snohomish	0.6 million	18	1.1 million	23
King	1.7 million	53	2.1 million	45
Pierce	0.7 million	21	1.1 million	24
Kitsap	0.2 million	7	0.4 million	8
Total	3.2 million		4.7 million	

Commercial Building at 11555 Northup Way. This project will demolish a 9,000-square-foot building and construct a 17,700-square-foot multi-tenant building (City of Bellevue 2004).

What transportation projects are proposed in the project area?

This section describes the regional transportation projects that we are evaluating for this cumulative effects analysis. In addition to these regional transportation projects, our analysis takes into account transportation projects planned by the project area communities. Attachment 1 lists the regional and local projects that have been included in the cumulative analysis. We are considering these future projects in the cumulative effects analysis because NEPA requires an analysis that accounts for the incremental effect of a proposed project when added to other past, present, and reasonably foreseeable future projects.

Seattle

North Link Light Rail Project

This project would extend Central Link light rail service, currently under construction, from downtown Seattle to Northgate. On May 20, 2004, the Sound Transit Board identified the preferred route, profiles, and station locations for the North Link project. The Board is expected to select a final route in summer 2005, with construction starting as early as 2007, and operations scheduled to begin between 2013 and 2015. The route identified by the Sound Transit Board travels north via a tunnel alignment from the Downtown Seattle Transit Tunnel to stations serving First Hill and Capitol Hill. The tunnel route then crosses the Ship Canal via the Modified Montlake Route with cut-and-cover crossover track and a station at Husky Stadium. The light rail tunnel would pass approximately 140 feet underneath the SR 520 right-of-way at Montlake Boulevard (Exhibit 8). From Husky Stadium, the preferred route travels north to Northgate via the University District and the Roosevelt area. Alternative routes for the Roosevelt area north of the University District are currently under consideration.

The tunnel route near SR 520 would also have an emergency vent facility at East Roanoke Street and 22nd Avenue East (Hop-In Market site) in the Montlake neighborhood to meet operational and system requirements.

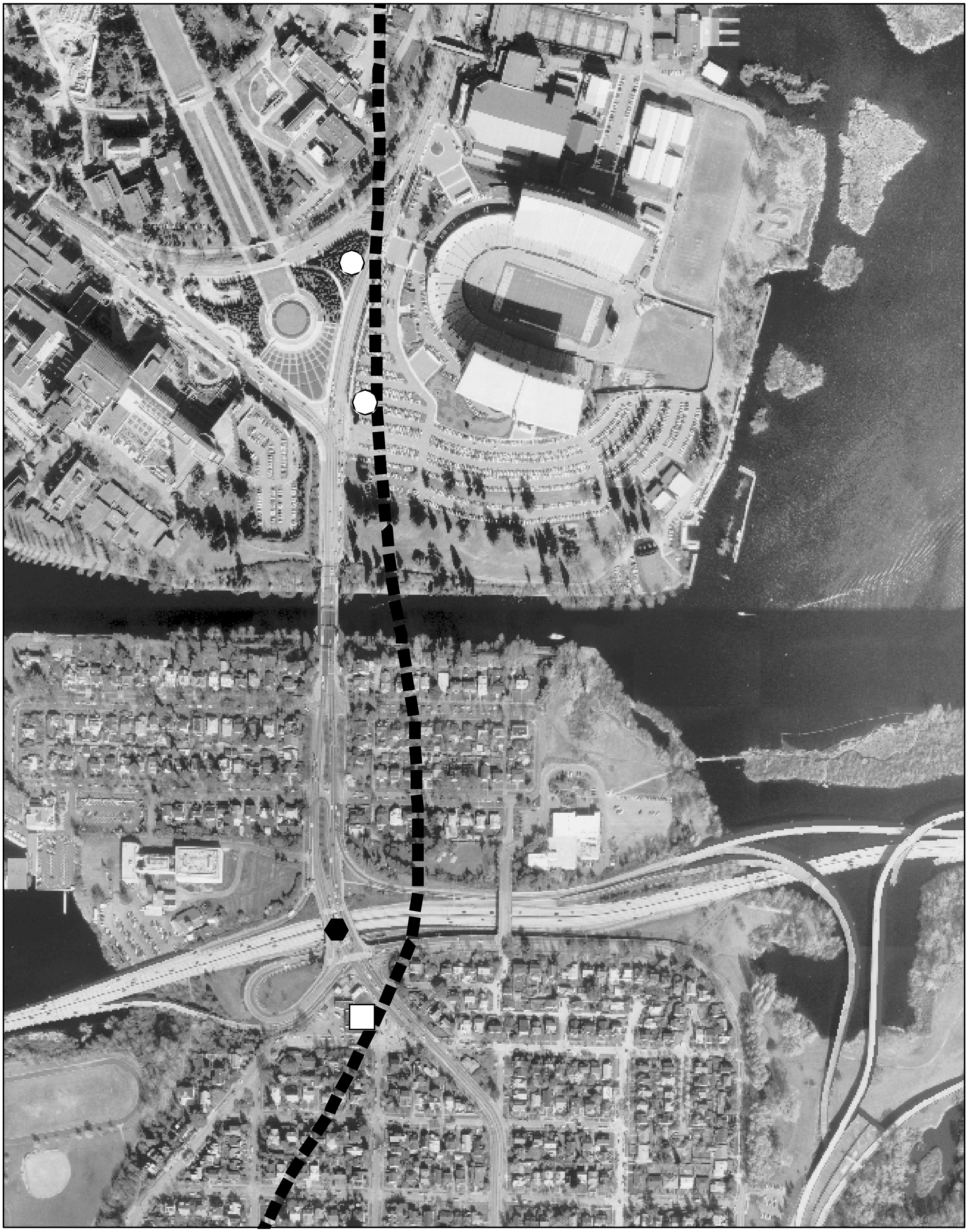
Alaskan Way Viaduct

This project, which extends from South Spokane Street to Ward Street north of the Battery Street tunnel, would replace the aging and deteriorating Alaskan Way Viaduct and waterfront seawall in downtown Seattle and improve SR 99 to the north and south of the viaduct. In January 2005, WSDOT and the city of Seattle agreed on the Alaskan Way Tunnel as the Preferred Alternative. WSDOT expects to complete the environmental review process in mid-2007. Construction is anticipated to start in mid-2009 (WSDOT 2004a) if funding becomes available.

Seattle, Lake Washington, and Eastside

I-90 Two-Way Transit and HOV Operations Project

Currently the HOV lanes on I-90 between Seattle and Bellevue operate in a reversible configuration, westbound in the a.m. and eastbound in the p.m. Under the I-90 R-8A project, HOV lanes will be added on the outer roadways, providing dedicated HOV lanes in both directions at all times. The reversible center roadway operation will be retained. A Draft EIS was issued on the I-90 project in April 2003. After agency and public review, the I-90 Steering Committee identified R-8A as the preferred alternative. The Sound Transit Board identified Alternative R-8A as the preferred alternative in November 2003. The Final EIS was issued on May 21, 2004. A Record of Decision was issued on the project on September 28, 2004, by the Federal Highway Administration. The preferred alternative, R-8A, will add HOV lanes on the outer roadways by narrowing the existing lanes and shoulders. Sound Transit plans to initiate construction in early 2006, with construction to be completed as funds are secured.



Approximate Location of North Link Emergency Vent Shaft

Approximate Locations of North Link Stadium Station Entrances

Approximate Location of new SR 520/Montlake Blvd Interchange

Approximate Location of North Link Tunnel

N

0 250 500 Feet

Exhibit 8. **Relationship between SR 520 and North Link Project Elements**

SR 520 Bridge Replacement and HOV Project

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Sound Transit Light Rail on I-90

The Regional Transit Long-Range Vision, prepared by Sound Transit, proposed an extensive rail transit system across the region along major travel corridors, including a line along I-90 from downtown Seattle to downtown Bellevue with branches to Redmond and Issaquah (Sound Transit 1996). These potential light rail alignments were analyzed as part of the Trans-Lake Washington Project, the precursor to the SR 520 Bridge Replacement and HOV Project (Trans-Lake Executive Committee 2002). As a result of that analysis, the Trans-Lake Executive Committee endorsed supporting the current Sound Transit Long-Range Vision that places fixed guideway transit in the I-90 corridor (Sound Transit 1996). Sound Transit is currently updating its Long-Range Vision (now called the Long-Range Plan) and anticipates issuing a Final Supplemental EIS in support of the Long-Range Plan by spring 2005. Adoption of a revised Long-Range Plan will follow the issuance of the Final Supplemental EIS.

Sound Transit is also in the early stages of planning for the next phase of regional transit improvements, which includes examining high-capacity technologies on I-90 to Bellevue and beyond. The technologies include bus rapid transit and fixed guideway (light rail and monorail). In spring 2005, the Sound Transit Board will select the alternative to be pursued for project-level analysis as part of its adoption of the Long-Range Plan, based on technical and environmental analysis and public and agency input.

Eastside

I-405 Congestion Relief and Bus Rapid Transit Projects—Phase I

The I-405 Master Plan proposes multimodal improvements to the freeway, transit system, and arterials along the I-405 corridor, stretching from Tukwila to Lynnwood (WSDOT 2004b). These improvements will occur in phases because the total project cost exceeds approximately $11 billion. Phase I, known as the Nickel Projects, adds a general purpose lane to sections of the freeway that have the most congested traffic: Kirkland from SR 520 to SR 522,[1] Bellevue from 8th Avenue

[1] The Sound Transit 128th Direct Access project complements the Kirkland Nickel project. The 128th Direct Access project began construction in 2004 and will rebuild the Northeast 116th Street interchange. Stage 1 will provide an additional northbound and southbound lane from Northeast 85th Street to Northeast 124th Street. Stage 2 will provide an additional northbound lane from Northeast 70th Street to Northeast 85th Street, as well as an additional southbound lane from SR 522 to Northeast 124th Street and from Northeast 85th Street to SR 520.

Southeast to I-90, and Renton from the West Valley Highway to the Maple Valley Highway. WSDOT anticipates construction from 2007 through 2011. If funding becomes available, the I-405 corridor could see construction of Phase II, the implementation plan, over the next 10 to 15 years. The improvements would provide a continuous multimodal corridor from I-5 in Tukwila to SR 522 in Bothell, adding general purpose lanes on I-405 and SR 167, a bus rapid transit line with stations, HOV direct access ramps, park-and-ride lots, bus services, and an expanded vanpool program. The remaining phase of the improvements would complete the full vision. However, the timing of this phase is very speculative and therefore has not been included in this indirect and cumulative effects analysis.

Potential Effects of the Project

What methods were used to evaluate the project's potential indirect and cumulative effects?

The SR 520 Bridge Replacement and HOV Project could affect the timing of planned growth; therefore, the pattern of development in 2030 could be different depending on the alternative. The following methodology considers the effects of development of the project alternatives by themselves (indirect effects), and the effects of the project alternatives combined with other past, present, and reasonably foreseeable development and transportation projects (cumulative effects).

To predict the differing development patterns, the discipline team used PSRC's DRAM/EMPAL model to forecast the location of population and employment growth in the region for each alternative under an indirect scenario and a cumulative scenario. We mapped the redistribution of development (increases or decreases in population and employment) from the No Build Alternative to the 4-Lane and 6-Lane Alternatives for both the indirect and cumulative scenario. Following this, we did a qualitative analysis to determine the indirect and cumulative effects on built and natural resources based on the changes in the development patterns.

The changes forecast by the DRAM/EMPAL models are considered indicative of how changes in capacity on the project corridor could influence the timing of future development and provide a valid means of comparing the alternatives to each other.

The following section is a brief description of the process that we used to forecast the different patterns of development for the alternatives.

PSRC Population and Employment Model Forecast

This report uses forecasts prepared by PSRC as the baseline for its indirect and cumulative effects analysis.

A comprehensive plan is presumed to be consistent with state and regional planning requirements (PSRC 2001), unless it is challenged and appealed to a Growth Management Hearings Board.

The DRAM/EMPAL models are based on the land use and development densities allowed by the region's individual jurisdictions. These local land use regulations implement the policies of Washington's Growth Management Act (GMA) and the Vision 2020 policies agreed to by PSRC's member jurisdictions and agencies. Both the policies of Vision 2020 and the GMA are designed to assist the region in managing growth in ways that optimize the movement of goods and people, protect the environment, revitalize communities, and develop a healthy economy. The following highlights the key Vision 2020 policies and strategies for future development patterns.

- **Urban Growth Areas**: Locate development in urban growth areas to conserve natural resources and enable efficient provision of services and facilities. Within urban growth areas, focus growth in compact communities and centers in a manner that uses land efficiently, provides parks and recreation areas, is pedestrian-oriented, and helps strengthen communities. Connect and serve urban communities with an efficient, transit-oriented, multimodal transportation system. (Policy RG-1)

- **Contiguous and Orderly Development**: Coordinate provision of necessary public facilities and service to support development and to implement local and regional growth planning objectives. Provide public facilities and services in a manner that is efficient and cost-effective, and conserves resources. Emphasize interjurisdictional planning to coordinate plans and implementation activities and to achieve consistency. (Policy RC-2)

- **Regional Capital Facilities**: Strategically locate public facilities and amenities in a manner that adequately considers alternatives to new facilities (including demand management), implements regional growth planning objectives, maximizes public benefit, and minimizes and mitigates adverse impacts. (Policy RF-3)

- **Housing**: Provide a variety of choices in housing types to meet the needs of all segments of the population. Achieve and sustain an adequate supply of low-income, moderate income, and special needs housing located throughout the region. (Policy RH-4)

- **Rural Areas**: Preserve the character of identified rural areas by protecting and enhancing the natural environment, open space and recreational opportunities, and scenic and historic areas; supporting small-scale farming and forestry uses; and permitting low-density residential living and cluster development maintained by rural levels of service. Support cities and towns in rural areas as locations for a mix of housing types, urban services, cultural activities, and employment that serves the needs of rural areas. (Policy RR-5)
- **Open Space, Resource Protection, and Critical Areas**: Use rural and urban open space to separate and delineate urban areas and to create a permanent regional green-space network. Protect critical areas, conserve natural resources, and preserve lands and resources of regional significance. (Policy RO-6)

Destination 2030 provides a forecast of population and employment growth from 1998 to 2030 (PSRC 2001). PSRC forecasts regional population growth from 3,148,700 to 4,695,300, an average annual rate of 1 percent. Employment is forecasted to grow at a lesser annual rate of 0.8 percent, from 1,845,000 to 2,601,400.

The environmental effects of these policies have been analyzed in the *Final Environmental Impact Statement: Vision 2020 Growth Strategy and Transportation Plan for the Central Puget Sound Region* (PSRC 1990) and *Vision 2020 Update and Metropolitan Transportation Plan: Addendum and Final Supplemental Environmental Impact Statement (*PSRC 1995a).

PSRC created forecasts in 2004 of the population and employment for its four-county region (King, Kitsap, Pierce, and Snohomish counties) in 2030. (Actual changes in population and employment distribution may be different than the model indicates because comprehensive plans may change in the future.)

Taking the totals from these regional forecasts, PSRC allocated them to Forecast Analysis Zones (FAZs) using its DRAM/EMPAL models. See Exhibit 9 for a map of the FAZs. These models forecast the distribution of population and employment within the four-county area. The models predict population and job locations based on travel times from zone to zone and a set of variables about the attractiveness of each zone. The forecasts are subject to regional population and employment totals derived from the PSRC regional forecasts. PSRC's model forecasts a regional population of 4.7 million and 1.9 million jobs by 2030. In other words, the total number of people and jobs in the region remains the same under each alternative,

Forecast Analysis Zones (FAZs) are based on census tracts and blocks and generally approximate relevant boundaries such as municipal jurisdictions and community planning areas. See Exhibit 9.

including the No Build Alternative, but the population and employment distribution may vary between the alternatives.

For the indirect and cumulative effects analysis, the **study area** is PSRC's four-county region: Snohomish, King, Pierce, and Kitsap counties. The **project area** comprises neighborhoods in Seattle from I-5 to the Lake Washington shore, Lake Washington, and Eastside communities and neighborhoods from the Lake Washington shore to 124th Avenue Northeast just east of I-405.

Travel Demand Forecasts

PSRC staff input forecasted regional population and employment into their travel demand forecasting model to forecast travel times for each of the project alternatives under both the indirect scenario and the cumulative scenario.

Indirect Scenario Transportation Network

The indirect scenario includes the same baseline transportation network used in the transportation analysis done for this project (see Chapter 3 of the *Transportation Discipline Report* in Appendix R). The transportation network includes the following local Nickel Projects:

- I-405—Congestion Relief & Bus Rapid Transit (BRT) Projects
- SR 520—West Lake Sammamish Parkway to SR 202–Add Lanes

A full description of baseline transportation network can be found in the *Final Year 2030 No-Action Definition Memorandum* (WSDOT 2003).

Cumulative Scenario Transportation Network

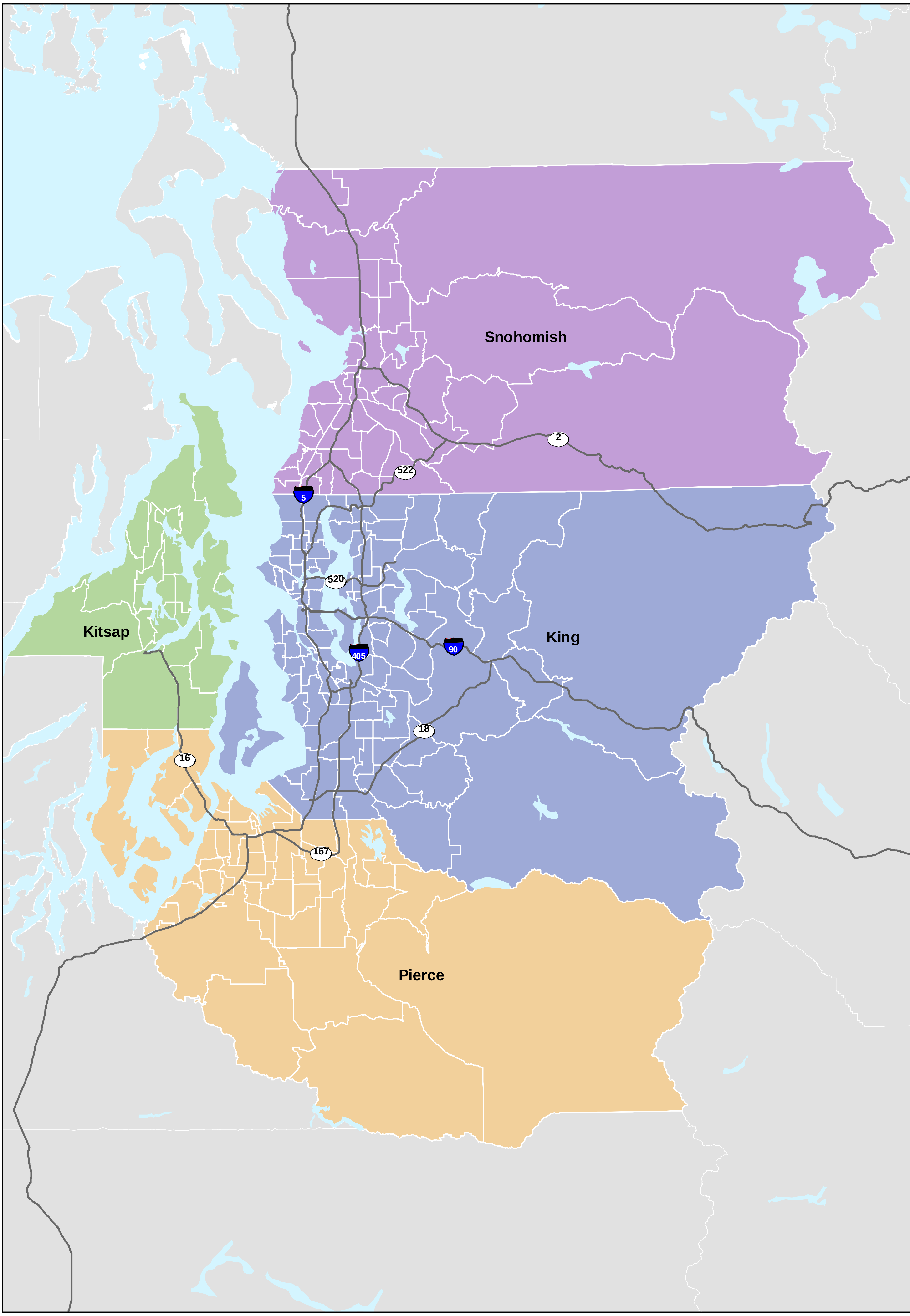
As noted previously, a cumulative effects analysis considers the project when added to other past, present, and reasonably foreseeable future actions. Therefore, the transportation network for the cumulative scenario encompasses both the projects included in the indirect scenario, including current projects, and the following reasonably foreseeable future projects:

- Regional high-priority projects (including the I-405 Corridor 10-15 Year Implementation Plan)
- High-priority local arterial projects in the project area that have either undergone or are currently undergoing some form of environmental review

Attachment 1 provides a list of these projects.

Population and Employment Reallocation

PSRC then used the DRAM/EMPAL models again to forecast the reallocation of population and employment based on the travel time results for the alternatives under both the indirect scenario and the cumulative scenario. The premise of the analysis is that people make choices about where they live and work based on travel time. The



Source: PSRC (2004a)

FAZ Boundaries by County

- King County
- Kitsap County
- Pierce County
- Snohomish County

N

0 2.5 5 10 Miles

Exhibit 9. **Forecast Analysis Zones by County**

SR 520 Bridge Replacement and HOV Project

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DRAM/EMPAL model results provide the population and employment distribution for the year 2030 for each alternative under both scenarios.

The project team took PSRC's DRAM/EMPAL model forecasts of population and employment by FAZ for the No Build, 4-Lane, and 6-Lane Alternatives and calculated the percent change from the baseline (the No Build Alternative) for each build alternative, using the following formula:

$$\frac{\text{(4-Lane Pop + 4-Lane Emp)* - (No Build Pop + No Build Emp)}}{\text{(No Build Pop + No Build Emp)}}$$

*Population and employment are combined into one amount to simplify comparisons between alternatives

Because the DRAM/EMPAL models are premised on the development permitted by local land use regulations, the redistribution of population and employment that occurs under the different scenarios reflects a change in the timing of development within an individual FAZ, and not a change in the overall amount of development anticipated to occur in that FAZ over time. The differences between the No Build Alternative and the 4-Lane and 6-Lane Alternatives do not show that one alternative would lead to more growth than another, but instead reflect how the alternatives would redistribute population and employment, which would affect the timing and distribution of development.

How does impervious surface affect surface water resources?
Impervious surfaces such as rooftops, sidewalks, roads, parking lots, and compacted urban soils prevent rain from infiltrating soils as it would naturally. These barriers shift more water into creeks and lakes, and can increase the transport of pollutants from land to adjoining surface waters.

Changes in Impervious Surface Area

We used impervious surface area as an indicator of the health of the ecosystem. The less impervious surface, generally the healthier the ecosystem will be. A number of authors (Booth and Reinelt 1993, May et al. 1997, and Brabec et al. 2002) have presented the concept that the quality of aquatic habitat is affected when a certain percentage of impervious surface, or a threshold amount of impervious surface, is exceeded (Exhibit 10).

In general, as the impervious surface area in a basin increases to approximately 10 percent, the physical habitat and aquatic community in the basin's streams show rapid decreases in quality and the numbers and species of fish and insects (May et al. 1997). When the amount of impervious surface exceeds 10 percent, habitat quality degrades at a less rapid, more constant rate. Changes in physical elements (temperature, flow, etc.) are thought to be the leading cause of observable changes in physical habitat conditions of streams (May et al.

Exhibit 10. Impervious Surface Thresholds Associated with Adverse Effects on Aquatic Habitat Features

Aquatic Habitat Features	Affected Features	Threshold for Degradation (Percent of Basin with Impervious Surface)
Biotic Diversity	Changes in vertebrate and invertebrate density and diversity	3.6 to 15%
Physical Elements	Changes in temperature, base flow, peak flow, streambank erosion, large woody debris, and sediment	4.6 to 45%
Chemical Elements	Changes in nutrients, total suspended solids, turbidity, dissolved oxygen, and metals	4.5 to 50%

Source: Adapted from Table 5 in Brabec et al. (2002).

1997). In contrast, adverse effects from increasing chemical elements are typically associated with much higher levels of impervious surface in a basin. Habitat quality starts to degrade due to chemical elements at a detectable level in basins with approximately 40 percent of the area covered by impervious surface. Habitat quality is consistently affected by increased metal concentrations in basins where the amount of impervious surface is 50 percent or higher (May et al. 1997).

Recently, researchers investigating the effects of impervious surface on aquatic habitats have observed that other basin characteristics, such as forest cover, riparian buffers, and limited hydrologic connectivity between impervious surface and water resources, can modify the threshold and magnitude of these effects (Booth et al. 2002, Brabec et al. 2002, Center for Watershed Protection 2003, Wang et al. 2001). For example, forest areas can potentially mitigate effects for other land uses associated with increases in impervious surface. The forest areas mitigate effects by slowing stormwater runoff rates and dampening stream peak flows (Brabec et al. 2002, Center for Watershed Protection 2003).

As an example of this effect, studies of salmon streams in the Puget Sound area found that high quality stream buffers could help maintain fish diversity in basins with up to 15 percent impervious surface and help maintain good aquatic insect diversity in basins with up to 30 percent impervious surface (Horner and May 1999 and Horner et al. 2001, as cited in Center for Watershed Protection 2003). Similarly, riparian buffers in Seattle watersheds had some mitigating effect in areas where impervious surface increased to 45 percent. In areas with more than 45 percent impervious surface, the riparian buffers were ineffective in further mitigating effects (Horner et al. 1997, as cited in Brabec et al. 2002). Lastly, in watersheds with moderate to high levels of impervious surface, small increases in impervious surface do not generate detectable changes in the quality of water resources (Center for Watershed Protection 2003).

When development increases, generally so does the percentage of impervious surface area. To evaluate how the redistribution of population and employment could affect impervious surface area in the project corridor, the discipline team compared the results of the DRAM/EMPAL modeling to a U.S. Geological Survey data layer that shows the types of land cover in Snohomish, King, Pierce, and Kitsap counties (Exhibit 11); urbanized areas are represented by commercial, industrial, and low and high intensity residential development. We also factored into their analysis areas that are considered not developable, which we identified based on local zoning and ordinances. The land use zones considered not developable include parks/open space, agriculture, commercial forest, and resource extraction. Land zoned commercial, industrial, mixed use, residential, tribal, government, and military is considered developable.

We then compared the current level of development to the redistributed population and employment to determine whether more or less new impervious surface might be created on developable land under each alternative scenario. Comparing the zoning and current level of development to the redistributed population and employment gives an indication of how much new impervious surface might be created on developable land under each alternative.

An increase in impervious surface in watershed basins with a currently low level of development or impervious surface is considered detrimental to stream hydrology, water quality, and Endangered Species Act–listed fish species. Population and employment increases in areas where impervious surface is already high (increasing density) would be preferred because watersheds with high levels of imperviousness are already highly degraded in terms of habitat value when compared to watersheds with lower levels of imperviousness.

What were the results of the development forecasts?

The results of the development forecasts for indirect and cumulative scenarios are described at the beginning of the following sections: *What* *are the project's indirect effects?* and *What are the cumulative effects of this project and other planned development and transportation projects?*

What are the project's indirect effects?

Under the indirect scenario, the redistribution of development in the study area from the No Build Alternative to the 4-Lane and 6-Lane Alternatives would be minimal. As shown in Exhibit 12, the amount of redistribution at the FAZ level would range from an increase of less than 1 percent to a decrease of less than 0.5 percent. Attachment 2 presents the population and employment distribution for the No Build Alternative under the indirect scenario.

Indirect effects are effects caused by the action that are later in time or farther removed in distance from the action than direct effects, but those indirect effects are still reasonably foreseeable.

The redistribution of development would vary slightly between the 4-Lane and 6-Lane Alternatives. Under the 4-Lane Alternative, forecasted population and employment growth is primarily directed to the areas east and northeast of Lake Washington, including areas in Snohomish County. This development pattern indicates that rather than crossing the Evergreen Point Bridge from the west to get to homes and businesses on the Eastside, people would be locating on the Eastside. These outlying areas have low levels of impervious surface area.

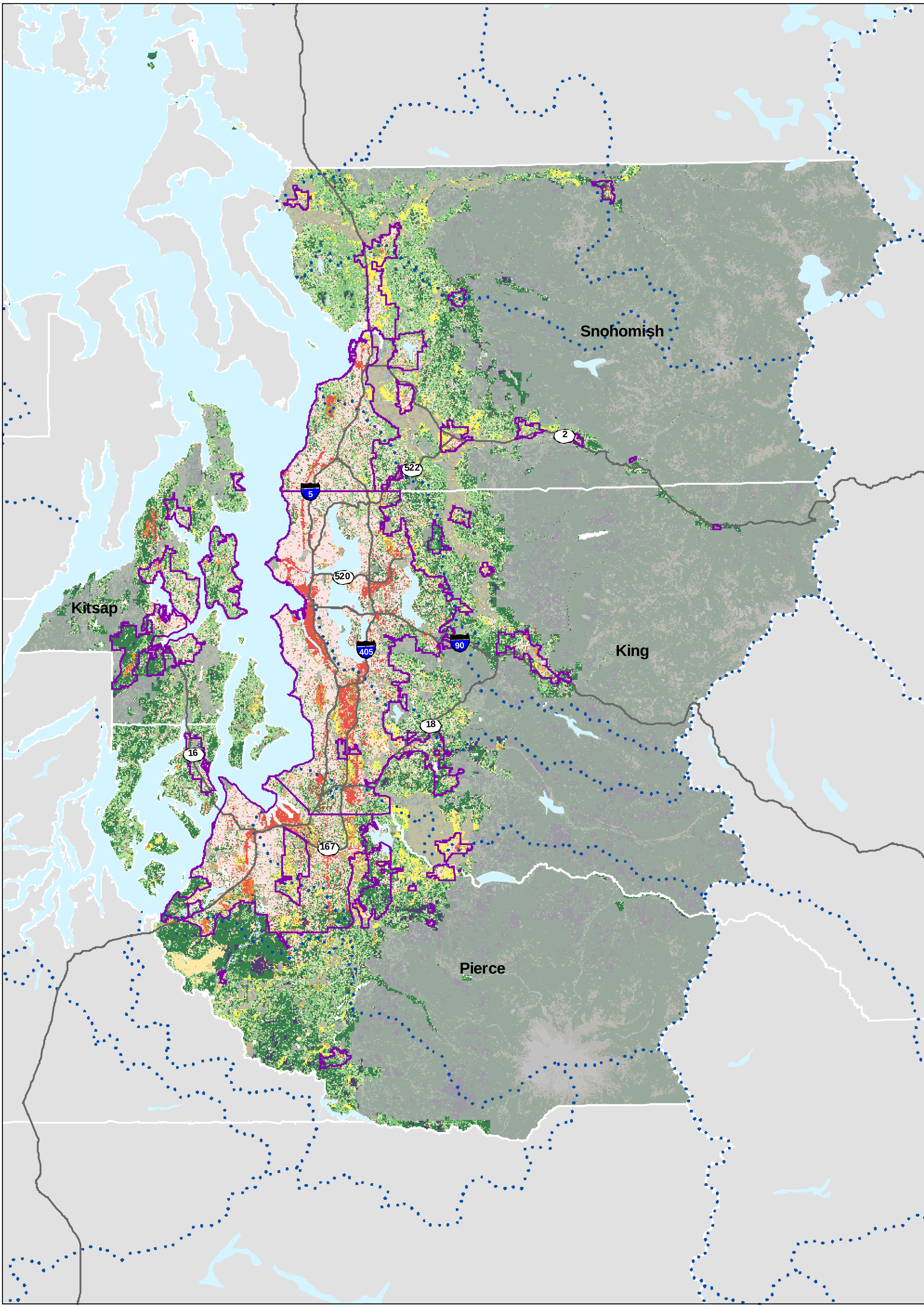
Under the 6-Lane Alternative, forecasted population and employment growth would be more evenly distributed across the middle of the study area. Population and employment growth would occur on the west side of Lake Washington, including the highly urbanized areas of north Seattle and less developed areas of Kitsap County and western Pierce County. Under the 6-Lane Alternative, people would move more easily across the Evergreen Point Bridge and apparently be willing to locate in highly developed areas on the west side of Lake Washington on the west side of Puget Sound.

Nondevelopable Lands

To indicate where population and employment growth would be unlikely to occur, land designated by local jurisdictions as park/open space, agriculture, commercial forest, and resource extraction have been identified on Exhibit 11 as nondevelopable. Growth would be expected both inside and outside the urban growth areas, but not in the nondevelopable areas.

The following sections describe the potential indirect effects of the project on the following elements of the environment:

- Land Use and Economics
- Social (including Recreation, Public Services and Utilities)
- Visual Quality and Aesthetics
- Cultural Resources
- Transportation
- Water Resources
- Wetlands
- Fish Resources



Source: USGS (1992) National Land Cover Dataset.

- Low-Intensity Residential
- High-Intensity Residential
- Commercial/Industrial/Transportation
- Bare Rock/Sand/Clay
- Quarries/Strip Mines/Gravel Pits
- Transitional
- Deciduous Forest
- Evergreen Forest
- Mixed Forest
- Shrubland
- Orchards/Vineyards
- Grasslands/Herbaceous
- Pasture/Hay
- Row Crops
- Small Grains
- Fallow
- Urban/Recreational Grasses
- Woody Wetlands
- Emergent Herbaceous Wetlands
- Urban Growth Boundaries
- Nondevelopable
- Watershed Boundaries

N

0 2.5 5 10 Miles

Exhibit 11. **Land Cover within the Puget Sound Region**

SR 520 Bridge Replacement and HOV Project

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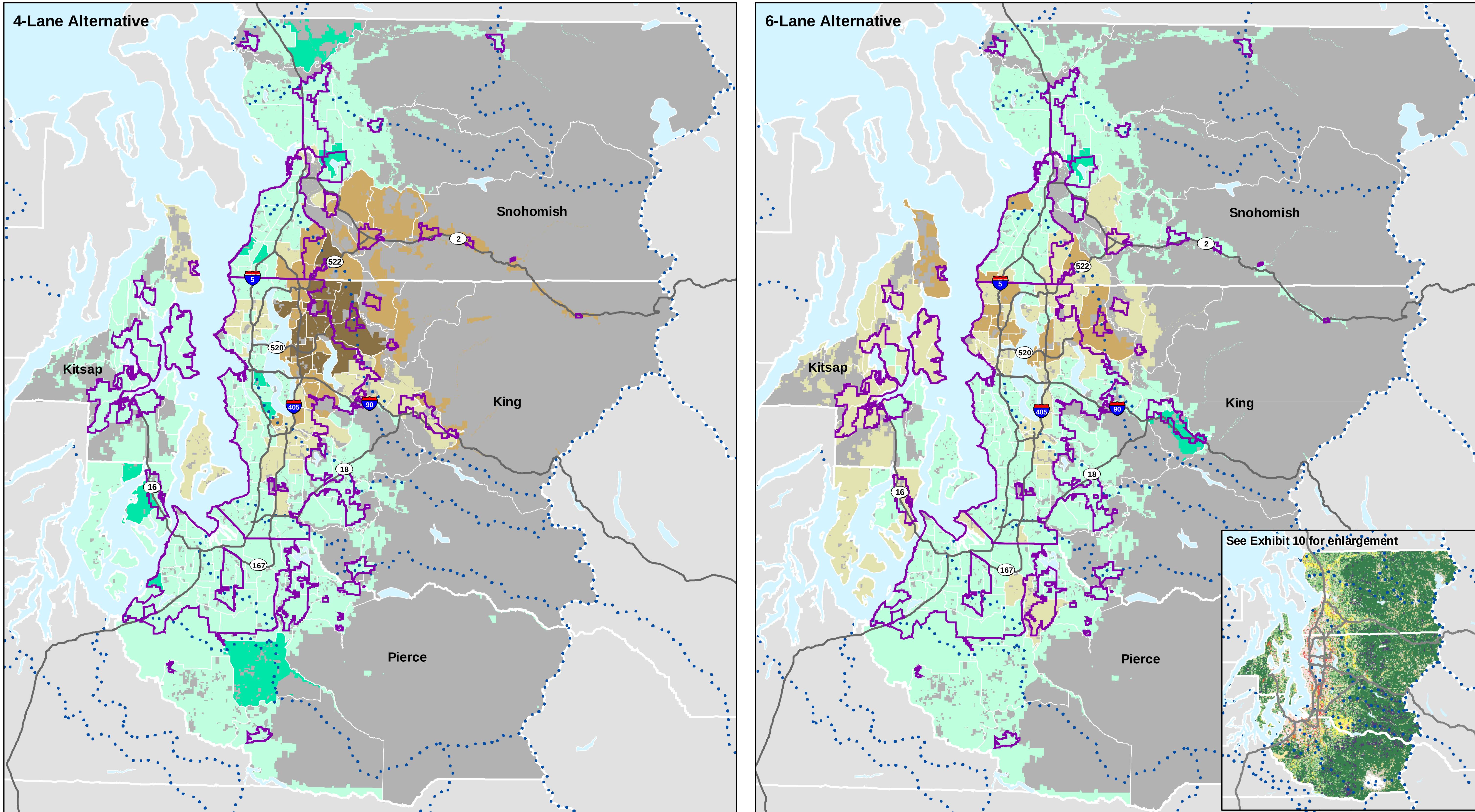

Source: PSRC (2004b) Population and Employment Forecast

Average Percent Change in Population and Employment from No Build Alternative

- -0.50% - -0.25%
- -0.25% - 0.00%
- 0.00% - 0.25%
- 0.25%- 0.50%
- 0.50% - 1.00%
- Urban Growth Boundaries
- Watershed Boundaries
- Nondevelopable

N

0 5 10 Miles

Exhibit 12. **Weighted Average Percent Change of 2030 Population and Employment by FAZ from No Build to 4-Lane and 6-Lane Alternatives —** ***Indirect Scenario***

SR 520 Bridge Replacement and HOV Project

- Wildlife and Habitat
- Geology and Soils
- Air Quality

Land Use and Economics

The GMA guides land use development in Washington. The GMA requires counties and cities to adopt comprehensive plan goals that meet the goals of the GMA. The first two planning goals of the GMA are:

- Encourage development in urban areas where adequate public facilities and services exist or can be provided in an efficient manner.
- Reduce the inappropriate conversion of undeveloped land into sprawling, low-density development.

The intent of these two goals is to maximize jurisdictions' investment in existing infrastructure and services and to protect undeveloped lands. The goals of the GMA provide the basis for assessing the indirect effects of the 4-Lane and 6-Lane Alternatives and for determining which project alternative would best achieve these goals.

Based on the 2030 population and employment forecasts, the 4-Lane and 6-Lane Alternatives generally would have limited indirect effects. Exhibit 11 shows the forecasted redistribution of population and employment from the No Build Alternative to the 4-Lane and 6-Lane Alternatives. The redistribution of population and employment would be very small throughout the study area, ranging from an increase of less than 1 percent to a decrease of 0.5 percent.

The 4-Lane Alternative would encourage more growth in the less developed outlying areas northeast and east of Lake Washington than the 6-Lane Alternative. The 6-Lane Alternative would spread the forecasted population and employment growth over more areas of the region, leading to lesser forecasted increases in population in the potentially affected areas. While the 6-Lane Alternative would direct more growth to the highly urbanized area of north Seattle, it would also direct growth to the outlying areas of Kitsap County, western Pierce County, and the area northeast of Lake Washington. Given the minor difference between the forecasted redistribution, both alternatives would have little if any indirect effects when compared to the No Build Alternative. In addition, the forecasted redistribution of population and