5.7 Noise

The noise analysis for the project followed the guidance of state and federal transportation agencies in order to identify the project's potential noise effects and mitigation. The guidelines and standards for analyzing and mitigating highway noise are established by the FHWA and state departments of transportation. The results of the analysis are summarized below. This information draws from the information included in the Noise Discipline Report Addendum and Errata (Attachment 7).

KEY POINTS

Noise

The Preferred Alternative and all options would have a lower number of residences where noise levels exceed the NAC than the No Build Alternative. This is because of the noise-reducing elements of the proposed design, which include lids, depressed roadway sections, and roadway realignments. Noise walls, if used, would further reduce the effects.

The potential effects of the Preferred Alternative were evaluated using the same methods used to evaluate the potential effects of the No Build Alternative and Options A, K, and L. As discussed in Section 5.1, however, the No Build Alternative and the Preferred Alternative traffic analysis was updated for this Final EIS to include the most current assumptions about future population and employment levels, road improvements, and transit services that will be in place by 2030. Since noise analysis is based on traffic data, this updated transportation information (traffic volumes, mixture, speed projections, etc.) was then used to evaluate the noise effects of the Preferred Alternative and the updated No Build Alternative. Section 5.1 provides more information on the updated transportation analysis. In addition, the Medina area was re-evaluated for the Final EIS to account for the removal of several homes occurring prior to project construction, which reduced the total number of residences in the project corridor.

The design files used in the model included a full three-dimensional plan and profile of the proposed highway, ramps, retaining walls, and other design elements that could affect the transmission of noise. WSDOT also used updated topographical maps for the surrounding areas and reviewed and verified all noise modeling locations.

Noise Modeling

In the FEIS, noise levels were modeled at 230 locations (representing 838 residences) for the Preferred Alternative.

In the SDEIS, noise levels were modeled at 211 receiver locations (representing 862 residences) for the No Build and Existing Conditions, at 208 receiver locations (representing 858 residences) for Options A and K, and 207 receiver locations (representing 855 residences) for Option L. The locations were chosen based on aerial mapping and onsite visits.

Under FHWA and WSDOT policy, all alternatives and design options are initially modeled without noise mitigation, and an analysis is then performed to determine whether consideration of noise abatement measures (typically noise walls) is warranted. If so, abatement measures are modeled to determine their feasibility and cost-effectiveness. Thus, initial results without mitigation are described for the Preferred Alternative and the SDEIS options, followed by a discussion of whether further mitigation is warranted. The traffic noise models for the Preferred Alternative and Options A, K, and L without noise mitigation do not include the noise-reducing effects of a traffic barrier.

How would the project affect noise levels without mitigation?

The noise analysis was performed for 230 receptors along the project corridor. The 230 receptors represent 617 single and multi-family

residences and residential equivalents and 220.8 residential equivalents, which are used to represent noise sensitive non-residential areas, such as parks and schools. As shown in Table 5.7-1 the Preferred Alternative, would result in 206.6 residences exceeding the noise abatement criteria (NAC) without noise mitigation as compared to 287.2 under the updated No Build Alternative. The primary reasons for this reduction are the modifications in the horizontal and vertical alignment, construction of new retaining walls, and expanded Montlake lid design. Within the corridor along the Portage Bay Bridge between I-5 and the Montlake lid, the posted speeds would be reduced to 45 mph, which also aids in lowering the traffic noise levels within this area. Modifying speed limits is an approved abatement measure that can be considered under WSDOT policy. Typically a speed reduction of 10 mph can result in a reduction in traffic noise of up to 3 A-weighted decibels (dBA). The Montlake lid design for the Preferred Alternative would cover a larger portion of SR 520 and would also result in lower traffic noise level projections near the lid compared to lid designs developed for Options A, K, and L.

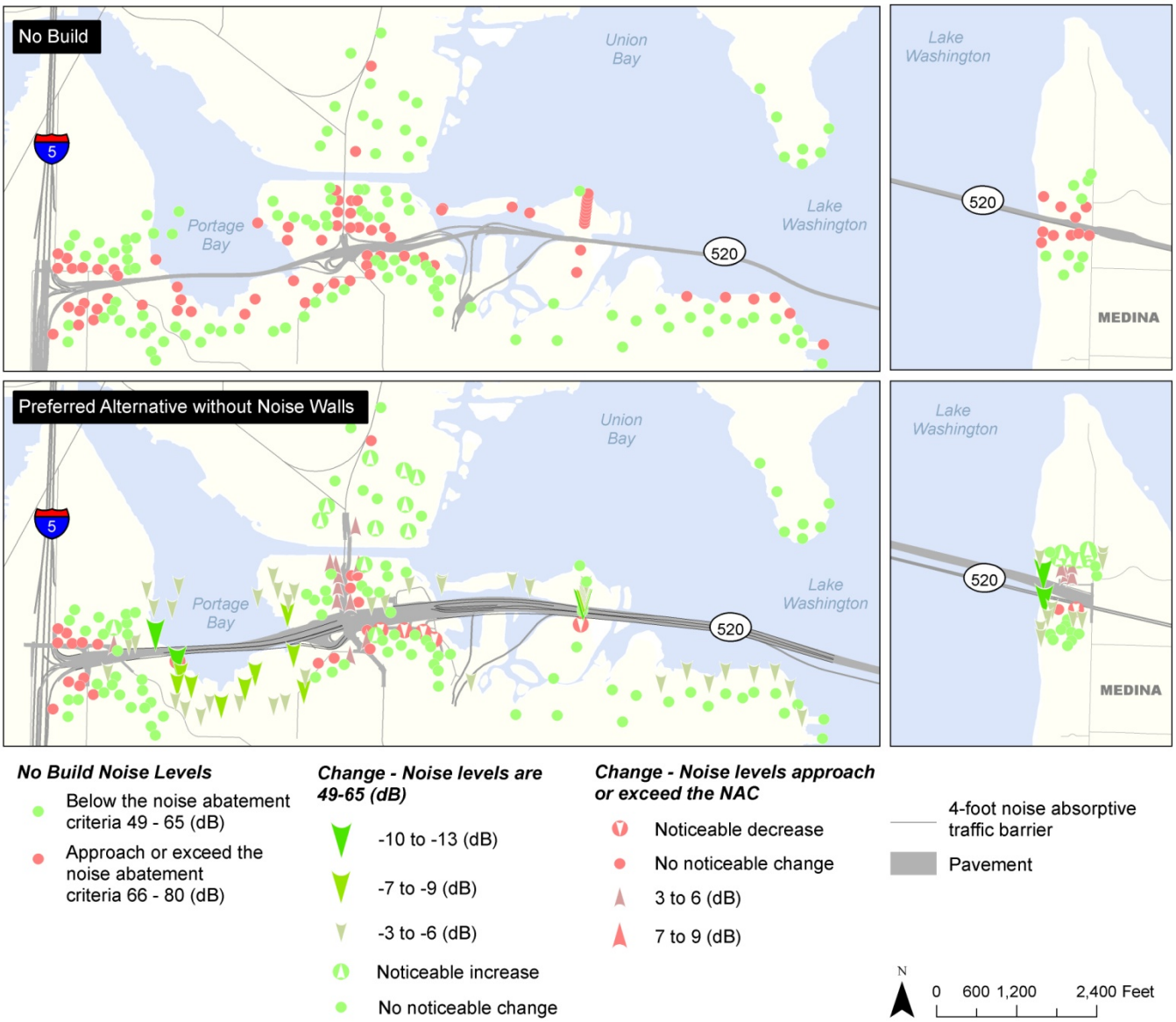
Table 5.7-1. Residences where Noise Levels Would Approach or Exceed the NAC in 2030 for the Preferred Alternative without Mitigation

	Total Residences	2004 Existing	2030 Updated No Build	2030 without Noise Walls- Preferred Alternative	2030 with Traffic Barriers and Noise Walls- Preferred Alternative
Project Corridor	837.8	270.3	287.2	206.6	142.8
Portage Bay/Roanoke[a]	83	24	24	22	22
North Capitol Hill	219	99	101	53	44
Montlake North of SR 520[a]	106.4	37	41.6	34.3	28
Montlake South of SR 520	141.6	63	66.6	48.2	39
University of Washington [a]	82.7	2	4.4	7.1	4.4
Washington Park Arboretum [a]	54	22	21.6	27	5.4
Madison Park	99.4	16	16	7	0
Laurelhurst	15	0	0	0	0
Medina	37	8	12	8	0

[a] This area also includes residential equivalents.

Exhibit 5.7-1 shows the locations where modeling occurred and the results for the updated No Build Alternative and Preferred Alternative without mitigation. The map shows the noise modeling sites, notes which receivers

Exhibit 5.7-1. **Noise Modeling Results for Receivers without Noise Walls (2030) - Preferred Alternative**



would approach or exceed the NAC, and provides a symbol indicating whether an average person would notice an increase, decrease, or no change in traffic noise. Changes in traffic noise are typically noticeable at 3 dBA. Noise levels at locations shown as having no noticeable change would remain within 2 dBA of current levels.

As shown in Table 5.7-2 and Exhibit 5.7-2, Options A, K, and L would also decrease the number of residences where noise levels exceed the NAC, although the decrease would be less than with the Preferred Alternative. Under Option A, the number of residences exceeding the NAC would decrease to 249. Under Options K and L, the number of residences exceeding the NAC would decrease to 256 and 235, respectively. The

addition of lids and landscape features over the highway would be the primary reasons for the reduction in noise levels.

Table 5.7-2. Residences where Noise Levels Would Approach or Exceed the NAC for SDEIS Options in 2030 for Options A, K, and L

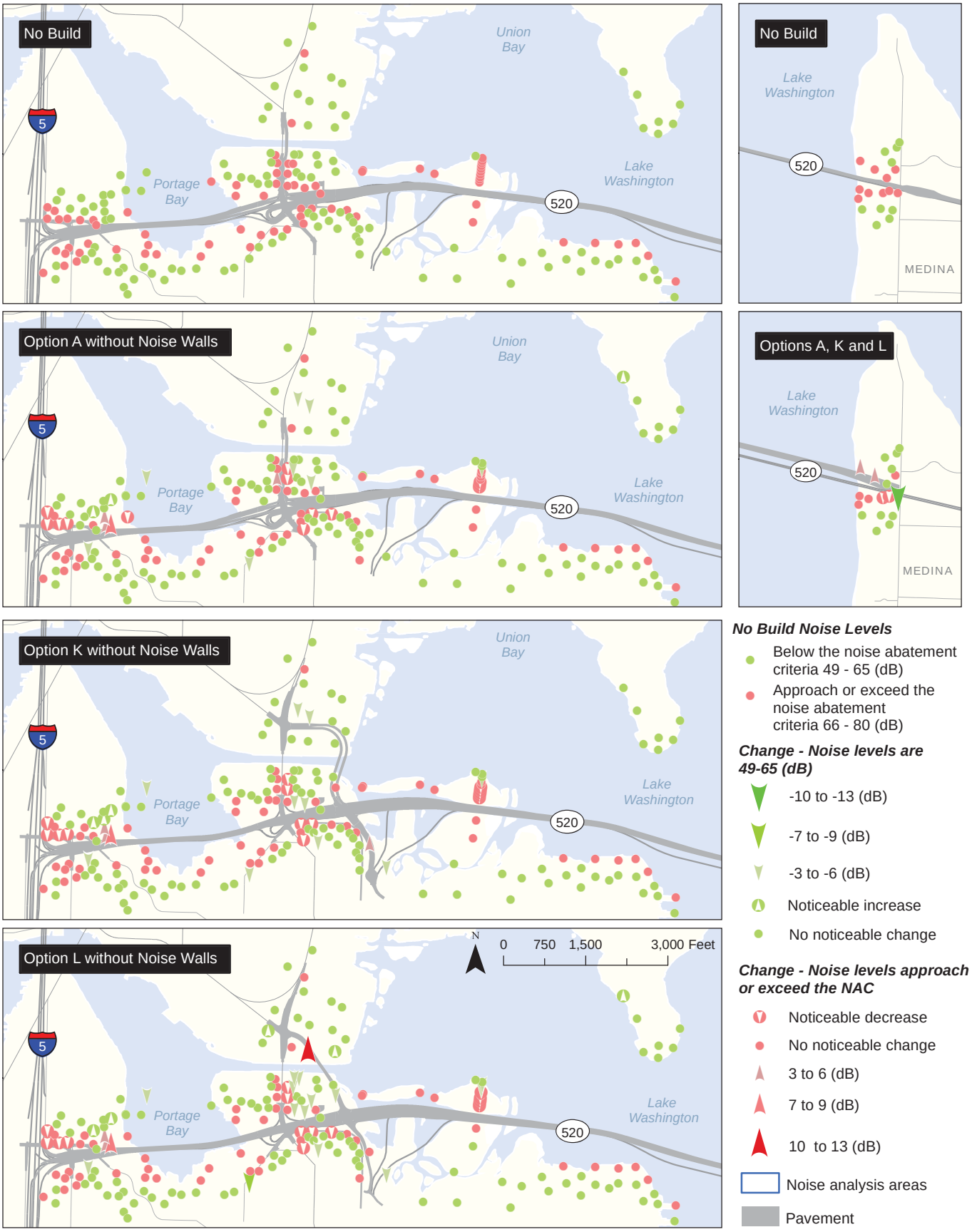
	Total Residences	2004 Existing	2030 No Build	2030 without Noise Walls			2030 w/ Noise Walls		
				Option A	Option K	Option L	Option A	Option K	Option L
Project Corridor	862	288	327	249	256	235	94	123	119
Portage Bay/Roanoke[a]	83	24	24	26	27	27	13	16	16
North Capitol Hill	219	99	109	89	89	83	35	35	35
Montlake North of SR 520[a]	106	37	47	27	28	28	0	19	18
Montlake South of SR 520	142	63	70	57	52	45	28	24	24
University of Washington [a]	83	2	4	2	2	4	2	2	4
Washington Park Arboretum[a]	54	22	27	16	27	22	16	27	22
Madison Park	99	16	16	10	10	5	0	0	0
Laurelhurst	15	0	0	0	0	0	0	0	0
Medina	61	26	30	21	21	21	0	0	0

[a] This area also includes residential equivalents.
Note: Adding the suboptions to Option A, K, or L would not change the noise effects listed in this table.

What policies apply to noise mitigation for WSDOT/FHWA projects?

Under FHWA regulations (23 Code of Federal Regulations [CFR] Part 772), noise abatement must be considered when highway noise levels approach or exceed the thresholds set in FHWA's noise abatement criteria, as they currently do along much of the SR 520 corridor and would continue to do under the No Build Alternative. (See section 4.7 for information on existing noise levels and the FHWA criteria.) Abatement measures must meet FHWA and WSDOT guidelines for feasibility and reasonableness, including a WSDOT requirement of making every reasonable effort to attain a 10-decibel or greater reduction in the first row of properties affected by project noise. WSDOT works with these property owners during detailed project design to determine some of the mitigation measures planned for the project.

Exhibit 5.7-2. Noise Modeling Results for Receivers without Noise Walls (2030) - Options A, K, and L



What has been done to avoid or minimize negative effects from noise?

Several design elements and general corridor improvements that were added to the Preferred Alternative as a result of the SR 520 Noise Expert Review Panel and in response to community input. In particular, many comments on the SDEIS and in other public forums expressed concern about the aesthetic impacts of noise walls, coupled with requests that WSDOT explore different and more innovative noise reduction measures. As a result, the Preferred Alternative design includes 4-foot noise-absorptive concrete traffic barriers along both sides of the SR 520 project alignment. The median planter on the Portage Bay Bridge will also be constructed using the barriers. These noise reduction measures could also be added to Options A, K, and L if one of these options became the preferred alternative.

The noise analysis for the Preferred Alternative includes the results of modeling standard concrete-type traffic barrier, but does not include any benefits from the acoustically absorptive material on the surface of the barriers. The noise-reducing effects of the 4-foot concrete traffic barriers were added to the traffic noise model as a corridor design element, and it was concluded that these barriers would reduce the number of traffic noise impacts along the project alignment by approximately 57 residences and residential equivalents compared to the model without traffic barriers. A WSDOT report on special noise barrier applications suggests that single-wall absorptive barriers may provide an additional 2-dBA decrease in noise levels compared to standard concrete barriers.

Additionally, within the corridor along the Portage Bay Bridge, between I-5 and the Montlake lid, the posted speeds would be reduced to 45 mph, which also aids in lowering the traffic noise levels within this area. Modifying speed limits is one of the abatement measures that can be considered under WSDOT policy and, typically, a reduction in traffic noise of up to 3 dBA can be expected with a speed reduction of 10 mph.

The final design element, which includes expanding the Montlake lid to cover a larger portion of SR 520, would also result in lower traffic noise levels near the lid compared to lid designs considered in previous analyses.

The combined effect of the design elements discussed above would result in overall lower noise levels along the project alignment. However, there would continue to be project-related noise effects and, therefore, additional mitigation measures must be considered under WSDOT policy. As described in the 2009 Noise Discipline Report section "What has been done to avoid or minimize negative effects from noise?" (see page 107), noise walls were determined to be the only viable mitigation option for the remaining noise-affected residences.

Alternative Noise-Reducing Design Measures

In addition to the 4-foot noise-absorptive traffic barriers and lower speed limits, the project team is currently evaluating quieter concrete pavement. The FHWA noise program policy related to tire/pavement noise (USDOT 1995) reads as follows:

> Pavement is sometimes mentioned as a factor in traffic noise. While it is true that noise levels do vary with changes in pavements and tires, it is not clear that these variations are substantial when compared to the noise from exhausts and engines, especially when there are a large number of trucks on the highway. Additional research is needed to determine to what extent different types of pavements and tires contribute to traffic noise.
>
> It is very difficult to forecast pavement surface condition into the future. Unless definite knowledge is available on the pavement type and condition and its noise generating characteristics, no adjustments should be made for pavement type in the prediction of highway traffic noise levels. Studies have shown open-graded asphalt pavement can initially produce a benefit of 2–4 dBA reduction in noise levels. However, within a short time period (approximately 6-12 months), any noise reduction benefit is lost when the voids fill up and the aggregate becomes polished. The use of specific pavement types or surface textures must not be considered as a noise abatement measure.

Sound measurements have increased over time for the three different types of quieter asphalt pavement installed along the SR 520 corridor. In general, the asphalt testing did not produce a pavement type that meets all WSDOT criteria; however, WSDOT is committed to continuing to test other types of pavements and is also committed to using a pavement type that will meet overall pavement standards for state highways while potentially providing some level of noise reduction when compared to most standard pavement types.

What noise walls were modeled and recommended for the project area?

The mediation group recommended different traffic noise mitigation and design elements intended to reduce noise for Options A, K, and L. Option A was defined as including noise walls and/or quieter rubberized asphalt pavement. Option K was defined as including only quieter rubberized asphalt pavement. Option L would include noise walls similar to those defined in the Draft EIS, which would extend along most of the corridor. Although these recommendations reflect the preferences of the mediation participants and the community, they do not affect FHWA's and WSDOT's responsibility to identify and consider effective and allowable noise

abatement measures under existing laws. For this reason, as noted above, the Preferred Alternative and all of the SDEIS options were modeled both with and without noise walls.

In accordance with FHWA and WSDOT guidance, WSDOT evaluated noise walls for all areas along the SR 520 corridor from I-5 to Medina where traffic noise levels in 2030 are expected to approach or exceed the NAC. Because noise wall configuration depends on roadway design, the location, length, and height of noise walls would vary for each design option. Based on the evaluation, WSDOT recommended noise walls only where modeling indicated that they would meet the guidelines for reasonableness and feasibility.

Preferred Alternative

Because design features such as reduced speeds, expanded lids, and 4-foot concrete traffic barriers were incorporated into the Preferred Alternative at many locations in the Seattle portion of the SR 520 corridor, noise walls would not provide enough additional reduction to be considered cost-effective. Therefore, the Preferred Alternative includes only two recommended noise walls: noise walls along both sides of SR 520 from just east of the floating span to Evergreen Point Road. If the recommended noise walls are included in the Preferred Alternative, the overall length would be 1,713 feet with height varying between 10 and 20 feet.

Noise abatement along I-5 in the North Capitol Hill area was also considered in the analysis for the Preferred Alternative. A noise wall along WSDOT right-of-way between I-5 and Harvard Avenue East and along a small spur of Broadway East near 10th Avenue East and SR 520 was evaluated for cost-effectiveness. However, further structural review is required to conclude if including the wall is reasonable and feasible before recommending it to the communities. This review will take place during final design.

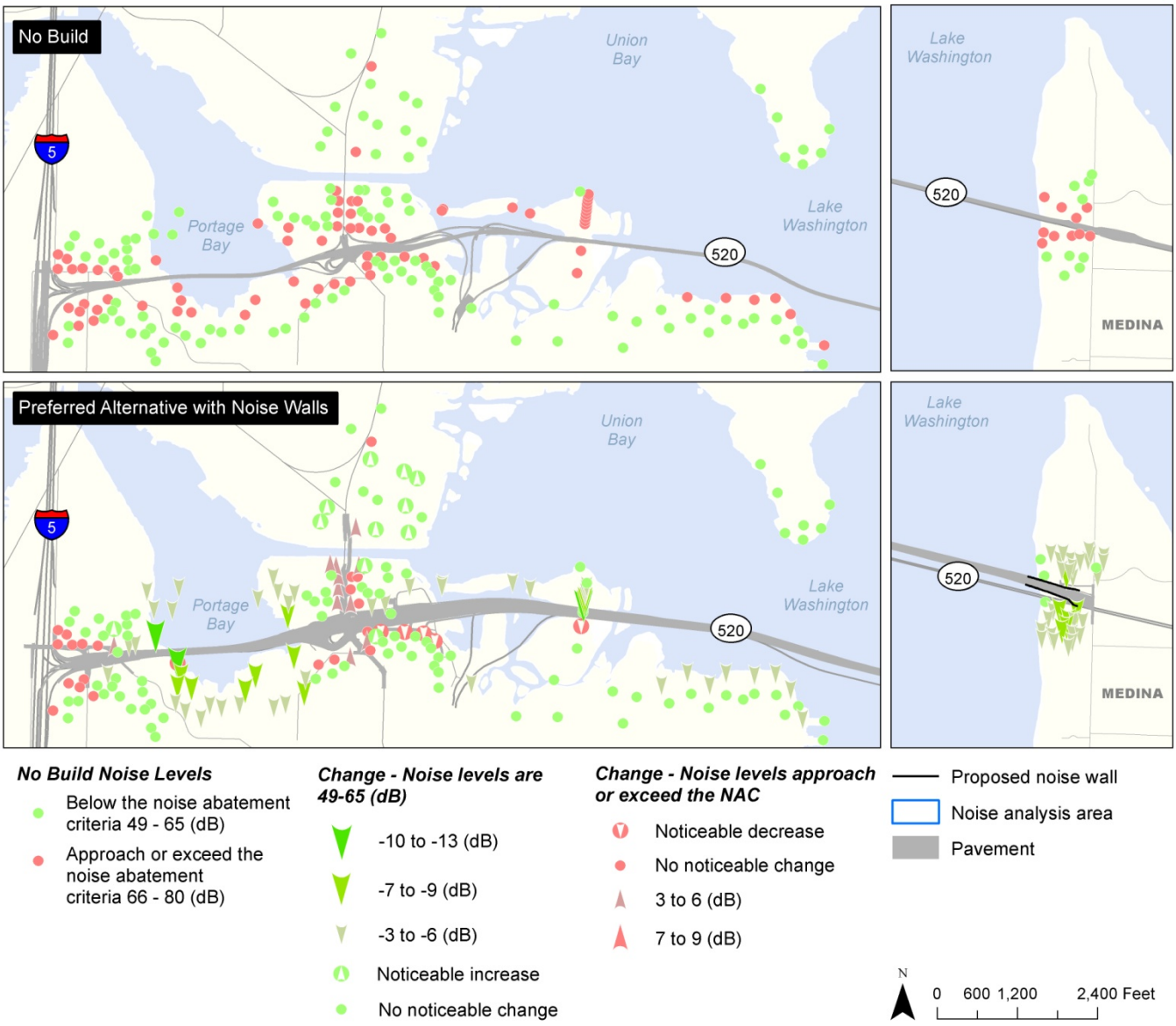
Exhibit 5.7-3 shows the locations of the recommended noise walls and identifies those receivers that would benefit. With the noise walls recommended for the Preferred Alternative, the number of residences that exceed the NAC would be reduced to 143 (Table 5.7-2) and a total of approximately 8 residences would benefit. The walls would meet WSDOT cost criteria.

Options A, K, and L

Options A, K, and L included the following recommended noise walls (Exhibit 5.7-4):

- Noise walls along the north side of SR 520 from the 10th and Delmar lid to the Montlake lid
- Noise walls along the south side of SR 520 from the 10th and Delmar lid to just west of Montlake Boulevard

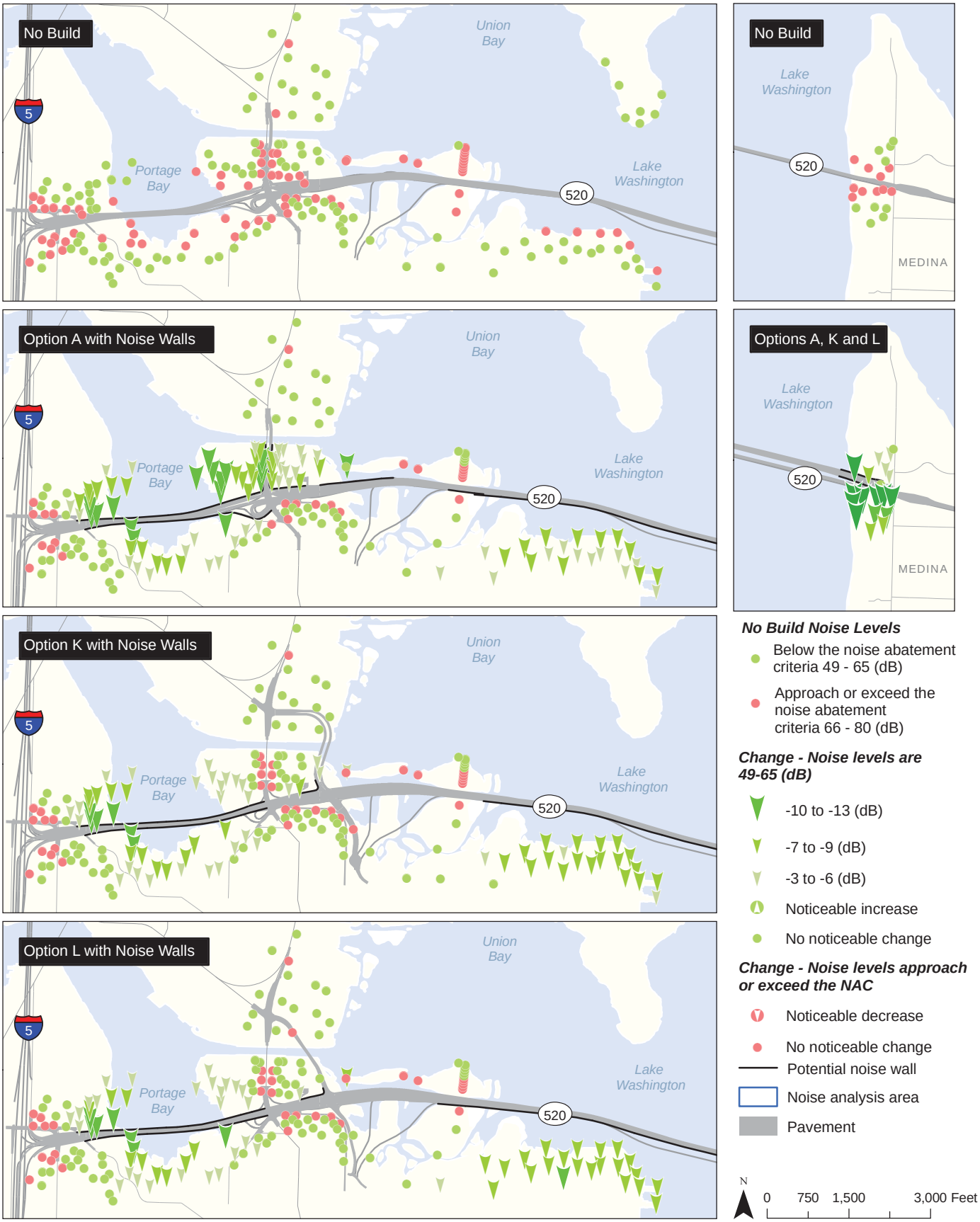
Exhibit 5.7-3. **Noise Modeling Results for Receivers with Noise Walls (2030) - Preferred Alternative**



- Noise walls on the south side of SR 520 along the Madison Park neighborhood
- Noise walls along both sides of SR 520 from just east of the floating span to Evergreen Point Road

In areas where the evaluated noise walls did not meet the WSDOT reasonableness and/or feasibility criteria (for example, between Montlake Boulevard NE and the Arboretum), noise walls were not recommended. Exhibit 5.7-4 shows the receiver locations where noise walls would be located and the changes in noise levels.

Exhibit 5.7-4. Noise Modeling Results for Receivers - Noise Walls (2030)



Note: No noise walls were evaluated for the Laurelhurst neighborhood because noise levels from SR 520 would remain below the NAC for the 6-Lane Alternative with the design options.

Option A

If the recommended noise walls were included in Option A, their overall length would be 18,819 feet, with heights varying from 8 to 14 feet. The taller noise walls would be necessary in areas where residents are located uphill from the project corridor. Exhibit5.7-4 shows the locations of the recommended noise walls.

With the noise walls recommended for Option A the number of residences that would exceed the NAC would be reduced to 94 (Table 5.7-2) and a total of 468 residences would benefit. Each wall would meet WSDOT cost criteria.

Option K

If the recommended noise walls were included in Option K, overall length would be 16,528 feet, with heights varying from 8 to 16 feet. Exhibit 5.7-4 shows the locations of the recommended noise walls.

With the noise walls recommended for Option K the number of residences that would exceed the NAC would be reduced to 123 (Table 5.7-2) and a total of 409 residences would benefit. All the walls would meet the WSDOT cost criteria with the exception of the one wall in Washington Park Arboretum. Although with Option A the noise walls on the south and north sides of SR 520 would be cost-effective for the Arboretum, the project roadway profile with Option K would require higher (more expensive) noise walls near the Arboretum to achieve similar noise level reductions. The wall that would extend along the south side of SR 520 in the Arboretum would not be cost-effective.

Option L

If the recommended noise walls were included in Option L, overall length would be 16,738 feet, with heights varying from 8 to 16 feet. Exhibit5.7-4 shows the locations of the recommended noise walls with Option L.

With the noise walls recommended for Option L the number of residences that would exceed the NAC would be reduced to 119 (Table 5.7-2) and a total of 400 residences (8 with noise levels of 70 dBA or higher) would benefit. Each wall would meet WSDOT cost criteria.

What indirect effects would the project likely have on noise?

WSDOT considered all noise-related effects of project operation to be direct. This is because project-related noise would be detected by people only while they were in or close to the SR 520 corridor and at the same time the noise was being generated. No indirect noise effects were identified from operation.

What has been done to avoid or minimize negative effects?

The Preferred Alternative includes WSDOT approved noise abatement such as reduced speed limits and increased roadway heights, expanded lids, as well as noise-reducing design elements including absorptive treatments on 4-foot traffic barriers. By reducing noise levels, the Preferred Alternative design results in fewer recommended noise walls compared to those recommended under the SDEIS options. In areas where the number of affected residences is higher with the Preferred Alternative compared to the SDEIS options, the difference is primarily due to the fact that only two noise walls (in Medina) are recommended under the Preferred Alternative.

The Preferred Alternative and Options A, K, and L include up to five landscaped lids (depending on the design option) over depressed sections of the roadway. Although these lids are included as community enhancements rather than noise mitigation, they would also help prevent noise from reaching noise-sensitive receiver locations near the lidded areas. The Noise Discipline Report Addendum and Errata (Attachment 7) provides a detailed explanation of where the lids will reduce noise levels.

Changes in the horizontal or vertical alignment of a roadway can reduce noise levels depending on the modification and surrounding conditions. These types of changes can qualify as noise mitigation. A depressed (lowered) roadway can provide substantial noise reduction, depending on the amount of depression. Under the Preferred Alternative and all design options, SR 520 would be depressed at the approach to the I-5 interchange and the Montlake interchange. With Option K, the depressed SPUI and tunnel under the Montlake Cut would substantially reduce noise levels in the immediate surrounding areas compared to Option L with the elevated SPUI. Options K and L also include a depressed intersection at NE Pacific Street/Montlake Boulevard East.

What negative effects would remain after mitigation?

Overall, with the Preferred Alternative, 143 residences or residential equivalents would continue to have noise levels that meet or exceed the NAC. With SDEIS Options A, K, and L, the residual noise effects totaled 94, 123, and 119 residences, respectively. With the Updated No Build Alternative, there would be 287 traffic noise effects within the project area. Currently, there are 270 residences that have noise levels exceeding the NAC.

There would be no negative effects remaining in Laurelhurst or Madison Park under the Preferred Alternative. Also, with the recommended mitigation measures in Medina, no negative effects would remain in Medina under the Preferred Alternative.

Within the Arboretum, five residential equivalents would have noise levels that exceed the NAC with the Preferred Alternative compared to 22 under the No Build Alternative. Similarly, within the North Capitol Hill neighborhood, 44 residences would have noise levels exceeding the NAC with the Preferred Alternative with recommended mitigation compared to 101 under the No Build Alternative.

Compared to the No Build Alternative, the numbers of affected residences within the Montlake neighborhoods north and south of SR 520 are reduced from 42 to 28 and 67 to 39, respectively. Within the University of Washington, the number of affected residences remains the same as the No Build Alternative.

Within the Portage Bay/Roanoke neighborhood, there would be 22 affected residences with the Preferred Alternative, which is less than the 24 predicted under the No Build Alternative.

Overall, the number of affected residences under the Preferred Alternative without the recommended noise walls or the 4-foot concrete traffic barrier would be lower than the number under either the No Build Alternative or under any of the SDEIS options without mitigation. However, the number of affected residences under the Preferred Alternative with the 4-foot traffic barrier in Seattle is somewhat higher than any of the SDEIS options with mitigation. This is primarily because the project design elements and the barrier reduce noise to levels where other noise abatement, such as noise walls, is no longer feasible and reasonable. Design elements that could not be modeled, such as absorptive treatment on traffic barriers, lid portals, and bridge joints may further reduce noise levels below the values reported in this analysis.

5.8 Air Quality

This section is based on the Air Quality Discipline Report Addendum and Errata (Attachment 7) and discusses how the project would affect local and regional air quality, including criteria pollutants and mobile source air toxics.

As discussed in Chapter 4, Washington is subject to air quality regulations issued by EPA, Ecology, and local air quality agencies. EPA's National Ambient Air Quality Standards (NAAQS) set limits on levels of criteria pollutants. Concentrations of the criteria pollutants must not exceed the NAAQS over specified time periods. Ecology and the Puget Sound Clean Air Agency (PSCAA) monitor air quality in the Puget Sound region to compare the levels of criteria pollutants found in the atmosphere with the NAAQS.

Mobile source air toxics (MSATs) are hazardous air pollutants found in motor vehicle exhaust. EPA has identified seven "priority MSATs" as having the greatest influence on health. Currently, no standards establish allowable concentrations of mobile source air toxics emissions. Ecology conducted a study to monitor several air toxic compounds in the Seattle area from 2000 to 2001. This study indicated that the primary contributors to air toxics are diesel exhaust and wood smoke (Ecology 2001).

The air quality effects of the Preferred Alternative were evaluated using the same methods used to evaluate the effects of the No Build Alternative and Options A, K, and L. The local air quality effects of the Preferred Alternative and the Updated No Build Alternative are compared to Options A, K, and L in this chapter. As discussed in Section 5.1, the No Build Alternative was updated for this Final EIS to include the most up-to-date assumptions about the future population and employment levels, road improvements, and transit services that will be in place by 2030. This updated transportation information (traffic volumes, mixture, speed projections, etc.) was then used for analysis of regional air quality effects of the Preferred Alternative and the updated No Build Alternative. Section 5.1 provides more information on the updated transportation analysis. Options A, K, and L are qualitatively compared to the updated No Build Alternative and Preferred Alternative, as described later in this chapter.

KEY POINTS

Air Quality

The Preferred Alternative and all options would meet air quality standards. The modeled concentrations of air pollutants are well below the 1-hour and 8-hour NAAQS.

How would the project affect air quality?

The Preferred Alternative as well as all the SDEIS options would meet air quality standards. The modeled concentrations of air pollutants are below the 1-hour and 8-hour NAAQS for all design option in all future years. MSAT emissions are expected to decrease between existing conditions and future years, regardless of the design option.

Local Air Quality

The Puget Sound area has a history of not meeting the NAAQS for carbon monoxide (CO). Although ambient concentrations have been below the NAAQS for many years, the area is still designated by EPA as a CO maintenance area. Because the project is in a CO maintenance area, a project-level analysis is necessary to verify that no localized effects would cause or contribute to a violation of the NAAQS. The analysis must include air dispersion modeling to calculate CO concentrations in the vicinity of selected intersections chosen based on their high level of traffic and delay. The purpose for this is to demonstrate that the project would not cause a new violation or increase the frequency or severity of an existing violation of the air quality standards. This is called a "conformity analysis" because it is intended to demonstrate whether projects conform with the State Implementation Plan (SIP) for maintaining air quality standards.

Preferred Alternative

For the final EIS, the transportation model was updated for the Preferred Alternative and No Build Alternative, and a new conformity analysis was performed. The following five intersections were analyzed for the Preferred Alternative:

- Montlake Boulevard and Lake Washington Boulevard/SR 520 Eastbound Ramps
- Montlake Boulevard and East Shelby Street
- Montlake Boulevard and Pacific Street
- Montlake Boulevard and Pacific Place
- Pacific Street and 15th Avenue NE

The intersections of Boylston Avenue/East Lynn Street and Boylston Avenue/East Roanoke Street were included in the SDEIS analysis but were not analyzed under the Preferred Alternative. This is because the updated traffic operations analysis indicated that these intersections would operate similarly under both the Preferred Alternative and the No Build Alternative and would therefore have similar CO concentrations.

To meet conformity requirements, the local air quality analysis for the Preferred Alternative was also conducted for the year 2040. The regional transportation plan, *Transportation 2040*, was adopted by the Puget Sound Regional Council in May 2010. Because *Transportation 2040*, which calculated regional emissions for the same year, is now in effect, the project is required to show conformity to air quality standards in 2040.

As shown in Table 5.8-1, the modeled concentrations for the Preferred Alternative are well below the 1-hour and 8-hour NAAQS.

Table 5.8-1. Preferred Alternative - Maximum 1-Hour and 8-Hour Carbon Monoxide Concentrations (parts per million [ppm])

Intersection Name		NAAQS	2008	2030		2040	
			Existing	No Build	Preferred Alternative	No Build Alternative	Preferred Alternative
Montlake Blvd/Lake Washington Blvd/ SR 520 Eastbound ramps	1-hour	35	11.9	9	9.6	9.0	10.3
	8-hour	9	9.8	7.8	8.2	7.8	8.7
Montlake Boulevard/ East Shelby Street	1-hour	35	11.5	9	9.0	9.2	9.1
	8-hour	9	9.5	7.8	7.8	7.9	7.9
Montlake Boulevard/ Pacific Place	1-hour	35	9.7	7.8	7.8	7.8	7.9
	8-hour	9	8.3	7.0	7.0	7.0	7.0
Pacific Street/ 15th Avenue NE	1-hour	35	9.4	7.5	7.4	7.5	7.5
	8-hour	9	8.1	6.8	6.7	6.8	6.8
Montlake Boulevard/ Pacific Street	1-hour	35	10.2	8.3	8.4	8.3	8.5
	8-hour	9	8.6	7.3	7.4	7.3	7.4

Note: All concentrations include a background concentration of 5 ppm.

Options A, K, and L

For the SDEIS options, the following five intersections were analyzed (Exhibit 5.8-1):

- Boylston Avenue/East Lynn Street
- Boylston Avenue/East Roanoke Street
- Montlake Boulevard/Pacific Place
- Pacific Street/15th Avenue NE
- Montlake Boulevard/Pacific Street

As shown in Table 5.8-1 and Table 5.8-2, the modeled concentrations are well below the 1-hour and 8-hour NAAQS for the Preferred Alternative and the SDEIS options.

Regional Air Quality

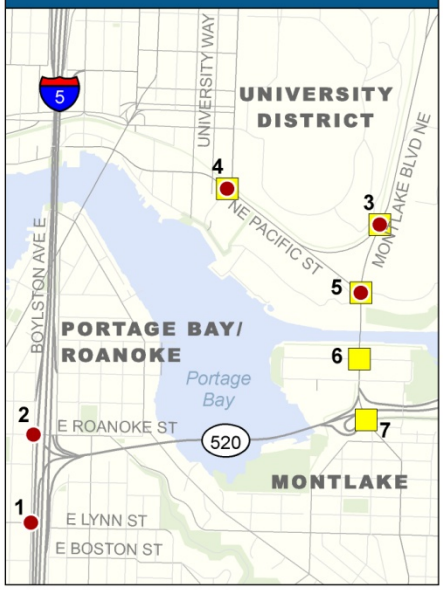
WSDOT performed an emissions burden analysis to evaluate how the project would contribute to regional emissions of criteria pollutants. This was done by calculating the emissions from vehicles in the region with the Preferred Alternative and Options A, K, and L and comparing them to the regional "emissions budget" as calculated by the Puget Sound Regional Council (PSRC). This budget, established and approved as a part of the SIP, sets a limit on allowed pollutant emissions for motor vehicles within the

KEY POINT

There is no measurable difference in regional air quality related to traffic emissions between build and no build conditions when the project is evaluated in the context of the study area as required.

region. Emission factors are stated in terms of grams of pollutants per vehicle mile traveled. WSDOT also performed a Mobile Source Air Toxics MSAT analysis as described below. Note that there are no standards established for project-specific emissions burdens or MSAT emissions. The section below describes how the information on those two factors is used to identify the project's contribution to air emissions in the region.

Exhibit 5.8-1 **Intersections Evaluated for CO**



Study Intersection (SDEIS Options)

Study Intersection (Preferred Alternative)

1 - Boylston Ave/E Lynn St

2 - Boylston Ave/E Roanoke St

3 - Montlake Blvd/Pacific Pl

4 - Pacific S/15th Ave. NE

5 - Montlake Blvd/Pacific St

6 - Montlake Blvd/Lake Washington Blvd/SR 520 EB ramps

7 - Montlake Blvd/E Shelby St

N 0 1,000 2,000 4,000 Feet

Emissions Burden Analysis

Preferred Alternative

In 2030, the Preferred Alternative would result in lower vehicle emissions than current conditions, primarily because of more stringent vehicle emission standards, and lower emissions that for Options A, K, and L (Table 5.8-3). The Preferred Alternative findings relative to Options A, K, and L are due primarily to the updated tolling and light rail assumptions in the transportation network.

There is no measurable difference in model results for regional emissions with and without the project on the scale of the study area, although differences would exist on local roads. The very slight differences in volatile organic compounds (VOCs) and nitrogen oxide (NOx) among all options in future years (Table 5.8-3) would occur because of the small differences in average speed throughout the study area. The average speed for the Preferred Alternative would be slightly faster than the average speed for the Updated No Build Alternative, which equates to slightly lower VOC and NOx emissions. CO emissions would also be lower than existing conditions, but this is not reflected in the table because of rounding. There would be no difference in particulate matter (PM) in future years due to likely age of vehicles on the road. .

Options A, K, and L

Table 5.8-3 shows that emissions are almost identical for Options A, K, L and the No Build Alternative. Based on the SDEIS analysis, the predicted vehicle miles traveled (VMT) in the study area would slightly decrease for Option A and increase for Options K and L over the No Build Alternative, but the differences are so small as to be insignificant. The decrease in Option A is a result of the reduced capacity of the Seattle interchanges caused by elimination of the Lake Washington Boulevard ramps. Adding the suboptions to Option A, K, or L would result in no measurable differences in effects.

MSAT Analysis

FHWA bases its recommendation for MSAT analysis on a project's average daily traffic volume. According to FHWA's guidelines, projects with an annual average daily traffic volume (AADT) of 140,000 or more should be analyzed quantitatively. Because the highest AADT among the design options was 133,750 (Options K and L), the effects in the SDEIS were

Table 5.8-2. SDEIS Options - Maximum 1-Hour and 8-Hour Carbon Monoxide Concentrations (ppm)

Intersection Name		NAAQS	2008 Existing	2030 No Build	2030 Option A	2030 Option K	2030 Option L
Boylston Avenue/East Lynn Street	1-hour	35	7.6	6.6	6.6	6.6	6.6
	8-hour	9	6.8	6.1	6.1	6.1	6.1
Boylston Avenue/East Roanoke Street	1-hour	35	7.5	6.4	6.4	6.4	6.4
	8-hour	9	6.8	6.0	6.0	6.0	6.0
Montlake Boulevard/ Pacific Place	1-hour	35	9.6	7.8	7.8	8.5	8.5
	8-hour	9	8.2	7.0	7.0	7.4	7.4
Pacific Street/ 15th Avenue NE	1-hour	35	9.6	7.8	7.8	7.8	7.8
	8-hour	9	8.2	7.0	7.0	7.0	7.0
Montlake Boulevard/ Pacific Street	1-hour	35	10.4	8.1	8.0[a]	9.2	9.5
	8-hour	9	8.8	7.2	7.1a	7.9	8.1

[a] Adding the suboptions to Option A would result in an additional 0.2 ppm.
Notes:
All concentrations include a background concentration of 5 ppm.
Adding the suboptions to Option K or L would not change the CO concentrations listed in this table.

Table 5.8-3. Burden Emissions Analysis: Daily Project Emissions of Criteria Pollutants (tons per day)

Alternative	VMT	CO	CO % of SIP Budget	VOCs	NOx	PM_{10}	$PM_{2.5}$
2008 Existing	10,996,900	222	9%	15.5	23.3	0.6	0.4
2030 No Build	13,803,200	175	7%	7.7	7.5	0.4	0.2
2030 Option A	13,785,200	175	7%	7.7	7.5	0.4	0.2
2030 Option K/L	13,866,800	175	7%	7.7	7.6	0.4	0.2
2008 Revised Existing	11,200,000	226	9%	15.1	23.5	0.6	0.4
2030 Revised No Build	13,100,000	166	7%	7.3	7.2	0.4	0.2
2030 Preferred Alternative	13,100,000	166	7%	7.2	7.1	0.4	0.2
SIP Budget	N/A	2,510	N/A	N/A	N/A	N/A	N/A

Notes:
Emissions were calculated using the MOBILE6.2 emission factor for 30 miles per hour and the daily VMT from the 2009 Transportation Discipline Report (Attachment 7).
State Implementation Plan (SIP) inventory data are from 61 Federal Register (FR) 53323 (October 11, 1996), which was established through the year 2010.
Pollutant emissions in tons/day should not be compared to NAAQS, which are pollutant concentrations.
PM_{10} = particulate matter smaller than 10 microns
$PM_{2.5}$ = particulate matter smaller than 2.5 microns

evaluated qualitatively. However, comments received on the SDEIS from the public and the EPA requested that a quantitative analysis be conducted for the Preferred Alternative, WSDOT performed that analysis as requested.

Emissions for each of the seven priority MSATs were estimated for the SR 520 corridor. The MOBILE6.2 mobile source emissions model was used to estimate an emission factor in grams per mile for all vehicle speeds. Model inputs included vehicle volume and average speed data for a series of segments representing eastbound and westbound traffic on SR 520. The emissions for each segment were determined by multiplying the emission factor by the segment length and the segment volume. Emissions from each segment were added together for a total emission value in tons per year for SR 520. Emissions were calculated for existing conditions (2008) and for the Preferred Alternative and No Build in 2030.

As seen in Table 5.8-4, MSAT emissions are slightly lower for the Preferred Alternative than emissions for the Updated No Build Alternative in 2030. The lower emissions are due to the general reduction in traffic congestion. The emissions in 2030 are significantly lower than the emissions in 2008, which is consistent with FHWA projections and is due to technological advancements in vehicles and fuel, as discussed in the Air Quality Discipline Report Addendum and Errata (Attachment 7). The Preferred Alternative would not cause an adverse effect due to MSAT emissions.

Average Daily Vehicle Miles Travelled

The Washington State Department of Transportation (WSDOT) has estimated vehicle miles traveled as part of the Highway Performance Monitoring System since 1980.

In 2009, the average daily vehicle miles traveled in the central Puget Sound region was 80,875,000. As the most dense population and employment area in the state, the four-county region experiences 52% of the statewide VMT while containing only 24% of the lane-miles.

Exhibit 5.9-3 in the next section illustrates the study area used in the Emissions Burden Analysis. The average daily vehicle miles traveled in this study area was 10,996,900 in 2008.

Table 5.8-4. MSATs Emissions Analysis: Daily Project Emissions of Criteria Pollutants (tons/day)

Alternative	Acrolein	Benzene	1,3-Butadiene	Formaldehyde	Naphthalene	POM	DPM
2008 Existing	0.52	35.03	2.74	8.71	0.53	0.0050	102.49
2030 No Build	0.26	19.80	1.41	4.47	0.37	0.0027	26.94
2030 Preferred Alternative	0.24	18.68	1.32	4.04	0.36	0.0027	26.40

Notes:
POM = polycyclic organic matter
DPM = diesel particulate matter

Air toxics is an emerging field and current scientific techniques, tools, and data are not sufficient to accurately estimate human health effects that would result from a transportation project in a way that would be useful to decision-makers in a National Environmental Policy Act (NEPA) context. Because of the limitations in the methodologies for forecasting health effects, any predicted difference among alternatives would likely be much smaller than the margin of error in the prediction methods. The results would also not account for other public health benefits of the project, such as reducing such as reducing criteria

pollutants emissions, accident rates, and fatalities as well as improved access for emergency response.

Does the project meet project-level conformity requirements?

Because the project is not anticipated to create any new violations, nor increase the frequency of an existing violation of the CO standard, it conforms with the purpose of the current SIP and the requirements of the federal Clean Air Act and the Washington Clean Air Act. The proposed project is included in the regional transportation plan (RTP), *Transportation 2040* (PSRC 2010a), and in the 2010-2013 Transportation Improvements Program, also known as the Transportation Improvement Program (TIP) (PSRC 2010b). The RTP and the TIP meet the conformity requirements identified by federal and state regulations for CO.

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

The project has the potential to provide indirect benefits to air quality in the form of reduced single-occupancy-vehicle use resulting from expected increases in transit ridership on SR 520. (See Section 5.1 and the Final Transportation Discipline Report for more information on transit.)

What has been done to avoid, minimize, and/or mitigate for negative effects?

Even without the project (the No Build Alternative), air quality in 2030 is expected to improve compared to current conditions, primarily because of the introduction of cleaner fuels and more efficient vehicle engines. Slight improvements in air quality would also result from increased mobility resulting from the SR 520 project. The project would comply with all applicable air quality standards, conform with the State Implementation Plan, and reduce emissions of MSATs. Therefore, no mitigation would be necessary for project operations.

5.9 Energy and Greenhouse Gases

Policies at the federal, state, and local levels support energy conservation for all sectors, including transportation. Transportation energy efficiency is largely regulated though requirements on vehicle manufacturers rather than on transportation infrastructure, since transportation agencies are typically required by law to provide facilities and services that will meet planned travel demand. However, in support of policies and legislation related to energy efficiency and greenhouse gas (GHG) emissions, WSDOT evaluates energy usage and GHGs for all its major transportation infrastructure projects. This section provides the results of these evaluations.

The information in this section is based on the Energy Discipline Report Addendum and Errata (Attachment 7). The potential effects of the Preferred Alternative were evaluated using the same methods used to evaluate the potential effects of Options A, K, and L. However, since publication of the SDEIS, the No Build Alternative and the Preferred Alternative traffic models and findings have been updated as described in Section 5.1, and that updated information was used for the energy analysis as well to ensure the most accurate analysis of the projected effects on energy and greenhouse gases.

How would the project affect energy use?

The analysis of energy effects is based on projected 2030 traffic volumes within the SR 520 corridor and the resultant annual vehicles miles traveled (VMT). The findings for the Preferred Alternative and Options A, K, and L are similar. Options A, K, and L have the same relative change compared to their SDEIS No Build Alternative as the Preferred Alternative has to the Updated No Build Alternative. The Preferred Alternative and all the SDEIS options would reduce annual consumption of fuel by motor vehicles (the major source of energy usage on a roadway) between 5 and 10 percent.

KEY POINT

Energy Savings

The Preferred Alternative and all options would reduce annual fuel consumption between 5 and 10 percent on SR 520 between Seattle and Medina as compared to the No Build Alternative.

Preferred Alternative

In 2030, the annual VMT on the SR 520 corridor under the updated No Build Alternative would be approximately 609 million miles. Like Options A, K, and L, the VMT for the Preferred Alternative is expected to be lower than the Updated No Build Alternative because no tolls would in place on SR 520 under No Build conditions in 2030. As discussed in Section 5.1, tolls can affect travel demand in the corridor by causing drivers to take alternate modes (such as transit or carpooling) or alternate routes.

Average Daily Vehicle Miles Traveled

In 2009, the average daily VMT in King County was 44,299,000 (PSRC 2010a).

In 2006, the average daily VMT on the project corridor was 1,600,000.

Vehicles operating in the study area under the updated No Build Alternative would consume about 4.1 million MBtu (million British thermal units) of energy, which is equivalent to 32.8 million gallons of fuel per year (see Table 5.9-1). The Preferred Alternative is estimated to consume about 4 percent less energy (the equivalent of 1.3 million gallons of fuel) than the

updated No Build Alternative in 2030. The reduction in energy use under the Preferred Alternative is attributable to two factors:

- A reduction in VMT because of tolling in the SR 520 corridor, which would cause some commuters to shift transportation modes or find alternate routes across Lake Washington
- The addition of HOV lanes, which would improve traffic flow for buses and carpools

Table 5.9-1. Annual Fuel Consumption during Operation (2030)

Alternative/Option	Annual VMT (millions)	MBtu	Gallons of Fuel[a] (millions)	% Change from 2030 No Build Alternative
Existing Conditions (2006) SDEIS [b]	562	3,818,000	30.3	NA
2030 No Build Alternative SDEIS	806	5,474,000	43.4	NA
2030 Option A SDEIS	738	5,012,000	39.8	-8%
2030 Option K/L SDEIS	756	5,134,000	40.7	-6%
Existing Conditions (2006) [b]	546	3,707,000	29.4	NA
2030 No Build Alternative	609	4,132,000	32.8	NA
2030 Preferred Alternative	584	3,967,000	31.5	-4 %

[a] Fuel includes both diesel and gasoline.

[b] "Existing Conditions (2006) SDEIS" refers to the original existing conditions from the Puget Sound Regional Council travel demand model that were used in the traffic modeling efforts for Options A, K, and L and the No Build Alternative. "Existing Conditions (2006)" refers to the findings from the updated travel demand model used for the Preferred Alternative and updated No Build Alternative. See Section 5.1 for more information on these two modeling results.

NA = not applicable

Sources: WSDOT 2009e, U.S. Department of Energy 2008.

Annual energy consumption was calculated by applying an energy consumption factor to VMT. This analysis did not take into account the improved vehicle speed that is anticipated to result with the project, nor did it account for changes in fuel efficiency standards for future vehicles. Therefore, the conclusions are conservative (i.e., they are likely to overstate actual energy consumption). The analysis focuses on the changes in VMT and uses current vehicle energy consumption factors to estimate the energy consumed during future operations. Incorporating expected improvements in vehicle speed under the Preferred Alternative and Options A, K, and L would likely lead to a greater decrease in fuel consumed than what is presented in Table 5.9-1. That decrease would be consistent across the Preferred Alternative and the SDEIS options.

Measuring Energy

Different energy sources (petroleum, natural gas, hydropower, wind, solar) are typically measured in different units, such as gallons of fuel or watts of electricity. To compare energy amounts for all sources, this report converts them all to British thermal units (Btus). For example, the energy content of one gallon of diesel is about 130,000 Btus. One kilowatt-hour of electricity is about 3,400 Btus.

Options A, K, and L

In the SDEIS analysis, the annual VMT across SR 520 under the 2030 No Build Alternative was approximately 806 million miles. Under No Build, vehicles operating in the study area would consume about 5,400,000 MBtu of energy per year (Table 5.9-1). With Options A, K, and L, the VMT across SR 520 is expected to be lower than under the No Build Alternative because of the same factors as the Preferred Alternative (reduction in VMT and addition of HOV lanes).

Effect of Suboptions

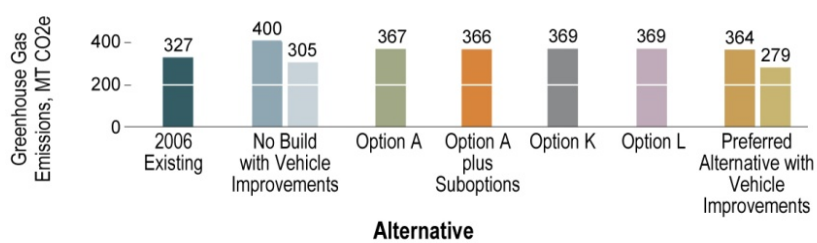
- Adding the potential suboptions to SDEIS Option A, K, or L could result in minor changes to the energy effects described above, based on estimated vehicle miles traveled, traffic operations, and the expected mix of vehicles. However, the relative effects of the three options would still be similar.

What effect would the project have on greenhouse gas emissions?

Corridor Analysis

Greenhouse gas emissions are typically measured as carbon dioxide equivalent units (CO_2e). Exhibit 5.9-1 shows the estimated CO_2e emissions in metric tonnes (MT) produced during the peak traffic periods on weekdays. The peak periods were used for comparison because they are the most congested times of day. The Preferred Alternative's operational emissions are comparable to the emissions from Options A, K, and L. In fact, the Preferred Alternative and all of the build options have essentially equal operational GHG emissions (the differences in the findings fall within a statistical margin of error and are negligibly different).

Exhibit 5.9-1. **Weekday Peak Period Greenhouse Gas Emissions**



Since the SDEIS was prepared, modeling tools have been updated to include the Corporate Average Fuel Economy (CAFE) standards currently in law (light duty fuel economy improvements between 2011 and 2016). To better understand the emissions associated with this project, the updated No Build Alternative and the Preferred Alternative were analyzed both with and without the updated CAFE standards as seen in Exhibit 5.9-1. In all

cases, regardless of option, the project would reduce emissions of GHG in the SR 520 corridor by almost 10 percent.

Effect of Suboptions

- Adding the potential suboptions to SDEIS Option A, K, or L would likely result in only minor changes to the GHG emissions effects described above since construction methods, materials, and costs would not be substantially altered. So adding the suboptions would yield approximately the same relative effects for the three options.

Sub-regional Analysis

In order to better understand the effects of the project on the greenhouse gas emissions, a sub-regional analysis was done for the Preferred Alternative and Updated No Build Alternative in addition to the corridor analysis. This additional analysis was not conducted for Options A, K, and L and their No Build Alternative since the findings from the corridor analysis above for all options including the Preferred Alternative were so similar.

A sub-regional analysis was also conducted for the Preferred Alternative in order to capture the potential for vehicle trip diversions away from SR 520 due to tolling. As shown in Exhibit 5.9-2, the study area included roads north and south of the SR 520 corridor. The sub-regional study area is based on daily average travel data from the PSRC travel demand model. Specific emission factors were generated using EPA's MOVES10a model.

As Exhibit 5.9-3 shows, the 2030 No Build Alternative and Preferred Alternative would both produce about 20 percent more emissions than the existing conditions. The vehicle miles traveled in this area would increase correspondingly. The difference between the Preferred Alternative and No Build Alternative is not discernible for either emissions or VMT.

How does the project relate to statewide greenhouse gas reduction goals?

In 2008, Washington State established statewide greenhouse gas reduction goals to reduce emissions to:

- 1990 levels by 2020
- 25% below 1990 levels in 2035
- 50% below 1990 levels in 2050

Exhibit 5.9-2. **Sub-regional Study Area Map for Greenhouse Gas Emissions**

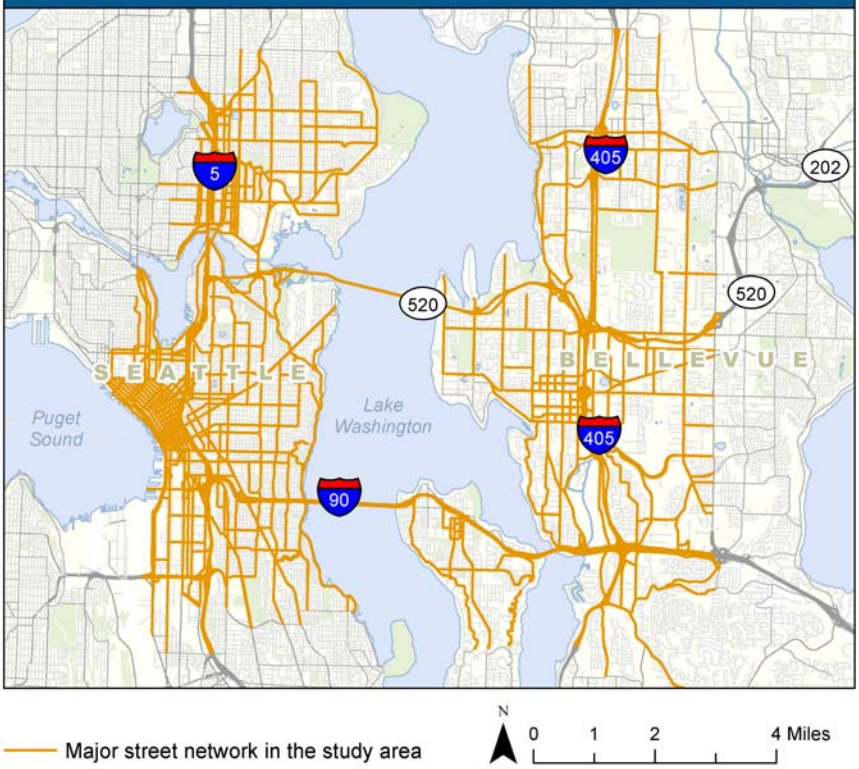
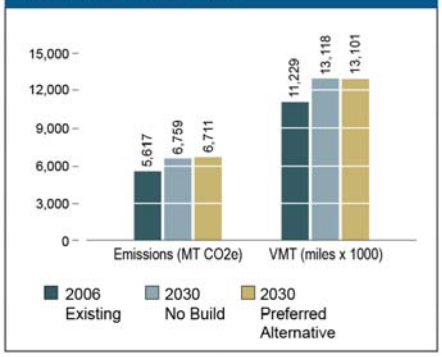


Exhibit 5.9-3. **Sub-regional Daily Emissions and VMT**



The state has not apportioned the goals to specific sectors such as transportation, electricity use and generation, or industrial sources. Achieving statewide greenhouse gas emissions targets will require reducing emissions from all sources.

Reducing transportation sector greenhouse gas emissions requires a systems approach to reduce inefficient movement of people, goods, and services over a variety of travel modes, geographic areas, and economic and social activities. WSDOT is working with regional and local jurisdictions and other interested parties to develop and implement strategies to reduce emissions throughout the state. For more information about recent work on statewide transportation greenhouse gas emissions, please see the WSDOT 2010 Sustainable Transportation report (available at: http://www.wsdot.wa.gov/SustainableTransportation/report.htm).

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

In general, operation of the project would reduce energy consumption and GHG emissions over the No Build Alternative within the SR 520 corridor, Within the subregion, however, the alternative chosen for SR 520, would not affect greenhouse gas emissions. 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. Therefore, no negative indirect effects are expected.

What has been done to avoid or minimize negative effects?

Because energy use and GHG emissions depend on the number of vehicles traveling on the roadway and their fuel efficiency, steps to improve travel efficiency on SR 520 would reduce GHG emissions within the corridor. The addition of an HOV lane would improve traffic flow for buses and carpools, which would encourage some travelers to change transportation modes (see Section 5.1).

WSDOT and its transportation partners will continue to work to reduce GHG emissions from the transportation sector throughout the state, including the SR 520 corridor. Examples of measures to reduce GHG emissions include 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.

5.10 Water Resources

This section examines the potential effects of the project operation on water resources, including surface water and groundwater. More detailed and technical discussions of the information presented in this section can be found in the 2009 Water Resources Discipline Report and the Water Resources Discipline Report Addendum and Errata in Attachment 7.

How do stormwater regulations affect the project's design?

The Washington State Department of Ecology is the primary agency that regulates stormwater in the state. Ecology requires stormwater from all new pollutant-generating impervious surfaces, such as highways, to be treated before it is discharged. Ecology and WSDOT have agreed that runoff from highway projects will be treated using best management practices (BMPs) from the *Highway Runoff Manual* (WSDOT 2008a). Ecology requires certain stormwater flows to be controlled or detained before they are treated and discharged.

The HRM establishes the level of water quality treatment ("basic" or "enhanced") required for a project. It also identifies if, and where, detention of stormwater runoff is required. Using the guidelines provided in the HRM, Lake Union, Portage Bay, Union Bay, and Lake Washington have been determined to be exempt from detention requirements (WSDOT 2008a). However, stormwater discharges into these waters must still be treated. Even though Ecology only requires basic treatment for discharges to these water bodies, WSDOT has included enhanced treatment wherever possible to protect fish and aquatic habitat.

WSDOT determined the size of the treatment facilities for the Preferred Alternative and the SDEIS options based on the expected volume of stormwater that would be generated by what is termed the "water quality design storm." The water quality design storm is defined as the predicted volume of runoff that would occur from a 6-month, 24-hour storm (Ecology 2005). The total volume of stormwater runoff to be treated is a function of the design storm, and the area of impervious surface on which rain falls.

Highway stormwater management facility design takes place within the context of threshold discharge areas (TDAs) (see definition at right). Essentially, the TDA is the portion of the overall basin within the project limits that could be contributing surface water runoff by redirecting precipitation from infiltrating the ground into stormwater runoff. Consequently, the water quality effects of this project are based on the amount of impervious surfaces located in the TDAs that would generate stormwater runoff before and after construction.

Basic versus Enhanced Treatment

Basic and enhanced stormwater treatment BMPs are different types of BMPs that have been designated in the *Highway Runoff Manual* to treat stormwater (see page 3-15, Chapter 3 of the HRM [WSDOT 2008a]).

Basic treatment BMPs remove pollutants such as metals, suspended solids, and nutrients from contaminated stormwater. The HRM performance goal for basic treatment BMPs is 80 percent removal of total suspended solids (WSDOT 2008a).

Enhanced treatment BMPs are designed to achieve greater removal of dissolved metals than basic treatment. In addition to removing 80 percent total suspended solids, the HRM performance goal for enhanced treatment is 50 percent removal of dissolved copper and zinc for influent concentrations, ranging from 0.003 to 0.02 milligram per liter (mg/L) for dissolved copper and 0.02 to 0.3 mg/L for dissolved zinc (WSDOT 2008a).

While these families of BMPs have different performance goals for the stormwater they are designed to treat, the intent of treatment is the same—to produce stormwater discharges that comply with state and federal water quality criteria.

DEFINITION

A **basin** is the portion of land drained by a river and its tributaries. A watershed can be composed of a single or multiple basins.

A **threshold discharge area** (TDA) is an onsite area draining to a single natural discharge location or multiple natural discharge locations that combine within 0.25 mile downstream (as determined by the shortest flow path).

How would the project affect stormwater runoff?

The Preferred Alternative and the SDEIS options would increase pollutant-generating impervious surface (PGIS) areas compared to the No Build Alternative because of their wider roadways and bridges. The Preferred Alternative and the SDEIS options have different road profiles that require different designs to convey the stormwater to the treatment facilities. The facilities were located to meet those conveyance needs. The treatment facilities were sized to meet the Highway Runoff Manual (HRM) requirements for the Preferred Alternative and the SDEIS options, with individual variations for each design.

The pollutant-loading analysis conducted for the Preferred Alternative includes a refinement to address the effect of highway lids. The analysis of Options A, K, and L in the SDEIS did not account for any rainfall slanting onto the roadways under each highway lid. The Preferred Alternative analysis evaluated both the original assumption (referred to herein as Lid Scenario 1) that rain would fall straight down around the outside of the lid, and an alternative assumption (Lid Scenario 2) that rainfall could fall at an angle and wash pollutants off a greater roadway surface underneath the lid. Lid Scenario 1 includes the entire SR 520 roadway, but does not include the areas above SR 520 associated with the landscaped lids at 10th Avenue East and Delmar Drive East and in the Montlake area. Lid Scenario 2 includes both the SR 520 roadway areas and the areas under these two lids, to the extent that rain falling at an angle of 30 degrees would be able to wash pollutants off these surfaces and into the stormwater conveyance and treatment system. The amount of existing untreated PGIS is the same for Lid Scenario 1 and Lid Scenario 2, but less than the future treated PGIS. Overall, both lid scenarios result in a lower total amount of future treated PGIS for the Preferred Alternative than for any of the SDEIS options (Table 5.10-1).

DEFINITION

Pollutant-generating impervious surface (PGIS) is impervious surface that is a source of pollutants in stormwater runoff. Study area PGIS includes roadways that receive direct rainfall, or the run-on or the blow-in of rainfall.

KEY POINTS

The Preferred Alternative and all options evaluated in the SDEIS would increase the amount of pollutant-generating impervious surfaces in the project area (Preferred Alternative – 37 percent increase, Option A – 35 percent increase, Option K – 45 percent increase, and Option L – 44 percent increase).

Changes to some of the treatment facility types for the Preferred Alternative compared to the SDEIS options would not change the pollutant-loading estimates or the environmental effects described in the SDEIS.

The pollutant-loading analysis was refined for the Preferred Alternative to look at the effects of PGIS at the portals of the proposed lids.

By including stormwater treatment in the Preferred Alternative design, the project would meet state and federal water quality regulations and would provide more water quality treatment than is required for stormwater under the specific conditions of WSDOT's *Highway Runoff Manual* in several areas of this project.

Table 5.10-1. Pollutant-Generating Impervious Surface

	Preferred Alternative[a]				
	Lid Scenario 1	Lid Scenario 2	Option A	Option K	Option L
Existing Untreated	66.4	66.4	57.5	64.2	60.4
Total Future Treated[b]	73.4	68.5	77.5	93.3	87.0
% Total Future Treated	100%	100%	100%	100%	100%

[a] See text for explanation of lid scenarios.
[b]See the Water Resources Discipline Report and Errata in Attachment 7.

The proposed stormwater treatment facilities for each of the receiving waters are discussed below and summarized in Table 5.10-2. Exhibit 5.10-1 shows the locations of these facilities, including outfalls and flow directions.

Table 5.10-2. Comparison of Stormwater Treatment by Threshold Discharge Area

		Preferred Alternative		SDEIS Options	
	TDA	Proposed Facility	Level of Treatment	Proposed Facility	Level of Treatment
Lake Washington	7	Biofiltration swale	Basic	Biofiltration swale, media filter vault	Basic
	8	Emerging technology best management practice (AKART)[a]	Basic	Emerging technology best management practice	Basic
	9	Constructed stormwater treatment wetland	Enhanced	Constructed stormwater treatment wetland, media filter vaults	Enhanced
Union Bay	10	Constructed stormwater treatment wetland, biofiltration swale	Enhanced/ basic	Constructed stormwater treatment wetland	Enhanced
Portage Bay	11	Constructed stormwater treatment wetland	Enhanced	Constructed stormwater treatment wetland	Enhanced
	12	Constructed stormwater treatment wetland	Enhanced	Constructed stormwater treatment wetland	Enhanced
	13	Biofiltration swale	Basic	Constructed stormwater treatment wetland	Enhanced
Lake Union	14	Biofiltration swale	Basic	Constructed stormwater treatment wetland, media filter vaults	Enhanced

[a]AKART = all known, available, and reasonable technologies

Lake Union

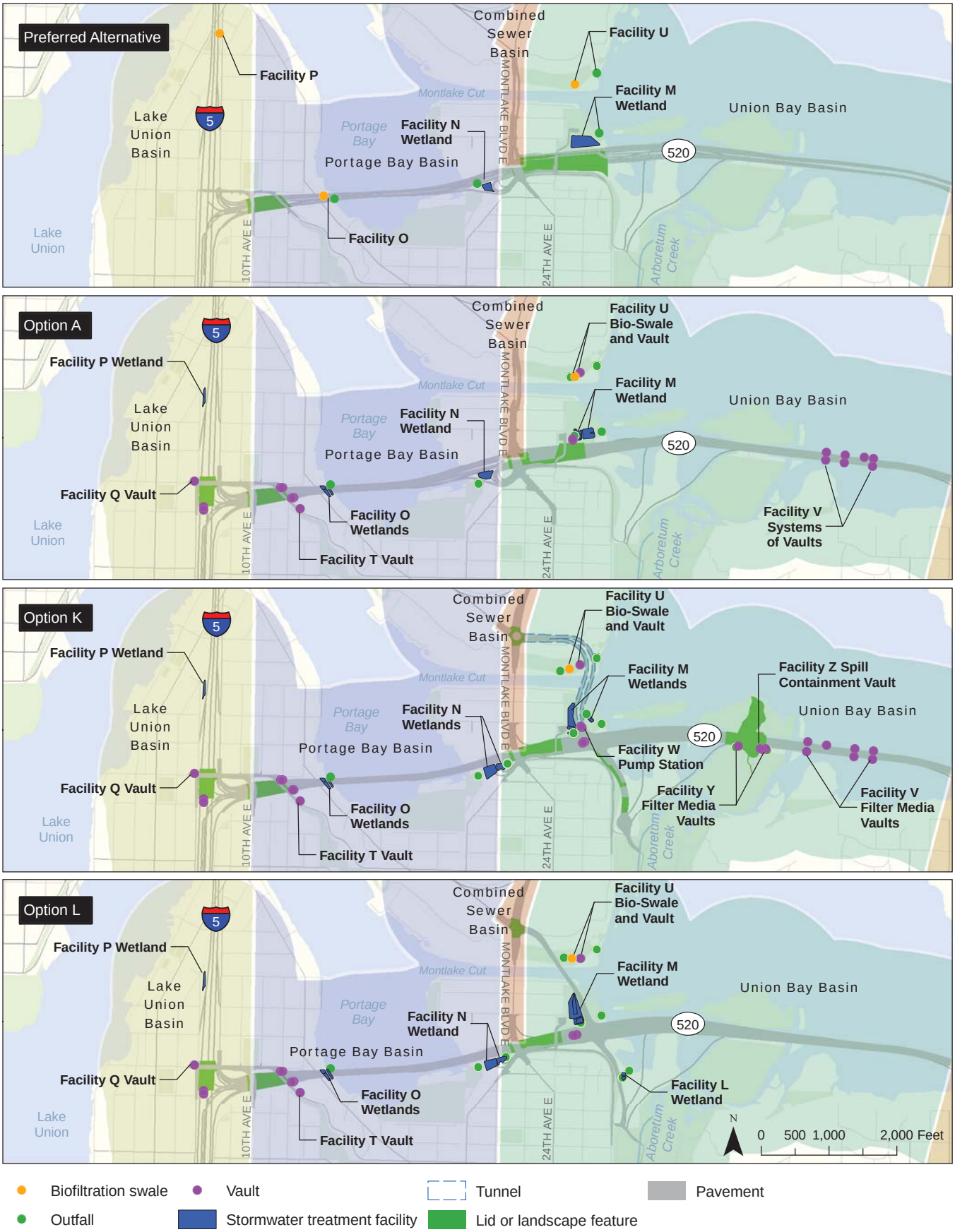
For the Preferred Alternative, a single biofiltration swale (basic treatment BMP, facility P) would convey treated stormwater from TDA 14 to Lake Union via an existing stormwater outfall located at Allison Street (Table 5.10-2 and Exhibit 5.10-1).

For the SDEIS options, stormwater from the I-5 interchange would drain to three treatment facilities (P, Q, and T) before entering Lake Union via an existing stormwater system outfall located at Allison Street (see Exhibit 5.10-1). Facility P would be a treatment wetland (an enhanced treatment BMP), while facilities Q and T would use media treatment vaults (a basic treatment BMP).

Portage Bay

For the Preferred Alternative and the SDEIS options, the stormwater design would discharge treated stormwater from three TDAs (11, 12, and 13) to Portage Bay through two existing outfalls—one on the eastern shoreline of Portage Bay and the other on the western shoreline (Table 5.10-2 and Exhibit 5.10-1). For the Preferred Alternative, however,

Exhibit 5.10-1. Proposed Stormwater Management Facilities in Seattle Project Area



stormwater from TDA 13 would be treated with a biofiltration swale (facility O, basic treatment BMP) prior to discharge at the western shoreline. This is in contrast to the stormwater treatment wetland identified for the SDEIS options. This change is a result of the Preferred Alternative's smaller project footprint, which would yield less space for stormwater treatment in this area, and from site constraints such as steep slopes and proximity to Lake Washington. For the Preferred Alternative and the SDEIS options, stormwater from TDAs 11 and 12 would be treated by means of individual constructed stormwater treatment wetlands and then discharged to Portage Bay on the eastern shoreline (Table 5.10-2 and Exhibit 5.10-1).

The West Approach Profile and Stormwater Management

The profile of a roadway can affect the movement of stormwater away from the traveling lanes, and toward stormwater conveyance and treatment facilities.

The west approach profiles described in the SDEIS for Options A and K would create low points along the roadway that would make stormwater movement more difficult and potentially more costly.

The profile identified for the Preferred Alternative provides for enhanced water quality treatment by working with gravity to move stormwater to the Montlake treatment facility. No pumping would be required, and the current design would enhance water quality runoff discharged to the fish migratory corridor in the project area.

Union Bay

In TDA 10, stormwater facilities for the Preferred Alternative (M and U) would be a constructed stormwater treatment wetland and a biofiltration swale, respectively. The Preferred Alternative would not include the media filter vaults described for the SDEIS options (see Table 5.10-2 and Exhibit 5.10-1). The SDEIS options would discharge treated stormwater to Union Bay by improving or replacing an existing City of Seattle outfall in TDA 10 (see Exhibit 5.10-1). The Preferred Alternative would add a new discharge location south of the existing outfall that was not previously described for the SDEIS options.

The proposed treatment for TDA 9 under the Preferred Alternative is most similar to SDEIS Option L, where stormwater along the west approach would be conveyed to a stormwater treatment wetland (facility M) and then discharged to Union Bay.

Lake Washington and the Floating Bridge

Stormwater on the floating bridge, which makes up TDA 8, would be treated in the same manner for the Preferred Alternative and all the SDEIS options, as detailed in two AKART ("all known, available, and reasonable technologies") studies (WSDOT 2009k, 2009l).

Stormwater treatment on the floating bridge would differ from treatment elsewhere in the corridor. Standard stormwater treatment facilities are difficult or infeasible to construct on floating bridges. Conventional BMPs would add weight to the floating bridge, and turbulence during storms would limit the stormwater facilities' ability to settle out sediments. To address these challenges, WSDOT conducted the AKART analyses to evaluate the technologies that could be applied in the bridge setting (WSDOT 2009k, 2009l).

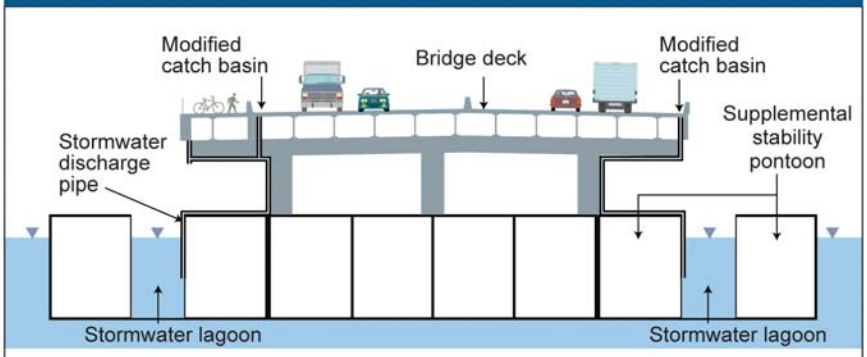
After application of a set of screening criteria, the AKART analyses determined that the most effective stormwater treatment technology would be high-efficiency sweeping of the paved roadway in conjunction with

AKART Analysis

An AKART (all known, available and reasonable technologies) analysis is conducted when a determination has been made that the standard BMPs identified in applicable stormwater management manuals cannot be used in a specific project or component of a project. The purpose of the AKART analysis is to develop and implement a project approach that meets WSDOT's and Ecology's objectives for stormwater treatment and discharge, to evaluate stormwater treatment options, and to identify and document the design constraints that define the range of feasible engineering options.

modified catch basin stormwater BMPs on the floating portion of the proposed bridge (see sidebar). The proposed floating bridge design creates separate, enclosed spill-containment lagoons (Exhibit 5.10-2) within the supplemental stability pontoons. Exhibit 5.10-2 also provides a schematic plan view drawing of the spill containment lagoon proposed for the SR 520, I-5 to Medina project. In addition to providing structural stability, the supplemental stability pontoons would create an area where roadway spills of petroleum or other pollutants would be contained. Surface pollutants in the lagoons would be removed on a periodic basis under normal monitoring and maintenance activities. The lagoons would also allow dilution of remaining pollutants prior to mixing with lake waters beneath the bridge. Ecology has reviewed and has conditionally approved the AKART studies (Fitzpatrick 2010). As part of the approval conditions, WSDOT will develop and implement a Department of Ecology approved monitoring program to verify the effectiveness of the treatment technologies.

Exhibit 5.10-2. **Stormwater Lagoons on the Floating Bridge**



Note: Stormwater discharges into the lagoon through an 8-inch or larger pipe.

Eastside

Under the SDEIS options, stormwater treatment for TDA 7 (Eastside transition area in Medina) would use a biofiltration swale and a media filter vault to treat stormwater before discharging to Lake Washington (Exhibit 5.10-3). Under the Preferred Alternative, stormwater in TDA 7 would be treated only with a biofiltration swale (basic treatment BMP, facility K). This treatment facility would not require flow control because it would discharge to Lake Washington.

Under the SDEIS options, stormwater also would discharge to Fairweather Bay and would be treated using a constructed wetland to enhance water quality. Under the Preferred Alternative, this stormwater also would be routed for treatment by an existing constructed wetland to achieve basic water quality treatment.

DEFINITION

High-Efficiency Sweeping

This technique is an "emerging technology" described in the Stormwater Management Manual for Western Washington (Ecology 2005). This alternative uses "new generation" sweeping equipment to prevent pollutants from entering the drainage systems and receiving waters. The technology consists of high-pressure air circulation and vacuuming of pollutants from the bridge road surface into a sweeping vehicle. Pollutants are collected in the sweeping vehicle and driven off the bridge.

DEFINITION

Modified Catch Basin Cleaning

This technology consists of combining larger than standard catch basin drainage structures (sized for increased sediment trapping capability) with a scheduled cleaning of trapped pollutants. Larger-than-standard sumps would provide increased residence time for sediments to collect prior to removal. In addition, oil/grease trapping could be provided with submerged outlets.

How might pollutant discharge change in the future?

Predictions of future pollutant loading presented here are based on the assumption that the composition of automobile brakes and tires (the sources of copper and zinc deposited on pavement) would not change between now and 2030.

A coalition of brake pad manufacturers and environmental groups is currently evaluating the contribution of copper from brake pads to stormwater (Brake Pad Partnership 2004). If their study concludes that brake pads are an important source of copper, the manufacturers have agreed to voluntarily reformulate their products.

Such unknown future changes in roadway pollutant sources could affect the calculations presented here.

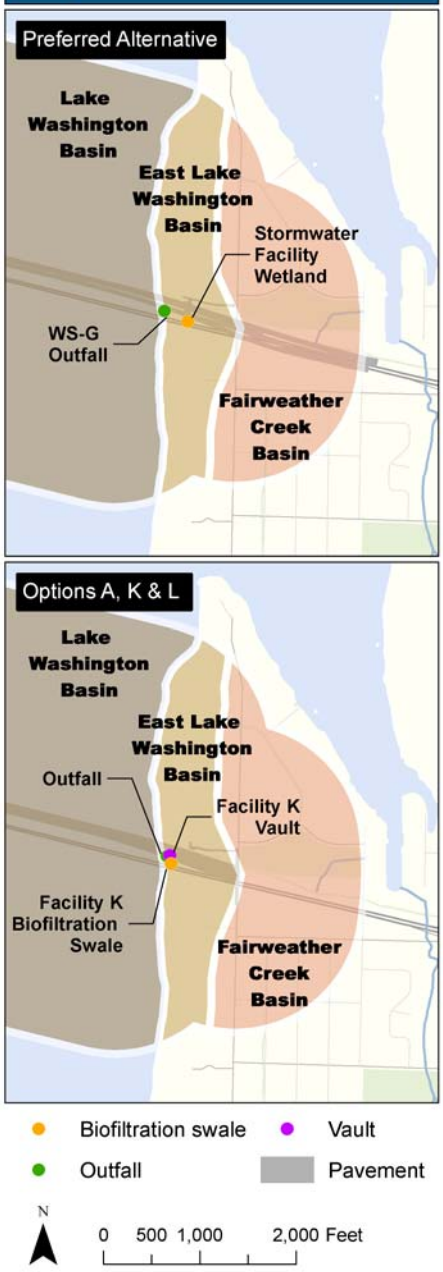
How would the project stormwater treatment system affect water quality?

The Preferred Alternative and the SDEIS options would construct a stormwater treatment system that, overall, would reduce pollutant loading to surface waters in the project area (Table 5.10-3). Stormwater discharges from these areas would meet water quality criteria according to the HRM's evaluation methods.

Stormwater discharges by the Preferred Alternative to Portage Bay and Union Bay would receive enhanced treatment that would exceed the minimum level of treatment required by the HRM. Pollutant loadings were calculated based on HRM requirements.

The patterns of net changes in pollutant loads would be generally the same for the Preferred Alternative as for the three SDEIS options. For the entire study area, the Preferred Alternative and the SDEIS options show a predicted net reduction for all five stormwater pollutants—total suspended solids (TSS), total zinc, dissolved zinc, total copper, and dissolved copper—compared with the No Build Alternative (Table 5.10-3). The differences in net reduction between the Preferred Alternative and the SDEIS options are slight, with either Option A, K, or L showing the greatest reduction in pollutant load for each evaluated pollutant. Overall, the Preferred Alternative would have a somewhat lower net reduction in pollutant load for TSS, total and dissolved zinc, and total copper than any of the three SDEIS options. This is because the Preferred Alternative would treat less existing PGIS than Options A, K, and L due to the smaller footprint and lesser amounts of existing PGIS to be disturbed in the Preferred Alternative. Project-wide, the net reduction in dissolved copper was essentially the same for the Preferred Alternative and the SDEIS options, with Lid Scenario 2 having the greatest reduction in dissolved copper of all the alternatives evaluated.

Exhibit 5.10-3 **Proposed Stormwater Management Facilities in Eastside**



How would the project affect groundwater?

The increased impervious surface associated with the Preferred Alternative and the SDEIS options in the study area would have little or no effect on groundwater recharge because the increase in impervious surface of the overland portions of the roadway is only a fraction of the total recharge area of the groundwater system.

Groundwater quality would not be affected because the Preferred Alternative and the SDEIS options would treat all stormwater prior to discharging to surface waters. Considering that groundwater moves from adjacent aquifers into project area surface water (rather than the reverse), stormwater discharged to these water bodies would not be a source of groundwater contamination in nearby aquifers. As noted in Chapter 4, there are no known drinking water supply wells in the project area.

Table 5.10-3. Net Changes in Pollutant Loads between Pre- and Post-project Conditions (pounds)

	TSS	Total Zinc	Dissolved Zinc	Total Copper	Dissolved Copper
Preferred Alternative – Lid Scenario 1	-24,611.5	-34.8	-5.94	-5.4	-0.2
Preferred Alternative – Lid Scenario 2	-24,848.0	-36.0	-6.78	-5.6	-0.4
Option A	-29,013.0	-41.6	-7.5	-6.5	-0.3
Option K	-32,074.0	-44.5	-7.0	-6.8	-0.1
Option L	-30,204.0	-42.1	-6.8	-6.4	-0.2

Foundations, fills, or ground improvements included in the project design could alter groundwater flow paths beneath the ground surface. The volume of earth affected by the project would be very limited relative to the groundwater flow regimes in the area. Therefore, the potential direct effects on groundwater flow are considered low for the Preferred Alternative and the SDEIS options.

The bridge maintenance facility under the east approach would be constructed and operated in an area of high groundwater pressure. A long-term dewatering program could be used to maintain reduced pressures in the vicinity of the facility. The amount of water that might be removed as a result of the dewatering program would be small compared to the overall groundwater in the area.

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

WSDOT expects that the project would not violate state water quality standards during its long-term operation. The improved highway infrastructure, including improved stormwater treatment facilities, would reduce pollutant amounts in stormwater runoff relative to the paved surfaces that exist on SR 520 now. The improved stormwater treatment associated with the project could have slight direct or indirect beneficial effects on water quality. There would be no adverse indirect effects associated with the operation of stormwater quality treatment facilities as part of the project action.

What has been done to avoid or minimize permanent adverse effects on water resources?

Permanent negative effects of the Preferred Alternative and the SDEIS options would be avoided by including stormwater treatment facilities as part of the project. Overall, the facilities provided by the Preferred Alternative would achieve a net reduction of pollutant-loading levels to receiving water bodies in the study area. In addition, the overall footprint of the Preferred Alternative is smaller than any of the SDEIS options, and as

such, disturbs a smaller amount of existing PGIS. Only the amount of disturbed existing PGIS is treated in the Preferred Alternative, so that accounts for the lesser amount of existing PGIS to be treated.

How could the project mitigate for unavoidable negative effects on water resources?

Although the Preferred Alternative and the SDEIS options would increase the amount of land covered by impervious surface in the study area, WSDOT would offset this by treating a comparable amount of existing untreated impervious area. Because the size of the treatment facilities are based on the volume of water being discharged from the TDA acreage would be greater for LID Scenario 1, the capacities of the treatment facilities was based on this scenario In addition, the Preferred Alternative would meet all applicable water quality standards and effects on groundwater are negligible. Therefore, no unavoidable negative effects are expected to result from the project.

5.11 Ecosystems

This section discusses how the project could affect wetlands, fish, wildlife, and habitat in the project area, including endangered and other protected species. The 2009 Ecosystems Discipline Report and the Ecosystems Discipline Report Addendum and Errata (Attachment 7) provide a detailed technical discussion on the potential effects of the project.

How would the project affect wetlands?

Filling a wetland or altering its vegetation by shading reduces the wetland's capacity to store stormwater, filter pollutants, protect stream banks and lakeshores, and provide wildlife habitat. These alterations can also reduce the uniqueness of wetlands (by decreasing vegetation diversity) or decrease their educational or scientific value by limiting access, reducing wetland size, or changing the wetland character. Loss of wetland area reduces the wetland's potential to remove pollutants from stormwater. Filling parts of project area wetlands may reduce their capacity to provide flood storage, although this capacity is very limited in the project area. Some of the shoreline habitat functions provided by wetlands would be lost.

KEY POINT

The Preferred Alternative and the SDEIS options would reduce the availability and quality of wetland and wetland buffer habitat due to filling and shading. Option K would fill the most wetland and wetland buffer area. The Preferred Alternative would shade the most wetland and Option L would shade the most wetland buffer.

The Preferred Alternative and the SDEIS options would reduce the availability and quality of wetland and wetland buffer habitat. Most effects would occur in Category II and III wetlands within the Portage Bay area and west approach area, with smaller effects on Category IV wetlands. There are no Category I wetlands in the project vicinity. Category II wetlands are those rated as having moderately high-level functions and Category III wetlands have a moderate level of function based on Washington Department of Ecology's (Ecology's) wetland rating system (Hruby 2004).

Table 5.11-1 summarizes the permanent fill and shading effects on wetlands and buffers from project operation. The affected wetlands are primarily lake fringe wetlands, containing aquatic bed, emergent, scrub-shrub, and forested classes. As reflected in the table, the Preferred Alternative and Option A would fill the least amount of wetland because the majority of the roadway would be on a bridge. As such, the fill footprint would consist of mostly individual support columns, with some fill resulting from stormwater facilities. The fill footprint for Option K would be larger due to the depressed single-point urban interchange (SPUI) and tunnel near the Montlake shoreline and the Foster Island land bridge in the Arboretum.

Most of the permanent effects on wetlands from project operation would be due to shading from the bridge roadway. Shading a wetland can reduce the distribution, density, and growth of wetland vegetation. The intensity of the shade would vary among the Preferred Alternative and the SDEIS options and would be based on the height and width of the proposed

Coordination with U.S. Army Corps of Engineers

The SR 520, I-5 to Medina project requires a permit under Section 404 of the Clean Water Act, which regulates filling in wetlands and open water. This permit is issued by the U.S. Army Corps of Engineers. To issue a permit, the USACE must determine that FHWA and WSDOT have chosen the least environmentally damaging practicable alternative (LEDPA) that meets the project purpose and need.

In anticipation of LEDPA requirements, FHWA and WSDOT coordinated with the USACE early on in project development. For this project, the USACE has been involved in the regulatory agency coordination process described in Chapter 1, and in several technical working groups associated with the regulatory agency coordination process. The USACE has also reviewed and commented on several discipline reports and the SDEIS. WSDOT and FHWA will also continue to work with the USACE on mitigation design as the project moves forward. Submittal of the Section 404 permit application occurred in early 2011.

structures. While the shaded wetlands would continue to function, the reduced light levels underneath the bridge could limit or retard plant growth, which could alter water quality, change the type and/or quality of the habitat, and potentially reduce wildlife use of the wetlands. These shade effects were a concern to regulatory agencies and the Muckleshoot Indian Tribe because they would result in wetlands that would function less effectively than undisturbed wetlands. This loss of function was determined by these agencies and the tribe to require mitigation, as described in the section entitled *What mitigation is proposed for effects that are not avoidable?*.

Table 5.11-1. Permanent Wetland and Buffer Fill Effects by Geographic Area (acres)

	Portage Bay Area		Montlake Area		West Approach Area		Total Effects	
Option	**Fill**	**Shading**	**Fill**	**Shading**	**Fill**	**Shading**	**Fill**	**Shading**
Preferred Alternative								
Wetland	<0.1	0.4	<0.1	0.1	0.1	4.3	0.1	4.8
Buffer	-	0.1	0.2	0.1	0.4	0.9	0.7	1.1
Option A								
Wetland	0.1	0.4	<0.1	0.1	<0.1[a]	2.6[a]	0.1[a]	3.2[a]
Buffer	0.3	0.1	<0.1	0.1	0.4[a]	0.8	0.7[a]	0.9
Option K								
Wetland	0.1[b]	0.1	0.1	<0.1	1.6[b]	2.7	1.8[b]	2.8
Buffer	0.4[b]	0.1	1.5	<0.1	3.6	0.1	5.4[b]	0.1
Option L								
Wetland	0.1	0.2	0.1[c]	1.0[c]	0.1	3.1	0.3[c]	4.3[c]
Buffer	0.4	0.1	0.6[c]	0.4	0.5	0.9	1.5[c]	1.3

[a] Adding the Lake Washington Boulevard ramps to Option A would fill less than 0.1 additional acre of wetland and 0.1 acre of buffer. An additional 0.1 acre of wetlands would also be shaded.
[b] Adding the eastbound off-ramp to Montlake Boulevard to Option K would fill less than 0.1 additional acre of wetland in the Portage Bay area and west approach area, and less than 0.1 additional acre of buffer in the Portage Bay area.
[c] Adding northbound capacity on Montlake Boulevard to Option L would fill less than 0.1 additional acre of wetland and less than 0.1 additional acre of buffer in the Montlake area. It would shade less than 0.1 additional acre of wetland in the Montlake area.
Note: Totals may not add up due to rounding.

The effect of the relationship between structure height and width on shading is complex. The height of the bridge and the width of the structure both affect shading of wetlands under the bridge. Higher bridge heights would decrease the effects of shading on wetlands under a bridge of a fixed width. A wider bridge structure would increase the shaded area. Additional discussion of shading effects is presented in the 2009 Ecosystems Discipline Report (Attachment 7) and in the Conceptual Wetland Mitigation Plan (Attachment 9).

Exhibit 5.11-1. **Permanent Effects on Wetlands and Buffers in Portage Bay**

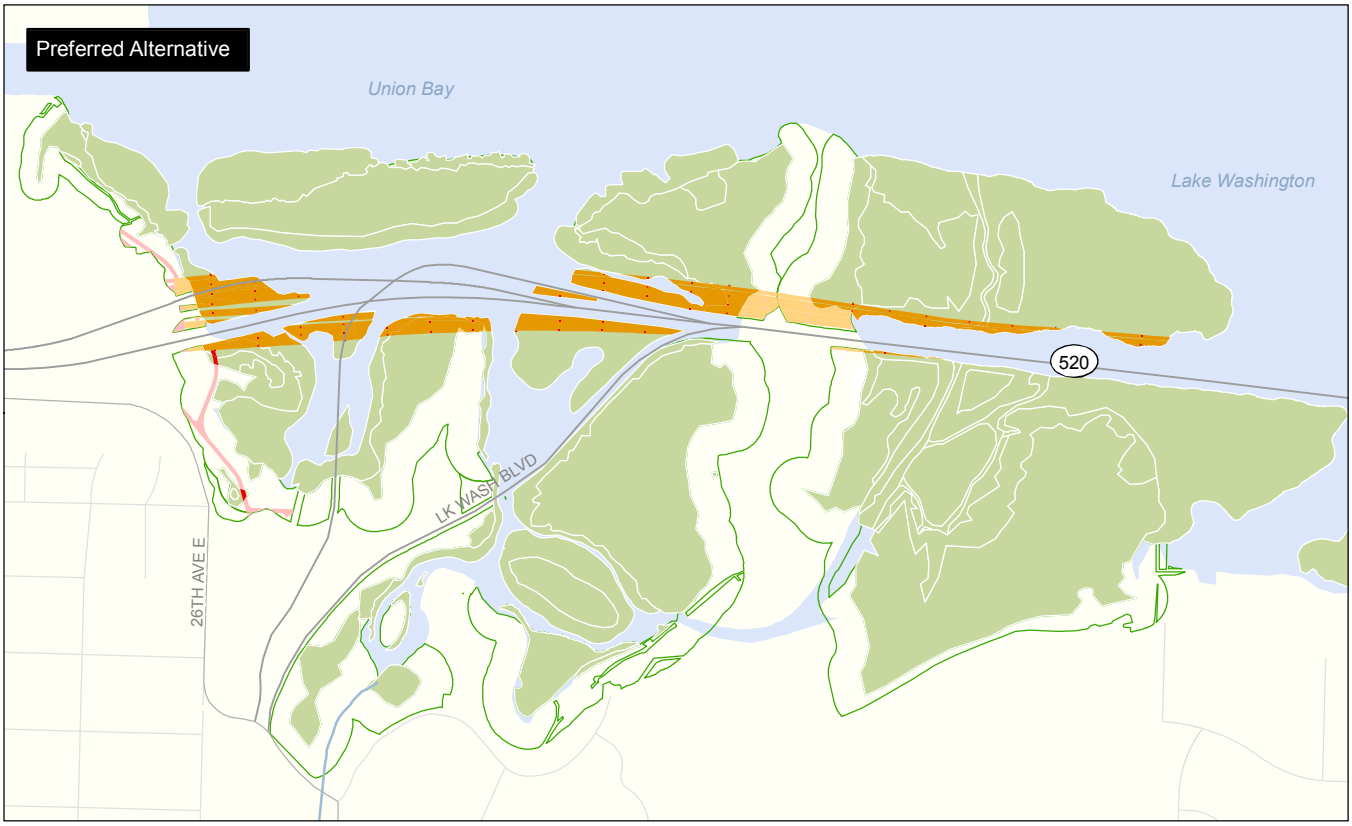
Operational Effect

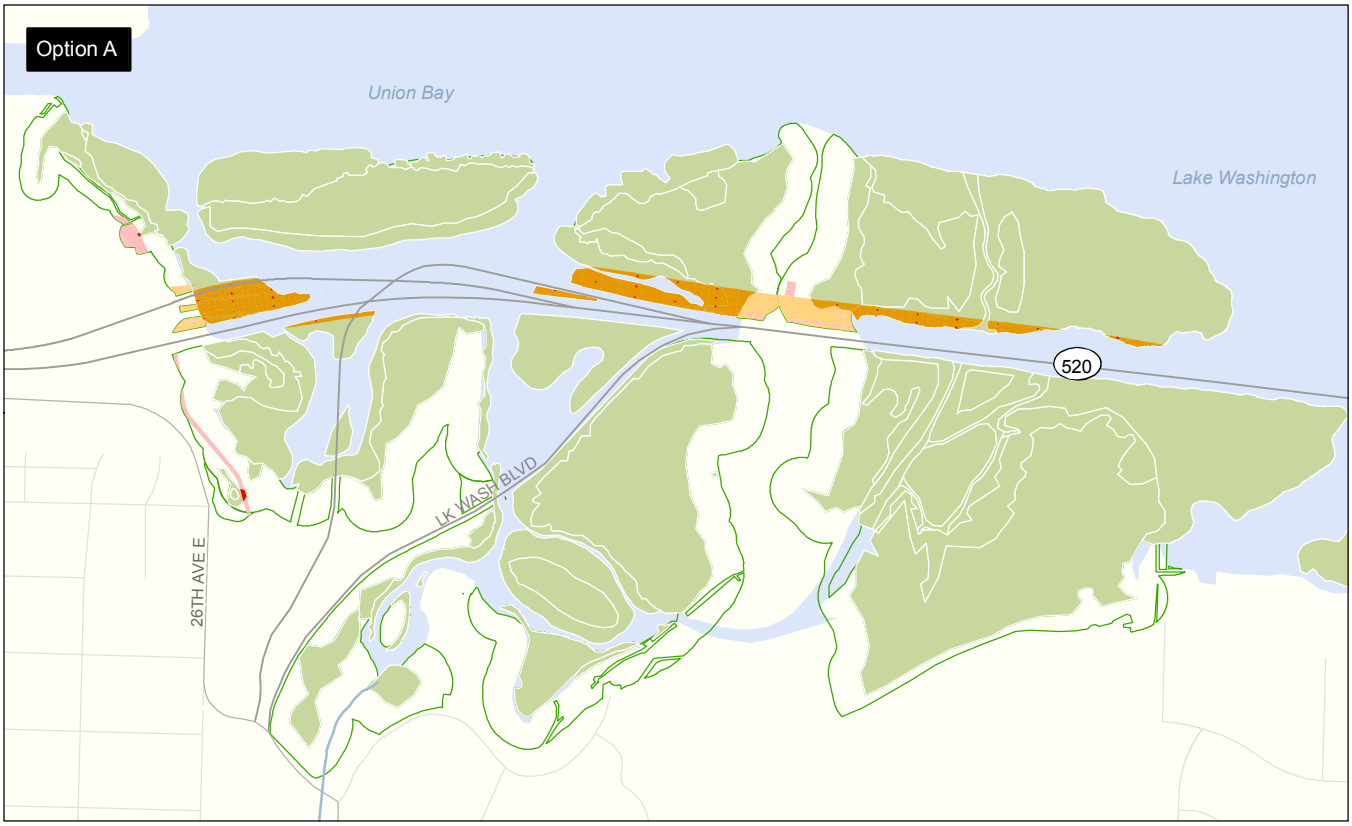
- Affected wetland (fill or clearing)
- Affected wetland (shade)
- Wetland
- Affected buffer (fill or clearing)
- Affected buffer (shade)
- Wetland buffer

N

0 250 500 1,000 Feet

Exhibit 5.11-2. **Permanent Effects on Wetlands and Buffers in Lake Washington (Preferred Alternative and Option A)**



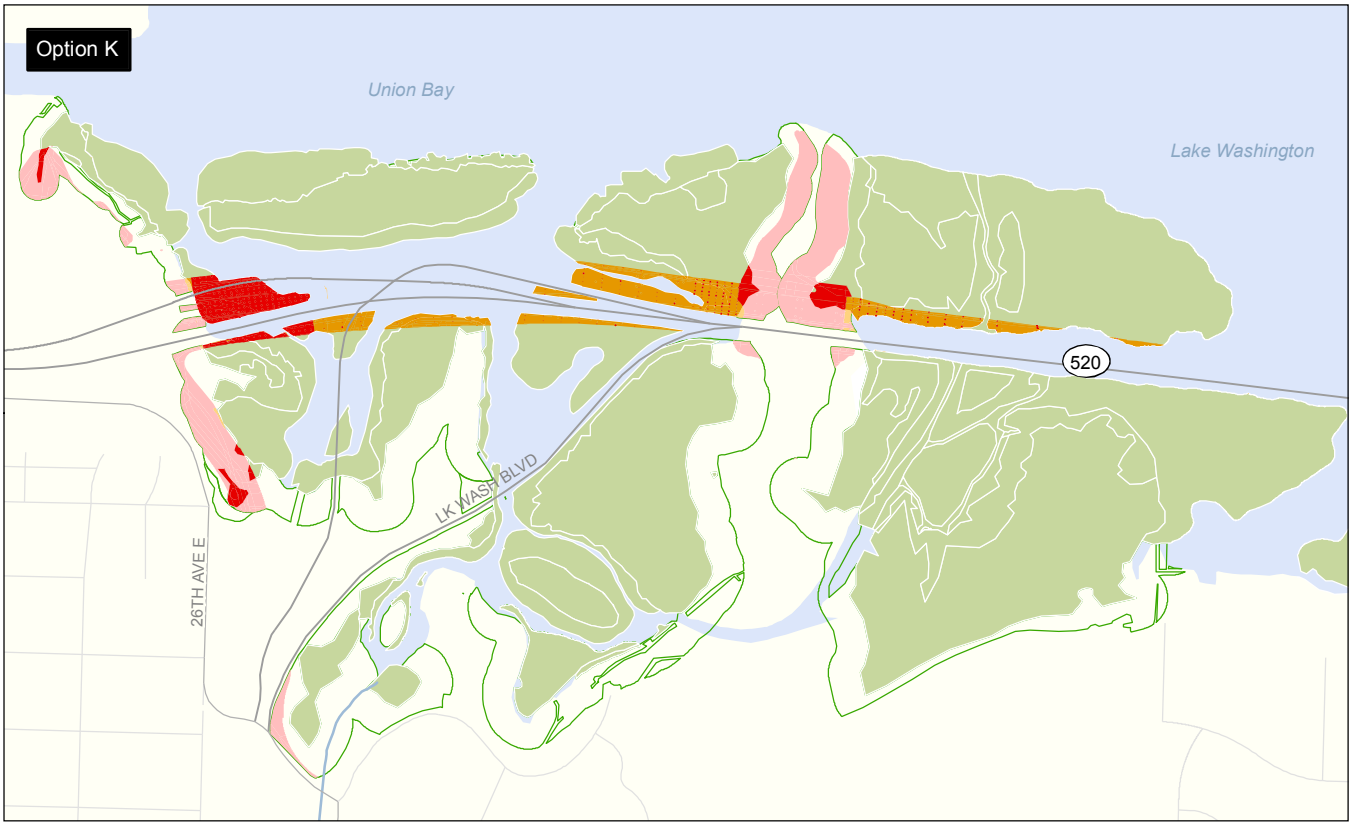


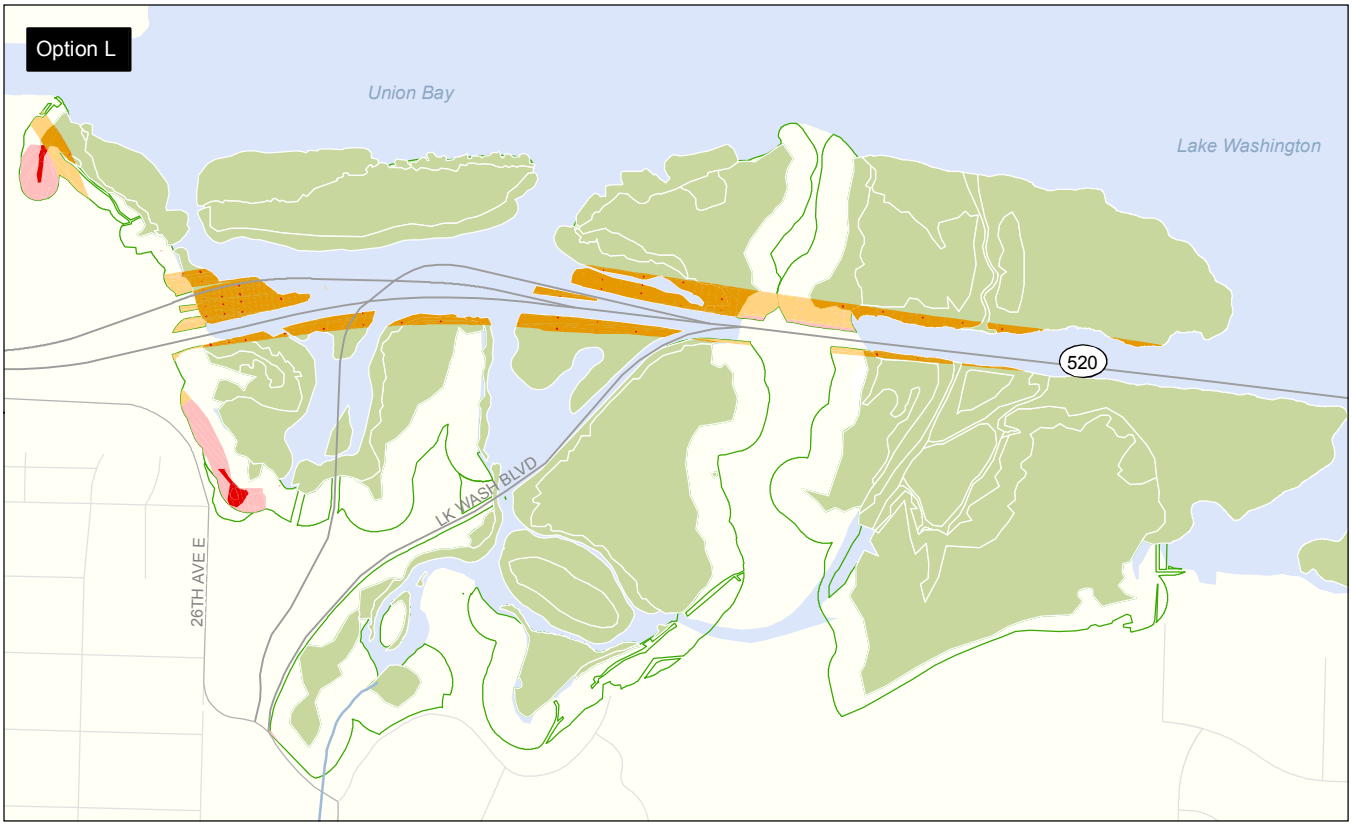
Operational Effect

Affected wetland (fill or clearing)
Affected wetland (shade)
Wetland
Affected buffer (fill or clearing)
Affected buffer (shade)
Wetland buffer

N
0 250 500 1,000 Feet

Exhibit 5.11-3. **Permanent Effects on Wetlands and Buffers in Lake Washington (Option K and Option L)**





Operational Effect

Affected wetland (fill or clearing)
Affected wetland (shade)
Wetland
Affected buffer (fill or clearing)
Affected buffer (shade)
Wetland buffer

N
0 250 500 1,000 Feet

In general, the operational effects from the Preferred Alternative are similar to those described for Option A. Table 5.11-1 and Exhibits 5.11-1, 5.11-2, and 5.11-3 show the permanent effects of the Preferred Alternative and SDEIS options on wetlands and buffers by geographic area.

Wetland effects in the Portage Bay Bridge area differ among the Preferred Alternative and the SDEIS options (see Table 5.11-1). While the effects of the Preferred Alternative are most similar to those of Option A, the design for the Preferred Alternative shifted the alignment to the south, and adjusted the overall width of the bridge in the middle and at the ends. This shifted the shading effects to a different wetland area within Portage Bay, but did not change the overall quantity of shading effect compared to Option A.

In the west approach area, the Preferred Alternative generally would be similar in design to Option A, but would be higher over land and water. The profile would be similar to but steeper than that of Option L, increasing at a constant slope from 12 feet above the water surface at the Montlake shoreline up to 48 feet at the west transition span of the floating bridge. The bottom of the bridge would be about 12 to 24 feet above the water through the Arboretum. The bridge would remain elevated over Foster Island, and would be 24 feet above ground on the west shoreline and 28 feet on the east shoreline.

The intensity of the shade cast by the structures would vary based on the height of the bridge. The intensity of shading of wetlands is expected to decrease as the structure increases in height. Where the bridge height is 24 feet or more, shaded areas would likely experience minimal changes in total vegetation cover except near the middle of the bridges (WSDOT 2009e). On the south side of the bridge, full sun and partial shade would extend northward under the bridge. Under the higher portions of the bridge, reflective and diffuse light would be sufficient to support plant growth. However, a change in vegetation composition could occur in some locations because of the reduced light. These effects on habitat functions have been qualitatively described; however, the entire area under the bridge was counted as shaded for the quantitative comparison of the Preferred Alternative to the SDEIS options.

Under the Preferred Alternative and all SDEIS options, the bridge structure through Union Bay would be wider than today (Exhibits 5.11-2 and 5.11-3). The gap between the eastbound and westbound structures would be wider than for Option A and the bridge structure for the Preferred Alternative would be farther south, resulting in more shading of wetlands for the Preferred Alternative than the SDEIS options. However, if any of the SDEIS options were identified as the Preferred Alternative, design refinements to better accommodate light rail would likely result in a similar increased effect.

How would the project affect fish resources?

The Preferred Alternative and the SDEIS options would create larger areas of reduced habitat function compared to existing conditions, primarily due to increased shading by the larger overwater structures. The Preferred Alternative and each option would also eliminate some aquatic habitat due to placement of columns and other in-water structures. Compared to the existing structures, the proposed overwater structures are about twice as wide for the Preferred Alternative and the SDEIS options. About half of the overwater structures (25.9 acres) are associated with deep-water habitat (more than 30 feet deep) under the floating portion of the Evergreen Point Bridge (Table 5.11-2).

Table 5.11-2. Area of Shade from Overwater Structures (acres)

Option	Portage Bay Area	Montlake Area	West Approach Area	Floating Bridge	Eastside Transition Area	Total
Existing Bridge and No Build	3.1	0.2	11.0	11.6	0.4	26.3
Preferred Alternative	5.3	0.3	17.1	25.9	1.3	49.9[a]
Option A	5.7	0.2	15.9	25.9	1.3	49.0[a]
Option K	4.6	0.0	16.8	25.9	1.3	48.6[a]
Option L	4.8	1.8	18.3	25.9	1.3	52.1[a]

[a] Includes between 2.3 and 3.7 acres of shading of aquatic bed wetlands within the aquatic environment. Effects on these resources and associated mitigation action are discussed in the Wetlands section of the Ecosystems Discipline Report Addendum and Errata in Attachment 7.

Nearshore habitats would also experience shading effects. Shading in these areas could affect fish and alter fish movement and distribution by reducing the growth of aquatic vegetation in shallower areas (WSDOT 2009c). This would alter the habitat conditions and potential fish use of these areas, including juvenile salmonids and their predators. Juvenile salmonids also tend to avoid or hesitate entering shaded areas such as under docks and bridges.

In the west approach area, the shadow of the bridge may delay, but not prohibit, outmigration of juvenile salmonids (Celedonia et al. 2008). Such delays could result in an increase in predation.

The amount of shading in the habitats would vary among the Preferred Alternative and the SDEIS options. Table 5.11-2 shows that Option L would have the most overwater structure that could cause shading effects, while Option K would have the least. However, the depressed interchange included in Option K would lie below the high water elevation of the lake,

resulting in an aquatic fill rather than overwater shading (see the Ecosystems Discipline Report Addendum and Errata in Attachment 7 for more information).

The overwater structures would create differing intensities of shade, based on structure width and the height above the water surface. Table 5.11-3 compares the heights of the No Build Alternative, Preferred Alternative, and SDEIS options structures. Option K has the lowest profile along the alignment and a relatively wider overwater footprint, so it would have the highest intensity of shading effects on fish resources (even though the area of shading is less than other options). As noted above, the effect of the relationship between structure height and width on shading is complex, but in general, a design that increases the overwater height would decrease the effects of shading.

Table 5.11-3. Approximate Structure Height (feet) Above High-water Level

Location	Existing (No Build)	Preferred Alternative	Option A	Option K	Option L
Portage Bay					
West shoreline	50	55	58	58	58
Mid-point	10	30	27	27	27
East shoreline	8	18	17	17	17
Montlake					
Montlake Cut	35-46	35-46	35-46	0[a]	43-57
Union Bay					
West Arboretum shoreline	2.5	12	17	<0[b]	8
West Foster Island shoreline	6	24	25	<0[b]	13
West Approach					
East Foster Island shoreline	4	29	23[d]	<1	15
Mid-point[c]	4	36	8[d]	5	19
West highrise	44	45	50[d]	50	47
East Approach					
East highrise	55-64	70	70	70	70

[a] Option K would tunnel under the Montlake Cut.
[b] The proposed roadway would be several feet below the high-water elevation in the nearshore area of the Arboretum.
[c] About 1,400 feet east of Foster Island, midway between Foster island and the west highrise.
[d] Adding the constant-slope profile to Option A would result in structure heights through the west approach similar to Option L.
Note: Height above high-water level is measured from the underside of the bridge structure.

The Preferred Alternative and the SDEIS options all include support piers for permanent bridge structures. These piers would occupy a small amount of substrate and result in a loss of salmonid habitat, and at the same time may correspondingly increase habitat for predators. Table 5.11-4 shows the number of columns or other structures and the resulting habitat loss for the No Build Alternative, the Preferred Alternative, and the SDEIS options. Effects range from approximately 0.7 acre for Option A to 2.8 acres for Option K. The Preferred Alternative would result in approximately 0.9 acre of habitat loss from columns.

Table 5.11-4. Estimated Numbers of In-Water Concrete Columns for Portions of the Proposed Bridges and Area of Substrate Occupied

Alternative	Portage Bay	West Approach	East Approach	Total
No Build (Existing)	119 1,890 sq/ft	404 6,590 sq/ft [a]	14 350 sq/ft [a]	537 8,830 sq/ft
Preferred Alternative	50 15,200 sq/ft [a]	228 12,800 sq/ft	5 7,800 sq/ft [a]	283 41,000 sq/ft [a]
Option A	47 18,020 sq/ft [a]	187 5,290 sq/ft	5 7,800 sq/ft [a]	239 31,110 sq/ft [a]
Option K	42 17,850 sq/ft [a]	928 [b] 97,890 sq/ft [c]	5 7,800 sq/ft [a]	975 [b] 123,540 sq/ft [c]
Option L	48 18,160 sq/ft [a]	185 9,150 sq/ft	5 7,800 sq/ft [a]	238 35,110 sq/ft

[a] Area includes footings or shaft caps at the mud line supporting the columns.
[b] Columns range from 2 to 7 feet in diameter in Option K, while the other options range from 6 to 10 feet.
[c] Area includes the entire in-water fill of the submerged roadway entering the SPUI. Many columns driven into the lakebed would be underneath the submerged roadway for support.

Effects on tribal fishing could result from loss of access, from effects on fish habitat, and from potential effects on fish populations. These effects are discussed below under the West Approach Area and Lake Washington Area sections.

Portage Bay Area

Through Portage Bay, the Preferred Alternative would result in slightly less shading than Option A but more than Options K and L (see Table 5.11-2). Approximately 800 linear feet of structure on the west side of the new Portage Bay Bridge would be slightly higher than the existing structure; the remaining 1,200 linear-feet of bridge structure at the east end would be more than twice the height above water level of the existing bridge (see Table 5.11-3).

Montlake Area

The Preferred Alternative and Options A and L would involve construction of a new bascule bridge across the Montlake Cut. Because the Preferred Alternative and Option A bridges would be constructed on an axis that is perpendicular to the cut, a smaller area of bridge structure would be over the water as compared to the more angled alignment of Option L (see Table 5.11-2). In addition, the Preferred Alternative and Option A bridge design would be about 7 feet narrower (53 feet wide) than the Option L bridge (60 feet wide). However, the Option L bascule bridge would be approximately 10 feet higher than the Preferred Alternative and Option A bridge designs. The bridges would not require new columns in the water. For Option K, two tunnels would be constructed under the Montlake Cut, and therefore there would be no overwater shading. Because the new bridges and tunnel would not have in-water structures, they are not expected to affect tribal fishing.

West Approach Area

In the west approach area, Option L would result in the largest area of overwater shading (see Table 5.11-2). As discussed earlier, shading effects are also dependent on the bridge height. For the Preferred Alternative, the proposed bridge would be higher above the water throughout much of the west approach than the existing bridge and the SDEIS options. Combined with the fewer (but larger) in-water columns, the higher bridge would allow greater amounts of light under the structure, effectively reducing the intensity of the overall shaded area and the shade edge. These reductions in shade intensity would minimize the effects of shade on fish and other aquatic species compared to the SDEIS options and existing conditions. The new bridge would be up to 32 feet higher than the existing bridge, with the greatest height difference in the area east of Foster Island, which is a primary migration route of juvenile salmonids.

Union Bay shoreline at Foster Island

The increased height and reduced shade of the Preferred Alternative, the reduced number of in-water structures compared to existing conditions, and the increased spacing between in-water structures would reduce overall habitat complexity. Because predator species use shade and structures to conceal themselves from their prey, these changes in the west approach bridge configuration would likely decrease the predation rates along the migratory corridor.

For Option K, the below-ground interchange configuration would result in filling a wedge of nearshore aquatic area, resulting in a permanent loss of approximately 2.7 acres of aquatic habitat. This is a substantially larger amount of aquatic fill than would be needed for support piles in the Preferred Alternative and Options A and L. Because wetlands are supported by Lake Washington rather than by groundwater, hydraulic conditions at the wetlands in Union Bay would not change. Under Section

KEY POINT

All of the options would create larger areas with reduced fish habitat functions, primarily due to increased shading by the larger overwater structures. Compared to the existing structures, the proposed overwater structures are about twice as wide for all options. Option L would result in the most overwater shading in the west approach area. Option K would result in the overall greatest loss of fish habitat due to the filling for the depressed SPUI.

404(b)(1) of the Clean Water Act, which requires selection of the least environmentally damaging practicable alternative, the large in-water fill could result in difficulties in permitting Option K.

The increased bridge width and aquatic fill by in-water structures in this area would affect tribal fishing under the Preferred Alternative and the SDEIS options. Although less fishing takes place in nearshore areas, shading and loss of habitat could reduce fish use in the west approach area.

Results of SR 520 Fish Tracking Study

Fish react to the presence of overwater and in-water structures. Celedonia et al. (2008, 2009) recently evaluated the migratory behavior of juvenile Chinook salmon near the west approach of the Evergreen Point Bridge and found both migratory and holding behavior patterns near the bridge, with highly variable behaviors within each general pattern. Approximately two-thirds of the actively migrating juvenile Chinook salmon tagged for the study tended to hold (pause) before migrating under the west approach area of the bridge. However, approximately half of these fish held for only a few minutes. In contrast, tagged fish that were not actively migrating appeared to selectively choose to reside in areas near the bridge for prolonged periods. These fish were observed to often cross beneath the bridge to the north and later return to holding immediately adjacent to the bridge's southern edge (typically within approximately 65 feet from the bridge edge). These fish may have been using the bridge as cover.

The fish tracking study began in 2007 and continued for a second year in 2008. Similar results were reported for both years. In general, both years' studies indicated that although the bridge appeared to have some effect on the migration of some juvenile Chinook salmon, many of the fish showed little to no migration delay. It should be noted that only one salmonid species (Chinook salmon) was examined and that there may have been other factors affecting fish behavior, such as fish origin (hatchery versus naturally spawned fish), seasonal effects (early season migration versus late season migration), and migration path location (fish were released only near the west approach). Despite the potential unknowns, these study data represent the best available science on juvenile salmon outmigration in the study area.

Lake Washington

The floating portion of the Evergreen Point Bridge would be the same for the Preferred Alternative and all the SDEIS options. It would be built over deep open-water habitat where bridge columns are not feasible. The Preferred Alternative bridge road surface would be approximately 10 feet higher than the existing bridge, and about 20 feet above the lake surface. The Preferred Alternative roadway height is about 10 feet lower than the SDEIS options, but this reduction is not expected to substantially affect

fish because only the superstructure would be different. The area of the floating bridge would be about 25.9 acres, which is the same as the SDEIS options (see Table 5.11-2).

As discussed above, fish react to the presence of overwater and in-water structures. Fish are expected to react similarly to the proposed bridge as to the existing bridge. However, the increased draft of the pontoons and the areas between the supplemental stability pontoons, as well as the greater overall width of the bridge, could affect fish use of the area near the bridge.

The new floating bridge would use larger pontoons than the existing bridge. The width of the floating bridge would be almost three times wider than the existing structure (175 feet versus 60 feet) when the supplemental stability pontoons are included (see Exhibit 2-23). The new floating portion of the bridge would be about 40 feet longer than the existing floating bridge (equivalent to less than 0.6 percent of the existing bridge). In addition, the pontoons would have a deeper draft (22 to 28 feet) below the surface of the water than the existing pontoons (8 to 14 feet). However, based on the relatively small magnitude of the increase and considering the overall lake volume, the increased size of the new pontoons would not be expected to substantially decrease the flow of wind-driven water past the floating bridge from the existing condition. The increased draft, in combination with the variable spacing of the supplemental stability pontoons along the longitudinal pontoons, could result in localized changes in water circulation patterns. The variable spacing between supplemental stability pontoons would produce recesses along the face of the pontoons, which would substantially increase the migration distance if fish followed the face of the pontoons. However, these recesses could also provide additional deepwater forage habitat for fish using the edge of the pontoons as cover.

The existing Evergreen Point Bridge impedes the movement of wind-driven Lake Washington surface water. The force of northerly or southerly winds tends to increase the height of the water slightly on the upwind side of the floating bridge, thus forcing a small movement of water under and around the ends of the bridge. However, calculated velocities of this water movement, even under the worst case scenario of a 100-year design storm, would not be of a sufficient magnitude to substantially affect fish migration (WSDOT 2009f).

As discussed in Section 5.3, the increased width of the floating span, its anchors, and its alignment north of the existing bridge would affect access to tribal fishing in the usual and accustomed fishing areas of the Muckleshoot Indian Tribe. WSDOT is coordinating with the tribe to develop appropriate mitigation measures. These measures will be documented in a separate agreement with the Muckleshoot Indian Tribe, which is expected to be completed in late 2011. See the Tribal Fishing section in Section 5.3 for information about this agreement.

Lake Washington Limnology and Fisheries

Users of the Evergreen Point Floating Bridge have noted that it acts as a floating breakwater, reducing or eliminating surface waves on the downwind side of the bridge. These observations created an interest in understanding how the proposed floating bridge might affect mixing of warmer surface waters with cooler subsurface waters in Lake Washington.

In response to these concerns, WSDOT conducted a follow-up study on this topic with regional experts on Lake Washington limnology and fisheries. This study provided more information on the potential effects on lake circulation from the deeper, longer, and wider floating bridge.

The study found that predicted effects on mixing of the surface and subsurface water layers are small compared to other natural processes, especially upwelling, and would not change existing Lake Washington conditions. These effects are not expected to change water temperatures in the surface layers nor influence salmonid temperature-dependent processes, including juvenile growth rates, adult energy depletion, or juvenile competition with other plankton-eating fish. A final report will be produced in 2011.

East Approach Area

Additional geotechnical studies in the area since the publication of the SDEIS found unsuitable lake bed substrate and upwelling along the shoreline, which resulted in a design change of the east approach bridge footings (see Geology and Soils Discipline Report Addendum and Errata in Attachment 7). The five in-water columns in this area would be supported by two mud-line footings, rather than each of the bridge columns being supported by individual drilled-shaft foundations. This design would displace about 7,800 square feet of substrate, compared to 450 square feet described in the SDEIS, and would likely increase the loss of potential sockeye spawning habitat in this area.

The new east approach for the Preferred Alternative and the SDEIS options would be higher than the existing structure by approximately 13 feet along most of its length. However, since the SDEIS was published, the structure design has been refined so that the eastbound and westbound lanes would be on separate structures with a gap between them. While this gap would increase the overall width of the east approach, it would allow increased light penetration, potentially decreasing the shading effects. It is not expected that the 70-foot-high bridge structure would create strong enough shade to affect the spawning of sockeye salmon, even if appropriate spawning conditions were present. This design would result in 1.3 acres of overwater shade for the east approach. This design refinement would apply both to the Preferred Alternative and to the SDEIS options (as reflected in Table 5.11-3) if one of those designs were ultimately selected.

Bridge Maintenance Facility

The design of the bridge maintenance facility and the dock would be the same for the Preferred Alternative and all the SDEIS options. The bridge maintenance facility could require dewatering to lower the local water table, or other structural features to maintain its proper operation. The draw down would be expected to be minor, however and not preclude or substantially degrade the quality of sockeye spawning habitat offshore. Located under the east approach, the bridge maintenance facility would consist of an upland facility and a dock extending approximately 100 feet offshore. The maintenance facility dock would add an overwater structure in the shallow nearshore environment, which could affect the migration and rearing behavior of juvenile salmonids in the area. It could also create habitat for smallmouth bass and other predators of juvenile salmonids. A small loss of bottom habitat would result from the dock support columns. To compensate for some of the potential effects on the nearshore habitat, the project would remove two existing residential docks nearby.

The dock design has been refined since publication of the SDEIS and would eliminate the wave barrier and all but two luminaires (overhead light stanchions). The wave barrier had been expected to cause some

redistribution of substrate material, which may have affected the spawning habitat. Reducing the number of luminaires minimizes the amount of incidental light reaching the water surface.

Eastside Transition Area

There would be no operational effects on aquatic habitat in the Eastside transition area.

How would project operation affect federally or state-listed fish species?

All anadromous salmonids (fish that migrate to the ocean) in the Lake Washington watershed travel under or adjacent to the Portage Bay and Evergreen Point bridges. The previous sections described the project's potential effects on fish resources, including habitat of Endangered Species Act (ESA) listed fish species. Based on these potential effects, the project has the potential to negatively affect individual fish in the Lake Washington watershed—including the ESA-listed populations of Chinook salmon, steelhead, and bull trout—by altering a portion of their rearing and migration habitat. However, the project is not expected to adversely affect overall salmonid populations or evolutionarily significant units in the watershed, as reported in the 2010 Biological Assessment (included in Attachment 18) and described in the following sections.

Of the state-listed and priority species of fish, only state candidate species occur in the project vicinity. All the state candidate species in the project vicinity also have federal designation and are discussed above.

How is WSDOT working with NOAA and USFWS to evaluate effects on ESA-protected species?

As described in Chapter 4, the federal agencies with jurisdiction over endangered species in the project area are NOAA Fisheries (responsible for protecting Chinook salmon, steelhead, and other marine species) and the U.S. Fish and Wildlife Service (USFWS) (responsible for protecting bull trout). WSDOT has done extensive coordination with NOAA and USFWS on this project, including biweekly meetings and opportunities for review of analyses. WSDOT has prepared a Biological Assessment (Attachment 18) that evaluates effects on ESA-listed species in detail (Table 5.11-5). The Biological Assessment incorporates specific design information for the Preferred Alternative, along with descriptions of the potential effects of proposed construction techniques. The Biological Assessment was submitted to NOAA and USFWS in November 2010.

After reviewing the Biological Assessment, USFWS issued its Biological Opinion on April 15, 2011 (Attachment 18). It concluded that "the action, as proposed, is not likely to jeopardize the continued existence of the bull trout in its coterminous (or connected populations) range" and that "the

May Affect, Likely to Adversely Affect

May affect, likely to adversely affect (MALAA) represents an effects determination made under ESA. Where this designation is noted, the project may have direct or indirect adverse effects on a listed species, which are not discountable, insignificant, or entirely beneficial.

This beaver lodge near Foster Island is within the footprint of the project.

action, as proposed, will not destroy or adversely modify bull trout critical habitat." The biological opinion also contained mandatory terms and conditions intended to minimize certain adverse effects. The conclusions, take analysis, reasonable and prudent measures, and mandatory terms and conditions are included in the Biological Opinion.

The Biological Opinion from NOAA was issued in May 2011. The conclusions of the Biological Opinion are presented in Attachment 18.

Table 5.11-5. Potential Effects of the Project on Federally ESA-Listed Fish Species in the Study Area

Species	Federal Status	Suitable Habitat Existence	ESA Effects Determination[a]	Rationale for ESA Effects Determination
Bull trout (*Salvelinus confluentus*)	Threatened	Suitable habitat for foraging and migrating bull trout in Lake Washington and Puget Sound	MALAA[b]	Individual bull trout might be injured or harmed by habitat or water quality changes.
Chinook Salmon (*Oncorhynchus tshawytscha)*	Threatened	Suitable habitat for foraging, rearing and migrating Chinook in Lake Washington and Puget Sound	MALAA	Individual Chinook might be injured or harmed by habitat or water quality changes.
Steelhead (*Oncorhynchus mykiss)*	Threatened	Suitable habitat for foraging, rearing and migrating steelhead in Lake Washington and Puget Sound	MALAA	Individual steelhead might be injured or harmed by habitat or water quality changes.

[a] This determination is supported and documented in the November 2010 Biological Assessment for the SR 520 I-5 to Medina Bridge Replacement and HOV Project (Attachment 18).
[b] May Affect, Likely to Adversely Affect (MALAA)

How would the project affect wildlife and habitat?

The Preferred Alternative and the SDEIS options would affect wildlife by permanently removing vegetation and wildlife habitat, increasing shading, and decreasing noise disturbance from increased highway operations.

The new roadway would displace some high quality wildlife habitat, principally wetlands and forested uplands, in the corridor and thereby reduce cover, nesting, and foraging habitat for some wildlife species. However, the area is already highly fragmented by the existing roadway and surrounding development.

Vegetation would be removed from areas where new roadway would be on the ground, and some vegetation would be removed for columns to support the roadway (Table 5.11-6). Removing vegetation would reduce cover for urban-adapted species such as black-capped chickadees, American robins, and eastern gray squirrels. Option K would result in the greatest loss

Cover Types

Parks and other protected areas contain mostly upland deciduous forests, riparian forests, and wetlands. The upland forests provide habitat for a variety of birds, mammals, reptiles, and amphibians.

Open water provides habitat for a variety of marine-associated wildlife including waterfowl.

Urban matrix provides limited wildlife habitat. Mostly commercial and residential areas with buildings, asphalt, ornamental gardens, lawns, and scattered trees.

of wildlife habitat, mostly within the Urban Matrix and Parks and Other Potential Areas cover types (see Table 5.11-6). The Preferred Alternative would remove the least amount of vegetation, primarily in the Urban Matrix cover type (see Table 5.11-6). Habitat quality is generally low for the Urban Matrix cover type. In the Open Water and in the Parks and Other Protected Areas cover types (specifically the Washington Park Arboretum), existing wildlife habitat quality is relatively high, and upland and wetland vegetation removal would represent a loss of wildlife cover and forage. Waterfowl such as Canada geese and mallards would likely continue to use the area.

Table 5.11-6. Permanent Vegetation Removal by Cover and Habitat Type (acres)

	I-5 Area	Portage Bay Area	Montlake Area	West Approach Area	Floating Bridge Area[a]	Total
Preferred Alternative						
Parks and Other Protected Areas	0.1	<0.1	0.1	1.7	-	2.0
Open Water	-	<0.1	-	<0.1	-	<0.1
Urban Matrix	1.0	0.5	2.1	0.9	1.6	6.0
Total	**1.1**	**0.5**	**2.2**	**2.6**	**1.6**	**8.1**
Option A						
Parks and Other Protected Areas	0.1	0.2	0.1	1.7	-	2.1
Open Water	-	<0.1	-	<0.1	-	<0.1
Urban Matrix	1.4	1.8	2.5	0.8	2.7	9.2
Total	**1.6**	**2.0**	**2.6**	**2.5**	**2.7**	**11.4**
Option K						
Parks and Other Protected Areas	0.1	0.2	2.9	5.4	-	8.7
Open Water	-	<0.1		1.1	-	1.1
Urban Matrix	1.4	2.5	2.6	0.4	2.7	9.7
Total	**1.6**	**2.7**	**5.5**	**7.0**	**2.7**	**19.5**
Option L						
Parks and Other Protected Areas	0.1	0.2	1.4	1.1	-	2.8
Open Water	-	<0.1	<0.1	<0.1	-	<0.1
Urban Matrix	1.4	2.5	1.2	0.2	2.7	8.0
Total	**1.6**	**2.7**	**2.5**	**1.3**	**2.7**	**10.8**

[a] Floating bridge area includes the east approach and Eastside transition areas for this analysis of wildlife habitat.
Parks and Other Protected Areas includes deciduous and/or coniferous trees, shrub/grass, and wetland.
Open Water includes wetland.
Urban Matrix includes deciduous and/or coniferous trees, shrub/grass, and wetland.

The proposed project would remove a large beaver lodge in Union Bay adjacent to Foster Island, which would displace the animals, but is not expected to reduce the viability of the beaver population in this area. Operation of the Preferred Alternative or the SDEIS options would have minimal effects on bald eagles and peregrine falcons, since those that forage in the area are accustomed to the presence of traffic. The Preferred Alternative would remove a narrow swath of wetland and shoreline vegetation in the west approach area where these birds forage for prey. The effect on prey availability would be minimal, however, because this affected foraging area is small relative to the total foraging area for these species.

Typical habitat in the Urban Matrix cover type in the study area.

Vegetation would be shaded where the roadway (bridges and approaches) would be elevated, including through the Washington Park Arboretum. Under the Preferred Alternative, approximately 6.5 acres of vegetation would be shaded by new bridge structures, with about half of this area over wetlands (Table 5.11-7). Shading effects on wetlands are discussed in the *How would the project affect wetlands?* section above. The elevated roadway would also shade open water, but shading in open-water areas would likely have only a minor effect on wildlife. The effects of shading on open-water habitat are discussed in the *How would the project affect fish resources?* section above. Actual shading effects in individual areas would depend on roadway height in the area and existing vegetation cover.

Table 5.11-7. Shading from Operation by Cover and Habitat Type for Each Option (acres)

Area, Cover Type, and Habitat Type	Preferred Alternative	Option A	Option K	Option L
Parks and Other Protected Areas	1.1	0.2	0.3	2.0
Open Water	3.5	2.9	2.5	3.8
Urban Matrix	1.8	0.1	1.4	1.3
Total	**6.5**	**3.2**	**4.2**	**7.1**

Also of potential concern is shading of wetland habitat in the Parks and Other Protected Areas habitat cover type. Wetland habitat supports a high diversity of wildlife species. The increased height of the elevated roadway through the Washington Park Arboretum area for the Preferred Alternative and Options A and L would allow more incoming light beneath the structures and could stimulate more growth of shrubs and some trees than existing conditions.

KEY POINT

The Preferred Alternative and all SDEIS options would affect wildlife by permanently removing vegetation and wildlife habitat, and increasing shading. Although, habitat quality is generally low for the Urban Matrix cover type, urban-adapted species such as black-capped chickadees, American robins, and eastern gray squirrels would be affected. Option K would result in the greatest loss of wildlife habitat from removal. Option L would have the largest habitat loss from shading.

Preferred Alternative

The Preferred Alternative would permanently remove approximately 8.1 acres of vegetation, mostly within the Urban Matrix cover type. The west approach area would have the most vegetation removed, followed by the Montlake area, floating bridge (bridge maintenance facility) area, and I-5

area, with Portage Bay area having the least vegetation removed. Less than 0.1 acre of this area filled would be wetland. In addition, approximately 6.5 acres of vegetation would be shaded, with 4.8 acres of this area over wetlands.

Option A

Option A would permanently remove approximately 11.4 acres of vegetation, mostly within the Urban Matrix cover type, spread relatively evenly among all areas—less than 0.1 acre of this area filled would be wetland. In addition, approximately 3.2 acres of vegetation would be shaded, with most of this area over wetlands.

Option K

Option K would permanently remove approximately 19.5 acres of vegetation, mostly within the Urban Matrix cover type, followed closely by Parks and Other Protected Areas, with most in the west approach area followed by the Montlake area. Of the 19.5 acres removed, 1.8 acres would be wetland. In addition, approximately 4.2 acres of vegetation would be shaded; of this area, 2.8 acres would be wetlands.

Option L

Option L would permanently remove approximately 10.8 acres of vegetation, primarily within the Urban Matrix cover type, spread somewhat evenly among the geographic areas. Of the 10.8 acres, less than 0.3 acre of wetland would be filled. In addition, 7.1 acres of vegetation would be shaded; of this area, 4.3 acres would be wetlands.

Lake Washington and Eastside Transition Areas

Since publication of the SDEIS, new information has resulted in design refinements to the bridge maintenance facility area. These refinements result in approximately 1.6 acres of vegetation removed for the bridge maintenance facility; this effect would apply to the Preferred Alternative as well as to SDEIS Options A, K, and L.

How would project operation affect federally and state-listed wildlife species?

There would be no effects on any wildlife species protected under the ESA or state lists from the operation of the project, because none occur in these portions of the project. Operation of any of the options would have minimal effects on bald eagles, which are protected under the Bald and Golden Eagle Protection Act as described above.

What indirect effects would the project likely have on wetlands, fish resources, wildlife, and habitat?

The wetlands assessment did not identify any expected indirect effects of the proposed project on wetlands. In addition, because of the project location, project effects on habitat would generally be limited to the lake and estuarine environments in the study area, not farther removed in distance, and would be consistent with those occurring from existing uses and activities. WSDOT did not identify any potential effect of the project on fish and aquatic habitat that would occur later in time than the project activity causing the effect. Therefore, the project is not expected to result in measurable indirect effects on fish and aquatic habitat.

What has been done to avoid or minimize adverse effects on wetlands, fish resources, wildlife, and habitat?

Consistent with regulatory guidance, WSDOT has designed the project to avoid and minimize the effects of the Preferred Alternative and the SDEIS options. Specific aspects of the design that have been incorporated to avoid and minimize effects on ecosystems are as follows:

- As discussed in Section 5.10, stormwater treatment facilities would be constructed to treat roadway runoff before it is discharged to downstream aquatic habitat. This would improve water quality in the study area.
- The roadway footprint has been minimized to the greatest extent possible over the course of project design to reduce impacts. For example, the cross-section of the floating bridge is 115 feet, compared with a 133-foot cross-section for the 6-Lane Alternative in the Draft EIS.
- The Preferred Alternative and Options A and L would include fewer bridge columns, spaced farther apart than the existing columns, to reduce impacts on wetlands, wetland buffers, and open waters. Fewer columns also help reduce potential habitat for salmonid predators.
- The existing Lake Washington Boulevard ramps and R.H. Thomson Expressway ramps would be removed, which would expose previously shaded areas. These ramps are mainly over upland or open water areas, as opposed to vegetated wetlands, but their removal would expose approximately 0.6 acre of previously shaded aquatic bed wetlands. In addition, 18 support columns (less than 0.1 acre of fill) would be removed.
- Although the elevated structures would be wider than existing structures, in many areas the bridges would be higher than they are today, allowing more light under the elevated roadway sections. This would improve aquatic habitat conditions in some areas and offset and

minimize potential negative effects in other areas. The Preferred Alternative has higher overwater structures than the SDEIS options, reflecting resource agency and tribal comments on the SDEIS and during the regulatory coordination process.

- The wave barrier for the maintenance facility dock was eliminated as part of design refinements for the Preferred Alternative in order to reduce potential effects on spawning habitat.

What mitigation is proposed for effects that are not avoidable?

Wetlands

Compensatory mitigation would for effects to wetlands be required for the Preferred Alternative and the SDEIS options. The information presented in this section is from the conceptual wetland and aquatic habitat mitigation plans, which are included as Attachment 9 to this Final EIS.

As described in Chapter 1, WSDOT engaged the regulatory agencies with jurisdiction over wetlands and aquatic habitat as well as the Muckleshoot Indian Tribe in the Natural Resources Technical Working Group (NRTWG) to assist in the development of appropriate mitigation for project effects. WSDOT identified candidate mitigation sites using a hierarchical selection process based on the watersheds in the study area. The SR 520, I-5 to Medina project will provide compensatory wetland mitigation in five locations for the project's wetland effects. Four of the locations are onsite or close to the project, and one is located several miles from the project but in the same watershed. The five sites are as follows (see the Conceptual Wetland Mitigation Plan in Attachment 9 for details):

- Washington Park Arboretum Mitigation Site - Four individual potential mitigation areas were identified along Arboretum Creek south of East Foster Island Road.
- WSDOT Peninsula - This site consists of a large, WSDOT-owned peninsula extending northward from the Arboretum area into Union Bay. The area currently contains the Lake Washington Boulevard and R.H. Thomson Expressway ramps.
- Union Bay Natural Area - The Union Bay Natural Area is owned and managed by the University of Washington. It is directly north across Union Bay from the SR 520, I-5 to Medina project.
- Magnuson Park – Magnuson Park is owned by the City of Seattle and managed by the Seattle Parks and Recreation. The site is approximately 2.5 miles north of SR 520 near the Lake Washington shoreline.
- Cedar River Elliott Bridge Reach (offsite) - WSDOT would develop a floodplain restoration site along the Cedar River on land owned by King County.

The compensatory mitigation for the project is a comprehensive package designed to follow Ecology and U.S. Army Corps of Engineers' joint guidance, as found in *Wetland Mitigation in Washington State: Part 1: Agency Policies and Guidance* (Ecology et al. 2006a) as well as local "no net loss" policies. The project was also designed to meet the mitigation sequencing, compensation, reporting, and monitoring requirements typically used in WSDOT projects.

The acreages of effect reported below are those developed for the Preferred Alternative during the NRTWG, reported in the Draft Conceptual Wetland Mitigation Plan, February 2011 (Attachment 9). All mitigation estimates are based on these quantities. These quantities were calculated using methods different from those used for the effects analysis conducted to compare NEPA alternatives and options as reported in Table 5.11-1. The reasons for this difference are:

- Since the SDEIS was published, WSDOT has developed more detail on project construction methods, resulting in more precise quantification of effects and required mitigation for the Preferred Alternative.
- Mitigation ratios for shade effects had not been concurred with by resource agencies and tribes at the time of the SDEIS, but were established in the NRTWG.

Table 5.11-8 summarizes the area of wetland effects and the corresponding required mitigation for the filled wetlands. Most of the affected wetlands in the study area are Category II and Category III, with smaller effects on Category IV wetlands. These effects would be mitigated at the five sites above. WSDOT will also add appropriate buffers to wetlands in the mitigation areas. If one of the SDEIS options is ultimately selected as the project proposal, a similar process would be followed to calculate the necessary mitigation.

Table 5.11-8. Wetland Effects and Required Mitigation for the Preferred Alternative of the I-5 to Medina: Bridge Replacement and HOV Project (acres)

Wetland Effect Category	Affected Area[a]	Mitigation Area[b]
Permanent Fill	0.3	1.7
Permanent Shading	4.3	7.8
Permanent Effect Subtotal	4.6	9.5

Note: Totals may not add up due to rounding.
[a] Wetland effect areas are based on the Draft Conceptual Wetland Mitigation Plan, February 2011.
[b] Mitigation areas are based on applying a modified standard ratio for rehabilitation (Ecology et al. 2006a). Mitigation using creation would be at approximately ½ of the area shown in this table, and mitigation using enhancement ratios would require twice the areas shown. Modified mitigation ratios were developed in consultation with and with the approval of the NRTWG at the NRTWG meeting 9/30/10.

Fish and Aquatic Resources

In cooperation with resource agencies and the Muckleshoot Indian Tribe through the NRTWG, WSDOT has developed conceptual plans for habitat improvements, restoration, or construction to mitigate the effects of bridge construction, the increased width of shoreline and open-water crossings, and direct physical impacts from construction activities. The Conceptual Aquatic Habitat Mitigation Plan is included in Attachment 9 to the Final EIS.

Water Resource Inventory Area (WRIA)

WRIA 8 (the Cedar River-Lake Washington watershed) is the land area in which rainwater drains to Lake Washington and out through the Hiram Chittenden locks. It includes the Cedar River and its tributaries and the Sammamish River.

Because of the different types of potential project effects on fish and aquatic resources, and because these potential effects would occur in several distinct habitat types (for example, open water versus shoreline) WSDOT will conduct specific mitigation activities at more than one location within the Water Resource Inventory Area (WRIA) 8 watershed. Several mitigation projects would be developed, including habitat restoration projects in Lake Washington, the Cedar River, and Bear Creek. The primary mitigation goal is to compensate for the project's physical and biological effects while enhancing the production and survival of fish species to the maximum extent practicable. Specific mitigation actions would support spawning, rearing, or migrating salmonids and are proposed to include the following:

- Floodplain acquisition, levee setbacks, and off-channel habitat creation in a reach of the lower Cedar River (Cedar River/Elliott Bridge Reach) would improve channel, riparian, and floodplain functions, benefitting spawning, rearing, and migratory habitat for multiple species of salmonids.
- Restoring 3,000 linear feet of lower Bear Creek would benefit migratory and rearing habitat for multiple salmonid species. Construction of a new channel would increase stream complexity, habitat, and channel sinuosity. The new channel would include substantial increases in pool habitat, large woody debris density, and off-channel habitat. Substantial riparian and wetland restoration in the study area would also provide habitat value for multiple salmonid species and life history stages.
- Restoring the lower reaches and associated delta of a fish-bearing stream (Taylor Creek) in south Lake Washington would increase foraging and rearing opportunities for juvenile salmonids (e.g., Chinook) during their early life history, while also serving as shallow-water refugia from predation.
- Restoring a portion of currently bulkheaded shoreline habitat to a natural grade and enhancement of offshore substrates. These actions would occur within the project alignment (East Approach site) and would improve the quality of sockeye spawning habitat in the area, as well as enhancing nearshore and riparian conditions that support juvenile salmonids. In addition, two existing residential docks would be

removed to provide in-kind and onsite mitigation for effects associated with the proposed maintenance facility dock.

- Enhancing the Lake Washington shoreline at four discrete sites within Seward Park and three sites within Magnuson Park. The enhancements would occur through grading and beach resloping, nearshore bulkhead and debris removal, and substrate augmentation, as well as riparian habitat creation and enhancement. These actions would improve the quality of sockeye spawning habitat in the area, as well as enhancing nearshore and riparian conditions that support out-migrating juvenile salmonids.
- Enhancing the shoreline at the south end of Lake Washington (South Lake Washington Shoreline Restoration site), including grading and beach resloping, removal of an existing flume and rubble, restoration of riparian areas, and removal of existing mooring dolphins. These enhancements would directly benefit juvenile Chinook salmon exiting the Cedar River by providing rearing and feeding opportunities prior to continued out-migration through Lake Washington.

Wildlife and Habitat

WSDOT has coordinated with the City of Seattle, the University of Washington, Seattle Parks and Recreation, and the Arboretum Foundation in developing a planting strategy to offset the project's effects on regulated shoreline habitat under the City's shoreline management regulations. Many shoreline areas of Union Bay and the Montlake Playfield are not fully vegetated and/or contain invasive species. Some of these areas could be replanted with native trees and shrubs and the invasive species removed.

5.12 Geology and Soils

The Pacific Northwest is a geologically active region and experiences earthquakes both large and small, as well as landslides and erosion along vulnerable slopes. Careful consideration of design, location, and construction techniques improves the safety of transportation structures during seismic events and increases stability in areas prone to erosion and landslides. The information presented in this section is based on the Geology and Soils Discipline Report Addendum and Errata (Attachment 7).

How would the project design account for geologic hazards?

Without the project, geologic hazards would continue to threaten SR 520's integrity and the safety of commuters. The new structures proposed by the Preferred Alternative and Options A, K, and L would be far better able to withstand earthquakes than the existing structures. WSDOT has included a number of features to reduce potential geologic hazards. Areas would be stabilized where soils are liquefiable and/or prone to settlement or landslide, including the eastern end of the Portage Bay Bridge and the Evergreen Point Bridge west approach structure. These measures could include supporting the roadway on columns, improving soils beneath bridge columns, designing bridge columns to withstand seismic motion, and/or excavating areas of vulnerable soil and replacing them with stronger material. Due to the sensitive nature of Foster Island as a TCP, ground disturbance and excavation in this area would be limited as much as possible and other measures would be used to address soil stabilization. As described in Chapter 2, many of the existing bridges in the SR 520 corridor have a strong probability of being damaged during an earthquake; the new bridges would be designed to handle an earthquake without substantial damage, as required by current WSDOT standards.

KEY POINT

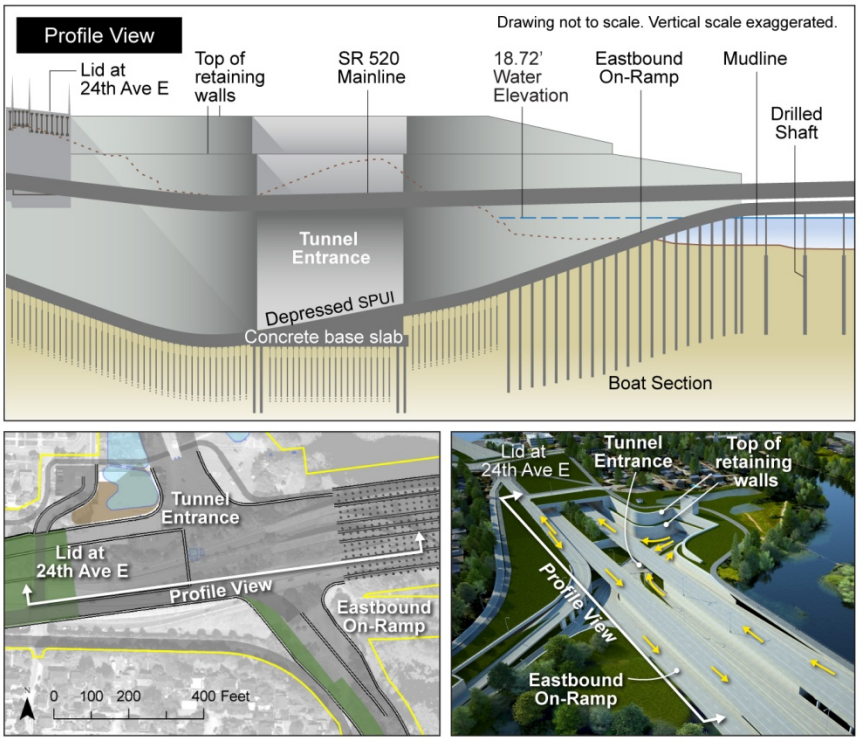
Geologic Hazards

As described in Chapter 4, the project area includes geologic hazards including steep slopes and soils that are prone to erosion and/or liquefaction. The project design would address these hazards by supporting the roadway on columns, improving soils beneath bridge columns, designing bridge columns to withstand seismic motion, and/or excavating areas of vulnerable soils and replacing them with stronger materials.

The Preferred Alternative and Options A, K, and L all have similar risks except in the Montlake and west approach areas where the depressed single-point urban interchange (SPUI) structures constructed under Option K would have some unique geologic considerations because portions of the roadway would be below the lake level (Exhibit 5.12-1). To prevent the roadway from floating, piles or tie-down anchors would be required to resist the buoyancy forces that would tend to cause the large structural slabs to float. Although extensive design and load testing would be performed on these elements, the risk of damage to the facilities would be greater for this option than if the facilities were located above the lake level.

Although the below-water structures, including the tunnels, would be designed to be watertight, some leakage would likely occur, and an active

Exhibit 5.12-1. **Option K SPUI**



pumping system would be required to remove water. Back-up pumping systems would be designed to limit the risk of flooding.

Effects of Suboptions

- Adding the Lake Washington Boulevard ramps and eastbound high-occupancy vehicle (HOV) direct-access ramp to Option A would result in no measurable differences in the geology and soils considerations and effects described above.
- Adding the eastbound off-ramp to Montlake Boulevard to Option K would result in no measurable differences in the geology and soils considerations and effects described above because the added ramp would be located within the existing right-of-way of the current Montlake Boulevard interchange.
- Adding northbound capacity on Montlake Boulevard to Option L would result in no measurable differences to the geology and soils considerations and effects described under Option L because only minor grading would be required.

How would the project affect topography?

The topography of the project area would change somewhat through the construction of new embankments and the excavation of some areas. However, these changes would be relatively small because the widened roadway would follow the same corridor as the existing roadway, much of

the roadway is on bridges, and the footprint has been kept as small as possible by the use of retaining walls. One exception would be the deep cut for the depressed SPUI in SDEIS Option K, which would create a localized but dramatic change in land form just west of the Montlake shoreline. The land bridge over Foster Island under that option would also noticeably change the island's topography.

Effect of Suboptions

- Adding the suboptions to Option A, K or L would result in no measurable differences in the topography effects described above.

What are the indirect effects of the project on geology and soils?

The geology and soils assessment did not identify any expected indirect effects of the proposed project on geology and soils in the study area.

What has been done to avoid or minimize negative effects?

The project would be designed to WSDOT and American Association of State Highway and Transportation Officials (AASHTO) design standards, which address seismic loading, retaining walls, and related components of the project.

5.13 Hazardous Materials

Project operations would result in primarily beneficial effects related to the identification and remediation of sites that would occur during construction. In addition, the new stormwater facilities would operate to collect the currently untreated stormwater runoff. The information presented in this section is based on the Hazardous Materials Discipline Report Addendum and Errata (Attachment 7).

How could the project affect hazardous materials?

Transporting hazardous materials carries with it some risk to the driver and occupants of vehicles and others on the road. Spilled chemicals on a public roadway can also lead to expensive cleanups and traffic delays. The Washington Department of Ecology (Ecology) serves as the state's Incident Command for emergency spills and, as such, responds to spills within highway rights-of-way. The risk of spills is inherent in all transportation facilities, but can be minimized by designing these facilities to meet safety standards that reduce the risk of accidents. Operation of the SR 520, I-5 to Medina project is generally expected to reduce the potential for hazardous material spills through improved traffic flow and increased safety. The risk of spills would not vary substantially between the Preferred Alternative and Options A, K, and L.

KEY POINT

Hazardous Materials

Project operations would result in primarily beneficial effects tied to the identification and remediation of sites that would occur during construction. In addition, the new stormwater facilities would operate to collect the currently untreated stormwater runoff.

All transportation facilities pose the risk of vehicular fluid spills by the travelling public. The risk of spills would not vary substantially between the Preferred Alternative and Options A, K, and L.

During project operation, stormwater facilities would collect polluted runoff from traffic. This runoff may include fuels, lubricants, heavy-metal compounds from tires and brakes, and automobile-engine coolants (such as ethylene glycol). Currently untreated, this runoff would be treated using Ecology-approved best management practices (BMPs) during project operation. Section 5.10, Water Resources, includes more information on water quality treatment methods proposed for the project.

The bridge maintenance facility would store hazardous materials such as fuels, adhesives, cleaners, epoxies, propane, grease, lubricants, paints, and solvents. These materials would be used in the study area during maintenance activities. The risk of potential releases to the environment is considered low, because the amounts of each of these materials onsite would be small, in most cases a few gallons each, and spill prevention control, and countermeasures would be implemented during the facility's operation.

The bridge maintenance facility would also have a diesel storage tank (size undetermined) onsite. This diesel tank, located either above ground or underground, would be used to supply the emergency power generator. WSDOT would comply with all applicable regulations regarding storage and spill containment for diesel fuels. Again, the risks of potential releases

to the environment would be low because spill pollution prevention measures would be implemented during the tank's design and operation.

Effects of Suboptions

- None of the suboptions for Options A, K, and L would result in any measurable differences in hazardous material effects compared to the options themselves.

What are the indirect effects of the project on hazardous materials?

The hazardous materials assessment did not identify any expected indirect effects of the proposed project on hazardous materials.

What has been done to avoid or minimize negative effects?

As described above, stormwater treatment facilities and operational practices incorporated into project design and maintenance procedures would minimize the risk of spills. No negative effects are expected to occur as a result of project operation.

5.14 Navigation

When proposing changes to structures that cross Lake Washington, WSDOT considered the beneficial or adverse effects of the project on navigation. The information presented in this section is based on analyses found in the Navigable Waterways Discipline Report Addendum and Errata (Attachment 7).

How would the project affect navigation channels?

The project would not change the current limits on ship passage through the Lake Washington Ship Canal or Lake Union. However, as Table 5.14-1 shows, there would be some changes in Lake Washington east of the Montlake Cut. Although the Preferred Alternative and Options A and L would add a new bascule drawbridge across the Montlake Cut, the new bridge would create no new navigational challenges because there would be no height restrictions, and the bridge openings would be coordinated with the existing Montlake Bridge.

KEY POINT

Navigation

Under the Preferred Alternative, the west transition span would be the same as under existing conditions, the draw span would be removed, and the east transition span would be 15 feet higher. Under Options A, K, and L, the west transition span of the new Evergreen Point Bridge would be 3 feet lower than the No Build Alternative, the draw span would be removed, and the east transition span would be 15 feet higher. The changes would impose a height restriction of 70 feet for vessels passing under the replacement SR 520 bridge. Boats with an overhead clearance of more than 44 feet would only be able to pass under the east transition span. The new bascule bridge under the Preferred Alternative and Options A and L would coordinate openings with the existing bridge and would not impose height restrictions.

Table 5.14-1. Changes in Navigational Restrictions in Lake Washington

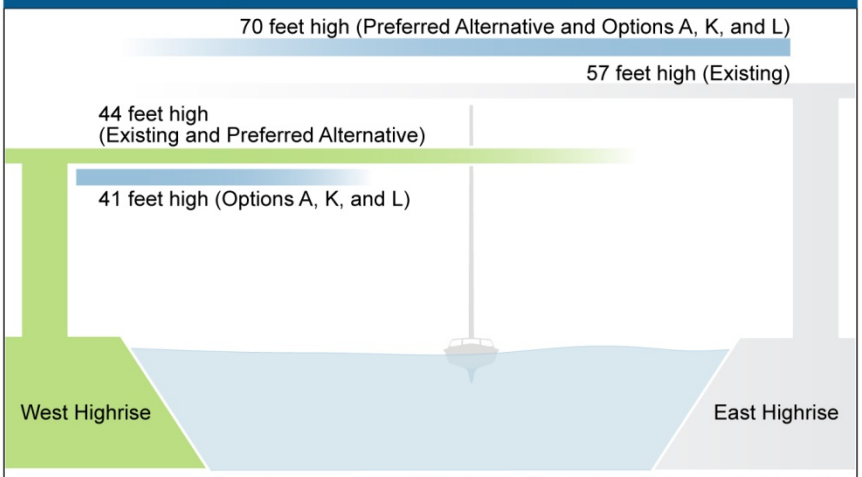
	Existing		Preferred Alternative		Options A, K, and L	
Bridge	**Width (ft)**	**Height (ft)**	**Width (ft)**	**Height (ft)**	**Width (ft)**	**Height (ft)**
New Montlake Bascule Bridge[a]	100	Drawspan	100	Drawspan	100	Drawspan
Evergreen Point Bridge						
West transition span	206	44	130	44	130	41
Mid span	200	Drawspan	Removed	Removed	Removed	Removed
East transition span	207	55 to 64	190	70	210	70

[a]Preferred Alternative and Options A and L only

The Preferred Alternative, like all the SDEIS options, would change the navigational channels under the Evergreen Point Bridge (see Table 5.14-1 and Exhibit 5.14-1). Under the Preferred Alternative, the west navigation channel would remain at its existing height. Under Options A, K, and L, the west navigation channel of the new Evergreen Point Bridge would be 3 feet lower. The only effect from the lower height under Options A, K, and L would be on boats with an overhead clearance of more than 41 feet and less than 44 feet, which would need to pass under the east transition span instead of the west transition span. All other vessels could continue using the same channels they use today.

Under the Preferred Alternative and Options A, K, and L, the drawspan would be removed, and the east navigation channel would be between 6 and 15 feet higher, depending on where in the channel a vessel crossed.

Exhibit 5.14-1. **Navigational Clearance with the Project**



Note: The dimensions shown here represent a 45-foot long sailboat with a 60-foot mast height and a 7-foot draft. Depth and width not to scale.

Effects of Suboptions

- Adding the suboptions to Option A, K or L would result in no changes to the navigation channel impacts described above.

What are the indirect effects of the project on navigation channels?

WSDOT did not identify any expected indirect effects of the proposed project on navigation in the study area.

What would be done to avoid or minimize effects on navigation channels?

The permanent effect of a height restriction for vessels passing under the replacement SR 520 bridge has been avoided by essentially matching the new east navigation channel's vertical clearance of 70 feet with I-90's east channel bridge clearance of 71 feet. Any vessel that can currently pass under the I-90 east channel bridge would also be able to pass under the replacement Evergreen Point Bridge.

The Coast Guard approves the locations and clearances of bridges through the issuance of bridge permits or permit amendments under the authority of Section 9 of the Rivers and Harbors Act of 1899, the General Bridge Act of 1946, and other statutes. Permits are required for new construction, reconstruction, or modification of a bridge or causeway over waters of the United States.

5.15 Construction Phase 1: Floating Bridge and Landings

As previously discussed in Chapter 2, currently committed funding is sufficient to construct the Evergreen Point floating bridge and landings; a Request for Proposals has been issued for construction of this portion of the project, with proposals due in June 2011. Accordingly, this Final EIS discusses the potential for the floating bridge and landings to be built as the first phase of the SR 520, I-5 to Medina project. This portion of the project is referred to in the Final EIS as Construction Phase 1, or simply Phase 1. Construction Phase 1 differs from the SDEIS Phased Implementation scenario, which included the west approach and the Portage Bay bridge in the first construction phase.

To address the effects of Construction Phase 1, this section of the Final EIS summarizes the operational effects of the floating bridge and landings separately as a subset of the "full build" analysis. The evaluation is qualitative in nature, and assumes that the floating bridge and landings would be the only project components in operation until the rest of the project has been funded and built. Since all improvements needed for Phase 1 are within the overall footprint of the facilities to be provided by full buildout, the discussion on differences in effects focuses on the timing of construction rather than the extent of impacts.

The time frame for which only the Phase 1 improvements would be in place depends upon WSDOT's ability to fund full construction of the SR 520, I-5 to Medina project. This funding will be based on future revenues and economic conditions. For analysis purposes, in disciplines where a design year is used (e.g. transportation), Construction Phase 1 is evaluated based upon a design year of 2030, the same as for full buildout. This does not mean that Phase 1 is expected to be the only part of the project built by 2030; it simply provides a way to look at the effects of Phase 1 consistently with the effects of the full project, and also to compare it with the No Build Alternative.

Transportation

For the SDEIS Phased Implementation Scenario, WSDOT modeled traffic operations for 2030 using the following assumptions:

- Completion of the SR 520, Medina to SR 202 project
- A new 6-lane floating bridge (two general-purpose lanes and one inside high-occupancy vehicle (HOV) lane in each direction) Evergreen Point Road and the west transition span of the Evergreen Point Bridge
- Use of the existing four general-purpose lanes from the west transition span to I-5

Construction Phase 1 for the Final EIS assumes the same physical configuration for SR 520 as described above. As described in Section 5.1, the traffic modeling for the Final EIS has been updated to reflect new assumptions about regional population and employment growth and about the future transportation network. However, the traffic results from Final EIS Construction Phase 1 would be similar to those of the SDEIS Phased Implementation Scenario. In fact, traffic is likely to operate slightly better under Construction Phase 1 than under the SDEIS Phased Implementation Scenario, because the predicted travel demand for SR 520 is lower. Therefore, model results for the SDEIS Phased Implementation Scenario are presented in this section as a conservative estimate of the transportation performance of Construction Phase 1. To maintain consistency, these results are compared against the SDEIS No Build Alternative.

Morning Commute

Westbound

Volumes and Mode Share

Table 5.15-1 summarizes demand and throughput for the vehicles per hour and persons per hour for the westbound morning peak period. As noted above, the results for Construction Phase 1 would be similar to (although slightly less than) those shown for the SDEIS Phased Implementation Scenario.

Table 5.15-1. Westbound AM Peak Period Cross-Lake Vehicle and Person Trips

	Vehicles per Hour	Persons per Hour
2030 SDEIS No Build Alternative		
Demand	4,400	8,200
Throughput	3,900	7,600
2030 SDEIS Phased Implementation Scenario		
Demand	4,400	8,200
Throughput	3,900	7,600

Congestion Points

During the westbound morning commute under the No Build Alternative, the most severe congestion on SR 520 would begin near the 84th Avenue NE on-ramp and the termination of the westbound HOV lane. Congestion in the general-purpose lanes would extend back to the 108th Avenue NE interchange area and would last for approximately 3.5 hours during the morning commute. Congestion along this portion of the corridor would limit the amount of traffic throughput across the bridge. There would also be some congestion in the HOV lanes as vehicles attempt to merge into the congested general-purpose lanes.

Under the Construction Phase 1, the acceleration lane from the Evergreen Point transit stop (Eastside Transit and HOV project) would be extended. This would allow buses to merge into the inside HOV lanes on the floating bridge at higher speeds. The congestion point would move to the west end of the floating bridge, where the HOV lanes merge into the 4-lane roadway. Because the new bridge would provide better sight distance and a longer taper than the existing merge point, it is likely that congestion would be somewhat less severe than under the No Build Alternative.

Travel Time

Under the SDEIS Phased Implementation Scenario, general-purpose travel times between I-5 and SR 202 were estimated to increase slightly (by 1 to 3 minutes) compared to the No Build Alternative. Travel times in HOV lanes would be 1 to 2 minutes faster than those for the No Build Alternative, which assumed that the Medina to SR 202 project would be operational in 2030. HOV trips would be able to bypass the congestion in the general-purpose lanes. Table 5.15-2 shows the travel times for SR 520 between I-5 and SR 202. As noted above, the results for Construction Phase 1 would be similar to those shown for the SDEIS Phased Implementation Scenario.

Table 5.15-2. Westbound AM Peak Period Travel Times (minutes) – I-5 to SR 202

	General-Purpose		HOV	
	Average[a]	Peak[b]	Average[a]	Peak[b]
2030 No Build Alternative	20	22	16	17
2030 SDEIS Phased Implementation Scenario	21	25	15	15

[a] Average of the 3-hour AM peak period from 6 AM to 9 AM.

[b] The highest 60-minute time period during the 3-hour peak period.

Eastbound

Under the No Build Alternative, SR 520 would continue to be congested between I-5 and the west end of the Evergreen Point Bridge (see Section 5.1). This would be the case for Construction Phase 1 as well. HOV lanes would begin on the bridge, easing congestion; however overall travel times for general-purpose and HOV lanes between I-5 and SR 202 would be similar to the westbound commute travel times shown in Table 5.15-2 due to the congestion approaching the bridge.

Afternoon Commute

In general, the afternoon commute under Construction Phase 1 would be congested for the same reasons as for the morning commute, but more severely. By 2030, congestion on I-405 will have a profound effect on the westbound SR 520 commute east of I-405. Traffic on I-405 through downtown Bellevue will back up onto the SR 520 ramps and affect how much traffic will be able to get through the SR 520/I-405 interchange.

Congestion lasting more than 3 hours would extend from I-405 as far back on SR 520 as the NE 40th/NE 51st Street interchange.

Westbound

Volumes and Mode Share

Table 5.15-3 summarizes the person and vehicle demand and throughput for the SDEIS No Build Alternative and the SDEIS Phased Implementation Scenario. As noted above, the results for Construction Phase 1 would be similar to (although slightly lower than) those shown for the SDEIS Phased Implementation Scenario, with traffic volumes remaining similar between Construction Phase 1 and the No Build Alternative.

Table 5.15-3. Westbound PM Peak Period Cross-Lake Vehicle and Person Trips

Alternative	Vehicles per Hour	Persons per Hour
2030 SDEIS No Build Alternative		
Demand	4,600	8,200
Throughput	3,800	6,700
2030 SDEIS Phased Implementation Scenario		
Demand	4,600	8,200
Throughput	3,900	6,900

Congestion Points

As described above, I-405 congestion during the westbound afternoon commute will cause queues on the SR 520/I-405 interchange ramps to back up onto SR 520. This would occur with or without the project. This congestion will limit the amount of traffic that can exit from SR 520 to I-405, and also will limit how much traffic can enter SR 520 from I-405. Carpools and buses on SR 520 would be able to bypass this congestion in the inside HOV lane.

As described for the morning commute, congestion on westbound SR 520 under the No Build Alternative would begin near the 84th Avenue NE on-ramp and would extend at least as far back as the 108th Avenue NE interchange, lasting for the entire peak period during the afternoon commute.

Under Construction Phase 1, the congestion point would move to the west end of the floating bridge where the HOV lanes merge into the 4-lane roadway. Although the congestion point would remain, the lane taper would be longer and sight distances would be better, allowing for improved traffic operations at the merge location compared to conditions at the current merge point.

Travel Times

Under the No Build Alternative, the average travel time between I-5 and SR 202 during the westbound afternoon commute would be approximately 49 minutes for general-purpose trips and 16 minutes for HOV trips.

General-purpose and HOV travel times for the SDEIS Phased Implementation Scenario would be similar to the No Build Alternative. Table 5.15-4 shows the travel times for SR 520 between I-5 and SR 202. As noted above, the results for Construction Phase 1 would be similar to those shown for the SDEIS Phased Implementation Scenario.

Table 5.15-4. Westbound PM Peak Period Travel Times (minutes) – I-5 to SR 202

Alternative	General-Purpose		HOV	
	Average[a]	Peak[b]	Average[a]	Peak[b]
2030 No Build Alternative	49	66	16	17
2030 SDEIS Phased Implementation Scenario	47	62	17	19

[a] Average of the 3-hour PM peak period from 3 PM to 6 PM.

[b] The highest 60-minute time period during the 3-hour peak period.

Eastbound

Volumes and Mode Share

Table 5.15-5 summarizes the person and vehicle demand and throughput for the SDEIS No Build Alternative and the SDEIS Phased Implementation Scenario. As noted above, the results for Construction Phase 1 would be similar to (although slightly lower than) those shown for the SDEIS Phased Implementation Scenario.

Congestion Points

As described above, I-405 would be severely congested on both northbound and southbound lanes during the afternoon commute, with or without the project. I-405 congestion would cause the SR 520/I-405 interchange ramps to back up onto SR 520. Carpools and buses would be able to bypass this congestion in the inside HOV lane and avoid the congested general-purpose lanes.

Table 5.15-5. Eastbound PM Peak Period Cross-Lake Vehicle and Person Trips

Alternative	Vehicles per Hour	Persons per Hour
2030 SDEIS No Build Alternative		
Demand	4,100	8,200
Throughput	3,600	7,000
2030 SDEIS Phased Implementation Scenario		
Demand	4,100	8,200
Throughput	3,700	7,200

Similar to the morning eastbound commute, SR 520 would also be congested between I-5 and the west end of the Evergreen Point Bridge (see Section 5.1) during the afternoon commute.

Travel Times

As described for the morning commute, SR 520 would continue to be congested between I-5 and the west end of the Evergreen Point Bridge (see Section 5.1) under Construction Phase 1. Overall travel times for general-purpose and HOV lanes between I-5 and SR 202 would be similar t those for the No Build Alternative.

Land Use and Economic Activity

Construction Phase 1 would require an aquatic lands easement from the Washington State Department of Natural Resources for construction and right-of-way for the new Evergreen Point Bridge and new anchors placed in Lake Washington. It would also require the acquisition of two parcels on the Eastside totaling 1.2 acres (see Section 5.2). No structures would be removed during this first phase of construction. All other land use effects from right-of-way acquisitions in the I-5, Portage Bay, Montlake, and west approach areas would occur later in time as a result of full buildout.

In general, the benefits to businesses that would occur from improved mobility and accessibility along the SR 520 corridor (as influenced by travel times, safety, and transportation choices) would be realized over a longer overall time period with phased construction than if the entire project were built at one time.

Social Elements

Neighborhoods

Because Construction Phase 1 includes only the floating bridge and landings, the operational effects on community cohesion that benefit the Eastlake, North Capitol Hill, Portage Bay/Roanoke, University District, Montlake, and Madison Park neighborhoods would be delayed until full buildout. These benefits, along with improved transit service reliability from a continuous HOV lane on SR 520, would therefore be realized over a longer overall time period than if the project were built all at once (see Section 5.3).

Effects on Low-income, Minority, and Limited-English-Proficient (LEP) Residents

Construction Phase 1 would affect the usual and accustomed tribal fishing areas of the Muckleshoot Indian Tribe through replacement of the Evergreen Point Bridge. The new bridge would have a substantially wider footprint than the existing Evergreen Point Bridge and the alignment would be shifted north, permanently reducing access to existing tribal fishing areas

(see Section 5.3). Effects on tribal fishing for replacement of the Portage Bay Bridge would occur later in time as a result of full buildout; however, the bulk of tribal fishing in the project area occurs in Lake Washington, so the majority of the project effects would take place during Phase 1.

Tolling would also be implemented during Construction Phase 1. As described in Section 5.3, tolls would affect low-income bridge users more than the general population because the tolls would constitute a larger percentage of their income. Low-income people and those with limited English proficiency are also likely to face greater difficulties in participating in electronic tolling. In addition, social service providers that cross the bridge may also be affected in their ability to provide services. However, proposed transit enhancements in the SR 520 travelshed, along with extensive outreach to low-income and minority populations and service agencies, are expected to minimize the adverse effects of tolling to the extent that they are not disproportionately high and adverse.

Recreation

Construction Phase 1 would require no acquisition of park land. Acquisition of land from Bagley Viewpoint, Montlake Playfield, McCurdy Park, East Montlake Park, and the Arboretum would occur later in time, as would improved connectivity between and within park areas from pathways and landscaping on lids in the I-5 and Montlake interchange areas as a result of full buildout (see Section 5.4).

Visual Quality

Construction Phase 1 would result in operational effects on visual quality from changes in the scale and appearance of the replaced Evergreen Point Bridge in the Lake Washington Landscape Unit (see Section 5.5). Changes in the Roanoke, Portage Bay, Montlake, and west approach landscape units would occur later in time as a result of full buildout. The interim connection bridge would be visible to boaters and from more distant vantage points such as Laurelhurst, but would have a similar appearance to the existing west approach structures.

Cultural Resources

Construction Phase 1 would result in the demolition of the National Register of Historic Places- (NRHP) eligible floating bridge, as described in section 5.6. Potential effects on other historic properties, on the Montlake Historic District, on the Canoe House, and on the Roanoke Park Historic District in the I-5 area would occur later in time as a result of full buildout (see Section 5.6).

Noise

Construction Phase 1 would provide noise reduction benefits in the Medina neighborhood as a result of the noise walls included in the east approach area. The noise reductions predicted in the Portage Bay/Roanoke, North Capitol Hill, and Montlake neighborhoods and in the Washington Park Arboretum would occur later in time as a result of full buildout (see Section 5.7).

Air Quality

Air emissions under Construction Phase 1 would be similar to those under the No Build Alternative. Because of the introduction of cleaner fuels and new emissions standards requiring more efficient vehicle engines, air quality will improve in the future with or without the project. Slight improvements in air quality would occur later in time as a result of increased mobility under full project buildout (see Section 5.8).

Energy and Greenhouse Gases

Energy consumption and greenhouse gas emissions from Construction Phase 1 would be similar to the No Build Alternative. As with air quality, the introduction of cleaner fuels and new emissions standards requiring more efficient vehicle engines will reduce energy consumption and greenhouse gas emissions in the future, with or without the project. Slight reductions in energy consumption and greenhouse gas emissions would occur later in time as a result of increased mobility under full project buildout (see Section 5.9).

Water Resources

Construction Phase 1 includes building stormwater management facilities to treat the runoff in the Lake Washington, East Lake Washington, and Fairweather Creek basins, as described in Section 5.10. These facilities will reduce pollutant loading to Lake Washington and Fairweather Creek basins. The stormwater facilities in the Lake Union, Portage Bay, and Union Bay basins would be constructed as part of full buildout (see Section 5.10); hence, there would be a delay in achieving the water quality benefits provided by the project in these basins.

Ecosystems

Wetlands

Construction Phase 1 would result in no permanent effects on wetlands because there are no wetlands in the Lake Washington area or Eastside transition area (see Section 5.11). The majority of wetlands and buffers are in the Portage Bay and west approach areas and would be affected at the

time of full buildout. There are no wetlands in the I-5 area, and only small portions of wetlands extend into the Montlake area.

Fish

Operation of the floating bridge and landings under Construction Phase 1 could affect fish in the Lake Washington area. As described in Section 5.11, the larger floating span and pontoons could affect fish use of the area near the bridge. The variable spacing between supplemental stability pontoons would produce recesses along the face of the pontoons which would increase the migration distance (if fish followed the face of the pontoons) and provide additional deepwater forage habitat for fish using the edge of pontoons for cover. The increased width of the bridge may also have minor effects on circulation and temperature in Lake Washington, as discussed in Section 5.11.

Construction Phase 1 would also include completion of the bridge maintenance facility and dock. The finish floor elevation of the bridge maintenance facility could result in localized water table lowering, or drawdown, that could result in upwelling in the sockeye spawning habitat near the east approach. However, as described in Section 5.11, this effect is expected to be relatively minor, and would not preclude sockeye spawning or substantially degrade the quality of spawning habitat. There are no indications that the presence of an overwater structure in the east approach area would affect the spawning of sockeye salmon.

Effects on fish resources in the Portage Bay and west approach areas would occur at the time of full buildout.

Wildlife

Operation of the floating bridge and landings would result in the loss of mostly open water habitat in the Lake Washington and Eastside transition areas. This type of habitat is most notable for its prevalence of waterfowl. Vegetation that provides the highest quality habitat for wildlife is located in the Portage Bay, west approach, and Montlake areas of the SR 520 corridor and would be not affected until full buildout. See Section 5.11 for additional information.

Geology and Soils

Effects of the floating bridge and landings on geology and soils would be limited to those related to construction of the east approach and Eastside transition area (see Section 5.12). The effects related to operation of the west approach and Portage Bay bridge would occur at the time of full buildout.

Hazardous Materials

Construction Phase 1 includes stormwater management facilities to treat the runoff from the new Evergreen Point Bridge and the stormwater facilities in the Lake Washington, East Lake Washington, and Fairweather Creek basins (see Section 5.13).). The new stormwater facilities would operate to collect currently untreated stormwater runoff. All transportation facilities pose the risk of vehicular fluid spills by the traveling public. Operation of the project is generally expected to reduce the potential for hazardous materials spills through improved traffic flow and increased safety.

The bridge maintenance facility in Medina would store small amounts of hazardous materials such as fuels, adhesives, cleaners, epoxies, propane, grease, lubricants, paints, and solvents. These materials would be used during maintenance activities. The risk of potential releases to the environment is considered low because the amounts of each of these materials onsite would be minimal, in most cases a few gallons each, and spill prevention, control, and countermeasures would be implemented during the facility's operation.

Navigable Waterways

Construction Phase 1 would affect the navigation channels under the Evergreen Point Bridge. The west transition span would remain at its current height of 44 feet, the drawspan would be removed, and the east transition span would be raised to 70 feet (see Section 5.14). These changes are not expected to affect commercial or recreational navigation in the project area.

5.16 Summary of Project Operation and Permanent Effects

Table 5.16-1 summarizes the project operation and permanent effects of the Preferred Alternative and SDEIS options on each element of the environment. Table 5.16-2 lists the quantifiable effects (those effects that could be estimated as measurable quantities, e.g., acres). Effects from adding the suboptions to each option are shown in parentheses in Table 5.16-2.

Table 5.16-1. Summary Comparison of Operation Effects of the Preferred Alternative and SDEIS Options

Transportation	
The Preferred Alternative and all SDEIS options include high-occupancy vehicles (HOV) lanes in both directions, an HOV direct-access ramp to I-5 express lanes, and HOV bypass lanes on all on-ramps. The Preferred Alternative and all SDEIS options would serve more vehicles and more people than the No Build Alternative. Overall congestion and travel times for both general-purpose and HOV trips would be reduced, particularly during the eastbound morning and westbound afternoon peak periods	
Travel Demand and Highway Operations	
The Preferred Alternative and SDEIS options would allow SR 520 to serve more traffic than the No Build Alternative during the peak period. The Preferred Alternative and SDEIS options would improve travel times between I-5 and SR 202 for both HOV and general-purpose traffic.	
Preferred Alternative	The Preferred Alternative would allow SR 520 to serve more vehicles and people per hour: ▪ AM Peak Period - 8,300 vehicles per hour (9% more than No Build) with Preferred Alternative; 14,600 people per hour (17% more than No Build) with Preferred Alternative ▪ PM Peak Period - 7,900 vehicles per hour (4% more than No Build) with Preferred Alternative; 14,400 people per hour (14% more than No Build) with Preferred Alternative
Option A	Option A would allow SR 520 to serve more vehicles and people per hour: ▪ AM Peak Period - 8,100 vehicles per hour (7% more than No Build) with Option A; 16,500 people per hour (14% more than No Build) with Option A ▪ PM Peak Period - 7,800 vehicles per hour (5% more than No Build) with Option A; 15,900 people per hour (16% more than No Build) with Option A.
Options K and L	Options K and L would allow SR 520 to serve more vehicles and people per hour: ▪ AM Peak Period - 8,600 vehicles per hour (13% more than No Build) with Option A; 17,500 people per hour (20% more than No Build) with Option A ▪ PM Peak Period - 8,400 vehicles per hour (14% more than No Build) with Option A; 17,400 people per hour (27% more than No Build) with Option A.
Local Traffic Volumes and Operations	
The greatest effect on traffic volumes would occur in the Montlake Boulevard interchange area.	
Preferred Alternative	Under the Preferred Alternative, travel patterns on local streets in the area would change due to the direct-access HOV ramp from SR 520, the removal of the Lake Washington Boulevard ramps, and the addition of a new bascule bridge adjacent to the existing bridge on Montlake Boulevard. From the north, more trips from the University District to I-5 would travel along Montlake Boulevard southbound and across the Portage Bay Bridge westbound than under the No Build

Table 5.16-1. Summary Comparison of Operation Effects of the Preferred Alternative and SDEIS Options

	Alternative. This is because travel along Montlake Boulevard would be improved by the additional bridge across the Montlake Cut, and congestion spilling back from westbound SR 520 would be reduced, leading to greater use of the highway. The Preferred Alternative would remove the Lake Washington Boulevard ramps, traffic volumes would decrease through the Arboretum and increase at the Montlake Boulevard interchange compared to the No Build Alternative. The Preferred Alternative would add capacity across the Montlake Cut with the second bascule bridge, and on the SR 520 eastbound on-ramp with the addition of a second general-purpose lane. As a result, local and SR 520 vehicles and buses would benefit over the No Build Alternative by reduced congestion and delay on both directions of Montlake Boulevard between East Roanoke Street and NE Pacific Street.
Option A	Option A would have similar effects as described for the Preferred Alternative.
Options K and L	Under Options K and L, traffic volumes north and south of the Montlake Cut would increase when compared to the No Build and Option A. This is because drivers would take advantage of the capacity made available with the new interchange (SPUI) and its connecting ramps north and south of the Montlake Cut. Traffic volumes would decrease on the existing Montlake Bridge because access to SR 520 would occur via the new SPUI ramps.
Parking	
The Preferred Alternative would have fewer parking effects than SDEIS options A, K, and L. Option L would have the greatest overall effect on parking due to construction of the northern interchange ramps across the Montlake Cut, which would pass through the Husky Stadium's south parking lot. The Preferred Alternative and Options A, K, and L would require removal of the existing lot at Bagley Viewpoint Park due to construction of the 10th and Delmar lid. WSDOT is considering replacement of part or all of this parking. At the NOAA property, only the portion of the facility parking lot located on WSDOT right-of-way under the Evergreen Point Bridge structure would be removed under the Preferred Alternative. Under Option A, roughly 12 spaces could be removed from the portion of the parking lot that is not under the existing structure due to column placement. Options K and L would not affect parking at this location.	
Preferred Alternative	The Preferred Alternative would remove approximately 172 parking spaces in the project area.
Option A	Option A would remove approximately 196 parking spaces in the project area.
Option K	Option A would remove approximately 211 parking spaces in the project area.
Option L	Option A would remove approximately 337 parking spaces in the project area.
Transit	
The Preferred Alternative and SDEIS options with an inside HOV lane across the Evergreen Point floating bridge, would substantially increase the demand for bus service across SR 520, allowing SR 520 to carry more people with greater efficiency, and allowing buses and carpools to move faster and more reliably than under No Build conditions. This increase reflects the effect of tolling on mode choice, the reversible connection to the I-5 express lanes and other corridor improvements. The capacity added across the Montlake Cut with the Preferred Alternative and SDEIS options would improve local traffic operations and allow transit to move faster and more reliably than the No Build Alternative.	
Preferred Alternative	In addition to the HOV facilities listed above, the Preferred Alternative would add HOV direct-access ramps at the Montlake Boulevard interchange area, connecting Montlake Boulevard with SR 520 to and from the east. The Preferred Alternative would also add HOV lanes to Montlake Boulevard NE from SR 520 across the Montlake bascule bridges.
Montlake Freeway Station	
The Preferred Alternative and SDEIS options would remove the Montlake Freeway Transit Station. Loss of the transit station would require passengers to change their current travel routes and these changes could include using light rail, additional bus transfers, and finding alternate bus routes to get to the same destination.	

Table 5.16-1. Summary Comparison of Operation Effects of the Preferred Alternative and SDEIS Options

Preferred Alternative	Under the Preferred Alternative, new westbound and eastbound bus stops would be provided on the new Montlake lid. This configuration would allow the transit agencies to maintain SR 520 bus service to the Montlake interchange area during off-peak periods. SR 520 transit travel patterns would not be substantially affected by this change. During the morning and evening peak periods, downtown Seattle-Eastside bus routes would have one less stop on their route, resulting in travel time savings. Because downtown Seattle-Eastside bus routes would not serve the Montlake lid bus stops during the a.m. and p.m. peak periods, riders would lose access to approximately 220 bus trips between Montlake Boulevard and Evergreen Point or Yarrow Point freeway transit stations compared to the No Build Alternative.
Mitigation	The design modifications that mitigate effects on traffic include number of lanes needed for on- and off-ramps, intersection configurations, and stop controls adjacent to the corridor.
Land Use and Economic Activity	
WSDOT would acquire land in order to accommodate right-of-way for the project. The Preferred Alternative and all SDEIS options would permanently remove two residences on the west end of the Portage Bay Bridge and the Museum of History and Industry (MOHAI) building. Estimated property tax effects would be similar across for the Preferred Alternative and SDEIS options, and result in a less than 0.01 percent decrease in tax revenue.	
Preferred Alternative	The Preferred Alternative would require the least amount of new right of way (10.6 acres). This alternative would result in 9 full parcel acquisitions, and would remove 6 residential structures.
Option A	Option A would require 11.5 acres of new right-of-way. This option would result in 7 full parcel acquisitions, and would remove two additional residences, the Montlake 76 gas station, and 9 of the 11 buildings on the south campus of National Oceanographic and Atmospheric Administration's (NOAA's) Northwest Fisheries Science Center.
Option K	Option K would require the most new right-of-way (15.5 acres). This option would result in 6 full parcel acquisitions, and the University of Washington's Waterfront Activities Center (WAC) would be relocated for a multiple-year period.
Option L	Option L would require 12.4 acres of new right-of-way. This option would result in 5 full parcel acquisitions.
Mitigation	Property acquisition and relocations will be completed in accordance with Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, as amended.
Social Elements	
The Preferred Alternative and the SDEIS options include lids that would benefit community cohesion by reconnecting neighborhoods originally bisected by SR 520 and/or I-5, providing linkages between adjacent and nearby parks, improving views toward the highway from nearby residences, and providing safe passage across I-5 and SR 520. The Preferred Alternative includes an enhanced bicycle/pedestrian path over I-5 instead of the I-5 lid designed for the SDEIS options. Option K includes three additional landscape features: one across Foster Island, one across East Lake Washington Boulevard (partial lid), and one at the NE Pacific Street and Montlake Boulevard NE intersection. Option L also includes a lid at the NE Pacific Street and Montlake Boulevard NE interchange. WSDOT concludes that there is no disproportionately high and adverse effect to low-income or LEP populations as a result of the toll. WSDOT has determined that there would not be a disproportionately high and adverse effect on tribal fishing because of the project, regardless of build option. This is because WSDOT will continue to work through government-to-government consultation with the Muckleshoot Indian Tribe on an agreement to resolve fully and fairly issues associated with the impacts of the project on treaty rights.	
Recreation	
WSDOT would acquire some parkland adjacent to the existing corridor for new permanent right-of-way in order to accommodate alignment and interchange improvements. The number of acres that would be converted to right-of-way would differ between the Preferred Alternative and Options A, K, and L. All or part of up to six recreational properties (depending on the alternative) would be acquired. The largest acquisitions would occur at McCurdy and East Montlake Parks.	

Table 5.16-1. Summary Comparison of Operation Effects of the Preferred Alternative and SDEIS Options

The Preferred Alternative and all SDEIS options would also acquire Bagley Viewpoint in its entirety. For the Preferred Alternative and all SDEIS options the west approach bridge width and profile through the Arboretum could change boaters and park users' experience in this area. The landscaped lids at 10th Avenue East and Delmar Drive East, and in the Montlake area would provide new areas for passive recreation. Trails across these lids would further improve connectivity for bicyclists and pedestrians. The proposed regional bicycle/pedestrian path across SR 520 would provide a new connection between the City of Seattle's bicycle and pedestrian system and the Points Loop Trail in Medina.	
Preferred Alternative	The Preferred Alternative would acquire the least amount of park land (6.7 acres).
Option A	Option A would acquire 7.5 acres of park land.
Option K	Option K would acquire 9.1 acres of park land. The Option K land bridge located on the north portion of Foster Island would change the island from a wetland viewing area to a more landscaped upland setting
Option L	Option L would acquire 7.6 acres of park land.
Mitigation	Both Section 4(f and Section 6(f) involve mitigation planning for recreation effects. The Section 6(f) and 4(f) processes were conducted together for the most part. WSDOT worked with the Parks Technical Working Group (TWG), which consisted of WSDOT, Seattle Parks and Recreation, the University of Washington, the Recreation and Conservation Office, the National Park Service, and FHWA, to evaluate park effects. This coordination effort included effects as defined under both Sections 4(f) and 6(f). Chapter 9 of the Final EIS provides a solid framework for evaluating recreation effects and determining and coordinating appropriate mitigation under Section 4(f). Section 6(f) of the LWCFA requires that replacement property be acquired for conversion effects. Chapter 10 of the Final EIS provides a complete description of the Section 6(f) resources affected at both East Montlake Park and Washington Park Arboretum.
Visual Quality	
The Preferred Alternative and SDEIS options would affect visual quality as a result of the new lids and wider bridges and roadways that would be shifted in some areas and raised or lowered in other areas. The Preferred Alternative and SDEIS options would improve the visual quality of the Roanoke landscape unit with the addition of the 10th Avenue East and Delmar Drive East lid. The overall quality of the Portage Bay landscape unit would not change but views under the Portage Bay bridge would open up because of the wider column spacing, especially looking northward from the south side of the bridge. The Preferred Alternative and SDEIS options would result in changes to the visual character and quality in the Montlake area. The mainline profile for all options through the Montlake area would be at roughly the same height as the existing SR 520 main line and therefore would be about as visible as the existing roadway from most residences, where not covered by the lid. However, Option K and L would include additional structures in the McCurdy Park and East Montlake Park areas that would be most visible to motorists and park users. These structures would dominate views much more than the existing ramps and main line.	
Preferred Alternative	The smaller bicycle/pedestrian crossing over I-5 near Roanoke Street would improve the visual character for the Roanoke area, compared to the No Build alternative. The Preferred Alternative would include a planted median along Portage Bay Bridge and could potentially change the view for drivers. The path beneath SR 520 on Foster Island would offer a more open and potentially pleasant experience than the SDEIS options or the No Build Alternative.
Option A	Under Option A, the SR 520 bridge over Foster Island would be higher than the existing bridge and the bridge proposed for Option L.
Option K	Option K would include a SPUI and tunnel configuration that would require tall retaining walls at the tunnel entrance and columns to support the main line over the SPUI. Under Option K, the land bridge at Foster Island would remove naturalized woodlands on both sides of SR 520.

Table 5.16-1. Summary Comparison of Operation Effects of the Preferred Alternative and SDEIS Options

Option L	Option L would include an elevated SPUI over the main line and a new bridge through East Montlake Park and over the Montlake Cut. Under Option L, the bridge on Foster Island would be wider than the existing bridge and 2 to 4 feet higher at the Arboretum Water Trail.
Mitigation	WSDOT has reinitiated discussions with the Seattle Design Commission to develop urban design guidelines for the project in collaboration with community members, and will continue to update and expand these guidelines as design progresses.
Cultural Resources	
WSDOT and FHWA evaluated the project's potential effects on historic properties within the project area using the Criteria of Adverse Effect (36 CFR 800.5) outlined in Section 106 of the NHPA. This legislation states that a project would have an adverse effect on a historic property if it results in changes to the property's characteristics that qualify it for inclusion in the National Historic Preservation Act (NRHP). Subsequent to the Final EIS analysis, FHWA and WSDOT determined that the project would have an adverse effect on historic properties. FHWA and WSDOT continued consultation with the State Historic Preservation Office (SHPO) and the other Section 106 consulting parties to seek resolution of the adverse effect from the project. The project's Programmatic Agreement memorializes the stipulations agreed upon to avoid, minimize, and mitigate adverse effects to historic properties located within the Area of Potential Effects. The Preferred Alternative and all the SDEIS options would result in an "adverse effect" determination for the project as a whole (referred to in Section 106 as "the undertaking"). The findings under Section 106 for the Preferred Alternative were submitted to SHPO on January 26, 2011, and concurrence was received on February 28, 2011.	
Noise	
Without noise mitigation, the Preferred Alternative and all SDEIS options would have smaller number of residences where noise levels exceed the Noise Abatement Criteria (NAC) than the No Build Alternative. This is because of the noise-reducing elements of the proposed design, which include lids, depressed roadway sections, and roadway realignments. The addition of lids and other landscape features over the highway would be the primary reasons for the reduction in noise levels.	
Preferred Alternative	The Preferred Alternative would have the least number of residences exceeding the NAC (207). With noise walls, 143 residences would exceed the NAC.
Option A	Under Option A, 249 residences would exceed the NAC. With noise walls, 94 residences would exceed the NAC.
Option K	Under Option K, 256 residences would exceed the NAC. With noise walls, 123 residences would exceed the NAC.
Option L	Under Option L, 235 residences would exceed the NAC. With noise walls, 119 residences would exceed the NAC.
Mitigation	Because design features such as reduced speeds, expanded lids, and 4-foot concrete traffic barriers were incorporated into the Preferred Alternative at many locations in the Seattle portion of the SR 520 corridor, noise walls would not provide enough additional reduction to be considered cost-effective. Therefore, the Preferred Alternative includes only two recommended noise walls: noise walls along both sides of SR 520 from just east of the floating span to Evergreen Point Road. If the recommended noise walls are included in the Preferred Alternative, the overall length would be 1,713 feet with height varying between 10 and 20 feet. For Options A, K, and L, noise walls would be warranted for consideration along I-5 near the Capitol Hill neighborhood, and along both sides of SR 520 from the Delmar Drive East lid to the west end of the Evergreen Point Bridge and along both sides of SR 520 from the east of the Evergreen Point Bridge to Evergreen Point Road. For SR 520 between 10th Avenue East to Montlake Boulevard NE and out through the Arboretum, the analysis indicated that noise walls would not meet WSDOT reasonableness or feasibility criteria. Designs that include noise walls would meet all WSDOT and FHWA requirements for avoidance and minimization of negative effects. As noted above, all noise walls recommended in the analysis (with the exception of the south Arboretum wall under Option K) would meet WSDOT criteria for feasibility and cost-effectiveness.

Table 5.16-1. Summary Comparison of Operation Effects of the Preferred Alternative and SDEIS Options	
Air Quality	
The Preferred Alternative and all SDEIS options would not cause a violation of the National Ambient Air Quality Standards (NAAQs). The modeled concentrations of air pollutants are well below the 1-hour and 8-hour NAAQS for the Preferred Alternative and all SDEIS options.	
Energy and Greenhouse Gases	
The Preferred Alternative and all SDEIS options would reduce annual energy consumption between 4 and 10 percent on SR 520 between Seattle and Medina. The Preferred Alternative and all SDEIS options would reduce greenhouse gas emissions by approximately 10 percent in the project area.	
Water Resources	
The Preferred Alternative and all SDEIS options would increase the amount of land covered by pollutant-generating impervious surfaces in the project area (Preferred Alternative – 37 percent increase, Option A – 35 percent increase, Option K – 45 percent increase, and Option L – 44 percent increase). By applying stormwater treatment in the designs, all options would meet state and federal water quality regulations and would provide more water quality treatment than is required for stormwater under the specific conditions of WSDOT's HRM at several locations.	
Ecosystems	
The Preferred Alternative and all of the SDEIS options would reduce the availability and quality of wetland and wetland buffer habitat due to filling and shading. Option K would fill the most wetland and wetland buffer area. The Preferred Alternative and all of the SDEIS options would reduce fish habitat functions, primarily due to increased shading by the larger overwater structures, and in-water structures. Compared to the existing structures, the proposed overwater structures are about twice as wide for all designs. The Preferred Alternative would result in the most overwater shading in the west approach area. Option K would result in the overall greatest loss of fish habitat due to the filling for the depressed SPUI. The Preferred Alternative and all of the SDEIS options would affect wildlife by permanently removing vegetation and wildlife habitat, and by increasing shading. Increased bridge elevation could have both positive and negative effects on wildlife movement and behavior. Option K would result in the greatest loss of wildlife habitat.	
Wetlands	
Preferred Alternative	The Preferred Alternative would fill 0.1 acre of wetland, and 0.7 acre of wetland buffer. The Preferred Alternative would shade 4.8 acres of wetland, and 1.1 acres of wetland buffer.
Option A	Option A would fill 0.1 acre of wetland and 0.7 acre of wetland buffer. Option A would shade 3.2 acres of wetland and 0.9 acre of wetland buffer.
Option K	Option K would fill 1.8 acres of wetland and 5.4 acres of wetland buffer. Option K would shade 2.8 acres of wetland and 0.1 acre of wetland buffer.
Option L	Option L would fill 0.3 acre of wetland and 1.5 acres of wetland buffer. Option L would shade 4.3 acres of wetland and 1.3 acres of wetland buffer.
Mitigation	The SR 520, I-5 to Medina Project would provide compensatory wetland mitigation in five locations for the project's wetland effects. Four of the locations are onsite or close to the project, and one is located several miles from the project but in the same watershed. See the Conceptual Wetland Mitigation Plan in Attachment 9 for details.
Fish Resources	
Preferred Alternative	The Preferred Alternative would result in approximately 49.9 acres of shaded aquatic habitat, and approximately 41,000 square feet of in-water concrete bridge structure. This option has the highest bridge profile through Union Bay and Lake Washington, further minimizing the effects to fish and aquatic resources.

Table 5.16-1. Summary Comparison of Operation Effects of the Preferred Alternative and SDEIS Options

Option A	Option A would result in approximately 49.0 acres of shaded aquatic habitat, and approximately 31,000 square feet of in-water concrete bridge structure.
Option K	Option K would result in the least shading overall shading—48.6 acres. Option K would be below the high-water elevation east of the Montlake shoreline, and would be the lowest profile design through Union Bay and east of Foster Island. This option would result in filling approximately 123,500 square feet of aquatic habitat.
Option L	Option L would result in the most overall shading through the corridor- 52.1 acres and approximately 35,000 square feet of in-water concrete bridge structure.
Mitigation	WSDOT has developed a comprehensive conceptual mitigation plan for aquatic restoration and habitat improvements at seven locations within the Water Resource Inventory Area (WRIA) 8 watershed, including restoration projects in Lake Washington, the Cedar River, and Bear Creek. The primary mitigation goal is to compensate for the SR 520, I-5 to Medina project's physical and biological effects while enhancing the production and survival of fish species to the maximum extent practicable. See the Conceptual Aquatic Mitigation Plan (Attachment 9) for further detail.
Wildlife and Habitat	
The Preferred Alternative and the SDEIS options would affect wildlife habitat by permanently removing vegetation and habitat, and increasing shading.	
Preferred Alternative	The Preferred Alternative would remove the least amount of habitat; approximately 8.1 acres of mostly the Urban matrix cover type across the entire project area.
Option A	Option A would remove 11.4 acres of mostly the Urban Matrix cover type, evenly spread among all areas.
Option K	Option K would remove 19.5 acres of mostly the Urban Matrix cover type, with most in the Montlake area.
Option L	Option L would remove 10.8 acres of mostly the Urban Matrix cover type, with effects evenly distributed among the geographic areas.
Mitigation	WSDOT will continue to work with City of Seattle, University of Washington, and the Arboretum Foundation to develop mitigation planting strategies to offset operational effects on shoreline habitat in Portage Bay and Union Bay.
Geology and Soils	
The Preferred Alternative and all SDEIS options include designing bridge columns to withstand seismic motion, and/or excavating areas of vulnerable soils and replacing them with stronger material. The Preferred Alternative and Option A would have a lower risk of damage from liquefaction and long term settling than Options K or L. This is because Options K and L both have a large a single-point urban interchange (SPUI) located at the Montlake shoreline.	
Option K	The risk of damage to the below-water facilities for Option K would be greater than if the interchange were constructed above water.
Mitigation	The proposed project would be designed to WSDOT and AASHTO design standards to address seismic loading, bridges, retaining walls, and other components of the project.
Hazardous Materials	
Project operations would include a variety of hazardous materials (fuels, lubricants, asphalt, paint, solvents, etc.) being transported along the SR 520 corridor. Any time such materials are transported, there is a risk that they could be accidentally released to the environment. These risks are approximately the same for the Preferred Alternative and the SDEIS options.	
Mitigation	Project stormwater facilities would reduce the risk of hazardous material spills to waters of the state by collecting and treating polluted runoff from traffic operations.

Table 5.16-1. Summary Comparison of Operation Effects of the Preferred Alternative and SDEIS Options

Navigation	
For the Preferred Alternative and all SDEIS options, the draw span on the floating bridge would be removed, and the east transition span would be 15 feet higher than existing. The changes would impose a height restriction of 70 feet for vessels passing under the new Evergreen Point Bridge.	
Preferred Alternative	For the Preferred Alternative, the new bascule bridge would coordinate openings with the existing bridge and would not pose height restrictions over the Montlake Cut. Boats with an overhead clearance of more than 44 feet would only be able to pass under the east transition span.
Option A	Under Option A, the new bascule bridge would coordinate openings with the existing bridge and would not pose height restrictions over the Montlake Cut. Boats with an overhead clearance of more than 41 feet would only be able to pass under the east transition span.
Option K	Boats with an overhead clearance of more than 41 feet would only be able to pass under the east transition span.
Option L	Under Option L, the new bascule bridge would coordinate openings with the existing bridge and would not pose height restrictions over the Montlake Cut. Boats with an overhead clearance of more than 41 feet would only be able to pass under the east transition span.
Mitigation	The permanent effect of a height restriction for vessels passing under the new Evergreen Point Bridge has been minimized by increasing the new east navigation channel's vertical clearance to 70 feet, which is similar in height to the I-90 east channel bridge clearance of 71 feet.

Table 5.16-2. Project Operation and Permanent Effects – Quantitative Effects Summary

Element	Type of Effect	Operation Effects			
		Preferred Alternative	Option A	Option K	Option L
5.1 Transportation		Please see qualitative effects summary in Table 5.16-1.			
5.2 Land Use and Economics	Land converted to right-of-way (acres)	10.6	11.5	15.5	12.4 (1.4)
	Full parcel acquisitions	9	7	6	5
5.3 Social Elements		Please see qualitative effects summary in Table 5.16-1.			
5.4 Recreation	Parks effects (acres)	6.7	7.5	9.1	7.6
5.5 Visual Quality		Please see qualitative effects summary in Table 5.16-1.			
5.6 Cultural Resources		Please see qualitative effects summary in Table 5.16-1.			
5.7 Noise	Residences where noise levels would approach or exceed the NACs – without noise walls	207	249	256	235
5.8 Air Quality	Local NAAQS violations	0	0	0	0
5.9 Energy and Greenhouse Gases	Estimated gallons of fuel (millions) consumed annually during operation (2030)	31.5	39.8	40.7	40.7
	Percent change in GHG emissions as compared to No Build Alternative	-10%	-10%	-9%	-9%
5.10 Water Resources	Total pollutant generating impervious surface area (acres)	73.4 [a] 68.5 [b]	77.5[a]	93.3[a]	87.0[a]
5.11 Ecosystems	Wetland fill (acres)	0.1	0.1	1.8	0.3
	Wetland buffer fill (acres)	0.7	0.7	5.4	1.5
	Wetland shading (acres)	4.8	3.2	2.8	4.3
	Wetland buffer shading (acres)	1.1	0.9	0.1	1.3
	Aquatic habitat filled (acres)	0.9	0.5	2.7	0.6
	Overwater structures (acres)	49.9	49.0	48.6	52.1
	Vegetation removal (acres)	8.1	11.4	19.5	10.8
5.12 Geology and Soils		Please see qualitative effects summary in Table 5.16-1.			
5.13 Hazardous Materials		Please see qualitative effects summary in Table 5.16-1.			
5.14 Navigation		Please see qualitative effects summary in Table 5.16-1.			

[a] Lid Scenario 1
[b] Lid Scenario 2