FINAL ENVIRONMENTAL IMPACT STATEMENT
AND FINAL SECTION 4(f) AND 6(f) EVALUATIONS
SR 520 BRIDGE REPLACEMENT AND HOV PROGRAM

MAY 2011

SR 520, I-5 to Medina: Bridge Replacement and HOV Project

Final Indirect and Cumulative Effects Discipline Report

Washington State Department of Transportation

U.S. Department of Transportation
Federal Highway Administration

SR 520, I-5 to Medina: Bridge Replacement and HOV Project Final Environmental Impact Statement and Final Section 4(f) and 6(f) Evaluations

Final Indirect and Cumulative Effects Discipline Report

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May 2011

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List of Exhibits

Acronyms and Abbreviations

APE	Area of Potential Effects
Arboretum	Washington Park Arboretum
BMP	best management practice
Btu	British thermal unit(s)
CAFE	Corporate Average Fuel Economy
CCDP	concrete containment and disposal plan
CFR	Code of Federal Regulations
CO	carbon monoxide
CO_2	carbon dioxide
DNR	Washington State Department of Natural Resources
Ecology	Washington State Department of Ecology
EIS	environmental impact statement
EPA	U.S. Environmental Protection Agency
ESA	Endangered Species Act
ETL	express toll lane
FHWA	Federal Highway Administration
GHG	greenhouse gas
GIS	geographic information system
HOT	high-occupancy toll
HOV	high-occupancy vehicle
I-5	Interstate 5
LEP	limited-English proficient
MBtu	million British thermal units
$MtCO_2e$	metric tonnes of carbon dioxide equivalent
MOHAI	Museum of History and Industry

NAAQS	National Ambient Air Quality Standards
NAC	noise abatement criteria
NEPA	National Environmental Policy Act
NOAA	National Oceanic and Atmospheric Administration
NRHP	National Register of Historic Places
PGIS	pollutant-generating impervious surface
PM	particulate matter
PSCAA	Puget Sound Clean Air Agency
PSRC	Puget Sound Regional Council
RTP	regional transportation plan
SDEIS	Supplemental Draft Environmental Impact Statement
Ship Canal	Lake Washington Ship Canal
SPCC	spill prevention control and countermeasures
SR	State Route
SR 520, I-5 to Medina project	SR 520, I-5 to Medina: Bridge Replacement and HOV Project
SR 520, Medina to SR 202 project	SR 520, Medina to SR 202: Eastside Transit and HOV Project
TCP	traditional cultural property
TESC	temporary erosion and sediment control
USACE	U.S. Army Corps of Engineers
UW	University of Washington
VMT	vehicle miles traveled
vpd	vehicles per day
WDFW	Washington Department of Fish and Wildlife
WHR	Washington Heritage Register
WRIA	Water Resource Inventory Area
WSDOT	Washington State Department of Transportation

Introduction

This discipline report describes indirect and cumulative effects expected to be associated with the proposed State Route (SR) 520, Interstate 5 (I-5) to Medina: Bridge Replacement and High-Occupancy Vehicle (HOV) Project (SR 520, I-5 to Medina project) and discusses potential mitigation measures. This report provides an update to the 2009 Indirect and Cumulative Effects Analysis Discipline Report (WSDOT 2009a).

The Introduction defines indirect and cumulative effects, explains why they are considered in an environmental impact statement (EIS), and describes the Preferred Alternative for the SR 520, I-5 to Medina project, which was developed after the Supplemental Draft Environmental Impact Statement (SDEIS) was published in January 2010. The SDEIS evaluated a No Build Alternative and Preferred Alternative with three SDEIS options (Options A, K, and L) for the Seattle portion of the SR 520 corridor. In April 2010, the Washington State Department of Transportation (WSDOT) and the Federal Highway Administration (FHWA) announced a Preferred Alternative for the 6-lane design of the SR 520 corridor. All components of the Preferred Alternative consist of design elements that were previously evaluated in the SDEIS. The Preferred Alternative incorporates refinements made in response to comments received during public review of the SDEIS.

The Approach section describes the process the project team used to identify and evaluate the indirect and cumulative effects expected to be associated with the Build and Preferred Alternatives. This approach complies with WSDOT and federal guidance (Council on Environmental Quality 1997; WSDOT et al. 2008).

The Affected Environment section provides an overview of the project vicinity, including past actions and trends in their historical context, present conditions, and other present and reasonably foreseeable actions.

The Indirect and Cumulative Effects section presents concise discussions of expected indirect and cumulative effects on the resources listed below. Unless stated otherwise, the analyses are discussed in terms of the Build Alternative, also called the project, including Options A, K, and L and the Preferred Alternative. This is because in most cases, the analysis finds that the indirect or cumulative effects would not vary sufficiently among the SDEIS options and Preferred Alternative to allow meaningful discrimination. The expected condition of the resources under the No Build Alternative serves as the basis for comparison with the Build Alternative.

The indirect and cumulative effects assessments address the following disciplines or resources:

- Water Resources
- Ecosystems (wetlands, aquatic resources, and wildlife and wildlife habitat)
- Air Quality
- Geology and Soils
- Hazardous Materials
- Recreation
- Environmental Justice
- Cultural Resources
- Transportation
- Navigation
- Land Use
- Visual Quality
- Noise
- Energy Consumption and Greenhouse Gas (GHG) Emissions
- Economic Activity
- Social Elements

The final section provides references for the sources cited in this discipline report.

What are indirect and cumulative effects?

Indirect effects (sometimes called secondary impacts or effects) result from one project but, unlike direct effects, typically involve a sequence of cause-and-effect relationships that can take time to develop and can occur at a distance from the project site. This makes some indirect effects difficult to predict accurately and usually requires a qualitative estimate more general than predictions of direct effects. The effect must also be reasonably foreseeable, which means that a prudent and reasonable person has reason to believe the event could occur.

Indirect effects (sometimes called secondary impacts or effects) are defined as effects that: "...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 1508.8).

A **cumulative effect** (also called cumulative impact) is the project's direct and indirect effects on a specified resource, combined with the effects of other past, present, and reasonably foreseeable human activities on that same resource. The assessment is also cognizant of natural events or phenomena, such as wildfires or climate change, affecting the resource. The result is the expected future condition of the resource when all of the external factors known or likely to affect it, including the project, are taken into account. Cumulative effects typically involve long-term trends in the changing status or condition of a resource.

Cumulative effects (also called cumulative impacts) are defined 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 nonfederal) 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 1508.7).

Why are indirect and cumulative effects considered in an EIS?

Federal regulations (40 Code of Federal Regulations [CFR] 1502.16, 1508.7, 1508.8) require that indirect and cumulative effects be considered in an EIS because they inform the public and decision-makers about possible unintended consequences of a project that are not always revealed by examining direct effects alone. This information places the proposed action in context with other development and transportation improvement projects planned throughout a region, and provides a brief assessment of each resource's present condition and how it is likely to change in the future as a result of the cumulative effect.

What is the SR 520, I-5 to Medina: Bridge Replacement and HOV Project?

The SR 520, I-5 to Medina project would widen the SR 520 corridor to six lanes from I-5 in Seattle to Evergreen Point Road in Medina and would restripe and reconfigure the lanes in the corridor from Evergreen Point Road to 92nd Avenue NE in Yarrow Point. It would replace the vulnerable Evergreen Point Bridge (including the west and east approach structures) and Portage Bay Bridge as well as the existing local street bridges across SR 520. The project would complete the regional HOV lane system across SR 520, as called for in regional and local transportation plans. New stormwater treatment facilities would be constructed for the project to provide stormwater treatment.

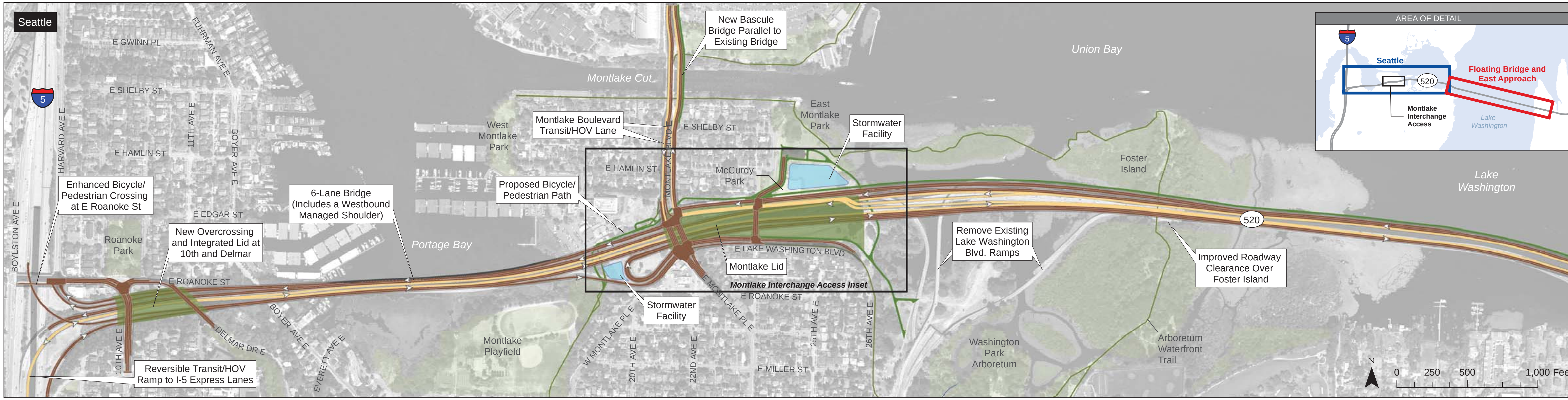
What is the Preferred Alternative?

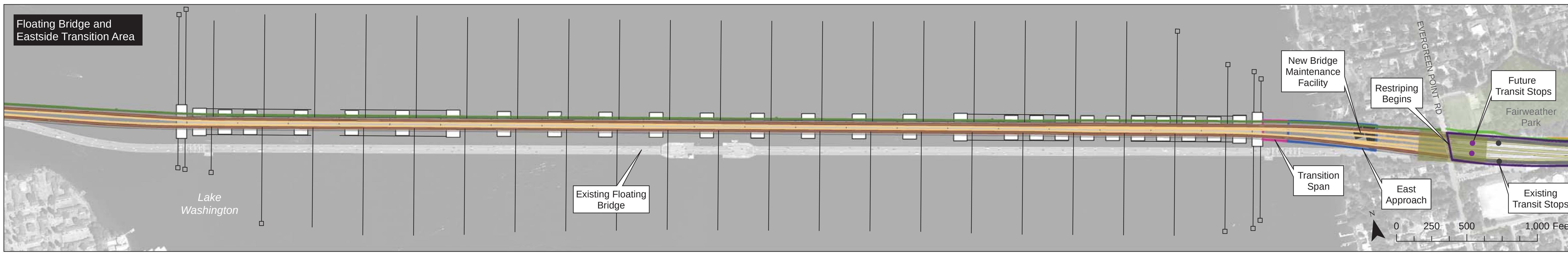
The SR 520, I-5 to Medina project SDEIS, published in January 2010, evaluated a 6-Lane Alternative with three SDEIS options (Options A, K, and L) for the Seattle portion of the SR 520 corridor, and a No Build Alternative. Since the SDEIS was published, WSDOT and FHWA announced a Preferred Alternative for the SR 520, I-5 to Medina project. All components of the Preferred Alternative were evaluated in the SDEIS, and the design of the SR 520 corridor has been further refined in response to comments received during public review of the SDEIS. The Preferred Alternative is summarized below. More information about the Preferred Alternative is provided in the Description of Alternatives Discipline Report Addendum (WSDOT 2011a).

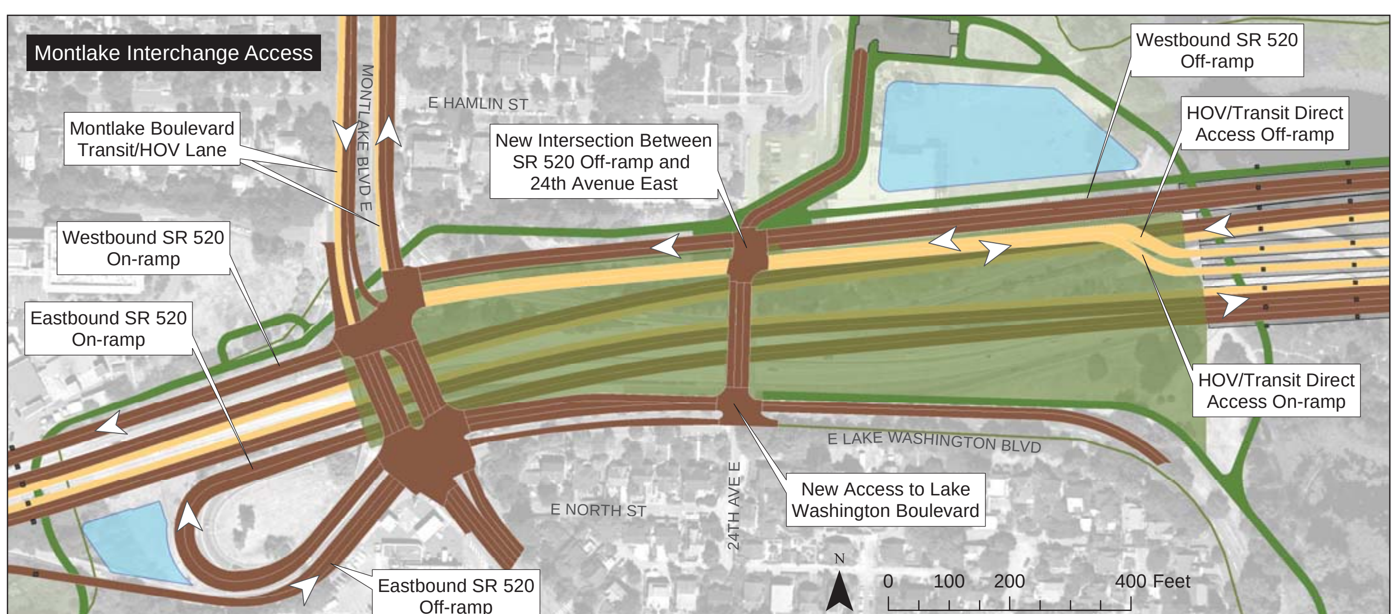
The new SR 520 corridor would be six lanes wide (two 11-foot-wide outer general-purpose lanes and one 12-foot-wide inside HOV lane in each direction), with 4-foot-wide inside shoulders and 10-foot-wide outside shoulders across the floating bridge. In response to community interests expressed during public review of the SDEIS, the SR 520 corridor between I-5 and the Montlake area would operate as a boulevard or parkway with a posted speed limit of 45 miles per hour and median planting across the Portage Bay Bridge. Exhibit 1 highlights the major components of the SR 520, I-5 to Medina project Preferred Alternative.

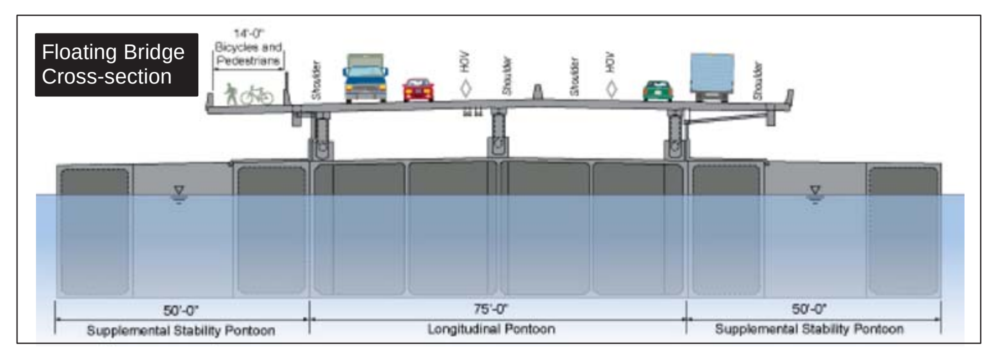
The Preferred Alternative would include design elements that would also provide noise reduction such as a reduced speed limit between I-5 and the Montlake area, 4-foot concrete traffic barriers, noise absorptive material on the inside of the traffic barriers and around the lid portals, and encapsulated bridge joints. The Preferred Alternative, like the SDEIS options, would also include quieter concrete pavement along the main line between I-5 and the floating bridge. Traffic noise modeling completed for the Final EIS resulted in fewer recommended noise walls for the Preferred Alternative than for the SDEIS options. Noise walls would meet all FHWA and WSDOT requirements for avoidance and minimization of negative noise effects. In areas where noise walls are warranted, they would only be constructed if approved by the affected communities.

The description and evaluation of the Preferred Alternative and the comparison of the Preferred Alternative to the options presented in the SDEIS are organized by three areas along the project corridor: Seattle,









I-5 to Medina Project Elements

- Column
- Anchor and Cable
- Existing Regional Bicycle/Pedestrian Path
- General-Purpose Lane
- HOV, Direct Access, and/or Transit-Only Lane
- Westbound Managed Shoulder
- Proposed Bicycle/Pedestrian Path
- East Approach
- Transition Span
- Restriping Area
- Stormwater Treatment Facility
- Lid
- Pontoon

Medina to SR 202 Project Elements

- General-Purpose Lane
- HOV Lane
- Bike Path
- Points Loop Trail
- Medina to SR 202 Project Lid

Source: King County (2006) Aerial Photo, King County (2008) GIS Data (Stream), CH2M HILL (2008) GIS Data (Park). Horizontal datum for all layers is NAD83(91); vertical datum for layers is NAVD88.

Exhibit 1. **Preferred Alternative Project Elements**

SR 520, I-5 to Medina: Bridge Replacement and HOV Project

Lake Washington, and the Eastside. Within these larger areas, project elements are described by geographic area, as identified in Exhibit 2. The project features for the Preferred Alternative are described under the geographic area headings so that the differences between the Preferred Alternative and the SDEIS options can be easily identified and compared.

Exhibit 2. Preferred Alternative and Comparison to SDEIS Options

Geographic Area	Preferred Alternative	Comparison to SDEIS Options A, K, and L
I-5/Roanoke Area	The SR 520 and I-5 interchange ramps would be reconstructed with generally the same ramp configuration as the ramps for the existing interchange. A new reversible transit/HOV ramp would connect with the I-5 express lanes.	Similar to all options presented in the SDEIS. Instead of a lid over I-5 at Roanoke Street, the Preferred Alternative would include an enhanced bicycle/pedestrian path adjacent to the existing Roanoke Street Bridge.
Portage Bay Area	The Portage Bay Bridge would be replaced with a wider and, in some locations, higher structure with six travel lanes and a 14-foot-wide westbound managed shoulder.	Similar in width to Options K and L; similar in operation to Option A. Shoulders are narrower than described in SDEIS (2-foot-wide inside shoulders, 8-foot-wide outside shoulder on eastbound lanes), posted speed would be reduced to 45 mph, and median plantings would be provided to create a boulevard-like design.
Montlake Area	The Montlake interchange would remain in a similar location as today. A new bascule bridge would be constructed over the Montlake Cut. A 1,400-foot-long lid would be constructed between Montlake Boulevard and the Lake Washington shoreline. The bridge would include direct-access ramps to and from the Eastside. Access would be provided to Lake Washington Boulevard via a new intersection at 24th Avenue East.	Interchange location similar to Option A. Lid would be 74 feet longer than previously described for Option A, and would be a complete lid over top of the SR 520 main line, which would require ventilation and other fire, life, and safety systems. Transit connections would be provided on the lid to facilitate access between neighborhoods and the Eastside. Montlake Boulevard would be restriped for two general-purpose lanes and one HOV lane in each direction between SR 520 and the Montlake Cut.
West Approach Area	The west approach bridge would be replaced with wider and higher structures, maintaining a constant profile rising from the shoreline at Montlake out to the west transition span. Bridge structures would be compatible with potential future light rail through the corridor.	Bridge profile most similar to Option L and slightly steeper; structure types similar to Options A and L. The gap between the eastbound and westbound structures would be wider than previously described to accommodate light rail in the future.
Lake Washington Area	A new floating span would be located approximately 190 feet north of the existing bridge at the west end and 160 feet north of the existing bridge at the east end. The floating bridge roadway would be approximately 20 feet above the water surface at the midspan (about 10 to 12 feet higher than the existing bridge deck).	Similar to design described in the SDEIS. The bridge would be approximately 10 feet lower than described in the SDEIS, and most of the roadway deck support would be constructed of steel trusses instead of concrete columns.
Eastside Transition Area	A new east approach for the floating bridge and a new SR 520 roadway would be constructed between the floating bridge and Evergreen Point Road.	Same as described in the SDEIS.

The differences between the Preferred Alternative and the options presented in the SDEIS include:

- Reduced the lid over I-5 to a smaller bicycle/pedestrian overcrossing
- Designed the westbound shoulder on the Portage Bay Bridge to operate as a managed shoulder that would be used as an auxiliary lane during peak commute hours
- Reduced the posted speed to 45 miles per hour in the Seattle portion of the corridor and reduced the overall footprint by narrowing the shoulders
- Reconfigured Montlake Boulevard between SR 520 and the Montlake Cut to include transit/HOV lanes
- Increased the size and length of the lid located in the Montlake area
- Reconfigured the west approach bridges (eastbound and westbound structures) to have a wider gap between them
- Lowered the roadway height on the floating bridge

Seattle

As described in the SDEIS, SR 520 would connect to I-5 in a configuration similar to the way it connects today. Improvements to the I-5/SR 520 interchange would include a new reversible HOV ramp connecting the new SR 520 HOV lanes to existing I-5 reversible express lanes. The project would include an enhanced bicycle/pedestrian crossing spanning I-5 near Roanoke Street, and landscaped lids across SR 520 at 10th Avenue East and Delmar Drive East, and in the Montlake area to help reconnect the communities on either side of the roadway.

The new Portage Bay Bridge design under the Preferred Alternative would have two general-purpose lanes and an HOV lane in each direction, plus a managed westbound shoulder. In response to community interest and public comment on the SDEIS, the width of the new Portage Bay Bridge at the midpoint has been reduced, and a planted median would separate the eastbound and westbound travel lanes. The Preferred Alternative design of the Portage Bay Bridge would operate traffic at 45 mph as a boulevard.

Under the Preferred Alternative, the SR 520 interchange with Montlake Boulevard would be similar to today's interchange, connecting to the

University District via Montlake Boulevard and the Montlake bascule bridge. A new bascule bridge would be added to Montlake Boulevard NE, parallel to the existing bridge, and Montlake Boulevard would be restriped and reconfigured between SR 520 and the Montlake Cut to include two general-purpose lanes and one HOV lane for improved transit connectivity. A large new lid would be provided over SR 520 in the Montlake area, configured for transit and bicycle/pedestrian connectivity. The lid would function as a vehicle crossing for eastbound SR 520 traffic exiting to Montlake Boulevard and Lake Washington Boulevard. The lid would also serve as a pedestrian crossing, a landscaped area, and open space. The Lake Washington Boulevard ramps and the Montlake Freeway Transit Station would be removed. Most transfers that currently take place at the freeway transit station would occur at the new multimodal transit station at Montlake Boulevard and NE Pacific Street.

The SR 520 roadway would maintain a constant slope profile rising from the east portal of the new Montlake lid, through Union Bay, across Foster Island, out to the west transition span of the Evergreen Point Bridge. This profile is most similar to the profile described in the SDEIS for Option L, but is slightly steeper for improved stormwater management.

Lake Washington

Floating Bridge

The alignment of the floating bridge is the same as evaluated in the SDEIS. The floating span would be located approximately 190 feet north of the existing bridge at the west end and 160 feet north at the east end.

The pontoon layout for the new 6-lane floating bridge is the same as evaluated in the SDEIS. The new floating bridge would be supported by 21 longitudinal pontoons, 2 cross pontoons, and 54 supplemental stability pontoons. As described in the SDEIS, the longitudinal pontoons would not be sized to carry future high-capacity transit, but would be equipped with connections for additional supplemental stability pontoons to support high-capacity transit in the future.

The new bridge would have two 11-foot-wide general-purpose lanes in each direction, one 12-foot-wide HOV lane in each direction, 4-foot-wide inside shoulders, and 10-foot-wide outside shoulders. As a result of comments on the SDEIS, the height of the bridge deck above the water would be lowered to reduce visual effects. At midspan, the floating bridge would now rise approximately 20 feet above the water, compared to approximately 30 feet for the design described in the Draft EIS and SDEIS. The roadway would be about 10 feet higher than the existing bridge deck. At each end of the floating bridge, the roadway would be supported by rows of concrete columns. The remainder of the roadway across the pontoons would be supported by steel trusses.

Bridge Maintenance Facility

The new bridge maintenance facility would be constructed as described in the SDEIS. Routine access, maintenance, monitoring, inspections, and emergency response for the floating bridge would be based out of a new bridge maintenance facility located underneath SR 520 between the east shore of Lake Washington and Evergreen Point Road in Medina. This bridge maintenance facility would include a working dock, an approximately 7,200-square-foot maintenance building, and a parking area.

Eastside Transition Area

The SR 520, I-5 to Medina project and the SR 520, Medina to SR 202: Eastside Transit and HOV Project (SR 520, Medina to SR 202 project) overlap between Evergreen Point Road and 92nd Avenue NE in Yarrow Point. Work planned as part of the SR 520, I-5 to Medina project between Evergreen Point Road and 92nd Avenue NE would include moving the Evergreen Point Road transit stop west to the lid (part of the SR 520, Medina to SR 202 project) at Evergreen Point Road, adding new lane and ramp striping from the Evergreen Point lid to 92nd Avenue NE, and moving and realigning traffic barriers for the new lane striping. The restriping would transition the SR 520, I-5 to Medina project improvements into the improvements completed as part of the SR 520, Medina to SR 202 project.

When will the project be built?

Construction for the SR 520, I-5 to Medina project is planned to begin in 2012, after project permits and approvals are received. In order to maintain traffic flow in the corridor, the project would be built in stages. Major construction in the corridor is expected to be complete in 2018. The most vulnerable structures (the floating portion of the Evergreen Point Bridge, its east and west approaches, and the Portage Bay Bridge) would be built in the first stages of construction, followed by the less vulnerable components (Montlake and I-5 interchanges).

Exhibit 3 provides an overview of the anticipated construction stages and durations identified for the SR 520, I-5 to Medina project.

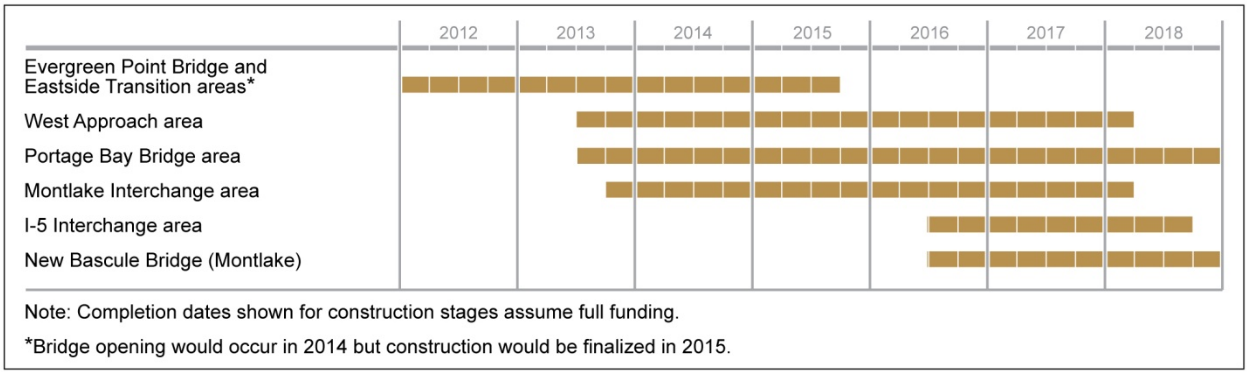


Exhibit 3. Preferred Alternative Construction Stages and Durations

A Phased Implementation scenario was discussed in the SDEIS as a possible delivery strategy to complete the SR 520, I-5 to Medina project in phases over an extended period. FHWA and WSDOT continue to evaluate the possibility of phased construction of the corridor should full project funding not be available by 2012. Current committed funding is sufficient to construct the floating portion of the Evergreen Point Bridge, as well as the new east approach and a connection to the existing west approach. The Final EIS discusses the potential for the floating bridge and these east and west "landings" to be built as the first phase of the SR 520, I-5 to Medina project. This differs from the SDEIS Phased Implementation scenario, which included the west approach and the Portage Bay Bridge in the first construction phase. Chapters 5.15 and 6.16 of the Final EIS summarize the effects for this construction phase. Therefore, this discipline report addendum addresses only the effects anticipated as a result of the updated construction schedule.

Are pontoons being constructed as part of this project?

WSDOT has completed planning and permitting for a new facility that will build and store the 33 pontoons needed to replace the existing capacity of the floating portion of the Evergreen Point Bridge in the event of a catastrophic failure. If the bridge does not fail before its planned replacement, WSDOT would use the 33 pontoons constructed and stored as part of the SR 520 Pontoon Construction Project in the SR 520, I-5 to Medina project. An additional 44 pontoons would be needed to complete the new 6-lane floating bridge proposed for the SR 520, I-5 to Medina project. The additional pontoons would be constructed in a casting basin at Concrete Technology Corporation in the Port of Tacoma and, if available, at the new pontoon construction facility located on the shores of Grays Harbor in Aberdeen, Washington. Final construction locations will be identified at the discretion of the contractor. For additional information about project construction schedules and pontoon construction, launch, and transport please see the Construction Techniques and Activities Discipline Report Addendum and Errata (WSDOT 2011b).

Approach

This section summarizes the approach the project team used to identify, evaluate, and compare the indirect and cumulative effects expected to be associated with the project. This approach complies with WSDOT and federal guidance.

How did the project team identify and evaluate indirect effects?

The project team followed WSDOT and FHWA guidance to conduct the indirect effects assessments summarized in this discipline report. They characterized potential indirect effects by probable location and extent; magnitude and duration; whether beneficial (an improvement over existing conditions) or adverse (a decline from existing conditions); and, if adverse, how WSDOT could avoid or minimize the effect. Section 412 of the WSDOT *Environmental Procedures Manual* (WSDOT 2009b) and FHWA Technical Advisory T 6640.8A, *Guidance for Preparing and Processing Environmental and Section 4(f) Documents* (FHWA 1987) provide general guidance for identifying, evaluating, and documenting indirect effects of transportation projects. More specifically, WSDOT's *Environmental Procedures Manual* (WSDOT 2009b) and FHWA's *Indirect Effects Analysis Checklist* (FHWA 2006) recommend the eight-step approach presented in National Cooperative Highway Research Program Report 466, *Desk Reference for Estimating the Indirect Effects of Proposed Transportation Projects* (Louis Berger Group Inc. 2002). The project team used the eight-step approach for the indirect effects analyses.

The project team completed Steps 1 through 4 before and during the direct effects analyses. The resource-specific discipline reports and technical memoranda supporting the SDEIS and Final EIS provide information on these steps. In Steps 5 through 8, the project team went beyond the direct effects assessments and focused on the intermediate cause-and-effect relationships and interconnections among resources that can lead to indirect effects. The Indirect and Cumulative Effects section summarizes these indirect effects assessments.

How did the project team identify and evaluate cumulative effects?

To identify and evaluate likely cumulative effects and the extent to which the project would contribute to them, the project team first reviewed the general guidance in Section 412 of the WSDOT *Environmental Procedures Manual* (WSDOT 2009b) and in FHWA Technical Advisory T 6640.8A (FHWA 1987). Next, they followed the eight-step procedure set forth in *Guidance on Preparing Cumulative Impact Analyses* (WSDOT et al. 2008), shown in Exhibit 4. The project team made two general assumptions in following the guidance: first, in most cases they considered construction-related effects to be short term, with the effect ending at the same time as the construction activity causing it. Second, they considered operational effects of the project to be long-term and permanent through the project design year, 2030.

In addition to examining the operational effects, WSDOT scrutinized the potential long-term effects that project construction could have on the resources in the study area. WSDOT carefully considered the potential for short-term construction effects to contribute to adverse cumulative effects – especially on resources that are already under stress from the effects of other past, present, and reasonably foreseeable future actions. WSDOT's assessment considered the project's measures to reduce and avoid construction related effects. In two cases—aquatic resources and GHG emissions—WSDOT found that construction effects would persist over the long-term and make minor contributions to cumulative effects.

For aquatic resources, WSDOT found that Pacific salmon stocks, specifically Steelhead and Chinook salmon and Bull Trout, that migrate through the Lake Washington Ship Canal (Ship Canal) and Montlake Cut and inhabit Lake Washington and its tributaries, would be vulnerable to construction activities. These species are classified as threatened under the Endangered Species Act (ESA). They would be vulnerable to impact pile-driving and to the presence of work bridges in ways that could adversely affect their life cycles over the long term, mainly through direct mortality and interference with migration. For this reason, WSDOT included construction effects in the cumulative effects assessment for aquatic resources.

Exhibit 4. Eight-Step Approach for Cumulative Effects Assessment Summarized from Guidance on Preparing Cumulative Impact Analyses

No.	Step
1	**Identify the resources to consider in the analysis—**List each resource for which the project could cause direct or indirect effects. If the project will not cause a direct or indirect effect on a resource, it cannot contribute to a cumulative effect on that resource. Make a statement to that effect, and stop.
2	**Define the study area for each resource—**Define the geographic resource study area and the temporal resource study area for each resource.
3	**Describe the current status/viability and historical context for each resource—**Characterize the current condition of the resource and trends affecting it, and briefly summarize the historical context and past actions that have had a lasting effect on the resource.
4	**Identify direct and indirect effects of the project that might contribute to a cumulative effect—**Summarize the direct and indirect effects already identified. The project's contribution to a cumulative effect would be the residual direct or indirect effect(s) remaining after mitigation.
5	**Identify other current and reasonably foreseeable actions—**Ask what other present and reasonably foreseeable actions (development projects) are affecting your resource today or could affect it in the future. A reasonably foreseeable action is a private or public project already funded, permitted, or under regulatory review, or included in an approved final planning document.
6	**Identify and assess cumulative effects—**Review the information gathered, describe the cumulative effect(s), and draw conclusions that put into perspective the extent to which the project will add to, interact with, or reduce the cumulative effect.
7	**Document the results—**Describe the analyses, methods, or processes used; explain the assumptions; and summarize the results of each analysis, all the steps in adequate detail to disclose its strengths and weaknesses, your conclusions, and how and why you reached those conclusions.
8	**Assess the need for mitigation—**WSDOT does not mitigate cumulative effects, because many entities contribute to them in ways that are beyond WSDOT's jurisdiction. But WSDOT does disclose the project's likely contribution to each identified cumulative effect and suggest practicable ways by which the cumulative effect could be mitigated.

Source: WSDOT et al. 2008

Any large transportation infrastructure project will contribute to energy consumption and GHG emissions during construction. Energy consumption is irretrievable in that the energy, once consumed, cannot typically be recovered and reused. For this reason, construction makes a permanent contribution to cumulative energy consumption. GHG emissions are of concern because of their long-term accumulation in the atmosphere and the consequences of that accumulation for climate change. Short-term incremental releases of exhaust emissions during construction can persist and contribute to the long-term trend of GHG accumulation.

WSDOT makes a distinction between cumulative effects and concurrent construction effects. Whereas cumulative effects are long-term trends in the condition or status of a regional resource, more likely to be affected by project operation, concurrent construction effects are local and last only as long as the construction activities of two or more projects overlap in vicinity and duration. Concurrent construction effects are addressed in Final EIS Chapter 6, Effects during Construction of the Project.

How was the scope of the study defined?

Resources

WSDOT performed indirect and cumulative effects assessments on the same resources and disciplines they evaluated for the project's potential direct effects. The project team responsible for each resource or discipline conducted the direct, indirect, and cumulative effects assessments in that order.

Study Areas and Time Frames

For the indirect and cumulative effects assessments, the geographic study area for most resources was the central Puget Sound region as defined by the Puget Sound Regional Council's (PSRC's) *Transportation 2040* (PSRC 2010a), which includes King, Kitsap, Pierce, and Snohomish counties. This study area is shown in Exhibit 5. Certain disciplines had resource-specific study areas, and these are shown in Exhibits 6 and 7.

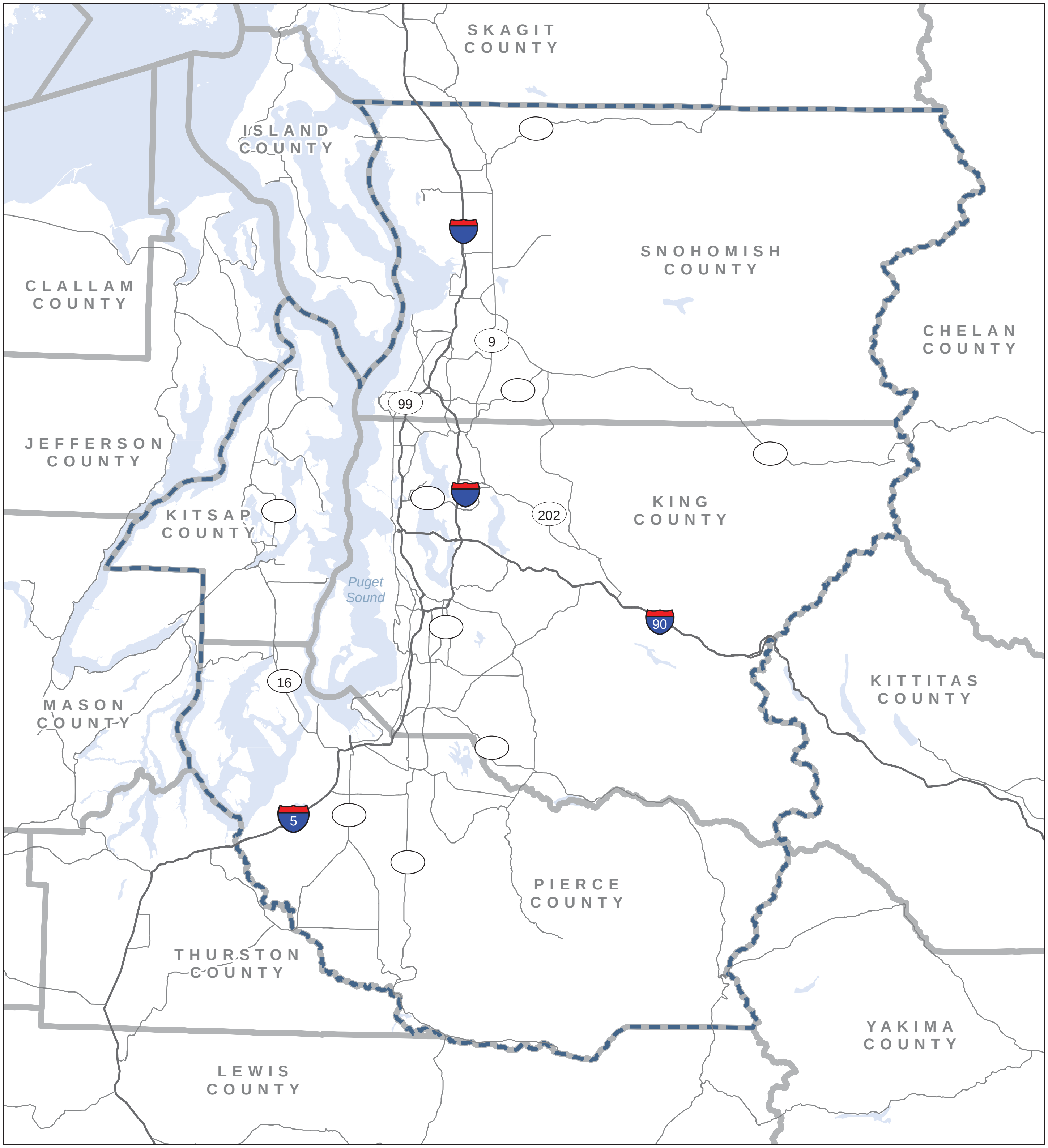
The start of the time frame depended on the specific discipline or resource and the nature of the effect being evaluated. The end point for most analyses was 2030, the project design year. The following subsections discuss the reasons for selecting study areas and time frames for indirect and cumulative effects, which are different from those used to assess direct effects.

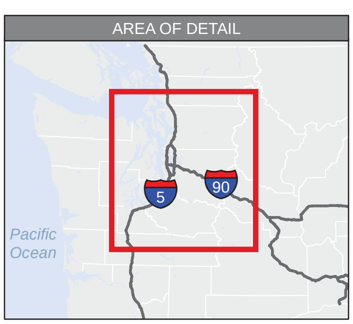
Study Area

Indirect Effects

Indirect effects typically have a different or larger study area than direct effects because indirect effects can occur through a series of cause-and-effect relationships that can place them farther from the project site than direct effects. They can also occur across disciplines in complex ways that make it difficult to predetermine

The **study area** used to assess potential **indirect effects** on each resource or discipline was the same as the study area applied to that same resource or discipline for the **cumulative effects** assessment.





Study Area: Air Quality, Cultural Resources, Economic, Geology and Soils, Greenhouse Gas Consumption and Emissions, Land Use, and Social Elements

County Boundary

N

0 2.5 5 10 15 Miles

Source: WSDOT (1995) GIS Data (Counties), WSDOT (2001) GIS Data (County and State Route), King County (2007) GIS Data (Water Bodies). Horizontal datum for all layers is NAD83(91); vertical datum for layers is NAVD88.

Exhibit 5. **Indirect and Cumulative Effects Study Area - General**

SR 520, I-5 to Medina: Bridge Replacement and HOV Project

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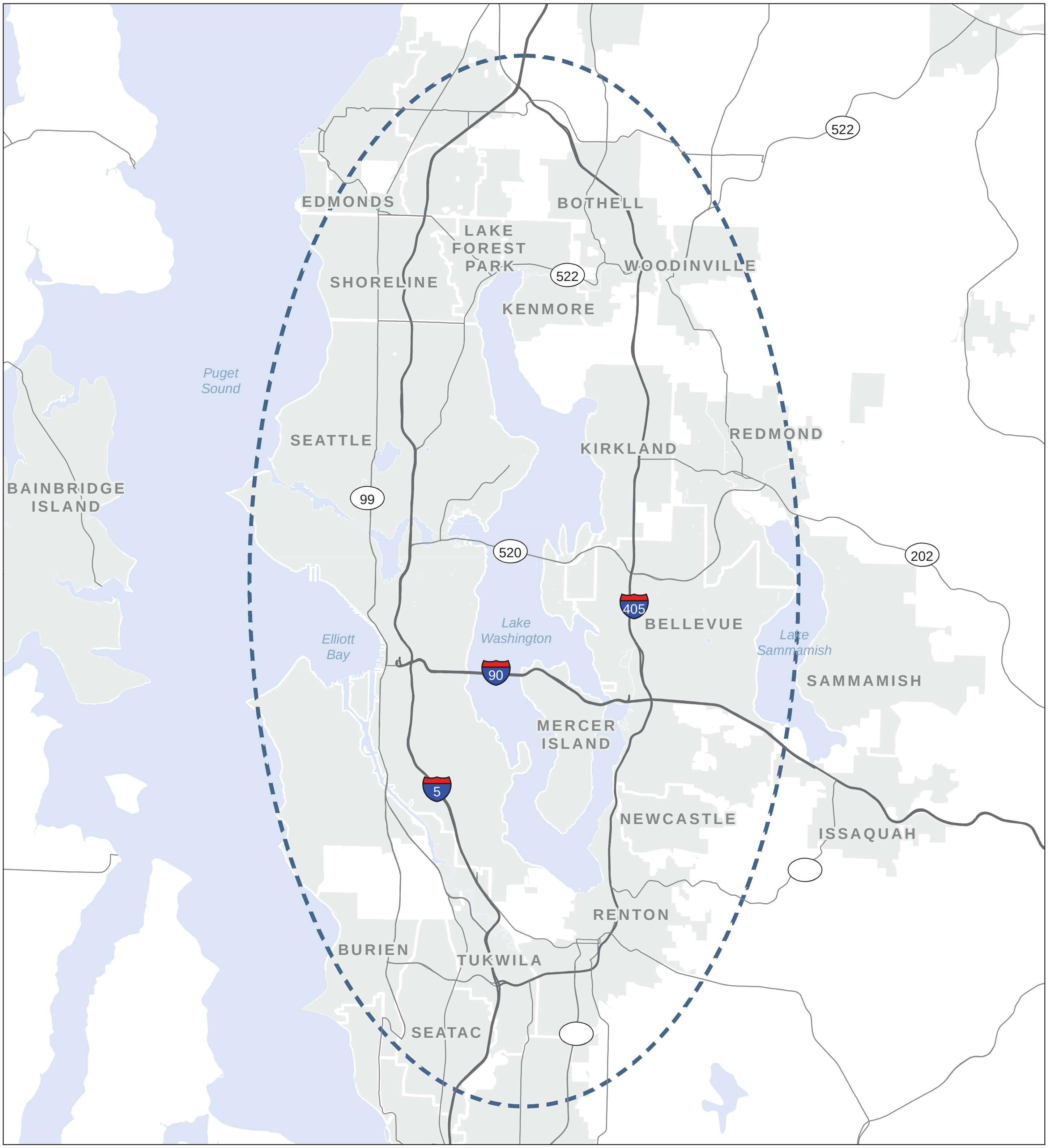
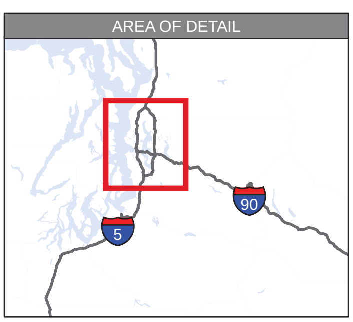




Study Travelshed includes: Ecosystems-Wetlands, Environmental Justice, Hazardous Materials, Noise, Recreation, and Transportation

City Limit

N

0 1 2 4 Miles

Source: WSDOT (1995) GIS Data (Counties), WSDOT (2001) GIS Data (County and State Route), King County (2007) GIS Data (Water Bodies). Horizontal datum for all layers is NAD83(91); vertical datum for layers is NAVD88.

Exhibit 6. **Indirect and Cumulative Effects Study Area - Travelshed**

SR 520, I-5 to Medina: Bridge Replacement and HOV Project

SEA \\JAFAR\PROJ\PARAMETRIX_400707\MAPFILES\WESTSIDE\DR\INDIRECTCUMULATIVE\2010\WS_DR_ICE_STUDYAREATRAVELSHED.MXD AJOHNSON 4/29/2011

Water Resource Inventory Area (WRIA) Boundary

Study Area for Water Resources is WRIA 8.

Study Area for Ecosystems – Wildlife includes WRIA 8, Puget Sound, Georgia Strait, and Strait of Juan de Fuca.

Study Area for Ecosystems – Aquatic Resources includes north Pacific Ocean, northwest Washington coast, Strait of Juan de Fuca, Georgia Strait, Puget Sound, WRIA 8, and WRIA 22.

Source: Grays Harbor County (2007) GIS Data (City Limits, waterbody, and Street). Horizontal datum for all layers is State Plane Washington South NAD 83; vertical datum for layers is NAVD88.

Exhibit 7. **Indirect and Cumulative Effects Study Area - Resource-Specific**

SR 520, I-5 to Medina: Bridge Replacement and HOV Project the study area boundaries. The cumulative effects study area typically extends beyond the direct effects study area. The cumulative effects study area is defined in terms specifically relevant to each resource—such as habitat boundaries, air quality attainment areas, census tracts, state highway and local road systems, traffic analysis zones, jurisdictional boundaries, or other appropriate areas. Therefore, the cumulative effects study area satisfies criteria applicable to indirect effects as well (Louis Berger Group, Inc. 2002).

Cumulative Effects

The cumulative effects study area is the total area of the resource or discipline that could be influenced by the direct or indirect effects of the project in combination with the effects of other past actions, present actions, and reasonably foreseeable actions. To define each cumulative effects study area, the project team started with each resource's direct effects study area. They expanded that area to include the larger region within which indirect effects of the project and the effects of other past actions, present actions, and reasonably foreseeable actions could influence the resource (WSDOT et al. 2008). Thus, the cumulative effects study area for each resource was determined (1) by the distribution of the resource itself, and (2) by the area within that distribution where the resource could be affected by the project in combination with actions external to the project. As previously noted, the cumulative effects study area for a particular resource or discipline was also the study area for indirect effects of the project on that same resource or discipline. In most cases, the project team found that the central Puget Sound region (PSRC 2009a) was an appropriately large area for assessing indirect and cumulative effects.

> The **cumulative effects study area** is the total area of the resource or discipline that could be influenced by the direct or indirect effects of the project in combination with the effects of other past actions, current actions, and reasonably foreseeable actions.

Time Frame

Indirect Effects

Like the study area, the time frame used to assess indirect effects must also be appropriate to the nature of the effect. Some indirect effects can occur relatively quickly (for example, increased lunchtime business at sandwich shops near construction areas). Other indirect effects can take months or years to become apparent (for example, a change in wetland plant succession following a construction-related drainage alteration). Because indirect effects must be reasonably foreseeable, the time frame for their analysis has to be short enough to anticipate reasonably

> The **time frame** for cumulative effects assessment starts at a representative year or decade when a past action or actions began to change the health or status of the resource from its original condition, setting a trend that is still evident in the present and likely to continue into the reasonably foreseeable future. In most cases, the time frame begins in the 1850s and ends in 2030, the project design year.

foreseeable outcomes, but also long enough to capture effects that become apparent only within longer time horizons. For most disciplines and resources, the project team used the project design year (2030) as an appropriate end point for the time frame (Louis Berger Group, Inc. 2002).

The **design year** is used in transportation planning to estimate how projects will perform on a variety of criteria at a time in the future. The design year is about 20 years after the start of project construction is expected to begin, consistent with standard practice and agency guidance for metropolitan transportation planning. When project analysis began, the year 2030 was identified as the design year based on the current planning models available from the Puget Sound Regional Council.

Cumulative Effects

The cumulative effects assessment focuses on long-term trends in the condition of valued resources that could be affected by the project. For this reason, the time frame is a continuum that starts in the past and ends in the reasonably foreseeable future. The beginning can vary from one resource to another, depending on the point in the past at which historical information on the resource became available or when past actions began to change the health or status of the resource from its original condition. For most disciplines and resources, the start date selected was 1850, which approximates the introduction of Euro-American settlers into the central Puget Sound region.

The time frame must extend far enough into the future to include at least portions of the operational periods of the project and other present and reasonably foreseeable actions. The time frame can stop at the project design year (for this project, 2030) or at a future year determined by the characteristics of the particular discipline or resource under study. For example, the end point could be based on a characteristic response time of a plant or wildlife species to environmental stressors or, for land use or transportation, the planning horizon in a comprehensive plan or long-range transportation plan (WSDOT et al. 2008). For most resources discussed in this discipline report, the end date is 2030, the project design year.

How was the baseline condition of each resource determined?

As with direct and indirect effects, for the cumulative effects assessments, the project team characterized the baseline (present) condition of each resource by describing its current status within the cumulative effects study area and by providing historical context for understanding how the resource got to its present state (WSDOT et al. 2008; see Exhibit 4, Step 3). The project team used information from field surveys, interviews, and literature searches to assess the current condition of the resource, relying especially on baseline information presented in *Transportation 2040* and the associated Final EIS issued by PSRC in May 2010 (PSRC 2010a, PSRC 2010b). Past actions affecting the resource were reviewed to "tell the story of the resource" and to identify persistent trends in the changing condition of the resource over time (WSDOT et al. 2008). The project team did not address the past in detail, but prepared a brief summary to place the resource in its historical context and provide a comparative basis for the cumulative effects assessment.

How were other present and reasonably foreseeable actions identified?

Reasonably foreseeable actions are defined as projects with a reasonable expectation of actually happening, as opposed to potential developments expected only on the basis of speculation.

To identify other present and reasonably foreseeable actions (see Exhibit 4, Step 5), the project team reviewed comprehensive land use planning documents, long-range transportation plans, and projections presented in *Transportation 2040* and the associated Final EIS (PSRC 2010a, PSRC 2010b) and on agency Web sites. They also interviewed agency and tribal officials, representatives of private companies and organizations, and members of the public during the scoping process conducted for this environmental review process. The Agency Coordination and Public Involvement Discipline Report Addendum and Errata (WSDOT 2011c) provides information about the scoping process and meetings.

Reasonably foreseeable actions were defined as actions or projects with a reasonable expectation of actually happening, as opposed to potential developments expected only based on speculation. Accordingly, the project team applied the following criteria (WSDOT et al. 2008):

- Is the proposed project included in a financially constrained plan?
- Is it permitted or in the permit process?
- How reasonable is it to assume that the proposed project will be constructed?
- Is the action identified as high priority?

Applying these criteria, the project team compiled lists of present and reasonably foreseeable actions. An extensive list was presented in the SDEIS and is incorporated by reference (WSDOT 2010a). For this revision of the discipline report, the list of projects was reduced to those actions most likely to contribute to a cumulative effect along with the project. Actions listed in the SDEIS list that were not carried forward did not continue to meet the above criteria. However, these actions are part of the trend affecting the resources into the future and thus are considered in this aspect of the cumulative effects analysis. See Exhibit 8 for the list of actions considered.

The reasonably foreseeable actions include WSDOT's proposed SR 520 Pontoon Construction Project and the SR 520, Medina to SR 202. These projects, each with independent utility, received completed environmental reviews under the National Environmental Policy Act (NEPA). These and other present and reasonably foreseeable transportation improvement and land development projects are included in the forecasts presented in *Transportation 2040* and the *Transportation 2040* Final EIS, which informed the cumulative effects assessments summarized in this Final EIS. As demonstrated in Exhibit 8, the analysis was not limited to actions identified in *Transportation 2040* and the *Transportation 2040* Final EIS but was inclusive of projects and actions likely to have project-specific cumulative effects in conjunction with the Build Alternative.

Exhibit 8. Reasonably Foreseeable Actions

Project	Notes
Roadway	
I-405 Southbound Braided Ramps	I-405 Master Plan, *Transportation 2040*; estimated completion by 2030
SR 520 – 124th Avenue Interchange	I-405 Master Plan, *Transportation 2040*; unfunded (possible funding by City of Bellevue)
I-405 at North 8th Street (HOV Interchange)	*Transportation 2040*
I-405 at I-90 (HOV/High-Occupancy Toll [HOT])	*Transportation 2040*, estimated completion by 2030
I-405 at NE 6th Street Extension (HOV/HOT)	*Transportation 2040*
I-405 at SR 520 (HOV)	*Transportation 2040*, unfunded
I-405 at SR 522 Interchange	*Transportation 2040*
I-405: SR 169 to NE 6th Street Express Toll Lanes (ETLs)	I-405 Master Plan, *Transportation 2040*; partially funded (initial stages expected to be completed by 2030)
I-405: I-5 to SR 167 ETLs	I-405 Master Plan, *Transportation 2040*
I-405: SR 167 to SR 169 ETLs	I-405 Master Plan, *Transportation 2040*
I-5 at Airport/Industrial Way (HOV)	*Transportation 2040*, estimated completion by 2025
I-5: Olive–SR 520 (transit)	*Transportation 2040*, estimated completion by 2025
Mercer Corridor Improvements: Phase II	City of Seattle

Exhibit 8. Reasonably Foreseeable Actions

Project	Notes
NE 132nd Street Road Improvements (116th to NE 118th Street)	City of Kirkland; 25 to 30 percent increase in capacity
124th Avenue NE Road Improvements, NE 85th Street to NE 116th Street	City of Kirkland
132nd Avenue NE Road Improvements (NE 85th Street to Slater Avenue NE)	City of Kirkland
120th Avenue NE Corridor Widening (NE 4th Street – NE 12th Street)	City of Bellevue
Bellevue Way HOV Lanes and Transit	City of Bellevue, *Transportation 2040*; funded
Bel-Red Regional Connectivity – Extend NE 16th Street and Widen 13th Place NE (124th Avenue to 132nd Avenue)	City of Bellevue, *Transportation 2040*; unfunded
Bel-Red Regional Connectivity – Downtown/Overlake and Bel-Red Transit-oriented Development Node	City of Bellevue, *Transportation 2040*; funded by 2040
Coal Creek Parkway Widening at I-405	City of Bellevue, *Transportation 2040*; unfunded
Coal Creek Parkway (HOV and Transit)	WSDOT, *Transportation 2040*; funded by 2040
SR 520, Medina to SR 202: Eastside Transit and HOV Project	Contract awarded November 2010 and construction expected to start in 2011
SR 520 Pontoon Construction Project	Final EIS published December 2, 2010
I-90 Two-Way Transit and HOV Operation Project	WSDOT/Sound Transit; funded
Non-Roadway	
SR 520 Cross-lake Tolling	Same as Final EIS Preferred Alternative
I-90 Cross-lake Tolling	No project identified; tolling consistent with ESHB 3096
SR 167 Tolling	Same as the Final EIS No Build and Preferred Alternative
SR 99 Bored Tunnel Tolling	Potential funding source for SR 99 project
Sound Transit's East Link	Funded
Sound Transit's North Link	Funded
Sound Transit's University Link	Funded
Sound Transit 2 Program	Funded
Transit Now Program	Funded
Development	
University of Washington Campus Master Plan	Approved January 2003
Seattle Children's Hospital Major Institution Master Plan (2010)	Council Ordinance 123263, May 12, 2010
Washington Park Arboretum Master Plan and Final EIS	Final EIS issued January 2001 and Master Plan approved May 2001

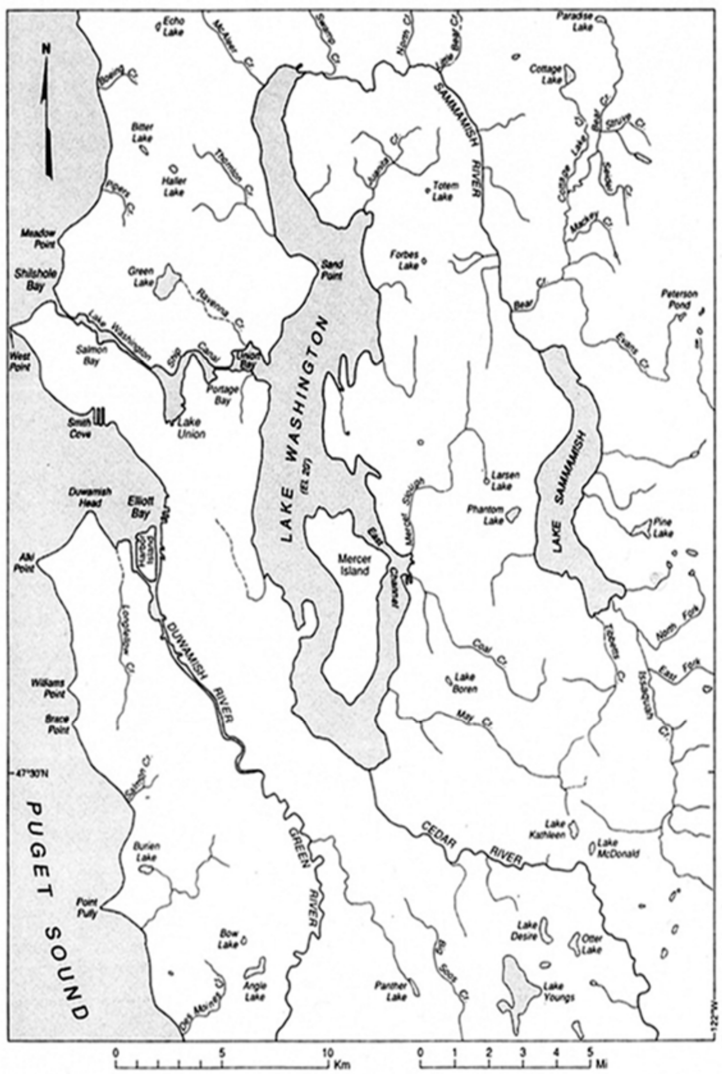
Affected Environment

The following provides a background on the project vicinity, including historical context, present condition, and present and reasonably foreseeable land development and transportation projects. Detailed descriptions of the area and its history, from which the following information is excerpted and summarized, are presented with citations to source material in the Ecosystems Discipline Report Addendum and Errata (WSDOT 2011d) and the Final Cultural Resources Assessment and Discipline Report (WSDOT 2011e).

What is the history of the project vicinity?

Natural Setting

Retreating glaciers shaped the topography of the project vicinity at the end of the most recent Ice Age, from about 20,000 to 15,000 years ago. The shorelines, deltas, and intertidal zones of Puget Sound acquired their shapes as sea levels rose and the land adjusted to the removal of glacial ice. The landforms of the region typically comprise a series of north-south trending ridges and valleys showing the direction of glacial advance and retreat. During these advances and retreats, the glaciers deposited a thick layer of unsorted material, including clays, sands, gravels, silts, and boulders. This material, called till, can be several thousands of feet thick in some areas (Alt and Hyndman 1984). More recently, rivers, springs, streams, and lakes have occupied the low-lying areas, creating a complex landscape dominated by water (Exhibit 9).



Source: Galster and Laprade 1991

Exhibit 9. Major Drainages and Water Bodies of the Seattle Area

Pollen in sediment cores from Lake Washington and the Puget Sound area indicates that the initial post-glacial climate was cooler and drier than today, with vegetation forming open parkland of lodgepole pine and spruce, grasses, and bracken fern, with scattered hazel and cedar. By about 11,700 to 7,800 years ago, vegetation included open forest with a mosaic of grasses, bracken fern, and scattered Douglas fir, alder, lodgepole pine, and hemlock trees. Cedar, alder, and willow were on wetter landforms, such as lake margins and alluvial floodplains.

An increase in western red cedar pollen indicates the beginning of a cooler, moister climate regime around 7,800 years ago in the Lake Washington basin. A closed canopy forest with western red cedar, western hemlock, and Douglas fir similar to today's tree cover is likely to have existed in the Lake Washington vicinity by about 6,500 years ago.

Today, forested and shrub wetlands in the study area support a mixture of native and introduced woody plant species. Red alder, black cottonwood, western red cedar, and Oregon ash generally dominate the forested wetlands. Dominant species in shrub wetlands include various willows, Himalayan blackberry, red-osier dogwood, rose spirea, and salmonberry. Along Lake Washington and in wetlands with standing water, non-native white water lilies, cattails, rushes, horsetails, and various native and non-native grasses dominate.

Lake Washington serves as the primary source of water for all the wetlands in the study area. The U.S. Army Corps of Engineers (USACE) controls water levels in Lake Washington and Lake Union at the Ballard Locks. The USACE lowers the water level by approximately 2 feet each winter. This vertical fluctuation is the dominant hydrologic change in these wetlands, which otherwise have very stable water levels.

Forested wetland on Lake Washington.

The Lake Washington watershed supports a diverse group of fish species, including several species of native salmon and trout. Many of these species are an integral part of the economy and culture of the Pacific Northwest. Large-scale alteration and destruction of fish habitat within the Lake Washington watershed have occurred over the last 100 years, reducing local fish populations such as Chinook and coho salmon, steelhead, and bull trout by altering their spawning, rearing, and migration habitats.

Because of its habitat diversity and complex shoreline and wetland ecosystems, the project vicinity supports diverse wildlife species that include invertebrates, amphibians, reptiles, birds, and mammals. Wildlife species in the project vicinity are described in the Ecosystems Discipline Report Addendum and Errata (WSDOT 2011d).

Early Human History

The project vicinity lies within lands and waters once occupied by several Puget Sound tribes. Their descendants are represented by federally recognized Indian tribes, including the Suquamish, Muckleshoot, Snoqualmie, Yakama, and Tulalip tribes, as well as the non-federally recognized Duwamish. Because of the historical presence of these Puget Sound tribes, the project vicinity is considered to have a high level of archaeological sensitivity.

The earliest occupation of Puget Sound occurred between 13,000 and 6,000 years ago, beginning with the glacial retreat from the region. For the period from 6,000 to 2,500 years ago, the archaeological record shows differences between coastal and inland sites that probably reflect differing food procurement strategies (marine versus terrestrial) and perhaps localized cultural development. From 2,500 to 250 years ago, archaeological sites reveal further specialization in the focus of resource procurement—the full-scale development of the maritime cultures (recorded ethnographically) and land-mammal hunting and upriver fishing groups. Few sites from 250 to 150 years ago (just before people of European descent settled the region) have been examined.

As previously noted, the project vicinity includes springs, streams, and freshwater lakes and bays. Salmon Bay, Lake Union, Lake Washington, and their tributary streams formed a series of connected waterways that could be entered from Puget Sound only at Shilshole, along a meandering course through fresh water lakes and overland portages, or by the Duwamish and Black rivers. A group of Duwamish inhabited this area. The Euro-American settlers knew them as the Lakes people, and Lake Washington was first called Lake Duwamish in recognition of the aboriginal Duwamish people. Other groups in what is now the greater Seattle area included the Muckleshoot and Suquamish.

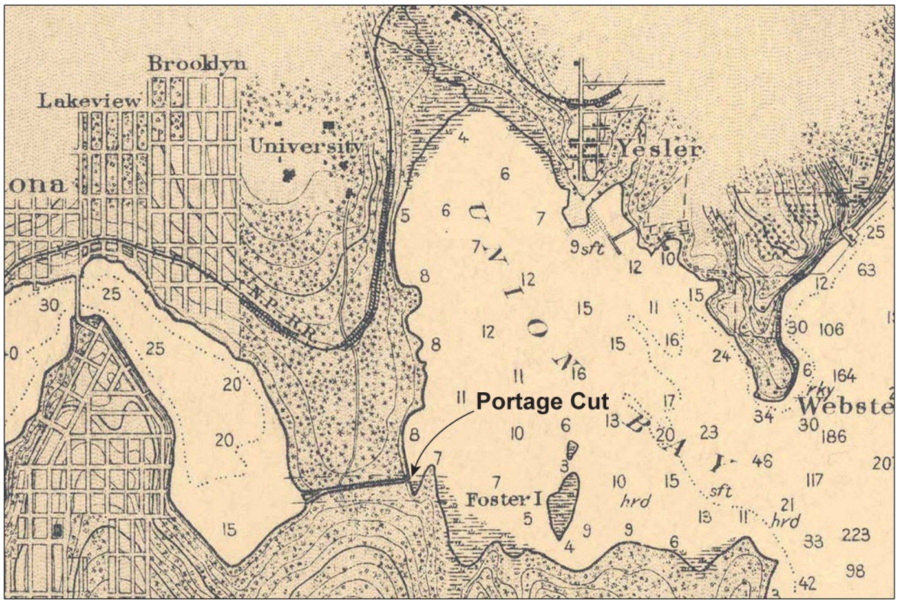
The Oregon Treaty of 1846 defined the boundary between the United States and Canada at the 49th parallel, spurring settlement by Euro-Americans throughout the Pacific Northwest. The Oregon Territory was created as part of the United States shortly afterward (in 1848). In

1853, the Washington Territory was formed from the northern part of the Oregon Territory. The Donation Land Claim Act of 1850 and the Homestead Act of 1869 spurred population growth in the area, luring settlers with the promise of free land. In the fall of 1851, a group of Midwestern settlers, led by Arthur Denny, arrived at Alki Point in present-day west Seattle. They found a region thickly forested with tall, large-diameter Douglas fir, western red cedar, and western hemlock, along with red alder and cottonwood on river floodplains. That same year, the settlers relocated to the east and named their settlement for the local Native American leader, Chief Seattle.

Seattle and Lake Washington

The early economy of Seattle was based on timber and coal, and the opportunities available brought more and more settlers. By 1883, Seattle had grown to over 3,000 citizens, making it the second largest municipality in the Washington Territory.

At first, logging activities focused along waterways to take advantage of these areas for transporting logs to the sawmills. To meet the needs of bustling timber and sawmill operations, in 1885, builders excavated a shallow, 16-foot-wide canal for passing logs between Union Bay on Lake Washington and Portage Bay on Lake Union. Known locally as the Portage Cut, this narrow canal took advantage of the natural difference in the lake-water levels, which produced a current facilitating the westward transport of logs through the chute from the higher Lake Washington to Portage Bay. Exhibit 10 shows the location of the Portage Cut. (For further detail, see the Final Cultural Resources Assessment and Discipline Report, WSDOT 2011e).



Source: Coast and Geodetic Survey 1905.

Exhibit 10. 1905 Geodetic Survey Map Showing Location of the 1885 Portage Cut and Lake Depth in Feet

By the 1890s, most of the area on the west side of Lake Washington had been logged. Within the next 10 years, all of the timber had been cut from the shores of Lake Washington (Blukis Onat et al. 2007).

Fueled by continuing population growth, the introduction of cable cars and streetcars in the 1880s fed the push for residential development beyond the Seattle city center. The Klondike Gold Rush in 1897 added to the growth of Seattle.

Over the summer of 1909, the Alaska-Yukon-Pacific Exposition showcased the city and celebrated its achievements and economic potential. The Olmsted Brothers designed the exposition, which was held on the grounds of the University of Washington (UW). Part of the plan remains today, incorporated into the present campus. By 1910, only 60 years after its founding, Seattle had grown to 230,000 people.

In 1910, construction began on a navigable ship canal between Lake Union and Lake Washington. An excavation known as the Montlake Cut was completed between Union Bay on Lake Washington and Portage Bay on Lake Union in 1916. As a result of the Montlake Cut, Lake Washington was lowered about 9 feet.

Most of the Seattle portion of the project vicinity was developed in the early decades of the 20th century. This includes the Capitol Hill neighborhood, Eastlake neighborhood, Roanoke Park and associated neighborhood, and Montlake neighborhood. Construction of I-5 and SR 520 in the 1960s physically separated the neighborhoods of Eastlake, Capitol Hill, and Roanoke Park into their current distinct areas. The Washington Park Arboretum (Arboretum), one of the city’s first parks (created from 1900 through 1904), borders Montlake and was officially set aside as a botanical garden and arboretum in March 1924.

East Side of Lake Washington

On the east side of Lake Washington, coal was discovered in the Coal Creek area in 1867. Extensive mining began there at the Newcastle Coal Mine, bringing in settlers. William Meydenbauer and Aaron Mercer staked large claims on the east side of Lake Washington in 1869, becoming some of the first non-Native American settlers there. During the 1870s, Seattle businesspeople and real estate investors began to buy property on what came to be known as the Eastside. Many of Seattle’s wealthy citizens developed estates there, although settlers in the area were homesteaders. Logging, almost by necessity, became a primary occupation on the Eastside, as the settlers who came to pursue agriculture needed to clear land for their farms. Much of the Eastside area became a haven for berry-growing and fruit orchards.

With the creation of the Montlake Cut and the lowering of the water level in Lake Washington, property owners in Medina found that they had additional lakeshore acreage in front of their homes, while others suddenly had additional acreage for planting (Rochester 1998). The additional shoreline of Yarrow Bay created a natural wetlands area and, on Hunt's Point, the marshlands of Cozy Cove and Fairweather Bay were formed (Knauss 2003, Town of Hunts Point 2006).

By the 1920s, a road system connected the Eastside communities, and ferries linked them to Seattle. The fruits and produce grown on the Eastside filled the Seattle markets. Many families still used Eastside property for summer vacations. The ferry landing in Kirkland served the most popular route, bringing people and goods to or from Seattle in just over 30 minutes (Stein 1998a).

The relative isolation of the Eastside ended in 1940 with the opening of the Lacey V. Murrow Bridge just south of Bellevue. This was the first floating bridge across Lake Washington (the present-day route of the I-90 bridge) (Wilma 2001). The bridge spurred tremendous growth in the Eastside communities, resulting in increased property values. After the United States entered World War II, the Japanese-American residents of the area had their land confiscated and were sent to internment camps. These two actions signaled the end of the agricultural era of the Eastside and the beginning of its suburban development (City of Bellevue 2006).

World War II brought more growth to the area, particularly with the influx of workers at Boeing Field. In 1946, developer Kemper Freeman opened Bellevue Square shopping center, the first shopping center in the region and one of the first in the country (Stein 1998b). Housing and commercial developments on the Eastside mushroomed. Bellevue and Clyde Hill both incorporated in 1953, followed by Medina and Hunt's Point in 1955 and Yarrow Point in 1959 (Stein 1998b, City of Clyde Hill 2009, City of Medina 2008).

The second span across Lake Washington, 4 miles north of the Lacey V. Murrow Bridge, was the Evergreen Point Bridge. As part of the original SR 520 project, construction on the Evergreen Point Bridge began in August 1960. The bridge officially opened in August 1963 (Hobbs and Holstine 2005). It was officially renamed the Governor Albert D.

Rosellini Bridge in 1988. At the time of its construction, at 1.4 miles long, the Evergreen Point Bridge was the largest floating span in the world. With the sinking of the original Lake Washington floating bridge (I-90) in November 1990, the Evergreen Point Bridge became the oldest remaining floating bridge across Lake Washington, exemplifying an engineering feat of outstanding proportions. For the Eastside communities, the new bridge would lead to even more residents and greater development pressures.

Throughout the first half of the 20th century, farming remained the most important industry on the Eastside. However, the opening of the Lacey V. Murrow Bridge across Lake Washington in 1940 changed the area from a collection of small rural communities to much denser, more developed communities, many of which function today as Seattle suburbs. While Bellevue, Kirkland, and Redmond have embraced this intense growth, Medina and the Points communities have focused instead on remaining quiet residential enclaves. Medina has become one the most affluent residential communities in the region. Today Bellevue, Kirkland, and Redmond are prosperous and growing commercial and residential communities.

Physical Modifications

With development of the Montlake Cut, between August and October 1916, Lake Washington was gradually lowered about 9 feet to the level of Lake Union. The lowering of Lake Washington eliminated the lake's outlet to the Black River, and the Cedar River was diverted into Lake Washington. This lowering of the lake level led to exposure of broad, wave-cut terraces around the perimeter of the lake and development of marshes in the southern portion of Union Bay. In some areas, waterfront homes now occupy this terrace. Foster Island significantly increased in size at this time.

Because the new canal required a channeled approach, USACE dredged a straight channel between the Montlake Cut and the eastern edge of Union Bay. Dredging also continued in Union Bay after completion of the Montlake Cut, largely in soft mud and sand. Dredged material was deposited in shallow water about 75 feet beyond channel lines. Some of this dredged material was probably placed in shallow water north of the Arboretum or in marshes that emerged in 1916 around Foster Island.

On the western side of Montlake, filling in the 1930s created some of the original Montlake Playfield area along the southern shore of Portage Bay. Beginning in 1960, the playfield was again filled and expanded northward. Fill placement continued until the late 1960s, as material was brought into the park from projects around the Seattle area, including the original SR 520 project.

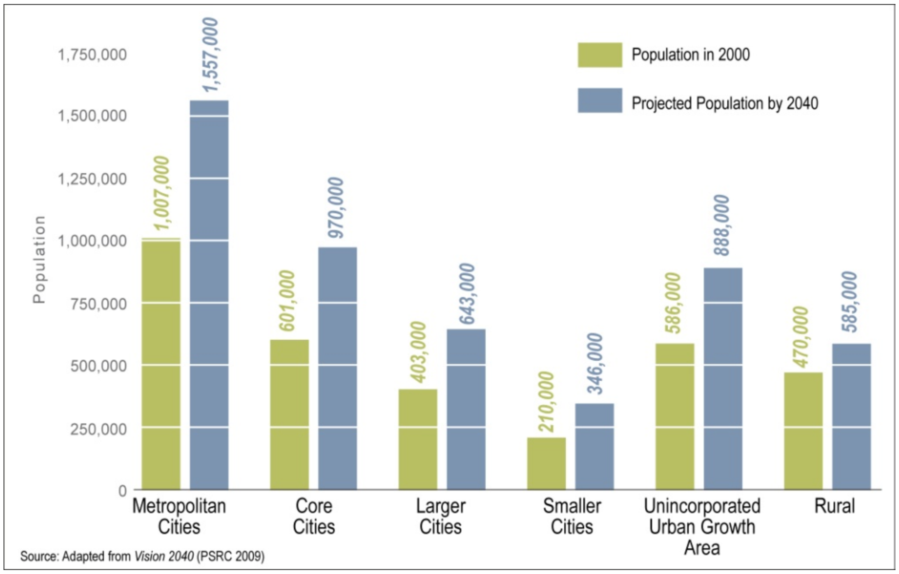
Low-lying portions of the project vicinity were also used for landfill. Prior to the late 1960s, steep ravines, low-lying swampy areas, former borrow pits, and tidal areas were frequently used as dump sites in the Seattle area. The largest dump site in the project vicinity was an area now known as the Montlake Landfill, established in 1925. This site occupied a 200-acre swampy area on the north side of Union Bay. The Montlake Landfill was closed in 1966, and UW acquired it in 1972. UW now operates the 73.5-acre Union Bay Natural Area on a portion of the former landfill (Howell and Hough-Snee 2009).

Significant land alteration and displacement in the form of cutting and filling occurred during the original construction of SR 520. In Seattle, major areas of cutting occurred on north Capitol Hill, through the Montlake neighborhood, and along the route of the old portage canal across Montlake. The old portage canal land has mostly been removed, except for a segment near the National Oceanic and Atmospheric Administration (NOAA) Northwest Fisheries Science Center and the Museum of History and Industry (MOHAI). The Arboretum lost approximately 60 acres of lagoon area to the SR 520 project.

Great expanses of the marshes surrounding Foster Island were dredged prior to construction of the Evergreen Point Bridge footings, to allow access for a pile-driver. At least some of the dredged peat was cast to the side adjacent to the dredged areas. Dredging operations also removed some of the garbage fill material and underlying peat from the Miller Street Landfill site. Dredging extended up to the western and eastern edges of Foster Island.

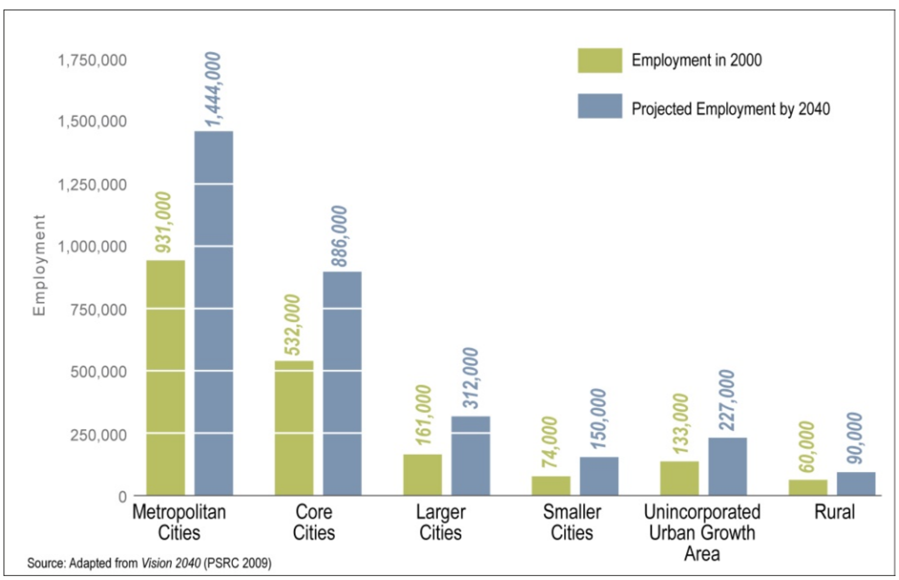
How is the region expected to change by 2030?

Vision 2040 (PSRC 2009a) provides comprehensive planning guidelines for the central Puget Sound region (Snohomish, King, Pierce, and Kitsap counties) through 2040. As documented in *Vision 2040*, population in the region is expected to increase from approximately 3.6 million in 2007 to nearly 5 million in 2040. Employment will increase from about 2 million jobs in 2007 to more than 3 million in 2040 (see Exhibits 11 and 12). PSRC has based regional transportation planning on *Vision 2040's* allocation of population and employment volumes and densities around Puget Sound.



Source: *Vision 2040* (PSRC 2009a)

Exhibit 11. Population Growth by Regional Geography and County 2000 to 2040 for Central Puget Sound Region (Snohomish, King, Pierce, and Kitsap Counties)



Source: *Vision 2040* (PSRC 2009a)

Exhibit 12. Employment Growth by Regional Geography and County 2000 to 2040 for Central Puget Sound Region (Snohomish, King, Pierce, and Kitsap Counties)

*Transportation 2040 Final EIS (*PSRC 2010b) analyzes transportation alternatives that will be used for developing the Transportation 2040 Plan itself. *Transportation 2040 Final EIS* notes that population and employment growth is anticipated to be concentrated in 27 regional growth centers within *Vision 2040*'s designated metropolitan and core cities. Smaller-scale centers in smaller jurisdictions will also play an important and increased role over time as places that accommodate growth.

What are growth centers ?

Vision 2040 calls for the creation of central places with a mix of uses and activities. Growth centers are locations of more compact, pedestrian-oriented development with a mix of residences, jobs, retail, and entertainment. They are identified to receive a greater portion of the region's population and employment growth.

Centers are designed as places for improved accessibility and mobility — especially for walking, bicycling, and transit. As a result, they also play a key transportation role.

Source: *Vision 2040* (PSRC 2009a)

Exhibits 11 and 12, adapted from *Vision 2040*, show the changes in population and employment projected for the central Puget Sound region between the base year of 2000 and the planning horizon year of 2040.

Continued growth in the region is seen as an opportunity to restore watersheds, develop environmentally sensitive approaches to stormwater treatment, enhance habitat, and pioneer new technologies and industries that benefit both the environment and the regional economy. The conclusion of the *Vision 2040* planning effort is that future land use and transportation development can occur in a sustainable manner, accommodating the expected economic growth and increased population, without environmental deterioration. The approach in *Transportation 2040* is intended to be consistent with that of *Vision 2040*.

Indirect and Cumulative Effects

This section discusses indirect and cumulative effects that are likely to be associated with the Build and Preferred Alternatives. For all resources, indirect effects of the Build and Preferred Alternatives, and contributions by the Build and Preferred Alternatives to cumulative effects, are similar to those previously assessed for the 6-Lane Alternative, and in particular design Option A, in the 2009 Indirect and Cumulative Effects Analysis Discipline Report (WSDOT 2009a). This is because the Preferred Alternative has been optimized with stakeholder input to reduce the expected long-term direct effects of the project as compared with Options A, K, and L, which were evaluated in the SDEIS.

As discussed in the Approach section, WSDOT assessed indirect and cumulative effects for project operation. Effects occurring over the project's operational life could influence long-term trends in the future condition or status of the affected resources. Short-term effects of multiple projects likely to be under construction at the same time as the SR 520, I-5 to Medina project are not considered likely to substantially alter the long-term trends typical of cumulative effects. However, concurrent construction effects can alter traffic volumes and patterns on surface streets and in neighborhoods adjacent or near to the projects under construction. In turn, these local traffic-related effects can influence other environmental factors such as noise levels; air quality; visual quality; community cohesion and access to businesses, neighborhoods, public services, and institutions; and recreational lands and facilities over the short term. For this reason, concurrent construction effects are addressed in Chapter 6 of the Final EIS, Effects During Construction of the Project.

Natural Environment

The following section discusses the cumulative effects on the natural environment for the Preferred and Build Alternatives. The Build Alternatives considered in the 2010 SDEIS and the Preferred Alternative are similar and, for the purpose of this analysis, nearly indistinguishable. Therefore, all the Build Alternatives are discussed together except where a separate discussion is warranted.

Water Resources

What direct and indirect effects would the project likely have on water resources?

As documented in the Water Resources Discipline Report Addendum and Errata (WSDOT 2011f), the Build and Preferred Alternatives would not have an adverse direct or indirect effect on water resources because stormwater runoff and waterborne contaminants would be appropriately mitigated. However, Lake Washington remains on the Washington State Department of Ecology (Ecology) list of impaired waterbodies and the proposed increase in pollutant-generating impervious surface (PGIS) over existing conditions warrants a cumulative effects analysis.

During project construction, WSDOT would prepare and follow a temporary erosion and sediment control (TESC) plan, spill prevention control and countermeasures (SPCC) plans, concrete containment and disposal plans (CCDPs), and collect and treat stormwater runoff from the project footprint in compliance with National Pollutant Discharge Elimination System (NPDES) requirements and WSDOT best management practices (BMPs). Consequently, stormwater discharged during construction activities would not cause a change from the baseline condition of receiving waters or violate Washington State water quality standards.

Construction of the additional supplemental stability pontoons in the Port of Tacoma or Grays Harbor sites, and storage and towing of pontoons to the project site are included in the construction effects analysis of the SR 520, I-5 to Medina project Final EIS. WSDOT would implement TESC plans, SPCC plans, and CCDPs at these sites so there would not be direct construction effects for supplemental stability platoon construction in the Port of Tacoma or Grays Harbor.

While the Build and Preferred Alternatives would increase the PGIS area compared to the No Build Alternative, the project includes stormwater treatment. As previously stated, the existing roadway does not have stormwater treatment and it would not be added under the No Build Alternative. Additionally, the stormwater discharges under the Build and Preferred Alternatives would meet or exceed water quality criteria according to the Highway Runoff Manual’s evaluation methods (WSDOT 2008). Stormwater discharges to Portage Bay and Union Bay would receive enhanced treatment that would exceed the minimum level of treatment required by the Highway Runoff Manual (WSDOT 2008).

The Build and Preferred Alternatives would include construction of a stormwater treatment system that would reduce net pollutant loading to surface waters compared to the No Build Alternative. An overall net reduction in pollutant loadings would be realized by treating enough existing untreated PGIS to offset the increased pollutant load associated with the project's new PGIS. For the Lake Washington area, the Build and Preferred Alternatives shows a predicted net reduction for all five stormwater pollutants (total suspended solids, total zinc, dissolved zinc, total copper, and dissolved copper), compared with the No Build Alternative.

The improved stormwater treatment associated with the project would have slight direct beneficial effects on water quality. There would be no adverse effects associated with the operation of stormwater treatment facilities as part of the project action.

How was the cumulative effects assessment of water resources conducted?

The project team followed the standard method for cumulative effects assessment as detailed in the Approach section. The study area for the cumulative effects assessment on water resources is shown in Exhibit 7. For this analysis, the time frame has an assumed start date of 1941, when water quality began to measurably decline in Lake Washington from sewage discharge, and an endpoint of 2030, the design year for the project. Reasonable foreseeable projects included in the analysis are transportation and development projects located within Water Resource Inventory Area (WRIA) 8 (Cedar-Sammamish) as listed on Exhibit 8. Because of local and state laws, new land development actions and road developments and improvements in the study area would include new or improved stormwater treatment facilities, all of which would improve water quality conditions in Lake Washington and other receiving waters.

Since the project includes water quality protection measures for construction activities along the SR 520 corridor and for the supplemental stability platoons at the Port of Tacoma or Grays Harbor sites, there would be no direct or indirect water quality effects from construction and therefore, no cumulative water quality effects.

The baseline condition of water resources in the study area was determined by consulting the scientific literature and a variety of relevant technical reports (King County 2009a, 2009b). Information was mapped using geographic information system (GIS) technology to aid the assessment. The project team obtained discharge data for stormwater evaluations from WSDOT. The analysis compared potential future conditions against the present condition for stormwater and for surface water.

What trends have led to the present water resources condition in the study area?

Starting in the late 1800s, urban development and the discharge of untreated stormwater and sewage have reduced water quality in the study area. Lake Washington received increasing amounts of secondary treated sewage between 1941 and 1963, causing over-enrichment of the water with nutrients and decreasing the water quality of the lake. Surface water bodies in the study area receive urban runoff from residential areas and roads, including the present SR 520 roadway and sources within the greater Seattle area.

The present improved water quality condition of the study area is largely the consequence of efforts to remove secondary treated sewage from Lake Washington (King County 2009a). Since the construction of a substantial sewage infrastructure beginning in 1958 (for example, trunk lines and interceptors to carry sewage to treatment plants built at West Point and Renton), Lake Washington's water quality has dramatically improved (King County 2009a). Stormwater regulations since the 1990s have been aimed at treating and reducing pollutants in runoff before discharge to streams and lakes. Data collected from 1990 through 2001 indicate that Lake Washington's water quality supports and is consistent with the lake's beneficial uses (Tetra Tech and Parametrix 2003). Lake Washington now appears to be in a stable ecological condition with respect to water quality. Lake Washington has some of the best water quality for a large lake entirely within a major metropolitan area in the world (Tetra Tech and Parametrix 2003).

However, problems remain. Current regulations effectively regulate point discharge (end of pipe) from new projects but do not effectively regulate nonpoint discharges or pre-regulation point source discharges. While Lake Washington's overall water quality is improved over historical conditions and water quality is considered excellent for most parameters, Ecology still lists the lake as impaired because of bacterial contamination.

How are water resource conditions likely to change in the reasonably foreseeable future without the project?

The likely future condition of the surface water bodies of the study area will be a gradual and steady improvement in quality. This is expected to result from an ongoing decrease in the quantities of pollutants in treated stormwater from the continuing development and redevelopment of public and private lands in the study area. These newly developed and redeveloped properties and facilities, including roads and highways, will be required to provide appropriate and effective stormwater treatment following Ecology's regulations, which will contribute to these gradual improvements.

Under the No Build Alternative, the Evergreen Point Bridge would not receive increased stormwater treatment, thereby continuing its contribution of pollutions. However, other new construction, redevelopment projects, and upgrades to existing stormwater and wastewater treatment and discharge systems would improve water resources in the study area. For roads and highways, the new infrastructure would introduce modern stormwater treatment facilities where none existed before or that replace older, less effective treatment facilities. For example, water quality entering Lake Washington that was treated from the SR 520, Medina to SR 202 project would improve over time after construction. The long-term trend, therefore, would be a gradual improvement in the quality of stormwater runoff from transportation facilities because of increasing and more effective stormwater treatment.

What would the cumulative effect on water resources likely be?

The proposed project would add to the positive trend of improved surface water quality in WRIA 8 but would not affect the rest of the cumulative effect study area.

Stormwater runoff during construction of the Preferred Alternative would be mitigated to minimize the entry of waterborne contaminants into surface waters, and the project’s improved stormwater treatment facilities would reduce pollutant runoff from SR 520 paved surfaces relative to present conditions. For these reasons, the project team concluded that the proposed project would slightly offset negative trends from other past and present actions, and slightly add to the gradual improvement of water quality expected in the study area between now and 2030.

How could cumulative effects on water resources be mitigated?

Under the Build Alternative scenarios, the project does not contribute to a negative cumulative effect so, per WSDOT guidance, mitigation is not provided.

Ecosystems

Ecosystems can be divided into three components: wetlands, aquatic resources, and wildlife and wildlife habitat. Project construction would directly affect wetlands, streams, and wildlife habitat, but these effects would be mitigated as part of the project and design (WSDOT 2011d).

Wetlands

What direct and indirect effects would the project likely have on wetlands?

As discussed more fully in the Ecosystems Discipline Report Addendum and Errata (WSDOT 2011d), both project construction and operation of the Build and Preferred Alternatives would directly affect wetlands. Some of the wetlands along the SR 520, I-5 to Medina project corridor would be filled, cleared, or shaded. All such effects are considered direct effects.

The permanent effects on wetlands include filling 0.2 acre and shading 6.8 acres of wetlands. While the shaded wetlands would continue to function, the reduced light levels underneath the bridge could limit or retard plant growth or change species composition, which could change the type or quality of the habitat, and potentially alter wildlife use of the wetlands.

The wetlands assessment did not identify any expected indirect effects of the proposed project on wetlands (WSDOT 2011d).

How was the cumulative effects assessment of wetlands conducted?

The cumulative effects analysis for wetlands followed the standard method described above in the Approach section. The study area for indirect and cumulative effects on ecosystems, including wetlands, is WRIA 8, shown in Exhibit 6. The time frame for the ecosystems cumulative effects assessment starts at 1850, when significant Euro-

American settlement began within the Puget Sound region, and ends at 2030, the project design year.

The project team assessed typical potential effects of transportation and major redevelopment projects listed in Exhibit 8 on ecological resources and compared these to the potential effects of the Build and Preferred Alternative. Transportation projects were specifically reviewed because they are either long, linear structures that cut across landscapes or complex roadway interchanges confined by public right-of-way and that potentially affect ecological resources differently than a site development project. The review focused on activities that have long-term or far-reaching effects on wetland functions, such as habitat, water quality, and hydrology.

Many of the transportation projects in Exhibit 8 involve widening an existing highway. These widening projects are often constrained by the limits of the public right-of-way. Wetlands or other habitats in the right-of-way are often removed because of highway safety and space requirements. Thus, unavoidable effects on wetlands can occur and incrementally add to the loss of wetlands in the watershed. However, many of projects would be conducted along existing highways that have already affected the natural habitat in the right-of-way. In other projects, modification of existing interchanges may affect wetlands in or near the interchange right-of-way. These wetlands may have been created specifically for stormwater treatment or left from the original project construction. These wetlands have limited habitat function because of the frequent passage of vehicles.

What trends have led to the present wetlands conditions in the study area?

Chapter 10 of the *Transportation 2040* Final EIS (PSRC 2010b), Ecosystems and Endangered Species Act Issues, provides an overview of wetlands and trends in the Puget Sound region. Wetlands in the study area have been substantially affected by past and present actions including alteration of ecosystem processes; loss of forests and riparian habitat; loss of wetlands and habitat fragmentation; introduction of invasive species; agriculture; and increases in impervious surface area and water pollution associated with urban environments (including, but not limited to, changes in hydrologic flow regimes). Taken together, these effects have resulted in significant wetland loss in WRIA 8. Transportation systems, which are a component of the overall urban development pattern within the central Puget Sound region, have historically played a key part in these ecosystem changes (PSRC 2010a).

Wetlands do not function as isolated systems. The landscape and land uses that surround a wetland influence a wetland's ability to function. The majority of the adverse effects on wetlands have been from past and present actions, although several reasonably foreseeable actions could also contribute to the further decline of existing conditions.

Changes to the ecosystem typically affect many aspects of the system. For example, a change to a wetland, such as filling, may degrade water quality and reduce the quantity and quality of habitat for fish and wildlife. Substantial alterations to the natural environment in central Puget Sound have occurred. The most significant, from an ecosystem standpoint, was the construction of the Ship Canal and Ballard Locks, which lowered Lake Washington by about 9 feet in 1916, and construction of SR 520 and the Evergreen Point Bridge in the 1960s. In addition, wetlands in the region have been substantially affected by logging, agriculture, industrialization, and urban development, including increasing impermeable surface areas, altering ecosystem processes, and removing or fragmenting forested and riparian habitats, including wetlands.

Local government wetland protection standards, which have been established in Washington State only during the last 20 years, differ from jurisdiction to jurisdiction and may not always be sufficient to protect and maintain the long-term sustainability of wetland functions. Effects to wetlands generally require mitigation under local, state, and federal regulations.

Ecology now emphasizes that mitigation should occur within an ecological context using a landscape-based approach (Hruby 2004, Sheldon et al. 2005). Ecology has prepared two guidance documents to facilitate more effective compensatory wetland mitigation, *Wetland Mitigation in Washington State, Part 1: Agency Policies and Guidance* (Ecology et al. 2006a), and *Wetland Mitigation in Washington State, Part 2: Developing Mitigation Plans* (Ecology et al. 2006b), both prepared as part of a collaborative effort among Ecology, the USACE, and the U.S. Environmental Protection Agency (EPA). Long-term programs, such as in-lieu fee payments toward future mitigation and mitigation banking, are mitigation options that have recently become available in Washington State, and that are expected to improve success in addressing unavoidable effects to wetland resources.

How are wetlands conditions likely to change in the reasonably foreseeable future without the project?

It is expected that current regulatory and voluntary efforts to improve wetlands would continue with or without the project. Restoration efforts identified in the Arboretum Master Plan (City of Seattle et al. 2001) and Union Bay Natural Area and Shoreline Management Guidelines (UW Botanic Gardens 2010), would improve wetland habitat in the project vicinity relative to existing conditions. The UW Campus Master Plan has a number of improvements planned for the stadium and other areas on the campus (UW 2003). Any effects of constructing these non-WSDOT projects would be mitigated according to City of Seattle critical areas regulations and appropriate state and federal regulations.

Under the No Build Alternative, the project’s proposed stormwater treatment facilities would not be installed to improve the functions of wetlands in the study area, and untreated stormwater from SR 520 would continue to discharge into wetlands in Union Bay and Portage Bay. Stormwater from the reasonably foreseeable actions in Exhibit 8 would presumably be treated according to Washington State regulations, thereby minimizing water quality degradation in the future. However, if future projects do not include adequate mitigation for their effects, they could continue an incremental cumulative pattern of wetland decline by changing surface water quality and increasing impervious surface area in an already urbanized area. These effects, in turn, could alter plant and wildlife species diversity and habitat functions within the remaining wetlands.

What would the cumulative effect on wetlands likely be?

As discussed in the Ecosystems Discipline Report Addendum and Errata (WSDOT 2011d), WSDOT has worked to avoid and minimize effects on ecosystems during the scoping and design of this project. WSDOT avoided many effects on wetlands through careful identification of critical areas early in the design process of the project.

Where avoidance was not possible, effects were minimized by raising bridge heights, and improving water quality functions of aquatic wetlands. The project would make a beneficial contribution to wetlands resources in the Lake Washington area near the SR 520 corridor through improved stormwater management and treatment, which would help to reduce the cumulative effect of development on wetlands habitat. Through BMPs, conservation measures, and the application of specific construction sequencing and timing (such as minimizing in-water work), WSDOT would ensure that short-term construction effects on wetlands would be minimized to prevent any effects that could lead to any decreased permanent wetland function to the extent possible.

The Preferred Alternative's direct effect on wetlands includes filling 0.2 acre and shading 6.8 acres of wetlands. As noted above, no indirect effects are expected from the Build or Preferred Alternative.

The *Conceptual Wetland Mitigation Plan* (included in Attachment 9 of the Final EIS) provides an in-depth examination of mitigation sequencing, site selection, site characteristics, mitigation goals and acreage, construction activities, performance monitoring, and long-term protection of the sites. The goal of the compensatory mitigation would be to achieve no net loss of wetland area or function. The mitigation proposal is intended to fully mitigate for project effects on wetlands. As a result, the project's contribution to cumulative effects of wetlands within WRIA 8 is anticipated to be minor to negligible.

How could cumulative effects on wetlands be mitigated?

The federal wetland regulatory goal of no net loss and the recently updated state and local regulations for protecting and managing critical areas under the Growth Management Act are intended to slow the cumulative decline of wetlands. Beyond these measures, the cumulative effect of wetland conversion and loss could be mitigated by more stringent regulations, greater regulatory consistency and coordination among jurisdictions, improved planning at both regional and local levels, and increased participation of nongovernmental organizations and other stakeholders in restoration efforts. As noted above, long-term programs such as in-lieu fees and mitigation banking are intended to slow the loss and decline of wetland resources and functions. The City of Seattle has comprehensive plans and critical areas ordinances that guide future community development so that adverse cumulative effects on wetlands can be alleviated.

Aquatic Resources

What direct and indirect effects would the project likely have on fish and aquatic habitat?

As discussed in the Ecosystems Discipline Report Addendum and Errata (WSDOT 2011d), the Build and Preferred Alternatives would require construction activities that would temporarily affect salmonids, other fish species, and habitat in Lake Washington and the Ship Canal. Such construction effects would result from construction to replace the existing over-water and nearshore bridge structures.

Construction activities occurring within or directly adjacent to the study area water bodies could increase turbidity and total suspended solids levels. This could result in immediate and direct effects on fish related to changes in their migration, rearing, or feeding behavior. Such changes could result in delayed mortality to juvenile fish occurring in the study area. Construction would also include extensive pile-driving activities in the area, which could result in direct mortality to juvenile fish, or indirect effects related to behavioral modifications.

In-water work windows allow for construction at times when the least harm is anticipated for salmonid species and other species of concern, based on their expected occurrence in the area. Additionally, construction BMPs to reduce turbidity could be implemented to further reduce construction effects such as noise from pile-driving and sediment disturbances.

The use of work bridges would temporarily increase shading in the shallow areas along the route and may affect the density of near-shore vegetation. Much of this dense vegetation is invasive species and an area used by salmonids so the actual effect is likely to be both beneficial and negative. Proposed shoreline restoration work would further improve salmonid habitat in the nearshore area (water less than 20 feet deep) of Lake Washington.

Recent fish tagging studies show that smolt migration past the bridge is highly variable and indicates that other factors, such as natural cues unrelated to the bridge including rain events, have a greater influence on movement. A 2009 study found that the existing lights on the Evergreen Point Bridge attract juvenile salmonids (Tabor et al. 2010), but lighting would not be included on a substantial portion of the over-water areas covered by the new bridge.

In addition to the potential effects in Lake Washington and the Ship Canal, the Build and Preferred Alternatives could also directly affect aquatic resources in Grays Harbor and the pontoon-towing route from Grays Harbor to Lake Washington. While the potential effects of building and temporarily storing the pontoons in Grays Harbor are addressed in the SR 520 Pontoon Construction Project Final EIS (WSDOT 2010b), towing pontoons constructed under the SR 520 Pontoon Construction Project and the construction and towing of the supplemental stability pontoons are part of the SR 520, I-5 to Medina Project. The supplemental stability pontoons could be constructed at and towed from the site at Grays Harbor or the Concrete Technology

Corporation facility at the Port of Tacoma. Construction of the pontoons at the Grays Harbor facility could, if not mitigated, affect water quality in adjacent waters, which could in turn affect aquatic habitat and fish. The construction BMPs are intended to limit potential effects. During towing operations, the pontoons or towing vessels could startle or strike aquatic species or sink and affect aquatic substrate. These effects are unlikely to occur, and measures are in place (including towing protocols) to minimize the risk of sinking. Strikes are not generally a concern for fish species. None of the proposed activities at the pontoon construction sites or the towing would affect habitat conditions.

Habitat modification and shading from permanent bridge structures were identified as having potential indirect effects on aquatic species. Direct changes to the shoreline habitat as part of operation of the bridge could modify fish behavior though whether this change would be beneficial or negative was not determined. An example of fish behavior changes that could occur is increased use of the shoreline by all fish species, including predators of salmonids. The new bridge would also lead to shading over a larger area. However, the bridges would be higher and thus cast a less intense shadow over aquatic areas than the existing bridge. This could modify aquatic species behavior, though the exact nature of the modifications would be speculative at this time.

Changes in stormwater discharges to Lake Washington would likely improve long-term water quality conditions within the project vicinity relative to present conditions. These beneficial changes would likely have minimal influence on the overall fish and aquatic resources in the project vicinity.

How was the cumulative effects assessment of fish and aquatic habitat conducted?

The standard method for assessment is described in the Approach section. As noted, the project team considered the potential for construction effects of the SR 520, I-5 to Medina project, such as pile-driving's potentially long-term impacts to aquatic species, to contribute to a cumulative effect. However, avoidance measures, including restricting in-water work periods and BMPs, have reduced the potential impact resulting from construction so that it does not contribute to a cumulative effect.

The range of anadromous salmonids, along with where project activities would occur, determines the study area. For project operations, this includes the north Pacific Ocean, the northwest

Washington coast, the Strait of Juan de Fuca, the Georgia Strait, Puget Sound, and the Lake Washington watershed (WRIA 8). Additionally, project effects could include Grays Harbor (WRIA 22) because of the towing of pontoons as part of this project from the pontoon construction site.

The cumulative effects analysis for aquatic resources follows the standard time frame with a start date of 1850, as defined by the presence of significant European settlement within the Pacific Northwest and Alaska (including the operation of large-scale commercial fisheries), and an end point of 2030, which represents the design year for the project.

The baseline condition of the fisheries and aquatic habitat in the study area was determined by evaluating trends from past actions that led to the present (baseline) condition, and existing trends that would influence the future condition of the resource. This evaluation was done by consulting the scientific literature and a variety of relevant technical reports (PSRC 2010a, Good et al. 2005, Washington Department of Fisheries et al. 1993, Washington Department of Fish and Wildlife [WDFW] 2002, WDFW 2004, Kerwin 2001, Smith and Wenger 2001, Williams et al. 1975).

The reasonably foreseeable projects used in the analysis are listed in Exhibit 8. The SR 520, Medina to SR 202 project is immediately east of the SR 520, I-5 to Medina project. This nearby project would affect aquatic resources and improve water quality conditions in the watershed. The SR 520, Medina to SR 202 project would also provide substantial mitigation for its project effects.

What trends have led to the present fish and aquatic habitat conditions in the study area?

The existing conditions of Lake Washington are the result of a series of major physical and limnological changes within the study area resulting from human occupation and use of the watershed since the mid-1800s. The following are the most significant of these:

- The outlet of Lake Washington was changed from the Black River to the newly constructed Montlake Cut, Ship Canal, and Ballard Locks in 1916.
- The change in outlet lowered the lake level by about 9 feet, eliminating much of the natural shallow water and wetland habitat around the lake and producing similar new habitat in Union and

Portage Bays. This exposed about 1,300 acres of previously shallow water habitat, reduced the lake's surface area by 7.0 percent, decreased the shoreline length by about 12.8 percent, and eliminated much of the lake's shoreline wetlands (Chrzastowski 1983).

- The Ballard Locks created a regulated outlet and limits the fluctuation of the Lake Washington water level to 2 feet or less. The lake level historically varied by up to 6.5 feet during flood events.
- Also in 1916, the Cedar River was redirected from the Black River into Lake Washington, resulting in an increase in the amount of inflow to the lake.

These changes provided a new migratory/rearing corridor for juvenile anadromous salmonids produced in the Lake Washington watershed. Juveniles leaving the Cedar River had to migrate about 10 miles north to the new lake outlet of the Ship Canal after 1916, through slack water lake habitat, rather than directly to the free-flowing Black and Green-Duwamish Rivers. This eliminated the use of the migrants' rearing and saltwater transition habitat of the lower Duwamish River and its extensive estuary. The Ballard Locks and Salmon Bay produce an abrupt transition from the high-salinity water of Puget Sound into a small estuary that supports initial saltwater transition and rearing (Cooksey et al. 2008).

East of Montlake Cut lies approximately 12 linear miles of Lake Washington shoreline between the Cedar River and Union Bay. The shoreline along this migration route has human-made bulkheads over about 80 percent of its length and about 400 residential docks that extend offshore 30 to 100 feet to cover an estimated 4 percent of the lake surface area within 100 feet of the shoreline (Toft et al. 2003, Weitkamp et al. 2000). The natural riparian vegetation has been removed from nearly 90 percent of the shoreline between the Cedar River and Union Bay. Non-native aquatic vegetation populates substantial portions of the shallow water habitat along the migration route, becoming sufficiently dense in late spring and summer to block access to this generally preferred habitat of migrating/rearing juvenile salmonid species (Celedonia et al. 2008). This vegetation also provides habitat for predator fish species and reduces the water quality conditions for salmonids and other aquatic species (Frodge et al. 1995).

Construction of the I-90 and Evergreen Point bridges has also affected Lake Washington aquatic habitat conditions (see Exhibit 13). The I-90 bridge was rebuilt in the early 1990s to produce a much wider structure over Lake Washington, with a gap between the eastbound lanes and the westbound lanes and HOV lanes. These structures have the potential to alter the migratory and rearing behavior of fish residing or migrating through the area. The existing Evergreen Point Bridge's lights have been found to attract juvenile salmonids, also causing changes in fish behavior (Tabor et al. 2010). These behavioral changes could reduce the survival rates of these fish.

Exhibit 13. Dates of Significance for Construction of Lake Washington Bridges

Year	Action
1940	I-90 bridge completed
1963	Evergreen Point Bridge completed
1990	Portions of the I-90 bridge sank, discharging a large volume of contaminated water to Lake Washington
1993	New I-90 bridge completed

More recently, the Lake Washington watershed has experienced the following changes, most of which are likely attributable to human development, together with climate change:

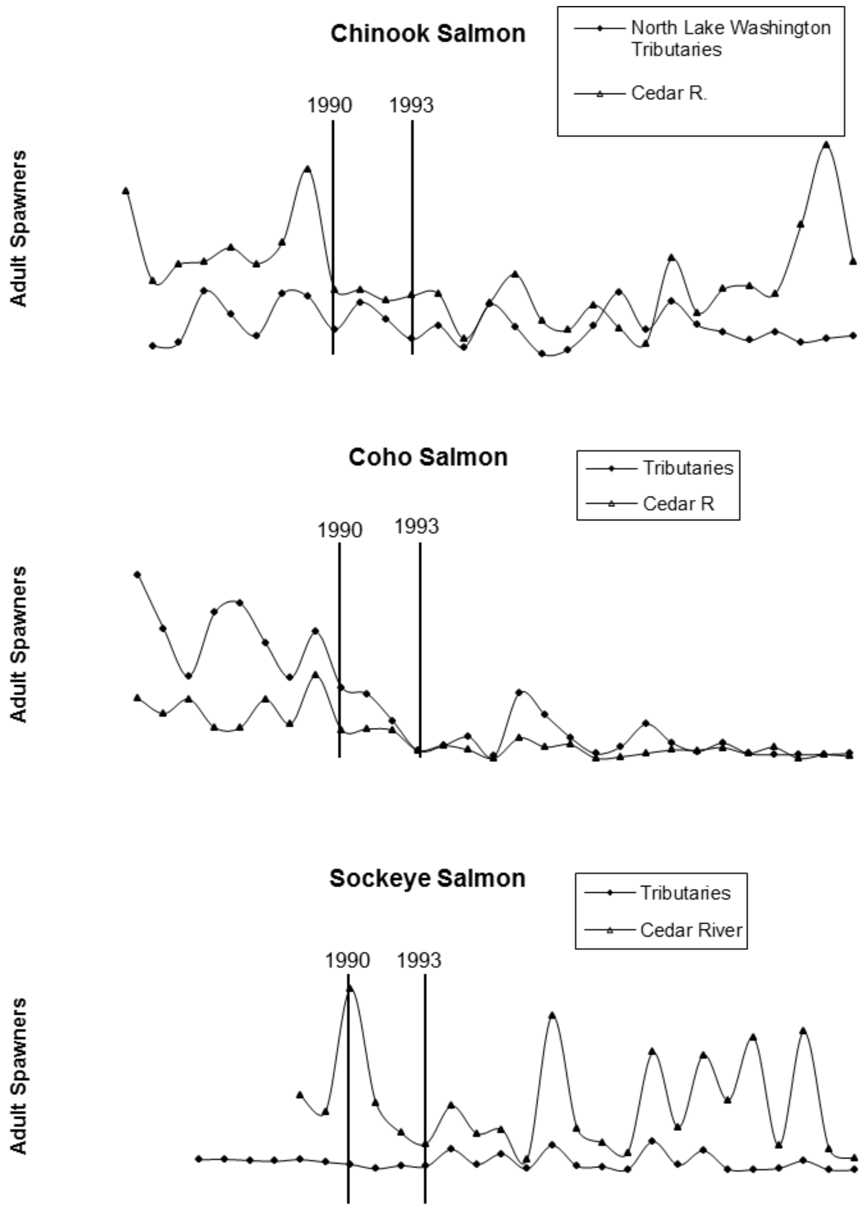
- Increasing long-term trend in seasonal and annual average water temperatures, with a 1.5 degree Fahrenheit rise in the upper approximately 30 feet of the lake between 1964 and 1998 (Arhonditsis et al. 2004)
- Introduction of sockeye salmon into the Cedar River with a recently introduced hatchery program to enhance the run
- Hatchery-reared Chinook salmon resulting in about 2 million juveniles released each year and returns of approximately 10,000 or more adults annually (WDFW 2010a)
- Introduction of at least 23 non-native predator and competitor fish species into the lake, thereby substantially altering the lake's biological community, as well as its habitat (Weitkamp et al. 2000). Some of these non-native species now form major populations in the lake and potentially compete with or prey on juvenile anadromous fish. Known substantial predators of young salmon

include smallmouth and largemouth bass (Fayram 1996, Tabor et al. 2004).

- Planting of hatchery-reared rainbow trout in Lake Washington for a number of years. The larger individuals preyed on juvenile salmonids (Beauchamp 1987).
- Artificial rearing and release of coho salmon in the Lake Washington watershed since at least 1950 (Donaldson and Allen 1958). Juvenile coho salmon are released in the Lake Washington watershed in large numbers. In other areas, the young coho have been shown to be substantial predators of smaller juvenile salmonids (Pearsons and Fritts 1999).

The number of anadromous salmon returning to Lake Washington should provide information on potential effects of the existing floating bridges on salmon populations. The dates of important bridge changes are listed in Exhibit 13. The original construction of the I-90 and Evergreen Point bridges was completed before salmon population counts, although the 1990 sinking of the I-90 bridge and construction of the new bridge in 1993 were completed during the period of available salmon data (Exhibit 14). Effects on the juvenile salmon populations should have been evident in returns 2 to 3 years later, if effects have occurred.

Generally, the counts of adult returns show a decline in numbers since the late 1980s, before the changes occurring with the I-90 bridge. Chinook returns to Lake Washington have been highly variable, with substantial differences between the trends of the Cedar River counts and north Lake Washington-Issaquah counts, potentially showing an effect of the bridges on the Cedar River population that migrates past both bridges. The north lake populations remained relatively strong through the 1990s and then show clear declines. However, the Cedar River Chinook salmon population has been modestly robust since about 2000, with low numbers from 1996 to 2000. These numbers do not show obvious trends related to the I-90 changes in 1990 and 1993. Although coho counts for the Cedar River show a decline since 1991 compared to earlier years, the counts for other Lake Washington and Lake Sammamish tributaries show the same trend. Sockeye counts do not indicate any changes relative to the timing of the changes in the I-90 bridge. Thus, the salmon population counts do not show obvious evidence of effects resulting from the changes in the I-90 bridge.



Note: Cedar R. sockeye counts derived from Ballard Lock counts minus tributary and beach counts.
Source: WDFW 2010b, 2010c

Exhibit 14. Variability in Numbers of Returning Salmon Spawners Relative to the Timing of Changes in Bridge Structures across Lake Washington

By inference, the replacement of the Evergreen Point Bridge is not expected to result in changes to salmonid returns.

The portion of the study area that includes WRIA 22 encompasses the Grays Harbor estuary and Chehalis and Humptulips Rivers. The salmonids in WRIA 22 depend on the estuary for food, rearing, and migration habitat. The estuary is currently in relatively good condition. The loss of near-shore habitat, degraded water quality, and routine ship channel dredging are the primary issues of concern (The Chehalis Basin Partnership 2008).

How are the fish and aquatic habitat conditions likely to change in the reasonably foreseeable future without the project?

Some WRIA 8 salmonid stocks have appeared to stabilize because of improved management and recovery efforts. However, continued recent and present trends and stressors (such as continued regional population growth and global climate change) indicate that, under the No Build Alternative, the condition of fish and aquatic habitat would most likely continue along a level or downward trend into the reasonably foreseeable future. These factors are directly influenced by ocean temperatures and circulation patterns, which are influenced by climate processes, and might be negatively affected by global climate change associated with GHG emissions.

Large-scale restoration plans and activities are being implemented in the study area and throughout the Puget Sound area. These activities might slow, or even halt, the existing downward trends in fish populations. For example, Shared Strategy for Puget Sound, a collaborative initiative to restore and protect salmon runs across Puget Sound, coordinates with existing recovery efforts and works with federal, tribal, state, and local governments, businesses, and conservation groups. Fifteen watersheds, including Lake Washington, are participating in the Shared Strategy process to identify actions to recover salmon and obtain the commitments needed to achieve the actions. Goals for Lake Washington include improvements to fish access and passage, riparian restoration projects, improvements in water quantity and quality, and protection and preservation of existing high-quality habitat. The Chehalis Basin Partnership, which includes WRIA 22 and Grays Harbor, is another example of watershed planning and restoration occurring in the study area.

Improvements to water quality are expected to continue for Lake Washington and Puget Sound through improvements to stormwater management and treatment, as roads are upgraded and new development and redevelopment occurs with stricter water quality and runoff regulations. Such improvements would occur from the SR 520, Medina to SR 202 project. The new project would collect and treat stormwater from new and replaced road surfaces, thereby improving water quality in nearby streams that drain to Lake Washington. In addition, several stream crossings under SR 520 between Medina and I-405 would be upgraded to improve fish passage. Portions of Yarrow Creek would be reconfigured and large woody debris would be installed to improve fish habitat and use. However, these types of improvements would not occur on the SR 520, I-5 to Medina project under the No Build Alternative, so the roadway would continue to contribute to the degraded, though improving, water quality conditions in Lake Washington.

In addition, the added protection provided to species listed as threatened or endangered under the ESA, as well as their designated critical habitat, would improve conditions for other species occurring in the area. This is particularly true for other salmonid species, which occupy similar habitats as the three salmonids species currently protected by the ESA.

Survival of salmonids within the north Pacific Ocean portion of their migration route is a major factor in assessing the cumulative effects of a project on aquatic resources. Ocean conditions such as the Pacific Decadal Oscillation, El Niño, sea surface temperature anomalies, coastal upwelling influence the growth and survival of all northwest Pacific salmon stocks (Peterson et al. 2010). These conditions will continue to change and be a major factor in the survival of anadromous salmon produced in the Lake Washington and Grays Harbor watersheds.

What would the cumulative effect on fish and aquatic resources likely be?

The fact that Pacific salmon stocks inhabiting Lake Washington and its tributaries are classified as endangered under the ESA indicates that their populations are at a tipping point where long-term trends in their condition could be adversely altered by short-term construction effects. In particular, impact pile-driving and the presence of construction work bridges could impede salmon migration, and the overhead structures provided by work bridges could increase salmon mortality by providing habitat for predators. These short-term construction effects could thus contribute to the cumulative effect on salmonids. Over the long term, the SR 520, I-5 to Medina project would have a minor beneficial, though likely not measurable, contribution to the cumulative effect on aquatic resources. The condition of habitat and expected restoration plans for salmonid recovery as described above would not change as a result of the SR 520, I-5 to Medina project. This project is expected to provide a slight beneficial contribution to the cumulative effect on water quality in Lake Washington, though it would have no effect throughout the rest of the study area. Recent juvenile salmon studies indicate that the new bridge would have an effect similar to or less than the existing Evergreen Point Bridge on smolt migration. The new transition spans, specifically the west transition span, would have less intense direct effects on smolt migration as they are higher and farther offshore, thus reducing shading effects on behavior. Data for adult spawner returns also support the conclusion that the project would not have a measurable effect on aquatic resources. As previously discussed, the condition of the ocean is a major factor in survival of anadromous salmon, though the incremental loss of freshwater habitat cannot be discounted or ignored. However, this cumulative loss, part of a greater trend, would not receive a contribution from the direct or indirect effects of the SR 520, I-5 to Medina project.

How could cumulative effects on fish and aquatic resources be mitigated?

A variety of measures could mitigate the cumulative effects on fish and aquatic resources, such as the following:

- A region-wide cooperative interagency approach or public-private partnerships, with a focus on improving fish habitat conditions and water quality within WRIAs 8 and 22 and Puget Sound, would aid in the recovery of fish stocks. This is underway with watershed planning, which specifically addresses water quality and habitat, as well as ESA recovery plans addressing listed species but also possibly improving habitat and other life cycle issues for other non-listed species.

- More stringent land use regulations could reduce future negative effects on fish associated with stormwater runoff and human development.

- Habitat restoration at the south end of Lake Washington is potentially available at the Cedar River Delta and the adjacent Washington State Department of Natural Resources (DNR) site east of the delta. These potential projects offer the opportunity to produce new high-quality shoreline habitat at locations where it would be most valuable to salmonid fry emigrating from the Cedar River.

Wildlife and Wildlife Habitat

What direct and indirect effects would the project likely have on wildlife and wildlife habitat?

The wildlife species and habitat types potentially affected are identified and described in the Ecosystems Discipline Report Addendum and Errata (WSDOT 2011d). The SR 520, I-5 to Medina project would directly affect wildlife and wildlife habitat from both construction and operation of the Build and Preferred Alternatives.

Activities related to construction of the Build and Preferred Alternatives would disturb wildlife and might cause them to leave the study area. Many of the animals that live next to the highway corridor (for example, raccoons, crows, and waterfowl) are accustomed to living in urban areas and may not be disturbed by construction-related activity and habitat alteration. Individuals that are more sensitive to disturbance would be displaced to other areas of suitable habitat. These effects are generally not permanent, as urbanized wildlife are generally adaptable to changing conditions. Construction and transport of pontoons could also cause short-term disturbance of marine wildlife found in the waters of the outer Washington coast, the Strait of Juan de Fuca, and Puget Sound.

The Build and Preferred Alternatives could affect wildlife by permanently removing 8.1 acres and shading 6.5 acres of vegetation and other features of wildlife habitat. The project would also provide beneficial effect by improving stormwater treatment, decreasing noise disturbance, and reducing barriers to animal movement. Specific effects on wildlife would vary by species and throughout the SR 520, I-5 to Medina project corridor. Indirect effects may occur if any animals move to other areas in response to habitat loss, displacing individuals already present in those areas.

How was the cumulative effects assessment of wildlife and wildlife habitat conducted?

The project team followed the standard method described in the Approach section. The project team also reviewed the list of reasonably foreseeable actions in Exhibit 8 for effects on wildlife habitat. The methods of analysis are similar to those used to analyze wetland resources. Wildlife habitat along the linear margins of the highway rights-of-way varies depending on location, width of the right-of-way, and road surfaces. In general, wildlife habitat is low quality within the right-of-way, especially if adjoining areas are developed. Adjacent undeveloped areas may add to the overall habitat quality near the area, but wildlife may be killed while attempting to cross from one habitat to another. In roadway interchanges, wildlife habitat is limited because of frequent passage of vehicles and by maintenance activities in the right-of-way.

The project team considered potential cross-disciplinary effects that could affect wildlife and wildlife habitat by reviewing other discipline reports and communicating with other authors. The project team reviewed the other disciplines (wetlands and aquatic resources) in the Ecosystems Discipline Report Addendum and Errata (WSDOT 2011d). They also reviewed the Construction Techniques Discipline Report Addendum and Errata (WSDOT 2011b), the Recreation Discipline Report Addendum and Errata (WSDOT 2011g), the Noise Discipline Report Addendum and Errata (WSDOT 2011h), the Final Transportation Discipline Report (2011i), and the Final Cultural Resources Assessment and Discipline Report (WSDOT 2011e).

The SR 520, I-5 to Medina project has the potential to affect reptiles, amphibians, mammals, and birds along the SR 520 corridor as well as marine wildlife and birds along the pontoon transportation route. For this reason, the study area also includes WRIA 8, Puget Sound, the Georgia Strait, and the Strait of Juan de Fuca. The time frame for the analysis was from 1850 to 2030.

What trends have led to the present wildlife and wildlife habitat conditions in the study area?

Chapter 10 of the *Transportation 2040* Final EIS (PSRC 2010b), Ecosystems and Endangered Species Act Issues, provides an overview of ecosystems, including wildlife, and trends in the Puget Sound region. Past development actions, such as road construction and housing, have adversely affected wildlife habitat within the study area. Recent past and present trends in habitat quality and quantity are expected to continue in response to present actions and reasonably foreseeable actions. These actions include alteration of ecosystem processes; loss, alteration, and fragmentation of suitable habitat; introduction of invasive species; overharvesting; increases in impervious surface area and water pollution; and changes in natural flow regimes. Taken together, these effects have resulted in significant loss of wildlife habitat in WRIA 8. Transportation systems, which are a component of the overall urban development pattern within the central Puget Sound region, have historically played a key part in these ecosystem changes (PSRC 2010a).

How are wildlife and wildlife habitat conditions likely to change in the reasonably foreseeable future without the project?

In the reasonably foreseeable future without the SR 520, I-5 to Medina project, wildlife and wildlife habitat, with the exception of urban-adapted wildlife, is likely to continue to decline as the factors affecting wildlife mentioned above continue. However, the ESA and other federal, state, and local regulations are designed to protect wildlife and the ecosystems on which they depend. Regulatory and voluntary efforts to improve habitat are expected to continue with or without the project. Water quality in Lake Washington is likely to continue to improve as land development and roadway projects in the study area are constructed and the management and treatment of stormwater improves.

Land development and roadway projects may either benefit or adversely affect wildlife and wildlife habitat. In the project area, there are no large tracks of undeveloped land; even parks are highly managed, though may be more compatible with wildlife. The Arboretum and other restoration programs discussed in the Wetlands section will likely benefit wildlife as well.

The coastal route for shipping the pontoons contains suitable habitat or occurrences of six ESA-listed species (leatherback sea turtle, southern resident killer whale, humpback whale, Steller sea lion, brown pelican, and marbled murrelet), as well as designated critical habitat for the southern resident killer whale population. No species listed under the ESA occur along the SR 520 corridor, although the bald eagle receives protection under the Bald and Golden Eagle Protection Act and the Migratory Bird Treaty Act. The trends for effects on wildlife and wildlife habitat are likely to continue, though state and federal regulations and international treaties that may be implemented within the project timeframe would slow or mitigate those losses.

What would the cumulative effect on wildlife and wildlife habitat likely be?

In general, wildlife in the study area has been substantially affected and would continue to be affected by past actions, present actions, and reasonably foreseeable actions. The availability of suitable habitat for many species of wildlife is likely to continue to decline. In contrast, wildlife adapted to urban conditions (such as crows, sparrows, and raccoons) is likely to continue to flourish.

The existing SR 520 roadway creates a barrier to not only people but also wildlife. Many of the features of the proposed project to increase connectivity for people, such as trail improvements, may also help wildlife. WSDOT has made efforts to avoid and minimize negative effects on wildlife. However, the project would result in permanent loss of wildlife habitat. Adverse effects associated with habitat loss may be offset to some degree by long-term improvements in stormwater quality, decreased noise disturbance, and reduced barriers to animal movement.

In association with wetland mitigation and shoreline restoration efforts, vegetation would be planted in the Arboretum and the Union Bay Natural Area. These enhanced wildlife habitats would reduce the overall effect of the project on wildlife habitat. Additional information is presented in the *Conceptual Aquatic Mitigation Plan* and *Conceptual Wetland Mitigation Plan* (in Attachment 9 of the Final EIS).

Urban habitats in the SR 520 corridor are not likely to provide key habitat for the maintenance of wildlife populations that are threatened by range-wide habitat degradation and loss. Considered with the effects of past, present, and reasonably foreseeable actions, the direct effects of the project operation would be expected to have a negligible contribution to cumulative effects on wildlife in the study area.

How could cumulative effects on wildlife and wildlife habitat be mitigated?

A number of initiatives under way would also improve wildlife habitat. These include improving park areas and creating corridors for people that also function as wildlife corridors. The City of Seattle has a number of regulations that limit vegetation removal, which could be strengthened or expanded to further promote wildlife habitat. The following are other potential measures:

- More stringent regulations through land use planning and growth management
- Improved planning on a larger scale to include wildlife corridors
- Better coordination among agencies to voluntarily implement planting and corridor strategies

- National or global agreements limiting the emission of GHGs that could help slow or stop the manifestations of global climate change
- Voluntary efforts by individual developers that can often be implemented at relatively small additional cost; these efforts could create small but, with time, cumulatively substantial new habitat areas to slow and offset cumulative habitat loss from past development, such as the following:
  - Using native plants in landscaping
  - Designing curved or irregular rather than straight boundaries between vegetated and nonvegetated areas
  - Leaving islands of native vegetation connected by vegetated corridors
  - Providing vegetated buffers along streams

Air Quality

What direct and indirect effects would the project likely have on air quality?

As discussed more fully in the Air Quality Discipline Report Addendum and Errata (WSDOT 2011j), construction of the SR 520, I-5 to Medina project would produce exhaust gas and particulate emissions during excavation and other onsite activities using heavy equipment. Haul trucks would also generate dust along their routes without use of BMPs. However, air emissions from construction activities are not expected to cause a change from the baseline condition or a violation of National Ambient Air Quality Standards (NAAQS). WSDOT would minimize potential direct effects from project construction consistent with the procedures outlined in the Memorandum of Agreement between WSDOT and the Puget Sound Clean Air Agency (PSCAA) for controlling fugitive dust. In addition, federal regulations require the use of ultra-low-sulfur diesel fuel in on-road trucks as of 2010.

Trucks hauling construction materials to and from the SR 520 corridor would generate vehicle air emissions and could generate dust. Particulate release (fugitive dust) could occur as a result of excavating fill materials at borrow sites distant from the construction zone or from haul trucks or onsite equipment. Dust at excavation sites would be abated by the regulations governing operation of those sites and would not noticeably increase as a result of this project.

Project operation would result in higher vehicle miles traveled (VMT), but lower vehicle emissions in 2030 than under existing conditions (existing conditions are the baseline year of 2008). The Energy Discipline Report and Addendum (WSDOT 2011k) provides more detail. The reduction of emissions, which would occur even with more VMT in 2030, is due to the general increase in vehicle speed resulting from reduced congestion, as well as advancements in vehicle and fuel technology. The project is not anticipated to introduce any NAAQS violations or have an adverse effect due to Model Source Air Toxics emissions (WSDOT 2011j). However, operation of the project has the potential to provide indirect benefits to air quality in the form of reduced single-occupancy vehicle use resulting from expanded transit service on SR 520.

Potential direct, indirect, and cumulative effects on GHG emissions are discussed in the Energy Consumption and Greenhouse Gas Emissions section of this report.

How were cumulative effects on air quality assessed?

The project team followed the method outlined in the Approach section. Air quality is usually discussed in terms of regional effects, although direct effects within specific locations, such as near a large emission source, can also be estimated. Emissions from many sources accumulate in the atmosphere and together contribute to regional air quality. When transportation and land development projects are built and then used over the long term, emissions are released into the air by heavy equipment and haul trucks during construction, the vehicles traveling on the completed roadway or other transportation facility, the heating systems of buildings and houses, and other sources. The following sections explain how past trends, present actions, and regionally planned transportation and land development projects are expected to contribute to the future cumulative effect on air quality in the central Puget Sound region, with and without the proposed project.

The project team based the air quality cumulative effects assessment on applicable federal regulations and standards. The federal Clean Air Act, last amended in 1990, requires EPA to set NAAQS (40 CFR 50) for pollutants considered harmful to public health and the environment. EPA has set federal standards for six principal air pollutants, which are called “criteria” pollutants: fine and coarse particulate matter (PM), ozone, carbon monoxide (CO), sulfur dioxide, and lead. In addition, EPA regulates nearly 200 chemical compounds known as hazardous air pollutants, or air toxics, under Section 112 of the Clean Air Act. Air toxics can be emitted into the air directly and can be formed in the atmosphere by chemical reactions (Seigneur 2005). Federal, state, and regional agencies operate ambient air monitors near to ensure the region meets national air quality standards. Areas where air pollution levels persistently exceed the NAAQS may be designated as "nonattainment" areas and are subject to stricter regulations regarding air emissions from new industrial sources and transportation projects. An area may be considered a "maintenance" area if it was formerly nonattainment but is currently meeting the NAAQS. Maintenance areas are also subject to stricter regulations to ensure continued attainment of the NAAQS. The project team used the NAAQS as the benchmark to characterize present air quality and expected air quality trends in the reasonably foreseeable future with and without the project.

The project team made the following assumptions:

- Once a region is designated as a maintenance area (a former nonattainment area where a maintenance plan is in effect), it is no longer in nonattainment and meets the NAAQS. Therefore, there is no longer an adverse cumulative effect of pollutant emissions.
- All present and reasonably foreseeable actions, including transportation and land development projects, are and will be subject to regulatory limits on their pollutant emissions.

The project team used recent ambient air monitoring data near the SR 520 corridor as presented in the Air Quality Discipline Report Addendum and Errata (WSDOT 2011j). The study area for air quality is the central Puget Sound region and the timeframe is from 1970 to 2030. This timeframe reflects the passing of the Clean Air Act when air quality issues were placed under federal regulatory control. Before 1970, air quality was deteriorating in various regions around the United States and the act was passed in response.

What trends have led to the present air quality condition in the central Puget Sound region?

PSRC's *Transportation 2040* provides an overview of air quality conditions and trends in the Puget Sound region, concluding that "regional air pollution trends have generally followed national patterns over the last 20 years, with the level of criteria air pollutants decreasing over the last decade to levels below the federal standards" (PSRC 2010a). The *Transportation 2040* points out that CO levels have decreased substantially in the region, in large part because of federal emission standards for new vehicles and the gradual replacement of older, more polluting vehicles. It notes that "oxygenated fuels programs, inspection and maintenance programs, and traffic control measures have also played a role in the declining CO emissions trend" (PSRC 2010a).

Portions of the central Puget Sound region have been designated as maintenance areas for CO and PM, although the project is not located within the PM maintenance area. The region is in attainment for all other criteria pollutants. Federal, state, and regional agencies cooperate to coordinate jurisdictional responsibilities for air quality throughout the region. In addition to the EPA Office of Air Quality Planning and Standards, which establishes the NAAQS, Ecology, PSRC, and PSCAA have all established compatible air quality management goals and exercise jurisdiction at the state and regional levels. County and municipal air quality statutes contribute further to air quality regulation and management at local levels.

In general, air quality trends and projections in the central Puget Sound region conform with Ecology, PSRC, and PSCAA management goals to maintain air quality criteria pollutant levels below the NAAQS and to achieve steady improvement, although there have been recent localized exceptions with respect to ozone and PM (PSRC 2010a). Recent ambient air monitoring data for monitors near the SR 520 corridor indicate that concentrations have been below the NAAQS for each of the six criteria pollutants for the past 5 years (WSDOT 2011j). Although 5 years may be too short a period to establish a reliable trend, the data do suggest that ambient air quality may be improving in the project vicinity, a trend reflected nationally. Cleaner cars, industries, and consumer products have contributed to cleaner air throughout much of the United States. EPA expects air quality to continue to improve as recent regulations are fully implemented and states work to meet national standards. Among these regulations are the Locomotive Engines and Marine Compression-Ignition Engines Rule, the Tier II Vehicle and Gasoline Sulfur Rule, the Heavy-Duty Highway Diesel Rule, the Clean Air Non-Road Diesel Rule, and the Mobile Source Air Toxics Rule (EPA 2008).

How is air quality likely to change in the reasonably foreseeable future without the project?

Without the project, regional air quality is still likely to improve between the present and 2030 because of trends towards cleaner vehicles and industries. A number of transportation infrastructure projects are planned for the reasonably foreseeable future, including the provision of HOV lanes from SR 520, Medina to SR 202 and Sound Transit's North Link and East Link light rail projects. These projects would increase transit and multiple-occupancy vehicle use on the SR 520 corridor beyond present levels, increase the overall efficiency of the transportation system, and help to reduce the overall VMT.

What would the cumulative effect on air quality likely be?

Because the Build and Preferred Alternatives would be a major transportation project located in a maintenance area for CO, it would be subject to transportation conformity requirements. The intent of transportation conformity is to ensure that new projects, programs, and plans do not impede an area from meeting and maintaining air quality standards. Conformity with the state implementation plan means that transportation activities will not produce new air quality violations, worsen existing violations, or delay timely attainment of the NAAQS.

Operation of the project is not anticipated to create any new violations or increase the frequency of an existing violation of the CO standard; it would conform with the purpose of the current State Implementation Plan and the requirements of the federal Clean Air Act and the Washington Clean Air Act. As a "regionally significant" project, the proposed project is included in the current regional transportation plan (RTP), *Destination 2030* (PSRC 2007), and in the *Central Puget Sound Regional 2007-2010 Transportation Improvement Program*, which lists all current transportation projects (PSRC 2009b). The RTP and the transportation improvement program meet the conformity requirements identified by federal and state regulations for CO. The proposed project is also included in all of the action alternatives in *Transportation 2040* (PSRC 2010a).

How could cumulative effects on air quality be mitigated?

No cumulative effects were identified so per WSDOT guidance, so mitigation is not provided.

Geology and Soils

What direct and indirect effects would the project likely have on geology and soils?

As discussed more fully in the Geology and Soils Discipline Report Addendum and Errata (WSDOT 2011l), building the Build and Preferred Alternatives could have a number of direct effects related to geology or soil conditions. These include soil erosion and runoff during heavy rains, site-specific topographic changes, local slope instability and landslides, ground disturbance from vibrations during pile-driving and heavy equipment use, and soil compression. Potential effects are carefully considered for highway construction projects, and WSDOT would apply BMPs to avoid or minimize them. WSDOT anticipates that the effects would be for the duration of construction and minor.

Direct effects during operation of the Build and Preferred Alternatives could include slope instability, erosion, and landslides; changes in groundwater flow; and long-term soil settlement. While the project would not cause seismic events, there is always a risk of seismic events occurring during the period of operation. The proposed project would be designed and built to withstand a major earthquake, as discussed in the Geology and Soils Discipline Report Addendum and Errata (WSDOT 2011l).

The only potential indirect effect associated with construction of this project relates to material use. Aggregate for concrete and other granular material for construction fill would be mined from borrow pits distant from the project site, reducing by a small amount the regional availability of aggregate and fill for use on other projects. Because material extraction would occur farther in distance from the SR 520 corridor than other construction effects, this is considered to be a minor indirect effect of the project.

How was the cumulative effects assessment on geology and soils conducted?

The project team, following the standard assessment methodology, considered cumulative effects on geology and soils to be lasting changes to landforms, terrain, soil conditions, subsurface features, mineral material supplies, and other regional geophysical characteristics occurring as trends over long periods.

The time frame for the analysis is from post-glacial times with a focus on modifications resulting from European settlement starting in 1850 through to the design year of 2030. The study area is the central Puget Sound as shown on Exhibit 6. Reasonably foreseeable actions that were considered include the SR 520, Medina to SR 202 project, the East Link light rail project, the North Link Light Rail Station at Husky Stadium project, and the UW Campus Master Plan.

What trends have led to the present geology and soils conditions in the Puget Sound region?

The Puget Sound has undergone multiple glaciations that have deposited a variety of soil types (PSRC 2010a). Supplies of aggregate, including sand and gravel, are in the many millions of tons, with gravel mines located throughout the Puget Sound region.

Near the corridor, human activities since the late 19th century have substantially changed the topography. These activities include lowering of Lake Washington; construction of the Montlake Cut; and substantial terrain alterations to build the I-5 and SR 520 roadways, the UW campus, and other buildings and structures along the SR 520 corridor.

Past construction practices were less effective than today's in anticipating geologic and seismic hazards, gravel depletion, and soil erosion. As the infrastructure aged, a greater percentage of constructed projects did not meet evolving seismic design standards. As these trends became evident, roadway and bridge design codes were updated to provide better protection for the public, resulting in facilities that are more capable of resisting seismic events without damage. BMPs are standard practice in protecting against soil erosion and landslide potential. Construction debris can now be recycled into usable building materials.

How would geology and soils likely change in the reasonably foreseeable future without the project?

Proposed projects would continue to result in minor changes to topography through excavation and filling. Near the project, for example, the SR 520, Medina to SR 202 project, the East Link light rail project, the North Link Light Rail Station at Husky Stadium project, and the UW Campus Master Plan would all contribute to changes in the adjacent topography. However, these and other transportation and development projects would be constructed to ever-evolving design and seismic safety standards; no negative effects on geologic and soil conditions would be likely.

Planned construction projects would likely require sand, gravel, and other mineral materials extracted from borrow sites. Over the long term, this could result in development of new borrow sites or expansion of existing sites to maintain adequate supplies for construction.

What would the cumulative effect on geology and soils likely be?

The SR 520, I-5 to Medina project would be constructed to current seismic standards and would decrease the risks associated with a seismic event along a major transportation corridor used by thousands of people every day.

Construction of the project would contribute towards depleting regional sources of aggregate in conjunction with other past, present, and reasonable and foreseeable projects in the central Puget Sound region. However, given the large supply of aggregate across the region, no adverse cumulative effects would be anticipated.

How could cumulative effects on geology and soils be mitigated?

No cumulative effects were identified, so per WSDOT guidance, mitigation is not provided.

Hazardous Materials

Hazardous materials are not themselves a resource that would be evaluated for cumulative effects. Hazardous materials can, however, enter the air and water and eventually affect human health and ecosystems. Hazardous materials can be associated with contaminated soils and groundwater, building materials encountered through demolition, accidental spills at construction sites, and leaking underground storage tanks. Depending on the type of contamination, there can be risks to worker safety and public health as well as environmental damage.

The risk of encountering hazardous materials during the construction of this project is low, however, and safeguards would be in place to minimize construction effects, including the WSDOT SPCC Plan for construction projects. The Build and Preferred Alternatives would further contribute to the gradual reduction in existing ground and water contamination by removing hazardous materials that might be encountered during construction. See the Hazardous Materials Discipline Report Addendum and Errata (WSDOT 2011m) for additional information.

Transportation improvement projects improve hazardous materials conditions because contaminated soil or water encountered during construction must be removed and disposed, leaving the site cleaner than it was before. *Transportation 2040* (PSRC 2010a) concludes that future projects will continue a positive, declining trend in the total amount of hazardous materials present in the central Puget Sound region.

Built Environment

Recreation

What direct and indirect effects would the project likely have on recreation?

The direct recreation effects of the SR 520, I-5 to Medina project would involve permanent and temporary acquisition of portions of parks and trails, as well as noise and visual effects on users of recreation facilities during construction. Recreational boating access around in-water work would also be limited at times. The following parks and trails would be near construction activities: Rogers Playground, Roanoke Park, Interlaken Park, Montlake Playfield, East Montlake Park, Arboretum, the UW Open Space, the Bill Dawson Trail, the Ship Canal Waterside Trail, and the Arboretum Waterfront Trail. Recreational boaters use Lake Washington, the Ship Canal, Union Bay, and Portage Bay near the project site. Exhibit 14 of the Recreation Discipline Report Addendum and Errata (WSDOT 2011g) shows all locations and acreage of park lands that would be permanently used by WSDOT and unavailable for recreation.

The Preferred Alternative would result in the temporary use of 7.4 acres, which would be fully restored after construction is completed, and the permanent change in use of 6.7 acres for operation of the roadway, which is less than the SDEIS options. WSDOT would acquire Bagley Viewpoint for right-of-way and replace it with a viewpoint on the new lid at 10th Avenue East/Delmar Drive East, as was proposed for all options in the SDEIS. WSDOT would also acquire all of McCurdy Park for WSDOT right-of-way. MOHAI, located across McCurdy and East Montlake Parks, would be relocated and continue to provide the services it does today. The design refinements of the Preferred Alternative would result in the same right-of-way acquisition as Option A within East Montlake Park, but less than the other SDEIS options.

The other direct effects on park users once construction is complete would be:

- Changes in views at East Montlake Park (with the removal of the MOHAI building and construction of a stormwater pond); and
- Reduced noise levels in some park areas and trails (resulting from the use of 4-foot tall concrete traffic barriers with noise absorptive materials and other design features).

A new stormwater outfall would somewhat alter the shoreline where access to the shoreline is available for boat launch and landings. Many of the direct operational effects on park and recreational resources would be positive because they would facilitate greater use of recreational resources, improve connectivity and linkages between parks, improve noise levels and visual quality in certain locations, and improve water quality in Lake Washington, which would benefit park users at the shoreline as well as boaters.

Replacement properties developed as part of the mitigation of direct effects on parklands would provide recreational land available to park users. A number of mitigation measures have been proposed for effects on Section 4(f) properties and are currently under review. Section 6(f) of the Land and Water Conservation Fund Act of 1965 requires replacement of recreation lands converted to non-recreation uses (WSDOT 2011n). The Preferred Alternative would result in a net gain of Section 6(f)-protected recreational space after construction is complete. The new site is 3.9 acres; development of this site would provide a total of 1.3 acres of new Section 6(f) protected parkland, after accounting for the permanent conversion under Section 6(f).

The SR 520 regional bicycle/pedestrian trail, the lids over SR 520, and the enhanced bicycle/pedestrian crossing over I-5 at East Roanoke Street would help reconnect neighborhoods and encourage pedestrian and bicycle use over the long-term. In the Arboretum, removal of the Lake Washington Boulevard ramps and the unused R.H. Thomson ramps would remove visual clutter and improve views to and from the park over the long term. Inclusion of traffic barriers coated with noise absorptive material, a higher roadway profile, and other design features along SR 520 would achieve a reduction in noise and long-term benefits for park users near the project site. Additional detail on effects on recreational resources and proposed mitigation is contained in the Recreation Discipline Report Addendum and Errata (WSDOT 2011g), the Section 4(f) Evaluation (WSDOT 2011n), and the Final Section 6(f) Environmental Evaluation (WSDOT 2011o).

WSDOT considered the potential for indirect recreation effects to occur as a result of the project and did not identify any recreation effects likely to occur at a distance from the site or later in time. It is possible that park users would choose to use parks farther away from the project vicinity rather than the facilities described above while construction is in process, but it is not possible to know what criteria people would use to make that individual choice or to identify which other parks people might choose to use.

How was the cumulative effects assessment for recreation conducted?

The cumulative effects analysis follows the standard method outlined in the Approach section. The study area for cumulative effects on recreation was the central Puget Sound region as defined and discussed in *Transportation 2040* (PSRC 2010a). The timeline is from 1900, when park planning in the city began, to the project design year of 2030.

Reasonably foreseeable actions considered in the cumulative effects analysis include the SR 520 Pontoon Construction Project, SR 520, Medina to SR 202 project, and Sound Transit's East Link and North Link light rail projects. In addition, park and recreation plans, including the *Seattle Parks and Recreation 2006-2011 Development Plan* (Seattle Parks and Recreation 2006), the *University of Washington Master Plan – Seattle Campus* (UW 2003), the *Washington Park Arboretum Master Plan* (City of Seattle et al. 2001), and the *City of Medina's Comprehensive Plan* (1994, amended in 1999 and 2005), were reviewed to identify other present and reasonably foreseeable actions related to parks and recreation.

What trends have led to the present recreation condition in the study area?

Seattle's park and recreation resources are interspersed across Seattle and are a key element in defining the development pattern of residential, business, civic, and recreational land uses across the city. Recreational resources are diverse and include open space, parks, boulevards and trails, beaches, lakes, and creeks, as well as recreational, cultural, environmental, and educational facilities (Seattle Parks and Recreation 2006).

The vision and guiding principles for the City of Seattle park system that are still in use today date back to 1903 when the City hired the

Olmsted Brothers to prepare a comprehensive plan for Seattle's park system. The dominant feature of the plan was a 20-mile landscaped boulevard linking most of the existing and planned parks and greenbelts within the city limits. The plan included numerous playgrounds and playfields in support of a new concept then of "public recreation."

Over the next 30 years, planning and development of Seattle's park system continued. In 1936, John Olmsted made his last visit to the city to plan the Arboretum. These early planning efforts serve as the framework for today's park system and distribution of recreational facilities throughout the city.

Park and recreational resources are valued highly by Seattle residents. In addition to park areas on land, hundreds of boats participate in the Seattle Yacht Club's annual opening day activities in May, a tradition since the 1920s. On land, people gather to watch the on-water events from the shoreline around the area.

Seattle's growth, a long-term trend that accelerated during the second half of the 20th century, has placed increasing pressure on the city's parklands. For example, traffic increased substantially on Lake Washington Boulevard, part of the 20-mile greenway originally envisioned by the Olmsted Brothers, following the construction of SR 520 in the 1960s, affecting the recreational setting of the Arboretum.

In 2008, voters approved a $146 million parks and green spaces levy for the acquisition, improvement, and maintenance of open spaces and recreational lands and facilities in neighborhoods across Seattle (Seattle Parks and Recreation 2008). The levy includes greenbelts; existing parks; new parks identified in neighborhood plans and in the Seattle Parks and Recreation Development Plan (Seattle Parks and Recreation 2006); boulevards; and existing or new athletic fields, open play spaces, and similar areas, including spectator enhancements such as seating.

How is recreation likely to change in the reasonably foreseeable future without the project?

Without the project, change in use of 7.4 acres of parkland (adjacent to the roadway) to transportation right-of-way would not occur. However, the benefits to park users from improved connectivity, trail linkages, lower noise levels, and elimination of the ramps at the Arboretum as described above would also not occur.

Overall, Seattle has 6,100 acres of parkland and plans for continued property acquisition and park development, as supported by the levy and outlined in the Seattle Parks and Recreation development plan (Seattle Parks and Recreation 2006). The SR 520, I-5 to Medina project would not affect new parks, park improvements, or recreational facilities included in this plan. As part of the 2006 plan, a "gap analysis" was conducted to identify neighborhood areas in Seattle that were deficient in open space. No neighborhoods along the SR 520 corridor were identified, largely because of the presence of the Arboretum, UW, and existing neighborhood parks within the adjacent well-established neighborhoods.

What would the cumulative effect on recreation likely be?

The direct effect of converting 7.4 acres of parkland adjacent to the SR 520 corridor to transportation right-of-way, considered in the context of other past, present, and reasonably foreseeable actions, would contribute a small physical change to the long-term cumulative effect of development on Seattle's recreational lands. Unlike the experience of past years, however, today's transportation improvement projects include mitigation in the form of replacement parkland. No permanent loss in total park area would result from the Build and Preferred Alternatives in combination with the SR 520, Medina to SR 202 project, Sound Transit's East Link and University Link light rail projects, and other planned transportation improvement and land development or redevelopment projects. In all cases, adverse effects on recreation lands would be mitigated as consistent with applicable requirements. Cumulatively over time, the study area is likely to show an increase in the total area of parkland. WSDOT's mitigation proposals, developed cooperatively with the City of Seattle and UW, include replacement parkland that will result in a net gain of parkland within the city.

How could cumulative effects on recreation be mitigated?

Past effects on recreational and parkland resources resulting from transportation projects were often significant. However, since the 1960s a number of federal regulations have been put in place to limit the effects of transportation projects on this resource, including Section 6(f) and Section 4(f). In addition, most cities and counties include protections for existing recreational resources and provisions to add to recreational opportunities. The City of Seattle has several strong ordinances and planning programs to do just this. Continued implementation of existing regulations and ordinances, which require avoidance and minimization measures before considering mitigation, would slow and possibly reverse the loss of recreational resources. The inclusion of new parklands and other recreational resources, including preservation of views and access to water, is another measure to mitigate loss of recreational opportunities and resources.

WSDOT's mitigation requirements include replacement parkland. Under Section 6(f), WSDOT identified a 3.9-acre replacement park site along Portage Bay on property owned by UW. WSDOT identified a suite of measures to address Section 4(f) effects, including those contained in the *Arboretum Mitigation Plan* developed by the Engrossed Substitute Senate Bill 6392 workgroup for effects to parkland in the Arboretum (included in Appendix 9 of the Final EIS). Chapter 9 of the Final EIS provides more detail on measures to address Section 4(f) effects that mitigate for recreation effects.

Environmental Justice

This section summarizes potential direct and indirect effects from the SR 520, I-5 to Medina project and evaluates the potential for cumulative effects on low-income and minority populations, including Native Americans. The Environmental Justice Discipline Report Addendum and Errata (WSDOT 2011p) provides additional information and details used in the cumulative effects analysis.

What direct and indirect effects would the project likely have on low income, minority, or limited-English proficient populations?

According to the GIS demographic analysis, the neighborhoods that would be affected by project construction do not have a high proportion of low-income, minority, or limited-English proficient (LEP) populations. Therefore, the project team concludes that the effects of project construction (such as increased noise and traffic) would not have a disproportionate effect on low-income, minority, or LEP populations and it would not contribute to a cumulative effect on these populations.

The SR 520, I-5 to Medina project would have potential direct effects on usual and accustomed fishing areas of the federally recognized Muckleshoot Indian Tribe and the Foster Island traditional cultural property (TCP) during construction and operation. During demolition of the Evergreen Point Bridge and installation of the transition spans, periodic closures of several days would be required at the east and west navigation channels; these closures would limit or prevent access to usual and accustomed tribal fishing areas. Construction-related vessel and barge movement in Portage Bay, Union Bay, Lake Washington, and Puget Sound could interfere with tribal fishing; pontoon storage and staging areas could limit access to tribal fishing areas; and the Muckleshoot Indian Tribe would lose access to fishing areas for several years while in-water work is taking place.

As detailed in the Ecosystems section and the Ecosystems Discipline Report Addendum and Errata (WSDOT 2011d), construction could adversely affect fish population productivity, aquatic habitat, and migration of juvenile and adult fish near the work bridges and under the new, wider structures (WSDOT 2011d). The new bridge maintenance facility dock proposed under the east transition span is located in potential sockeye salmon spawning habitat. This habitat would be reduced because of the construction of the dock and wider bases of the columns in the east transition span structure. However, these effects would be offset by the improved water quality and other mitigation measures and would not contribute to a cumulative effect on the fisheries resource. WSDOT is coordinating with the Muckleshoot Tribe to identify important access points to usual and accustomed fishing areas in areas where proposed structures would be built.

Construction on Foster Island would include work bridge construction and permanent bridge pile construction. These construction activities would disrupt the character of the island and affect its use as a TCP. However, these direct effects would be limited to the time of construction and would not contribute to the long-term cumulative effect separate from the operational effects discussed below.

During operations, the new Evergreen Point Bridge would be farther north and have a wider footprint than the existing bridge, permanently limiting access to the Muckleshoot Indian Tribe’s access to usual and accustomed fishing areas and reducing fish habitat functions primarily because of shading. Operational effects on the Foster Island TCP would be limited to maintenance activities that would require ground-disturbing activities and would be similar to construction effects, resulting in a similar conclusion. However, the operation of the SR 520, I-5 to Medina project would provide beneficial effects, including improved water quality because of the treatment of stormwater and improved visual and access resulting from the reduced number of columns in the water, increased spacing, and a higher bridge deck.

The environmental justice analysis concluded that since publication of the SDEIS, there have been substantial new improvements to transit services across SR 520. WSDOT has been and will continue to conduct extensive outreach to community-based social service agencies that serve low-income and LEP populations. This outreach will include information about the electronic toll system, how to purchase a transponder and open an account, and affordable alternatives to paying the toll. Coupled with mitigation described in the 2009 Environmental Justice Discipline Report, these improvements lead the project team to conclude that the effects of SR 520 tolling on low-income populations has been greatly minimized. Therefore, the environmental justice analysis does not recommend additional mitigation measures to further avoid or minimize adverse effects.

According to the demographic analysis, some of the neighborhoods surrounding untolled alternative routes SR 522 and I-90 have moderate to high proportions of low-income, minority, and LEP populations. Residents of these neighborhoods have raised concerns about the effect of traffic diverting from the tolled Evergreen Point Bridge to SR 522 and I-90 and the potential for additional congestion and noise, which could be perceived as an indirect effect from the SR 520, I-5 to Medina project.

According to the Final Transportation Discipline Report (WSDOT 2011i), there would only be a modest increase in traffic volumes on untolled routes as a result of the project (about 3 percent greater than the No Build Alternative on SR 522 and about 1.5 percent greater than the No Build Alternative on the I-90 bridge). Recent improvements to SR 522 have added sidewalks and medians and improved traffic movements through intersections, which will benefit all residents, including low-income populations. Improvements in transit service, as noted below in the mitigation discussion, would also reduce adverse effects if increases in traffic volumes were to occur on these routes.

How were cumulative effects on low-income and minority populations assessed?

The cumulative effects analysis follows the standard method described in the Approach section. The environmental justice analysis study area is the Evergreen Point Bridge "travelshed," which is the geographic area where bridge traffic originates and is shown on Exhibit 7. In addition to reviewing the PSRC's regional planning documents including *Vision 2040* (2009a) and *Transportation 2040* (2010a), the project team reviewed relevant census data and reasonable and foreseeable actions in the study areas that may also contribute to a cumulative effect on low-income, minority, or LEP populations over the long-term. The time frame is similar to the standard time frame of 1850s to 2030.

What trends have led to the present circumstances for low-income and minority populations in the study area?

Native American Population

Long before the first European explorers sailed into the Puget Sound area, native peoples inhabited the lands and waters of the Lake Washington basin. The Duwamish people were the Native Americans most closely associated with the SR 520, I-5 to Medina project vicinity. Euro-American settlers first arrived in Seattle in the mid-1850s. Since then, the region has experienced accelerating population growth and industrial, commercial, and residential development. Over the course of history, Native American tribes have yielded much of the land and water where they lived, hunted, and fished to this development.

Past actions have altered the fish and aquatic habitat in usual and accustomed tribal fishing areas and set trends leading to degraded present conditions. Land use activities associated with logging, road construction, urban development, mining, agriculture, shipping, and recreation have significantly altered fish habitat quantity and quality in usual and accustomed tribal fishing areas. The Ecosystems section of this discipline report has an expanded discussion of trends for habitat and fisheries potentially affected by the SR 520, I-5 to Medina project.

Low-Income Populations

The Land Use section of this report summarizes the past actions that have resulted in today's residential pattern. According to outreach conducted for *Transportation 2040*, many low-income populations live outside of urban areas (PSRC 2010a). The 2000 census shows pockets of low-income residents in the city limits (see Exhibit 15). This is because affordable housing in urban areas is increasingly scarce. Low-income populations living outside urban areas have less access to jobs, transit, and the goods and services that make it possible to manage daily life (such as grocery stores and health care). Present social and economic conditions highlight the importance of affordable mobility throughout the region.

How are the circumstances for low-income, minority, and LEP populations likely to change in the reasonably foreseeable future without the project?

Native American Populations

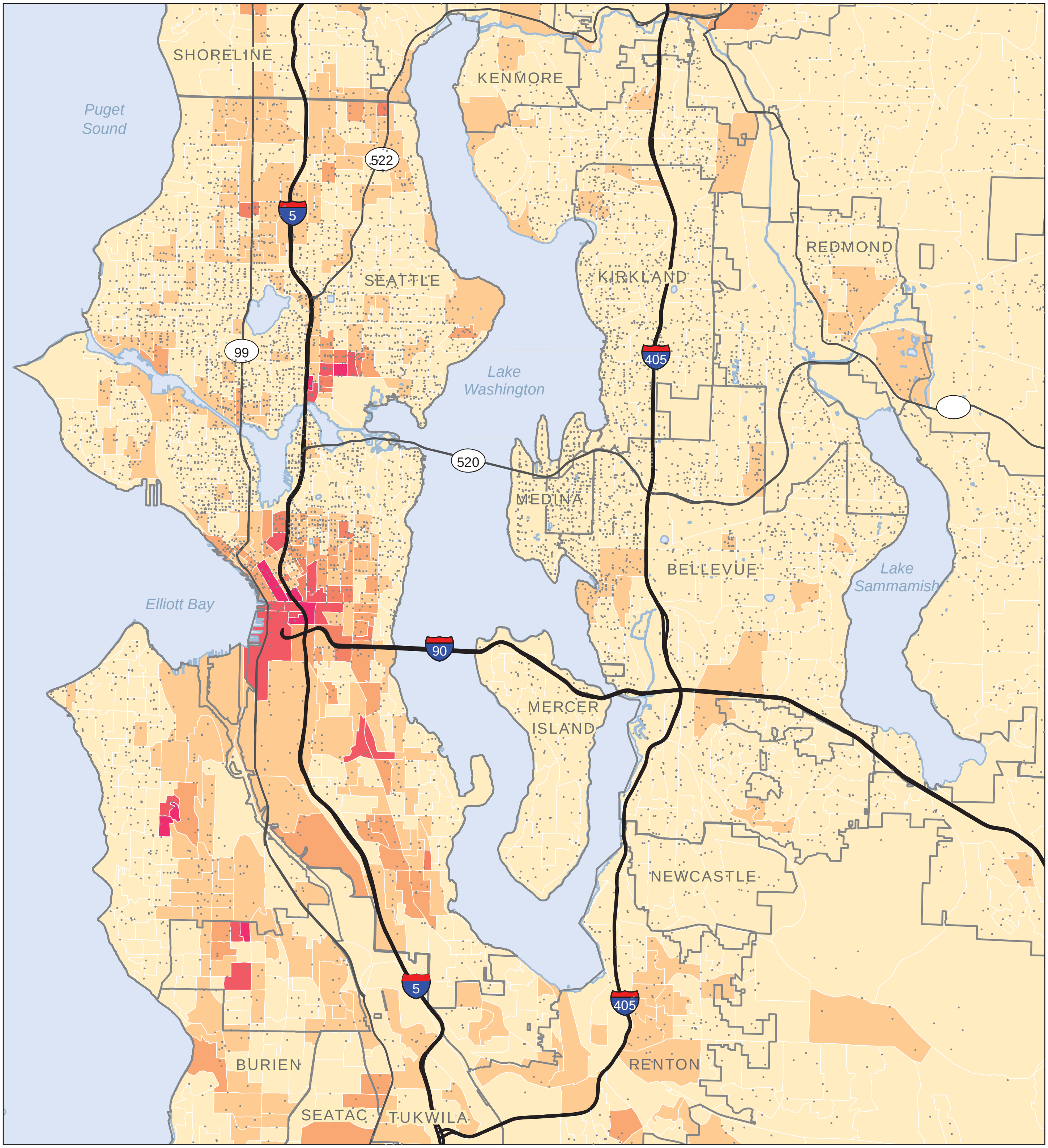
Recent and present trends and stressors (such as continued regional population growth, urbanization, and global climate change) indicate that the condition of fish and aquatic habitat would most likely continue to degrade into the reasonably foreseeable future. Compensatory mitigation, regulatory, and voluntary efforts to improve habitat will continue with or without the project.

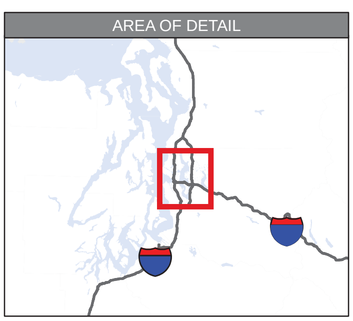
Large-scale restoration plans and activities are being implemented throughout the Puget Sound area (see the Ecosystems section). These activities could slow, or even halt, the existing downward trends in fish populations. Goals for recovery and restoration efforts in Lake Washington include improvements to fish access/passage; stream restoration projects; improvements in water quantity and quality; and protection/preservation of existing high-quality habitat.

Low-Income Populations

The regional growth strategy outlined in *Vision 2040* focuses the majority of job, housing, and transit facility growth in urban and employment centers. *Vision 2040* also encourages the construction and preservation of housing for low-income households. If these plans become a regional trend, circumstances may improve for the region's low-income populations, as they would have much better access to jobs and services. In 2008, voters approved a new sales tax under the Sound Transit 2 ballot measure that pays for 100,000 hours of additional Sound Transit Express Bus service, including some additional service hours on SR 520 (Sound Transit 2011). Because of budget shortfalls and other factors, Sound Transit has revised the implementation scenario for all projects, though at this time it appears that Express Bus service will be implemented during the 2009 to 2012 budget period. In addition, as part of King County Metro's *Transit Now*, voters approved a sales tax that will create a bus rapid transit line on the Eastside. This will connect the SR 520 corridor with high-frequency transit service between Bellevue and Redmond. This service is projected to begin in 2011.

The Sound Transit 2 program includes a number of improvements including the East Link project, which would expand light rail across I-90; the North Link project providing access to the University District and UW campus; and extension of North Link to Lynnwood. These





Percent at or below Poverty Level by 2000 Census Block Group

- Less than 10%
- 10 - 20%
- 20 - 30%
- 30 - 40%
- 40 - 50%
- Greater than 50%

Registered Address of Vehicle Videotaped at Evergreen Point Bridge On- and Off-Ramps

N

0 0.75 1.5 3 Miles

Source: King County (2005) GIS Data (Streams), King County (2007) GIS Data (Water Bodies), WSDOT (2004) GIS Data (State Routes), US Census (2000) GIS Data (Demographics) and WSDOT (2009) GIS Data (Registered Addresses). Horizontal datum for all layers is NAD83(91); vertical datum for layers is NAVD88.

Exhibit 15. **Percent Below Poverty Level in the Evergreen Point Bridge Travelshed Area**

SR 520, I-5 to Medina: Bridge Replacement and HOV Project

SEA \\JAFAR\PROJ\PARAMETRIX_400707\MAPFILES\WESTSIDE\DR\INDIRECTCUMULATIVE\2010\WS_DR_ICE_POVERTY.MXD AJOHNSON 5/5/2011 improvements would benefit transit riders, including low-income riders, who cross Lake Washington.

The Washington State legislature, WSDOT, PSRC, and other governmental entities are exploring opportunities to introduce tolling as a sustainable source of transportation funding or a congestion management tool. PSRC evaluated tolling as a potential funding source to replace outdated funding sources, such as the gas tax, as part of *Transportation 2040* (PSRC 2010a). PSRC indicates that tolling would be a funding source in the future and that tolling should be a part of the development of new roadways and improvements to existing roadways as one of the tools available to improve the overall transportation system.

What would the cumulative effect on low-income and minority populations likely be?

Native American Populations

The project and other reasonably foreseeable actions would have a cumulative effect on low-income and minority populations similar to future conditions without the project. The cumulative effects on fisheries and fish habitat would be similar to the future trends without the project with an exception for a slight benefit to water quality and fish habitat; however, the effects on long-term fisheries trends or stressors would not be measurable. As demonstrated in the Ecosystems section, the presence of the SR 520 and I-90 bridges is not a limiting factor for salmon production.

There would be no perceptible difference to the cumulative effects on access to usual and accustomed fishing areas with the project. The Build and Preferred Alternatives have larger footprints than the existing bridge, but this increase is minor compared to the size of Lake Washington. In addition, the bridge will be in essentially the same location.

As discussed in the Final Cultural Resources Assessment and Discipline Report (WSDOT 2011e), WSDOT, in consultation with interested and affected tribes, determined that there would be an adverse effect on historic properties, including Foster Island, which has been determined eligible for the National Register of Historic Places (NRHP) as a TCP. The qualities that contribute to the significance of Foster Island would be diminished from impacts associated with construction and operation of the project. These impacts to Foster Island, as a culturally important site, would contribute to the cumulative effects on Native American populations. See the Final Cultural Resources Assessment and Discipline Report for more information.

Low-Income Populations

In the SDEIS, WSDOT disclosed its initial analysis (completed in 2008) of the effect of tolling on the low income, car-dependent users of the bridge. Since publication of the SDEIS, WSDOT and King County Metro Transit have taken meaningful steps to provide affordable alternatives to paying the toll. The SR 520, I-5 to Medina project, in conjunction with planned transit and light rail projects and the SR 520 Variable Tolling Project, would help promote affordable mobility for low-income populations by increasing the efficiency of the transportation system and providing HOV lanes along the corridor to accommodate improvements in transit services. These are more fully discussed in the Environmental Justice Discipline Report Addendum and Errata (WSDOT 2011p). The conclusion in the Final EIS is that there is not a high and disproportionate adverse effect on low-income populations due to tolling. After careful consideration of the project benefits, other current and future projects, and the regional dialogue on mobility, WSDOT found that the project would not contribute to an adverse cumulative effect on low-income populations.

How could cumulative effects on low-income populations be mitigated?

Since the 1960s, federal and state regulations have been enacted to minimize impacts to TCP and usual and accustomed areas. Potential mitigation for these resources is further discussed in the Cultural Resources section of this report.

Cumulative effects on low-income populations from tolling could be minimized by regional planning efforts to improve transit service and implement light-rail across the region. In addition, mitigation measures that are being considered for the SR 520 Variable Tolling Project could help reduce the burden that electronic tolling would place on low-income drivers through offering transit-accessible service centers, establishing transponder retail outlets in convenient locations, and allowing several different types of payment methods (see the Environmental Justice Discipline Report Addendum and Errata [WSDOT 2011p]).

There are many federal, state, regional, and local efforts that seek to address the transportation needs of low-income populations. For example, low-income people and LEP are considered in PSRC's

Coordinated Transit-Human Services Transportation Plan (PSRC 2010c). The 2011-2014 Coordinated Transit Human Services Plan, adopted by PSRC's General Assembly on May 20, 2010, outlines how transit agencies, social service agencies, school districts, and other transportation providers can most efficiently and effectively work together to improve regional mobility for individuals with special transportation needs throughout King, Kitsap, Pierce, and Snohomish counties.

Cultural Resources

This section summarizes direct effects on cultural resources from the SR 520, I-5 to Medina project and evaluates the potential for indirect and cumulative effects to occur on historic properties located within the Area of Potential Effects (APE). The term "historic properties" includes historic districts, sites, buildings, structures, or objects listed on or eligible for listing in the NRHP. The term also includes significant archaeological sites and TCPs.

The APE includes 367 historic properties, including one NRHP-eligible TCP. No NRHP-eligible archaeological sites have been discovered. A detailed study of potential effects on historic properties located within the APE is documented in the Final Cultural Resources Assessment and Discipline Report (WSDOT 2011e). Native American tribes are discussed further in the Environmental Justice section of this report and in the Environmental Justice Discipline Report Addendum and Errata (WSDOT 2011p).

What direct and indirect effects would the project likely have on cultural resources?

The Build and Preferred Alternatives would affect cultural resources within the APE. The Final Cultural Resources Assessment and Discipline Report (WSDOT 2011e) contains more details on how the properties would be affected.

The following historic properties are located in the study area:

- Roanoke Park Historic District, which is listed in the NRHP. The Roanoke Park Historic District is made up of 101 properties, 80 of which are contributing elements to the district, including Roanoke Park and the individually listed William H. Parsons House.
- Montlake Historic District, which is eligible for listing in the NRHP. The Montlake Historic District is only partially located in the APE;

159 properties in the APE are contributing elements to the district, including the individually listed Seattle Yacht Club.

- Governor Albert D. Rosellini/Evergreen Point Bridge (most commonly referred to as the Evergreen Point Bridge), which is eligible for listing in the NRHP.
- Montlake Bridge, which is listed in the NRHP and in the Washington Heritage Register (WHR). The historic Montlake Bridge is also a designated Seattle Landmark.
- The Montlake Cut, which is listed in the NRHP.
- A total of 133 individually listed or eligible historic properties within the APE but outside of any historic district, in the Seattle area.
- The Arboretum, which is eligible for listing in the NRHP.
- Foster Island, located in the Arboretum, which is eligible for listing in the NRHP as a TCP.
- Three residential properties in the Eastside transition area, two of which are eligible for listing in the NRHP and one that is eligible for listing in the WHR.

FHWA and WSDOT identified the adverse effects on historic properties from construction and operation of the Preferred Alternative. An adverse effect is found when an undertaking may alter any of the characteristics of a historic property that qualify it for inclusion in the NRHP. Some of the adverse effects identified through the cultural resources assessment could also be considered direct effects under NEPA. Direct effects are caused by an action and occur at the same time and place.

Direct effects on historic properties in the APE include the following:

- Removal of the Evergreen Point Bridge
- Demolition of two residential properties that contribute to the Montlake Historic District
- Permanent and temporary acquisition of a portion of the NOAA Northwest Fisheries Science Center and potential disruption of the scientific research conducted onsite during construction

- Disruption of the Seattle Yacht Club's marine activities, as well as potential intermittent access limitations to the historic property
- Change to the setting and feeling of the Montlake Historic District from removal of mature vegetation, demolition of contributing resources, and acquisition of land including permanent acquisition of the Canal Reserve land, McCurdy Park, and parts of East Montlake Park and Montlake Playfield
- Change to the setting and feeling of the Roanoke Park Historic District from removal of mature vegetation adjacent to the district, and from the visual impact of the new Portage Bay Bridge
- Effects on the existing Montlake Bridge and other historic properties that have a view of the historic bridge from the construction of a new, parallel bascule bridge
- Permanent acquisition and usage effects on the Foster Island TCP

How was the cumulative effects assessment on cultural resources conducted?

The indirect and cumulative effects project team followed the project assessment methodology described in the Approach section. The analysis timeline starts with the development of Puget Sound by non-native inhabitants in the late-1800s through the project end date of 2030. The cumulative analysis study area is the APE, as shown on Exhibit 5.

Cumulative effects on cultural resources would occur from the piecemeal removal, disturbance, or permanent alteration of historic built environment properties, and the TCP. Reasonably foreseeable projects considered are shown in Exhibit 8.

What trends have led to the present condition of cultural resources in the study area?

Past and present development has removed or altered the character of many cultural resources in the central Puget Sound region during the past 150 years. Area development has slowly changed the original setting and feeling of many historic properties in the APE, and the traditional use of the Foster Island TCP has changed. This follows the national trend that led to federal and state regulations to protect these resources. By the mid-20th century, it had become apparent that piecemeal losses of individual cultural resource sites were accumulating to a significant level. In 1966, Congress passed the National Historic Preservation Act to slow this trend. The act requires federal actions (for example, development projects that have federal funding or require federal permits) to evaluate the effects of a project on cultural resources such as archaeological sites, traditional use areas, and historic built environment properties. NEPA requires federal agencies to use all practicable means to preserve important cultural and historic aspects of our heritage.

Around the country, state legislatures and regional and local jurisdictions have passed additional statutes and ordinances intended to slow the cumulative loss of cultural sites. In Washington, the Department of Archaeology and Historic Preservation, King County, and the City of Seattle also require consideration of effects on properties that have local or statewide significance, are listed or eligible for listing in the WHR, or are designated as a King County or Seattle landmark. These agencies work together to guide and coordinate the administration of historic preservation laws and regulations in order to protect cultural resources.

Although many of these resources have already been lost, the rate of attrition is slowing as a result of federal, state, and local protections and an increasing public interest in preserving the nation’s cultural heritage for future generations.

How are cultural resources likely to change in the reasonably foreseeable future without the project?

Transportation 2040 (PSRC 2010a) provides an overview of expected cumulative losses of cultural resource sites between now and 2040, noting that increasing urbanization to accommodate population and employment growth in the central Puget Sound region could have both good and bad consequences for cultural resources. Reasonably foreseeable actions could place additional pressure on cultural resources by removing or altering them, or by compromising their settings. *Transportation 2040* concludes that without oversight and protection, high-density redevelopment in the region could perpetuate the continuing loss of cultural properties and artifacts. It also notes, however, that development and growth can provide opportunities for the appropriate redevelopment and reuse of historic or culturally significant structures (PSRC 2010a).

What is the cumulative effect on cultural resources likely to be?

In the project area, residential neighborhoods established in the late 90th and early 20th centuries now include houses and other structures eligible for inclusion in the NRHP as well as historic districts, as explained in the Final Cultural Resources Assessment and Discipline Report (WSDOT 2011e). Construction of the SR 520, I-5, and I-90 bridges and state and interstate highways through the area has removed some of these historic properties and affected Native American archaeological sites. Although the project would not affect any known archaeological sites, it would remove some aboveground historic properties and affect one TCP.

Three historic properties that would be removed by the project are contributing elements to the Montlake Historic District. Another is an individually eligible bridge structure. It is not expected that there would be sufficient loss of property or other effects from this or reasonably foreseeable projects to reduce the significance of any historic property enough to affect its status for NRHP eligibility. The project is not likely to add to the cumulative effect on built environment properties or archaeological resources. The project would make a minor contribution to the cumulative effect on TCPs.

How could cumulative effects on cultural resources be mitigated?

The primary federal law regulating effects on cultural resources is Section 106 of the National Historic Preservation Act. Section 106 protects properties that are listed in, or eligible for listing in, the NRHP. Under Section 106, federally sponsored or funded projects are required to avoid, minimize, or mitigate adverse effects if project activities would directly or indirectly cause harmful effects on recognized historic properties or sites.

The legislation and ordinances described above have slowed the pace of loss of cultural resources. However, not all projects are required to comply with all the regulations, so the increased interest by the public in the preservation and restoration of cultural resources is a key factor when legislation and ordinances do not apply.

WSDOT developed a Programmatic Agreement that addresses mitigation requirements for historic and cultural resources. This agreement, including the mitigation measures, is an attachment to the Final EIS.

Transportation

What direct and indirect effects will the project likely have on transportation?

A highway project can directly affect elements of the local and regional transportation network such as capacity, circulation, access, safety, and level of service. The transportation analysis conducted for the SR 520, I-5 to Medina project focuses on the potential effects that the project might have on traffic volumes and the flow of vehicular traffic for both freeway and local street traffic, and non-motorized travel, transit, and parking. A travel demand model was used to estimate the direct growth of traffic volumes and transit usage with the magnitude of potential effects based on a comparison of the No Build Alternative with the Build and Preferred Alternatives at the project design horizon (year 2030). Operational analysis was completed using a simulation model for the alternatives.

A major change in the corridor for the Build and Preferred Alternatives would be tolling on SR 520 and new westbound and eastbound HOV lanes. These changes would influence people's choices related to travel in the SR 520 corridor. Some drivers might change their travel mode (to bus or carpool), time of day for travel, or route (some drivers will avoid SR 520 and either drive around Lake Washington on SR 522 or use I-90). It is estimated that the Preferred Alternative would reduce single-occupancy vehicle volume by 10 percent daily as compared to the No Build Alternative, as some people would opt for transit, carpools, or non-motorized travel. The completion of the HOV lanes and tolling is projected to increase transit ridership by 33 percent and cut transit travel time by up to 4 minutes for westbound travel and 12 minutes for eastbound travel, depending on the time of day (see Chapter 2, Final Transportation Discipline Report [WSDOT 2011i]).

The project would not generate additional regional traffic, particularly as it would not increase the capacity for single-occupancy vehicles. Thus, the project would have similar traffic volumes across the Evergreen Point Bridge. However, traffic circulation patterns to and from SR 520 and in the vicinity of the project would change (as well as those on SR 520 itself) because of improvements in the SR 520/I-5 interchange vicinity, the addition of HOV lanes, and improved access ramps in the Montlake area. These changes would improve traffic circulation and decrease congestion (see Chapter 6, Final Transportation Discipline Report [WSDOT 2011i]). In addition, widening the shoulder area of SR 520 would help manage congestion and travel delays caused by accidents, because there would be room to move vehicles off the travel lanes.

The proposed project would include constructing a bicycle/pedestrian path on the Evergreen Point Bridge, as well as providing bicycle/pedestrian path connections across new highway lids to increase north-south non-motorized travel across SR 520. This would improve mobility for non-motorized travel (see Chapter 7, Final Transportation Discipline Report [WSDOT 2011i]).

The project would cause some loss of parking spaces around the Montlake and I-5 interchange areas.

The travel demand model estimated indirect effects on transportation, which include changes in cross-lake travel patterns and regional travel patterns in Seattle and Eastside areas outside the project limits resulting from the project. For trips across Lake Washington, while daily vehicle demand on SR 520 could be about 5 percent lower with the Build and Preferred Alternatives, daily vehicle demand on other parallel facilities (that is, SR 522 and I-90) may be approximately 1 to 2 percent higher with the Build and Preferred Alternatives when compared to the No Build Alternative. This difference would be lessened during peak commute periods when cross-lake travel routes are typically more congested. During these periods, fewer drivers are expected to use SR 522 and I-90 to avoid a toll on SR 520. For both the Eastside and Seattle areas, the model predicts that vehicle and person trips for the Build and Preferred Alternatives and No Build Alternative would be similar (that is, the differences were slight) (see Final Transportation Discipline Report [WSDOT 2011i]). No additional, quantifiable, indirect effects were identified for the transportation analysis.

How was the cumulative effects assessment on transportation conducted?

The cumulative effects analysis for transportation followed the standard method described in the Approach section. PSRC, the regional Metropolitan Transportation Planning Organization, is tasked with modeling the future regional transportation system to ensure that this system supports anticipated growth and development. *Vision 2040* is PSRC's Regional Growth Strategy, which provides the policy structure for the related transportation plan, *Transportation 2040* (PSRC 2009a, PSRC 2010a). PSRC gathers information on future anticipated transportation projects from the state and local jurisdictions and uses this information to estimate future traffic volumes and identify potential transportation issues. Additional travel demand modeling is used to determine a specific project's cumulative effects. WSDOT used PSRC's *Transportation 2040* and model network assumptions to help identify the SR 520, I-5 to Medina project's potential cumulative effects.

For the SR 520, I-5 to Medina project, travel demand models were used, which incorporate a number of future projects as well as taking into account transportation effects of past and present actions. Thus, the models themselves yield information on direct, indirect, and cumulative effects. For example, future planned, programmed, and funded projects such as the Alaskan Way Viaduct, portions of I-405, and Sound Transit's East Link, North Link (and the extension to Lynnwood), and University Link (including the Husky Stadium Station), are considered in the direct effects assessment (Exhibit 8; Final Transportation Discipline Report [WSDOT 2011i]). A separate cumulative effects model was used to evaluate the effects of transportation projects that are planned to be complete by 2030, but were not programmed or funded at the time of the direct effects analysis. This includes evaluation of reasonably foreseeable regional pricing strategies for the I-90, I-405, and SR 99 corridors by 2030, in addition to the SR 520 toll that is included in the Build and Preferred Alternatives (Final Transportation Discipline Report [WSDOT 2011i]).

The project travel demand model was developed with a background network assumption that matched the project description, and then the model was validated against actual data for the SR 520 corridor. The No Build and Build Alternatives were then modeled relative to the cumulative effects scenarios to obtain travel demand forecasts for each scenario at several locations on I-5, I-405, I-90, SR 522, and SR 520. The forecasts reported both daily and p.m. peak periods. The primary measures used to make the comparisons included vehicle trips and person trips. See the Final Transportation Discipline Report (WSDOT 2011i) and the 2009 Transportation Discipline Report (WSDOT 2009c) for more information.

What trends have led to the present transportation condition in the study area, and how is transportation likely to change in the reasonably foreseeable future?

Traffic volumes have increased over time because of population growth in the area, and traffic now exceeds the capacity of SR 520 during certain times of the day. The existing configuration of SR 520 adds to the problem because of the limited capacity of its four lanes, the incomplete HOV system, the need for traffic entering SR 520 on the westbound approaches to the Evergreen Point Bridge to weave through the HOV traffic, and SR 520's narrow shoulders. This makes the corridor especially prone to traffic congestion during times of high volumes or accidents on SR 520. Traffic congestion adversely affects both vehicle and transit travel times. Congestion on SR 520 also backs up traffic onto local streets such as Montlake Boulevard and Lake Washington Boulevard, creating travel delays and circulation problems on local streets and through the Arboretum and UW campus. In addition, lack of non-motorized facilities along the SR 520 corridor and especially the Evergreen Point Bridge create a challenge for bicycles to travel between Seattle and the Eastside.

In the reasonably foreseeable future, regional population growth will add more travel demand to an already congested transportation system. Travelers will continue to face congestion in some areas, particularly during the morning and evening commutes. As described in the *Transportation 2040* Final EIS (PSRC 2010b), investments in the region's transportation system will be targeted to preserve the existing system, improve system efficiency, increase choices to users, and provide strategic capacity improvements to meet future travel needs.

How is transportation likely to change in the reasonably foreseeable future without the project?

In the year 2030, SR 520 would be operating without a toll if the project were not constructed. Daily traffic demand across Lake Washington would increase by 11 percent by the year 2030 because of growth in population and employment, causing worsening congestion on SR 520 and the connecting local street system, particularly during the peak travel times. Travel times for general-purpose westbound traffic on SR 520 would increase by up to 20 minutes over existing levels. Travel times for eastbound traffic would increase by 8 minutes. HOV and transit travel times would be similar or improve because of completion of the SR 520, Medina to SR 202 project. Without the project, one of the 18 study intersections would experience level of service operations of E or F (that means operations are failing) during the morning commute, and operations of E or F at three study intersections during the evening commute (Final Transportation Discipline Report [WSDOT 2011i]).

In the nearer term, the Lake Washington Congestion Management Project will implement tolling on SR 520 in 2011 for the primary purpose of managing traffic congestion. This toll would remain in place until the construction of the SR 520, I-5 to Medina project. It would then be replaced with new tolls adopted by the Washington State Transportation Commission to provide project funding in accordance with the financing plan. Based on the Lake Washington Congestion Management Project, if the SR 520, I-5 to Medina project were not built, there would be no toll in effect in 2030. This is why the baseline No Build assumption is that the SR 520 corridor would not be tolled. However, the tolling program on SR 520 and other major roadways in the study area could be modified by the Washington State Transportation Commission. These possible scenarios are included in *Transportation 2040* and reflected in the models developed for the SR 520, I-5 to Medina project (PSRC 2010a).

Tolling is expected to reduce vehicle travel demand across Lake Washington (when compared to levels without a toll). These lower travel demand levels are likely to continue as long as a toll is in place. This reduction in overall vehicle travel demand is expected to take place in the form of reduced general-purpose vehicle trips and increased HOV trips on SR 520. Some drivers who would typically use SR 520 to cross Lake Washington would also be expected to choose I-90 or SR 522 instead as their cross-lake travel route.

What is the cumulative effect on transportation likely to be?

The SR 520, I-5 to Medina project, regardless of the Build Alternative selected, would not affect regional growth but would affect regional traffic conditions, including how people move east and west between Seattle and the Eastside. It would also affect levels of congestion along local roads such as Lake Washington Boulevard and Montlake Boulevard. In the year 2030, total traffic crossing the SR 520 corridor under the No Build Alternative would be 127,570 vehicles per day (vpd). Under the Preferred Alternative, it would be 121,110 vpd, which would be 5 percent less traffic than the No Build Alternative (see Exhibit 16). The corridor would not be tolled in the year 2030 under the No Build Alternative, resulting in more traffic than with the Build Alternatives. When the reasonably foreseeable projects are included in the model for the cumulative effects scenario, there would be a 1 percent increase in traffic over the No Build Alternative.

Exhibit 16. Comparison of Vehicle Trip Volumes on SR 520 (Cross-Lake)

Alternative/Scenario	Average Weekday Volumes (vpd) Non-HOV	HOV (3+)	Total
2006 Existing Conditions	110,360	4,860	115,220
2030 No Build Alternative	123,040	4,530	127,570
2030 Preferred Alternative	111,640	9,470	121,110
2030 Cumulative Effects Scenario	118,960	10,080	129,040

Source: Final EIS Travel Demand Model (WSDOT 2011i)

Nearly all of the increase in volume in the Preferred Alternative (9,470 vpd) and the Cumulative Effects Scenario (10,080 vpd) compared to the No Build Alternative (4,530 vpd) would occur in the HOV lanes (see Exhibit 13). Under the Preferred Alternative (including the Cumulative Effects Scenario), SR 520 would be tolled but HOV 3+ vehicles would be exempt from the toll. The SR 520 corridor HOV lane would have adequate capacity to accommodate this level of increase.

WSDOT expects there to be a considerable increase in HOV demand along SR 520 with the Preferred Alternative compared to the No Build Alternative, because the SR 520 Bridge Replacement and HOV Program would complete the HOV lane system between Redmond and Seattle and carpools and transit riders would not be required to pay a toll. The combination of reduced travel time and cost avoidance is a powerful incentive for carpool and transit use. An additional, but smaller, increase in carpool demand is also projected in the region if a toll were added to the I-90 Lake Washington crossing.

With the cumulative effects scenario in 2030, total net peak and daily cross-lake vehicle travel would be expected to decrease compared to the No Build Alternative. This overall decrease would occur because increases in the number of peak and daily cross-lake trips by HOV vehicles would be more than offset by the decrease in cross-lake general-purpose trips. Fewer vehicles would be moving more people across Lake Washington compared to the No Build Alternative. The increase in HOV travel would result from the implementation of tolls on both SR 520 and I-90 and the completion of HOV lanes on SR 520.

Internal traffic circulation on the Eastside would improve and more trips would likely remain on the Eastside with the introduction of tolls on SR 99 and I-90, and capacity improvements along regional corridors such as I-405 and SR 167.

How could cumulative effects on transportation be mitigated?

Generally, transportation improvements provide a beneficial effect by increasing or effectively managing roadway capacity and the efficiency of intersection operations by reducing congestion, enhancing safety, and improving access. The SR 520, I-5 to Medina project would provide these benefits, as well as improving transit and non-motorized facilities and reducing transit travel times.

A number of planned or reasonably foreseeable transportation improvements would offset potential increases in traffic on SR 522 and I-90, resulting from the proposed tolling of SR 520. For I-90, these include the Sound Transit East Link light rail project, the WSDOT/Sound Transit I-90 Two-Way Transit and HOV Operations project, and potential future implementation of a toll on the I-90 bridge midspan. The WSDOT I-5 to I-405 Multi-modal project is planned for SR 522. In addition, Sound Transit 2 and the *Transit Now* programs will continue to expand and increase the regional express and local bus service. As more fully discussed in Chapter 2 of the Final EIS, the SR 520 corridor can physically accommodate light rail.

Navigation

What direct and indirect effects would the project likely have on navigation?

Operation of the project would not have a direct or indirect effect to navigation in Puget Sound so the study area is limited to Lake Washington. Vessels enter the waters around the project site from Puget Sound, passing under the railroad bridge over Salmon Bay, through the Ballard Locks, and then through a series of canals including the Ship Canal and Montlake Cut into Union Bay and Lake Washington. The project team considered construction and operation of three portions of the project to identify their potential direct and indirect effects on navigation (including recreational boating). The project team considered the effects associated with the new bascule bridge across the Montlake Cut, the Portage Bay Bridge, and the floating bridge and transition spans of the bridge across Lake Washington. Navigation in the Montlake Cut will function mostly the same as it does today with the new bascule bridge in place. Recreational boat movement around SR 520 in Portage Bay would be substantively the same as at present.

There would be fewer, although larger, columns in the water supporting the Portage Bay Bridge. The changes to navigation around the Lake Washington bridge structures would not adversely affect navigation. Exhibit 17 shows the existing vertical clearances and water depth for the Evergreen Point Bridge and the I-90 bridge, and those features for the new Evergreen Point Bridge.

Exhibit 17. Navigation Clearances for SR 520 and I-90 Bridges

	Existing			Preferred Alternative		
	Depth (feet)	**Height Limits (feet)**	**Channel Width (feet)**	**Depth (feet)**	**Height Limits (feet)**	**Channel Width (feet)**
Montlake Bridge		N/A	N/A		100	N/A, draw span
SR 520						
West Transition Span	29	44	206	23 to 29	44	130
Mid-span	100+	None	200	N/A, draw span removed		
East Transition Span	33	57	207	21 to 33	70	190
I-90						
West Channel Bridges		29		N/A	No change	
East Channel Bridge	32 to 35	71		No change	No change	

The project would have no indirect effects from construction. However, direct construction effects would occur at all three locations. Construction of the project would directly affect navigation of recreational boats through the Montlake Cut. The cut would be closed for up to 6 days in order to complete construction of the new bascule bridge. An additional 6 weeks of limited navigation may be necessary depending on final design of the bridge deck. None of these closures would occur during peak recreational boating season, and the U. S. Coast Guard would notify mariners of these navigational restrictions. During most of the multi-year construction period for the Portage Bay Bridge, access to and from private moorage at the Bayshore Condominiums in south Portage Bay would be limited because of the height of the work bridges across the bay. In addition, access beneath the work bridges would not be possible for any boat at times in order to ensure public safety. No boats would be allowed to pass underneath the portions of the Portage Bay Bridge where demolition would be occurring and at certain times during construction. WSDOT would work with private boat owners at the south end of Portage Bay to ensure access or find alternate moorage. During construction of the floating bridge and transition spans across Lake Washington, navigation underneath the bridge structures would always be maintained, but would be restricted for larger vessels to a single channel at times.

How was the cumulative effects assessment of navigation conducted?

The cumulative effects analysis followed the *Guidance on Preparing Cumulative Impact Analyses* (WSDOT et al. 2008), which outlines a process to assess how past and present actions, in combination with reasonably foreseeable actions, may contribute to a cumulative effect on a resource.

Reasonably foreseeable actions that are considered in the cumulative effects discussion for navigation include the SR 520 Pontoon Construction Project, the SR 520, Medina to SR 202 project, and Sound Transit's East Link and North Link light rail projects.

What trends have led to the present navigation condition in the study area?

Navigation through Puget Sound and the north Pacific Ocean is regulated by maritime laws and overseen by the U.S. Coast Guard. Construction of the Lake Washington Ship Canal in 1917 by the USACE established a series of dredged navigation channels linking Lake Washington with the marine waters of Puget Sound to facilitate commercial shipping. The Ballard Locks and the Lake Washington Ship Canal later opened Lake Washington to larger vessels and expanded recreational boater use of Lake Washington. The maritime history of the project study area is discussed earlier in this report.

Subsequent construction of the I-90 and Evergreen Point bridges across Lake Washington in the 1950s and 1960s established a set of horizontal and vertical clearances for vessels traveling to the south end of the lake. Since 1995, the annual number of Evergreen Point Bridge openings has been low. Annual openings decreased from 14 in 1995 to zero in 2003. Since 2003, annual openings have been between 0 and 6 for all years except 2006 and 2008, which had 10 openings each. In contrast, the number of openings for the Montlake and University Bridges (located northwest of the project vicinity near I-5) ranged between 1,000 and 3,000 over the last 10 years, as discussed in the Navigable Waterways Discipline Report Addendum and Errata (WSDOT 2011q).

How is the navigation condition likely to change in the reasonably foreseeable future without the project?

Without the project, the existing navigation conditions throughout the study area would remain similar to current conditions. Navigation restrictions are not expected to change on Lake Washington or Puget Sound. The mid-span of the Evergreen Point Bridge would likely still operate as it does today and, thus, would provide no height limits to vessels north of I-90 on Lake Washington. There would be no change to the bascule bridge openings across the Montlake Cut or to boat traffic in Portage Bay. No foreseeable development actions were identified on Lake Washington that would further modify either vertical or horizontal restrictions on vessel traffic south of the Evergreen Point Bridge. Sound Transit's East Link light rail project would cross I-90 but would not change the navigational limits of the East Channel Bridge; the North Link light rail project would cross under the Montlake Cut in a tunnel and would not alter navigation.

What would the cumulative effect on navigation likely be?

There would be no substantive changes to navigation around the new Portage Bay Bridge or the new Montlake Cut bascule bridge. The future navigation conditions on the Evergreen Point Bridge would be similar to conditions without the project, with the exception of the closure of the mid-span drawbridge, which would impose a vertical height limitation on vessel traffic moving south of the floating portion of the Evergreen Point Bridge. This closure would create an additional location on Lake Washington where vertical clearance is limited. However, the clearance limit would match that of the existing I-90 lake crossing and existing and future land uses along the south portion of the lake would not be affected by this reinforcement of the existing limitation. The project is not expected to have any effects on the Puget Sound or north Pacific Ocean navigation. With no permanent effects on navigation, the project would not contribute to adverse cumulative effects on navigation.

How could cumulative effects on navigation be mitigated?

No cumulative effects were identified so per WSDOT guidance, mitigation is not provided.

Land Use

What direct and indirect effects would the project likely have on land use?

Direct effects on land use by transportation projects often involve the acquisition of land for right-of-way, thereby converting the land from its existing use to transportation land use. As discussed more fully in the Land Use, Economics, and Relocations Discipline Report Addendum and Errata (WSDOT 2011r), the Preferred Alternative would permanently convert 10.6 acres of existing land uses to transportation use as WSDOT right-of-way. The 19 parcels to be fully or partly changed to transportation use are a mix of residential and park uses, interspersed with civic and commercial uses. Under the Preferred Alternative, four single-family residences and the MOHAI building would be removed as part of the right-of-way acquisition. Approximately 0.5 acre of the NOAA Northwest Fisheries Science Center would be converted to right-of-way for the new alignment of the Bill Dawson Trail, though none of the structures would be affected. During construction, several docks or moorage slips at the Queen City Yacht Club and Bayshore Condominiums would also be unavailable for use during construction; however, these would be restored after construction is complete.

Transportation projects can have indirect effects on land use if the projects bring about later changes in the rate and pattern of development. These changes can be either anticipated and planned or unanticipated and undesirable. Anticipated and planned growth patterns are the underlying foundation of Washington State's Growth Management Act, which is described briefly below. Unanticipated and undesirable growth is often referred to as induced growth and is an indirect effect. The SR 520 Bridge Replacement and HOV Program, and specifically the SR 520, I-5 to Medina project, is not expected to have indirect effects on land use, including induced growth effects. As indicated by *Vision 2040* and shown in project-specific traffic modeling, the central Puget Sound region population is expected to increase by about 50 percent over the next 30 years (PSCR 2009a, WSDOT 2011i). Additionally, the modeling shows that the SR 520, I-5 to Medina project would not increase capacity or create new areas for growth and land development (WSDOT 2011i). Instead, this and other regional transportation projects would improve efficiency and shift travel from single-occupancy vehicles towards HOV/ high-occupancy toll (HOT) and transit options. Tolling would help with this shift. The result would be more people being moved by fewer vehicles on a transportation network that would accommodate increased population growth but not direct the growth pattern or lead to unintended growth patterns. PSCR's integrated transportation and land use models indicate "approximately 97 percent of growth occurs within designed urban growth areas, in a manner consistent with the Regional Growth Strategy" (PSCR 2010a).

Efforts to regulate development patterns and population growth led to the passing of the Growth Management Act (Revised Code of Washington 36.70A) in 1990. This act directs local jurisdictions to plan and regulate development patterns and population growth. The act requires that state and local governments work cooperatively to identify and protect critical areas and natural resource lands, designate urban growth areas, prepare comprehensive plans, and implement them through capital investments and development regulations. The City of Seattle Comprehensive Plan was first adopted in 1994 with the last major update in 2004 (City of Seattle 2005). The Comprehensive Plan provides long-term guidance for development throughout Seattle through land use regulations and other tools. The Comprehensive Plan guides decisions on transportation, economic development, human services, and neighborhood growth, among others.

At the regional level, the PSRC addresses growth and development for the central Puget Sound by working with these communities to develop policies and make decisions about regional issues including transportation and land use. *Vision 2040* contains numerous land use-related policies that emphasize concentrating growth in urban centers and connecting those centers with an efficient, transit-oriented, multimodal transportation system. *Transportation 2040* uses integrated transportation and land use modeling to examine six alternative future transportation scenarios, including a baseline alternative that is similar to the No Build Alternative for this project. Under the PSRC baseline alternative, a replacement of the Evergreen Point Bridge in the existing configuration is assumed. Each action alternative describes a different way in which the comprehensive planning in *Vision 2040* could be implemented through transportation improvements. All PSRC "action" alternatives include a 6-lane alternative for the SR 520 corridor and are similar to the Build and Preferred Alternatives for this project (PSRC 2010b).

Overall, the 10.6 acres that would be converted from civic, park, commercial, and single-family residential uses represent a small percentage of these types of land uses within the City of Seattle. No change to the urbanized land use pattern of Seattle or the surrounding central Puget Sound Region would occur because the project would perpetuate the existing SR 520 corridor and not alter trip destinations, open new areas to development, or otherwise induce changes in land use.

How was the cumulative effects assessment on land use conducted?

The project team followed the standard assessment methodology as outlined in the Approach section (see Exhibit 4). The time frame for analysis starts with the non-native settlement of Seattle in the late 1800s through the project design date of 2030. The study area is shown on Exhibit 6.

What trends have led to the present land use condition in the study area?

As described in the Affected Environment section of this discipline report, the central Puget Sound region was first settled by non-indigenous people in the mid-19th century and the land use trends today were established shortly thereafter. The region experienced accelerating population growth and industrial, commercial, and residential development in the late 19th and early 20th centuries, after World War II, and through the second half of the 20th century to the present.

According to *Transportation 2040*, the total number of housing units in the central Puget Sound region increased from approximately 683,000 in 1970 to about 1,484,000 units in 2006. During those same years, the proportion of single-family units decreased from 75 percent to 68 percent, and multifamily units increased from 25 percent to 32 percent (PSRC 2010a). Large corporations such as Boeing, Microsoft, Amazon, Starbucks, and others have established headquarters in the study area, leading to the continuing expansion of residential and commercial development, including service industries. Much of this growth has occurred on the Eastside where, since the 1970s, Bellevue and Redmond have become urban centers. Eastside urbanization has greatly increased daily vehicle trips on the SR 520 and I-90 corridors crossing Lake Washington.

How is land use likely to change in the reasonably foreseeable future without the project?

As previously described, in *Transportation 2040* PSRC analyzed and compared land use changes that could result from six transportation alternatives: a baseline alternative and five "action alternatives."

The PSRC baseline alternative forecasts population growth, land use, and transportation trends into the future to 2040 on the basis of stated assumptions, including construction of state highway projects funded under the state's Nickel gas tax and Transportation Partnership Account programs, and Sound Transit's Phase 2 plan. Under the PSRC baseline alternative, it is assumed that existing ferry service and demand management programs would continue and that some improvements to King County Metro and Community Transit service would occur. It is further assumed that the region would find sufficient additional revenue to fully maintain and preserve the existing transportation system, including the Alaskan Way Viaduct or a replacement facility at its present capacity, and the Evergreen Point Bridge and its approaches in their present configuration (PSRC 2010a).

All of the "action alternatives" considered by PSRC include the Build and Preferred Alternatives for SR 520 and the transit improvement projects in the region. The analysis concludes that at the regional level, the PSRC baseline alternative would not lead to future land use, population growth, or development patterns by 2040 that would be substantively different from those under the five action alternatives. This means that at the local and regional level, the analysis indicates that growth will occur in a planned and anticipated pattern and that induced growth will not occur.

PSRC predicts that by 2040, there will be an additional 1.5 million people, an additional 1.2 million jobs, and approximately 800,000 additional housing units in the central Puget Sound region regardless of any transportation project constructed or planned. Regional growth will be incremental, adding gradually to the present condition of over 3.5 million people and 1.5 million housing units. *Transportation 2040* concludes that much of the forecasted growth will occur as infill development within areas that are already urbanized, making their development denser than it is today (PSRC 2010a). This is one of the goals of the Growth Management Act and further supports that growth patterns will be planned and anticipated.

On the basis of the *Transportation 2040* analysis, it appears that land use changes likely to occur if the SR 520, I-5 to Medina project were not built would depend largely on the cumulative effect of the other present and reasonably foreseeable actions considered in the analysis, provided the SR 520 link across Lake Washington was maintained at its present capacity.

What is the cumulative effect on land use likely to be?

Land use planning is conducted at the regional level (*Vision 2040),* and the decisions are implemented in local comprehensive plans that must be consistent with *Vision 2040* and Washington's Growth Management Act.

The SR 520, I-5 to Medina project would not contribute to a cumulative effect on land use in combination with other past, present, and reasonably foreseeable actions. As described above, this finding is supported by the land use analysis in *Transportation 2040*, which incorporated reasonably foreseeable changes in central Puget Sound's future land use, population, employment, and travel patterns, including the SR 520, I-5 to Medina project (PSRC 2010a).

The SR 520, I-5 to Medina project, in conjunction with other reasonably foreseeable actions, would convert existing land uses to transportation right-of-way. Although these conversions would reduce the area of land available for non-transportation uses, they would cumulatively convert only a small portion of the total land in the central Puget Sound region over the next 30 years. As discussed above, regional growth is expected to occur within designed urban growth centers consistent with regional growth strategies. The Preferred Alternative's contribution of 10.6 converted acres would be negligible in a regional context.

How could cumulative effects on land use be mitigated?

No cumulative effects were identified, so per WSDOT guidance, mitigation is not provided.

Visual Quality and Aesthetics

What direct and indirect effects would the project likely have on visual quality and aesthetics?

As discussed more fully in the Visual Quality and Aesthetics Discipline Report Addendum and Errata (WSDOT 2011s), the Build and Preferred Alternatives would produce direct effects on visual quality during construction and operation. During construction, many visible activities would temporarily change the local visual environment. These activities include signage, lighting, and glare; additional noise from demolition and construction; removal of vegetation; and traffic congestion. Before and during replacement of the Evergreen Point Bridge, pontoons towed from Grays Harbor and from moorage locations in Puget Sound would be visible at many points along the Puget Sound coast, the Ship Canal, Lake Union, and Lake Washington.

The following would be key direct visual effects during operation (WSDOT 2011s).

- Lids over SR 520 between 10th Avenue East and Delmar Drive East, and between Montlake Boulevard and the East Montlake shoreline, would hide the roadway and provide landscaped connections between the communities on either side of SR 520.
- A planted median along the center of the Portage Bay Bridge would screen views across the lanes toward both sides of the bridge.
- An enhanced bicycle/pedestrian crossing adjacent to the existing East Roanoke Street bridge over I-5 would change the appearance of the structure, particularly as viewed from the south.
- A new bascule bridge parallel to and east of the existing historic bridge over the Montlake Cut would alter the setting of the historic bridge.
- Views westward from East Montlake Park, particularly views of the historic bridge, would be changed by the presence of the new bascule bridge.
- The bridge over Foster Island would be slightly higher than the bridge in Option A, making it more visible but opening up additional space for trail users.
- The addition of active traffic management equipment would add to the overhead visual clutter of existing highway lighting and signage.

The proposed project would not produce indirect effects on visual quality and aesthetics; the visual effects would be confined to direct effects on structures, landforms, and vegetation along the SR 520 corridor.

How was the cumulative effects assessment for visual quality and aesthetics conducted?

The cumulative effects assessment for visual quality and aesthetics followed the standard method described in the Approach section.

The project team relied on *Vision 2040* and *Transportation 2040* (PSRC 2009a, 2010a) for regional forecasts, and considered the likely visual quality effects of present and reasonably foreseeable actions. These include expansion of the UW campus housing and other land use development projects in the study area.

The time frame for this cumulative effects assessment is consistent with the standard method described in the Approach section: 1850s to 2030. The study area for the visual quality cumulative effects assessment consists of the viewsheds within which changes to the SR 520 corridor would be visible from ground level or from buildings, as described in the Visual Quality and Aesthetics Discipline Report Addendum and Errata (WSDOT 2011s). This study area is considered within the broader visual quality context of the central Puget Sound region, which includes Pierce, King, Kitsap, and Snohomish counties (PSRC 2009a).

What trends have led to the present visual quality and aesthetics of the study area?

Transformation of the landscape character began with the arrival of the Euro-Americans in the 1850s. They logged, mined, moved hills and rivers, deposited fill, and developed the Seattle and Lake Washington areas on a scale faster and larger than previous actions by the indigenous peoples. Over a century and a half of growth, they harvested the forests and built transportation routes to reach undeveloped resources, steadily developing the central Puget Sound region. Development followed the roads, railroads, and shipping routes.

Because of the region's steady population growth, traffic volumes have increased, and the regional transportation infrastructure has expanded to accommodate the increasing traffic. During the 1960s, construction of the SR 520, I-5, and I-90 bridges and state and interstate highways opened more distant, sparsely developed areas to development. Today, the SR 520 corridor crosses Lake Washington to connect downtown Seattle with major Eastside urban centers such as Bellevue and Redmond, as well as smaller suburban communities. The cities and roadways, including bridges across Lake Washington, became significant features of the visual landscape.

How would visual quality and aesthetics likely change in the reasonably foreseeable future without the project?

With or without the proposed project, the visual character of the central Puget Sound region would remain a complex mixture of forested and open-water areas with urban and suburban centers, much like today. Urbanization and development are expected to continue as demonstrated by the planned roadway, non-roadway, and land development projects listed in Exhibit 8 and through development plans such as *Vision 2040* (PSRC 2009a).

What would the cumulative effect on visual quality and aesthetics likely be?

The long-term presence of the proposed new Evergreen Point Bridge would not make much difference to the cumulative effect of past, present, and reasonably foreseeable actions on visual quality and aesthetics, because it would replace a similar bridge that exists in approximately the same location today. Although the exact view may be altered from the existing view, the setting of the roadway within the urban community and across Lake Washington will not be altered to any significant degree. Therefore, the project will not have cumulative effect on visual quality and aesthetics in the study area. In particular, a new interchange at Montlake Boulevard would change the appearance of that immediate area enough to contribute visibly to the cumulative effect.

As discussed in the Visual Quality and Aesthetics Discipline Report Addendum and Errata (WSDOT 2011s), the proposed project's direct effects on visual quality would be a mixture of positive and negative changes. For example, an increase in paved surfaces and concrete structures could be considered negative, whereas the introduction of vegetated roadway lids would add visual continuity and soften the harder effect of the solid surfaces. On balance, the cumulative effect on visual quality and aesthetics within the SR 520 study area and surrounding central Puget Sound region would be an increasingly urban visual character, to which the proposed project would make a small contribution with both positive and negative visual elements.

How could cumulative effects on visual quality and aesthetics be mitigated?

No cumulative effects were identified so per WSDOT guidance, mitigation is not provided.

Noise

What direct and indirect effects would the project likely have on noise?

As documented in the Noise Discipline Report Addendum and Errata (WSDOT 2011h), construction of the project including the Build and Preferred Alternatives would produce noise and vibration, especially from major construction activities such as pile-driving, demolishing existing structures, and concrete pumping. All construction activities, including noise from staging, laydown, and storage areas, would be required to meet applicable local noise regulations or obtain a noise variance from the appropriate agency.

Overall, with the Preferred Alternative, 130 residences or residential equivalents would continue to have noise levels that meet or exceed WSDOT's noise abatement criteria (NAC). With the project's noise reduction strategies, there would be no negative effects remaining in Laurelhurst or Madison Park. With the recommended mitigation measures in Medina, no negative effects would remain in Medina under the Preferred Alternative. With the Preferred Alternative, five residential equivalents within the Arboretum would have noise levels exceeding the NAC. With the Preferred Alternative with recommended mitigation, 31 residences within the North Capitol Hill neighborhood would have noise levels exceeding the NAC.

The number of affected residences within the Montlake neighborhoods north and south of SR 520 would be 28 and 39, respectively. Within UW, the number of affected residences (four) remains the same as the No Build Alternative. With the Preferred Alternative, there would be 22 affected residences within the Portage Bay/Roanoke neighborhood.

Overall, while the number of affected residences under the Preferred Alternative without the recommended noise walls would be significantly lower than the number under either the No Build Alternative or the SDEIS options without mitigation, the number of affected residences under the Preferred Alternative with noise walls is somewhat higher when compared to any of the SDEIS options with mitigation. This is primarily due to the inclusion of project design elements that have noise-reducing effects, namely the inclusion of 4-foot tall concrete traffic barriers with noise-absorptive materials along the project alignment, reduced speeds between I-5 and the Montlake lid, increased heights of the elevated roadways, and expanded lids. By reducing noise levels, these same Preferred Alternative elements reduce the number of recommended noise walls compared to those recommended under the SDEIS options. In short, in those areas where the number of affected residences is higher with the Preferred Alternative compared to the SDEIS options, the difference is primarily because no noise walls are recommended under the Preferred Alternative, whereas noise walls were recommended with one or more of the SDEIS options (see Exhibit 19 of the Noise Discipline Report Addendum and Errata [WSDOT 2011h]).

No indirect noise effects were identified from construction or operation.

How was the cumulative effects assessment of noise conducted?

The project team identified cumulative effects on noise by following the standard project assessment method outlined in the Approach section. This included consideration of the Final Transportation Discipline Report (WSDOT 2011i). To assess the Build Alternative's contribution to a cumulative effect, the project team factored in the changes in noise levels anticipated to result from the Build and Preferred Alternatives, as modeled and documented in the Noise Discipline Report Addendum and Errata (WSDOT 2011h).

The cumulative effects analysis study area is shown on Exhibit 6 and the time frame spans from before construction of the original Evergreen Point Bridge in 1960 to the project design year of 2030.

What trends have led to the present noise condition in the study area, and how is noise likely to change in the reasonably foreseeable future without the project?

When the Roanoke Park, Montlake, and other neighborhoods west of Lake Washington near the SR 520 corridor were settled and developed during the opening decades of the 20th century, they were quieter in comparison to present conditions. After World War II, population growth in the central Puget Sound region accelerated, leading to increased commercial development and roadway traffic.

In the 1960s, I-5 and SR-520 were built, and traffic noise from these major highways and from arterial roads such as East Roanoke Street, 10th Avenue East, Lake Washington Boulevard, and Montlake Boulevard NE had substantially increased ambient noise levels in comparison to the prewar years. Noise from local streets, air traffic, water-related traffic, and industry has also increased and contributed to this trend. As the number of daily trips has increased on SR 520, so has the road noise. Over time, vehicular traffic has contributed to deterioration of the road surface, which contributes to existing traffic noise as vehicles move along the corridor. In addition, infill development has occurred with more residences close to the highway than when it was built.

Without the project, six of the ten roadway segments would have an increased number of residences negatively affected by anticipated traffic noise in 2030. The expected local reductions in noise adjacent to the roadway would not be achieved if the project were not constructed and its proposed noise reduction strategies not implemented. The Noise Discipline Report Addendum and Errata (WSDOT 2011h) contains a detailed discussion of noise effects.

What is the cumulative effect on noise likely to be?

The Build and Preferred Alternatives would have noise contributions equal to or slightly less than present levels and projected future levels without the project. No reasonably foreseeable project has been identified that would be built close enough to SR 520 to contribute to a cumulative noise effect. The project would, however, contribute to the noise effects of the other previously built transportation projects as these projects continue to operate in the reasonably foreseeable future. Compared with the 2030 No Build Alternative, the Preferred Alternative would substantially decrease the number of residences exceeding the NAC noise levels.

How could cumulative effects on noise be mitigated?

The cumulative effect of transportation-related noise is gradually being diminished over time as many new transportation improvement projects incorporate noise attenuation features such as lids, noise-absorptive coating on surfaces, and noise walls. As motor vehicles become more efficient and incorporate new ways to generate power, such as electric or hydrogen propulsion, the proportion of quieter vehicles will increase over time. In addition, *Transportation 2040* (PSRC 2010a) notes that policies encouraging vehicle trip reductions through transit improvements, HOV lanes, and non-motorized modes of travel where practicable would further reduce the cumulative noise effect. More broadly, *Vision 2040* (PSRC 2009a) includes many policies that emphasize concentrating growth in urban centers within the central Puget Sound region and connecting those centers with an efficient, transit-oriented, multimodal transportation system.

Energy Consumption and Greenhouse Gas Emissions

The SR 520, I-5 to Medina project would consume energy over the approximately 5-year construction period and during the long-term operation of the roadway. Much of this energy consumption would result from the use of petroleum, a fossil fuel. Any process that burns fossil fuel emits carbon dioxide (CO_2), which makes up the majority of GHG emissions from transportation. GHG emissions have been found to contribute to worldwide climate. Federal, state, and local agencies are considering ways to reduce GHG emissions to minimize future effects on climate change related to GHG levels. This section describes the expected direct, indirect, and cumulative effects of the project on energy consumption and GHG emissions and discusses them in relation to relevant goals and policies (U.S. Department of State 2007).

What direct and indirect effects would the project likely have on energy consumption and greenhouse gas emissions?

Energy use during construction over the short term and from vehicles using the completed SR 520 during long-term operation would be the main source of GHG emissions from this project. The global warming effect of GHGs is measured in terms of equivalency to the global warming potential of $CO_{2,}$ the reference gas against which the other GHGs are measured. GHG emissions are reported in terms of metric tonnes of carbon dioxide equivalent ($MtCO_2e$), which is proportional to the amount of energy used.

Considering the most likely construction approach based on currently available information, the project team assumed that construction energy needs would be met with diesel fuel only. The amount of energy consumed was calculated as proportional to the project cost. The GHG emission analysis is based on the results of the energy consumption analysis and thus reflects project cost. Exhibit 18 provides a comparison of the GHG emissions and energy consumption. The Preferred Alternative and Option A have the same calculated consumption of energy and GHG emissions, which is also the lowest level of the alternatives evaluated.

Exhibit 18. Energy Consumption and GHG Emissions during Construction

Alternative	Energy Consumption (MBtu)	GHG Emissions ($MtCO_2e$)
Option A	15,118 ,000	1,117,000
Option K	34, 411,000	2,541,000
Option L	18,893,000	1,395,000
Preferred Alternative	15,118 ,000	1,117,000

Source: WSDOT 2011k
MBtu = million British thermal units

As a point of comparison, in 2007, the most recent year for which data are available, Washington State's transportation sector consumed approximately 338 trillion British thermal units (Btu) (338,000,000 million Btu [MBtu]) of gasoline and approximately 143 trillion Btu of distillate fuel, a total of about 481 trillion Btu (Energy Information Administration 2009a, 2009b). Therefore, construction of the project, in total, would consume a negligible amount of energy (from about 0.005 percent to 0.009 percent) relative to the state's annual transportation-related energy consumption.

Operation of the Preferred Alternative would consume 4 percent less energy (and the SDEIS options would consume about 6 to 8 percent less energy) than the No Build Alternative in 2030 on the SR 520 corridor (WSDOT 2011k). This would be at least in part due to the addition of HOV lanes with the project, which would improve traffic flow for buses and carpools. The HOV lanes would lead to lower VMT, which directly translates into lower annual energy consumption. The Preferred Alternative would reduce VMT about 4 percent below VMT estimated for the No Build Alternative. This is compared to about 6 to 8 percent under the SDEIS Alternatives. Energy consumption during operation would be about 4 MBtu for the Preferred Alternative and 5 MBtu for the SDEIS Alternatives, or about 1 percent of the Washington State transportation sector's total annual energy consumption of 481 trillion Btu, as previously noted.

Operational GHG emissions would be produced by the vehicles that use the roadway once it is complete. These emissions would depend on the number of vehicles, vehicle speed, distance traveled, and vehicle fuel efficiency. Federal legislation on fuel economy is anticipated to result in higher fuel efficiencies in the future. Present conditions produce about 327 $MtCO_2e$ during the daily peak traffic periods each weekday (5:30 a.m. to 10:15 a.m. and 3 p.m. to 7:45 p.m.). As shown in Exhibit 19, in 2030, the No Build Alternative would produce about 400 MtCO_2e during the same time, because future traffic volumes would be higher than at present. The SDEIS Alternatives would produce between 366 and 369 MtCO_2e during the same peak periods in 2030, roughly 9 to 10 percent lower GHG emissions than under the No Build Alternative. The Preferred Alternative would produce 364 MtCO_2e during the same peak periods in 2030. When the updated Corporate Average Fuel Economy (CAFE) standards are incorporated into the model, the No Build Alternative operational emissions would be 305 MtCO_2e (compared to 400 MtCO_2e with current CAFE standards) and the Preferred Alternative would be 279 MtCO_2e (WSDOT 2011k).

Exhibit 19. Energy Consumption and GHG Emissions during Operation

Alternative	Energy Consumption Annually (MBtu)	GHG Emissions Weekday Peak Period (2030) (MtCO_2e)
Option A	5,012,000	367
Option K	5,134,000	369
Option L	5,134,000	369
Preferred Alternative	3,967,000	364 (279 with vehicle improvements)

Note: Values are annual estimates.
Source: WSDOT 2011k

Indirect effects related to energy consumption would occur if construction and operation of the project were to cause measurable effects on other sectors of the economy, such as utilities, or affect the ability of Washington State to meet the energy demands for this project, requiring expansion of existing resources. The project's operational contribution of about 1 percent of the state's total annual transportation energy consumption, previously noted, would be too small to have a consequential indirect effect.

Approximately 90 percent of Washington State's crude oil supply currently comes from the Alaska North Slope. Five refineries in the Puget Sound area distribute refined petroleum products to Washington State and adjacent states (FHWA et al. 2008). Energy supplies are sufficient to build and operate the project without placing undue demands on energy sources and would not affect other sectors of the economy.

In general, operation of the project would improve energy consumption and GHG emissions over the No Build Alternative. The addition of HOV lanes as part of the corridor system and a regional bike path would be consistent with the Governor's Executive Order 09-05, which includes direction to WSDOT to continue developing GHG reduction strategies for the transportation sector. No negative indirect effects would occur.

How were cumulative effects on energy consumption and GHG emissions assessed?

The cumulative effects analysis follows the project's standard analysis as detailed in the Approach section. The timeframe for the cumulative effects analysis is the 1920s to 2030. The study area is the central Puget Sound region.

Reasonably foreseeable transportation projects that are considered in the cumulative effects discussion include the SR 520 Pontoon Construction Project, the SR 520, Medina to SR 202 project, the Variable Tolling Project, and Sound Transit's East Link and North Link light rail projects.

What trends have led to present energy consumption and GHG emissions in Washington State?

At the national level, industrial uses had the highest share of energy demand in 2005, the most recent data available. However, the transportation sector's energy demand is expected to grow by 1.4 percent annually (to a 29.9 percent share by 2030) and will exceed the industrial sector's demand (FHWA et al. 2008). Energy-related activities, primarily burning of fossil fuels, accounted for the majority of CO_2 emissions from 1990 through 2004, when approximately 86 percent of the energy consumed in the United States was produced through the combustion of fossil fuels. GHG emissions rose by about 15 percent during the same period (U.S. Department of State 2007).

Consistent with the national trend, transportation is a major consumer of energy in Washington State. This trend started locally in the 1920s when the Eastside was connected to the Seattle area by ferries and roadways. Growth in the region accelerated after completion of the interstate highway system and the I-90 and Evergreen Point bridges across Lake Washington in the 1950s and 1960s. Growth continues as interconnectivity of roadways increase.

Total demand for all energy sources in Washington State has grown steadily since the early 1970s. Even though Washington State is the leading hydroelectric producer in the nation, energy derived from petroleum products outpaced hydroelectric in 2004.

While the transportation sector is the largest producer of GHG emissions, per capita use of gasoline is about the same and diesel use is slightly lower than the national average. Hydroelectric power, which does not contribute to GHG emissions, accounts for Washington State's higher than average GHG emissions level for transportation compared to the national average. Transportation is projected to be the largest contributor to future emissions growth from 2005 to 2020; transportation growth could add just over 12 million $MtCO_2e$ to Washington State's emissions by 2020 (Ecology 2007).

In recent years, the fuel efficiency of new vehicles has declined because of the popularity of larger engine vehicles, such as pickups, vans, and sport utility vehicles. Revised federal fuel efficiency standards have been mandated and increasing fuel efficiency will help reduce effects on energy and GHG levels. Requiring an average fuel economy standard of 35.5 miles per gallon in 2016 is projected to save 1.8 billion barrels of oil, gain a fuel economy averaging more than 5 percent per year, and reduce approximately 900 million metric tonnes in GHG emissions. President Obama has also directed the EPA and the National Highway Traffic Safety Administration to establish mid- and heavy-duty fuel efficiency standards and extend light-duty vehicle standards from 2017 to 2025.

How are energy consumption and greenhouse gas emissions likely to change in the reasonably foreseeable future without the project?

The Puget Sound region experienced accelerating population growth and industrial, commercial, and residential development, particularly during the second half of the 20th century. Population growth and economic development is projected to continue (PSRC 2010a). Similarly, traffic volumes have increased with population, leading to increased automotive emissions; this trend is likely to continue in the reasonably foreseeable future.

Policies at the federal, state, and local levels support energy conservation and are intended to reduce energy use, including petroleum, as well as GHG levels over the long-term. As described above, fuel efficiency is largely regulated though requirements on vehicle manufacturers. The trend toward more fuel-efficient vehicles is expected to continue. At the same time, investment in transit and transit service are helping to reduce emissions (PSRC 2010a).

In 2007, Governor Gregoire and the legislature set the following GHG reduction goals for Washington State:

- 1990 GHG levels by 2020
- 20 percent reduction below 1990 levels by 2035
- 50 percent reduction below 1990 levels by 2050

The Washington State legislature passed House Bill 2815 in spring 2008. This bill includes, among other elements, statewide per capita VMT reduction goals as part of the state's GHG emission reduction strategy. Also in 2007, the Climate Advisory Team was formed by Governor's Executive Order 07-02 to find ways to reduce GHG emissions. The final report included 13 broad recommendations, many of which are now being implemented.

In March 2008, the Governor signed Washington's Climate Change Framework/Green-Collar Jobs Act (HB 2815), which was developed with the help of a broad coalition of business, environment, education, labor, and energy leaders. This law includes, among other elements, statewide per capita VMT reduction goals as part of the state's GHG emission reduction strategy. The final report and other information on the process can be found on the 2008 Climate Action Team's Web page (Ecology 2011).

In 2009, the Governor issued Executive Order 09-05. Under the order, WSDOT is leading an effort to evaluate the changes needed in transportation, including reductions in VMT, to meet the state's GHG reduction goals. The agency is collaborating with businesses, environmental groups, transportation advocates, and local and regional jurisdictions to complete this work. In addition, WSDOT is among the six agencies leading the development of the initial climate change response strategy, due December 2011.

What would the cumulative effect on energy consumption and greenhouse gas emissions likely be?

Construction and operation of the Preferred Alternative, along with the other present and reasonably foreseeable transportation improvement projects listed in Exhibit 8 would make a very small contribution to statewide GHG emissions. At the same time, the Preferred Alternative's long-term operation would reduce VMT below present conditions and below future conditions projected for the No Build Alternative.

Operation of the SR 520, I-5 to Medina project in conjunction with the SR 520, Medina to SR 202 project, the East Link and North Link light rail projects, and other reasonably foreseeable transportation improvement projects would consume energy and emit GHGs over the long-term. However, these projects would together generate a smaller contribution to the cumulative effect on energy consumption and GHG emissions than their No Build Alternatives because the projects would improve regional transportation efficiency and increase HOV and transit ridership.

HOV lanes would encourage people to carpool, vanpool, or take transit, assisting in reducing GHG emissions. Tolling of the corridor is also anticipated to encourage transit use and reduce VMT on the corridor. Over the long term, improvements proposed for the SR 520 corridor in conjunction with Sound Transit's light rail projects would contribute to meeting GHG reduction goals outlined by the legislature and the Governor.

How could cumulative effects on energy consumption and greenhouse gas emissions be mitigated?

Many forms of energy consumption, including burning petroleum-based fuels, produces GHG emissions, which are known to contribute to global climate change. Global climate change is being addressed at local, regional, national, and international levels.

State and federal policies are being developed to reduce GHG levels substantially between now and 2050. WSDOT is supporting GHG reductions through existing and new strategies, such as: providing alternatives to driving alone (such as carpooling, vanpooling, and transit); developing transportation facilities that encourage transit, HOV, bike, and pedestrian modes; supporting land use planning and development that encourage such travel modes (such as concentrating growth within urban growth areas); and optimizing system efficiency through variable speeds and tolling.

The cumulative effect on GHG emissions would be further reduced by continuing advancements in automobile technology, fuel content regulations, and the increased availability of lower-carbon fuels. Furthermore, the region's dedication to providing alternative transportation options, such as public transit and bicycle trail networks, could help reduce the number of single-occupancy vehicles on the roads (PSRC 2010a).

Economic Activity

What direct and indirect effects would the project likely have on economic activity?

As discussed more fully in the Land Use, Economics, and Relocation Discipline Report Addendum and Errata (WSDOT 2011r), the Build and Preferred Alternatives would create jobs during construction and increase revenues to firms that supply materials necessary to build the project. This effect is expected to last the length of the construction period (up to 7 years) and would be focused on King, Kitsap, Pierce, and Snohomish counties (the cumulative effects study area as shown on Exhibit 6).

Operation of the Build and Preferred Alternatives would not affect the regional economy, except through beneficial effects of improved transportation efficiency along the SR 520 corridor. Because the proposed project would replace part of an existing transportation corridor through an urban area that has already been developed, it would not change land use or development patterns as demonstrated by PSRC integrated transportation and land use models (PSRC 2010a). For more information on the long-term effects of the project on transportation efficiency, see the Final Transportation Discipline Report (WSDOT 2011i). The Land Use, Economics, and Relocations Discipline Report Addendum and Errata (WSDOT 2011r) contains more information on the direct effects of the project on land use and growth patterns.

What would the cumulative effect on economic activity likely be?

The project team concluded that construction-related effects of the Build and Preferred Alternatives on economic activity would be positive but temporary, and that long-term operation of the proposed project would not directly or indirectly affect the economy. For these reasons, the project team concluded that the proposed project would not contribute to lasting trends from other past, present, or reasonably foreseeable actions that would have a cumulative effect on economic activity.

Social Elements

What direct and indirect effects would the project be likely to have on social elements, including public services and utilities?

This section briefly discusses the Build and Preferred Alternatives' potential to have direct, indirect, or cumulative effects on social elements such as community cohesion, emergency response services, and utilities. Other effects are discussed more fully in the Land Use, Environmental Justice, Recreation, and Cultural Resources sections of this report and in the discipline reports and addenda on those topics (WSDOT 2011r, WSDOT 2011p, WSDOT 2011g, and WSDOT 2011e). The cumulative effects timeline starts with non-native settlement of the Seattle area in the 1850s and ends with the project design year of 2030. The study area is shown on Exhibit 6.

Construction effects on adjacent communities would include typical construction impacts such as noise, dust, and detours. These effects could temporarily affect community cohesion and limit connections to community resources, patronage at neighborhood businesses, or use of recreational amenities. Detour routes for public service providers (especially police and fire) would be developed in advance and in coordination with the providers to minimize negative effects on response times of emergency response vehicles. In addition, construction activities could result in intermittent short-term utility outages (for example, to reroute utilities). These effects would not contribute to long-term or cumulative effects.

The operational project would result in several long-term benefits to community cohesion. The Build and Preferred Alternatives feature landscaped lids with pedestrian and bicycle pathways near the I-5 and Montlake interchanges. The lids would reconnect neighborhoods originally bisected by SR 520 and improve views towards the highway. The regional bicycle/pedestrian trail would link Montlake to the Eastside across the Evergreen Point Bridge as well as provide linkages to local trails in the parks adjacent to the corridor. Travel times for transit, carpools, and vanpools across SR 520 would decrease, and access between urban centers east and west of Lake Washington would improve. Increased shoulder width across the Evergreen Point Bridge could reduce delays for public service providers crossing the bridge.

Operation of the Build and Preferred Alternatives would not change demographics or existing land use patterns, or increase demand for public services or utility infrastructure within the project vicinity, as the project would not induce growth (see the Land Use, Economics, and Relocations Discipline Report Addendum and Errata [WSDOT 2011r]). Growth patterns are expected to be consistent with the Regional Growth Strategy. Project modeling indicates that improvements to traffic would be achieved through traffic efficiencies and shifts to HOV/HOT and transit options (PSRC 2010a, WSDOT 2010i). Therefore, no indirect effects on public services and utilities would result from the project.

What would the cumulative effect on social elements likely be?

Because the proposed project would have no long-term adverse direct or indirect effects on social elements, including public services and utilities, the project team did not conduct a cumulative effects assessment (WSDOT et al. 2008).

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